DEVELOPING HIGHLY SKILLED WORKERS: REVIEW OF CANADA

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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FOREWORD

A major conclusion of the OECD Growth Study was that governments need more effective policies for developing human capital and realising its potential in order to increase productivity and growth. In the framework of the project on *Growth Follow-Up: Micro-Policies for Growth and Productivity*, the OECD is conducting peer reviews of member countries' policies for developing highly skilled workers. Peer reviews are also being carried out on policies for increasing access to venture capital, increasing the diffusion of information technology to business, and enhancing public/private partnerships for research and innovation.

This peer review of Canada was carried out by the Committee on Industry and Business Environment (CIBE) in March 2004. The report presents recommendations for policy actions based on the strengths and weaknesses observed in the Canadian policy approach to developing highly skilled workers to fulfill future industry requirements. Once a critical mass of countries has been reviewed, a cross-country comparative synthesis report will be prepared with a view to identifying common good policy practices.

This report was prepared by Günseli Baygan of the OECD Secretariat. It is published under the responsibility of the Secretary-General of the OECD.

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ASSESSMENT AND RECOMMENDATIONS

Canada compares favourably in terms of its stock of human capital to other OECD economies, but continues to have significant gaps with the United States in terms of innovation and productivity performance and the comparative returns to higher skills. As part of an increasingly integrated North American labour market, it faces growing competition for skilled workers from its southern neighbour. Although access to a skilled workforce is one of the main competitive advantages of Canadian firms, the highly-educated confront more limited job prospects and lower salaries than in the United States. Due to an ageing labour force and expected high retirement rates, Canada will become increasingly dependent on immigration to fill needs for specialised skills and sustain labour force growth in the longer-term.

Canada needs to better utilise its highly skilled labour force, both Canadian-born and from abroad, which partly depends on creating an economic environment more conducive to innovation. In part due to industrial structure, business investment in research and development (R&D) remains low compared to other leading OECD countries. Canada also has lower graduation rates in technical subjects, regulatory barriers to geographical mobility among its qualified workforce, and lower levels of worker training than its OECD counterparts. Although the country has benefited by importing skilled human resources, there have been delays in fully recognising and applying their skills.

The government introduced an *Innovation Strategy* in 2002 focusing on developing human capital and fostering a stronger research environment as a means of raising productivity growth and closing the gap with the United States. Life-long learning is being strengthened, immigration policies are being revised to fill short-term skill needs and steps are being taken to enhance science and technology education. However, Canada may need additional measures to become a more attractive place for highly skilled personnel to live and work. These include enhancing worker mobility, addressing gender-based wage gaps, better integrating skilled immigrants, and stimulating more business and individual investments in job-related training. The 2004 Budget has indicated support for skills upgrading and faster recognition of foreign credentials. A summary of progress and recommendations concerning policies for highly skilled workers in Canada is given in **Table 1**.

Table 1. Progress and recommendations

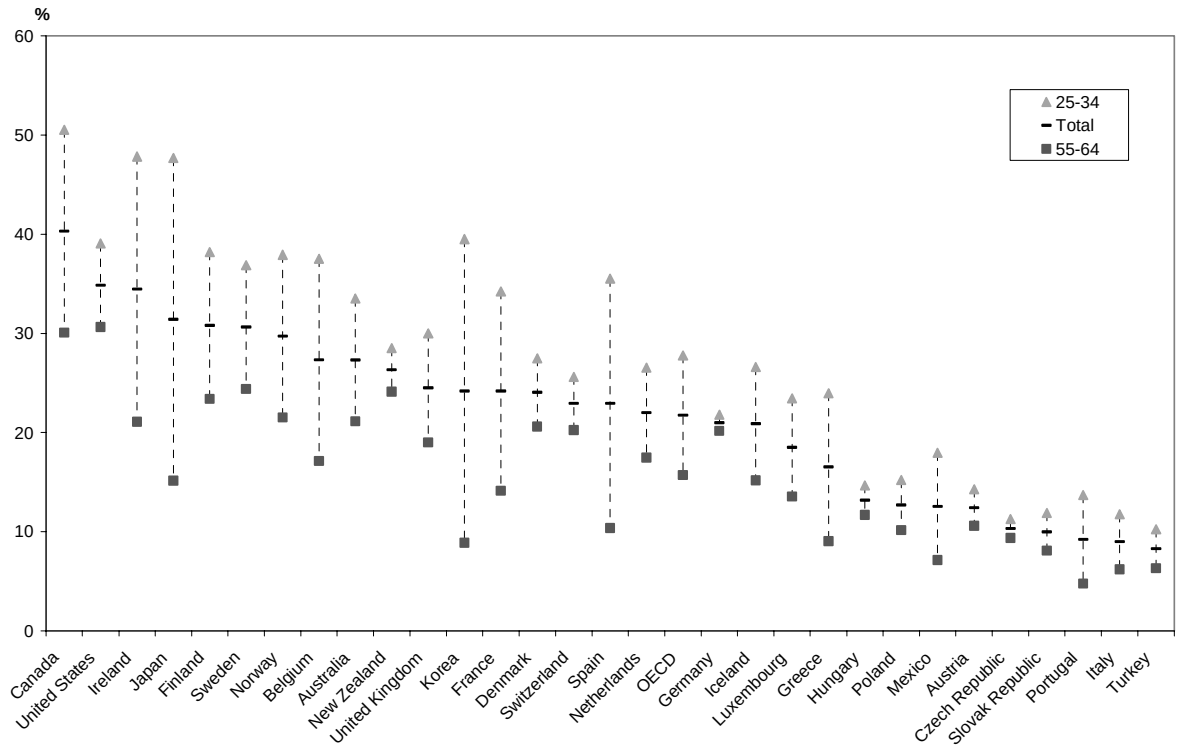
Area	Recent/planned action	Recommendations
Monitoring supply and demand of the highly skilled	Sophisticated labour force monitoring system using skill-based data and participation of stakeholders through *Sector Councils*.	Enhance co-ordination of labour market forecasting and analysis at different government levels.
Measures to increase enterprise and individual training	Education tax credit for individuals, individual learning account (ILA) projects, and small firm training schemes.	Implement co-financing schemes with firms and unions to stimulate more enterprise and individual investments in training.
Measures to increase national worker mobility	Barriers to geographic mobility reduced through 1995 *Agreement on Internal Trade* (AIT); professional standards and qualifications accepted through provincial mutual recognition systems.	Extend mutual recognition system to all occupations and ensure implementation at provincial level; accelerate programmes to foster accreditation and portability of training.
Measures to adjust to international worker mobility	Immigration policies modified to address short-term cyclical skill shortages, including issuance of temporary work visas.	Accelerate initiatives to eliminate impediments to the recognition of foreign credentials and enhance integration of skilled immigrants into the workforce.
Measures to increase workforce participation by highly skilled women	Enhanced parental benefits, extended parental leave and augmented childcare supports.	Address discrimination-based wage gaps between men and women.
Measure to develop human resources in science and technology (HRST)	2002 *Innovation Strategy* has a focus on increasing R&D and developing HRST, particularly female enrolment in science and engineering programmes.	Enhance S&T education at all levels; improve job prospects and salaries for S&T workforce through intensified efforts to develop innovation capabilities of private sector.

TRENDS IN SUPPLY AND DEMAND OF HIGHLY SKILLED WORKERS

Canada has the highest stock of human capital in terms of educational attainment in the OECD. In 2001, the share of the adult population with tertiary education was 40%, followed by the United States (35%) and Ireland (34%) (**Figure 1**). Educational attainment is higher among 25-34 year-olds, around 50%, well above the OECD average of 28%. Over half of these individuals had university qualifications while the rest held college diplomas. When tertiary type-B vocational education is excluded, Canada ranks around the OECD average. The primary emphasis of universities is on degree programmes, while colleges offer shorter duration programmes to facilitate quick entry to the labour market. There is also a range of adult education centres, private training institutions and distance education services (OECD, 2002*b*).

