Catalogue No. 88-003-XIE

Innovation Analysis Bulletin

A report from Statistics Canada with statistical and analytical updates on:

- **Government science and technology activities**
- **Industrial research and development**
- **Intellectual property commercialization**
- **Advanced technology and innovation**
- **Biotechnology**
- **Information society**
- **Telecommunications and broadcasting**
- **Electronic commerce**

Innovation Analysis Bulletin
Vol. 9, no. 1 (May 2007)

Catalogue Number 88-003-XIE
Aussi disponible en français, n° 88-003-XIF au catalogue

In this issue

How do innovative manufacturing establishments acquire knowledge and technology: Findings from the 2005 Survey of Innovation (p. 3)

This article analyzes the two-thirds of manufacturing establishments that were innovative – that is they introduced a new or significantly improved product or process during the three reference years, 2002 to 2004 – and sheds light on their purchase of knowledge and technology, the importance of information sources, and their collaborative partners.

Innovative biotech firms: Early results from the 2005 Biotechnology Use and Development Survey (p. 5)

Preliminary data from the Biotechnology Use and Development Survey (BUDS) 2005 indicate that growth continued in the sector, but at a slower pace than has been reported in earlier years. This article highlights some key biotechnology indicators for innovative biotech firms in Canada, by sector, size and province.

Innovative establishments in ICT service industries (p. 7)

Canada's ICT sector, comprised of both manufacturing and service industries, is one of several important players in the strategy towards improving the country's innovation performance. In particular, the ICT service industries are leading the way in terms of economic growth and innovative activity.

Innovation indicators: More than technology? (p. 9)

The third edition of the Oslo Manual poses several challenges to future innovation surveys: measuring organizational innovation and marketing innovation; coping with complex and multinational organizations; understanding innovation in services and low-tech manufacturing.

Size counts: Outcomes of IP commercialization (p. 12)

This article uses data from the 2004 Survey of Intellectual Property Commercialization in the Higher Education Sector to examine the relationship between the amount of research conducted and the outcomes of intellectual property (IP) commercialization. The results show that most university IP commercialization is taking place in large institutions.

Canada's top online spenders: Who are they and what are they buying? (p. 14)

In 2005, Canadians placed almost 50 million online orders valued at $7.9 billion. However, many of these orders were made by a relatively small group of people. In fact, Canada's top online spenders represented fewer than 7% of adult Canadians and accounted for three-quarters of total online expenditures to consumers. Who are these Canadians and what are they buying?

Examining barriers to business e-commerce (p. 16)

In 2005, only 6% of Canadian firms sold goods online. Even though 43% of firms made purchases online, it appears that the majority of firms are still having difficulties adapting their business to the online environment or are simply choosing not to do so.

Retirement of Janet Thompson (p. 17)

In January 2007, colleagues and friends wished Janet Thompson well as she ended her 35½ year career with Statistics Canada, of which 32 years were spent in the field of science and technology.

What's new? (p. 18)

Read about recent releases, updates and new activities in the areas of information and communications technology, and science and technology.

New economy indicators (p. 20)

Innovation analysis bulletin

ISSN 1488-433X

Please address all inquiries to the Editor, Innovation Analysis Bulletin

E-mail: sieidinfo@statcan.ca
TTY: 1 800 363-7629
Fax: 613-951-9920
Post: SIEID, Statistics Canada
7th Floor, R.H. Coats Building
100 Tunney's Pasture Driveway
Ottawa, Ontario, Canada K1A 0T6

The **Innovation Analysis Bulletin** is an occasional publication of the Science, Innovation and Electronic Information Division (SIEID) of Statistics Canada. It is available, free of charge, on the Statistics Canada Web site (http://www.statcan.ca) under *Publications*, in the area *Free internet publications*, under the category **Science and technology**.

The **Innovation Analysis Bulletin** is produced under the direction of Fred Gault, Director, SIEID, and edited by Heidi Ertl. Special thanks to the contributing authors and reviewers, as well as Rad Joseph, Heather Berrea and Claire Racine-Lebel for their assitance with production and coordination.

Published by authority of the Minister responsible for Statistics Canada

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued cooperation and goodwill.

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, the Agency has developed standards of service which its employees observe in serving its clients. To obtain a copy of these service standards, please contact Statistics Canada toll free at 1-800-263-1136. The service standards are also published on www.statcan.ca under About us > Providing services to Canadians.

The paper used in this publication meets the minimum requirements of American National Standard for Information Sciences—Permanence of Paper for Printed Library Materials, ANSI Z39.48-1984.

Downloadable publications

To obtain PDF versions of the papers and questionnaires mentioned in this bulletin, please visit the Statistics Canada Internet site www.statcan.ca:

- Our publications are in:

  Publications

  Free internet publications (PDF or HTML)

  Documents are under the categories:

  Information and communications technology and

  Science and technology

- Sample questionnaires are in:

  Definitions, data sources and methods, in the area

  - *Questionnaires – List by subject,* under
    - *Information and communications technology*
    - *Science and technology*

Subscription request

If you would like to receive a printed version of the *Innovation Analysis Bulletin*, please contact the Editor by e-mail.

To receive notification of the *Innovation Analysis Bulletin*, and other related publications, subscribe to *The Daily by subject*. From www.statcan.ca,

The Daily

- Free Subscription → Subscribe now
  - *Information and communications technology*

    and
  - *Science and technology*

Get connected with us

Besides the articles to which we refer in this bulletin, Statistics Canada's Web site provides a wealth of statistics, facts and research papers on a variety of related topics. As well, the questionnaires we have used to collect the information are available for research purposes.

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	use with caution
F	too unreliable to be published

How do innovative manufacturing establishments acquire knowledge and technology: Findings from the 2005 Survey of Innovation

The 2005 Survey of Innovation asked innovative manufacturing establishments questions related to how they acquired knowledge and technology for innovation and from whom. This article analyzes the two-thirds of manufacturing establishments that were innovative – that is they introduced a new or significantly improved product or process during the three reference years, 2002 to 2004 – and sheds light on their purchase of knowledge and technology, the importance of information sources, and their collaborative partners.

In order to develop new and significantly improved products and processes, firms acquire knowledge and technology from various external sources and by various methods. In the most general terms, firms have three different options when acquiring knowledge and technology from outside the firm. They can purchase the knowledge and technology, they can acquire information relevant to their innovation activities, or they can enter into collaborative arrangements to jointly develop innovative products and processes with partners. [1]

The 2005 Survey of Innovation surveys manufacturing and logging industries for the reference period 2002 to 2004. The statistical unit of observation is the establishment. Innovative establishments are those that indicated in the Survey of Innovation that they introduced a new or significantly improved product or process during the reference period.

For more information on the Survey of Innovation, see:

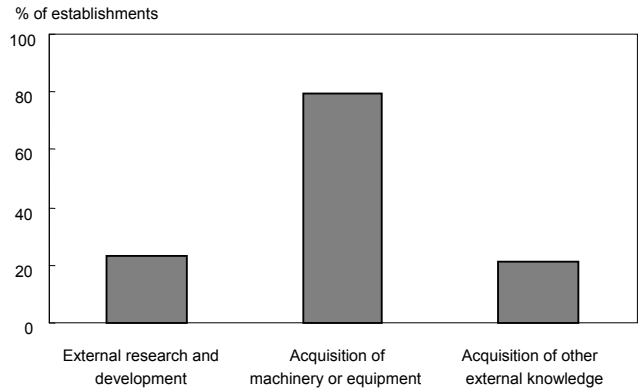
http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=4218&lang=en&db=IMDB&dbg=f&adm=8&dis=2

From where did innovative manufacturing establishments purchase their knowledge and technology?

The survey asked innovative manufacturing establishments to identify in which of three types of innovation activities involving the purchase of knowledge and technology they were engaged. Firstly, establishments can purchase research and development (R&D) services from other firms or from public private and public research organizations. Secondly, establishments can purchase advanced machinery, equipment or computer hardware or software. Thirdly, establishments can purchase other external knowledge including the purchase or licensing of patents and non-patented inventions, and know-how.

Chart 1 shows the most commonly cited type of innovative activity involving the purchase of knowledge and technology between 2002 and 2004: the purchase of machinery, equipment and software. This was identified by four out of five innovative manufacturing establishments. Approximately one in five innovative establishments indicated that they had purchased external R&D, with the same proportion indicating that they had purchased other external knowledge.

Chart 1 Percentage of innovative manufacturing establishments by type of knowledge and technology purchased, 2002 to 2004



Source: Statistics Canada, Survey of Innovation, 2005.

