

# **Canada's Innovation Performance: A preliminary benchmarking within the OECD**

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## **Abstract**

In response to Canada's Innovation Strategy "Achieving Excellence", the following research paper examines Canada's relative standing among the OECD countries across four areas as purported by Industry Canada: knowledge performance, skills development, innovation environment and community innovation.

This document was prepared by the Institute for Intellectual Capital Research as principal research investigator on behalf of Helix Commerce International Inc.'s application to Industry Canada's RFP # 79511 entitled: "Innovation Benchmarking Report.

## **Preamble**

Canada's goal must be to reverse a century of relative economic decline by raising the sustainable rate of growth. To achieve this, more Canadian businesses have to match the best in the world. The Government's aim is for Canadian business to close the performance gap with its competitors, in terms both of productivity and of its ability to produce innovative new products and create high-value services. The Government is determined that Canada will be a competitive and profitable base for business. To make the most of its capabilities, Canadian business needs to combine its innovative know-how with healthy investment and a flexible skilled workforce. In addition, Canada must guarantee modern infrastructure and macroeconomic stability in a world of ever greater pressure on material resources and the environment. Industry Canada must lead this process of modernisation by responding to the spur of competition and by exploiting market opportunities.

In the global economy, capital is mobile, technology spreads quickly and goods can be made in low cost countries and shipped to developed markets. Canadian business therefore has to compete by exploiting capabilities which competitors find hard to imitate. The distinctive capabilities are not raw materials, land or cheap labour. They must be our knowledge, skills and creativity. Crucially, the intellectual capital challenge is for all industries, not just new ones. Businesses in all sectors need to exploit new sources of competitive advantage and respond rapidly and flexibly to change. All businesses in Canada, large and small, manufacturing and services, low and high-tech, urban and rural, need to marshal their knowledge and skills to satisfy customers, exploit market opportunities and meet society's aspirations for a better environment.

## CANADA'S INNOVATION PERFORMANCE

Indicators that capture the changing relationship between innovation, science, technology, human capital and economic performance are crucial so that policy makers may make informed decisions, set priorities and address the challenges of the knowledge-based economy. This section reviews a set of indicators used for measuring the knowledge-based economy in four interconnected areas as set out by the Achieving Excellence document: knowledge performance, skills, innovation environment and community innovation. It also describes a proposed dataset that will be used to develop a benchmarking report, causal map and longitudinal examination.

### Background

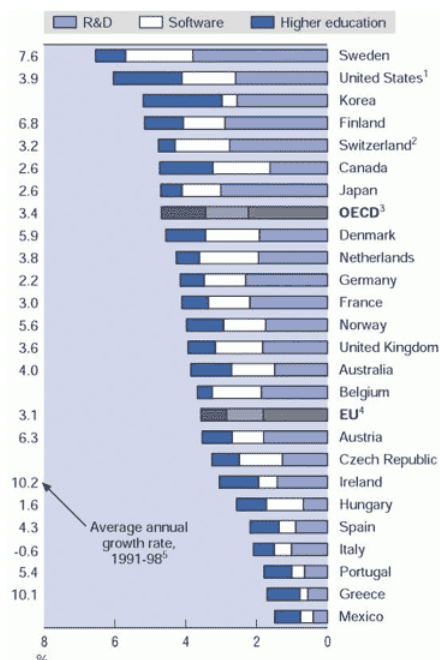
The ability to create, distribute and exploit knowledge is increasingly central to competitive advantage, wealth creation and better standards of living. Investment in knowledge, defined as public and private spending on higher education, expenditure on research and development (R&D) and investment in software, accounts for about 4.7% of OECD-wide GDP. ICT hardware and software have been the most dynamic area for investment. The available data show that it rose from less than 15% of total non-residential investment in the business sector in the early 1980s to between 15% and 35% in 1999. Investment in software accounted for 25-40% of the contribution of ICT to overall investment growth. Education and skills, which underpin the growth of a skilled workforce, account for the bulk of investment in knowledge. In 1999, 65% of the population aged 25-64 in the OECD area had completed upper secondary schooling. Despite a recent slowdown, venture capital remains a major source of funding for new technology-based firms. Between 1995 and 1999, it amounted to 0.21% of GDP in the United States and 0.16% of GDP in Canada and the Netherlands for early and expansion stages.

### Canada's Positioning within the OECD

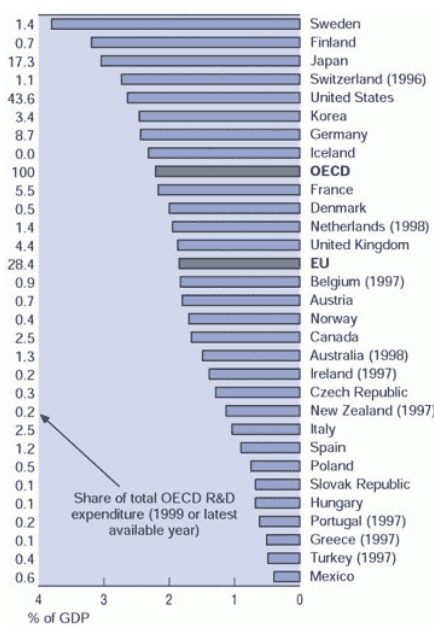
#### Knowledge Performance – R&D Investment

Canada currently invests 4.7% of GDP in its intellectual capital development. Of that total, 1.6% is attributed to R&D, 1.6% to software and 1.5% to public and private spending on higher education (see Table 1). Since 1991, Canada has increased investment by 2.6% whereas the OECD has increased by 3.4%. Canada currently ranks 6<sup>th</sup> in the OECD but must sustain its growth rate in order to maintain its position in the upper echelons of this group. OECD countries allocated about \$553 billion USD (current USD PPP) to R&D in 1999, or approximately 2.2% of overall GDP. OECD-area R&D expenditure in constant USD PPP has increased continuously over the past two decades (except during 1991-94), accelerating since the mid-1990s. Between 1981 and 1999, it grew by 4% annually. Most of the increase between 1994 and 1999 is due to the United States.

Investment in intellectual capital as a % of GDP



Expenditure on R&D as a % of GDP



Sweden, Finland and Japan are the only three OECD countries that allocate more than 3% of their GDP to R&D, well above the OECD average of 2.2%. The fastest growth in R&D expenditure during the 1990s occurred in Ireland, Mexico and Iceland, which had average annual growth rates of more than 13% (see Table 2).

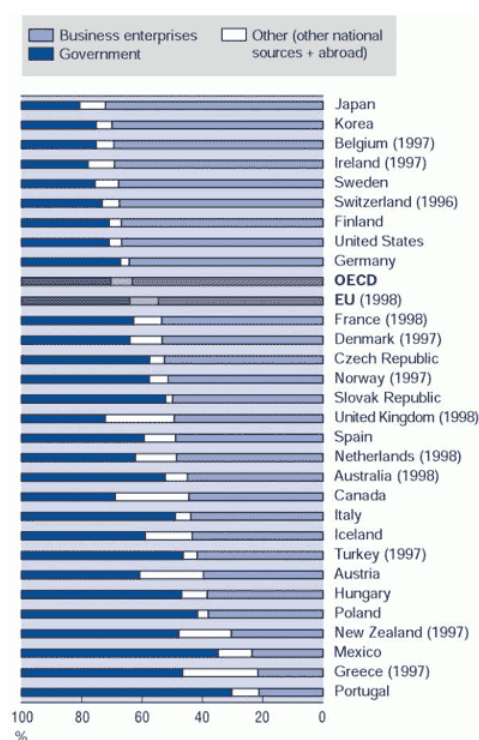
### Knowledge Performance – Business Investment in R&D

The business sector is the major source of financing of total domestic R&D (GERD). In 1999, it provided more than 60% of funding for domestic R&D carried out in OECD countries, a slight increase from 1990.

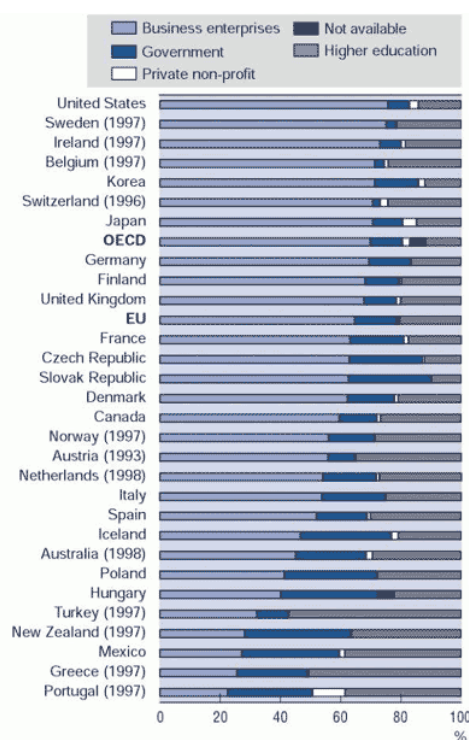
The role of the business sector in funding R&D differs sharply across regions. About 72% of R&D in Japan and 67% of R&D in the United States is funded by the business sector, compared with 55% in the European Union and only 44.5% in Canada (see Table 3). During the 1990s, the share of business funding of R&D increased significantly in the United States; it remained stable in Japan and increased slightly in the European Union.

About 59.6% of Canada's overall R&D expenditure was performed by business which is lower than the OECD average of 69.9%. However, Canada's R&D performance by Higher Education was equal to 26.7% of overall R&D performance which is higher than the OECD average of 17.0% (see Table 4).

**R&D expenditures by source of financing**



**R&D expenditures by performing sector**



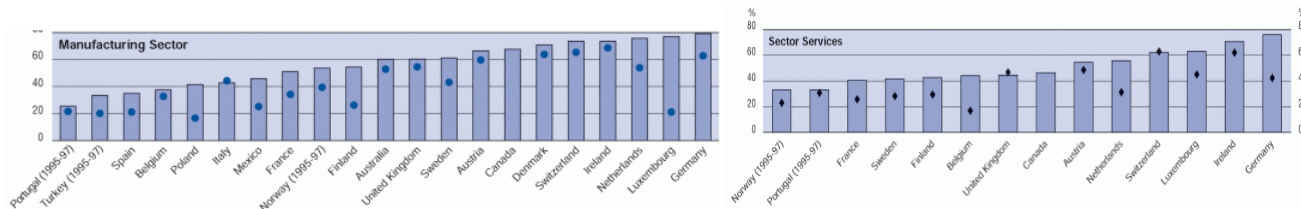
Canada has remained stable with an investment of 1.66% in 1999 having peaked at 1.77% in 1994 (see Table 2). From 1991 to 1999 Canada's growth in gross domestic expenditure on R&D (GERD) was 3.57%. This compares favourably to the OECD growth rate of 2.78% but falls short of the highest growth county which is Ireland at 13.91%.

