



# Publication

## POLICY PERSPECTIVES

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### INNOVATION AND CANADA'S ECONOMIC PROSPECTS

Economists increasingly have come to view **innovation** as central to creating a prosperous, globally competitive economy. Innovation has been defined as “a process through which economic and social value is extracted from knowledge through the generation, development, and implementation of ideas to produce new or improved products, services or processes.”<sup>1</sup> A recent review of the Canadian economy by the Organization for Economic Cooperation and Development (OECD) devotes an entire chapter to innovation and its role in shaping the country's economic performance.<sup>2</sup>

Innovation should be distinguished from **invention**. The latter term refers to the original development of new ideas, typically by scientists, engineers and other highly skilled individuals working in universities, non-profit research institutes or research-intensive businesses. Innovation seeks to transform knowledge into new or improved products, processes and ways of doing business. When this occurs, the economic value derived from advances in knowledge increases.

Entrepreneurs occupy a key position in the innovation process. Often it is they who bring new knowledge – in the form of fresh ideas, products, services, or ways of doing business – into the economic system.<sup>3</sup> In many cases, entrepreneurs are the ones responsible for introducing disruptive technologies or fundamentally different business strategies. Innovation also occurs when existing enterprises make incremental changes to current technologies, products, production processes, or organizational practices.

Four types of innovation have been identified in the academic and policy literature:<sup>4</sup>

- Product innovation – the introduction of a new or significantly improved good or service.
- Process innovation – the implementation of a novel or better method of production.
- Organizational innovation – the adoption of new/better business methods or workplace practices

<sup>1</sup> Conference Board of Canada, 4<sup>th</sup> Annual Innovation Report, 2002, p. 1.

<sup>2</sup> OECD, Economic Surveys: Canada (June 2006), chapter 3.

<sup>3</sup> This point was made by Joseph Schumpeter, The Theory of Economic Development (1934).

<sup>4</sup> OECD, Economic Surveys: Canada (June 2006), pp. 74-5.



- Marketing innovation – significant changes in product design, packaging, pricing, or marketing/sales strategy.

In practice, innovation has multiple dimensions – research and development carried out in universities, businesses and specialized institutes; patent activity; commercialization of ideas and technologies; the spread of new technologies and knowledge across business sectors; and the availability of venture and other “seed” capital to support the formation and growth of innovative, knowledge-based firms.

### **Canada’s Innovation Record**

An examination of the state of innovation in Canada presents a mixed picture.

Aggregate R&D activity in Canada has increased over time. But private sector R&D expenditures as a share of GDP are low compared to the United States, the Scandinavian countries, Japan, the UK, France and Germany.<sup>5</sup> Canada lags behind the US and some European countries in the proportion of the work force engaged in R&D. Canada also trails the US in the production of graduate-level (masters and doctoral) scientists, engineers, and other specialized research personnel, as well as in educational attainment among managers. The US is also well ahead of Canada in patent output.<sup>6</sup> However, Canada is one of the world leaders in “connectivity,” with a high share of the population computer literate and using the internet.

From a broader perspective, cross-country surveys show that the percentage of Canadian firms engaged in “innovation” – including research and development, the introduction of new products/processes, and patenting activity – is similar to the proportions in most other OECD countries, but lower than in innovation leaders like the US, Finland and Sweden.

A large body of research confirms that investments in machinery, equipment, and information and communications technologies (ICTs) are critical to developing a more productive economy. There are strong causal links between investments in machinery, equipment, and ICTs and both firm-level productivity and the overall rate of economic growth.<sup>7</sup> Indeed, such investments are the primary means by which firms acquire leading-edge technology and the latest ideas embedded in it. Published estimates suggest that more than half of Canada’s productivity gains in the 1990s were attributable to industries that either use ICTs intensively or are ICT producers. Canada invests less in machinery, equipment and ICTs on a per worker basis than either the US or a number of other

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<sup>5</sup> Conference Board of Canada, Performance and Potential 2005-06: The World and Canada – Trends Reshaping Our Future (2005), pp. 35-40.