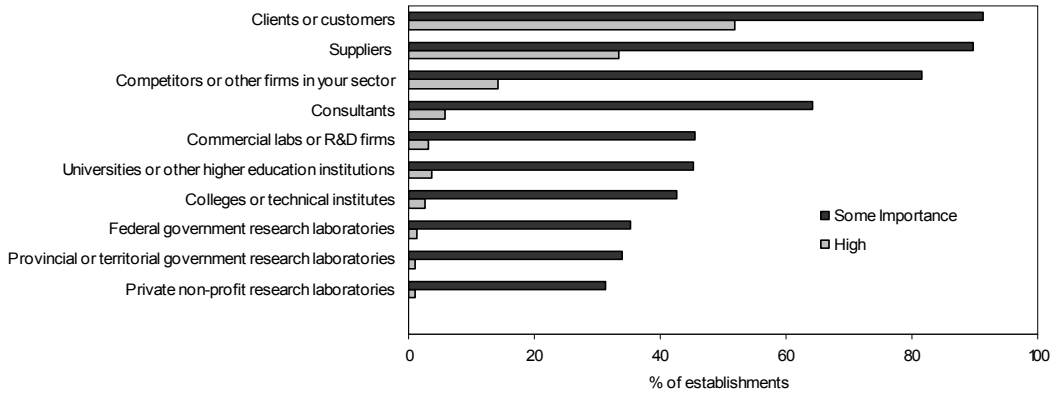
How important were information sources for innovative manufacturing establishments?

Establishments were asked to identify information sources that provided information for new innovation projects, contributed to the completion of existing innovation projects or provided information for the commercialization of innovation. Ten possible external market and institutional sources were listed and establishments were also asked to indicate the degree of importance of the sources they used (high, medium, low or not relevant).

Chart 2 presents two indicators of the importance of the information sources: 1. "high importance" for respondents who indicated the source was of "high" importance; and 2. "some importance" for respondents who indicated the source was of high, medium or low importance.

1. For a more detailed discussion of the issue of the acquisition of knowledge and technology see: OECD/EUROSTAT. 2005. *Guidelines for Collecting and Interpreting Innovation Data (Oslo Manual)*. Paris: pp. 75-88.

Chart 2 Percentage of innovative manufacturing establishments indicating that a source of information was of high or some importance, 2002 to 2004



Source: Statistics Canada, Survey of Innovation, 2005.

In terms of the sources which were considered by innovative establishments to be of some importance (and thus to be of some relevance) to their innovative activities, market information sources were ranked highest. More than four out of five innovative establishments assigned some importance to: 1. clients or customers; 2. suppliers of equipment, materials, components or software; and 3. competitors or other firms in their sector. These were followed by consultants who were considered to be of some importance by two-thirds of innovative establishments, and commercial labs or R&D firms, considered to be of some importance by one half of innovative manufacturing establishments.

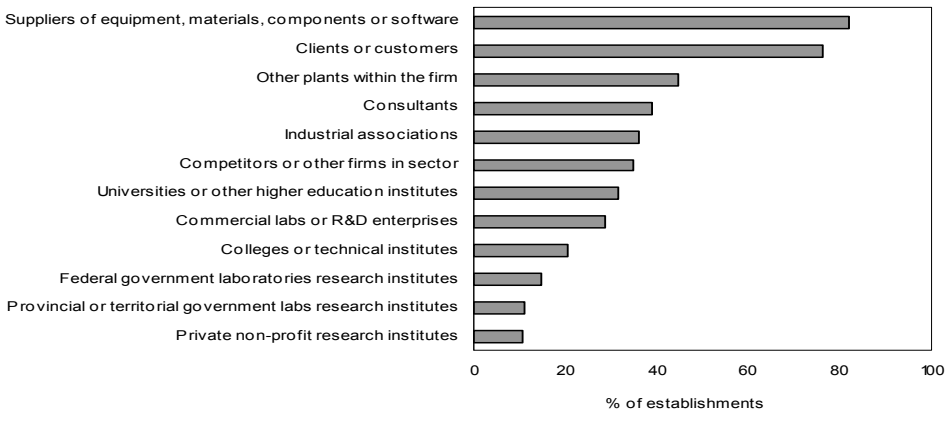
Between one-third and one-half of innovative establishments considered public institutional sources to be of some importance, while one half of innovative establishments considered universities and higher education institutions to be of some importance.

A higher percentage of innovative establishments indicated that market sources were of high importance than they did public institutional sources. Only suppliers and clients or customers were considered to be highly important sources of information by more than one out of five innovative establishments.

With whom did innovative manufacturing establishments co-operate?

Innovative manufacturing establishments were first asked if they co-operated on any of their innovation activities with other firms or other organizations, innovative co-operation being specified as the active participation with other firms and organizations on innovation activities, excluding pure contracting out where there is no active co-operation. Overall, one fifth of innovative establishments indicated that they had some type of co-operative arrangement. Those that collaborated were then asked to identify who their partners were from a list of twelve.

Chart 3 Percentage of collaborating innovative establishments by collaborative partner, 2002 to 2004



Source: Statistics Canada, Survey of Innovation, 2005.

Suppliers of equipment, materials, components or software, along with clients were identified as partners by three-fourths of innovative establishments who collaborated. It is interesting to note that collaboration with other plants within the same firm was indicated by 40% of the collaborating establishments, while industrial associations were identified by one-third of collaborating establishments.

Among the public organization partners, universities and higher education institutions were identified as a partner by the highest percentage (one-third) of collaborating innovative establishments.

Summary

From the results presented above, it can be concluded that suppliers are very important for the acquisition of knowledge and technology by innovative manufacturing establishments in terms of sources of information, purchase of knowledge and technology, and collaborative partners. In general, market actors, including clients, were used more frequently for acquiring knowledge and technology than public institutional sources. This being said, public institutions were found to be of some importance as sources of information by between one-third and one-half of innovating firms. They were also collaborating partners in innovation for between 10% and one-third of establishments that entered into such arrangements.

Further work needs to be done to better understand the conditions under which innovative manufacturing establishments acquire their knowledge and technologies from actors other than their suppliers and clients with whom they have on-going and market relations. The results of this study show that the acquisition of knowledge and technology from suppliers and clients is very widespread, with only a relatively small percentage of innovators not being involved with their suppliers and clients. Further analysis could examine whether size, geographical location, type of industry, innovation intensity or absorptive capacity play a significant role in firms' acquisition of knowledge and technology from market actors who are not clients or suppliers, and from public institutions.

Preliminary results from the 2005 Survey of Innovation, covering manufacturing industries, are now available. Please contact frances.anderson@statcan.ca for more information.

Raymond Leung and Frances Anderson, SIEID, Statistics Canada

Innovative biotech firms: Early results from the 2005 Biotechnology Use and Development Survey

Preliminary data from the Biotechnology Use and Development Survey (BUDS) 2005 indicate that growth continued in the sector, but at a slower pace than has been reported in earlier years. This article highlights some key biotechnology indicators for innovative biotech firms in Canada, by sector, size and province.

There were 532 innovative biotechnology firms in 2005, up 9% from 490 in 2003. This was less than the 31% increase in firms reported between 2001 and 2003. Overall, since 1997 the number of firms has increased at a compound annual rate of 8%.

An innovative biotechnology firm is a firm that uses biotechnology for the purpose of developing new or significantly improved products or processes. Biotechnology is the application of science and engineering in the direct and indirect use of living organisms in their natural or modified forms. Biotechnologies include the use of DNA, proteins and molecules, cell and tissue culture, process biotechnologies and sub-cellular organisms. Traditional biotechnologies such as fermentation for beer, bread, cheese and yogurt are excluded.

For more information on the Biotechnology Use and Development Survey, see:

http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=4226&lang=en&db=IMDB&dbg=f&adm=8&dis=2

Biotechnology related to human health remained most significant sector

Of these 532 innovative biotechnology firms, more than half were found in the human health sector (Table 1). Products and processes related to human health biotechnologies include diagnostics, therapeutics and drug delivery technologies. This sector also led in terms of biotechnology employment, research and development (R&D) expenditures, and revenues. Human health biotech accounted for 57% of all innovative biotechnology firms in Canada, 70% of all biotech revenues and almost 90% of all biotech R&D.

Biotechnology related to agriculture and food processing was second largest, followed by environmental biotechnologies. Average biotech revenues per firm were higher for firms in agriculture than in human health. This reflects the common phenomenon of human health firms with very low or no revenues during the early years of drug development, before the product is approved for the market. In each sector however, revenues from biotechnology exceeded the amounts spent on biotechnology R&D indicating that at least some innovative

biotechnology firms are able to convert their discoveries to a solid income stream.

Table 1 Biotechnology revenues and research and development (R&D) expenditures by sector, 2005

Sector	Number of firms	Biotech revenues	Biotech R&D expenditures
		$ millions	
All innovative biotech firms	**532**	**4,191**	**1,703**
Human health	303	2,955	1,486
Agriculture and food processing	130	1,075	157
Environment	54	121	34
Other	45	41	27

Source: Statistics Canada, Preliminary data from the Biotechnology Use and Development Survey, 2005.