Figure 1. Educational attainment in OECD countries, 2001

(Percentage of the population with tertiary education)



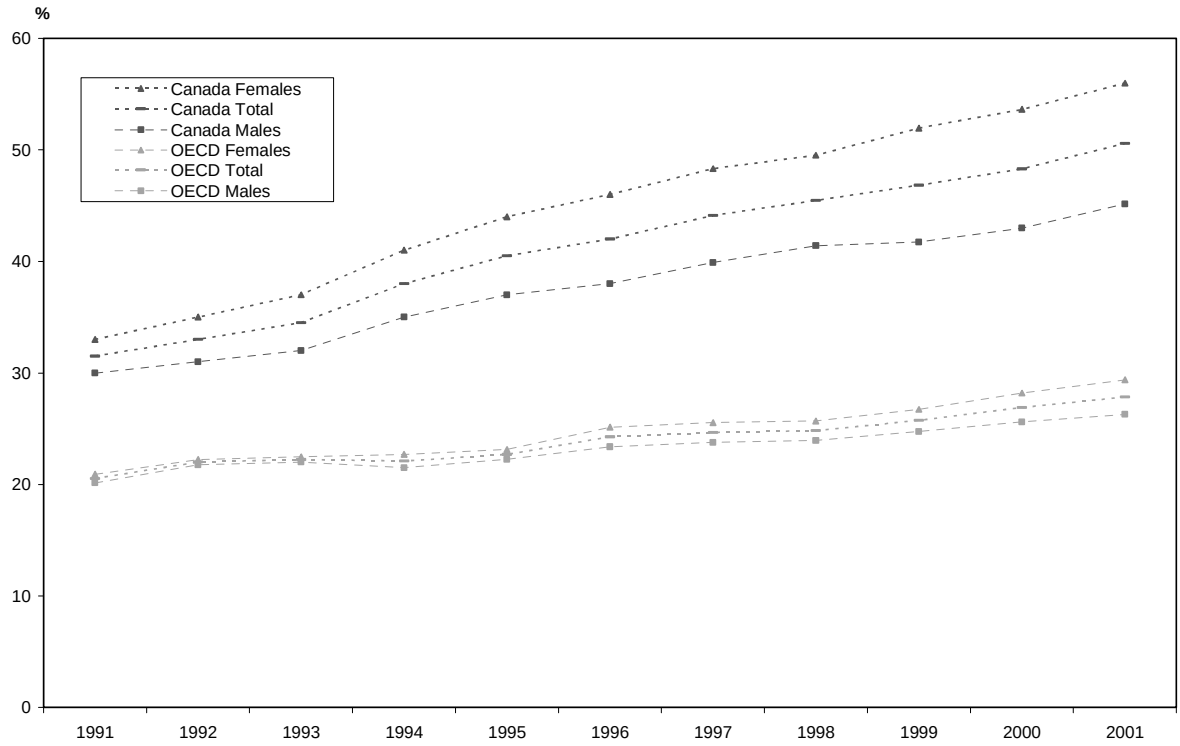
Notes: Includes tertiary type-A ducation, which corresponds to tertiary academic education (university), and tertiary type-B education, which corresponds to tertiary vocational education (practical/technical/occupationally-specific programmes).
Source: OECD, 2003*a*.

Growth rates in educational attainment in Canada were among the highest in the OECD in 1991-2001 (**Figure 2**), although post-2001 data indicate more sluggish growth in higher education participation rates.

The pick-up in tertiary education among young Canadian females was particularly remarkable in the 1990s, with an increase from 33% in 1991 to 56% in 2001. Structural change in the Canadian economy towards knowledge-intensive industries and the rise of new skill requirements partly inspired this growth. The recession of the early 1990s also increased preferences for staying in school given a lack of alternatives in the labour market. The number of people with degrees above the Bachelor's level increased rapidly. Canada, however, continues to lag behind the leading OECD countries in terms of graduation rates at PhD level. While Switzerland, Sweden, Germany and Finland had the highest shares of doctorates in total university degrees at over 2%, less than 1% of university graduates received a doctoral degree in Canada in 2000 (OECD, 2003*a*). Canada also produces fewer researchers and technical personnel than many other OECD countries.

Figure 2. Growth in tertiary education, 1991-2001

(Percentage of the population of 25 to 34-year-olds that has attained tertiary education)



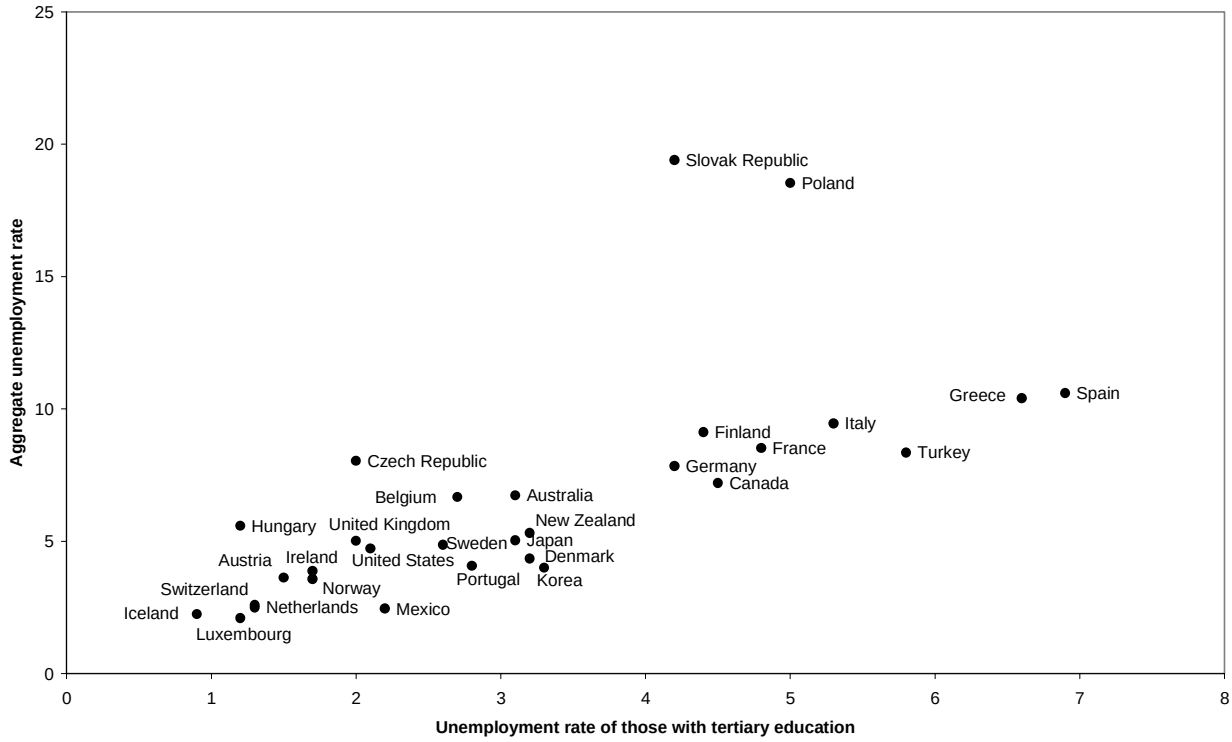
Notes: Includes tertiary type-A education, which corresponds to tertiary academic education (university), and tertiary type-B education, which corresponds to tertiary vocational education (practical/technical/occupationally-specific programmes).
Source: OECD, 2003*a*.

The education system in Canada is highly decentralised. Each of the ten provinces and three territories are accountable for the provision of education, offering a wide range of advanced learning as well as training opportunities. Canadian universities also increasingly offer combined degree programmes to meet new demands for multi-disciplinary skills. The demand for highly skilled workers is expected to increase as the role of knowledge-intensive sectors continues to expand in the Canadian economy. Long-run trends in labour markets also indicate significant upskilling in various sectors and the creation of new occupations with special skill requirements. Firms will be looking for more research personnel – technicians, specialists, managers – to strengthen their innovative capacity, and the public sector needs to replace the large number of professors, teachers, researchers and administrators reaching retirement age (GOC, 2002).

The education sector is under increasing pressure to meet these changes in a cost-effective way. Among OECD countries, Canada has one of the highest levels of investment in tertiary education. In 2000, public and private expenditure on higher education constituted a little over 2.5% of GDP, similar to ratios in the United States and Korea. But there are signs of fewer secondary school leavers going on to degree programmes at universities. Instead, many students are choosing community colleges or trade schools that provide shorter duration courses. Net social returns to Canada's tertiary education system - which is one of the most expensive in the world partly because it has to pay high North American salaries to attract good staff - appear to be low (Blondal *et.al*., 2002).

