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Innovation Analysis Bulletin

A tri-annual report from Statistics Canada with updates on:

- **Government science and technology activities**
- **Industrial research and development**
- **Intellectual property commercialization**
- **Advanced technology and innovation**
- **Biotechnology**
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As of October, 2005 there were:

- 6 publications for sale
- 16 free publications
- 12 research papers
- 118 working papers, and
- 25 questionnaires.

Symbols

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
p	preliminary
r	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
e	estimated figures
E	use with caution
F	too unreliable to be published

Outcomes associated with information and communications technology use and literacy skills

The penetration of information and communications technologies (ICTs), most notably computers and the Internet, has been analyzed extensively in recent years. Studies of the digital divide have identified important gaps in access and use of ICTs between different groups of people, depending on their demographic and socio-economic characteristics. More research is needed however, to understand outcomes associated with ICT use.

Literacy skills provide insight

Such research is more insightful when measures of ICT use are combined with other factors that significantly affect social and economic outcomes. One such factor is literacy skills. The results of a Statistics Canada survey combined measure of individuals' computer use and literacy in order to get to such outcomes. Data from six countries participating in the 2003 *Adult Literacy and Life Skills Survey (ALL)*, a unique source in that it captures respondent literacy skills and use of ICTs in detail, to explore the association of such skills with the personal income of respondents, was utilized.

In order to estimate the odds that an individual would be a high-income earner based on their literacy and computer use characteristics, logistic regression models for each country were applied. This is done while controlling for other factors affecting personal income, including gender, age, educational attainment and labour force status (see Text Box 1).

In order to simplify the analysis, we classify respondents into four groups based on their profile of computer use and literacy skills (see Text Box 2 for details regarding the delineation of the groups). We define a "high-income earner" (dependent variable) as being someone whose income falls in the top 25% of respondents. It was also necessary to identify high-intensity computer users. This was accomplished by creating an index score for each respondent based on their answers to questions concerning their time spent and activities performed on computers[1].

Text box 1. Using odds ratios

Data presented here come from a logistic regression model that measures the odds of being a high-income earner for people with different characteristics. High-income earners are defined as those individuals with income falling in the top quartile (highest 25%) of personal income.

The logistic regression produces a series of odds ratios. These ratios reflect the likelihood of an event occurring (in this case, being a high income earner) for a particular group compared to a predefined "reference" group, as follows:

Odds ratio:	Interpretation:
equals 1.0	Equal chances of being a high-income earner compared to the reference group;
less than 1.0	Less chance of being a high-income earner compared to the reference group
greater than 1.0	Increased chance of being a high-income earner compared to the reference group

For more information about odds ratios, refer to Hosmer and Lemeshow, 1989.

Results indicate that the combined literacy and computer use profiles were strongly associated with personal income. In Canada, respondents who were in one of either the "average or higher" category for literacy or the "high-intensity" classification of computer users (Group 2 or 3) had over two times the odds of being a high income earner compared to those respondents with low literacy and low-to-medium intensity computer use. Interestingly, in Canada at least, it made little difference whether the high score was obtained for literacy or computer use. This was true to some extent in most other countries, except for Switzerland where being a high-intensity computer user gave an individual better chances of being a high income earner than having average (or higher) literacy skills alone.

The chances of earning high income are even greater for those with both average or higher literacy skills and intensive computer use (Group 4). In fact, in Canada, Switzerland and Bermuda, individuals in this group had over five times the odds of being high income earners compared to those with below average literacy and less intense computer use, while controlling for other factors. Being in this group also significantly improved the chances of making income in the top quartile in the United States and Norway, albeit to a lesser degree than the other countries measured except Italy.

Further work is needed to understand the impacts of ICT use more fully, an effort that is particularly helpful when ICT use is placed in the context of additional factors that influence social and economic outcomes. Such work could provide further insight if measures of ICT use were supplemented with actual measures of ICT skills.

1. We refer to the index score as a measure of respondents' "level of use of computers for task-oriented purposes". This score is based on respondents' assessments of the amount of time they spend on computers at home, as well as their use of a computer at any location for the following purposes: writing or editing text; using accounts, spreadsheets or statistical software; creating graphics, designs, pictures or presentations; programming; keeping a schedule or calendar; and reading information on a CD-ROM or DVD. We then identify a "high-intensity" user as someone who scored in the top 25% of respondents in this measure.

Text box 2. Literacy and computer use profiles

The logistic regression models used here assess the effects of various literacy and computer use profiles on the chances that a respondent would have a high level of income. In order to do so, respondents were divided into 4 groups on the basis of their literacy and computer use "profiles" as follows:

Group	Prose literacy level*	Level of use of computers for task-oriented purposes
Group 1	below average (levels 1 & 2)	low-to-medium intensity (lowest 75% of computer use index)
Group 2	average or higher (levels 3-5)	low-to-medium intensity (lowest 75% of computer use index)
Group 3	below average (levels 1 & 2)	high-intensity (top quartile of computer use index)
Group 4	average or higher (levels 3-5)	high-intensity (top quartile of computer use index)

The regression estimates the odds of being in the top income quartile (highest 25%) in terms of personal income, relative to a reference group. For this study, we use Group 1 as the reference group.

The ALL survey measures literacy in four skill domains. Here we use respondent levels obtained in tests of their prose literacy, defined as "the knowledge and skills needed to understand and use information from texts including editorials, news stories, brochures, and instruction manuals." For further information on literacy measures used in the survey, refer to Statistics Canada and OECD (2005).

This article is based on information from a report released on May 11, 2005, ***Skills and information and communications technologies*** *by Ben Veenhof, Yvan Clermont and George Sciadas, Chapter 8 in Statistics Canada and OECD,* ***Learning a living: First results of the Adult Literacy and Life Skills Survey****, Ottawa and Paris.*

Information in this article as well as a further analysis of ICT use and literacy skills will appear shortly in a Statistics Canada national report, scheduled to be released November 9, 2005, and a study for the Connectedness Series, No. 12, covering international data (forthcoming).

Ben Veenhof and George Sciadas, SIEID, Statistics Canada.

Table 1. Adjusted odds ratios showing the likelihood of adults aged 16 to 65 of being a top quartile income earner, by combined literacy and computer use profiles, by country, 2003

	Group 1	Group 2	Group 3	Group 4
Canada	1.00	2.63**	2.52**	5.18**
Bermuda	1.00	2.38**	2.06[E]	5.68**
Italy	1.00	1.27[E]	1.69**	1.8*
Norway	1.00	1.79**	1.95*	3.85**
Switzerland	1.00	2.25**	3.27**	6.3**
United States	1.00	1.86**	2.07**	3.75**

Notes:
* $p<0.05$, statistically significant at the 5 per cent level.
** $p<0.01$, statistically significant at the 1 per cent level.
E - use with caution
Group 1 is used as the reference group.
Odds are adjusted for gender, age, educational attainment, and labour force status.
For definition of Groups 1-4, see Text box 2.
Source: Statistics Canada, Adult Literacy and Life Skills Survey, 2003

Yvan Clermont, Centre for Education Statistics, Statistics Canada.

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Measuring industrial R&D: Comparing Canada with the G-7

Measuring industrial research and development interests many analysts of science and technology. Comparing Canada with other G-7 countries is common in other areas. This article links those two concepts and provides highlights.

Canada accounted for 4.1% of total value-added of the G-7 countries (Canada, France, Germany, Italy, Japan, United Kingdom and United States) in 2000[1], but only 2.5% of total industrial research and development (R&D)[2].

Purchasing power of the Canadian dollar

The Organization for Economic Cooperation and Development (OECD) provides data for industrial R&D in terms of purchasing power parity (PPP) dollars. PPP takes into account the absolute difference in prices between countries. For example, the cost of a litre of gasoline in the US and Canada differs even when converted to the same currency.