### Knowledge Performance – Innovation Output

Data from innovation surveys are available for a limited number of countries. Such surveys are relatively new and data may not be comparable across countries. In particular, the coverage of services is partial in some countries. The share of firms having introduced at least one new or improved product or process on the market over a given period of time is an indicator of the output of innovative activities. It is weighted here by number of employees. In most countries, innovative firms (weighted by size) represent between 25% and 80% of all firms.

For most countries, and notably Norway and Sweden, the share of innovative firms is higher in manufacturing than in services. The exceptions are Portugal and Belgium, and to a lesser extent Germany and Ireland, where a higher proportion of innovative firms are in services. In Canada, 67.4% of manufacturing firms and 46.4% of services firms introduced new technology from 1994-1996 (see Table 5).

**Share of firms that introduction new technology (1994-1996)**

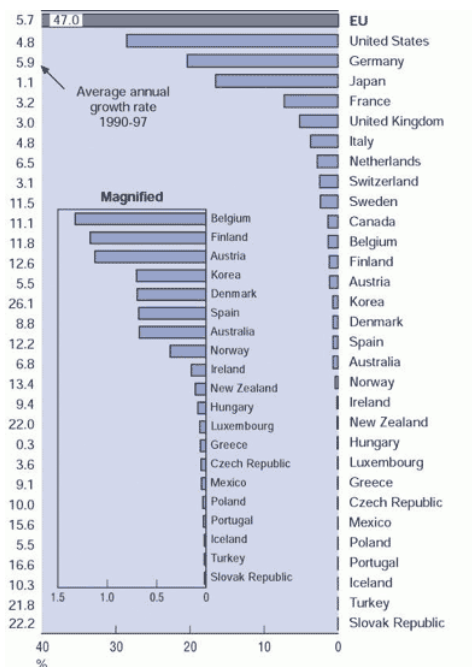


Patent-based statistics are widely used indicators of the output of inventive activity. There were 82 846 patent applications filed by OECD countries at the European Patent Office (EPO) in 1997 (priority year), a 37% increase from 1990.

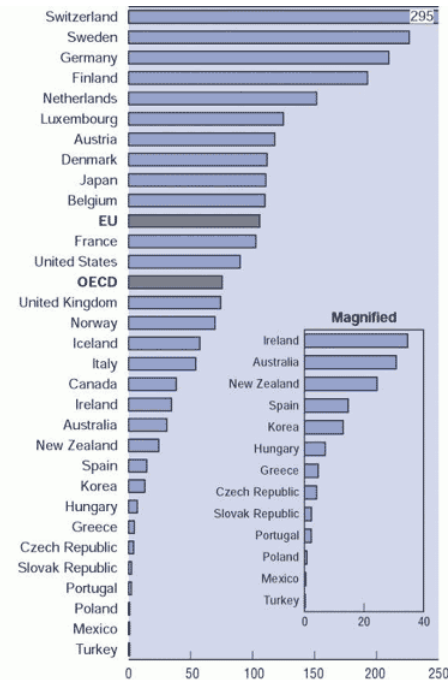
Almost half of the total patent applications filed at the EPO are from European Union countries, far above the shares of the United States (29%) and Japan (17%). However, the European Union’s share most likely overestimates its actual share in world inventions owing to the “home advantage” factor, as patents taken at the EPO primarily reflect the domestic market of the European countries.

Canada filed 38.45 patents per 100 million people to the EPO which is lower than the OECD average of 75.56. However, Canadian inventors typically file with the USPO first given its close proximity. The average growth of patent applications in Canada has been 11.1% from 1990-1997 which is significantly higher than the OECD.

**Share of countries in EPO patent applications**



**Patent applications per million population**



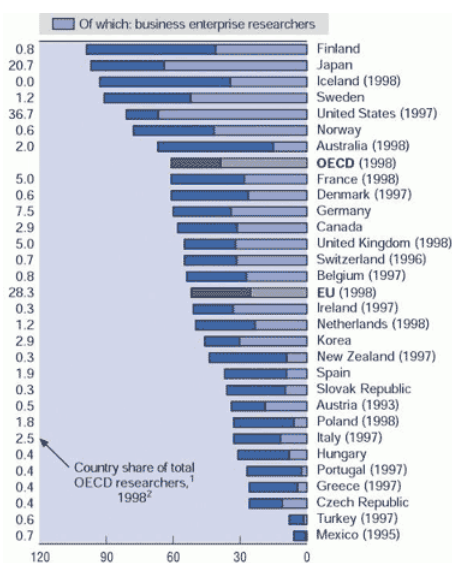
### Skills Development – Education

Measures of educational attainment are the most commonly used proxies for human capital, despite their imperfections; for example, they do not cover quality of schooling and formal or on-the-job training. In the OECD area, 65% of the population aged 25-64 has completed secondary schooling and 14% of the population aged 25-64 have attained tertiary-level education. The share is highest in the United States, Norway and the Netherlands (above 20%) whereas Canada has 19% of the population aged 25-64 with tertiary-level education (see Table 6).

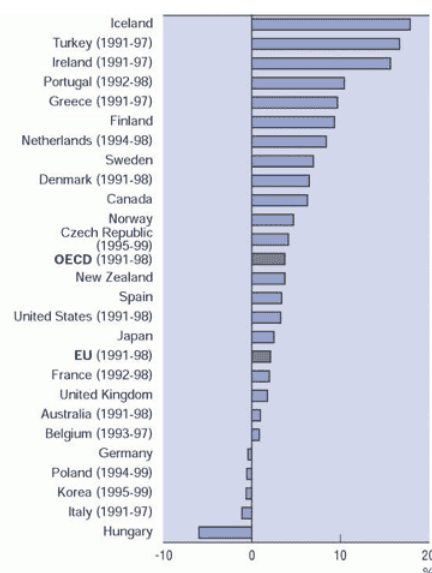
Expenditure per student for tertiary level education varies by a factor of 8 between Turkey at the lowest end (\$2,397 USD PPP) and the United States at the highest (\$18,493) roughly double the OECD average (\$9,255). Canada's expenditure per student in public and private institutions is \$14,579.

In 1998, approximately 3.2 million researchers were engaged in R&D in the OECD area. This corresponds to about 61 researchers per 10 000 labour force, a significant increase from the 1991 level (54 researchers per 10 000 labour force). In the major OECD regions, Japan has the highest number of researchers relative to the labour force, followed by the United States and the European Union. However, around 37% of total OECD area researchers reside in the United States, 28% in the European Union and 21% in Japan. Five large OECD countries (the United States, Japan, Germany, France and the United Kingdom) account for about 75% of all OECD researchers. Canada's researchers has grown from a level of 46 per 10,000 labour force in 1990 to 60 in 1995 and 58 in 1999.

Researchers per 10,000 labour (1999)



Annual growth of business researchers (1991-1999)



### Skills Development – Access

The Internet continues to grow at an extremely fast pace. By October 2000, the number of Internet hosts in the OECD area reached 90 million, up from 54 million in July 1999. Telecommunication networks continue to expand rapidly. At the end of 1999, OECD countries had more than one network access channel for every two inhabitants, and several had more than one access channel per inhabitant. In terms of standard access lines, Sweden has long enjoyed the highest penetration rate in the OECD area, and it remains the OECD country with the highest PSTN (public switched telephone network) in terms of fixed network penetration. However, other networks, such as wireless and high speed networks, also need to be taken into consideration in terms of access to communication.

The Nordic countries maintain a clear lead over the rest of the OECD area when the connectivity provided by wireless networks is taken into account. The leading countries are Norway, Sweden, Iceland and Finland. All had more than 120 telecommunication access paths per 100 inhabitants by the end of 1999.

Differences in the development of individual access paths in OECD countries will depend on the development of the network, the relative pricing structure and the level of competition for a particular access technology. Countries with low penetration rates for standard access lines (Czech Republic, Hungary, Poland, Mexico, Turkey and to a lesser extent Ireland) have continued to expand their network in the 1990s. In countries with un-metered telecommunications pricing (e.g. Australia, Canada, the United States), a second residential line is generally used to keep a line free for telephony.

In countries with metered telecommunication charges, it is sometimes as economical to install an ISDN connection as to have two standard access lines. Access to mobile communications, typically higher in the Nordic countries, has spread rapidly to other countries, especially to those ones where operators have actively-marketed prepaid cards.

With increased demand for higher speed Internet access, new access channels are emerging and ISDN lines are likely to be rapidly overtaken by digital subscriber lines (DSL) or cable modems. By the end of 2000, there were 22 countries with commercial high-speed digital subscriber line services – up from just seven in 1999. High-speed Internet access via cable modems was available in 21 OECD countries.

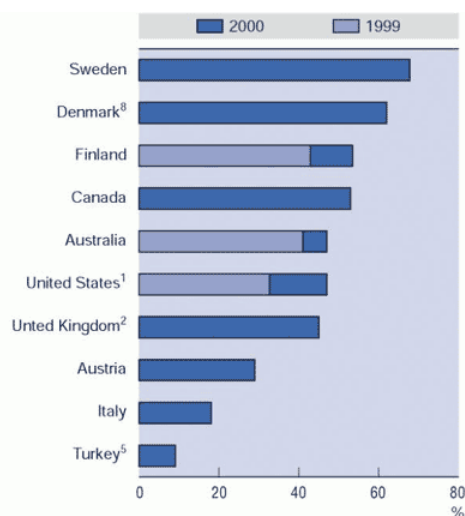
This is beginning to change the access landscape. For example, although Korea has had a low penetration rate for some Internet access indicators, its broadband penetration rate increased from 0.6 per 100 inhabitants at the end of 1999 to 10.3 at the end of February 2001. Only two other countries – Canada (4.54) and the United States (2.25) – had exceeded two broadband subscribers per 100 inhabitants by the end of 2000. The trend towards greater infrastructure competition in local markets will encourage the shift towards higher speed access technologies.

As of 1999, Canada had 65.5 telecommunications channels per 100 inhabitants and 88.1 fixed and wireless access paths per 100 inhabitants. Both these are figures are slightly above the OECD average but well below the leading nations of the world (see Table 6).

**DSL and cable modem lines per 100 inhabitants (2001)**



**Individuals using Internet from any location**



### ***Innovation Environment – Tax***

Most OECD countries have special tax schemes for R&D expenditures, such as immediate write-off of current R&D expenditures (all except New Zealand) and various types of R&D tax credits. As a policy instrument, tax credits are on the rise in OECD countries. The most significant moves towards a favourable R&D tax regime occurred in Portugal, the Netherlands and Austria in the 1990-99 period (see Table 7).

Depending on the country, R&D tax credits can be “flat rate” (e.g. on the amount of R&D, as in Canada) or “incremental” (e.g. taking account of the difference between current R&D and a past reference point as in the United States). Tax relief may apply equally to all firms performing R&D or give special treatment to small firms or to collaborative R&D.

These schemes resulted in tax subsidies for R&D in 12 OECD countries in 1999. The largest subsidies are observed for Spain, Canada and Portugal (large firms). Tax subsidies are calculated as 1 minus the B-index. The B-index is defined as the present value of before-tax income necessary to cover the initial cost of R&D investment and to pay corporate income tax, so that it becomes profitable to perform research activities. Algebraically, the B-index is equal to the after-tax cost of an expenditure of USD 1 on R&D divided by one minus the corporate income tax rate. The after-tax cost is the net cost of investing in R&D, taking into account all the available tax incentives. For example, in Canada 1 dollar of R&D expenditure by large firms results in 17 cents of tax relief.