Private returns to higher education are limited as seen in trends in the employability and earnings potential of the highly skilled. In the early 1990s, the Canadian economy faced a severe recession, the unemployment rate reached over 10% of the labour force and remained high, with job prospects starting to recover only in the late 1990s. While the unemployment rate has fallen, it remains around 7.4%, above the average of similar OECD economies. The high level of unemployment among skilled workers is particularly marked. In 2001, the unemployment rate among workers with tertiary education was 4.5%, compared to around 2% in the United Kingdom and the United States (**Figure 3**).

Figure 3. Comparative unemployment rates in OECD countries, 2001



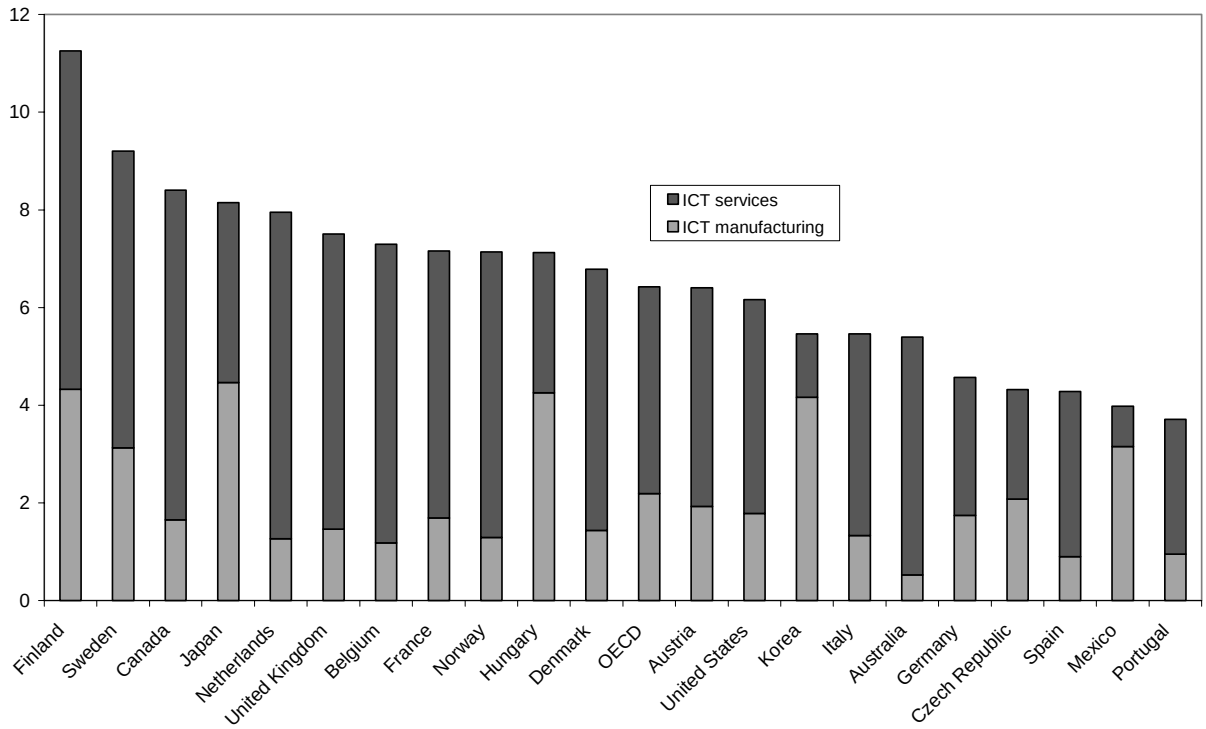
Source: OECD Employment Outlook 2003.

Less than four out of five working-age men with a university degree were in full-time employment in Canada in 2003. And while investment in higher education is generally associated with significant wage premia, young male workers - irrespective of their educational attainment - continued to face a downward trend in their real earnings in the first half of the 1990s. Relative wages however started to improve after 1995. The wage gap - particularly between the university and high-school educated which had remained relatively constant up to that time - increased steeply (Boudarbat, Lemieux, Riddell, 2003). Based on earning differentials and length of studies, the private annual rate of return to tertiary education in Canada

was estimated to be around 8.4% for men and 10.6% for women in 1999-2000 compared to 13% to 19% in the United Kingdom, the United States and France (Blondal *et.al*., 2002).

The high unemployment rate at the aggregate level masks the surge in demand for highly skilled workers in certain occupations. The Canadian Advisory Council on Science and Technology documents that firms in various sectors are experiencing difficulties in recruiting and retaining highly skilled workers in specialised areas. For example, Canada has experienced rapid growth in a number of information and communications technology (ICT) sectors, whose share in business sector employment was just above 8% in 2000, following Finland and Sweden (OECD, 2003*d*) (**Figure 4**). Employment growth was particularly significant in ICT services. Certain ICT skill sets experienced extended recruitment and retention problems with pronounced effects on real earnings. The base salary of database analysts and programmers, for instance, increased 5% to 7% annually between 1995 and 1999, compared to a 2% to 2.5% average annual increase for the ICT sector as a whole. The wage premium also increased among the highly-educated in the biotechnology sector (ACST, 2003).

Figure 4. Share of ICT sector in business sector employment, 2000



Source: STI Scoreboard 2003.

The coexistence of unemployment and high vacancy rates with regard to skilled workers indicates allocational problems in the Canadian educational system and labour market. While educational attainment is an important element for successful labour market entry, there has been insufficient emphasis on research and technical skills in Canada and on the combination of technical and business skills now needed in industry. In addition, labour market adjustment mechanisms have been generally slow to respond to rising skill shortages through higher wages, on-the-job training or higher mobility. After the next decade, demographic shifts will start to have an impact on the skill structure of the Canadian workforce. An ageing population and high retirement rates are expected to slow the long-term growth of the labour force, with immigration increasingly filling the gap.

POLICIES FOR DEVELOPING HIGHLY SKILLED WORKERS

Overview

The Canadian government has launched successive strategies for the development of the labour force in general and highly skilled workers in particular. Under the 2002 *Innovation Strategy*, public policy initiatives have placed the focus on increasing research and developing human capital. A comprehensive reform agenda has been introduced and backed with a set of specific targets to be attained over the next decade. New measures to increase support for university research infrastructure, commercialisation of public research and the adoption of new technologies have been adopted to improve the productivity and innovation performance of the Canadian economy.

The Canadian government has also initiated programmes to help small firms hire skilled workers and enhance the labour force participation of highly skilled women, particularly in science and technology fields. Temporary work permits for skilled immigrants, similar to the H1-B visa category in the United States, are being introduced to address specialised technical shortages in the short-run. The 2003 Budget allocated CAD 2 billion to new initiatives over three years to support innovation and learning. The 2004 Budget maintained support for various programmes such as skills upgrading in partnership with unions and businesses and faster recognition of foreign credentials and prior work experience.

However, there remain obstacles to the effective use of Canada's highly skilled labour force. Labour market adjustment mechanisms to deal with skill imbalances could be improved through better integration and application of knowledge regarding emerging skill needs. Remaining barriers that limit geographic mobility, such as occupational licensing requirements and accreditation of skills, need to be addressed. Better use could be made of the stock of Canadian human capital through higher labour force participation, particularly by skilled women, and fuller integration and retention of skilled immigrants. Particular emphasis should be placed on increasing levels of job-related training and enhancing the overall innovation capabilities of the Canadian economy.

Monitoring supply and demand for highly skilled workers

Canada has a highly-developed labour market monitoring system, which combines a range of qualitative and quantitative information. In the 1990s, comprehensive occupational forecasting models were developed at national level (*e.g*. *Canadian Occupational Projection System*) and provincial levels (*Labour Force Development Board* occupational forecasts in Quebec and British Columbia) to diagnose future skill shortages in a systematic way. They are also used to direct government-funded training courses towards skills in high demand. To supplement occupational forecasting models, Human Resources Development Canada (HRDC) introduced sector studies and employer-based surveys. Industrial and professional associations also develop their own surveys, *e.g*., the *Canadian Federation of Independent Business* survey on the employment practices of small firms. The National Occupation Classification (NOC) system and occupational skill standards form the basis of all these surveys and data sets.