To illustrate the concept of PPP dollars, the value for Canada is calculated by comparing the purchasing power of the Canadian dollar in Canada with the purchasing power of the U.S. dollar in the United States. For 2000, the PPP factor for Canadian dollars was 1.208. This means that in 2000 it cost $1.21 in Canadian dollars to purchase in Canada what could be bought for $1.00 U.S. dollar in the United States. Value-added data can be converted to PPP dollars using the appropriate conversion factor for each country and a total for the G-7 can then be calculated. This total can be used as a reference point to compare the structure of the Canadian economy and Canadian industrial R&D to total G-7 figures.

G-7 Industrial profile

The industrial profiles of the members of the G-7 are similar (Table 1)[3]. Using the total economy figures as a reference point, the most notable differences include larger utilities components in Canada and Japan, larger manufacturing sector in Germany and Japan, and larger business services sector in the United States.

Industrial R&D

The picture for industrial R&D is more diverse (Table 2). Canada reports high levels of R&D in utilities and services with lower levels in construction and manufacturing. France and Japan show significant levels of industrial R&D in utilities; Germany reports high levels of industrial R&D in manufacturing; Japan accounts for almost 70% of all construction R&D while the United States accounts for over 80% of industrial R&D by the service sector. Canada is the only other country to report a proportion of industrial R&D performed by the business service sector that is greater than its overall share of total industrial R&D.[4]

Industry level comparison

A comparison at the industry level identifies those industries which account for a significantly greater share of total value-added than Canada's overall share (% of GDP, Table 3). For example, while Canada accounted for 4.1% of value-added in the G-7 (Table 1), the Canadian "wood and wood products" industry accounted for 13.7% of value-added, while Canadian "office, accounting and computing machinery" represented only 1.6% of all G-7 value-added in that industry.

Canadian industries that account for 6% or more of total G-7 value-added include: "wood and wood products"; "pulp, paper, paper products, printing and publishing"; "basic metals"; "motor vehicles"; and "other transportation" (consisting mainly of aerospace).

With the exceptions of "other transportation" and "wood and wood products", a completely different set of industries are *over represented* with respect to industrial R&D (% of industrial R&D, Table 3). While Canada accounts for 2.5% of all G-7 industrial R&D, the following industries in Canada account for 5% or more of the total: "textiles"; "wood and wood products"; "radio, television and communications equipment"; "other transportation" and "utilities".

1. Note that 2000 is the latest year for which complete R&D and GDP data are available for all G-7 countries.
2. GDP data came from the STAN database and industrial R&D data came from the ANBERD database (2005 versions).
3. All data in this article, including Canadian data, are from OECD databases which use the International Standard Industrial Classification (ISIC) Revision 3. (The major difference between NAICS and ISIC is that "publishing" is part of manufacturing under ISIC and part of services (Information and Cultural Services) under NAICS.) For more detailed information about ISIC industry groupings can be found on the United Nations website http://esa.un/org/unsd/cr/registry/

4. Note that classification issues may play a role in accounting for these differences. An example would be pharmaceuticals. In Canada, a significant component of pharmaceutical research falls under pharmaceutical wholesale and R&D services due to classification based on the primary activity, in terms of value-added, of the establishment. In the United States, R&D statistics are classified by primary activity based on employment, shifting some pharmaceutical firms to wholesale because of their large, well-educated and therefore well-paid, sales forces.

Table 1. Distribution of total value-added of the G-7, 2000

Industry	ISIC R3	Canada	France	Germany	Italy	Japan	UK	US
	% of G7 total							
Total economy	1-99	4.1	6.8	9.9	6.7	16.9	6.7	48.9
Total manufacturing	15-37	4.5	6.8	12.3	7.6	19.8	6.5	42.5
Total business services	50-74	3.7	6.8	9.4	6.5	15.7	6.7	51.3
Utilities	40-41	5.1	5.9	8.0	6.5	26.9	5.5	42.0
Construction	45	4.0	6.2	10.0	6.3	23.8	6.9	42.7

Source: OECD, STAN database, 2005.

Note 1: This table does not include resource industries and non-business services.

Table 2. Distribution of total industrial R&D of the G-7, 2000

Industry	ISIC R3	Canada	France	Germany	Italy	Japan	UK	US
	% of G7 total							
Total business enterprise	1-99	2.5	5.7	10.4	2.1	19.3	4.9	55.1
Total manufacturing	15-37	2.2	6.4	12.5	2.2	24.2	5.2	47.3
Total business services	50-74	3.2	2.7	3.6	1.9	1.8	3.6	83.3
Utilities	40-41	8.4	24.8	6.8	2.1	34.6	14.4	9.0
Construction	45	1.3	7.1	4.8	1.0	69.1	3.0	13.7

Source: OECD, ANBERD database, 2005.

Table 3. Canadian GDP, industrial R&D and industrial R&D/GDP as a proportion of G-7 by industry, 2000

Industry	ISIC R3	% of GDP	% of Industrial R&D	Industrial R&D/GDP ratio
Utilities	40-41	5.1	8.4	1.6
Radio, television and communication equipment	32	3.5	5.0	1.4
Office, accounting and computing machinery	30	1.6	2.2	1.4
Textiles, textile products, leather and footwear	17-19	4.1	5.0	1.2
Pharmaceuticals manufacturing	2423	1.8	1.9	1.1
Real estate, renting and business activities	70-74	3.2	3.2	1.0
Machinery and equipment	29-33	2.7	2.4	0.9
Aircraft and spacecraft	353	6.7	5.8	0.9
Coke, refined petroleum products and nuclear fuel	23	2.3	2.0	0.9
Business sector services	50-74	3.7	3.1	0.9
Other transport equipment	35	6.2	5.1	0.8
Manufacturing n.e.c.	36-37	4.0	2.7	0.7
Fabricated metal products, except machinery and equipment	28	4.1	2.7	0.7
Total business enterprise	**1-74**	**4.3**	**2.5**	**0.6**
Basic metals	27	6.7	3.6	0.5
Total manufacturing	15-37	4.5	2.2	0.5
Wood and products of wood and cork	20	13.7	6.0	0.4
Food products, beverages and tobacco	15-16	4.6	1.9	0.4
Chemicals and chemical products	24	3.3	1.4	0.4
Electrical machinery and apparatus, n.e.c.	30-33	2.3	0.9	0.4
Pulp, paper, paper products, printing and publishing	21-22	6.0	2.3	0.4
Chemical, rubber, plastics and fuel products	23-25	3.6	1.3	0.4
Construction	45	4.0	1.3	0.3
Machinery and equipment, n.e.c.	29	3.3	1.0	0.3
Chemicals excluding pharmaceuticals	24*	4.0	0.6	0.1
Rubber and plastics products	25	5.5	0.7	0.1
Other non-metallic mineral products	26	3.0	0.4	0.1
Motor vehicles	34	6.8	0.4	0.1

Note: "n.e.c." is "not elsewhere classified".

When the proportion of GDP is measured relative to the proportion of industrial R&D, it is not surprising to see that many of these industries are at the top of the list in terms of Canada's relative R&D intensity. The figure for relative R&D intensity is equal to the share of industrial R&D divided by the share of GDP.

Industries of note for Canada

For those industries with a relative R&D intensity greater than 1.0, Canada outperforms the G-7 in terms of its commitment to R&D. Using this measure, industries of note for Canada include: "utilities"; "radio, television and communications equipment"; "office, accounting and computing machinery"; "textiles" and "pharmaceuticals manufacturing". In the case of "pharmaceuticals manufacturing" and "office, accounting and computing machinery", industries that typically report high R&D intensities relative to other industries, their share of the Canadian economy is quite low.

At the other end of the spectrum, the "motor vehicle" industry represents a significant industry in Canada in terms of GDP, but is very *under represented* in terms of industrial R&D.

In 2000, Canada reported lower than average industrial R&D relative to its share of G-7 GDP. But in a few industries, most notably "utilities", "radio, television and communications equipment" and "office, accounting and computing machinery", Canada reported higher R&D commitments through its higher R&D intensities.

Charlene Lonmo SIEID, Statistics Canada.

