SCIENCE AND TECHNOLOGY DATA — 2007

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CONTENTS

ACRONYMS AND ABBREVIATIONS

AAFC — Agriculture and Agri-Food Canada
AECL — Atomic Energy of Canada Limited
BERD — Business enterprise expenditure on research and development
CFI — Canada Foundation for Innovation
CIDA — Canadian International Development Agency
CIHR — Canadian Institutes of Health Research
CRC — Communications Research Centre Canada
CSA — Canadian Space Agency
DND — Department of National Defence
EC — Environment Canada
F&O — Fisheries and Oceans Canada
GDP — Gross domestic product
GERD — Gross domestic expenditure on research and development
GOVERD — Government intramural expenditure on research and development
HC — Health Canada
HERD — Higher education expenditure on research and development
IC — Industry Canada

M&E — Machinery and equipment

NRC — National Research Council Canada

NRCan — Natural Resources Canada

NSERC — Natural Sciences and Engineering Research Council of Canada

OECD — Organisation for Economic Co-operation and Development

R&D — Research and development

RSA — Related scientific activities

S&T — Science and technology

SSHRC — Social Sciences and Humanities Research Council of Canada

STC — Statistics Canada

DEFINITIONS

ARC — "Average of Relative Citation" is an indicator based on the number of citations received by papers over a three-year period following the publication year. To account for different citation patterns across fields and subfields of science, the citation count of a paper in a given subfield is divided by the average citation count of all papers in its subfield to obtain a relative citation count (RC). The ARC of a given entity is the average of the RC of papers belonging to it. When the ARC is above 1, an entity scores better than the world average; when it is below 1, an entity publishes papers that are cited less often than the world average.

R&D — "Research and Development" is creative work undertaken on a systematic basis to increase the stock of knowledge, including knowledge of humankind, culture and society, and the use of this stock of knowledge to devise new applications.

RSA — "Related Scientific Activities" that complement and extend R&D by contributing to the generation, dissemination and application of scientific and technological knowledge.

S&T — "Science and Technology" includes both R&D and RSA and refers to the broad spectrum of activities required to generate, disseminate or apply new S&T knowledge.

Scientific Publications — Publications in the fields of health, pure and applied science.

INTRODUCTION

Science and Technology Data is published yearly by Industry Canada's Science and Innovation Sector. This publication presents a snapshot of the state of science and technology in Canada in an accessible and convenient format.

The booklet has five sections. The first, "National," provides a summary view of Canada's R&D. This is followed by three sections, each covering a specific player in the national S&T system: "Government," "Industry" and "Higher Education." The booklet concludes with a section entitled "Canada and the World," which describes links between Canada's S&T activities and those in other countries around the world.

Due to the delays involved in the collection and dissemination of data, the figures used for domestic indicators will often be more recent than those used for international comparisons.

NATIONAL

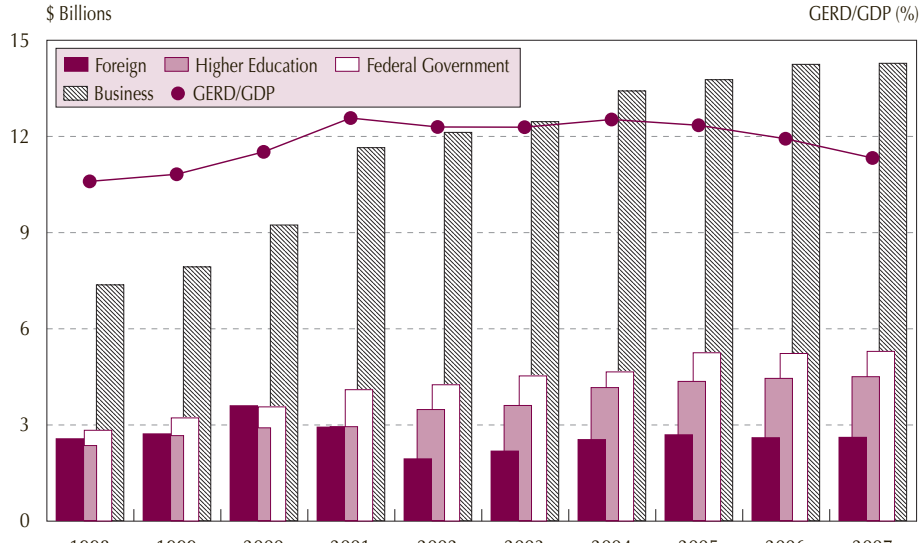
GERD represents the total R&D performed in a country. In Canada, as in most other OECD countries, the business sector is the most important performer of R&D and its largest funder. In 2007, businesses performed $16.2 billion of Canada's $28.9 billion in R&D expenditures.

GERD, expressed as a percentage of GDP, is a standard indicator of the share of resources a country devotes to R&D (i.e., its R&D intensity). In 2006, Canada's GERD-to-GDP ratio was ranked 13th among OECD countries.

Among Canadian provinces, Quebec and Ontario remain the only two whose R&D intensity is in line with the OECD average.

The sectoral contribution to a country's R&D performance varies significantly across OECD countries. Compared to the OECD, Canada's higher education sector contributes more to its aggregate R&D performance and the business sector contributes less.

Canada's GERD by Major Source of Funds, 1998 to 2007

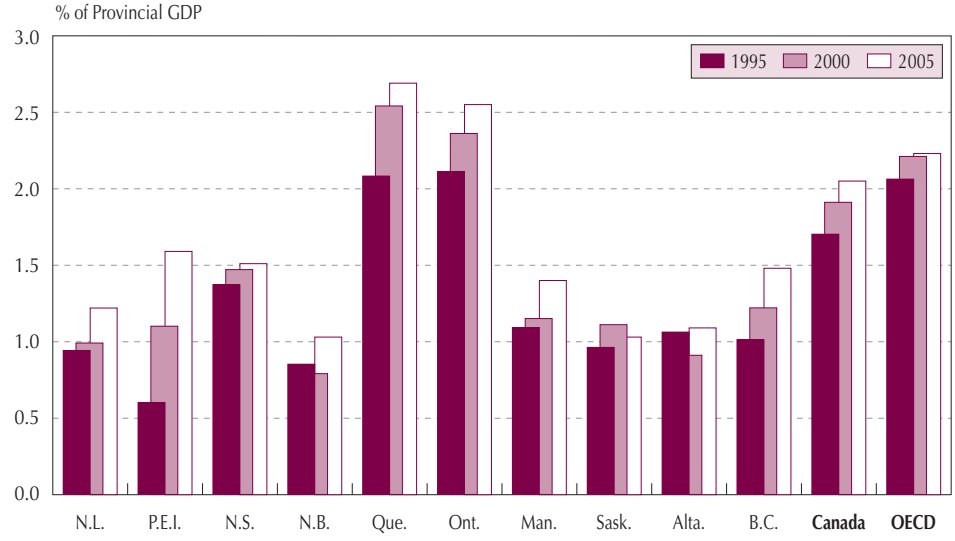


Source: Statistics Canada, *Gross Domestic Expenditures on Research and Development in Canada (GERD), and the Provinces*, Catalogue no. 88-221, December 2008.