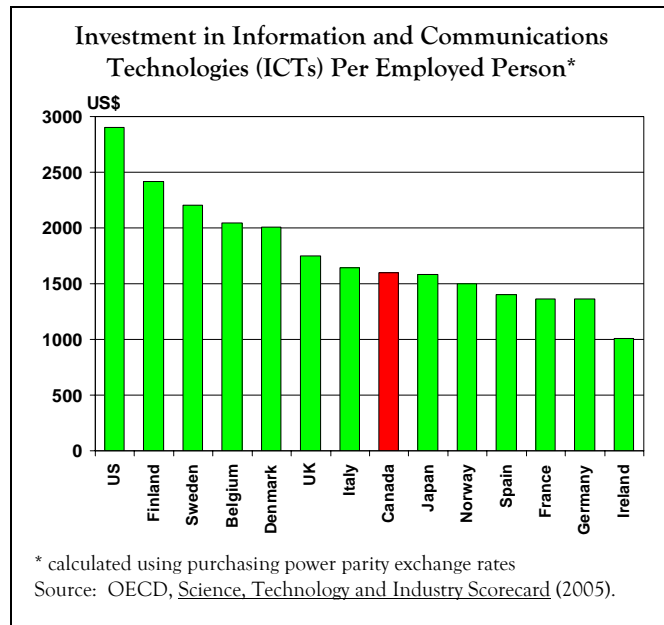
<sup>6</sup> Ibid., p. 36; also see Institute for Competitiveness and Prosperity, Realizing Canada’s Prosperity Potential (January 2005), pp. 29-30.

<sup>7</sup> See Aled ab Iorwerth, “Machines and the Economics of Growth,” Department of Finance Working Paper (March 2005); Dale Jorgenson, ed., Economic Growth in Canada in the Information Age (Ottawa: Industry Canada, December 2004); Andrew Sharpe, Someshwar Rao and Jeremy Smith, “An Analysis of the Labour Productivity Growth Slowdown in Canada Since 2000,” International Productivity Monitor (Spring 2005).



advanced economies – and this has been the case for some time. In 2004, ICT investment in Canada amounted to 2.5% of GDP, compared to 4.1% in the United States.<sup>8</sup>

For a small jurisdiction such as Canada, the rate of adoption of innovative technologies and management practices has a bigger impact on economic performance than the extent of local research and development spending. Canada accounts for a very small share of the world supply of innovation – for example, it is responsible for less than



3% of the R&D done in the OECD economies collectively.<sup>9</sup> The number of enterprises that actually perform R&D in Canada is also small – in the vicinity of 10,000, or substantially less than 1% of all businesses. The reality is that relatively few firms will ever engage in direct R&D activity. But to compete successfully, most businesses need to keep up-to-date in their understanding and deployment of advanced technologies and innovative business practices and techniques. The innovation and productivity performance of the vast majority of Canadian firms depends on the diffusion of better technologies and management practices and their adoption by firms. Without diffusion, the creation and commercialization of new ideas and technologies has little economic and social impact.<sup>10</sup>

Canada scores quite well on some indicators that measure the diffusion of new ideas, technologies and business practices.<sup>11</sup> However, here too there is a sizable gap vis-à-vis the United States – American firms, especially in manufacturing, are generally quicker to adopt new technologies and business practices than their Canadian counterparts.<sup>12</sup> In part this likely reflects cross-border differences in the tax treatment of investment in various kinds of business assets. The fact that small businesses play a greater role in the Canadian than the American economy also serves to slow diffusion, because the research shows that small firms are slower to adopt new technologies.

<sup>8</sup> OECD, *Economic Surveys: Canada* (June 2006), p. 96. The figures cited refer to the “business sector” and exclude the public or “non-market” sector of the economy.

<sup>9</sup> Centre for the Study of Living Standards, *The Diffusion and Adoption of Advanced Technologies in Canada: An Overview of the Issues* (September 23, 2005); available at [www.csls.ca](http://www.csls.ca)

<sup>10</sup> Ibid.