Canada has also made efforts to link various labour market information sources to related administrative bodies, *e.g.* those dealing with employment insurance and immigration. Vacancy and unemployment rates, and long-run movements in relative wages, are interpreted as indications of potential shortages or surpluses in given occupations. Likewise, significant shifts in hours worked per employee, training expenses, subcontracting activity, hiring standards, and immigration statistics can signal occupational imbalances. The *Job Futures* website combines various labour market indicators - unemployment rates, real earnings,

employment trends and immigration statistics - with qualitative information from private sector labour market analysts. It also provides information on a number of occupational groups and programmes of study to facilitate more informed decision-making about education, skills and career planning. In addition, an electronic labour exchange was recently designed to better match available skills to employer needs. The new *Workplace and Employee Survey* (WES) conducted by Statistics Canada looks at complementary developments in the workplace, such as the adoption of technologies, organisational change and training.

Sector Councils are another important source of information to implement long-term human resource planning and development strategies in different industrial sectors (**Box 1**). These councils are unique in the way that they bring together representatives from business, government, labour, education and other professional groups. The *Sectoral Partnerships Initiative* was launched in 1993, creating a network of sector councils to co-ordinate long term human resources planning and skills development strategies.

Box 1. Selected Sector Councils in Canada

There are 26 Sector Councils in Canada, including:

The **Biotechnology Human Resource Council** (BHRC) was created in 1997 as an industry government partnership between HRDC and the biotechnology industry. It provides on-line information on human resource management issues in the biotechnology sector. Various programmes to attract and retain highly skilled workforce to the sector are also offered.

The **Canadian Council for Human Resources in the Environment Industry** defines the core skills and knowledge necessary for environmental work to assist post secondary institutions in designing educational programmes.

The **Software Human Resource Council** and the **Canadian Information Processing Society** have developed an occupational skill profiles model describing emerging skills and responsibilities in the software industry.

The **Canadian Technology Human Resources Board** focuses on applied science technicians across all sectors. The Board surveys sectoral skill needs, establishes occupational skill standards in newly emerging fields, and develops education and training programmes. There are around 25 partnerships, bringing together firms, industry associations, unions, government and educational institutions, which examine technical skill needs in different sectors.

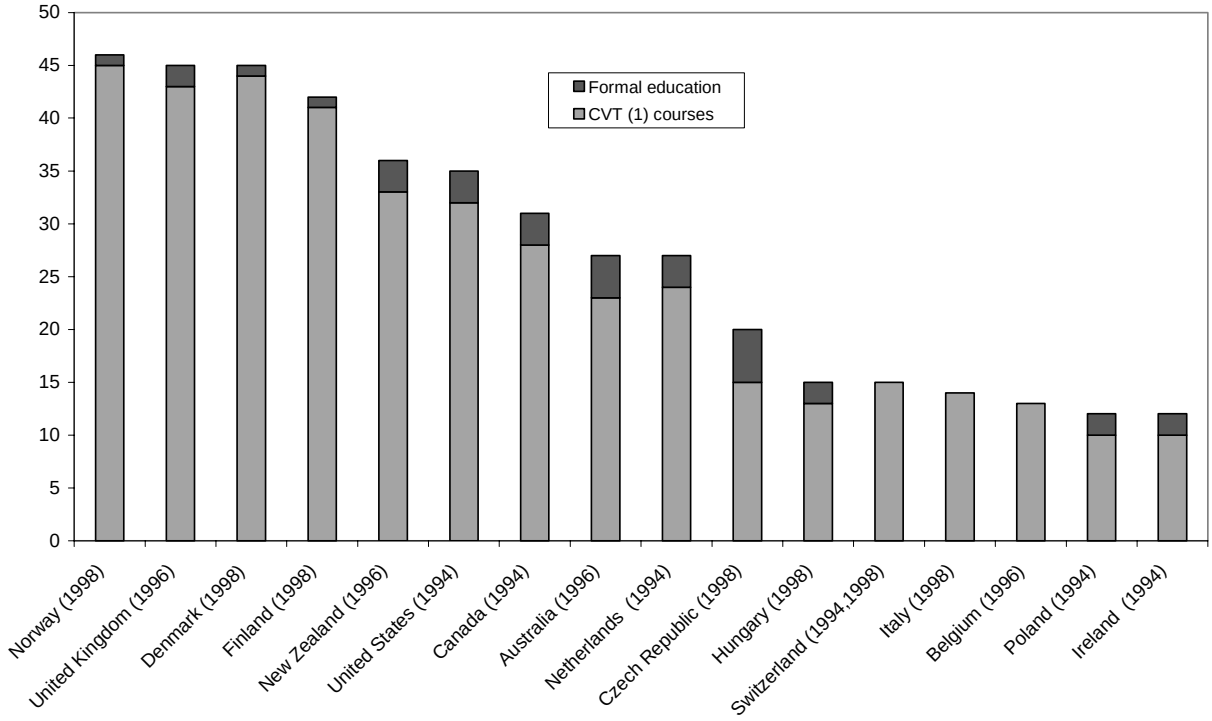
Even though data collection efforts have been intensified, the capacity to understand labour market developments is still limited in Canada. Most of the analyses are partial and highly sensitive to business cycles. Methodological problems also restrict the reliability and effectiveness of existing surveys. The NOC system is comprehensive and increasingly supported by skill-based data. However, the occupational classifications are slow to incorporate newly-emerging fields, particularly in science and technology, or changing skill requirements within occupations. There have been suggestions to shift the current occupational classification systems towards more skill-based data with standardised definitions of underlying skills. Given a constantly changing mix of technical, management and essential skills, this is no easy task.

Better co-ordination among various parties and integration of available labour market information is needed. The Sector Councils, which bring together the views of various stakeholders, play an important role in providing timely signals about the changing skill needs in particular industries. They should be encouraged to provide feedback on NOC and skills upgrading. The involvement of small firms could be extended to take advantage of the existing Council structure in identification of skill trends, which are increasingly heterogeneous and difficult to predict. The newly-created *Centre for Labour Statistics* is an important step forward in building a more coherent approach to assessing labour market trends, disseminating information as well as identifying structural imbalances in labour markets. However, labour market information that is provided at provincial/territorial level should be better linked to public and private sources at national level.

Increasing enterprise and individual training

Based on 1990s data, the level of investment in training by Canadian firms appears to be lower than that in the United Kingdom, the United States and the Nordic countries (**Figure 5**). According to the federal government, a general under-provision of training is due to the prevalence of small firms which typically lack the resources to invest in skills development, as well as the absence of a strong tradition of workplace training (GOC, 2002). In terms of delivery, employers are the single largest provider of job-related courses, followed by public educational institutions, such as community colleges, and other private training providers. In Canada, Sector Councils also play a role in long-term human resources planning and skills development strategies.

Figure 5. Employer-sponsored education and training, 1998 or latest year
(Percentage of employed persons participating in training in total employment)



Notes: (1) Continuous vocational training.
Source: OECD Employment Outlook 2003.

The *Workplace and Employment* (WES) survey shows a wide variation in human resource management and training practices across Canadian firms. Overall, 56% of workplaces have reported offering some type of training, classroom and/or on-the-job. Training is more common in sectors considered to be high-technology or undergoing considerable technological change, such as finance and insurance (Statistics Canada, 2001). Consistent with other OECD countries, training incidence also rises with firm size. Larger firms are more likely to train workers and provide classroom training than smaller ones. More than half of employees in small firms have reported not participating in any type of training. There is also a strong correlation between the employee's human capital and the amount of training received. University graduates are more likely to receive further classroom training rather than on-the-job training (**Table 2**).

Table 2. Employee training by educational attainment and firm size in Canada, 1999

(% of total employees)

	No training	Classroom training	On-the-job-training
Overall	45.4	36.6	30.3
By educational attainment:			
Secondary or less	56.1	23.7	26.6
Post secondary (non-university)	44.2	37.1	30.2
University	37.2	46.8	33.5
By workplace size:			
1-19	55.5	25.7	25.3
20-99	46.7	33.2	32.3
100-499	38.4	45.5	30.9
500 >	33.3	51.6	34.9

Source: Statistics Canada, 2001.