GERD as a Percentage of GDP, Top OECD Countries and Selected Non-OECD Countries, 2006

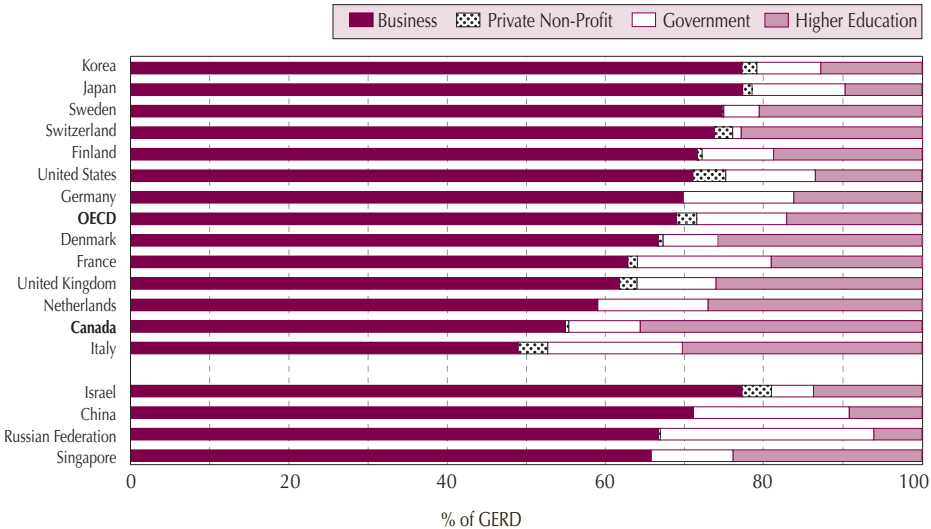
Source: OECD, *Main Science and Technology Indicators (MSTI)*: 2008/2 edition, December 2008.

R&D Intensity at the Provincial Level, 1995, 2000 and 2005



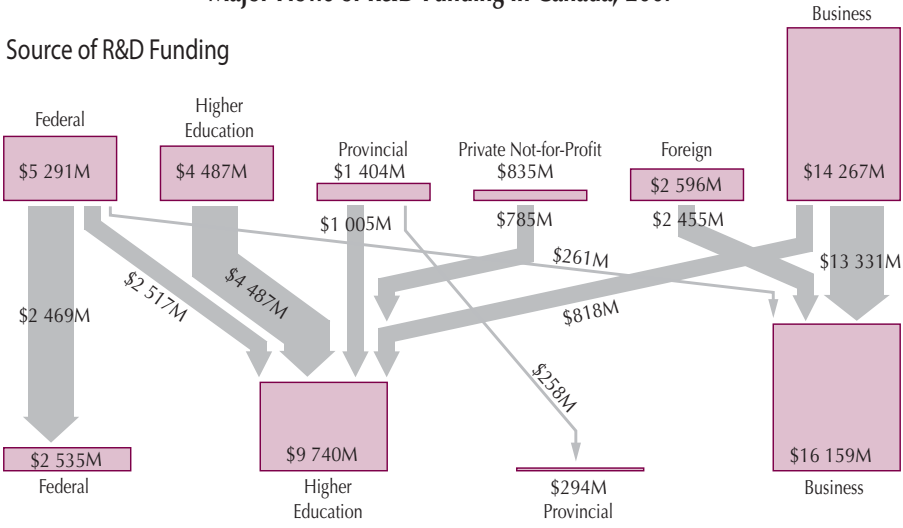
Sources: Statistics Canada, *Gross Domestic Expenditures on Research and Development in Canada (GERD), and the Provinces,* Catalogue no. 88-221, December 2008. OECD, *Main Science and Technology Indicators (MSTI)*: 2008/2 edition, December 2008.

Distribution of R&D Expenditures by Performing Sector, Selected OECD and Non-OECD Countries, 2006



Source: OECD, *Main Science and Technology Indicators (MSTI)*: 2008/2 edition, December 2008.

Major Flows of R&D Funding in Canada, 2007*



*Only flows larger than $150M are shown in the chart.

Source: Statistics Canada, CANSIM Database, Matrix 358-0001.

GOVERNMENT

The federal government is the second largest funder of R&D in Canada, behind the business sector. While it still performs a large share of its R&D in-house, its funding of higher education R&D performance in 2007 exceeded that of R&D in the government sector.

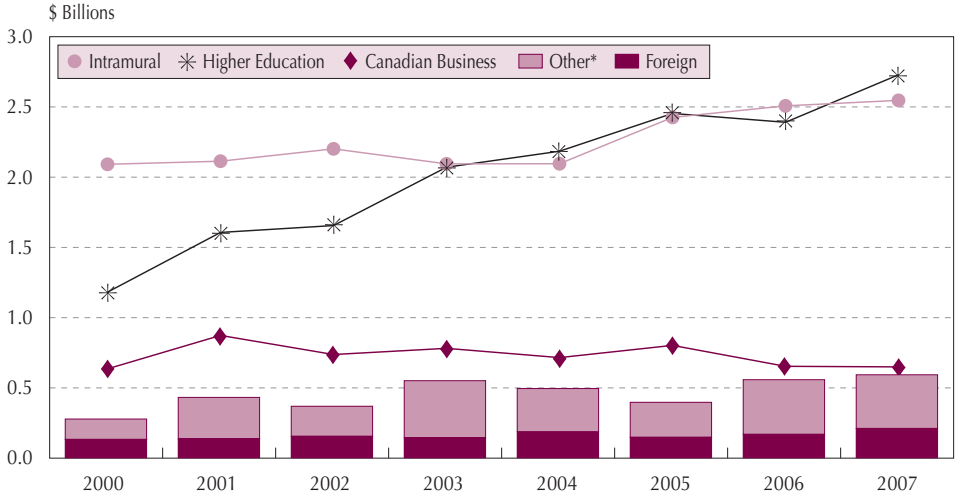
While governments are an important funder of R&D, they are usually not large performers. In 2006, governments in OECD countries performed, on average, 11 percent of the total R&D. Expressed as a percentage of GDP, Canada's GOVERD ranked 18th among OECD countries in 2006.

R&D is only one component of S&T. In 2007–2008, R&D accounted for 64 percent of the federal government expenditures on S&T. The other 36 percent represented expenditures on related scientific activities including, among others, data collection.

The federal government expenditures on S&T are made through a large number of departments and agencies. Among the top five, the granting councils (CIHR, NSERC and SSHRC) fund mainly extramural R&D while NRC funds mostly intramural R&D and Statistics Canada funds mostly RSA.

To support its objectives, the federal government has also increased its number of R&D personnel. Measured in full-time equivalents, the number of federal R&D personnel reached 15 250 in 2005, more than 12 percent above the 2003 level.

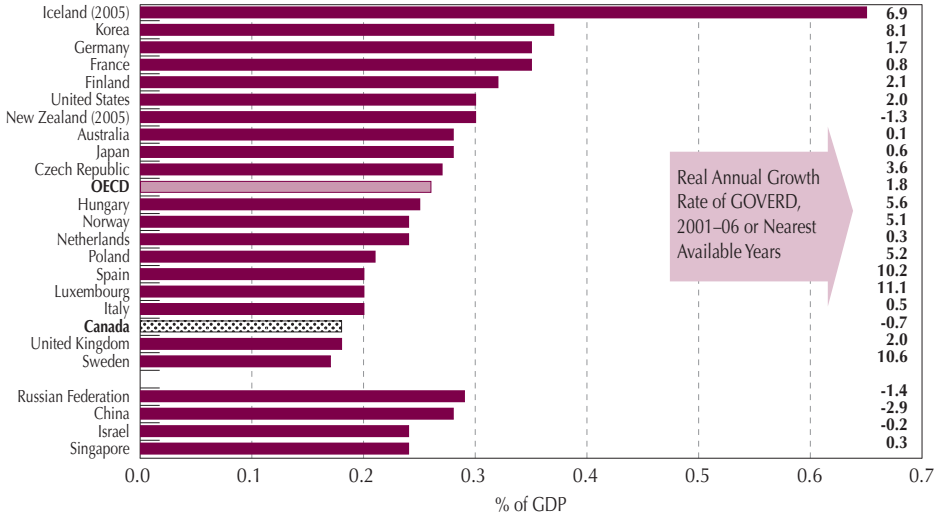
Federal R&D Spending by Performer Type, 2000 to 2007



*Other includes private not-for-profit organizations, provincial and municipal governments, and other Canadian performers.