<sup>11</sup> Conference Board of Canada, *Performance and Potential 2003-04: Defining the Canadian Advantage* (2003), pp. 23-4.

<sup>12</sup> Centre for the Study of Living Standards, *The Diffusion and Adoption of Advanced Technologies in Canada: An Overview of the Issues* (September 23, 2005); available at [www.csls.ca](http://www.csls.ca)



### **Improving Innovation**

The past several years have seen the publication of a host of studies and reports aimed at bolstering Canada's record on important dimensions of innovation activity. In broad terms, the policy directions and specific recommendations found in these studies and reports fall into three categories: 1) investing in the knowledge base; 2) advancing education and skills development; and 3) strengthening the business environment for innovation.

#### ***Investing in the Knowledge Base***

Innovation entails transforming knowledge into new/better products and services. Expanding the stock of knowledge is one way to strengthen the precursors of innovation. The federal government and some provincial governments provide significant support for research and development, using three channels. First, the public sector undertakes research on its own, mainly in federal research facilities. Second, there is large and growing public support for academic research through granting councils, research chairs, and the Canadian Foundation for Innovation. Finally, Canadian governments offer incentives to stimulate private sector research.

Over the past decade, the federal government has significantly increased funding and other support for research in universities and teaching hospitals – in fact, Canada ranks first in the G7 in the share of total research that is performed in the academic sector. Canada also provides attractive incentives for private sector R&D, mainly through the tax system. Yet in overall terms, the Canadian business sector is at best a middling performer on R&D. To a large extent, this is because Canada's industrial structure is heavily weighted toward industries that have a low propensity to engage in R&D.<sup>13</sup> Canadian businesses in several research-intensive industries actually are relatively big spenders on R&D.<sup>14</sup>

Because research has positive spillovers which benefit the wider economy, there is a policy rationale for instituting public programs and tax measures to encourage R&D. The Panel on Commercialization, appointed by the federal government in 2005 to recommend ways to improve the commercialization of new knowledge and technologies, called for continued increases in public funding of research in universities and other research-focused institutions.<sup>15</sup> As for incentives for business R&D, some analysts have suggested modifying Canadian R&D tax credits to increase their effectiveness and put a stronger focus on stimulating research among newer firms.<sup>16</sup>

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<sup>13</sup> Aled ab Iorwerth, "Canada's Low Business R&D Intensity: The Role of Industry Composition," Department of Finance Working Paper (March 2005).

<sup>14</sup> Examples include pharmaceuticals, office and computer machinery, and communications equipment. Ibid., p. 26.

<sup>15</sup> Final Report of the Expert Panel on Commercialization, Volume I (2006), p. 17.

<sup>16</sup> OECD, Economic Surveys: Canada (June 2006), pp. 89, 96.



Accelerating the commercialization of knowledge is essential to achieving larger economic payoffs from the substantial investments that Canada is making in knowledge generation. Expediting the diffusion of discoveries from universities, teaching hospitals and public research laboratories is one way to boost the economic benefits of public investments in front-end research. Academic R&D that never leaves campus may add to the stock knowledge, but it does little to raise productivity or develop new commercial ventures. An important goal for Canada should be to have more innovations developed with public funding/support lead to commercial applications, which then spawn successful businesses that operate from a Canadian base. This is an area where Canada has struggled - the country tends to be better at creating knowledge than at transforming new knowledge into profitable and growing enterprises.

### *Advancing Skills and Education*

Among OECD nations, Canada ranks highly on many measures of education and skills, including the share of the working-age population with post-secondary education. But Canada's record is less impressive in some areas that are directly relevant to innovation capacity, such as the production of master's and PhD graduates and the propensity of businesses to employ scientists and other research personnel.