The Survey of Business Incubators, 2005

For many organizations involved in economic development, business incubation is a key to creating and nurturing new business. There is currently very little information available on the business incubator sector in Canada. A new Statistics Canada survey will collect and benchmark vital information on this largely unknown sector of the Canadian economy.

Background

A business incubator is a business unit that specializes in providing a variety of services ranging from providing space, services, advice and support, designed to assist new and growing businesses to become established and profitable. Incubators tend to be small businesses, but also include several government offices and universities. Industry Canada and the Canadian Association of Business Incubators (CABI) have asked Statistics Canada to conduct a Survey of Business Incubators. The objective of the survey is to produce new statistical information on business incubators.

Survey benefits

The survey will provide data on the activities and benefits of this largely unknown sector of the Canadian business community: affiliation; infrastructure; sources of funding; policies; clients and activities; services; impact; management; and barriers. The information is critical in assessing the business incubator sector and in developing programs to support them.

The questionnaire was developed in consultation with Industry Canada and CABI, along with input from potential respondents and comments from business incubator industry experts.

Survey findings

Preliminary data tables are expected to be available in early winter 2005

Rad Joseph, SIEID, Statistics Canada

The increasing importance of energy R&D in today's context

In the context of the progressive depletion of the world's fossil fuel reserves, energy research and development (R&D) is turning towards renewable resources. This article shows a rise during the period 2000 to 2002, compared with the period 1994 to 1996, in the share of R&D dedicated to energy "alternatives", and in particular to renewable energy resources. Between the same periods, expenditures for "traditional" types of energy R&D have fallen.

The urgency of responding to the worldwide challenges in terms of energy production and consumption has increased during the last decade. Global warming threatens irreversible changes to the Earth's climate while its effects on our environment are already becoming visible. Meanwhile, constantly increasing worldwide demand for energy may not only increases the environmental damages caused by burning of petroleum and other fossil fuels, but also accelerate the rise in the price of crude oil and other energy sources.

Changing the way we produce and consume energy implies changing and diversifying our sources of energy, as well as the production techniques that go with them. This process takes place through the development of new technologies and the associated research. This article describes the changes that have taken place in energy R&D within Canada between two time periods: 1994 to 1996 and 2000 to 2002, the last period corresponding to the end of the two decades characterized by low crude oil prices.

What share of Canadian R&D is represented by energy R&D?

The share of expenditures for energy R&D represents 5.4% of all Canadian industrial R&D expenditures between 2000 and 2002. Over time, its importance has been decreasing in the overall Canadian R&D mix, its share having been 7.4% of all industrial R&D between 1994 and 1996.

This does not represent a net decrease of these activities, as between the two periods in question, energy R&D in Canadian industry has increased slightly, from $634 to $741 million[1] spent annually on average. However, this increase was not as rapid as the growth seen in all other types of Canadian industrial R&D taken together, where expenditures rose by 49%[2] between the period 1994 to 1996 and the period 2000 to 2002. By comparison, the growth of energy R&D between the same two periods was only 10.5%.

Important changes in the types of energy R&D carried out

Efforts in "traditional" forms of energy R&D (fossil fuels, nuclear energy and transport and transmission of energy) have all slightly decreased (in terms of expenditures), while only R&D in "energy alternatives" posted a growth of 49% in terms of constant dollars[3]. Within this category of energy alternatives, R&D in energy conservation remained relatively constant, while expenditures for R&D in "renewable resources" and "other cross-cutting techniques or research" doubled (see Figure 1).

The personnel allocated to R&D activities in energy alternatives within Canadian industry has also grown, from just over 1,700 employees annually between 1994 and 1996, to over 2,200 in the years 2000 to 2002.

Explanation of "energy alternatives"

The category **R&D in energy conservation** comprises the reduction of energy consumption in buildings, transportation, industrial processes and all R&D that seeks to reduce energy consumption.

The category **R&D in renewable energies** comprises R&D in solar energy, biomass energy, wind energy, hydroelectricity and all other R&D that the respondent identifies as R&D in renewable energy resources.

The category **other cross-cutting techniques or research** comprises energy system analysis, R&D on the environment and climate change, energy storage and alternative transportation fuels.

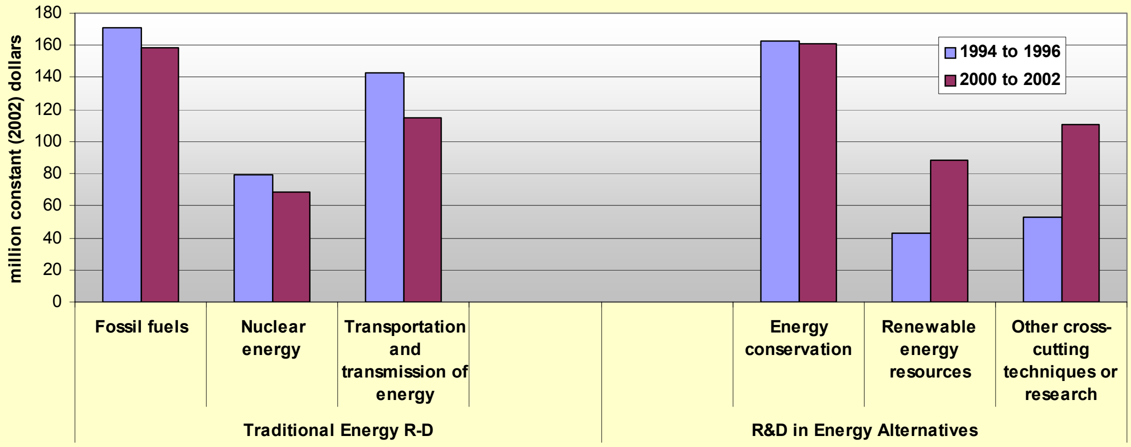
Fewer enterprises active in energy R&D

The number of enterprises active in energy R&D between 2000 and 2002 was smaller than during the period 1994 to 1996. This is the case for "alternative" as well as "traditional" energy R&D activities.

Within traditional energy R&D, the number of enterprises active fell from 177 to 96. This reduction is seen among all categories of R&D, be it fossil fuels, transport and transmission of energy and nuclear energy. Among enterprises active in alternative energy R&D, there were 292 between 1994 and 1996, and only 173 in the period 2000 to 2002[4].

1. Constant Canadian dollars, adjusted by GDP.
2. Statistics Canada. Survey on Research and Development in Canadian Industry.
3. Constant Canadian dollars, adjusted by GDP.
4. This method of counting enterprises considers two branches of the same enterprise as different, because they have a different Business Number. If we regroup the branches of the same enterprise, the number would be 287 enterprises in the first period and 172 in the second for R&D in energy alternatives.

Figure 1. Distribution of R&D energy types in Canadian industry, annual averages 1994-1996 compared with 2000-2002



Source: Statistics Canada. Survey of Energy Research and Development Expenditures by Area of Technology.

Fewer active enterprises, but larger financial outlays in alternative energy R&D

Between 1994 and 1996, there were very few enterprises with large financial outlays for R&D in energy alternatives, but a large number of enterprises with small expenditures for this type of R&D. Between 2000 and 2002, there were much fewer enterprises with small expenditures, and a larger number of enterprises allocating substantial financial efforts to R&D in energy alternatives. Because of this, between 1994 and 1996, the 5 largest enterprises in terms of expenditures for R&D in energy alternatives accounted for 63% of all of this R&D, while between 2000 and 2002, the share of the 5 largest fell slightly to 61%. At the same time, the R&D share of the 50 largest performers of this type of R&D increased from 91% between 1994 and 1996 to 97% between 2000 and 2002[5].

In terms of traditional energy R&D, the phenomenon is not exactly the same. In fact, the shares of the largest 5, 10 and 20 R&D performers remained stable between the two periods above, while the share of R&D carried on outside of the group of the 50 largest performers of this type of R&D fell to barely 1% of the total.