Most innovative biotech firms had fewer than 50 employees

As with the economy overall, most of the firms in the biotech sector were small, with fewer than 50 employees (Table 2). These smaller firms accounted for three-quarters of all innovative biotechnology firms. Medium-size firms accounted for about 15% and large firms 10%. Again – as with the economy overall – the largest portions of revenues were generated by larger firms. In the case of biotechnology firms, the largest firms accounted for two-thirds of revenues, but interestingly, only 37% of biotechnology R&D spending. This likely reflects the development time line of human health biotech firms which often have significant R&D expenditures in early development stages before they have many products on the market.

Table 2 Biotechnology revenues and research and development (R&D) expenditures by size of firm, 2005

Firm size	Number of firms	Biotech revenues	Biotech R&D expenditures
		$ millions	
All innovative biotech firms	**532**	**4,191**	**1,703**
Small (0 to 50 employees)	399	402	576
Medium (50 to 149 employees)	83	961	492
Large (more than 150 employees)	51	2,829	635

Source: Statistics Canada, Preliminary data from the Biotechnology Use and Development Survey, 2005.

Provincial distribution of biotechnology-related employment

The distribution of biotechnology employment mirrored total employment in Manitoba and in Ontario, the province with the most employees overall and the most biotechnology-related employment (Table 3). For other provinces the distribution of biotechnology-related employment did not match that of overall employment. The shares of biotechnology employment in Quebec and British Columbia exceeded their shares of total employment, while in the other provinces the proportion of biotechnology-related employment was lower than overall employment.

Table 3 Total employment and biotechnology-related employment by region/province, 2005

Region/Province	Total employment		Biotechnology-related	
	number	%	number	%
Canada	**13,533,378**	**100**	**13,433**	**100**
Atlantic	912,454	7	132	1
Quebec	3,181,097	24	4,555	34
Ontario	5,245,267	39	5,203	39
Manitoba	520,042	4	491	4
Saskatchewan	407,375	3	167	1
Alberta	1,516,363	11	944	7
British Columbia	1,700,800	13	1,942	14

Sources: Statistics Canada, CANSIM table 281-0024 and preliminary data from the Biotechnology Use and Development Survey, 2005.

Preliminary data from the 2005 Biotechnology Use and Development Survey are now available. Please contact charlene.lonmo@statcan.ca for more information.

The Biotechnology Use and Development Survey measures innovative biotechnology firms. It does not include data on firms which are not engaged in the development of new products or processes, nor does it include contract research organizations (CROs) or contract manufacturing organizations (CMOs). These firms have a more traditional business model and are more focused on generating revenues now rather than down the road. If the excluded firms were included, total biotechnology revenues and employment would be significantly higher.

Charlene Lonmo, SIEID, Statistics Canada

Innovative establishments in ICT service industries

Advances in science, medical research and information and communications technologies (ICTs) are bringing about significant economic and societal transformations, the full impacts of which are only beginning to emerge. Canada's ICT sector, comprised of both manufacturing and service industries, is one of several important players in the strategy towards improving the country's innovation performance. In particular, the ICT service industries are leading the way in terms of economic growth and innovative activity.

Context

In 2005, Canada's ICT sector accounted for nearly 6% of the country's GDP, with ICT services alone accounting for 5%. Whereas ICT manufacturing was hit hard by the sector's downturn in 2001, ICT services began to boom. With telecommunications services leading the way, ICT service industries grew to account for 82% of ICT sector GDP in 2005. The ICT sector also accounted for a substantial 39% of private sector research and development (R&D) in 2006.

It is no surprise that the industries supplying ICT goods and services, such as telecommunications services and computer equipment, are continuously innovating to improve the range and quality of their products and services in order to compete in the global market. Moreover, ICTs and their applications facilitate information sharing and knowledge management, both of which are key elements of the information society (Statistics Canada 2003).

For the purpose of this article, an innovation is defined as the introduction of new or significantly improved goods or services to market, or the introduction of new and significantly improved processes, including new or significantly improved ways of supplying services and delivering processes. Only innovations occurring between 2001 and 2003 – the survey reference period – were included in this analysis (Statistics Canada, Survey of Innovation 2003).

For more information about the Survey of Innovation: http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=4218&lang=en&db=IMDB&dbg=f&adm=8&dis=2

For more information about the manufacturing and service industries belonging to the ICT sector:

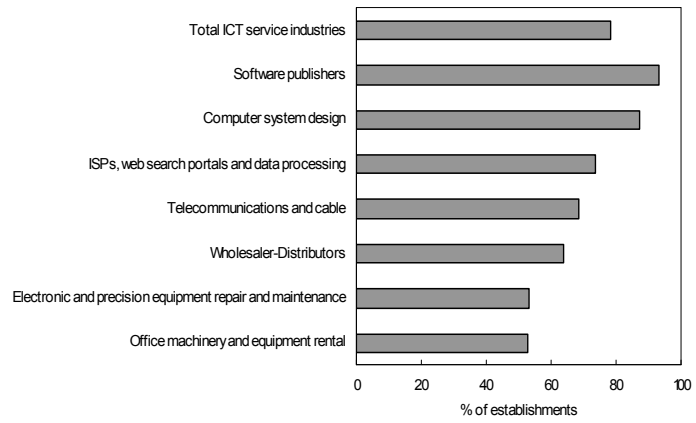
http://www.statcan.ca/english/concepts/definitions/econactiv.htm#ict

Using data from the Survey of Innovation (2003), this article examines some important dimensions of innovation in Canada's ICT service industries, including the propensity to innovate, types of innovations and innovators, success factors, problems, obstacles and barriers, skilled workers, exports, and intellectual property (IP) commercialization[1].

To innovate or not to innovate

More than three-quarters (78%) of ICT service establishments were engaged in some form of innovative activity between 2001 and 2003, however this proportion varied by industry (Chart 1). The software publishing industry was the most innovative, followed by computer system design, and Internet Service Providers (ISPs), web search portals and data processing. Of all ICT service industry innovators, 40% indicated they had introduced a Canada-first innovation (product and/or process), while 21% indicated a world-first.

Chart 1 Percentage of innovative establishments in ICT service industries, 2001 to 2003



Source: Statistics Canada, Survey of Innovation, 2003.

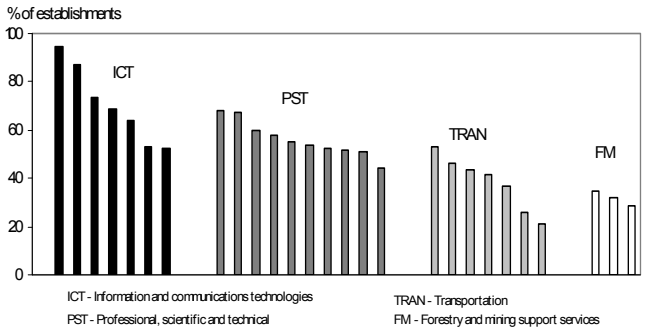
The majority of innovative establishments in ICT service industries were product innovators (71%), while less than half (44%) were process innovators. The percentage of establishments innovating both products and processes stood at 37%, and those innovating only products or only processes stood at 34% and 7%, respectively.

ICT service industries: leaders in innovation

Compared to other service industries in the survey – selected professional, scientific and technical (PST), selected transportation (TRAN), and forestry and mining support services (FM) – industries in the ICT service sector were among the most innovative (Chart 2). Four of the top five innovative services industries, belonged to the ICT service sector, with the fifth from the professional, scientific and technical services group. In fact, of the service industries with more than 60% of innovative establishments, five belonged to ICT, while two belonged to the PST group.

1. The 2003 survey covered only selected service industries. The 2005 survey covered selected manufacturing industries and results will be available in Spring 2007.

Chart 2 Percentage of innovative establishments in selected service industries, 2001 to 2003



Source: Statistics Canada, Survey of Innovation, 2003.

Success factors related to innovation

Innovators in ICT service industries, compared to non-innovators, were more likely to rate various success factors as important[2], with only one exception; a larger proportion of non-innovators (49%) than innovators (32%) identified 'geographic proximity to clients and suppliers' as important. This suggests that innovators are less concerned with being closely located to their clients than non-innovators, likely due to the fact that innovative establishments are more concerned with serving global markets, while local markets are more important for non-innovators.

The largest significant difference for the success factors indicated by innovators and non-innovators in ICT service industries emerged for 'a value system or culture promoting knowledge sharing', where 67% of innovators rated this factor as important compared to 42% of non-innovators. This was followed closely by 'implementing new ICTs' (76% of innovators vs. 51% of non-innovators). It comes as no surprise that these success factors were the two most important for innovators, as they are tied to the emergence of knowledge and technology.