In Canada, as in most OECD countries, employers may deduct employee training expenses from corporate taxes under the *Income Tax Act*. Employees can also claim part of their education and training-related expenses; an education tax credit provides for exemption from income tax of tuition assistance received for adult basic education. At provincial level, the Government of Quebec has introduced provisions that employers with a total annual payroll of CAD 250 000 or more are required to invest at least 1% of their payroll in employee training. These resources can fund the purchase of training from private providers, training done in-house, and training provided by unions. Such levies and compulsory investment schemes have been criticised as encouraging inefficient training given the difficulty of assigning optimal contribution levels and company size thresholds (Ok and Tergeist, 2003). However, in Quebec, eligible businesses have contributed over 1.5% of their payrolls to training in recent years, and both enterprises and unions have favoured the tax incentive as an effective stimulant to training (OECD, 2002*c*).

In addition to tax incentives, Canada has experimented with training grants. Under the *Skill Shortage Program*, around half a million workers were trained at a government cost of CAD 600 million between 1985 and 1992. However, the programme was found to be difficult and costly to implement and ceased in 1992 (Roy, Henson and Lavoie, 1996). There are several small firm training initiatives at provincial level. In Quebec, subsidies are provided by the *Fonds national de formation de la main-d'oeuvre* to promote workforce training, which gives support to applied research on management of employer-sponsored training, notably by SMEs (OECD, 2002*c*). In British Columbia, the *Small Business Training Partnerships* programme aims to encourage partnerships among small business owners in identifying and addressing common training needs and goals. This includes funding of up to 50% (and a maximum CAD$ 50 000) of the costs of planning, developing and delivering short-term employee training. To increase the responsiveness of training institutions to business needs, programmes are also designed to support collaboration between businesses and training providers, *e.g.*, the *Strategic Skill Investment* (SSI) programme in Ontario and the *Skills Investment Strategy* in Alberta.

Canada has also attempted to stimulate individual investments in training through savings vehicles that reduce individual credit constraints, *e.g.*, *Learn$ave*, the *Lifelong Learning Plan*, *Registered Education Savings Plan*, etc. The *Learn$ave* pilot project is a type of Individual Learning Account (ILA) where the government contributes CAD 3 for every CAD 1 contributed by participants (up to CAD 1 500) to purchase education or training services. The matched contributions are paid directly to the supplier of training services. The take-up of these programmes has been modest thus far, although such schemes have

been shown to enhance savings behaviour and educational planning on the part of individuals (OECD, 2003*b*).

International comparisons show that Canada places highly in overall levels of lifetime training. But Canada's employer-sponsored training appears to fall short of other OECD economies with similar human capital stock. Existing tax incentives, grant schemes and individual learning account initiatives remain small-scale and/or ineffective. The 2002 *Innovation Strategy* acknowledged Canada's poor performance in adult training and set a goal of increasing the number of adults pursuing learning opportunities by 1 million by 2007 (GOC, 2002). The 2004 Budget indicated that programmes would be enhanced to support skills upgrading in co-operation with the social partners. However, structural problems in the labour market may lead to shortfalls in certain skill sets in the longer-term, which could be partly offset by more worker training. Canada needs a consistent federal policy and better-funded programmes to promote skills upgrading through co-financing arrangements.

Enhancing national worker mobility

The decentralisation of Canadian government has acted to lower rates of national worker mobility, largely through differing provincial regulations, standards and licenses for workers. Canada is a highly decentralised federation made up of ten provinces and three territories, all of which have substantial legal autonomy. Inter-provincial trade accounts for some 20% of GDP, and Canada continues its efforts in "nation-building" through negotiations to create a practical framework for a single market which includes removing barriers to the movement of people, goods, services and investments. Such barriers were estimated to cost almost 1% of GDP in the late 1990s (OECD, 2002*a*).

Traditionally, Canadian labour markets have been artificially fragmented due to provincial licensing and certification requirements that limited the geographic mobility of the 15% to 20% of the workforce engaged in regulated occupations and trades. Harmonisation of national occupational standards across different jurisdictions started after the 1995 adoption of the labour mobility chapter of the *Agreement on Internal Trade* (AIT). In 2001, most remaining restrictions on labour mobility were eliminated. Recently, many of the larger regulatory bodies agreed to the mutual recognition of credentials for engineers, technicians and technologists. Mutual recognition agreements, in which professional qualifications granted in one province are recognised nation-wide, have now been signed for most regulated occupations. Under the *Red Seal Program*, the standardisation of provincial and territorial apprenticeship training and certification has also been carried out, covering forty-four trades on a national basis. Around 97% of regulated professional workers are covered by these agreements (HRDC, 2001).

Other impediments to geographic labour mobility include the limited transferability of work-related benefits. There is concern about regional differences in social security packages, such as unemployment insurance or social benefits, negatively affecting interregional migration patterns (Day and Winer, 2001). Variations in regional employment practices are another influence. Some provinces that experienced rapid growth in high technology sectors adjusted labour market regulations to enhance flexibility and reduce adjustment costs. In British Columbia, for example, high-technology professionals are mostly exempt from the parts of the *Employment Standards Act* that deal with hours of work, overtime and statutory holidays.

The portability of training and the accreditation of skills, which are important in non-integrated systems such as Canada, is another factor influencing worker mobility. The 13 provincial and territorial education ministers currently work together in the *Council of Ministers of Education Canada* (CMEC) to address these problems and have developed a protocol for *Prior Learning and Assessment Recognition* (PLAR). They have also improved the ability to transfer credits for university courses between provinces, but the limited opportunities for moving from community colleges to universities persists. The federal and

provincial governments could do more to knit together the disparate parts of the learning system and enhance the recognition and accreditation of skills and learning across the country.

The Canadian government is committed to continue working with regulators on harmonising occupational licensing and standards through the Forum of Labour Market Ministers and its working committee, the *Labour Mobility Coordinating Group*. But although legislation and regulations governing specific occupations and trades are being modified, implementation has to be closely monitored. Mutual recognition programmes are difficult to enforce, and new procedures for reaching agreement among the provinces may be needed. In addition, programmes to increase the accreditation and portability of training and other learning should be accelerated to enhance the mobility of skilled workers and the flexibility of the labour market in responding to changing skill needs.

Adjusting to international worker mobility

Although immigration is a major source of skilled human capital for Canada, the country is facing increased global competition for skilled workers and continues to be an important source of highly-educated temporary emigrants to the United States. In 1994, the *North Atlantic Free Trade Agreement* (NAFTA) accelerated cross-border activity between Canada and the United States with the result that Canadian firms compete with their US counterparts in attracting and retaining skilled workers, particularly in fast-growing information technology sectors. At the same time, an ageing population in the longer-term will put pressure on different parts of the Canadian economy, necessitating a broad skill mix of immigrants.

Net growth in the Canadian labour force is expected to come in part from new immigrants in the next decade. While domestic workers will represent the largest share of new labour market entrants, the representation of immigrants is projected to increase after 2016. The education profile of immigrants has been steadily improving, with 41% of working age immigrants in the 1990s university trained compared to 25% in the 1980s. Around 19% of male immigrants held engineering degrees and 6.5% were trained in computer science and applied mathematics. However, there is still a far larger portion of Canadian-born university graduates in the different age groups. Immigration is also an important channel for addressing specialised skill shortages. New immigrants are now highly represented in information technology, engineering and natural science occupations (Statistics Canada, 2003*b*).

Changes to immigration policy are being introduced to enhance Canada's ability to compete for highly skilled workers from abroad. Canada traditionally depended on permanent immigration to fill niche areas for skilled personnel. Like other receiving countries, the government is now focusing on the development of temporary migration schemes based on skills and competence criteria combined with greater selectivity in general migration policy. The new *Immigration and Refugee Protection Act*-- and the related regulations that came into effect in June 2002 - broadened selection criteria to take into account a wider range of attributes for skilled worker immigrants. The weight of education and language skills are increased to facilitate integration into the Canadian workforce and society. Firms are given a greater role in recruitment of highly skilled immigrants on a temporary basis to address short-term cyclical skill shortages. The new regulations also make it easier for qualified temporary foreign workers to become permanent residents (OECD, 2003*c*).