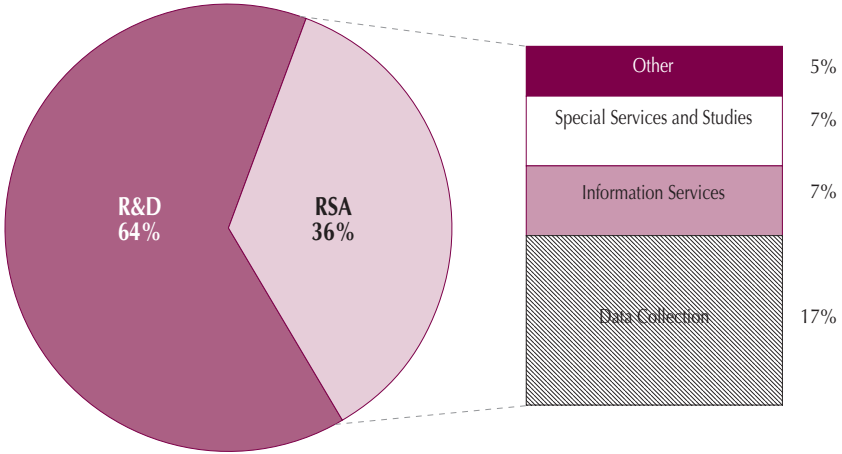
Source: Statistics Canada, *Science Statistics*, Vol. 32, No. 7, November 2008.

GOVERD as a Percentage of GDP, Top OECD Countries and Selected Non-OECD Countries, 2006



Note: Government expenditures include those by federal, provincial and local governments.
Source: OECD, *Main Science and Technology Indicators (MSTI)*: 2008/2 edition, December 2008.

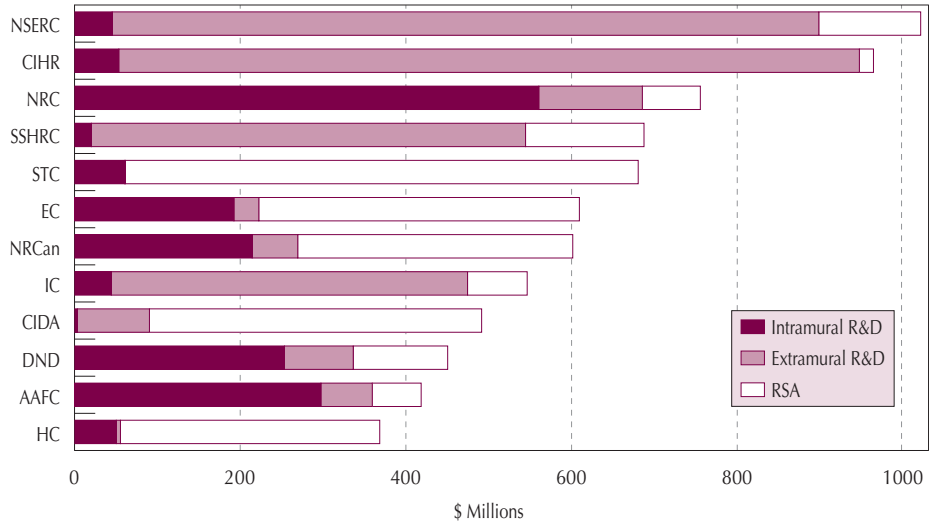
Federal S&T Spending by Activity, 2007



Total spending: $10.2B

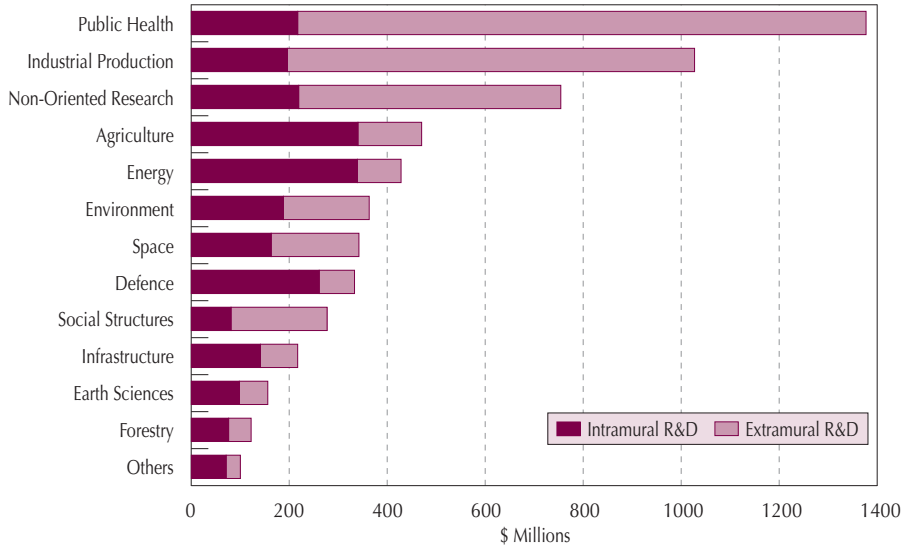
Source: Statistics Canada, *Science Statistics,* Vol. 32, No. 7, November 2008.

Major Federal S&T Departments and Agencies by Amount of Spending, 2007



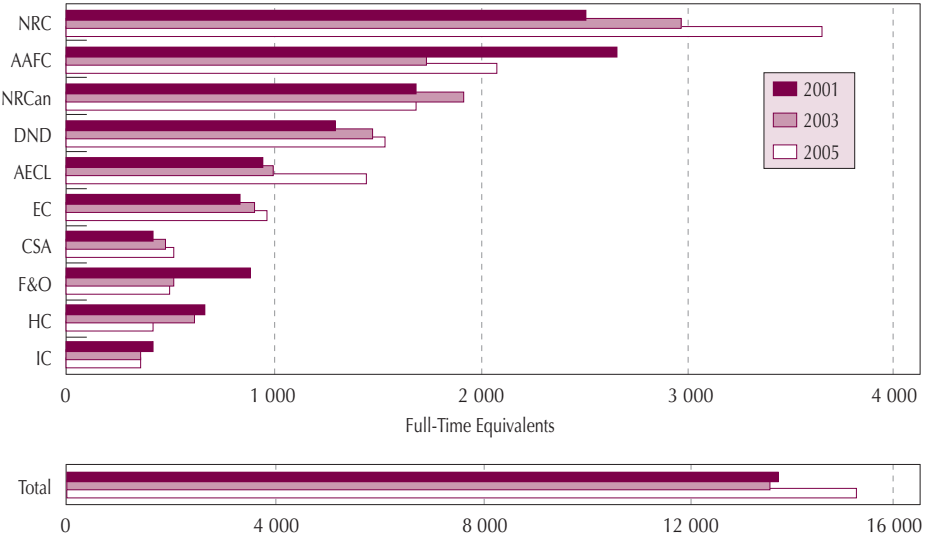
Source: Statistics Canada, *Science Statistics,* Vol. 32, No. 7, November 2008.

Federal R&D Spending by Socio-Economic Objective, 2006



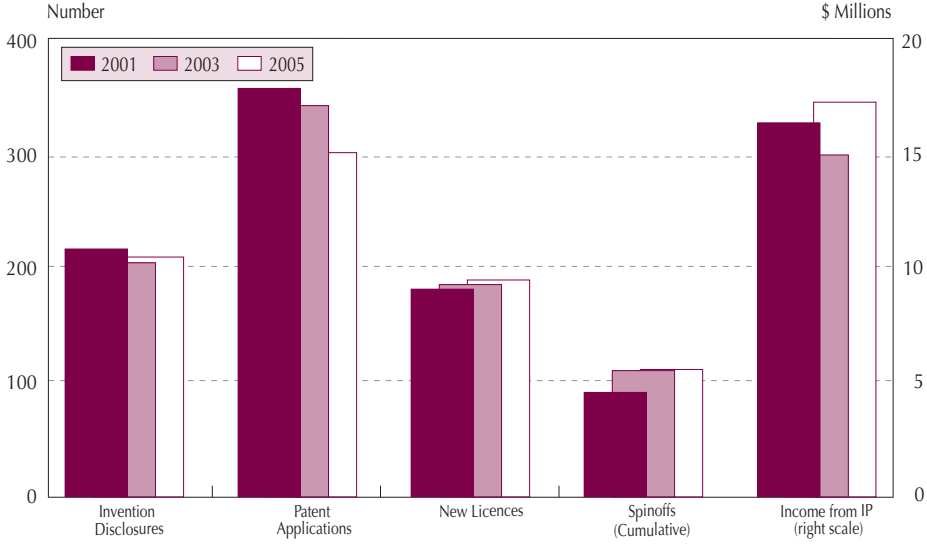
Source: Statistics Canada, *Science Statistics,* Vol. 32, No. 7, November 2008.