There are no R&D subsidies for large firms in Italy and the United Kingdom, but both countries have a favourable tax credit system for small and medium-sized firms. In most countries, tax incentives are geared more towards SMEs than towards large firms. R&D subsidies in Australia decreased significantly over the 1990-99 period, due to a reduction of the depreciation allowances from 150% to 125%.

### ***Innovation Environment – Venture Capital***

Although venture capital investment is quite small relative to GDP, it is a major source of funding for new technology-based firms and plays a crucial role in promoting the radical innovations often carried out by these firms.

As the venture capital market is extremely dynamic over short time periods, the country profiles reflect the situation at that time. Since the second quarter of 2000, venture capital investment has declined sharply.

Countries such as the United States, Canada, the Netherlands and Iceland have significant venture capital investment relative to GDP and tend to direct finance towards firms in their early stages. In contrast, countries such as Portugal and Spain have low venture capital investment relative to GDP and tend to finance the expansion of firms already present. Between 1995 and 1999, venture capital investment for early and expansion stages amounted to 0.21% of GDP in the United States and 0.16% of GDP in Canada and the Netherlands (see Table 7).

High-technology sectors (communications, information technology and health and biotechnology) accounted for more than 80% of total venture capital investment in the United States and around 67% in Canada. This is far above the figures for Japan and the European Union.

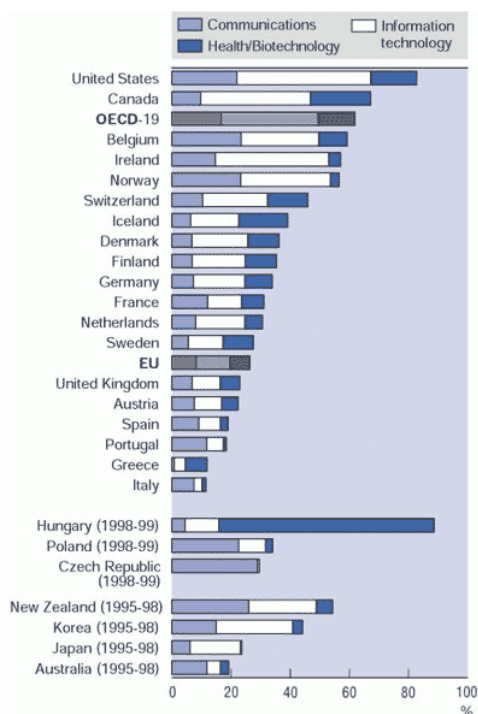
For most OECD countries, information technology accounts for the bulk of venture capital investment. It accounts for more than a third of total venture capital in the United States (45%), Ireland (38%) and Canada (37%).

A significant proportion of the venture capital of Scandinavian countries, Switzerland, Canada and Greece is directed towards financing firms in the health and biotechnology sectors; the share of Japanese venture capital invested in this sector is almost negligible.

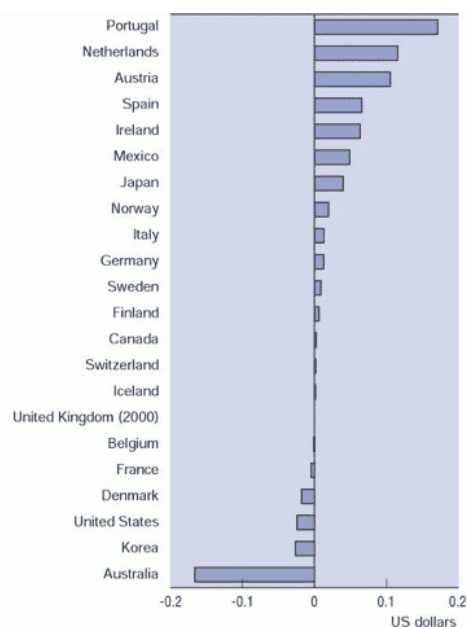
International flows of venture capital are increasing. Firms from the United States increasingly invest in Europe and Asia, and there is also significant cross-border investment within Europe and Asia.

International flows of venture capital to Denmark and Ireland (country of destination), are more than four times the investments managed by their domestic venture capital firms (country of management).

### High-tech sectors in total venture capital (1995-99)



### Change in the rate of tax subsidies for R&D (1990-99)



### Community Innovation – Localized Clusters

There are three types of innovation cluster approaches. Flagship research programs are those that conduct internationally significant research, that foster achieve significant success in national and global research competition. Though no jurisdiction has achieved an optimal policy environment, Quebec, Alberta, Michigan, North Carolina, and Scotland within the United Kingdom provide strong examples of the productive flagship and federation approach. British Columbia has been erratic in its policies, investing strategically in flagship research at times, to the benefit of the province, and then freezing or retracting significant support such that its research performance has been uneven and is presently lagging behind.

Of the U.S. jurisdictions studied, Ohio and Massachusetts took different approaches. Ohio, for the most part, emphasized a policy of strengthening system consistency. Massachusetts took a laissez-faire approach, avoiding any strategic university research policy and depending heavily on industrial R&D investment and the success of its flagship private universities to create national and international research success. Neither strategy has served to recession-proof and they are now moving to develop more strategic state research policies that have led to successes in other jurisdictions.

Ontario, by comparison, has recently taken bold steps to implement progressive research programs to advance innovation. Historically, however, it has lacked a coherent research policy and has fallen behind the growth of Quebec and Alberta in federal competition for research funding. While Ontario previously experienced an historic high of close to 45% success in attracting federal granting council awards from the Social Sciences and Humanities Research Council (SSHRC), the Medical Research Council (MRC) and the Natural Sciences and Engineering Research Council (NSERC), it is currently attracting only 38% of federal awards allocated through competition and has attracted as little as 35% of these awards in recent years. Ontario is underperforming significantly in relation to its numbers, talent, research capacity and potential. Ontario is uniquely positioned to create a highly productive hybrid university research policy that simultaneously grows its internationally competitive flagship research programs, increases the benefits of research to student education and workforce preparation, and fosters opportunities for seeding and growing research excellence through competition and collaboration within university clusters and with industry, government and other university research partners (see Table 8).

Table 1 Investment in knowledge and gross fixed capital formation

|                             | Investment in knowledge      |     |          |   |                                    | Gross fixed capital formation |                         |       |                                    |
|-----------------------------|------------------------------|-----|----------|---|------------------------------------|-------------------------------|-------------------------|-------|------------------------------------|
|                             | As a percentage of GDP, 1998 |     |          |   | Average annual growth rate 1991-98 | As a percentage of GDP, 1998  |                         |       | Average annual growth rate 1991-98 |
|                             | Total                        | R&D | Software | Public and private spending on higher education |                                    | Total                         | Machinery and Equipment | Other |                                    |
| Canada                      | 4.7                          | 1.6 | 1.6      | 1.5   | 2.6                                | 19.6                          | 9.4                     | 10.2  | 3.0                                |
| Mexico                      | 1.5                          | 0.4 | 0.4      | 0.7   | ..                                 | 20.9                          | 11.1                    | 9.8   | 4.6                                |
| United States <sup>1</sup>  | 6.0                          | 2.6 | 1.5      | 1.9   | 3.9                                | 19.2                          | 9.1                     | 10.2  | 6.2                                |
| Australia                   | 3.9                          | 1.5 | 1.2      | 1.2   | 4.0                                | 23.8                          | 8.7                     | 15.1  | 6.2                                |
| Japan                       | 4.7                          | 3.0 | 1.1      | 0.6   | 2.6                                | 26.8                          | 10.5                    | 16.3  | -1.2                               |
| Korea                       | 5.2                          | 2.6 | 0.4      | 2.2   | ..                                 | 29.8                          | 8.9                     | 20.9  | 0.7                                |
| Austria                     | 3.5                          | 1.8 | 0.9      | 0.8   | 6.3                                | 23.5                          | 9.0                     | 14.5  | 1.4                                |
| Belgium                     | 3.7                          | 1.9 | 1.4      | 0.4   | ..                                 | 20.9                          | 10.7                    | 10.1  | 1.3                                |
| Czech Republic              | 3.3                          | 1.3 | 1.2      | 0.8   | ..                                 | 28.1                          | 16.6                    | 11.5  | 3.7                                |
| Denmark                     | 4.6                          | 1.9 | 1.5      | 1.1   | 5.9                                | 20.5                          | 8.5                     | 12.0  | 3.5                                |
| Finland                     | 5.2                          | 2.9 | 1.2      | 1.1   | 6.8                                | 18.7                          | 7.0                     | 11.7  | -1.2                               |
| France                      | 4.1                          | 2.2 | 1.2      | 0.8   | 3.0                                | 18.3                          | 6.7                     | 11.7  | -1.1                               |
| Germany                     | 4.2                          | 2.3 | 1.2      | 0.7   | 2.2                                | 21.3                          | 7.8                     | 13.6  | -0.2                               |
| Greece                      | 1.7                          | 0.6 | 0.2      | 0.9   | 10.1                               | 21.6                          | 8.0                     | 13.6  | 1.2                                |
| Hungary                     | 2.6                          | 0.7 | 1.0      | 0.8   | 1.6                                | 23.6                          | ..                      | 23.6  | 2.6                                |
| Ireland                     | 3.1                          | 1.4 | 0.5      | 1.1   | 10.2                               | 21.9                          | 7.6                     | 14.3  | 10.7                               |
| Italy                       | 2.1                          | 1.0 | 0.5      | 0.6   | -0.6                               | 18.5                          | 8.9                     | 9.7   | -0.4                               |
| Netherlands                 | 4.3                          | 2.0 | 1.7      | 0.7   | 3.8                                | 21.7                          | 7.9                     | 13.8  | 2.6                                |
| Norway                      | 4.0                          | 1.7 | 1.2      | 1.0   | 5.6                                | 25.0                          | 8.7                     | 16.3  | 5.8                                |
| Portugal                    | 1.8                          | 0.6 | 0.4      | 0.8   | 5.4                                | 26.2                          | 9.4                     | 16.7  | 3.7                                |
| Spain                       | 2.2                          | 0.9 | 0.5      | 0.8   | 4.3                                | 22.9                          | 7.1                     | 15.8  | 0.8                                |
| Sweden                      | 6.5                          | 3.8 | 1.9      | 0.8   | 7.6                                | 16.0                          | 7.9                     | 8.1   | -2.2                               |
| Switzerland <sup>2</sup>    | 4.8                          | 2.8 | 1.5      | 0.5   | 3.2                                | 20.0                          | 9.9                     | 10.0  | -2.8                               |
| United Kingdom              | 3.9                          | 1.8 | 1.3      | 0.8   | 3.6                                | 17.4                          | 8.6                     | 8.8   | 2.2                                |
| European Union <sup>3</sup> | 3.6                          | 1.8 | 1.0      | 0.7   | 3.1                                | 19.9                          | 8.0                     | 11.9  | 0.4                                |
| Total OECD <sup>4</sup>     | 4.7                          | 2.2 | 1.2      | 1.2   | 3.4                                | 21.0                          | 9.0                     | 12.0  | 2.2                                |

1. Education data includes post-secondary non-tertiary education (ISCED 4).

2. Average annual growth rate refers to 1992-98.

3. Average annual growth rate excludes Belgium.

4. OECD total refers to the available countries and the average annual growth rate excludes Belgium, Czech Republic, Korea, Mexico and Switzerland.