There are also more targeted initiatives to attract and retain skilled workers. In view of long processing lags, the government has assigned higher priority to skilled worker applications and will fast track those with job offers. A significant number of professors, teachers, and researchers will reach retirement age raising concerns in the education field. Immigration regulations make it difficult to hire faculty from abroad for Canadian post-secondary institutions. Recently, the *Canada Research Chairs* programme has

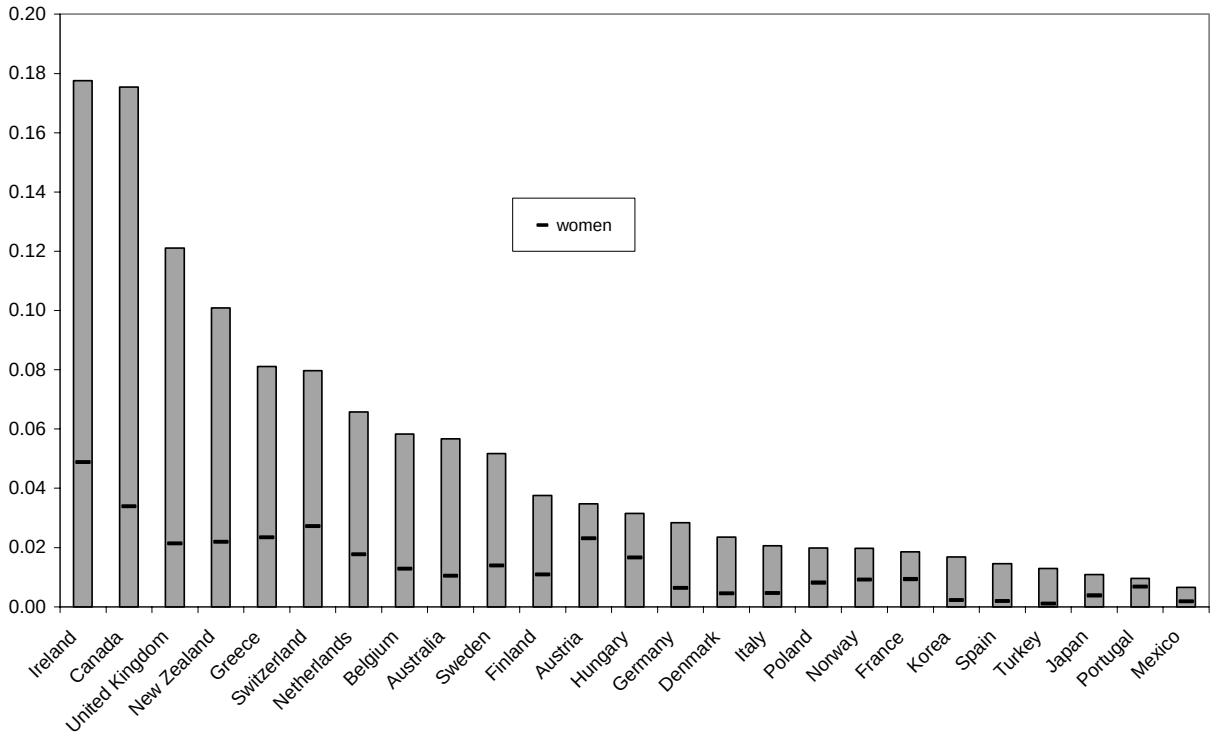
helped Canadian universities and research hospitals attract and retain top academic talent from around the world. At provincial level, the Quebec government is offering a 5-year income tax credit to attract foreign academics in information technology, engineering, health science and finance to take employment in the province's universities.

However, Canada's high unemployment rate presents challenges in creating opportunities for new entrants. The unemployment rate of recent immigrants aged 25-44 was 12.1% compared with 6.4% among the Canadian-born population. The income gap between immigrants and their Canadian-born counterparts with comparable skills also persists (Statistics Canada, 2003*c*). Programmes supporting the integration of immigrants into Canada's labour market, including language training and better job research assistance, are needed. Canada has taken steps to enhance integration and accreditation, including setting up specialised agencies for the assessment of academic qualifications and making professional standards and procedures more transparent. But Canadian employers continue to undervalue foreign credentials and work experience, which slows the assimilation of skilled immigrants and lessens their contributions to economic performance. Inadequate language skills are a main factor in lower returns to foreign education and work experience and low transferability of foreign credentials to the Canadian labour market. In addition to accreditation programmes, more co-operation with the private sector is needed to reduce the risk-averse attitudes of many employers (OECD, 2003*c*).

International students enrolled in Canadian post-secondary institutions constitute another potential source of highly skilled workers, and Canada could make better use of this pool. The number of foreign students in Canada has risen substantially in recent years, more than doubling between 1995 and 2001. These foreign students can obtain temporary work permits to work in their field of study in Canada for up to a year, and there are pilot projects in two Canadian provinces which allow foreign students to work for two years. As such, firm-sponsored internship programmes for international students help employers with recruitment. However, under the points system, it is difficult for them to qualify for permanent immigration as skilled workers. Canada should consider easing the rules and procedures for accepting foreign students in skilled employment in view of pending shortages in certain professions.

While net immigration to Canada remained positive, emigration of highly skilled professionals, mainly to the United States, increased in the 1990s. Canada is a major recipient of skilled workers from the rest of the work, but it is also one of the most important foreign sources of skilled labour for its southern neighbour (**Figure 6**). Annualised permanent emigration to the United States in the past decade was estimated at around 0.1% of the Canadian population. However, permanent emigration figures might be underestimating actual flows, as they do not account for the temporary renewable work permits introduced under NAFTA (Zhao *et. al.*, 2000).

Figure 6. High-skilled foreign workers in the United States, 1999



Notes: Non-US OECD citizens with science and engineering doctorates in the United States as % of source country's population.
Source: STI Scoreboard 2003.

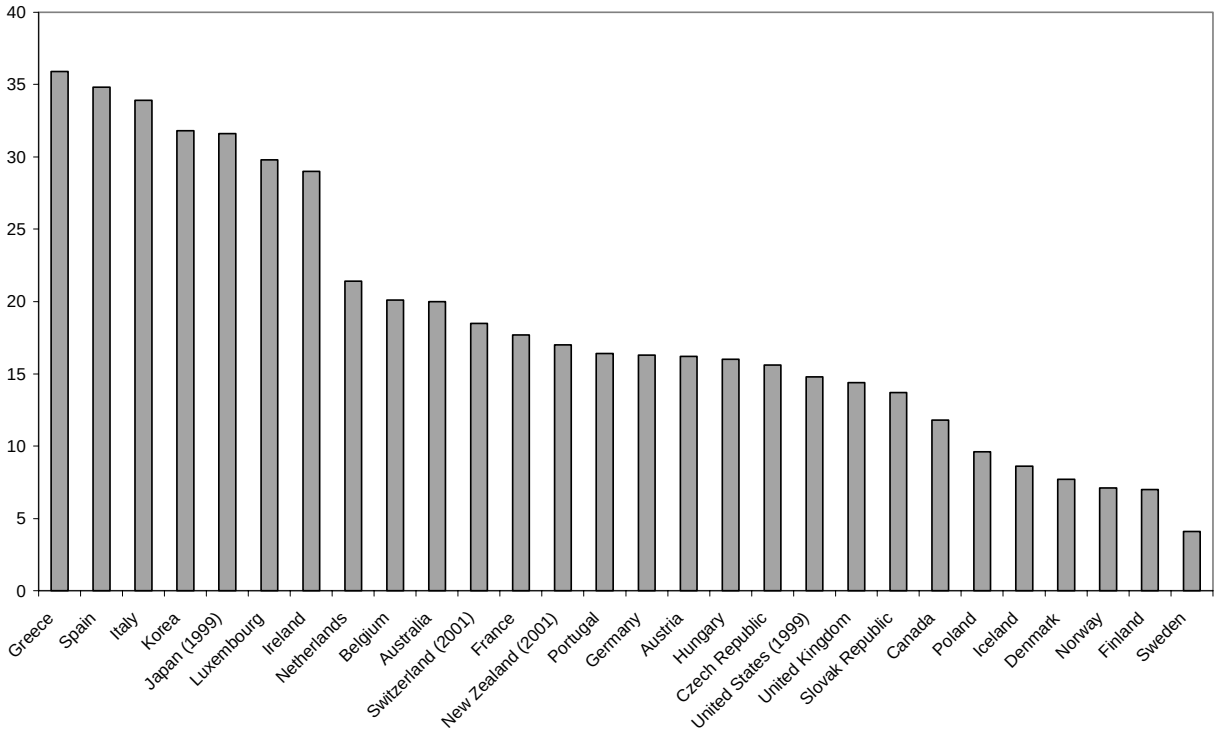
Canada's high unemployment in the 1990s and limited labour market outlets for highly-educated workers, especially in science and engineering, contributed to the outflow. A significant number of Canadians with Masters and Doctorates in science and engineering fields migrated to the United States. By some estimates, 15% of high earners return after 5 years and 20% after 10 years. Such internationally-mobile skilled workers could improve knowledge flows and spillovers. The Canadian government has a scheme in the health area to encourage the repatriation of researchers working and studying abroad, whereby they are given a supplemental year of funding if they return to work in a Canadian laboratory. To increase the return rate and to internalise the positive externalities from "brain circulation", this model should be extended to other fields.