Federal Personnel Engaged in R&D, Major Departments or Agencies, 2001, 2003 and 2005



Source: Statistics Canada, *Science Statistics,* Vol. 32, No. 1, May 2008.

Federal Government Licensing and IP Income, 2001, 2003 and 2005



Source: Statistics Canada, *Intellectual Property Management, by Federal Departments and Agencies Indicators*, 1997/1998 to 2005/2006, CANSIM Table 358-0026.

INDUSTRY

Businesses are the largest performers of R&D in Canada. In 2007, the business sector performed $16.2 billion of R&D, $13.3 billion of which was funded by the sector. In 2006, Canada ranked 16th among OECD countries for its BERD, expressed as a share of GDP.

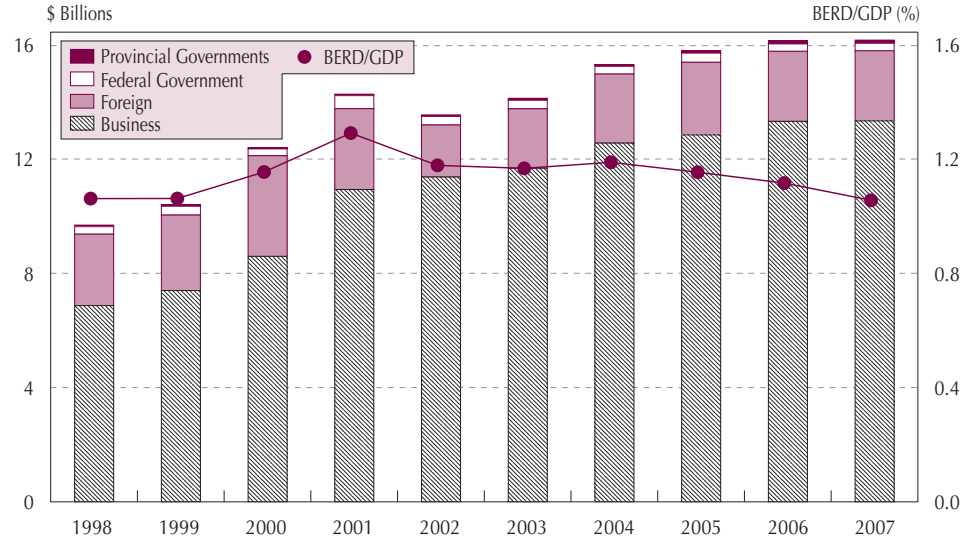
Businesses employ the vast majority of researchers in Canada. In 2005, business researchers accounted for 61 percent of the total.

Most OECD countries offer support to business R&D, although Canada appears to be more reliant on indirect support than a number of other competitor countries, such as the U.S.

A country's BERD-to-GDP ratio appears positively correlated to the share of BERD performed by large firms. Large firms account for over 90 percent of BERD in Japan, about 85 percent in Germany and 81 percent in the U.S., but less than 60 percent in Canada.

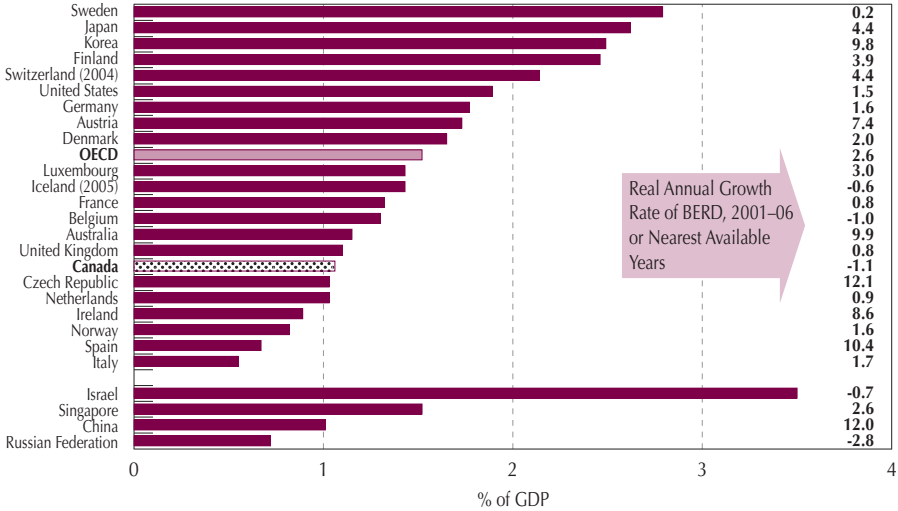
In 2006, Canada's venture capital investments, expressed as a share of GDP, were virtually unchanged from their 2003 levels. Canada's venture capital-to-GDP ratio stands below that of the OECD.

Canada's BERD by Major Source of Funds, 1998 to 2007



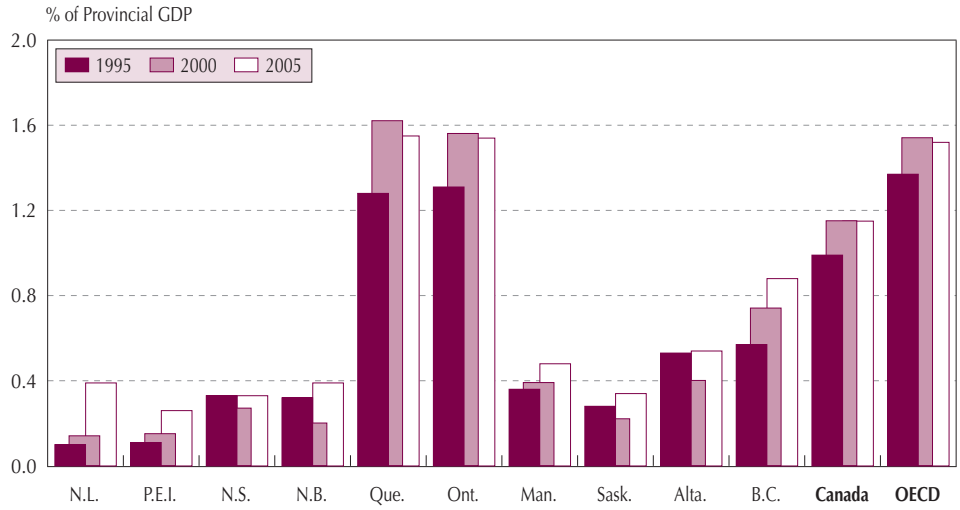
Source: Statistics Canada, *Gross Domestic Expenditures on Research and Development in Canada (GERD), and the Provinces*, Catalogue no. 88-221, December 2008.