5. 1995 US dollars using purchasing power parities.

Source: OECD, National Accounts database; Education database; MSTI database and International Data Corporation, March 2001.

Total investment in knowledge is defined and calculated as the sum of expenditure on R&D, on total higher education from both public and private sources and on software. Simple summation of the three components would lead to overestimation of the investment in knowledge owing to overlaps between the three components (R&D and software, R&D and education, software and education). Therefore, before calculating the total investment in knowledge, the data required various transformations in order to derive figures that meet the definition. The R&D component of higher education, which overlaps R&D expenditure, was estimated and subtracted from total higher education expenditure (both public and private sources). All expenditure on software cannot be considered investment. Some is considered as consumption. Purchase of packaged software by households and operational services in firms was estimated using data from private sources and excluded. The software component of R&D, which overlaps R&D expenditure, was estimated using information from national studies and subtracted from software expenditure.

Table 2 **Gross domestic expenditure on R&D (GERD)**  
As a percentage of GDP

|                          | 1981               | 1985               | 1990               | 1991               | 1992               | 1993               | 1994               | 1995               | 1996               | 1997               | 1998 | 1999 |
|--------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|------|------|
| Canada                   | 1.24               | 1.44               | 1.54 <sup>10</sup> | 1.60               | 1.66               | 1.71               | 1.77               | 1.74               | 1.70               | 1.71               | 1.71 | 1.66 |
| Mexico                   | ..                 | ..                 | ..                 | ..                 | ..                 | 0.22               | 0.29               | 0.31               | 0.31               | 0.34               | 0.46 | 0.40 |
| United States            | 2.37               | 2.78               | 2.65 <sup>10</sup> | 2.72               | 2.65               | 2.52               | 2.42               | 2.50               | 2.54               | 2.57               | 2.60 | 2.64 |
| Australia <sup>1</sup>   | 0.95               | ..                 | 1.31               | ..                 | 1.52               | ..                 | 1.57               | ..                 | 1.65               | ..                 | 1.49 | ..   |
| Japan <sup>2</sup>       | 2.13               | 2.58               | 2.85               | 2.82               | 2.76               | 2.68               | 2.63               | 2.77               | 2.83 <sup>10</sup> | 2.90               | 3.04 | 3.04 |
| Korea                    | ..                 | ..                 | ..                 | 1.92               | 2.03               | 2.22               | 2.44               | 2.50               | 2.60               | 2.69               | 2.55 | 2.46 |
| New Zealand              | ..                 | ..                 | 1.00               | 0.99               | 1.01 <sup>10</sup> | 1.02               | ..                 | 0.97               | ..                 | 1.13               | ..   | ..   |
| Austria                  | 1.13               | 1.24               | 1.39               | 1.47               | 1.45               | 1.47               | 1.54               | 1.56 <sup>10</sup> | 1.60               | 1.69               | 1.80 | 1.80 |
| Belgium <sup>3</sup>     | 1.57               | 1.63 <sup>10</sup> | 1.64 <sup>10</sup> | 1.62               | ..                 | 1.75 <sup>10</sup> | 1.74               | 1.74               | 1.82               | 1.83               | ..   | ..   |
| Czech Republic           | ..                 | ..                 | ..                 | 2.02               | 1.72               | 1.21               | 1.10               | 1.01 <sup>10</sup> | 1.03               | 1.17               | 1.27 | 1.29 |
| Denmark                  | 1.06               | 1.21               | 1.57 <sup>10</sup> | 1.64               | 1.68               | 1.74               | ..                 | 1.84               | 1.85               | 1.94               | 1.92 | 2.00 |
| Finland                  | 1.17 <sup>10</sup> | 1.55               | 1.88               | 2.04 <sup>10</sup> | 2.13               | 2.17               | 2.29               | 2.29               | 2.54               | 2.72               | 2.89 | 3.19 |
| France                   | 1.93 <sup>10</sup> | 2.22               | 2.37               | 2.37               | 2.38               | 2.40               | 2.34               | 2.31               | 2.30               | 2.22 <sup>10</sup> | 2.18 | 2.17 |
| Germany <sup>4</sup>     | 2.47               | 2.75               | 2.75               | 2.53 <sup>10</sup> | 2.41 <sup>10</sup> | 2.35               | 2.26               | 2.26               | 2.26               | 2.29               | 2.31 | 2.44 |
| Greece <sup>5</sup>      | 0.17 <sup>10</sup> | 0.27 <sup>10</sup> | 0.37 <sup>10</sup> | 0.36               | ..                 | 0.47               | ..                 | 0.49 <sup>10</sup> | ..                 | 0.51               | ..   | ..   |
| Hungary                  | ..                 | ..                 | 1.46               | 1.06               | 1.04               | 0.97               | 0.88 <sup>10</sup> | 0.73 <sup>10</sup> | 0.65               | 0.72               | 0.68 | 0.68 |
| Iceland                  | 0.63               | 0.73               | 0.98               | 1.16               | 1.33               | 1.33               | 1.38               | 1.54               | ..                 | 1.84               | 2.04 | 2.32 |
| Ireland                  | 0.68               | 0.77               | 0.83 <sup>10</sup> | 0.93               | 1.04               | 1.17               | 1.31               | 1.34               | 1.40               | 1.39               | ..   | ..   |
| Italy                    | 0.88               | 1.12               | 1.29               | 1.23 <sup>10</sup> | 1.18               | 1.13               | 1.05               | 1.00               | 1.01               | 0.99               | 1.02 | 1.04 |
| Netherlands              | 1.78               | 1.97 <sup>10</sup> | 2.07 <sup>10</sup> | 1.97               | 1.90               | 1.92               | 1.95 <sup>10</sup> | 1.99 <sup>10</sup> | 2.01               | 2.04               | 1.95 | ..   |
| Norway <sup>6</sup>      | 1.18               | 1.49 <sup>10</sup> | 1.69               | 1.65               | ..                 | 1.73               | ..                 | 1.71 <sup>10</sup> | ..                 | 1.66               | ..   | 1.70 |
| Poland                   | ..                 | ..                 | ..                 | ..                 | ..                 | ..                 | 0.76               | 0.69               | 0.71               | 0.71               | 0.72 | 0.75 |
| Portugal <sup>7</sup>    | 0.30               | 0.34               | 0.51               | ..                 | 0.61               | ..                 | ..                 | 0.57 <sup>10</sup> | ..                 | 0.62               | ..   | 0.77 |
| Slovak Republic          | ..                 | ..                 | 1.75               | 2.25               | 1.88 <sup>10</sup> | 1.45               | 0.96 <sup>10</sup> | 0.98               | 0.97               | 1.13               | 0.82 | 0.68 |
| Spain                    | 0.41               | 0.53               | 0.81               | 0.84               | 0.88 <sup>10</sup> | 0.88               | 0.81               | 0.81 <sup>10</sup> | 0.83               | 0.82               | 0.90 | 0.89 |
| Sweden                   | 2.21 <sup>10</sup> | 2.78               | 2.84               | 2.79               | ..                 | 3.27 <sup>10</sup> | ..                 | 3.46 <sup>10</sup> | ..                 | 3.67               | ..   | 3.80 |
| Switzerland <sup>8</sup> | 2.18               | 2.82 <sup>10</sup> | 2.83 <sup>10</sup> | ..                 | 2.66               | ..                 | ..                 | ..                 | 2.73               | ..                 | ..   | ..   |
| Turkey                   | ..                 | ..                 | 0.32               | 0.53               | 0.49               | 0.44               | 0.36               | 0.38               | 0.45               | 0.49               | ..   | ..   |
| United Kingdom           | 2.38 <sup>10</sup> | 2.24 <sup>10</sup> | 2.16               | 2.08               | 2.09               | 2.12               | 2.07               | 1.98               | 1.91               | 1.84               | 1.83 | 1.87 |
| European Union           | 1.69               | 1.87               | 1.96               | 1.90 <sup>10</sup> | 1.89 <sup>10</sup> | 1.88               | 1.83               | 1.81               | 1.81               | 1.80               | 1.81 | 1.85 |
| Total OECD <sup>9</sup>  | 1.97               | 2.28               | 2.30 <sup>10</sup> | 2.24 <sup>10</sup> | 2.20               | 2.15               | 2.10               | 2.11 <sup>10</sup> | 2.14               | 2.16               | 2.18 | 2.21 |

1. 1996 instead of 1995.

2. Adjusted by OECD up to 1995.

3. 1983 instead of 1981; 1989 instead of 1990.

4. Figures for Germany from 1991 onwards refer to unified Germany.

5. 1986 instead of 1985; 1989 instead of 1990.

6. 1989 instead of 1990.

7. 1982 instead of 1981; 1984 instead of 1985.

8. 1986 instead of 1985; 1989 instead of 1990.

9. Includes Mexico and Korea from 1991, and Czech Republic, Hungary, Poland and Slovak Republic from 1995.

10. Break in series from previous year for which data are available.

Source: OECD, MSTI database, May 2001.

Resources allocated to a country's R&D efforts are measured using two indicators, R&D expenditure and personnel. For R&D expenditure, the main aggregate used for international comparisons is gross domestic expenditure on R&D (GERD), the domestic R&D-related expenditure of a country for a given year. R&D data were compiled on the basis of the methodology of the Frascati Manual 1993 (OECD, Paris, 1994). The magnitude of estimated resources allocated to R&D is affected by several national characteristics, principally:

Improvements in national surveys on R&D: this includes wider coverage of firms, particularly in the services sector (United States, 1992; Norway, 1987 and 1995; the Netherlands, 1994; Japan, 1995); and improved estimates of resources allocated to R&D by the higher education sector (Finland, 1991; Germany, 1987; Greece, 1989; Japan, 1996; the Netherlands, 1990; Spain, 1992).

Improved international comparability: in Japan, R&D personnel data are expressed in full-time equivalents as of 1996 (previously, these data were overestimated by about 30%) and R&D expenditure has been adjusted accordingly; in Italy, extramural R&D expenditures were excluded as of 1991 (previously, GERD was overestimated by 6-10%); in Sweden, R&D in social sciences and the humanities (SSH) in the business enterprise, government and private non-profit institutions (PNP) sectors was included as of 1993.