To help address these weaknesses, the Expert Panel on Commercialization recommended that the federal government establish a Canada Commercialization Fellowships program. As envisaged by the Panel, the program would focus on providing work experience for graduate and post-graduate students in fields that support commercialization - such as management, marketing, and design, as well as the sciences, engineering, and other technology disciplines. A key benefit of the program, in the Panel's view, is that over time it would increase business demand for the talent needed to drive commercialization. The Expert Panel also urged the government to change immigration policy to make it easier for international students with relevant qualifications to work while studying in Canada, and then to remain here after graduation.<sup>17</sup>

### *Strengthening the Business Environment for Innovation*

The environment for innovation is also influenced by the tax system, general business framework laws (e.g., anti-trust policy), and the nature of government regulation.

Studies show that the United States maintains a more attractive fiscal regime for investments in machinery, equipment, and ICTs than Canada.<sup>18</sup> Much of the cross-border difference reflects variations in the treatment of capital cost allowances, as the US has higher rates of depreciation for many types of machinery, equipment and other technology-intensive business assets. To encourage greater investment in assets that are closely linked to

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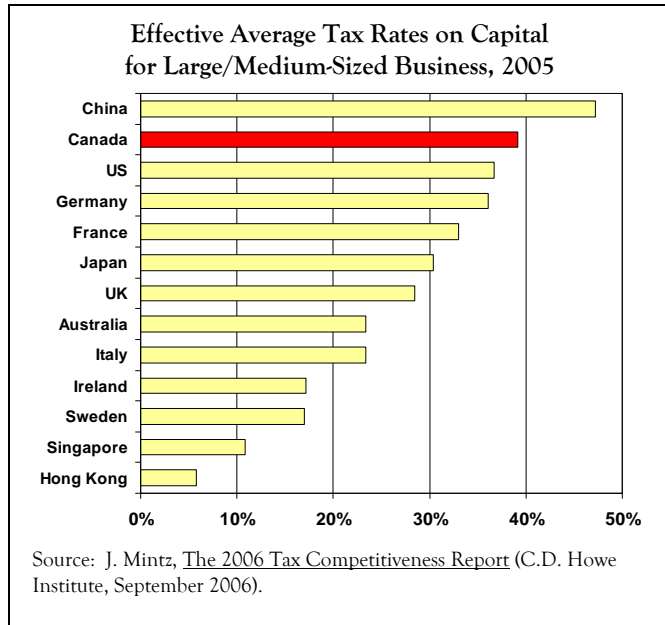
<sup>17</sup> [Final Report of the Expert Panel on Commercialization](#), Volume I (2006), pp. 12-16.

<sup>18</sup> Richard Harris, [Canada's R&D Deficit and How to Fix It](#), C.D. Howe Institute (2005), pp. 14-16.



improving productivity and spurring innovation, the federal government should review and modify current capital cost allowances.

More generally, there is still more work to be done in Canada to establish a competitive overall business tax regime. This is particularly true when it comes to the effective tax rate on capital investment by large and medium-sized businesses, which remains high in Canada compared to other industrial nations. Lowering the effective tax rate on capital would result in faster deployment of new equipment and



technologies, greater capital intensity, and higher labour productivity (by increasing the amount and quality of capital per worker). The key tax policy changes recommended by the OECD in its recent report on the Canadian economy include the following:

- abolishing capital taxes in the jurisdictions that still maintain them (e.g., Ontario, Quebec);
- accelerating the planned reductions in federal corporate income tax rates; and
- replacing current sales taxes in the provinces that have not harmonized with the federal GST with a value-added based provincial consumption tax, a shift that would eliminate sales tax on business inputs and significantly enhance Canadian competitiveness.<sup>19</sup>

The Expert Panel on Commercialization identified a number of other steps that would improve the environment for innovation and commercialization in Canada. Among other things, the Panel recommended removal of barriers to foreign venture capital investment, a comprehensive review of current public policies affecting the expansion-stage venture capital market, and an examination of options to increase pension fund and other institutional investment in commercialization opportunities at later stages of business growth.<sup>20</sup>

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<sup>19</sup> OECD, *Economic Surveys: Canada* (June 2006), p. 70.

<sup>20</sup> *Final Report of the Expert Panel on Commercialization*, Volume I (2006), pp. 26-27.