Growth in services trade and foreign investment flows are expected to accelerate the integration of North American labour markets, although there remain certain barriers including foreign ownership and control restrictions in a range of sectors, primarily services (OECD, 2002*a*). Canada has introduced a five-year tax reduction plan to reduce the tax disadvantage for individuals, firms and entrepreneurs vis-à-vis the United States. However, individuals with higher earnings generally still pay higher taxes in Canada than in the United States, which is a disincentive to repatriation of highly skilled workers. More programmes aimed at encouraging workers based overseas to remain in contact with their home country should supplement efforts to develop centres of excellence, expand innovation and entrepreneurship and improve job opportunities for skilled workers, both native-born and from abroad. In particular, Canada needs to resolve problems of credentials recognition and the geographical distribution of skilled immigrants, including foreign students, for their fuller integration into the Canadian labour force. To this end, the 2004 Budget includes steps to ensure faster recognition of foreign credentials and the prior work experience of immigrants.

Increasing workforce participation by highly skilled women

The gender employment gap for highly-educated women in Canada was around 10% in 2000, which is one of the lowest rates in the OECD (**Figure 7**). Labour force participation of women in Canada is around 72%, compared to the OECD average of 65%. Women accounted for two-thirds of the 1.3 million increase in the Canadian labour force during the 1990s. As in the United States, there is no major variation in the labour force participation rates for women at different stages of family building because employment is often combined with rearing children.

Figure 7. Gender employment gap for highly-educated women, 2000



Notes: Percentage point difference between the employment rates for men and women with tertiary education.
Source: OECD, 2002*d.*

However, Canada has one of the largest wage gaps in the OECD between men and women working full-time (OECD, 2002*d*). In 1994-1998, women earned 69% of men's wages in Canada compared to 76% in the United States and almost 90% in France. Earning differentials between males and females are slowly narrowing in Canada, although the gap remains at 30%. The differences in occupational choices and the relatively high incidence of part-time work among women relative to men negatively affect their wages. While women are over-represented in certain disciplines, *e.g.*, they constitute over two-thirds of graduates in the humanities, arts, education, health and welfare, they are scarcer in engineering, computer science and other technology-related fields. There were no technological fields in the top three growth disciplines among female university graduates in 2000 (Statistics Canada, 2003*a*). Research has also shown that differences in work history and job tenure act to depress women's earnings (Statistics Canada, 2003*c*). As women have increased their tertiary qualifications in Canada in the last decade, younger women are recording higher relative earnings than women overall.

The Canadian government has taken actions to improve support for work-family balance and facilitate the full-time participation of women in the labour force. Under changes to the *Employment Insurance Act* in 2001, maternity and parental benefits were doubled and the duration of maternity and parental leave extended up to 52 weeks. Parental leave claims have been on the rise in recent years, albeit from a low base. Proposals have been made to modify Canada's tax structure to increase the incentive for spouses to share work by reducing tax rates on second-earners. Support for children and families has also been strengthened through the *Canada Child Tax Benefit (CCTB),* the *National Child Benefit*, the *National Children's Agenda*, etc. (HRDC, 2002). However, tax allowances for childcare expenses in Canada only account for about 10% of total public spending on childcare. Overall, Canada is in the group of OECD countries (including the United States) which have low rates of public spending on childcare (Jaumotte, 2003).

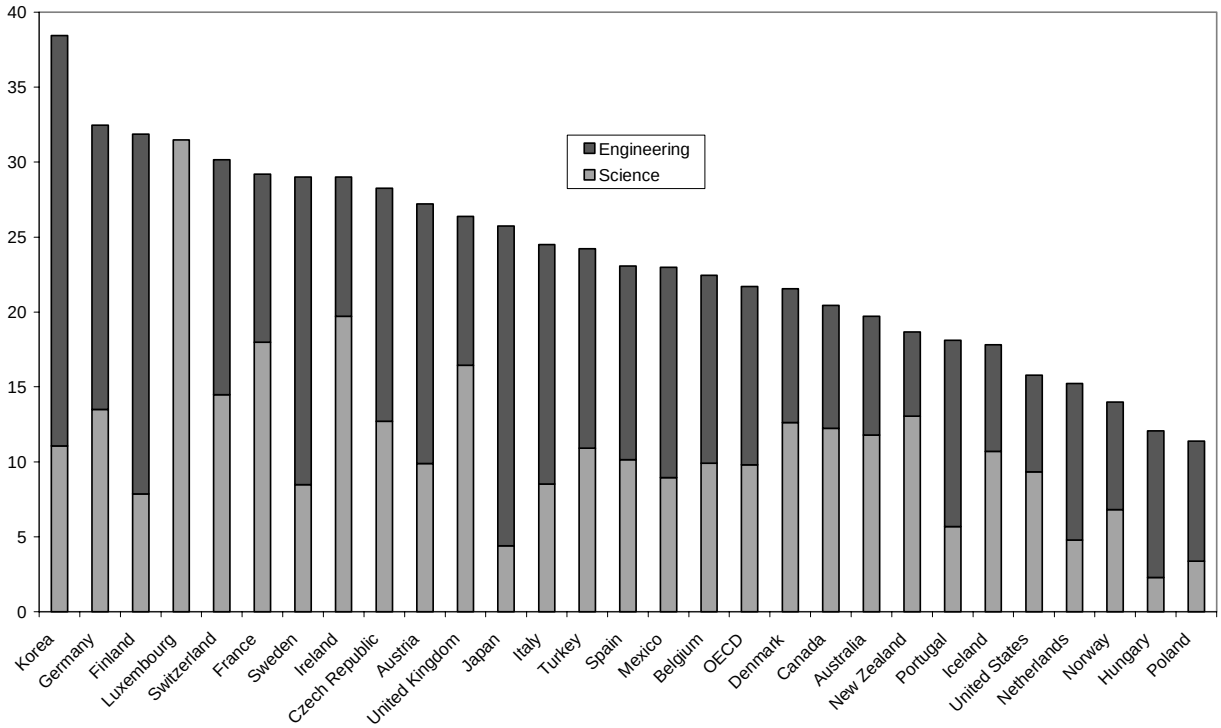
As the gender gap in employment further narrows in Canada with more women joining the labour force, the gender pay gap is not following suit due to different wage trends for women and men. In the past 20 years, the wage gap has decreased at a far slower rate than in the United States, which may reflect different stages of development in gender equality. Females should be encouraged to change their fields of study to more technical and industry-relevant areas and to improve their relative qualifications to counterbalance changes in the wage structure which may work against them. Policy initiatives to promote wider occupational choices and more equal wages are warranted. To the extent that discrimination contributes to the wage gap, it will continue to be a drain on increasing Canada's productivity performance through the fuller integration of highly skilled women.