BERD as a Percentage of GDP, Top OECD Countries and Selected Non-OECD Countries, 2006



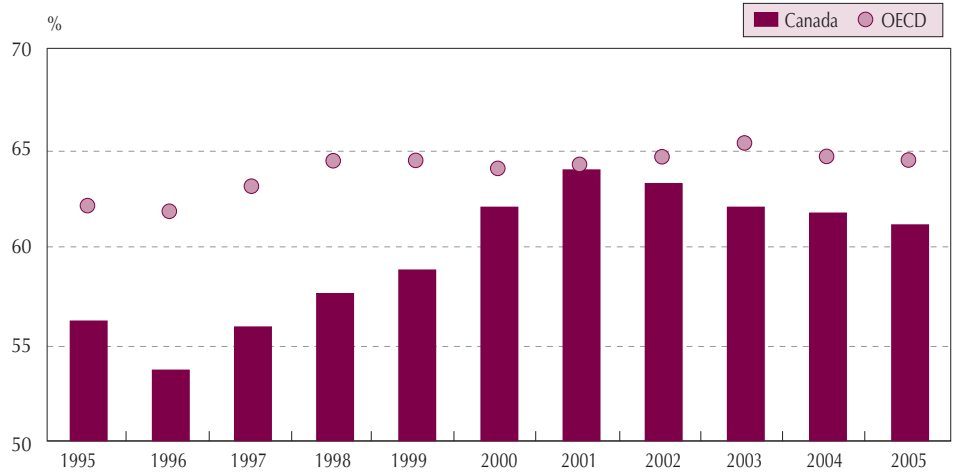
Note: Government expenditures include those by federal, provincial and local governments.
Source: OECD, *Main Science and Technology Indicators (MSTI)*: 2008/2 edition, December 2008.

BERD Intensity at the Provincial Level, 1995, 2000 and 2005



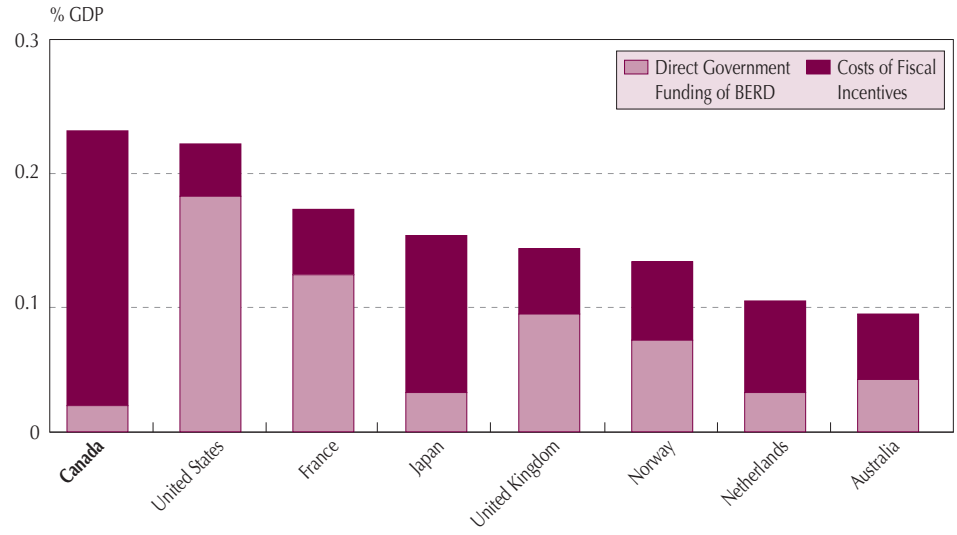
Sources: Statistics Canada, *Gross Domestic Expenditures on Research and Development in Canada (GERD), and the Provinces*, Catalogue no. 88-221, December 2008. OECD, *Main Science and Technology Indicators 2008/2*, December 2008.

Business Researchers as a Percentage of National Total, Canada and OECD, 1995 to 2005



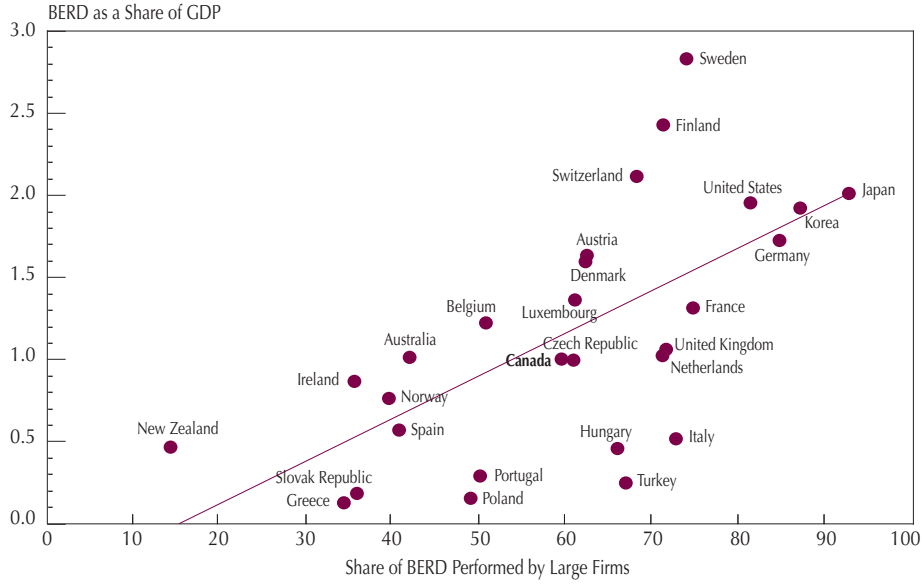
Source: OECD, *Main Science and Technology Indicators (MSTI)*: 2008/2 edition, December 2008.

Direct and Indirect Government Funding of Business R&D and Tax Incentives for R&D, Selected OECD Countries, 2005 (or Nearest Available Year)



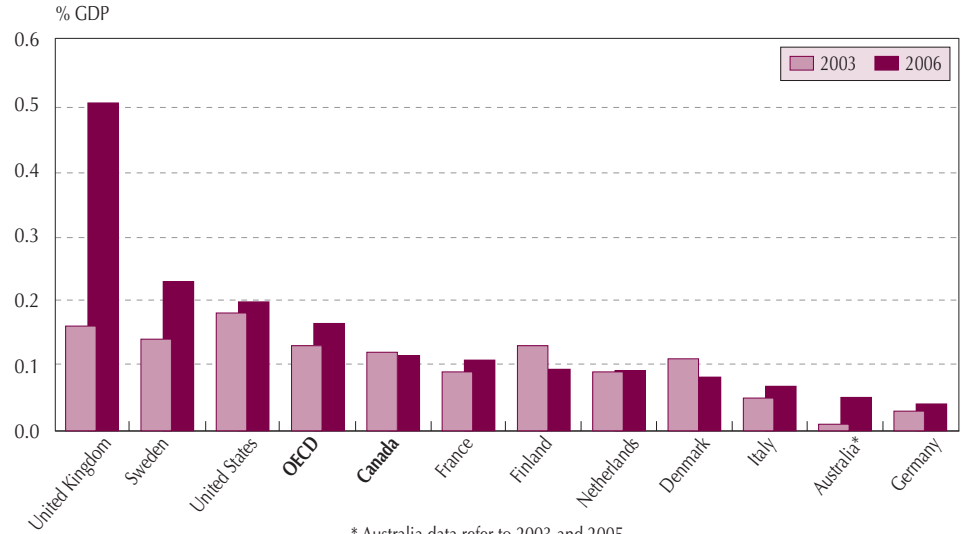
Source: OECD, *Science, Technology and Industry Outlook*, 2008.

Business R&D Intensity and Share of R&D Performed by Firms with 500 or More Employees, Selected OECD Countries, 2005 (or Nearest Available Year)



Source: OECD, *Science, Technology and Industry Outlook*, 2008.

Venture Capital Investment as a Percentage of GDP, Selected OECD Countries, 2003 and 2006



* Australia data refer to 2003 and 2005.

Source: OECD, *Science, Technology and Industry Outlook*, 2008.

HIGHER EDUCATION

The higher education sector performs a dual role in any national innovation system. In addition to performing a significant share of a country's R&D, it also provides training to the highly skilled workers on which knowledge economies rely.