Barriers, problems and obstacles to innovation

The reasons given for not conducting innovative activities can be just as revealing as the reasons for doing so, particularly for policy makers. Just over one-third of non-innovators in ICT service industries cited that they did not innovate because 'they had carried out innovative activities prior to the survey's reference period (2001-2003)'. This was followed by 'no market demand' and 'lack of funds' (both at 31%). A relatively small proportion of non-innovators cited 'lack of trained staff' (13%) as a barrier.

Even for innovators however, there can be problems and obstacles which may slow innovation or cause other difficulties when developing new or significantly improved products or processes. Half of innovators in the ICT service industries cited risk related to market success as an important[3] problem or obstacle, followed closely by high costs (Table 1).

Table 1 Problems and obstacles to innovation cited by innovators in ICT service industries, 2001 to 2003

Problems and obstacles	% of innovators
Risk in terms of innovation's market success	50
Innovation costs too high	44
Lack of appropriate sources of finance	39
Risk related to the feasibility of the innovative projects	37

Source: Statistics Canada, Survey of Innovation, 2003.

Skills, exports and IP commercialization

One of the most important dimensions of firm-based innovation is the various skill levels of the employees. Three-quarters of innovative firms in ICT service industries had R&D personnel, compared with just 29% of non-innovators. Similarly, a higher proportion of innovators than non-innovators had more than 25% of their employees graduated from university.

Is there a link between exporting and innovating? Overall, innovators in ICT service industries were more likely to export than non-innovators. In fact, two-thirds of innovators were exporters while this was the case for about 45% of non-innovators. However, the picture is very different when looking at each industry individually. Innovators in the software publishing (79%) and computer systems design (78%) industries had high exports – these were also the two ICT service industries with the highest innovation rates.

Innovators in ICT service industries were more likely than non-innovators to use all types of IP protection. Just over one-fifth of innovative units in ICT service industries used patents between 2001 and 2003. Almost all of these patent users were product innovators (99%) and 54% had more than half of their revenues protected by formal methods (i.e. trademarks, copyrights, etc.).

2. The survey asked respondents to rate the importance of various success factors on a scale of 1 (low) to 5 (high). The findings presented here are based on ratings of 4 and 5.

3. The survey asked respondents to rate the importance of various problems and obstacles on a scale of 1 (low) to 5 (high). The findings presented here are based on ratings of 4 and 5.

Table 2 Indicators of skills, exports and intellectual property (IP) commercialization, innovators and non-innovators in ICT service industries, 2001 to 2003

Indicators	Innovators	Non-innovators
	%	
Skills		
R&D personnel	75	29
More than 25% university graduates	73	47
More than 50% university graduates	18	7
Exports		
Sale of goods and/or services to clients outside of Canada	66	45
More than 25% of revenues in 2003 from exports	33	13
More than 50% of revenues in 2003 from exports	28	10
IP commercialization		
Use of patents	20	2
Use of trademarks	44	19
Use of copyrights	42	11
Use of confidentiality agreements	82	51

Source: Statistics Canada, Survey of Innovation, 2003.

The proportions of innovative units in ICT service industries using trademarks (44%) and copyrights (42%) were more than double the proportion using patents, while 82% used confidentiality agreements. In fact, confidentiality agreements were the most popular type of IP protection for both innovators and non-innovators.

Summary

Between 2001 and 2003, establishments in ICT service industries were innovation leaders compared to the other service industries surveyed. The majority were product innovators and despite the fact that they had some concerns about the risks and costs associated with innovation, they considered knowledge sharing and the implementation of new ICTs to be important success factors related to innovation. Innovative establishments in ICT service industries were more likely to employ R&D personnel and university graduates than non-innovators, and also more likely to export their products and services. They were also heavily committed to IP protection, the most notable being confidentiality agreements.

Preliminary results from the 2005 Survey of Innovation, covering manufacturing industries are now available. Please contact frances.anderson@statcan.ca for more information.

References

Lonmo, Charlene (2005). *Innovation in Information and Communication Technology (ICT) sector service industries: Results from the Survey of Innovation 2003,* Statistics Canada, SIEID Working paper series, Catalogue no. 88F0006XIE – no. 012, October.
http://www.statcan.ca/bsolc/english/bsolc?catno=88F0006XIE2005012

Statistics Canada (2003). *Canada's Journey to an Information Society*, Catalogue no. 56-508-XIE, December.
http://www.statcan.ca/bsolc/english/bsolc?catno=56-508-XIE

Heidi Ertl and Frances Anderson, SIEID, Statistics Canada

Innovation indicators: More than technology?

The third edition of the Oslo Manual poses several challenges to future innovation surveys: measuring organizational innovation and marketing innovation; coping with complex and multinational organizations; understanding innovation in services and low-tech manufacturing.

Background

The CEIES is a committee of the European Union to reflect the opinion of the European society at large on community statistics. CEIES stands for Comité consultatif européen de l'information statistique dans les domaines économique et social; in English: 'The European Advisory Committee on Statistical Information in the Economic and Social Spheres'.

Part of the work program of the CEIES is to organise seminars on current topics and the topic of the 32nd seminar, held in Århus, Denmark on February 5-6, 2007 was 'Innovation indicators: More than technology'. While the main purpose of the seminar was to advise Eurostat on the implementation of the third edition of the Oslo Manual (OECD/Eurostat 2005), many of the main messages were of broader interest. This article summarizes the main messages from the CEIES seminar.

The third edition of the Oslo Manual poses several challenges for future innovation surveys:

- It broadens the definition of innovation from technological product and process innovation to include organizational and marketing innovation. The term "technological", that is research and development (R&D)-based, has been dropped;
- It places a greater emphasis on linkages with other firms and institutions in the innovation process;
- It provides advice on obtaining information from the appropriate level of the organization;
- It recognizes the importance of innovation in less R&D-intensive industries such as services and low-technology manufacturing;
- It places emphasis on the creation of sub-national innovation statistics.

Main messages

Producer ability to collect data—some experiences

Peter Teirlinck (Belgium) noted that weighting procedures that take item non-response into account greatly affect the results.

Giulio Perani (Italy) provided an example of a two-tiered approach in which respondents at headquarters are asked to obtain information from establishments if they cannot answer on their behalf.

The Danish Survey of Innovation (presented by Peter Mortensen) asks respondents for innovation expenditures in each postal code.

Tomohiro Ijichi (Japan) noted that the results of the non-response analysis of Japan's Survey of Innovation 2003 showed that 23% of non-respondents did not respond because they were unfamiliar with the survey.

Lynda Carlson (USA) highlighted the importance of questionnaire testing and stakeholder consultations in the redesign of the US R&D survey. Such consultations had suggested changes in wording (but not necessarily in concept) from the OECD manuals.

Response unit; new to firm; knowledge management

The author's own presentation focused on "Response unit; new to firm, market and world; knowledge management". The presentation advised that the unit responding to the survey should be capable of responding on behalf of other levels of the organization. If the reliability of such a proxy response cannot be assured, approaches that survey multiple levels of large organizations should be used.

The Oslo Manual recommends substituting "new to the market" for "new to the country" as a measure of regional novelty of innovation. In testing the question for the Canadian Survey of Innovation 2005 (Statistics Canada 2005), it was found that "new to the market" was interpreted by smaller companies as the local market of that company. To avoid mixing local with national concepts of innovation, "new to the country" was retained.

Although some aspects of knowledge management were recommended in the Oslo Manual, the author suggested that the broader set of practices as piloted by Canada and several other OECD countries (see OECD/Statistics Canada 2003) be considered for future innovation surveys.

Data providers' response, ability and willingness

Patrick Corbel (France) showed how "vignettes" or realistic innovation stories helped focus the Oslo Manual revision discussions on including organizational and marketing innovation. The vignettes were adapted from actual write-in questions on the French Community Innovation Survey (CIS3).

Viggo Maegard (Danfoss A/S, Denmark) noted that for Danfoss, it was impossible to provide an estimate of in-country innovation activities. Part of the reason for this is that, while R&D was conducted in Denmark, a majority of the sales were outside the country. Because of these complexities, the company was averse to providing "rough estimates" of innovation expenditures.

Peter Mortensen (Denmark) noted the improvement in response rates with the shorter CIS4 questionnaire. Despite this, some items obtained poor item response rates. He suggested that innovation surveys should be linked with already-available administrative and survey data to reduce response burden.

Comparative analyses based on CIS data

Staffan Laestadius (Sweden) noted that a pilot survey on innovation in low-technology industries showed substantial knowledge production in these industries, which are not R&D intensive.

Leo Hannes (Austria) found that it was possible to conduct some international sectoral comparisons for some select firm types, such as gazelles and eco-industries.