Developing human resources in science and technology

While Canada develops and imports significant human resources qualified in science and technology (HRST), overall graduation rates in advanced research and returns to higher education in technology fields remain limited. In Canada, science and engineering degrees, including life sciences, physical sciences, mathematics and computing, constituted around 20% of new degrees in 2000, below the OECD average (**Figure 8**). In addition, labour market alternatives for graduates in science and engineering are neither extensive nor varied, largely due to the low level of research and innovative capacity in the Canadian private sector. For example, pure and applied science graduates, in particular at the undergraduate level, have faced high unemployment rates, poor earning prospects and low job satisfaction (Lavoie and Finnie, 1997**).**

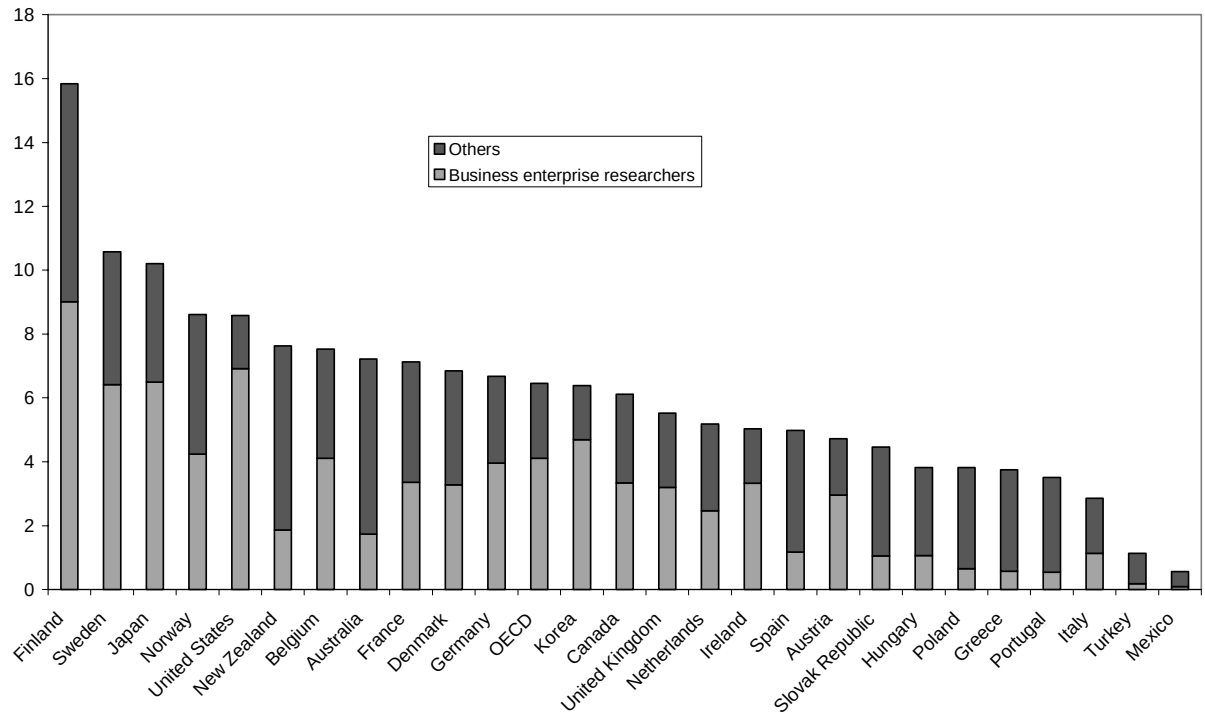
Canada lags other OECD players in terms of research and development (R&D) spending. Even though business research investments increased at an average annual rate of 5% between 1995 and 2001, business R&D intensity of 1.3% is still below the OECD average of 2.3%. The bulk of R&D in Canada continues to be performed by the higher education sector and government, which together employ more than 30% of the research workforce in Canada. The number of business researchers in industry is around 3 per thousand employees, compared to more than 6 per thousand in Finland, the United States, Japan and Sweden (**Figure 9**). The difference can in part be explained by the relatively higher share of small and medium-sized enterprises (SMEs) in business R&D in Canada, around 25%, compared to the OECD average of 17%. Business R&D expenditures are also highly concentrated in a few high-technology industries, particularly ICT manufacturing and services, and biotechnology.

Figure 8. Science and engineering degrees as % of new degrees, 2000



Source: STI Scoreboard 2003.

Figure 9. Employment of researchers, 2001



Note: Employment of researchers per thousand of total employment.
Source: STI Scoreboard 2003.

The R&D-to-GDP ratio is slowly inching up, with a growing share of research performed by businesses, partly due to government initiatives. The 2002 *Innovation Strategy* made a long-term commitment to improving the effectiveness of the innovation system. The government has set a target of raising Canada's ranking in R&D spending as a share of GDP from fifteenth to fifth place in the OECD by 2010. This includes federal government investments of CAD 13 billion in research and development. Policy initiatives to strengthen the university research infrastructure and facilitate the commercialisation of university research have been undertaken. In addition, the Canadian R&D tax credit for stimulating private business research investments remains one of the most generous in the OECD.

Also as part of the *Innovation Strategy*, the government has set targets of increasing the admission of Master's and PhD students at Canadian universities by an average of 5% per year, partly through providing financial incentives to students registered in graduate studies programmes and doubling the number of fellowships and scholarships. The Canadian government has increased support for university research through the *Canada Foundation for Innovation* and funding for research chairs. Other initiatives include awarding more research grants at higher funding levels and establishing a programme to support graduate and post-graduate students in combining academic training with applied research experience in a work setting.

Males remain more likely than females to obtain advanced research qualifications. However, women's participation rates in science and technology occupations, particularly information technology, are increasing in Canada, albeit from a small base. Universities are focusing on increasing female enrolment at both the undergraduate and graduate levels and on offering support to women currently enrolled in science and engineering programmes, *e.g.* the *Supporting Women in Information Technology* (SWIFT) project at the University of British Columbia. The Natural Sciences and Engineering Research Council (NSERC) offers financial support to women through the *Chairs for Women in Science and Engineering*. The National Research Council of Canada introduced the *Women in Engineering and Science* (WES) programme to provide support to women university students pursuing careers in non-traditional areas of research in the fields of engineering and science. *Women in Doctoral Studies* aims to increase the participation of women in certain fields of study at the doctoral level, *e.g.*, engineering and applied sciences, agriculture and biological sciences, mathematics and physical sciences, etc. A study grant of up to CAD 3 000 a year for a maximum of three years was made available. There are also non-profit, voluntary associations that support women in science and technology, including the *Society of Canadian Women in Science and Technology* (SCWIST) and the *Canadian Coalition of Women in Engineering Science and Technology* (CCWEST).

Steps are being taken to facilitate the transition of researchers from universities and the public sector to the private sector. Industry-university partnerships are being encouraged. There are R&D partnerships between industry and laboratories, researchers, university faculty and graduate students to increase the mobility of highly skilled workers, particularly researchers between the public and private sectors. Some universities offer science and engineering fields in combination with business courses to meet the demands of new interdisciplinary job requirements. Industry views are increasingly being integrated in the development of curricula in certain fields to better prepare students for work. Universities and research hospitals also seek out private sector partners to commercialise research. To improve the capacity of small firms to absorb recent graduates, work experience components have been introduced into college and university programmes (**Box 2**).

Box 2. Development of HRST in small firms

Natural Science and Engineering Research Council of Canada (NSERC) provides about one-sixth of all funds for university research and development in natural science and engineering. Industrial Research Fellowships support PhD graduates in science and engineering while engaged in industrial research and development by covering a significant portion of their salary for up to two years. The presence of highly-qualified personnel is intended to develop long-term research capacity in Canadian companies, in particular SMEs.

Collaborative Research Internship programmes provide financial assistance to innovative Canadian SMEs for the hiring of post-secondary graduates to work on innovation projects in these firms. The programme also seeks to provide career advancement opportunities for highly skilled young people. An initiative of the *Youth Employment Strategy*, this scheme provides financial support to hire post-secondary graduates to work in science and technology-related projects.

Technology First Work is an Internet-based placement service, helping recently graduated technicians and technologists to start careers in small firms, where they are mentored by a certified engineering technologist. *Skills for Business* is a cost-sharing program that allows Masters and PhD students complete their studies while working for an SME on a technology transfer project.

However, more needs to be done to increase the science and technology workforce and improve its utilisation. Graduation rates in science and engineering fields at the Master's and PhD levels will have to at least double to meet Canada's new innovation strategy - even after allowing for increases from other sources, such as immigration, repatriation and retraining. Given the low number of students going on to advanced degrees and limited production of scientists and engineers, interest in science and technology needs to be stimulated at all levels of education and researcher career prospects should be improved. Enhancing the business environment for these technical workers, particularly in terms of employment opportunities and wages, will be particularly important as the integration of North American labour markets accelerates. In general, Canada needs to develop a more high-technology and innovative industry sector in order to attract and retain skilled human capital. Business environment policies that foster entrepreneurship and the innovation capacity of the private sector are essential to improve job prospects and earnings potential for graduates and researchers. The measures proposed as part of the 2002 *Innovation Strategy* should advance this process, but careful attention should be paid to implementation, evaluation and follow-up.

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