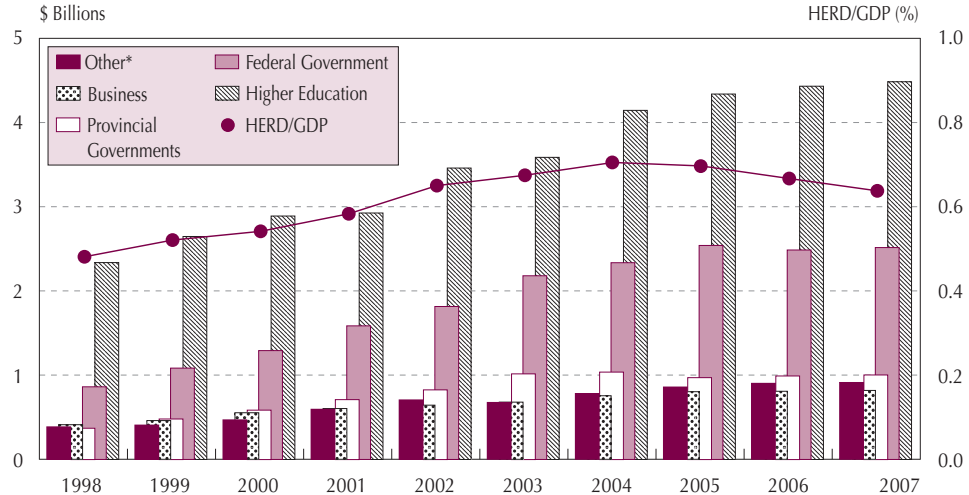
Canada's HERD reached $9.7 billion in 2007. Among OECD countries, Canada remained second, slightly behind Sweden, for its HERD-to-GDP ratio in 2006.

As in most OECD countries, Canadians with university degrees are twice as likely to be high-earners (earning twice the median income in the country) than those with college degrees.

Compared to the OECD average, Canada grants fewer natural science and engineering degrees (as a percentage of total degrees granted) but a relatively high share of social science degrees. However, Canada ranks fifth in the G7 for its number of doctoral graduates per million of population.

Scientific publications are one output of the higher education sector and those from Canada are of high quality.

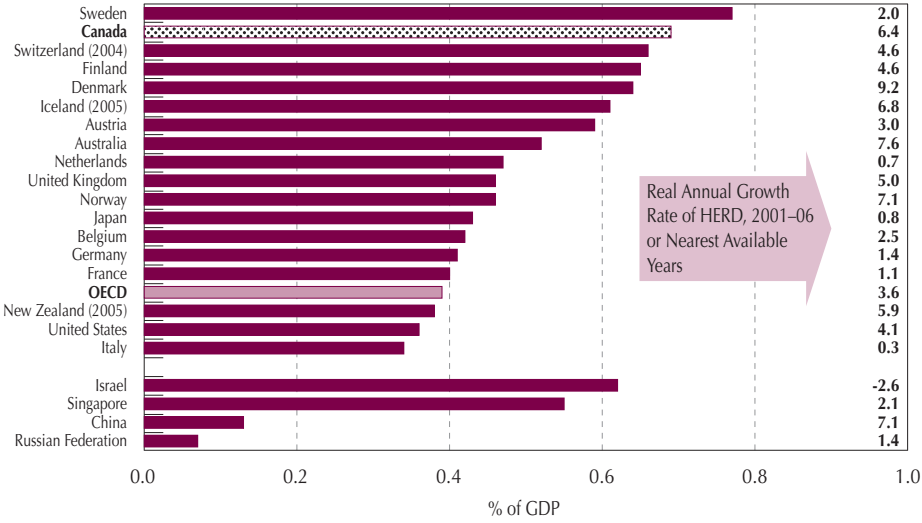
Canada's HERD by Major Source of Funds, 1998 to 2007



*Other includes foreign and private not-for-profit organizations.

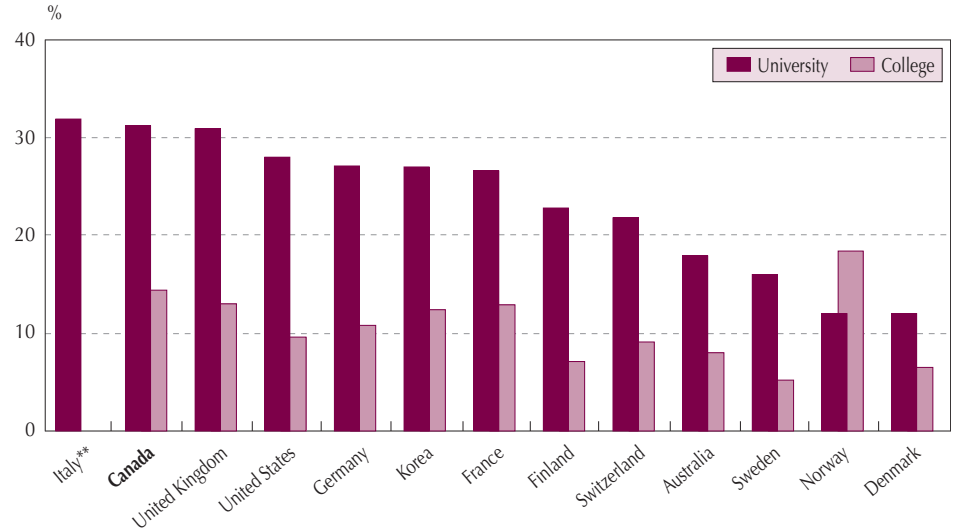
Source: Statistics Canada, *Gross Domestic Expenditures on Research and Development in Canada (GERD), and the Provinces*, Catalogue no. 88-221, December 2008.

HERD as a Percentage of GDP, Top OECD Countries and Selected Non-OECD Countries, 2006



Note: Government expenditures include those by federal, provincial and local governments.
Source: OECD, *Main Science and Technology Indicators (MSTI)*: 2008/2 edition, December 2008.

Percentage of High-Earners* Among Tertiary Degree Holders, Selected OECD Countries, 2006 (or Nearest Available Year)

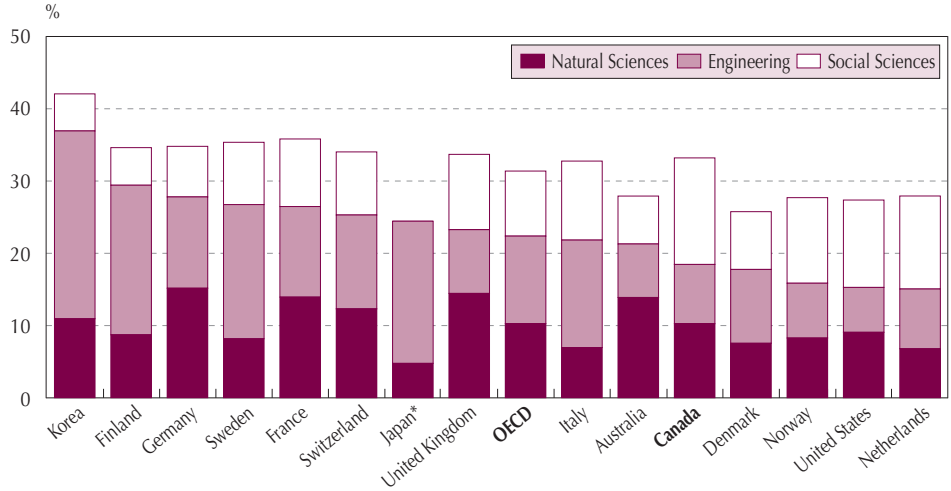


* High-earners are defined as individuals whose earnings are at, or above, twice the earning of the median individual in the country.