Conclusion

In this article, a brief portrait has been presented of the efforts allocated by Canadian industry in traditional and alternative forms of energy R&D, between 1994 and 2002, this period falling just before the end of two decades of low crude oil prices. We have noted an increase in the R&D dedicated to energy alternatives. Similarly, a concentration is noted of these efforts into a smaller number of enterprises, but which allocate larger financial efforts to R&D in energy alternatives.

As Canada lags behind Europe in terms of renewable energy technologies and their implementation[6] , it will be interesting to see if Canadian industry will continue to accelerate its efforts in this alternative energy R&D in the hope of closing the gap with Europe in the coming years. Alternatively, Canada's industrial energy R&D efforts may once again turn towards fossil fuel technologies, due to the sharply higher prices now commanded by these energy commodities.

Radu Chiru, SIEID, Statistics Canada.

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Harchaoui, Tarek M. 2003. *Greenhouse gas emissions in the Canadian economy, 1981-2000*. Insights on the Canadian economy, Statistics Canada. Cat. No. 11-624-MIE.

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5. These results are presented cross-sectionally, so the same enterprises are not followed through time. Instead, we report the R&D concentration in the first period, and then in the second period.

6. For example, 2.5% of annual European consumption comes from wind resources, with Germany (3.5%), Spain (6.0%) and Denmark (20%) known as the leading countries in these technologies. Iceland is known as a leader in geothermal energy technologies, which represent more than 50% of its primary energy production, while Norway derives almost all of its primary energy needs from hydroelectric resources.

Survey of earned doctorates: a profile of doctoral degree recipients

The international mobility of highly-qualified workers has never been higher and shows no signs of slowing. In fact, although the mix of graduates appears to be different, the US and Canada are losing similar proportions of their doctoral graduates.

The Statistics Canada report (Gluszynski and Peters, 2005), released on July 5, presents information about doctoral degree recipients who graduated from Canadian universities between July 1, 2003 and June 30, 2004 as collected by the Survey of Earned Doctorates (SED). The analysis focuses on the demographic and educational characteristics of doctoral graduates, how they financed their education, as well as their plans for further study, employment and where they intend to live in the period immediately following graduation.

Results show that a third of Canada's 3,327 doctorate graduates were registered in the biological sciences (21%) and engineering (13%). Male PhD graduates were over-represented in fields such as engineering, computer science/mathematics and other physical sciences. A smaller proportion (a third) of physical science and engineering graduates took on debts to finance their graduate studies. About half of the graduates from other fields of study took on debts to finance their graduate studies.

Table 1. Canadian and foreign or visa students, by field of studies

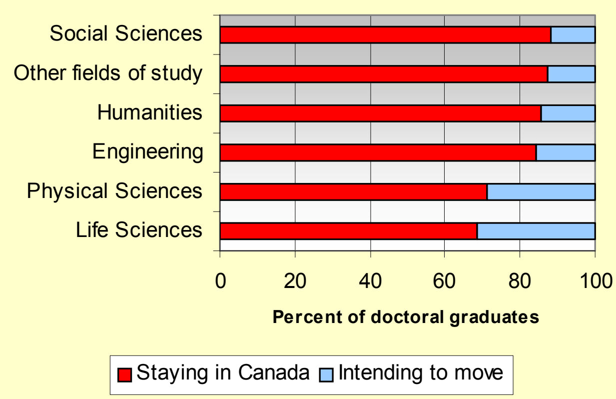
Field of Study	Foreign or visa student	Canadian student
Life sciences	17.5	82.5
Engineering	45.8	54.2
Physical sciences	36.8	63.2
Social sciences	9.3	90.7
Humanities	15.8	84.2
All other fields of study	19.9	80.1
Total	22.8	77.2

Source: Gluszynski and Peters, 2005.
Note: For quality indicators, please see the original publication.

About a quarter of doctoral graduates during that period were foreign students (see Table 1). These foreign students were mostly male (75%) and mostly in the engineering, physical sciences and life sciences.

One out of every five individuals (21%) who graduated with a doctorate during the reference period intended to leave Canada in the year following graduation.

Figure 1. The relocation plans of doctorate graduates, 2004



Source: Gluszynski and Peters, 2005.

Statistics from the National Science Foundation (2005) in the US show similar proportions (about 17%) planning to leave the country shortly after graduation. However, the rate for US citizens is much lower: only 5% of US citizens planned to leave the country. In Canada, the rate for Canadian-citizen doctoral graduates who planned to leave was about 18%.

SIEID is analyzing the Canadian SED data with a special focus on natural scientists and engineers. One of the reasons for paying attention to this group is that the highest proportions of "leavers" are in life sciences and physical sciences. About one in three graduates in these fields plan to leave the country (see Figure 1).

As mentioned in *NESTI Notes* elsewhere in this issue, the development of data on the careers of doctorate holders is a high priority internationally. The OECD, EuroStat and UNESCO are working to ensure that data supporting these indicators become more internationally available and comparable.

Michael Bordt and Suzanne Bernier, SIEID, Statistics Canada.

References

Gluszynski, Tomasz and Valerie Peters. 2005, *Survey of Earned Doctorates: A Profile of Doctoral Degree Recipients*, Cat. No. 81-595-MIE2005032, July 5, 2005, Culture, Tourism and the Centre for Education Statistics, Statistics Canada.

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Commercializing the results of research in Canadian universities and hospitals: an update for 2003

Canadian universities and hospitals have made great strides in commercializing inventions. Statistics Canada conducted the Survey of Intellectual Property Commercialization in the Higher Education Sector in 1998, 1999, 2001 and 2003 to track progress in this area. This article highlights some of the changes between 2001 and 2003, as well as presenting the 2003 regional results.

Major increases between 2001 and 2003

In recent years, the Government of Canada has made substantial new investment in university research. Between 2001 and 2003, total sponsored research funding rose from $3.3 billion to $4.3 billion. During this period, many indicators of the outcomes of university research also increased.

Patents way up

Between 2001 and 2003, the number of inventions reported or disclosed by researchers to universities and hospitals increased from 1,105 to 1,133 (3%). The number of patent applications filed by these institutions also increased from 932 to 1,252 (34%) and the total number of patents held rose from 2,133 to 3,047 (43%).

Patents are typically licensed to other parties, such as to other institutions and companies. New licenses and options rose from 354 to 422 (19%) while total active licenses and options rose from 1,424 to 1,756 (23%).

Revenues rise

Income from IP also increased from $52.5 million to $55.5 million (6%). In 2003, this income, less $4.5 million in patent and legal costs, was distributed as follows:

- $19.4 million (38%) to inventors and co-inventors
- $22.2 million (44%) to administrative units in the reporting institution
- $1.4 million (3%) to other institutions
- $7.4 million (15%) to other parties, such as to technology transfer offices for operations.

More spin-off companies

In 2002 and 2003, Canadian universities and hospitals created 64 spin-off companies to commercialize their technologies, for a total of 876 created to date. The spin-offs cover a wide range of industries, for example, research and development, computer systems design, engineering and medical devices manufacturing. At the end of 2003, the institutions held $52.4 million in equity in publicly traded spin-off companies. In 2003, 11 institutions also helped their spin-offs to raise $54.6 million in venture capital and other forms of investment.

Wide variation across regions

Research funding varies widely from institution to institution and from region to region. For example, the 19 universities and hospitals in the Atlantic region, which are mainly small, received $186 million in research funding in 2003. This compares to 37 institutions in Ontario that received $1.6 billion in research funding in the same year.

Regional differences in IP commercialization can be examined in proportion to research funding. Universities and hospitals in British Columbia received 11% of total research funding but accounted for a higher proportion of three major indicators of IP commercialization: 19% of inventions disclosed, 20% of inventions protected and 25% of spin-off companies created to date.