Heidi Armbruster (Germany) showed the benefits of a more detailed survey (and a longer time-frame) that obtains more detailed information on organizational innovation. She also emphasized the collection of information on the extent of use of a given practice as well as when the practice was first introduced. Such detail may be impossible to include on broader innovation surveys but may be useful for occasional focused surveys.

The revised Oslo Manual and its implementation into CIS

Frank Foyn (Norway) presented the results of successive Norwegian surveys of innovation. The proportion of product and process innovators changed little when the term "technological" was dropped but increased when the concepts organizational and marketing innovation were added. Intuitively, the opposite effects should have been observed.

Carter Bloch (Denmark) urged analysts of innovation data to develop composite indicators that would be more useful for telling a comprehensive story.

Vincent Dautel (Luxembourg) reported the shortening of the reference period from three years to two did, as expected, reduce innovation rates in services, low-technology industries and in small firms.

Aavo Heinlo (Estonia) emphasized that the concepts of "new" and "developing" are not as clear for non-technological innovation (organizational and marketing) as for technological product and process innovation.

User needs for new indicators – as well as the existing

Reinhard Büscher (European Commission) noted that existing innovation indicators were already playing a major role in the European Innovation Scoreboard (InnoMetrics 2006). Such composite indicators are essential as communication devices even though analysts debate the meaning and validity of national all-industry aggregates.

Anthony Arundel (UNU Merit) maintained that analysing more detailed breakdowns of innovation data (by size class, industry, innovation type and R&D performance) would highlight the "neglected innovators". That is those in certain industries that manage to innovate despite not performing R&D, being small and being in service sectors.

Sven Olaf Nås (Norway) suggested asking all questions on innovation surveys of non-innovators as well as of innovators. The firm information is useful for understanding the reasons for non-innovation or for discovering innovators who fail to report on innovation activities.

Giulio Perani (Italy) suggested facilitating access to all micro-data by European researchers.

CIS 2008 and beyond

August Gotzfried (Eurostat) described efforts underway to test modules on knowledge management, user-driven innovation and eco-innovation (that is, emerging environmental technologies) for the upcoming CIS.

How far and fast can we go?

Fred Gault reviewed the outcome of the Blue Sky II conference (see IAB, Vol. 8, no. 3, December 2006) and the challenges posed. Blue Sky II urged the S&T indicators community to: develop indicators to tell a comprehensive story; move from activity measures to impact measures; to coordinate, focus and synthesize; to move from macro to micro analysis; and to develop a "science of science policy".

In parallel with this, new modes of analysis were advocated that would develop micro-analytic and macro models, incorporate case studies and most essentially, to support the understanding of the Big Picture. In terms of new indicators, participants recommended improvements for cross-cutting areas: HR measures; classifications and guidelines; firm characteristics and sustainable development.

Summary

The Third Edition of the Oslo Manual posed several challenges to measuring innovation. The seminar proves that the coordinated experiments and analysis of the broad stakeholder community are going a long way to meeting these challenges. Blue Sky II, however, poses even further challenges that will inspire work over the next decade.

References

InnoMetrics (2006). European Innovation Scoreboard 2006. www.proinno-europe.eu.

OECD/Eurostat (2005). *Oslo Manual—guidelines for collecting and interpreting innovation data*, *3rd edition*. Paris, France.

OECD/Statistics Canada (2003). *Measuring knowledge management in the business sector—first Steps*. OECD Catalogue no. 96 2003 02 1 P. Paris, France and Ottawa, Canada.

Statistics Canada (2005). Survey of Innovation. http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=4218&lang=en&db=IMDB&dbg=f&adm=8&dis=2

Presentations and papers presented at all CEIES workshops as well as background information on the CEIES are available at: http://forum.europa.eu.int/Public/irc/dsis/ceies/library (Choose the folder "Seminars 31-40" and then "32nd CEIES Seminar").

Michael Bordt, Environment Accounts and Statistics Division, Statistics Canada

Size counts: Outcomes of IP commercialization

This article uses data from the 2004 Survey of Intellectual Property Commercialization in the Higher Education Sector to examine the relationship between the amount of research conducted and the outcomes of intellectual property (IP) commercialization. The results show that most university IP commercialization is taking place in large institutions.

The results show that most university IP commercialization is taking place in large institutions. In addition, income per total active license was lowest for small universities ($4,000) and increased with university size. However, hospitals had the highest income per total active license ($29,000) compared to $25,000 overall.

The Survey of Intellectual Property Commercialization in the Higher Education Sector, which has been conducted annually since 1998 (with the exception of 2000 and 2002), tracks such indicators as inventions reported to the institution, patent applications filed, income from IP and spin-off company formation.

A working paper with complete results from the 2004 survey was released in the Daily on October 4, 2006.

For the purpose of this study, universities were divided into three size categories according to their income from sponsored research: less than $25 million (in which there were 58 universities); $25 million to $79 million (10 universities); and $80 million or more (18 universities). These categories are denoted as "small," "medium" and "large." The division was done in order to protect respondent confidentiality.

Small universities accounted for 5% of sponsored research but only 3% of inventions disclosed, 4% of inventions protected, 2% of patent applications filed, 2% of patents issued, 1% of total patents held, 2% of new licenses and options, 1% of total active licenses and options, 1% of income from IP and 2% of spin-off companies created to date (Table 1). In other words, small universities accounted for a lesser proportion of IP commercialization outcomes than their share of sponsored research.

Table 1 Outcomes of IP commercialization in the higher education sector, by size, 2004

Size of university (amount of sponsored research)	Number of institutions	Total sponsored research	Inventions		Patents			Licenses and options executed		Income from IP	Spin-off companies created to date
			Disclosed	Protected	Applications filed	Issued	Held	New	Total active		
		millions of dollars	number		number			number		thousands of dollars	number
Small (less than $25 million)	58	269	33	19	28	7	22	8	15	57	19
Medium ($25 to $79 million)	10	528	155	62	121	31	217	27	117	1,668	179
Large ($80 million or more)	18	4,249	1,074	443	1,019	325	3,186	388	1,736	45,001	718
Total university	**86**	**5,046**	**1,262**	**524**	**1,168**	**363**	**3,425**	**423**	**1,868**	**46,726**	**916**
Hospitals	33	…	170	105	96	34	402	71	154	4,484	52
Total	**119**	**5,046**	**1,432**	**629**	**1,264**	**397**	**3,827**	**494**	**2,022**	**51,210**	**968**[r]
As a proportion of total university											
Small (less than $25 million)	67	5	3	4	2	2	1	2	1	1	2
Medium ($25 to $79 million)	12	11	12	12	11	9	6	6	6	3	20
Large ($80 million or more)	21	84	85	84	87	89	93	92	93	96	78
Total university	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Statistics Canada, Survey of Intellectual Property Commercialization in the Higher Education Sector, 2004.

One explanation for this finding could be that small universities tend to focus more on the liberal arts and less on science programs, particularly at the graduate level where most research is performed.

Medium-sized universities accounted for 11% of sponsored research and an equal or higher proportion of inventions disclosed (12%), inventions protected (12%), patent applications filed (11%) and spin-off companies created to date (20%). The remaining outcomes were lower: patents issued (9%), total patents held (6%), new licenses and options (6%), total active licenses and options (6%) and income from IP (3%).

The sequence of events can be followed from research funding as an input to the process, to outputs such as invention disclosures, inventions protected, patent applications filed, patents issued, new licenses executed, income earned and spin-off companies created. Note that for small and medium-size universities, the percentages trend downward through the sequence.

In contrast, large universities accounted for 84% of sponsored research and had an equal or higher proportion on all but one indicator: 85% of inventions disclosed, 84% of inventions protected, 87% of patent applications filed, 89% of patents issued, 93% of total patents held, 92% of new licenses and options, 93% of total active licenses and options and 96% of income from IP. However, large universities were responsible for only 78% of spin-off companies formed.

Clearly, most university IP commercialization is taking place in large institutions, both in absolute numbers and proportionately. The amount of research funding is most likely the single biggest factor related to IP outcomes.

For large universities, the percentages trend upward through the sequence of IP commercialization events. One reason could be the more established technology transfer programs in large universities. There are proportionately more patents held and more active licenses in large universities because they have been engaged in technology transfer longer. It would be expected then that small and medium-size universities will eventually show better results in the latter stages of IP commercialization.

Some additional differences are apparent when examining the indicators as ratios (Table 2).

Readers should note that there are timing differences between IP commercialization events. For example, for small universities in 2004, 33 inventions were disclosed and 19 were protected. However, the latter are not necessarily a subset of the former because an invention disclosed may not be protected until a subsequent year. Despite this limitation, the indicators were examined as ratios because theoretically at least, the timing differences should be equal for all institutions.