** College values are unavailable for Italy.

Source: OECD, *Education at a Glance 2008: OECD Indicators.*

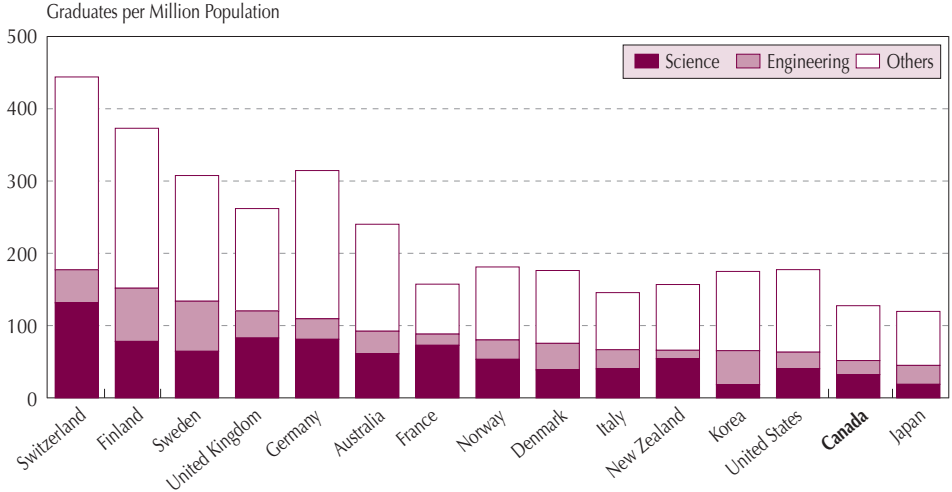
Science and Engineering Degrees as a Percentage of New Degrees, Selected OECD Countries, 2006



* The value pertaining to social science degrees was unavailable.

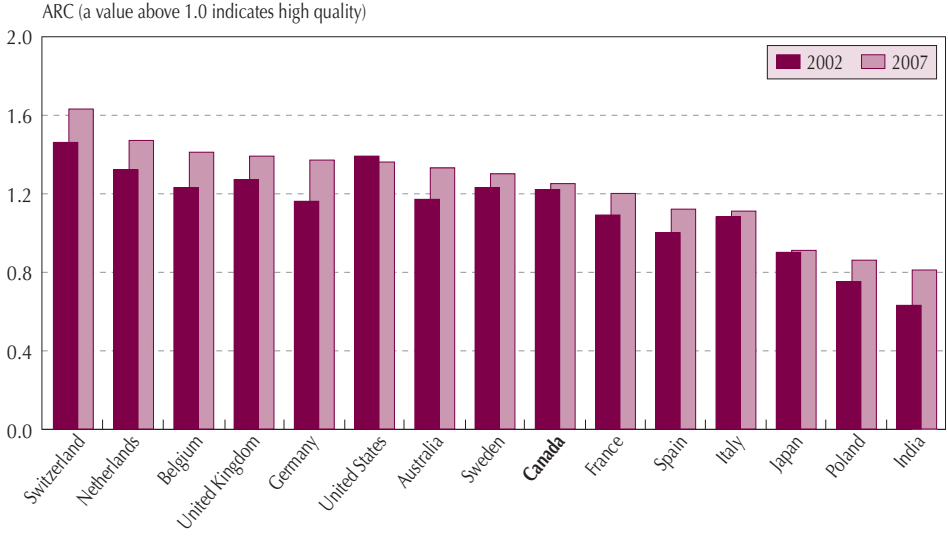
Source: OECD, *Education Database*, OECD.Stat extract, January 2009.

PhD Graduates in Science, Engineering and Other Fields, per Million Population, Selected OECD Countries, 2005



Note: Countries are ranked according to their PhD graduates in Natural Science and Engineering fields.
Source: OECD, *Science, Technology and Industry Outlook*, 2008.

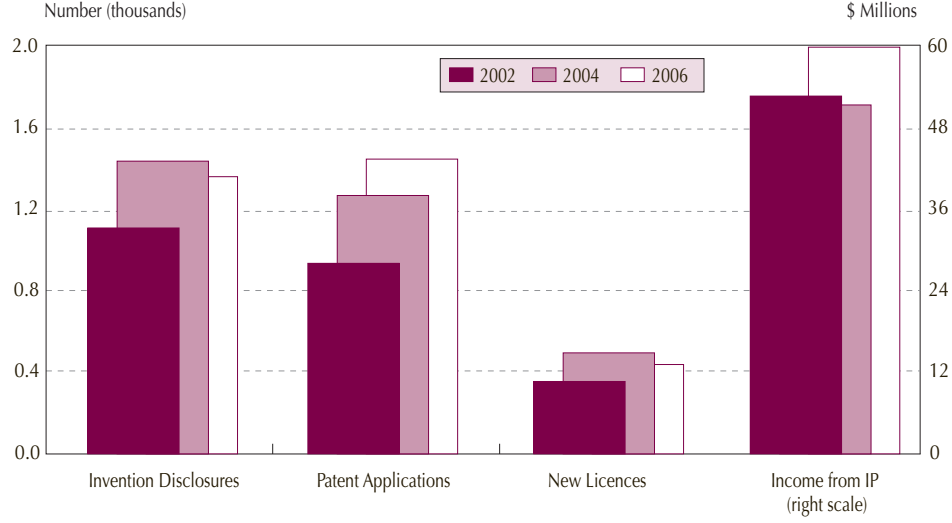
Average Relative Citations, Top 15 Countries,* 2002 and 2007



* Includes only countries with more than 10 000 publications.

Source: Observatoire des sciences et des technologies, Science Citation Index database, 2008.

Selected Commercialization Output of University Research, 2002, 2004 and 2006



Source: Statistics Canada, *Survey of Intellectual Property Commercialization, by Higher Education Sector Indicators,* 1998 to 2006, CANSIM Table 358-0025.

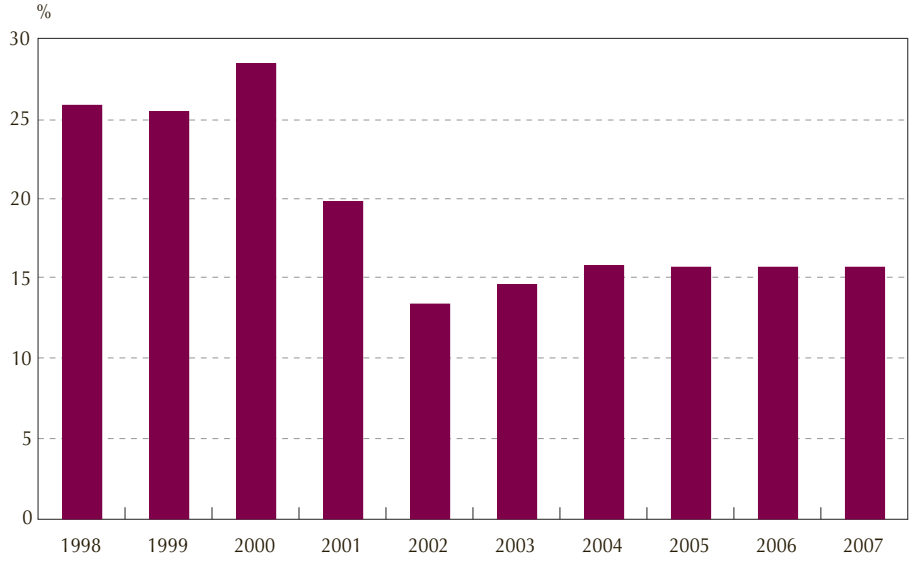
CANADA AND THE WORLD

In 2006, foreign sources funded a little over 15 percent of Canada's BERD. While this is lower than the 28 percent funded in 2000, Canada ranks 4th among OECD countries for its share of foreign-financed BERD.

Canada's interactions with other countries are not limited to BERD. Canada's researchers are also collaborating with foreign co-authors. Between 1997 and 2006, 41 percent of published Canadian papers were produced with a foreign co-author.