Prairie institutions also had above average results. They obtained 17% of sponsored research funding but earned a disproportionate 22% of income from IP. They also accounted for 20% of inventions disclosed, 26% of patents issued, 17% of new licenses and options, 21% of total licenses and options and 18% of spin-off companies created to date. However, Prairie institutions had a

Table 1: 2001-2003 comparison of IP commercialization outcomes

	Unit of measure	2001	2003	% change
Institutions in survey	number	116	121	4
Institutions actively managing IP	number	77	87	13
Inventions disclosed	number	1,105	1,133	3
Inventions protected	number	682	527	-23
Patent applications	number	932	1,252	34
Patents issued	number	381	347	-9
Total patents held	number	2,133	3,047	43
New licenses and options	number	354	422	19
Active licenses and options	number	1,424	1,756	23
Income from IP	$ thousands	52,510	55,525	6
Sponsored research	$ millions	3,328	4,282	29

Source: Statistics Canada, Survey of Intellectual Property Commercialization in the Higher Education Sector.

Table 2: Regional differences in IP commercialization, 2003, Part 1

	Institutions	Sponsored research	Income from IP	Inventions		Patents		
				Disclosed	Protected	Applications filed	Issued	Total held
	No.	$ millions	$ thousands	Number				
Atlantic	19	186	626	51	28	X	X	49
Quebec	29	1,279	X	236	156	427	89	682
Ontario	37	1,628	14,347	404	186	361	78	924
Prairies	21	718	11,955	227	50	178	89	X
BC	15	471	X	215	107	X	X	X
Total	**121**	**4,282**	**55,525**	**1,133**	**527**	**1,252**	**347**	**3,047**
	Percentage of national total							
Atlantic	16	4	1	4	5	X	X	1
Quebec	24	30	X	21	30	34	26	22
Ontario	31	38	26	36	35	29	22	30
Prairies	17	17	22	20	10	14	26	X
BC	12	11	X	19	20	X	X	X
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 2: Regional differences in IP commercialization, 2003, Part 2

	Licenses and options		Spin-off companies created to date	Other indicators of note		
	New	Total active		Expenditures on IP management	Research contracts	Inventions declined
	number			$ thousands	$ millions	number
Atlantic	X	X	63	1,869	66	X
Quebec	111	446	127	8,118	152	44
Ontario	178	611	314	13,855	394	66
Prairies	72	367	156	4,501	91	X
BC	X	X	216	8,076	107	93
Total	**422**	**1,756**	**876**	**36,419**	**810**	**256**
	Percentage of national total					
Atlantic	X	X	7	5	8	X
Quebec	26	25	14	22	19	17
Ontario	42	35	36	38	49	26
Prairies	17	21	18	13	11	X
BC	X	X	25	22	13	36
Total	**100**	**100**	**100**	**100**	**100**	**100**

Source: Statistics Canada, Survey of Intellectual Property Commercialization in the Higher Education Sector.

lower share of inventions protected (10%) and patent applications filed (14%).

In contrast, Ontario institutions received 38% of total research funding but accounted for a lesser proportion of most of the major indicators of IP commercialization: 26% of income from IP, 36% of inventions disclosed, 35% of inventions protected, 29% of patent applications filed, 22% of patents issued, 30% of total patents held, 35% of total active licenses and options and 36% of spin-off companies created to date. However, on one major indicator – new licenses and options – Ontario obtained a better result of 42%.

Quebec institutions obtained 30% of sponsored research funding and accounted for 30% of inventions protected and 34% of patent applications filed. However, on most indicators, Quebec had a lower result: 21% of inventions disclosed, 26% of patents issued, 22% of total patents held, 26% of new licenses and options, 25% of total active licenses and options and 14% of spin-off companies created to date.

In recent years, Atlantic institutions have become more active in IP commercialization. Atlantic institutions obtained 4% of sponsored research funding and accounted for 4% of inventions disclosed, 5% of inventions protected and 7% of spin-off companies created to date. However, they lagged in both income from IP and total patents held, with only 1%.

Other indicators that may play a role in IP commercialization outcomes are expenditures on IP management and the value of research contracts (see Table 2, Part 2).

Preliminary results from the 2003 ***Survey of Intellectual Property Commercialization in the Higher Education Sector*** *were released on December 9, 2004. This article includes revised estimates. The complete working paper with the revised estimates will be available in November.*

Cathy Read, SIEID, Statistics Canada.

The patenting activities of innovative biotechnology firms

In Canada, innovative biotechnology firms invest large amounts to develop new biotechnology products and processes. In 2003, they invested nearly $1.5 billion in research and development (R&D). In biotechnology, the development process is long and costly, with no guarantee of success. Some firms that discover a new biotechnology product or process with potential industrial applications may want to protect it against any infringement. The patent is a tool preferred by innovative biotechnology firms to protect their invention. This article describes the patenting activities of biotechnology firms in 2003 and examines the relationship between patents and funding.

A patent gives an innovative company the exclusive right to benefit from the commercialization of products derived from its invention for a specified period. If the innovative firm so wishes, it is entitled to prohibit any third party from manufacturing, using or selling the product or process that it has invented. It may also require anyone wishing to use or purchase the patent rights to pay an amount of money. In exchange for these privileges, the inventor must provide all information needed to reproduce the biotechnology product or process. Thus patents, unlike trade secrets, ensure a degree of transparency.

In Canada as a whole, more than two-thirds of biotechnology firms—315 firms out of 490—had biotechnology-related patents in 2003. In all, they held 13,869 patents (existing or pending), of which 5,199 were existing and 8,670 were pending.

Among all the patents owned by biotechnology firms, only 14% are Canadian patents. The others come from the U.S. Patent and Trademark Office (36%), the European Patent Office (15%) or other patent-issuing countries (36%). Many firms have patented their invention abroad. Two factors may explain this situation. First, Canada is a smaller commercial market than the United States or Europe. Second, the patent systems are different (Hirshhorn and Langford, 2001).

A firm's behaviour with respect to patents differs depending on the size of the firm and the industry to which it belongs (Table 1). Depending on its size, the firm will opt for a different strategy of patent use. Small and medium-sized innovative biotechnology firms are more likely than large firms to have at least one biotechnology-related patent. Indeed, they hold nearly 80% of the 13,869 biotechnology-related patents. However, on average, small firms have fewer biotechnology-related patents (16.0) than medium-sized firms (68.7) and large firms (48.4).

Firms in the human health sector are more likely to hold patents to protect their inventions than firms in other biotechnology industries. In 2003, they held nearly 90% of biotechnology-related patents. The complexity, lead times and costs associated with clinical trials and the approval process for new products are factors that may explain this greater tendency of firms in this sector (which includes biopharmaceutical firms) to patent their inventions. As regards other industries, patents may not be essential to a firm's development. Some firms may opt for other ways of protecting intellectual property, such as industrial secrecy, a leading position in the market or technological complexity. Other firms, such as those in the environmental and agricultural sector, cannot use patents to protect their new biotechnology process or product. Canadian legislation does not allow the patenting of

Table 1. Innovative biotechnology firms with biotechnology-related patents in 2003, by size and industry

	Number of innovative biotechnology firms	Number of firms with patents	Number of patents
Total	**490**	**315**	**13,869**
Size of firm			
Small (fewer than 50 employees)	352	237	5,622
Medium (50 to 149 employees)	77	50	5,293
Large (more than 150 employees)	61	28	2,953
Industry			
Human Health	262	215	12,258
Agricultural Biotechnology	86	55	994
Natural Resources	21	8	142[E]
Environment	38	11	82
Aquaculture	15	X	F
Bioinformatics	16	X	X
Food Processing	52	17	215

[E]: to be used with caution.
X: confidential under the provisions of the Statistics Act.
F: not sufficiently reliable to be published.
Source: Statistics Canada, Biotechnology Use and Development Survey, 2003.

higher life forms, such as plants, seeds or animals, in Canada.

A patent also serves to provide an innovative firm with a tangible and real asset that may be useful to it in the product's subsequent development stages. In general, biotechnology firms cannot rely solely on their resources and internal capacities to finance the different development stages of a new product or process. They must have recourse to loan capital to finance clinical trials or field tests and the different stages leading to the approval and commercialization of the new biotechnology product or process. In the 2003 **Biotechnology Use and Development Survey**, nearly half of innovative biotechnology firms, or 254 of the 490 surveyed, attempted to raise capital in 2003 for purposes related to biotechnology (Raoub et al., 2005). To be successful in attracting investor interest in its riskier products, patents may be an asset for a biotechnology firm.