Table 3 R&D expenditure by source of funds  
Percentages

|                              | Business enterprise   |                    |                       |                       |                    |                    | Government            |                    |                       |                       |                    |                       | Other             | Abroad            |
|------------------------------|-----------------------|--------------------|-----------------------|-----------------------|--------------------|--------------------|-----------------------|--------------------|-----------------------|-----------------------|--------------------|-----------------------|-------------------|-------------------|
|                              | 1981                  | 1989               | 1991                  | 1995                  | 1997               | 1999               | 1981                  | 1989               | 1991                  | 1995                  | 1997               | 1999                  | 1999              | 1999              |
| Canada                       | 40.8                  | 38.3 <sup>11</sup> | 38.2                  | 45.5                  | 46.9               | 44.5               | 50.6                  | 46.6 <sup>11</sup> | 45.6                  | 35.9                  | 32.7               | 31.2                  | 7.7               | 16.7              |
| Mexico                       | ..                    | ..                 | ..                    | 17.6                  | 16.9               | 23.6               | ..                    | ..                 | ..                    | 66.2                  | 71.1               | 65.3                  | 5.4               | 5.7               |
| United States                | 48.8 <sup>10</sup>    | 52.2 <sup>10</sup> | 57.3 <sup>10,11</sup> | 60.4 <sup>10</sup>    | 64.3 <sup>10</sup> | 66.8 <sup>10</sup> | 49.3                  | 45.6               | 38.9 <sup>10,11</sup> | 35.6 <sup>10</sup>    | 31.8 <sup>10</sup> | 29.2 <sup>10</sup>    | 4.0 <sup>10</sup> | ..                |
| Australia <sup>1</sup>       | 20.2                  | 41.1               | 44.0                  | 47.8                  | 45.0               | ..                 | 72.8                  | 54.9               | ..                    | 45.8                  | 47.8               | ..                    | ..                | ..                |
| Japan <sup>2</sup>           | 67.7 <sup>9</sup>     | 77.1 <sup>9</sup>  | 77.4 <sup>9</sup>     | 72.3                  | 74.0 <sup>11</sup> | 72.2               | 24.9 <sup>10</sup>    | 16.8 <sup>10</sup> | 16.4 <sup>10</sup>    | 20.9 <sup>10</sup>    | 18.2 <sup>11</sup> | 19.5                  | 7.9               | 0.4               |
| Korea                        | ..                    | ..                 | ..                    | 76.3                  | 72.5               | 70.0               | ..                    | ..                 | ..                    | 19.0                  | 22.9               | 24.9                  | 5.1               | 0.1               |
| New Zealand                  | ..                    | 33.2               | 27.4                  | 33.7 <sup>11</sup>    | 30.5               | ..                 | ..                    | 64.7               | 61.8                  | 52.3 <sup>11</sup>    | 52.3               | ..                    | ..                | ..                |
| Austria                      | 50.2                  | 53.0               | 50.2                  | 45.2                  | 42.6               | 39.7               | 46.9                  | 43.4               | 46.5                  | 47.3                  | 41.5               | 39.3                  | 0.4               | 20.7              |
| Belgium                      | ..                    | 63.9 <sup>11</sup> | 64.8                  | 68.9 <sup>11</sup>    | 69.4               | ..                 | ..                    | 32.0 <sup>11</sup> | 31.3                  | 26.3 <sup>11</sup>    | 24.9               | ..                    | ..                | ..                |
| Czech Republic               | ..                    | ..                 | ..                    | 63.1                  | 59.8               | 52.6               | ..                    | ..                 | ..                    | 32.3 <sup>10</sup>    | 30.8 <sup>10</sup> | 42.6 <sup>10,11</sup> | 0.8               | 4.0               |
| Denmark                      | 42.5 <sup>11</sup>    | 46.8               | 51.4                  | 45.2                  | 53.4               | ..                 | 53.5                  | 45.5               | 39.7                  | 39.6                  | 36.1               | ..                    | ..                | ..                |
| Finland                      | 54.5 <sup>11</sup>    | 62.2               | 56.3 <sup>11</sup>    | 59.5 <sup>11</sup>    | 62.9               | 66.9 <sup>11</sup> | 43.4 <sup>11</sup>    | 35.3               | 40.9 <sup>11</sup>    | 35.1                  | 30.9               | 29.2                  | 0.9               | 3.0               |
| France <sup>3</sup>          | 40.9 <sup>11</sup>    | 43.9               | 42.5                  | 48.3 <sup>11</sup>    | 48.3               | 51.6 <sup>11</sup> | 53.4 <sup>11</sup>    | 48.1               | 48.8                  | 41.9                  | 38.8 <sup>11</sup> | 37.3                  | 1.8               | 7.4               |
| Germany <sup>4</sup>         | 56.8                  | 63.5               | 61.9 <sup>11</sup>    | 61.1 <sup>11</sup>    | 61.4               | 64.3               | 41.8                  | 33.9               | 35.7 <sup>11</sup>    | 36.8                  | 35.9               | 33.0                  | 0.3               | 2.3               |
| Greece                       | 21.4 <sup>11</sup>    | 19.4 <sup>11</sup> | 21.7                  | 25.5                  | 21.6               | ..                 | 78.6 <sup>11</sup>    | 68.9 <sup>11</sup> | 57.7                  | 52.3                  | 53.5               | ..                    | ..                | ..                |
| Hungary <sup>5</sup>         | ..                    | 70.1               | 56.0                  | 38.4 <sup>11</sup>    | 36.6               | 38.5               | ..                    | 28.9               | 40.0                  | 53.1 <sup>11</sup>    | 54.8               | 53.2                  | 0.3               | 5.6               |
| Iceland                      | 5.7                   | 23.9               | 24.5                  | 34.6                  | 41.9               | 43.4               | 85.6                  | 65.8               | 69.7                  | 57.3                  | 50.9               | 41.2                  | 1.5               | 13.9              |
| Ireland                      | 37.7                  | 55.4               | 60.6                  | 68.7                  | 69.2               | ..                 | 56.5                  | 34.0               | 27.8                  | 21.4                  | 22.2               | ..                    | ..                | ..                |
| Italy                        | 50.1 <sup>9</sup>     | 46.4 <sup>9</sup>  | 44.4 <sup>11</sup>    | 41.7 <sup>11</sup>    | 43.3               | 43.9               | 47.2 <sup>9</sup>     | 49.5 <sup>9</sup>  | 49.6 <sup>11</sup>    | 53.0                  | 51.2               | 51.1                  | 0.0               | 5.0               |
| Netherlands <sup>3</sup>     | 46.3                  | 53.4 <sup>11</sup> | 47.8 <sup>11</sup>    | 46.0 <sup>11</sup>    | 45.6               | 48.6               | 47.2                  | 41.8 <sup>11</sup> | 48.6 <sup>11</sup>    | 42.2 <sup>11</sup>    | 39.1               | 37.9                  | 3.0               | 10.5              |
| Norway                       | 40.1                  | 45.6 <sup>11</sup> | 44.5                  | 49.9 <sup>11</sup>    | 49.4               | 51.4               | 57.2                  | 50.8 <sup>11</sup> | 49.5                  | 44.0 <sup>11</sup>    | 42.9               | 42.5                  | 1.6               | 4.4               |
| Poland                       | ..                    | ..                 | ..                    | 36.0                  | 35.1               | 38.1               | ..                    | ..                 | ..                    | 60.2                  | 61.7               | 58.5                  | 1.7               | 1.7               |
| Portugal <sup>6</sup>        | 30.0                  | 27.0               | 20.2                  | 19.5                  | 21.2               | 21.3               | 61.9                  | 61.8               | 59.4                  | 65.3 <sup>11</sup>    | 68.2               | 69.7                  | 3.7               | 5.3               |
| Slovak Republic <sup>5</sup> | ..                    | 67.2               | 68.3                  | 60.4 <sup>11</sup>    | 63.5               | 49.9               | ..                    | 32.8               | 31.7                  | 37.8 <sup>11</sup>    | 34.5               | 47.9                  | 0.0               | 2.3               |
| Spain                        | 42.8                  | 47.8               | 48.1                  | 44.5 <sup>11</sup>    | 44.7               | 48.9               | 56.0                  | 46.8               | 45.7                  | 43.6 <sup>11</sup>    | 43.6               | 40.8                  | 4.7               | 5.6               |
| Sweden                       | 54.9 <sup>10,11</sup> | 58.6 <sup>10</sup> | 61.9 <sup>10</sup>    | 65.6 <sup>10,11</sup> | 67.9 <sup>10</sup> | 67.8 <sup>10</sup> | 42.3 <sup>10,11</sup> | 38.1 <sup>10</sup> | 34.0 <sup>10</sup>    | 28.8 <sup>10,11</sup> | 25.8 <sup>10</sup> | 24.5 <sup>10</sup>    | 4.2 <sup>10</sup> | 3.5 <sup>10</sup> |
| Switzerland <sup>7</sup>     | 75.1                  | 73.9 <sup>11</sup> | 67.4                  | 67.5                  | ..                 | ..                 | 24.9                  | 23.2 <sup>11</sup> | 28.4                  | 26.9                  | ..                 | ..                    | ..                | ..                |
| Turkey <sup>5</sup>          | ..                    | 27.4               | 28.5                  | 32.9                  | 41.8               | ..                 | ..                    | 71.4               | 70.1                  | 62.4                  | 53.7               | ..                    | ..                | ..                |
| United Kingdom               | 42.0 <sup>11</sup>    | 50.6 <sup>11</sup> | 49.6                  | 48.0                  | 49.7               | 49.4               | 48.1 <sup>11</sup>    | 36.4 <sup>11</sup> | 35.0                  | 33.2                  | 31.1               | 27.9                  | 5.1               | 17.6              |
| European Union               | 48.4                  | 53.2               | 51.9 <sup>11</sup>    | 52.6 <sup>11</sup>    | 54.1               | ..                 | 47.0                  | 40.5               | 41.2 <sup>11</sup>    | 38.9                  | 36.9               | 36.0                  | 1.5               | 7.4               |
| Total OCDE <sup>8</sup>      | 51.1                  | 56.6               | 58.8 <sup>11</sup>    | 59.8 <sup>11</sup>    | 62.3               | 63.2               | 45.1                  | 38.9               | 35.7 <sup>11</sup>    | 33.8 <sup>11</sup>    | 31.1               | 29.8                  | 4.3               | ..                |

1. 1990 instead of 1989; 1992 instead of 1991; 1996 instead of 1995; 1998 instead of 1997.
2. Adjusted by OECD up to 1995.
3. 1998 instead of 1999.
4. Figures for Germany and zone totals from 1991 onwards refer to unified Germany.
5. 1990 instead of 1989.
6. 1982 instead of 1981; 1990 instead of 1989; 1992 instead of 1991.
7. 1992 instead of 1991; 1996 instead of 1995.
8. Includes Mexico and Korea from 1991; and Czech Republic, Hungary, Poland and Slovak Republic from 1995.
9. Overestimated.
10. Underestimated.
11. Break in series from previous year for which data are available.

Source: OECD, MSTI database, May 2001.