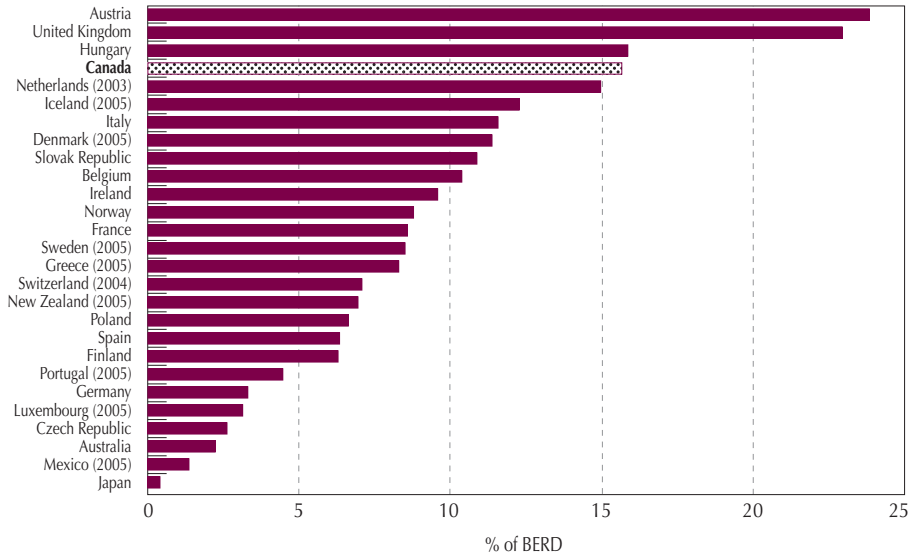
International trade is another avenue through which Canada interacts with other countries. It allows Canadian companies to both access new markets and obtain foreign technology. Among OECD countries, Canada ranks in the middle for its technology trade flows expressed as a share of GDP.

Percentage of BERD Funded by Foreign Sources, Canada, 1998 to 2007



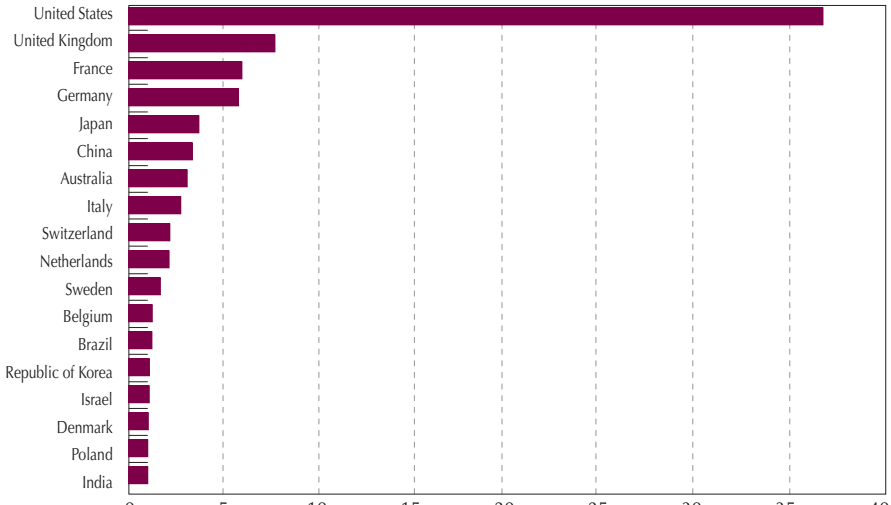
Source: OECD, *Main Science and Technology Indicators (MSTI)*: 2008/2 edition, December 2008.

Percentage of BERD Funded by Foreign Sources, Top OECD Countries, 2006



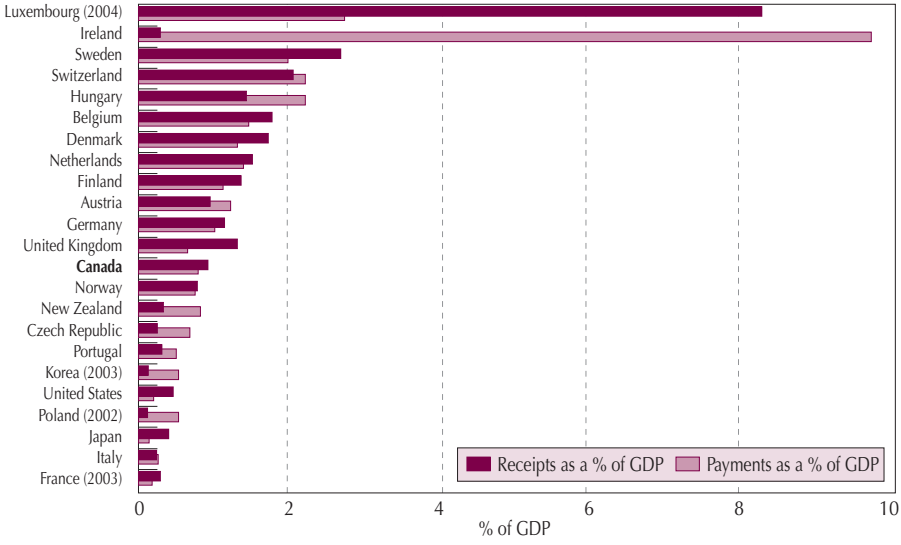
Source: OECD, *Main Science and Technology Indicators (MSTI)*: 2008/2 edition, December 2008.

Co-Authored Papers in Canada, Top Collaborating Countries, 1997 to 2006



Source: Science-Metrix, *Scientific Collaboration between Canada and California, a Bibliometric Study*, report submitted to the Department of Foreign Affairs and International Trade, 2008.

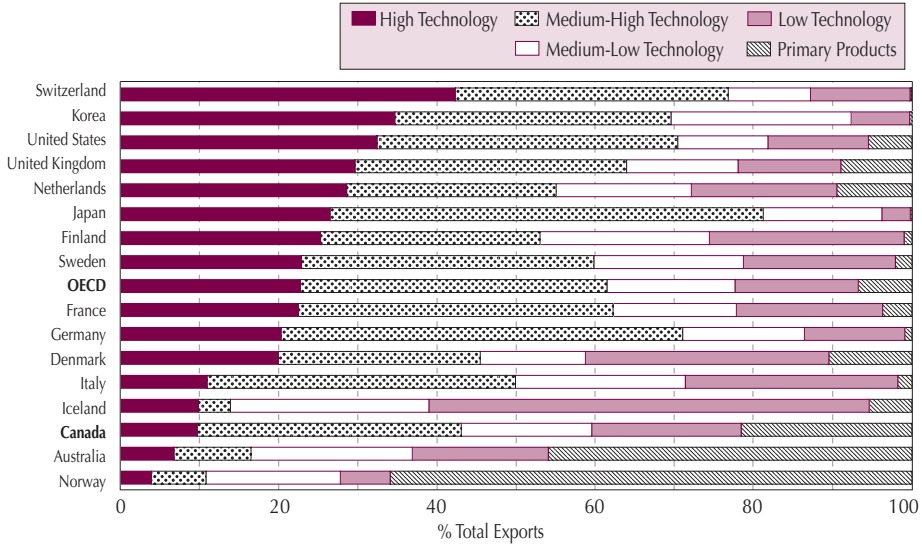
Technology Flows* as a Percentage of GDP, Top OECD Countries, 2005



* These measure technology transfers such as licence fees, patents, purchases and royalties paid, know-how, research and technical assistance.

Source: OECD, *Science, Technology and Industry Scoreboard 2007*.

Share of Technology Industries in Total Exports of Manufactured Goods and Primary Products, Selected OECD Countries, 2005



Note: Primary industries include Agriculture and Mining and Quarrying.
Source: OECD, *Science, Technology and Industry Scoreboard 2007*.

NOTES