Biotechnology firms that have patents—especially those with many patents—have a higher success rate in obtaining funding than do those with no patents. A patent gives investors an insight into the credibility and feasibility of the biotechnology product or process. In 2003, biotechnology firms that had many patents (more than 10) were proportionally more successful in raising capital than biotechnology firms with few (between 1 and 10) or no patents. Among firms seeking funding in 2003 that had more than 10 biotechnology-related patents, there were 3.8 firms that would secure funding for every one that would not. For firms with few or no biotechnology-related patents, the ratios are lower: for each grouping of firms, there were 1.6 firms that were successful for every firm that was unsuccessful.

In short, it appears that biotechnology firms with a sizable patent portfolio generally have an advantage in raising capital from different funding sources.

Hélène Maheux, SIEID, Statistics Canada.

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Hirshhorn, Ronald and Jock Langford. 2001. *Intellectual property Rights in Biotechnology : the Economic Argument*, prepared for "The Canadian Biotechnology Advisory Committee on Intellectual Property and the Patenting of Higher Life Forms".

Raoub, Lara, Annalisa Salonius and Chuck McNiven. 2005. *Overview of the Biotechnology Use and Development Survey 2003*, SIEID Working Paper Series, Cat. No. 88F0006XIE2005009, Statistics Canada.

What's new?

Recent and upcoming events in connectedness and innovation analysis.

Connectedness

A chapter on **Skills and information and communications technologies** (B. Veenhof, Y. Clermont and G. Sciadas) was released on May 11, 2005 in the international report, *Learning a living: First results of the Adult Literacy and Life Skills Survey* (Statistics Canada and OECD, 2005). Additional information based on the **Adult Literacy and Life Skills Survey** is planned for release in late fall, including a national report for Canada and the provinces, as well as an in-depth study on ICT use and literacy skills for the *Connectedness Series* (Cat. No. 56F0004MIE).

Telecommunications

Annual survey of telecommunications service providers

No updates to report.

Quarterly survey of telecommunications service providers

Selected statistics on the telecommunications services industries for the first quarter of 2005 were released on October 4, 2005. The first quarter 2005 issue of *Quarterly telecommunications statistics* (Cat. No. 56-002-XIE) will be available soon after.

Broadcasting

Selected statistics on the radio broadcasting industry for 2004 were released on July 27, 2005. More detailed information was made available on August 3, 2005 in *Broadcasting and Telecommunications*, Private Radio Broadcasting, 2004, Cat. No. 56-001-XIE, Vol. 35, No. 3.

Selected 2004 statistics for the cable and other program distribution industry were released on October 12, 2005.

Household Internet use

No updates to report.

Business e-commerce

Survey of electronic commerce and technology

The questionnaire for the 2004 Survey of Electronic Commerce and Technology will be mailed out in November.

Science and innovation

S&T activities

Research and development in Canada

The service bulletin *Estimates of total spending on research and development in the health field in Canada, 1988 to 2004*, (88-001 Vol. 29, No. 5) was released on July 27, 2005.

Provincial government science expenditures were released on September 6, 2005 in working paper *Scientific and technological (S&T) activities of provincial governments and provincial research organizations, 1995-96 to 2003-04*, (Cat. No. 88F0006XIE no. 011).

Industrial research and development

The service bulletin *Industrial research and development, 2001 to 2005,* (88-001 Vol. 29, No. 4) was released on June 30, 2005. Table number 358-0024 on CANSIM and associated tables on the Canadian Statistics website under the Science and technology heading were also updated the same day.

Federal science expenditures

No updates to report.

Higher education sector R&D

No updates to report.

Provincial research organizations

No updates to report.

Human resources and intellectual property

Federal intellectual property management

<u>Federal science expenditures and personnel, intellectual property management annex</u>

The 2003-04 and 2004-05 surveys are in the field.

The higher education sector

<u>Intellectual property commercialization in the higher education sector</u>

The 2004 survey is in the field. A working paper on the 2003 survey will be released shortly.

Innovation

Innovation in manufacturing

A survey on innovation in Canadian manufacturing and logging will be conducted during the fall of 2005. The survey will collect information on core issues surrounding innovation such as business success factors, innovation activities, sources of information for innovation, innovation cooperation, impact of innovation, problems and obstacles for innovators, intellectual property and technology acquisition, market and supply chain, and business funding and support. Preliminary data for Canada will be released on March 31, 2006.

Innovation in services

No updates to report.

Community innovation

No updates to report.

Commercialization

The **Survey of Business Incubators 2005** is in the field.

Biotechnology

The report *Canadian Trends in Biotechnology – 2nd Edition* was released September 19, 2005. This publication is the result of a partnership between Statistics Canada and the Canadian Biotechnology Secretariat. The report may be accessed electronically at www.biotech.gc.ca.

The *Survey on emerging technologies – 2005* will be mailed-out October 27, 2005. This survey is the pre-contact stage of the *Biotechnology use and development survey – 2005* that will be mailed-out in Spring 2006.

NESTI Notes

Iceland hosted the 2005 meeting of OECD's working party of National Experts on Science and Technology Indicators (NESTI) was held in Reykjavik from June 15th to the 17th. Thanks to our hosts, many of us had the opportunity to explore a new country and culture as well as to participate in a productive meeting.

Innovation

The working party accepted the final draft of the third edition of the ***Oslo Manual: Proposed Guidelines for Collecting and Interpreting Innovation Data***, which had been under development since 2003. The joint OECD-EuroStat manual will be printed and distributed shortly.

What's next for innovation data? Anthony Arundel presented a proposal to gather existing questionnaires and survey metadata from all participating countries; develop a database of questions; conduct comparative analysis of data from participating countries and recommend and test a core set of questions. Canada offered to participate in this initiative, which would also seek to document the approach to pre-testing innovation questionnaires in member countries.

Human resources in science and technology (HRST)

The joint OECD-EuroStat-UNESCO project of defining internationally comparable statistics on the Careers of Doctorate Holders (CDH) showed that cooperation among these three organizations can generate new and useful approaches. The work has produced some initial tabulations of data (from Canada and the US), a draft methodology and a database of questions. At least two European countries and two non-member countries will conduct pilot surveys this year or early next year.

Canada already conducts a survey of doctorate graduates (the **Survey of Earned Doctorates** or SED) and a cohort graduate survey (the **National Graduates Survey** or NGS). Most countries starting out to analyze their doctorates prefer a broader-based population survey (e.g., a sample of all doctorates working in the country). This approach gives data on immigrant doctorates and provides a broader base of information on careers. We are assessing the interest in developing and conducting a pilot doctorate population survey in Canada.

The OECD announced that they would lead a conference as part of the Global Science Forum on Declining Interest in Science Studies in Amsterdam on Nov. 14-15.

The National Science Foundation in the US presented a paper on Measuring Researchers in Business Enterprises suggesting that respondents have difficulty in providing detail on researchers (sex, age, country of origin, field of study, level of highest degree).

Biotechnology statistics

NESTI's *ad hoc* sub-committee on biotechnology statistics had completed its work and produced a publication (***A framework for biotechnology statistics***) and a compendium of biotechnology statistics. Canada presented a paper on future options for the continuation of the ad hoc work on biotechnology statistics. The group decided to continue the work virtually to improve the content of biotechnology surveys.

Internationalization of R&D

Large corporations conducting R&D have introduced new challenges to the statistical system that tracks who funds the R&D, who conducts it and who benefits from it. NESTI established a task force on measurement of internationalization of R&D. Led by the US, which has experience in linking R&D survey records (which track R&D conducted domestically) with data on Foreign Direct Investment (in and out). The task force will report to NESTI 2006.