The R&D effort (expenditure and personnel) is usually broken down among four sectors of performance: business enterprises, higher education, government and private non-profit institutions serving households (PNP). This breakdown is based to a large extent on the System of National Accounts, but higher education is viewed as a special sector, owing to the important role played by universities and similar institutions in the performance of R&D.

R&D has various sources of financing. Five sources are generally considered: the four R&D-performing sectors previously mentioned and funds from "abroad". Flows of funds are measured using performance-based reporting of the funds received by one unit, organisation or sector from another unit, organisation or sector for the performance of intramural R&D. What is therefore measured are direct transfers of resources used to carry out R&D; other government provisions to encourage R&D, such as tax concessions, the payment of bonuses for R&D, exemption from taxes and tariffs on R&D equipment, etc., are excluded. For the purposes of international comparisons, public general university funds (GUF) are included in the sub-total for government funds. These are the funds which higher education establishments allocate to R&D from the general grant they receive from the Ministry of Education or the corresponding provincial or local authorities in support of their overall research and teaching activities.

Table 4 R&amp;D expenditures by main sectors of performance

Percentages

|                              | Business Enterprise |                       |                       |                    |                    | Higher Education     |                       |                       |                       |                    | Government         |                    |                      |                      |                   | Private Non-profit |                      |                      |                   |      |
|------------------------------|---------------------|-----------------------|-----------------------|--------------------|--------------------|----------------------|-----------------------|-----------------------|-----------------------|--------------------|--------------------|--------------------|----------------------|----------------------|-------------------|--------------------|----------------------|----------------------|-------------------|------|
|                              | 1989                | 1991                  | 1995                  | 1997               | 1999               | 1989                 | 1991                  | 1995                  | 1997                  | 1999               | 1989               | 1991               | 1995                 | 1997                 | 1999              | 1989               | 1991                 | 1995                 | 1997              | 1999 |
| Canada                       | 50.2 <sup>12</sup>  | 49.8                  | 57.9                  | 59.1               | 59.6               | 29.9 <sup>12</sup>   | 30.6                  | 26.7                  | 26.7                  | 26.7               | 19.0               | 18.6               | 14.2                 | 13.0                 | 12.5              | 0.9 <sup>12</sup>  | 1.0                  | 1.1                  | 1.1               | 1.2  |
| Mexico <sup>1</sup>          | ..                  | 10.4                  | 20.8                  | 19.7               | 27.2               | ..                   | 53.7                  | 45.8                  | 39.9                  | 38.6               | ..                 | 35.5               | 33.0                 | 38.7                 | 32.5              | ..                 | 0.4                  | 0.4                  | 1.6               | 1.7  |
| United States                | 71.0 <sup>11</sup>  | 72.4 <sup>11,12</sup> | 71.9 <sup>11</sup>    | 74.2 <sup>11</sup> | 75.7 <sup>11</sup> | 15.5                 | 14.5 <sup>11,12</sup> | 15.3 <sup>11</sup>    | 14.5 <sup>11</sup>    | 14.1 <sup>11</sup> | 10.7               | 9.8 <sup>12</sup>  | 9.6                  | 8.2                  | 7.2               | 2.8 <sup>11</sup>  | 3.3 <sup>11,12</sup> | 3.3 <sup>11</sup>    | 3.1 <sup>11</sup> | 2.9  |
| Australia <sup>2</sup>       | 40.2                | 44.1                  | 48.2                  | 45.1               | ..                 | 25.5                 | 26.1                  | 26.2                  | 29.4                  | ..                 | 32.6               | 28.1               | 23.6                 | 23.4                 | ..                | 1.6                | 1.6                  | 2.0                  | 2.1               | ..   |
| Japan <sup>3</sup>           | 74.3 <sup>10</sup>  | 75.4 <sup>10</sup>    | 70.3 <sup>10</sup>    | 72.0 <sup>12</sup> | 70.7               | 12.5 <sup>11</sup>   | 12.1 <sup>11</sup>    | 14.5 <sup>11</sup>    | 14.3 <sup>12</sup>    | 14.8               | 8.6 <sup>11</sup>  | 8.1 <sup>11</sup>  | 10.4 <sup>11</sup>   | 8.8 <sup>12</sup>    | 9.9               | 4.5 <sup>11</sup>  | 4.4 <sup>11</sup>    | 4.8 <sup>11</sup>    | 4.8 <sup>12</sup> | 4.6  |
| Korea                        | ..                  | ..                    | 73.7                  | 72.6               | 71.4               | ..                   | ..                    | 8.2                   | 10.4                  | 12.0               | ..                 | ..                 | 17.0                 | 15.8                 | 14.5              | ..                 | ..                   | 1.1                  | 1.2               | 2.1  |
| New Zealand                  | 32.2                | 26.8                  | 27.0 <sup>12</sup>    | 28.2               | ..                 | 19.2                 | 28.6                  | 30.7 <sup>12</sup>    | 36.4                  | ..                 | 48.6               | 44.6               | 42.2 <sup>12</sup>   | 35.3 <sup>12</sup>   | ..                | ..                 | ..                   | ..                   | ..                | ..   |
| Austria <sup>1</sup>         | 58.6                | 55.9                  | ..                    | ..                 | ..                 | 32.4                 | 35.0                  | ..                    | ..                    | ..                 | 7.5                | 8.9 <sup>12</sup>  | .. <sup>12</sup>     | ..                   | ..                | 1.6                | 0.3 <sup>12</sup>    | ..                   | ..                | ..   |
| Belgium                      | 67.0 <sup>12</sup>  | 66.5                  | 70.4 <sup>12</sup>    | 71.4               | ..                 | 25.7 <sup>12,c</sup> | 26.2                  | 24.8 <sup>12</sup>    | 24.2                  | ..                 | 6.1 <sup>12</sup>  | 6.1                | 3.4 <sup>12</sup>    | 3.1 <sup>12</sup>    | ..                | 1.2 <sup>12</sup>  | 1.2                  | 1.4 <sup>12</sup>    | 1.3               | ..   |
| Czech Republic               | ..                  | 69.4                  | 65.1 <sup>12</sup>    | 62.8               | 62.9               | ..                   | 1.6                   | 8.5 <sup>12</sup>     | 9.1                   | 12.3               | ..                 | 29.0               | 26.4 <sup>12</sup>   | 26.6 <sup>12</sup>   | 24.3              | ..                 | ..                   | ..                   | 1.4               | 0.5  |
| Denmark                      | 55.0                | 58.5                  | 57.4                  | 61.4               | 62.3               | 24.8                 | 22.6                  | 24.5                  | 22.2                  | 20.9               | 19.1               | 17.7               | 17.0                 | 15.4                 | 15.6              | 1.1                | 1.2                  | 1.1                  | 1.0               | 1.2  |
| Finland                      | 61.6 <sup>12</sup>  | 57.0 <sup>12</sup>    | 63.2                  | 66.0               | 68.2               | 19.3                 | 22.1 <sup>12</sup>    | 19.5                  | 20.0 <sup>12</sup>    | 19.7               | 18.5 <sup>12</sup> | 20.2 <sup>12</sup> | 16.6                 | 13.6                 | 11.4              | 0.5                | 0.7 <sup>12</sup>    | 0.6                  | 0.5               | 0.7  |
| France                       | 60.3 <sup>12</sup>  | 61.5                  | 61.0 <sup>12</sup>    | 62.5 <sup>12</sup> | 63.1               | 14.9                 | 15.1                  | 16.7                  | 17.4 <sup>12</sup>    | 17.6               | 23.9 <sup>12</sup> | 22.7               | 21.0 <sup>12</sup>   | 18.7 <sup>12</sup>   | 17.9              | 0.9                | 0.8                  | 1.3 <sup>12</sup>    | 1.4 <sup>12</sup> | 1.5  |
| Germany <sup>4</sup>         | 72.3                | 69.5 <sup>12</sup>    | 66.4 <sup>12</sup>    | 67.5               | 69.4               | 14.2                 | 16.2 <sup>12</sup>    | 18.1 <sup>12</sup>    | 17.9                  | 16.6               | 13.0               | 14.0 <sup>12</sup> | 15.4                 | 14.6                 | 14.0              | 0.5                | 0.4 <sup>12</sup>    | ..                   | ..                | ..   |
| Greece                       | 22.3 <sup>12</sup>  | 26.1                  | 29.5                  | 25.6               | ..                 | 35.3 <sup>12</sup>   | 33.8 <sup>12</sup>    | 44.3                  | 50.6                  | ..                 | 42.4 <sup>12</sup> | 40.1               | 25.5                 | 23.4                 | ..                | ..                 | ..                   | 0.7                  | 0.4               | ..   |
| Hungary <sup>5</sup>         | 38.1                | 41.4                  | 43.4 <sup>12</sup>    | 41.5               | 40.2               | ..                   | 20.3                  | 24.8 <sup>12</sup>    | 23.0                  | 22.3               | ..                 | 24.5               | 25.6 <sup>12</sup>   | 25.1 <sup>12</sup>   | 32.3              | ..                 | ..                   | ..                   | ..                | ..   |
| Iceland                      | 19.4                | 21.8                  | 31.9                  | 40.6               | 46.7               | 25.0                 | 29.4                  | 27.5                  | 28.3                  | 20.9               | 49.2               | 44.5               | 37.4                 | 29.8                 | 30.2              | 6.4                | 4.4                  | 3.2                  | 1.3               | 2.2  |
| Ireland                      | 58.3                | 63.6                  | 71.4                  | 73.1               | ..                 | 22.6                 | 23.2                  | 19.4                  | 19.2                  | ..                 | 17.5               | 11.6               | 8.5 <sup>12</sup>    | 7.0 <sup>12</sup>    | ..                | 1.6                | 1.7                  | 0.7                  | 0.7               | ..   |
| Italy                        | 58.8 <sup>10</sup>  | 55.8 <sup>12</sup>    | 53.4 <sup>12</sup>    | 53.2               | 53.8               | 19.8 <sup>10</sup>   | 21.5 <sup>12</sup>    | 25.5                  | 26.1                  | 25.1               | 21.5 <sup>10</sup> | 22.7 <sup>12</sup> | 21.1                 | 20.7                 | 21.2              | ..                 | ..                   | ..                   | ..                | ..   |
| Netherlands <sup>6</sup>     | 59.2 <sup>12</sup>  | 49.7 <sup>12</sup>    | 52.1 <sup>12</sup>    | 54.6               | 54.2               | 21.4 <sup>12</sup>   | 29.7                  | 28.8 <sup>12</sup>    | 27.3                  | 27.1               | 17.3 <sup>12</sup> | 18.3 <sup>12</sup> | 18.1 <sup>12</sup>   | 17.1 <sup>12</sup>   | 17.7              | 2.1                | 2.3 <sup>12</sup>    | 1.0 <sup>12</sup>    | 1.0               | 1.0  |
| Norway                       | 56.6 <sup>12</sup>  | 54.6                  | 56.7 <sup>12</sup>    | 56.9               | 56.0               | 24.0 <sup>12</sup>   | 26.7                  | 26.0 <sup>12</sup>    | 26.6                  | 28.6               | 19.4 <sup>12</sup> | 18.8               | 17.3 <sup>12</sup>   | 16.4 <sup>12</sup>   | 15.4              | ..                 | ..                   | ..                   | ..                | ..   |
| Poland                       | ..                  | ..                    | 38.7                  | 39.4               | 41.3               | ..                   | ..                    | 26.3                  | 28.6                  | 27.8               | ..                 | ..                 | 35.0                 | 32.0                 | 30.8              | ..                 | ..                   | 0.0                  | 0.0               | 0.1  |
| Portugal <sup>7</sup>        | 26.1                | 21.7                  | 20.9 <sup>12</sup>    | 22.5               | 22.6               | 36.0                 | 43.0                  | 37.0 <sup>12</sup>    | 40.0                  | 38.5               | 25.4               | 22.1               | 27.0                 | 24.2                 | 28.1              | 12.4               | 13.1                 | 15.0 <sup>12</sup>   | 13.3              | 10.8 |
| Slovak Republic <sup>5</sup> | 64.1                | 74.6                  | 53.9 <sup>12</sup>    | 75.6 <sup>12</sup> | 62.6               | 4.4                  | 3.9                   | 5.9 <sup>12</sup>     | 6.7                   | 9.9                | 31.5               | 21.5               | 40.2 <sup>12</sup>   | 17.7 <sup>12</sup>   | 27.5              | ..                 | ..                   | 0.0 <sup>12</sup>    | 0.0               | 0.0  |
| Spain                        | 56.3                | 56.0                  | 48.2 <sup>12</sup>    | 48.8               | 52.0               | 20.4                 | 22.2                  | 32.0                  | 32.7                  | 30.1               | 22.7               | 21.3               | 18.6 <sup>12</sup>   | 17.4 <sup>12</sup>   | 16.9              | 0.5 <sup>12</sup>  | 0.5                  | 1.1 <sup>12</sup>    | 1.1               | 1.0  |
| Sweden                       | 65.4 <sup>11</sup>  | 68.5 <sup>11</sup>    | 74.3 <sup>11,12</sup> | 74.9 <sup>11</sup> | 75.1 <sup>11</sup> | 30.6 <sup>10</sup>   | 27.4 <sup>10</sup>    | 21.9 <sup>10,11</sup> | 21.4 <sup>10,12</sup> | 21.4 <sup>10</sup> | 3.9 <sup>11</sup>  | 4.1 <sup>11</sup>  | 3.7 <sup>11,12</sup> | 3.5 <sup>11,12</sup> | 3.4 <sup>11</sup> | 0.1 <sup>10</sup>  | 0.1 <sup>10</sup>    | 0.2 <sup>10,12</sup> | 0.1 <sup>10</sup> | 0.1  |
| Switzerland <sup>8</sup>     | 74.9 <sup>12</sup>  | 70.1                  | 70.7                  | ..                 | ..                 | 19.9 <sup>12</sup>   | 25.0                  | 24.3                  | ..                    | ..                 | 4.3 <sup>12</sup>  | 3.7                | 2.5 <sup>11,12</sup> | ..                   | ..                | 0.8 <sup>12</sup>  | 1.2                  | 2.5                  | ..                | ..   |
| Turkey <sup>9</sup>          | 20.4                | 21.1                  | 23.6                  | 32.3               | ..                 | 69.8                 | 71.1                  | 69.0                  | 57.2                  | ..                 | 9.8                | 7.9                | 7.4                  | 10.5                 | ..                | ..                 | ..                   | ..                   | ..                | ..   |
| United Kingdom               | 69.1 <sup>12</sup>  | 67.1                  | 65.3                  | 65.5               | 67.8               | 15.3 <sup>12</sup>   | 16.7                  | 19.0                  | 19.6                  | 20.0               | 13.9 <sup>12</sup> | 14.5 <sup>12</sup> | 14.4                 | 13.6                 | 10.7              | 1.8 <sup>12</sup>  | 1.8                  | 1.3                  | 1.3               | 1.4  |
| European Union               | 65.2 <sup>10</sup>  | 63.5 <sup>10</sup>    | 62.2 <sup>12</sup>    | 63.3               | 64.7               | 17.3 <sup>12</sup>   | 18.7 <sup>12</sup>    | 20.8 <sup>12</sup>    | 21.0                  | 20.4               | 16.6 <sup>12</sup> | 17.0 <sup>12</sup> | 16.2 <sup>12</sup>   | 14.9 <sup>12</sup>   | 14.0              | 0.9                | 0.9 <sup>12</sup>    | 0.9 <sup>12</sup>    | 0.9               | ..   |
| Total OECD <sup>9</sup>      | 68.8                | 68.8 <sup>12</sup>    | 67.4 <sup>12</sup>    | 69.1               | 69.9               | 16.2                 | 16.2 <sup>12</sup>    | 17.4 <sup>12</sup>    | 17.1                  | 17.0               | 12.6               | 12.4 <sup>12</sup> | 12.6 <sup>12</sup>   | 11.2 <sup>12</sup>   | 10.6              | 2.4                | 2.6 <sup>12</sup>    | 2.6 <sup>12</sup>    | 2.6               | 2.5  |