Hospitals and small universities stood out in several ways and some similarities were noted. The percentage of inventions protected versus disclosed was highest for hospitals (62%) and second highest for small universities (58%) compared to 44% overall. The percentage of new versus total active licenses was highest for small universities (50%) and second highest for hospitals (46%) compared to 24% overall. The number of patent applications filed (in various countries) per invention protected was lowest for hospitals (0.9) and second lowest for small universities (1.5) compared to 2.0 overall.

Hospitals had the highest income per total active license ($29,000) compared to $25,000 overall. They also had the highest percentage of patents issued per application filed at 35% compared to 31% overall.

In contrast, income per total active license was lowest for small universities ($4,000) and increased with university size.

Overall, most university IP commercialization is taking place in large institutions, both in absolute numbers and in proportion to research funding. In addition, income per total active license was lowest for small universities ($4,000) and increased with university size. However, hospitals had the highest income per total active license ($29,000) compared to $25,000 overall.

Cathy Read, SIEID, Statistics Canada

Table 2 Outcomes and ratios of IP commercialization in the higher education sector, by size, 2004

Size of university (amount of sponsored research)	Inventions			Patents				Licenses and options			Income from IP	Income per total active license
	Disclosed	Protected	% protected	Applications filed	Issued	% issued	Applications filed per invention protected	Total active	New	% new		
	number			number				number			thousands of dollars	
Small												
(less than $25 million)	33	19	58	28	7	25	1.5	15	8	50	57	4
Medium												
($25 to $79 million)	155	62	40	121	31	26	2	117	27	23	1,668	14
Large												
($80 million or more)	1,074	443	41	1,019	325	32	2.3	1,736	388	22	45,001	26
Total university	**1,262**	**524**	**41**	**1,168**	**363**	**31**	**2.2**	**1,868**	**423**	**23**	**46,726**	**25**
Hospitals	170	105	62	96	34	35	0.9	154	71	46	4,484	29
Total	**1,432**	**629**	**44**	**1,264**	**397**	**31**	**2**	**2,022**	**494**	**24**	**51,210**	**25**

Source: Statistics Canada, Survey of Intellectual Property Commercialization in the Higher Education Sector, 2004.

Canada's top online spenders: Who are they and what are they buying?

The Internet has changed the way many Canadians conduct their everyday activities, from viewing weather, news and sports to banking and paying bills. It has also changed the way many shop. In 2005, Canadians placed almost 50 million online orders valued at $7.9 billion. However, many of these orders were made by a relatively small group of people. In fact, Canada's top online spenders represented fewer than 7% of adult Canadians and accounted for three-quarters of total online expenditures to consumers. Who are these Canadians and what are they buying?

Before the Internet was launched commercially in 1993, few people outside the scientific and academic worlds knew anything about this new technology (Rowland 2006). Commerce has since changed in unimaginable ways and it is now possible to search, purchase and sell just about anything over the Internet. Even so, some of the expected impacts of electronic commerce (e-commerce), such as the potential detrimental effects on traditional retail, have not come to fruition, at least not yet (Sciadas 2006).

Despite enormous growth over the last few years, there is unevenness among Canadians in their online shopping behaviours. This article examines the relatively small group of online buyers accounting for the bulk of business-to-consumer (B2C) e-commerce.

The 2005 Canadian Internet Use Survey (CIUS) asked more than 30,000 Canadians aged 18 years and over about their Internet use for the last 12 months. All Internet users, from any location, were asked about electronic shopping, including the number and value of online orders. This survey replaces the Household Internet Use Survey (HIUS) which estimated that, during 2003, Canadian households made 21 million orders online with a total value of $3 billion. As the new survey examines individuals, some comparisons between HIUS and CIUS are not appropriate.

More information about the Canadian Internet Use Survey is available at:

http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=4432&lang=en&db=IMDB&dbg=f&adm=8&dis=2

Shopping on the Internet

According to the 2005 Canadian Internet Use Survey (CIUS), an estimated 16.8 million adult Canadians, or 68%, used the Internet for personal non-business reasons such as e-mailing, searching for information or making travel arrangements (Statistics Canada 2006a). In addition, an estimated 6.9 million adult Canadians placed over 49 million electronic orders for goods and services valued at $7.9 billion in 2005 (Statistics Canada, 2006b). These shoppers represented about 41% of Internet users in 2005, or about 28% of all adult Canadians. On average, each online consumer placed 7.2 orders over the Internet during 2005 with a total value of $1,150.

The most common types of electronic orders placed during 2005 were for travel services (reported by 36% of online buyers); books, magazines and online articles (35%); other entertainment products such as concert tickets (25%); and clothing, jewellery and accessories (25%). Computer software (20%), music (16%) and digital video discs (DVDs, 13%) were also popular.

In addition, an estimated 9.2 million adult Canadians, over one half (55%) of Internet users, went online to window shop for goods and services. The most popular items were consumer electronics, such as cameras and VCRs (42%); housewares, such as appliances and furniture (39%); clothing, jewellery and accessories (37%); and travel arrangements (37%).

More than six out of every ten window shoppers reported making a subsequent purchase directly from a retailer. In fact, offline retail sales influenced by consumers' online browsing are said to be the fastest growing channel of American retailing (JupiterResearch 2007). It is clear that whether consumers are buying or simply doing research about product characteristics and pricing, the Internet has become an important tool for shopping.

Big spenders

Despite the enormous growth of e-commerce over the last few years, just over one-quarter of Canadian adults reported having ordered online. For the analysis in this article, these online buyers were divided into quartiles, or four roughly equal groups, based on the total value of their online expenditures.[1] The biggest spenders racked up more than $1,000 in expenditures during 2005 and averaged close to 14 online orders (Table 1). Accordingly, they fall into the top 25% with an average total value just over $3,800.

Table 1 Average number and average value of orders by online expenditure quartile, 2005

Online expenditure quartile	Online orders per person	
	Average number	Average total value
Bottom ($1 to $150)	2.6	77
Second ($151 to $400)	4.8	272
Third ($401 to $1000)	8.4	726
Top (more than $1,000)	13.7	3,821

Source: Statistics Canada, Canadian Internet Use Survey, 2005.

1. With expenditures of $1,000 as the most commonly reported amount, the quartiles are not precisely four equal groups as the 'top quartile' represents slightly less than 25% of the online buyers.

The top online spenders placed nearly half (44%) of the online orders representing 76% of the total expenditure. This means that just under 7% of adult Canadians accounted for more than three-quarters of total B2C online expenditures in 2005. The top quartile averaged almost three times the number of orders and more than 10 times the total expenditure than the other groups combined.

Who are they?

Canada's top online spenders in 2005 had an average age of 41 years compared to 46 years for all Canadians (over the age of 18). More than half (58%) of these top spenders were men. Also, slightly more than half (51%) had a university education and most (63%) lived in households with incomes greater than $80,000 (compared to a Canadian average of 21% and 30% respectively). Of course, what made these Canadians the top online spenders in 2005 also had to do with what they purchased.

What are they buying?

With few exceptions, those who spent more than $1,000 online in 2005 were more likely to order all types of goods and services. However, the top spenders reported ordering travel services and computer hardware at three times the rate of other spenders (Table 2). These two types of purchases, due to frequency and expense, seemed to propel online shoppers into the top expenditure quartile.[2] Differences in rates were also apparent for other entertainment products such as concert tickets, consumer electronics and flowers or gifts.

Table 2 Selected products and services ordered online by expenditure quartile, 2005

Products and services	Top quartile	All other quartiles
	% ordering online	
Travel services or arrangements	75	25
Books, magazines, online newspapers	43	33
Other entertainment products (concert tickets)	33	17
Computer software over Internet	30	23
Clothing, jewellery, and accessories	28	24
Consumer electronics	26	13
Computer hardware over Internet	25	8
Flowers or gifts	22	11
Music (CDs, tapes, MP3)	21	15
Videos or DVDs	18	12
Toys and games	15	11
Housewares (appliances, furniture)	14	7

Source: Statistics Canada, Canadian Internet Use Survey, 2005.

More than eight of every ten (82%) top spenders reported paying for their purchase with a credit or bank card over the Internet, compared to 73% of all other spenders. Despite this, about one of every three (32%) top spenders was very concerned about credit card use over the Internet (versus 41% of all other spenders).

Almost four out of five (78%) of these top online spenders also reported searching for goods and services without making a corresponding online purchase (window shopping). Of these, 79% reported making a direct retail purchase as a result.

Summary

There are perhaps two issues to consider with respect to the future of e-commerce:

First, rates of e-commerce closely reflect factors influencing Internet use, such as age and income (Noce, Cznery and McKeown 2007, forthcoming). Although older persons are less likely to use the Internet, Internet users are not likely to stop using the Internet as they age. As such, Internet use among tomorrow's older Canadians will reflect the higher rate of today's younger adults. And if the relative cost of access, bandwidth, and computer equipment continues to decline, income will be less of an impediment to both Internet use and e-commerce.