R&D

The OECD paper on ANBERD (analytical business expenditures on R&D) highlighted the difficulty in obtaining consistent estimates of R&D by economic sector for comparison among OECD members.

The Canberra II Group on the **Measurement of Non-Financial Assets** recommended at its last meeting that R&D, using the definition of the Frascati Manual, be capitalized in the System of National Accounts. In July, the Advisory Expert Group on National Accounts (AEG) met and accepted the recommendation.

A new draft classification for Fields of Science, based on work led by the Netherlands, was accepted pending a decision by written procedure to classify biotechnology and nanotechnology.

OECD Forum 2006: Measuring the Changing Nature of Science, Technology and Innovation (Blue Sky II)

In June, 1996, the OECD hosted a conference on ***New Indicators for the Knowledge-based Economy (Blue Sky)*** in Paris. This conference became the source of many of the ideas that have led to changes in the measurement of S&T since then. NESTI recommended last year to hold a similar forward-looking meeting in 2006. The Canadian delegation announced that the Blue Sky II meeting will be in Ottawa, September 25-27, 2006. The meeting will be jointly sponsored by National Science Foundation in the US, Statistics Canada and Industry Canada.

Canada suggested that the areas of commercialization, Northern S&T and microfirms be included as topics for discussion.

In brief

In this section, we highlight articles of interest that have recently appeared in the Statistics Canada ***Daily*** and elsewhere.

Connectivity and ICT integration in First Nations schools: Results from the Information and Communications Technologies in Schools Survey, 2003/04

In this age of the information society, information and communications technologies (ICTs) have become everyday tools for living, learning and working. Nearly every facet of our economy and society has been touched by ICT. These days, ICT in education has become a priority for governments, educators, businesses and policy makers, in an effort to close the digital divide and monitor how well equipped students are with the skills necessary to succeed in today's technology-savvy workplace.

This report presents information on the information and communications technologies (ICT) infrastructure and reach in all responding First Nations schools in Canada. It uses data from the 2003/04 Information and Communications Technologies in Schools Survey.

The publication *Connectivity and ICT Integration in First Nations Schools: Results from the Information and Communications Technologies in Schools Survey, 2003/04* (free) is now available and was announced in ***The Daily*** on August 22, 2005

Johanne Plante, Culture, Tourism and the Centre for Education Statistics, Statistics Canada.

Functional foods and nutraceuticals: The development of value-added food by Canadian firms

The main indicators of functional food and nutraceutical activities in Canada are presented in this article. The data are from the 2003 Functional Foods and Nutraceuticals Survey which was designed to provide a benchmark measurement of the industry and a better understanding of the scope and nature of the sector.

In 2002, an estimated 294 firms in Canada engaged in activities with functional food and nutraceutical products. Over 60% of all firms believed that the ability to use claims about reducing the risk of diseases, generic health claims and structure-function claims would have a positive impact on sales.

The publication *Functional foods and nutraceuticals: The development of value-added food by Canadian firms* (88FOOO6XIE2005016, free) was announced in ***The Daily*** on September 26, 2005.

Jacqueline Tebbens, Communications and Library Services Division, Statistics Canada.

Canadian Trends in Biotechnology

A new compendium entitled *Canadian Trends in Biotechnology* is now available. It updates an earlier version of the document released in 1999, which was based on Statistics Canada's first available data on biotechnology.

This compendium provides an overview of biotechnology activities in Canada from 1997 to 2004.

It includes information on federal government spending for scientific and technological activities in biotechnology, as well as a portrait of the evolution of innovative Canadian biotechnology firms. The compendium provides information on financial profile, human resources, business relations and spin-off firms, along with the number of biotechnology products and processes at each stage of development.

This publication also uses data from the Organisation for Economic Cooperation and Development and places biotechnology activity in Canada in an international context. Some comparisons are provided on the number of biotechnology firms, patent activity and public sector investment in biotechnology research and development.

The publication *Trends in Canadian Biotechnology Activity*, *2nd edition* (free) is now available on the Canadian Biotechnology Secretariat Web site (http://bioportal.gc.ca/trends) and was announced in ***The Daily*** on September 19, 2005

Hélène Maheux and Chuck McNiven, SIEID, Statistics Canada.

Trends and conditions in census metropolitan areas: Final assessment

During the past 16 months, Statistics Canada has released a series of eight reports shedding light on economic and social issues of importance for the nation's 27 largest metropolitan centres.

Based primarily on census data, this series provided substantial information and analysis on topics such as low income, health, immigration, culture, housing, labour markets, industrial structure, mobility, public transit and commuting, and Aboriginal people.

This final assessment summarizes the major findings of the eight reports, and evaluates what has been learned.

1. Population growth rates vary, as do the sources of growth in metropolitan areas.
2. Employment in urban areas is shifting from goods to services production.
3. Large CMAs are centres of culture and computer and telecommunications industries.
4. There are tremendous differences in the labour market strength of CMAs.
5. Immigrants are changing the face of Canada's largest urban centres.
6. Aboriginal people are doing better, but still lag behind others across many indicators.
7. Income inequality and spatial income polarization have risen.
8. Many CMA residents live in housing they cannot afford.
9. Canadian CMAs have unequal health conditions and outcomes.
10. Commuting patterns have become more complex, creating a challenge for public transit.

The ninth and final paper *Ten Things to Know about Canadian Metropolitan Areas: A Synthesis of Statistics Canada's Trends and Conditions in Census Metropolitan Areas Series* (89-613-MIE2005009, free), was announced in ***The Daily*** on September 21, 2005.

Andrew Heisz and Sébastien Larochelle-Côté, Business and Labour Market Analysis Division, Statistics Canada.

In the service of Canadians: A framework for federal science and technology

This framework sets out the Government of Canada's continuing commitment to effectively conduct and manage science and technology (S&T) in support of action on issues of concern to Canadians. It has been prepared in response to the wide-ranging and rapidly evolving challenges and opportunities facing the federal government in carrying out, managing and communicating its S&T activities, many of which have been highlighted in a series of reports by the Council of Science and Technology Advisors (CSTA).

The framework consists of three related elements that

- articulate the unique and essential role of federal S&T;
- present a set of principles and corresponding commitments to guide the conduct and management of federal S&T activities; and
- identify the necessary features of an environment that promotes and supports federal S&T.

The document is available on the Internet at: http://innovation.gc.ca → Reports on Federal Science and Technology.

Scientific and technological (S&T) activities of provincial governments and provincial research organizations, 1995-1996 to 2003-2004

The information in this document is intended primarily to be used by scientific and technological (S&T) policy makers, both federal and provincial, largely as a basis for inter-provincial and inter-sectoral comparisons. The statistics are aggregates of the provincial government science surveys conducted by Statistics Canada under contract with provinces and cover the period 1995-1996 to 2003-2004. This working paper also provides nine years of data for the purpose of historical comparisons.

The publication *Scientific and technological (S&T) activities of provincial governments and provincial research organizations, 1995-1996 to 2003-2004* (88FOOO6XIE2005011, free) was announced in ***The Daily*** on September 6, 2005

Lorraine Chapman, SIEID, Statistics Canada.

New economy indicators

We have compiled some of the most important statistics on the new economy. The indicators will be updated, as required, in subsequent issues. For further information on concepts and definitions, please contact the editor.