1. 1993 instead of 1990.

2. 1990 instead of 1989; 1992 instead of 1991; 1996 instead of 1995; 1998 instead of 1997.

3. Adjusted by OECD up to 1995.

4. Figures for Germany and zone totals from 1991 onwards refer to unified Germany.

5. 1990 instead of 1989.

6. 1998 instead of 1999.

7. 1982 instead of 1981; 1990 instead of 1989; 1992 instead of 1991.

8. 1992 instead of 1991; 1996 instead of 1995.

9. Includes Mexico and Korea from 1991 and Czech Republic, Hungary, Poland and Slovak Republic from 1995.

10. Overestimated.

11. Underestimated.

12. Break in series from previous year for which data are available.

Source: OECD, MSTI database, May 2001.

Table 5 Innovation Output

|                 | Average growth rate of patent applications | Share in total EPO patent applications |       |       | Number of EPO patent applications per million population |        |        | Share of firms that introduce new technology 1994-1996 (%) |          |
|-----------------|--|--|-------|-------|--|--------|--------|--|----------|
|                 | 1990-1997                                  | 1990                                   | 1995  | 1997  | 1990   | 1995   | 1997   | Manufacturing  | Services |
| Canada          | 11.1                                       | 0.90                                   | 1.15  | 1.36  | 19.92  | 26.68  | 38.45  | 67.4   | 46.4     |
| Mexico          | 15.6                                       | 0.02                                   | 0.03  | 0.05  | 0.18   | 0.26   | 0.42   | 45.8   | ..       |
| United States   | 4.8  | 28.44                                  | 30.31 | 28.54 | 69.59  | 78.23  | 90.00  | ..   | ..       |
| Australia       | 6.8  | 0.59                                   | 0.71  | 0.68  | 21.14  | 26.56  | 30.81  | 59.9   | ..       |
| Japan           | 1.1  | 21.21                                  | 17.38 | 16.53 | 105.03   | 93.98  | 110.76 | ..   | ..       |
| Korea           | 26.1                                       | 0.19                                   | 0.66  | 0.71  | 2.75   | 9.99   | 12.98  | ..   | ..       |
| New Zealand     | 22.0                                       | 0.04                                   | 0.09  | 0.11  | 6.77   | 16.65  | 24.40  | ..   | ..       |
| Austria         | 5.5  | 1.07                                   | 0.99  | 1.13  | 85.00  | 83.40  | 117.93 | 66.2   | 54.5     |
| Belgium         | 11.8                                       | 0.84                                   | 1.17  | 1.33  | 51.59  | 78.41  | 110.04 | 37.4   | 44.1     |
| Czech Republic  | 10.0                                       | 0.04                                   | 0.03  | 0.05  | 2.08   | 1.82   | 4.07   | ..   | ..       |
| Denmark         | 8.8  | 0.53                                   | 0.70  | 0.70  | 63.63  | 91.32  | 111.78 | 70.4   | ..       |
| Finland         | 12.6                                       | 0.70                                   | 1.02  | 1.17  | 86.42  | 135.84 | 192.69 | 54.2   | 42.8     |
| France          | 3.2  | 8.05                                   | 7.49  | 7.27  | 84.64  | 85.55  | 102.67 | 50.7   | 40.5     |
| Germany         | 5.9  | 18.79                                  | 19.07 | 20.37 | 181.77   | 158.60 | 209.89 | 78.9   | 76.0     |
| Greece          | 9.1  | 0.04                                   | 0.04  | 0.06  | 2.61   | 2.58   | 4.63   | ..   | ..       |
| Hungary         | 0.3  | 0.11                                   | 0.08  | 0.08  | 6.64   | 5.14   | 6.94   | ..   | ..       |
| Iceland         | 10.3                                       | 0.01                                   | 0.01  | 0.02  | 30.85  | 38.08  | 57.52  | ..   | ..       |
| Ireland         | 9.4  | 0.11                                   | 0.14  | 0.15  | 19.31  | 26.32  | 34.64  | 73.4   | 70.8     |
| Italy           | 4.8  | 3.67                                   | 3.62  | 3.69  | 39.60  | 42.92  | 54.22  | 42.7   | ..       |
| Luxembourg      | 3.6  | 0.07                                   | 0.05  | 0.06  | 107.42   | 79.56  | 124.95 | 76.7   | 62.9     |
| Netherlands     | 6.5  | 2.49                                   | 2.52  | 2.80  | 101.84   | 110.85 | 151.67 | 75.4   | 55.7     |
| Norway          | 13.4                                       | 0.21                                   | 0.34  | 0.36  | 30.09  | 53.30  | 69.74  | 53.4   | 33.0     |
| Poland          | 5.5  | 0.03                                   | 0.02  | 0.03  | 0.51   | 0.35   | 0.74   | 41.5   | ..       |
| Portugal        | 16.6                                       | 0.01                                   | 0.02  | 0.03  | 0.78   | 1.41   | 2.29   | 25.4   | 33.1     |
| Slovak Republic | ..   | 0.00                                   | 0.01  | 0.02  | 0.00   | 1.29   | 2.36   | ..   | ..       |
| Spain           | 12.2                                       | 0.42                                   | 0.57  | 0.68  | 6.63   | 9.85   | 14.69  | 34.8   | ..       |
| Sweden          | 11.5                                       | 1.53                                   | 2.21  | 2.37  | 109.06   | 170.03 | 226.45 | 60.9   | 41.5     |
| Switzerland     | 3.1  | 2.76                                   | 2.45  | 2.47  | 251.44   | 236.31 | 294.50 | 73.4   | 62.2     |
| Turkey          | 21.8                                       | 0.01                                   | 0.01  | 0.02  | 0.07   | 0.08   | 0.23   | 33.3   | ..       |
| United Kingdom  | 3.0  | 5.83                                   | 5.48  | 5.18  | 61.94  | 63.48  | 74.19  | 60.1   | 44.5     |
| European Union  | 5.7  | 44.16                                  | 45.09 | 46.98 | 77.23  | 82.01  | 105.79 | ..   | ..       |
| Total OECD      | 4.6  | 98.72                                  | 98.38 | 98.01 | 71.99  | 61.76  | 75.56  | ..   | ..       |

*Note:* The patent data presented here refer to patent applications to the European Patent Office (EPO) by inventor's country of residence and priority date, using a fractional counting procedure.