Second is the unique advantage of the Internet as a channel for commerce. It is far superior to any other medium for serving niche markets (Rowland 2006). For example, specialty food, rare cars and antiques, books and instructions, and vacation spots are products for which the market may be substantial but geographically dispersed. These and other types of specialized goods and services should continue to enjoy an expanding online market.

How the interplay of these two issues will affect e-commerce sales is not clear. In the United States, online retail sales are beginning to mature and most new growth is expected from existing buyers spending more (JupiterResearch 2007). In Canada, results from the 2007 CIUS will help to determine whether this same trend is occurring.

References

JupiterResearch (2007). *U.S. Online Retail Forecast, 2006 – 2011*, www.jupiterresearch.com

Noce, A., P. Cznery, and L. McKeown (2007, forthcoming). *Factors associated with Internet use: Does rurality matter?* Rural and Small Town Canada Analysis Bulletin, Statistics Canada, Catalogue no. 21-006-XIE.

Rowland, W. (2006). *Spirit of the Web: The age of information from telegraph to Internet,* Toronto, Thomas Allen Publishers, Toronto, Ontario.

Sciadas, G. (2006). *Our lives in digital times,* Connectedness Series, Statistics Canada, Catalogue no. 56F0004MIE, no. 14, November http://www.statcan.ca/bsolc/english/bsolc?catno=56F0004MWE2006014

Statistics Canada (2006a). *Canadian Internet Use Survey, 2005*, *The Daily*, August 15 http://www.statcan.ca/Daily/English/060815/d060815b.htm

Statistics Canada (2006b). *E-commerce: Shopping on the Internet*, 2005, *The Daily*, November 1 http://www.statcan.ca/Daily/English/061101/d061101a.htm

Larry McKeown and Cathy Underhill, SIEID, Statistics Canada

2. Those who ordered travel services online reported an average of 11 orders, many of which were travel-related, while those who ordered just computer hardware spent an average of $875 per order.

Examining barriers to business e-commerce

In 2005, only 6% of Canadian firms sold goods online. Even though 43% of the firms made purchases online, it appears that the majority of firms are still having difficulties adapting their business to the online environment or are simply choosing not to do so. In order for Canadian electronic commerce to continue its growth, it is important to identify the perceived barriers and explore what firm characteristics, such as size and sector, may influence these barriers.

This article examines changes in the perceived barriers to electronic commerce (e-commerce) for private firms as measured by the Survey of Electronic Commerce and Technology (SECT) between 2001 and 2005. Three main barriers will be discussed: 1) goods and services do not lend themselves to Internet transactions; 2) the firm prefers to maintain current business model and; 3) the firm has security concerns (Chart 1). Differences between small and large firms and key industries will also be assessed.

Each year, the Survey of Electronic Commerce and Technology (SECT) asks respondents to identify the reasons why their organization does not buy or sell goods over the Internet. A list of seven barriers has been included on the survey since 2001. Respondents are asked to identify the barriers that they have encountered, and may select more than one barrier.

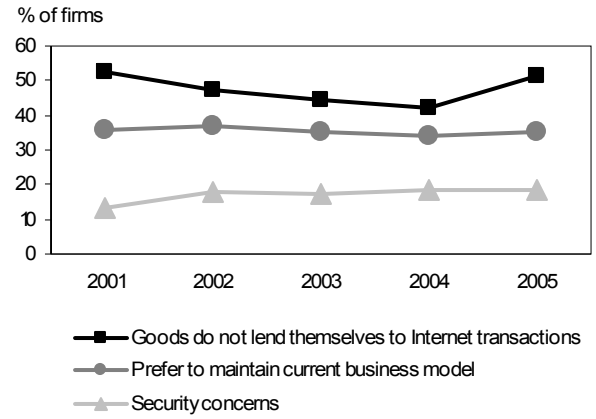
Data from the SECT 2006 are now available, but were not at the time of publishing.

More information about the SECT is available at:

http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=4225&lang=en&db=IMDB&dbg=f&adm=8&dis=2

For the purpose of this analysis, data cover private sector firms that do not conduct electronic commerce, although they may use the Internet for other business activities. Small firms are defined as those with fewer than 20 employees. Large firms have over 100 employees or over 500 for the manufacturing sector.

Chart 1 Proportion of private firms citing top three barriers to e-commerce, 2001 to 2005



Source: Statistics Canada, Survey of Electronic Commerce and Technology, 2005.

Goods and services do not lend themselves to Internet transactions

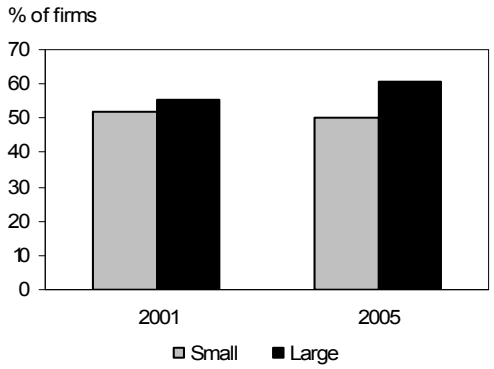
From the popularity of online auction services and the variety of goods and services available online, it would seem that the Internet can facilitate almost any transaction, from a box of paper clips to tonnes of raw steel. However, over 51% of private firms reported that their goods and services did not lend themselves to Internet transactions, essentially unchanged from the proportion reported in 2001.

The percentage of large firms identifying this as a barrier actually increased slightly, from 56% in 2001 to 61% in 2005. Meanwhile, the proportion of small firms citing that the goods and services they sold or purchased were not suited to Internet transactions remained steady at just over 50% (Chart 2).

In 2005, the professional, scientific and technical services sector had the highest proportion of firms that identified the nature of their goods and services as a barrier (58%), while this was the case for 46% of firms in the wholesale trade sector.

Difficulties in adapting goods and services to the online environment could be a result of the product mix that is unique to each sector of the economy. Whereas there is almost always a solution to providing a physical product that is ordered, the delivery of some on-line services is a new challenge for some Canadian firms.

Chart 2 Proportion of private firms citing 'goods and services do not lend themselves to Internet transactions' as a barrier to e-commerce, by firm size



Source: Statistics Canada, Survey of Electronic Commerce and Technology, 2005.

Prefer to maintain current business model

The second most important barrier to e-commerce for private firms was the preference to maintain their current business model, reported by just over 35% of firms in 2005. Large firms were less likely to identify this as a barrier to e-commerce than their smaller counterparts; however an increasing share of large firms reported a preference for maintaining the current business model. This may be seen more as a decision to stay focused on their current strategy.

In the retail trade sector the difference in firm size was quite noticeable. While the overall proportion of firms in the retail trade sector citing a preference for the current business model was 46%, the proportion of large firms reporting this as a barrier dropped by more than half from 53% in 2001 to 24% in 2005. For this sector, e-commerce is the next step in the progression from traditional retail to online retail, and is a natural extension of shopping from catalogues. Large retail firms have been among the early adopters willing to adjust their business model to potentially take advantage of benefits that e-commerce may offer.

Security concerns

Despite the increasing media scrutiny surrounding Internet security, only 18% of private firms reported security concerns as a barrier to e-commerce in 2005. This has increased only slightly over the past five years (from 13% in 2001), which may be due to better tools for providing security, increased awareness of security threats, and general comfort with using the Internet. Moreover, there was no distinct difference between firm size.

Inevitably, not all firms can be expected to introduce e-commerce into their business practices at the same time or to the same extent. In some cases, a shift towards e-commerce may in fact be generational as the tools for selling online become more readily available and in turn, as the selection of goods for procurement becomes even greater. In order to better understand how barriers to e-commerce affect Canadian firms, further monitoring and research must be undertaken on the impacts of buying and selling online.

Rhonda John-Huggins, SIEID Statistics Canada

Retirement of Janet Thompson

In January 2007, colleagues and friends wished Janet Thompson well as she ended her 35½ year career with Statistics Canada, of which 32 years were spent in the field of science and technology.

Known for her consummate professionalism and friendly manner, Janet was a highly regarded colleague. She displayed a very strong work ethic and served as a great example of commitment and dedication to her work. While working in the Science, Innovation and Electronic Information Division, her subject matter knowledge and reputation were widely acknowledged. Janet was the expert on research and development in the higher education sector, and responsible for compiling the aggregate gross domestic expenditures on research and development (GERD) data. In addition, Janet served as a key contact for Statistics Canada partners in the provinces.

Janet was admired and respected by all her colleagues whether they were superiors or members of her staff. Bert Plaus, Janet's supervisor for over 25 years, chuckled as he noted that "Janet knew how to manage both staff and superiors. She certainly kept me on my toes. It was a pleasure to work with Janet".

Congratulations on all your accomplishments and enjoy your retirement, Janet! No doubt you will now have more time for your gardening, golfing and curling, but you will surely be missed by all of us at Statistics Canada!