	Units	1999	2000	2001	2002	2003	2004
General economy and population[1]							
GDP	$ millions	982,441	1,076,577	1,108,200	1,157,968	1,218,772	1,293,289
GDP implicit price index	1997=100	101.3	105.5	106.7	107.8	111.2	114.8
Population	thousands	30,404	30,689	31,021	31,373	31,660	31,946
Gross domestic expenditures on R&D (GERD)[2]	$ millions	17,638	20,531	22,733	22,370	23,293	24,487
"Real" GERD	$ millions 1997	17,412	19,461	21,306	20,751	20,947	21,330
GERD/GDP ratio	ratio	1.80	1.91	2.05	1.93	1.91	1.89
"Real" GERD/capita	$ 1997	572.68	634.13	686.81	661.44	661.42	667.69
GERD funding by sector							
Federal government	% of GERD	18.2	17.3	18.0	18.9	19.3	19.3
Provincial governments	% of GERD	4.3	4.3	4.6	5.3	5.5	5.8
Business enterprise	% of GERD	44.9	39.7	49.4	49.3	47.5	46.2
Higher education	% of GERD	15.0	14.1	12.9	15.4	16.5	17.6
Private non-profit	% of GERD	2.2	2.2	2.3	2.8	3.0	3.2
Foreign	% of GERD	15.3	17.6	12.8	8.4	8.1	7.9
GERD performance by sector							
Federal government	% of GERD	10.5	10.1	9.3	9.8	9.6	9.1
Provincial governments	% of GERD	1.3	1.2	1.4	1.4	1.4	1.3
Business enterprise	% of GERD	59.0	60.1	60.9	55.4	53.0	51.2
Higher education	% of GERD	28.8	28.2	28.3	33.2	35.7	38.1
Private non-profit	% of GERD	0.4	0.3	0.2	0.2	0.3	0.3
Federal performance as a % of federal funding	% of federal	57.8	58.4	51.4	51.9	49.8	47.2
"Real" federal performance of R&D	$ millions 1997	1,835	1,972	1,971	2,032	2,013	1,946
Information and communications technologies (ICT)							
ICT sector contribution to GDP - basic prices[3]							
ICT, manufacturing	$ millions	13,621	17,070	11,069	8,889	8,871	9,949
% of total ICT	% of total ICT	28.4	30.9	20.6	16.3	15.9	17.1
ICT, services	$ millions	34,355	38,316	42,349	45,016	46,093	47,465
% of total ICT	% of total ICT	71.7	69.4	78.6	82.4	82.8	81.7
Total ICT	$ millions	47,891	55,176	53,857	54,608	55,698	58,112
Total economy[4]	$ millions	896,069	943,738	957,257	986,070	1,008,945	1,040,779
ICT % of total economy	%	5.3	5.8	5.6	5.5	5.5	5.6
Total business sector	$ millions	753,617	798,412	808,811	834,533	854,425	884,924
ICT % of business sector	%	6.4	6.9	6.7	6.5	6.5	6.6
ICT adoption rates (private sector)							
Personal Computer	% of enterprises	81.9	81.4	83.9	85.5	87.4	88.6
E-Mail	% of enterprises	52.6	60.4	66.0	71.2	73.8	76.6
Internet	% of enterprises	52.8	63.4	70.8	75.7	78.2	81.6
Have a website	% of enterprises	21.7	25.7	28.6	31.5	34.0	36.8
Use the Internet to purchase goods or services	% of enterprises	13.8	18.2	22.4	31.7	37.2	42.5
Use the Internet to sell goods or services	% of enterprises	10.1	6.4	6.7	7.5	7.1	7.4
Value of sales over the Internet	$ millions	4,180	7,246	10,389	13,339	18,598	26,438

1. Source: Statistics Canada, 2003, *Canadian Economic Observer*, Cat. No. 11-010-XIB, June 2004, Ottawa, Canada.
2. Source: Statistics Canada, 2003, *Science Statistics,* Cat. No. 88-001-XIB, various issues, Ottawa, Canada.
3. Source: Statistics Canada, 2002, *Beyond the information highway: Networked Canada (Information and communications technologies (ICT))*, Cat. No. 56-504-XIE, Ottawa, Canada.
4. The "total economy" is in chained-Fisher methods of deflation and therefore does not match GDP.

	Units	1999	2000	2001	2002	2003	2004
Information and communications technologies (ICT) continued							
ICT adoption rates (public sector)							
Personal Computer	% of enterprises	100.0	100.0	100.0	99.9	100.0	100.0
e-mail	% of enterprises	96.6	99.0	99.7	99.6	99.8	99.9
Internet	% of enterprises	95.4	99.2	99.7	99.6	100.0	99.9
Have a Web site	% of enterprises	69.2	72.6	86.2	87.9	92.7	92.4
Use the Internet to purchase goods or services	% of enterprises	44.2	49.1	54.5	65.2	68.2	77.4
Use the Internet to sell goods or services	% of enterprises	14.5	8.6	12.8	14.2	15.9	14.0
Value of sales over the Internet	$ millions current	244.6	111.5	354.8	327.2	511.4	1,881.5
Teledensity indicators							
Wired access (Voice Grade Equivalent - VGE)	per 100 inhabitants	64.4	66.1	66.8	64.5	63.2	60.8
Wireless access (VGE)	per 100 inhabitants	22.7	28.3	34.2	37.7	41.6	46.5
Total public switched telephone network (PSTN) (VGE)	per 100 inhabitants	87.1	94.4	101.0	102.2	104.8	107.3
Homes with access to cable	thousands	10,723.4	10,900.5	11,078.7	11,396.2	11,718.5	11,937.1
Homes with access to Internet by cable	thousands	..	7,609.7	9,341.8	10,058.8	10,705.6	11,156.4
Access indicators							
Total wired access lines (VGE)	thousands	19,806.3	20,347.0	20,805.1	20,300.8	20,067.6	19,470.5
Residential access lines (VGE)	thousands	12,743.9	12,871.7	12,854.2	12,752.1	12,648.2	12,488.1
Business access lines (VGE)	thousands	7,062.4	7,475.3	7,950.9	7,548.7	7,419.3	6,982.4
Total mobile subscribers	thousands	6,910.3	8,726.6	10,648.8	11,872.0	13,227.9	14,912.5
Digital cable television subscribers	thousands	..	387.2	808.4	1,150.1	1,382.4	1,843.5
Satellite and MDS subscribers	thousands	..	967.1	1,609.2	2,018.6	2,205.2	2,324.6
High speed Internet by cable subscribers	thousands	..	786.3	1,384.8	1,874.8	2,363.3	2,837.8
Investment indicators							
Investments by the telecommunications services industries (NAICS 517)	$ millions (current)	8,679.2	9,517.8	10,720.5	7,425.8	6,347.9	6,959.7
Investments by the telecommunications services industries (NAICS 517)	$ millions (constant)	8,847.6	9,864.2	11,240.7	7,693.2	7,037.7	7,944.3
Characteristics of biotechnology innovative firms[5]							
Number of firms	number	358	..	375	..	496	..
Total biotechnology employees	number	7,748	..	11,897	..	11,931	..
Total biotechnology revenues	$ millions	1,948	..	3,569	..	3,820	..
Expenditures on biotechnology R&D	$ millions	827	..	1,337	..	1,487	..
Export biotechnology revenues	$ millions	718	..	763	..	..	..
Import biotechnology expenses	$ millions	234	..	433	..	..	..
Amount of capital raised	$ millions	2,147	..	980	..	..	..
Number of firms that were successful in raising capital	number	138	..	134	..	..	..
Number of existing patents	number	3,705	..	4,661	..	..	..
Number of pending patents	number	4,259	..	5,921	..	..	..
Number of products on the market	number	6,597	..	9,661	..	..	..
Number of products/processes in pre-market stages	number	10,989	..	8,359	..	..	..
Intellectual property commercialization[6]							
Federal government							
New patents received	number	89	..	109[r]	133[p]	142[r]	..
Royalties on licenses	$ thousands	11,994	..	16,467	16,284[r]	15,509[r]	..
Universities and hospitals							
New patents received	number	349	..	381	..	347	..
Income from intellectual property	$ thousands	24,745	..	52,510	..	55,525	..

5. Source: Statistics Canada, 2003, *Features of Canadian biotech innovative firms: Results from the Biotechnology Use and Development Survey – 2001*, Science, Innovation and Electronic Information Division Working Paper Series, Cat. No. 88F0006XIE2003005, Ottawa, Canada.

6. Sources: Statistics Canada, Federal Science Expenditures and Personnel Survey, and Survey of Intellectual Property Commercialization in the Higher Education Sector (various years).