*Source:* OECD, Patent database, May 2001.

Innovation surveys, based on the Oslo Manual methodology, attempt to collect firm-level data on input to and output from innovation. The most well-known is the Community Innovation Survey (CIS), managed by Eurostat, which co-ordinates national innovation surveys in all countries of the European Union plus Norway. Expenditure on innovation includes all expenditure related to the scientific, technological, commercial, financial and organisational steps that are meant to lead to the implementation of technologically new or improved products and processes. The information requested concerns expenditure in a given year for innovation activities performed by enterprises having introduced a technologically new or improved product (or service) or process over a period of three years ending in the year of expenditure.

The number of firms having introduced at least one technologically new or improved product or process has been weighted by the number of employees, so as not to underestimate the weight of large firms. Unweighted results would give an unduly large weight to the mass of small firms, and the results would be heavily skewed towards the responses of such firms.

Patent data are readily available from patent agencies, and they contain much information (applicant, inventor, technology, claims, etc.). Patent indicators have some weaknesses, however. For instance, many inventions are not patented, and the propensity to patent differs across countries and industries. Another drawback is related to differences in patent regulations among countries, which hamper international comparability.

Table 6 Skills and access

|                             | Distribution of the population aged 25-64 by level of educational attainment, 1999 | Expenditure per student on public and private institutions, 1998 (PPP dollars) | Researchers per 10,000 labour force |      |      | Tele-communications channels per 100 inhabitants | Access paths (fixed & wireless) per 100 |
|-----------------------------|--|--|-------------------------------------|------|------|--|---|
|                             | Population with tertiary level education <sup>1</sup>                              | All tertiary level <sup>2</sup>  | 1990                                | 1995 | 1999 | 1999   | 1999                                    |
| Canada                      | 19   | 14,579.2   | 46                                  | 60   | 58   | 65.5   | 88.1                                    |
| Mexico                      | 12   | 3,799.9  | ..                                  | 6    | ..   | 11.2   | 19.1                                    |
| United States               | 27   | 18,493.1   | ..                                  | 74   | ..   | 69.8   | 101.4                                   |
| Australia                   | 18   | 11,539.1   | 51                                  | 65   | ..   | 60.7   | 100.2                                   |
| Japan                       | 18   | 9,870.6  | 75                                  | 83   | 97   | 54.6   | 99.5                                    |
| Korea                       | 17   | 6,919.5  | ..                                  | 48   | 46   | 46.6   | 96.6                                    |
| New Zealand                 | 13   | ..   | 30                                  | 34   | ..   | 48.0   | 81.0                                    |
| Austria <sup>3</sup> (1998) | 6  | 11,278.8   | 25                                  | 34   | ..   | 47.7   | 99.6                                    |
| Belgium <sup>4</sup>        | 12   | 7,784.3  | 43                                  | 54   | ..   | 50.2   | 81.3                                    |
| Czech Republic              | 11   | 5,397.1  | ..                                  | 23   | 26   | 37.5   | 56.4                                    |
| Denmark                     | 7  | 9,562.0  | 40                                  | 57   | ..   | 68.4   | 117.8                                   |
| Finland                     | 14   | 7,327.0  | 55                                  | 67   | 99   | 55.1   | 120.2                                   |
| France                      | 11   | 7,004.8  | 50                                  | 60   | ..   | 57.8   | 92.7                                    |
| Germany <sup>5</sup>        | 13   | 9,466.0  | 61                                  | 59   | 60   | 58.8   | 87.4                                    |
| Greece <sup>4</sup>         | 12   | 4,156.9  | 16                                  | 23   | ..   | 53.3   | 91.4                                    |
| Hungary                     | 14   | 5,047.7  | ..                                  | 26   | 31   | 41.4   | 57.6                                    |
| Iceland                     | 18   | ..   | 53                                  | 72   | ..   | 68.0   | 130.2                                   |
| Ireland (1998)              | 11   | 8,521.7  | 35                                  | 40   | ..   | 46.4   | 89.1                                    |
| Italy <sup>3</sup>          | 9  | 6,294.9  | 32                                  | 33   | ..   | 46.4   | 99.1                                    |
| Luxembourg                  | 12   | ..   | ..                                  | 46   | ..   | 71.9   | 120.1                                   |
| Netherlands                 | 20   | 10,756.5   | 63                                  | 73   | 78   | 60.8   | 103.7                                   |
| Norway <sup>3</sup> (1998)  | 25   | 10,917.7   | ..                                  | 29   | ..   | 70.5   | 132.0                                   |
| Poland (1998)               | 11   | 4,223.7  | 12                                  | 24   | ..   | 24.7   | 34.8                                    |
| Portugal                    | 7  | ..   | ..                                  | 39   | 36   | 42.3   | 89.1                                    |
| Spain                       | 15   | 5,037.8  | 25                                  | 30   | 37   | 45.0   | 82.8                                    |
| Sweden                      | 13   | 13,223.5   | 59                                  | 77   | 91   | 73.8   | 131.3                                   |
| Switzerland <sup>3</sup>    | 15   | 16,563.3   | 44                                  | 55   | ..   | 71.6   | 112.8                                   |
| Turkey <sup>3,5</sup>       | 8  | 2,397.0  | 5                                   | 7    | ..   | 27.4   | 39.3                                    |
| United Kingdom <sup>4</sup> | 17   | 9,421.9  | 46                                  | 51   | ..   | 56.5   | 96.6                                    |
| Total OECD <sup>6</sup>     | 14   | 11,463.6   | 56                                  | 55   | ..   | 52.8   | 84.1                                    |

1. Tertiary type A and advanced research programmes (ISCED 5A and 6).
2. Data refer to total tertiary education (ISCED 5A, 5B and 6).
3. Expenditure per student include public institutions only.
4. Expenditure per student include public and government-dependent private institutions only.
5. Expenditure per student data refer to 1997.
6. Average of the available countries.

Source: OECD, Education database, MSTI database, Communications Outlook May 2001.

Educational attainment is related to the stock of knowledge and skills in the population. The tertiary graduation rate reflects the rate of production of higher-level knowledge by the education system. A country with a high proportion of graduates is more likely to be developing and maintaining a highly skilled labour force.

The indicator of R&D personnel is limited to researchers, who are viewed as the central element of the R&D system. Researchers are defined as professionals engaged in the conception and creation of new knowledge, products, processes, methods and systems and are directly involved in the management of projects.

In the past, the penetration rate for standard access lines provided a reasonable indication of the extent to which basic connection is available to users. In the new environment, use of standard access lines would present a distorted view of network development unless both fixed and wireless potential access paths is also used.

Table 7 Innovation Environment

|                | Investment in venture capital as a percentage of GDP, 1995-99 |           | Rate of tax subsidies for 1 US dollar of R&D, 1999 <sup>1</sup> |
|----------------|---|-----------|---|
|                | Early Stages  | Expansion | Large Firms   |
| Canada         | 0.064   | 0.095     | 0.173   |
| Mexico         | ..  | ..        | 0.031   |
| United States  | 0.070   | 0.137     | 0.066   |
| Australia      | 0.008   | 0.055     | 0.110   |
| Japan          | 0.004   | 0.013     | 0.019   |
| Korea          | 0.061   | 0.088     | 0.082   |
| New Zealand    | 0.007   | 0.026     | -0.131  |
| Austria        | 0.003   | 0.007     | 0.122   |
| Belgium        | 0.035   | 0.070     | -0.012  |
| Czech Republic | 0.005   | 0.028     | ..  |
| Denmark        | 0.007   | 0.017     | -0.018  |
| Finland        | 0.027   | 0.044     | -0.009  |
| France         | 0.015   | 0.043     | 0.085   |
| Germany        | 0.018   | 0.040     | -0.041  |
| Greece         | 0.007   | 0.019     | -0.015  |
| Hungary        | 0.002   | 0.046     | ..  |
| Iceland        | 0.066   | 0.071     | -0.028  |
| Ireland        | 0.019   | 0.041     | 0.063   |
| Italy          | 0.009   | 0.025     | -0.027  |
| Luxembourg     | ..  | ..        | ..  |
| Netherlands    | 0.047   | 0.109     | 0.096   |
| Norway         | 0.009   | 0.092     | -0.018  |
| Poland         | ..  | ..        | ..  |
| Portugal       | 0.008   | 0.037     | 0.150   |
| Spain          | 0.007   | 0.039     | 0.313   |
| Sweden         | 0.025   | 0.054     | -0.015  |
| Switzerland    | 0.022   | 0.028     | -0.011  |
| Turkey         | ..  | ..        | ..  |
| United Kingdom | 0.010   | 0.106     | 0.000   |
| OECD           | 0.043   | 0.093     | 0.041   |

1. Tax subsidies are calculated as 1 minus the B-index. For example, in Canada 1 dollar of R&D expenditure by large firms results in 17 cents of tax relief.

Source: OECD, based on data from EVCA (Europe); NVCA (United States); CVCA (Canada); Asian Venture Capital Journal (*The 2000 Guide to Venture Capital in Asia*). Data compiled in the 2nd half of 2000.

Venture capital is provided both by specialised financial firms acting as intermediaries between primary sources of finance (such as pension funds or banks) and firms (formal venture capital) and by so-called "business angels" (usually wealthy individuals experienced in both business and finance who invest directly in firms).

Data on venture capital are collected among their members by national or regional venture capital associations. Only formal venture capital (provided by specialised intermediaries) is captured by statistics. According to estimates, business angels in the United States invested almost twice as much annually in new firms as venture capital funds. This figure is probably much lower in most other OECD Member countries.

Table 8 Provincial Innovation

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Canadian Provinces, 1997

|                      | Population <sup>1</sup> | GDP     | R&D as % of GDP |
|----------------------|-------------------------|---------|-----------------|
| Ontario              | 11,319                  | 347,149 | 1.8%            |
| Quebec               | 7,319                   | 185,366 | 2.1%            |
| British Columbia     | 3,980                   | 109,347 | 0.9%            |
| Alberta              | 2,857                   | 101,069 | 0.9%            |
| Manitoba             | 1,136                   | 29,246  | 1.0%            |
| Saskatchewan         | 1,023                   | 28,260  | 0.9%            |
| Nova Scotia          | 935                     | 20,322  | 1.2%            |
| New Brunswick        | 754                     | 17,061  | 0.8%            |
| Newfoundland         | 551                     | 10,880  | 0.8%            |
| Prince Edward Island | 137                     | 2,943   | 0.6%            |

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1. Thousands.

2. Gross domestic product in CAD \$ millions

*Source:* Quebec and Ontario figures exclude Federal Government expenditures performed in the National Capital Region, Service Bulletin, Science Statistics, Catalogue no. 88-001-XIB, Vol. 23, No. 6, 1999

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