What's new?

Read about recent releases, updates and new activities in the areas of information and communications technology, and science and technology.

Information and communications technology

On May 21, 2007, the 11th meeting of the OECD Working Party on Indicators for the Information Society (WPIIS) will take place in London. It will be followed on May 22 by a joint workshop with the Working Party on the Information Economy (WPIE) on **Economic and Social Impacts of Broadband Communications: From Measurement to Policy Implications.** The workshop is designed to review studies of the impacts of broadband on economic performance as well as studies of social and distributional impacts of broadband. Statistics Canada will present an overview of the work undertaken by the Information Society section, including social outcomes and impacts of ICTs. The outcomes of the workshop will feed directly into WPIE work on economic and social impacts of broadband for the 2008 OECD ministerial meeting.

On May 28 and 29, 2007, Statistics Canada will hold its annual Socio-economic Conference. As part of the first day, two sessions have been organized on **Indicators and Impacts of a Digital Society;**

Session I-F will focus on indicators and will include the following presentations:

Factors influencing Internet use in Canada: Does urban size matter? (Anthongy Noce, Industry Canada and Larry McKeown, SIEID, Statistics Canada)

The development of Internet use in Canada, 1997 to 2003: Use variables and economic policy (Ji-Youn Kim, Marc Gendron and Anthony Noce, Industry Canada)

The development of Internet use in Canada: Exploring Canadians' engagement with the Internet (Catherine Middleton and Jordan Leith, Ryerson University)

Session II-G will focus on impacts and will include the following presentations:

Connecting with Canadians: Assessing government on-line (Cathy Ladds, Treasury Board Secretariat and Cathy Underhill, SIEID, Statistics Canada)

Isolation, cohesion or transformation? How Canadians' use of the Internet is shaping society (Carsten Quell, Canadian Heritage, Ben Veenhof, SIEID, Statistics Canada and Barry Wellman and Bernie Hogan, University of Toronto)

Reconciling Canadian e-Commerce estimates: A review of definitional and measurement issues (Jeff Corman and Anthony Noce, Industry Canada and Bryan van Tol and Mark Uhrbach, SIEID, Statistics Canada)

For more information regarding this conference or to register please go to: www.statcan.ca and click on workshop and conferences or go directly to:

http://www.statcan.ca/english/conferences/socioeconomic2007/index.htm

Telecommunications and broadcasting

Annual Survey of Telecommunications Service Providers

The processing of 2005 data is on-going.

Quarterly Survey of Telecommunications Service Providers

Selected statistics on telecommunications services industries for the third quarter of 2006 were released on March 5, 2007.

Annual Surveys of the Radio, Television and Cable Industries

The collection and processing of 2006 data for the radio, television and program distribution industries is on-going. The release of statistics is planned for the July to September period.

Canadian Internet Use Survey

No updates to report.

Survey of Electronic Commerce and Technology

Final results from the 2006 Survey of Electronic Commerce and Technology were released on April 20, 2007.

Science and technology

Two sessions at the Statistics Canada Socio-economic Conference 2007 will focus on several issues in science and technology. A session entitled **R & D and Innovation in a Global Economy** includes the following presentations:

Characteristics of firms that participate in global supply chains: Evidence from the Survey of Innovation 2005 (Susan Schaan, SIEID, Statistics Canada)

Make, buy and sell as an organizational learning strategy in research and development: Evidence from Canadian business sector (Julio M. Rosa and Antoine Rose, SIEID, Statistics Canada, Pierre Mohnen, University Maastricht)

Main indicators of R & D in the services sector: A Canada – U.S. comparison (Horatio Sam-Aggrey, SIEID, Statistics Canada)

Developing statistical indicators of venture firms (Cindy Bennett, SIEID, Statistics Canada) will also be presented in a separate session.

Science and technology activities

Research and development in Canada

The service bulletin 'Research and Development (R&D) Personnel in Canada, 1995 to 2004' (88-001 Vol. 31, no. 1) was released on January 16, 2007.

The service bulletin 'Science Statistics' (88-001, Vol. 31, no. 2) was released on March 30, 2007.

Industrial research and development

The service bulletin 'Nature of Research and Development, 2000 to 2004' (88-001 Vol. 30, no. 8) was released on December 15, 2006.

Federal science expenditures

The service bulletin 'Distribution of federal expenditures on science and technology by province and territories, 2004/2005', (88-001 Vol. 30, no. 9), was released on December 15, 2006. A working paper titled 'Provincial Distribution of Federal Expenditures and Personnel on Science and Technology, 2000/2001 to 20004/2005' (Catalogue no. 88F0006-XIE no. 012) was released on December 22, 2006.

Higher education sector research and development

No updates to report.

Human resources and intellectual property

A working paper titled 'Where are the scientists and engineers?' (Catalogue no. 88F0006XIE2007, no. 002) was released on April 16, 2007.

Federal science expenditures and personnel, intellectual property management annex

No updates to report.

Intellectual property commercialization in the higher education sector

No updates to report.

Innovation

Innovation in manufacturing

The production of tables of national and provincial results from the Survey of Innovation 2005 continues. They are being made available through CANSIM.

A researcher database for the Survey of Innovation 2005 has been created. External researchers with approved facilitated access projects can now analyze the micro data from the survey.

Innovation in services

A special SIEID project to improve understanding of firms in Scientific Research and Experimental Development Services (NAICS industry group 5417) continues.

Innovation in advanced technologies

Questionnaire design for the Survey of Advanced Technology 2007 has been completed. Activities are underway in preparation for data collection which will start in September 2007.

Community Innovation

No updates to report.

Commercialization

A feasibility study is currently being conducted on the commercialization of innovation with a view to provide insights on the challenges associated with commercialization. The feasibility study will also provide material for an upcoming survey on commercialization of innovation. A report on this feasibility study will be available this spring.

Biotechnology

Preliminary data from the Biotechnology Use and Development Survey 2005 was released on January 30, 2007. Data collection for the Bioproducts Development and Production Survey 2006 is on-going.

A second session at the Socio-economic Conference 2007 entitled **The Bio-economy** will include the following presentations:

> Bioproduct development and government funding (Johanne Boivin, MCED, Statistics Canada)
>
> Transition to a bio-economy: A community development strategy discussion (S. Albert, Laurentian University)

Technological change

No updates to report.

Knowledge management practices

No updates to report.

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.

Table 1a General economy and population	2001	2002	2003	2004	2005	2006
Gross Domestic Product (GDP) ($ millions)	1,108,048	1,152,905	1,213,408	1,290,788	1,371,425	1,439,291
GDP implicit price index (1997=100)	106.7	107.8	111.3	114.7	118.4	121.0
Population (thousands)	31,021	31,373	31,676	31,989	32,299	32,624
Data source: Statistics Canada, 2007, Canadian Economic Observer, Catalogue no. 11-010-XWB.						

Table 1b Gross domestic expenditures on research and development (GERD)	2001	2002	2003	2004	2005	2006
GERD ($ millions)	23,169	23,539	24,337	26,003	27,174	28,357
"Real" GERD ($ millions 1997)	21,714	21,836	21,866	22,670	22,971	..
GERD/GDP ratio	2.09	2.04	2.01	2.01	1.98	1.97
"Real" GERD per capita ($ 1997)	699.98	696.01	690.30	708.68	711.20	..
GERD funding by sector			**% of GERD**			
Federal government	17.7	18.1	18.6	17.9	18.3	18.4
Provincial governments	4.5	5.0	5.7	5.4	5.6	5.8
Business enterprise	50.3	51.3	49.5	49.0	47.9	46.7
Higher education	12.6	14.7	14.7	15.9	16.6	17.4
Private non-profit	2.3	2.7	2.6	2.8	2.9	3.1
Foreign	12.6	8.2	8.7	9.0	8.7	8.5
GERD performance by sector						
Federal government	9.1	9.3	8.6	8.0	8.0	7.6
Provincial governments	1.2	1.2	1.2	1.2	1.1	1.1
Business enterprise	61.6	57.4	56.3	55.5	53.9	52.4
Higher education	27.7	31.7	33.5	34.8	36.4	38.4
Private non-profit	0.3	0.3	0.4	0.4	0.4	0.4
Federal performance as a % of federal funding	51.3	51.5	46.0	44.6	43.4	41.0
"Real" federal performance of research and development ($ millions 1997)	1,972	1,971	2,032	1,872	1,816	1,828
Data source: Statistics Canada, CANSIM Table 358-0001 "Gross domestic expenditures on research and development, by science type and by funder and performer sector, annual".						

Table 1c Information and communications technology (ICT) sector	2001	2002	2003	2004	2005	2006
ICT sector contribution to GDP[1]						
ICT, manufacturing ($ millions 1997)	11,069	8,619	9,239	9,516	10,261	10,742
% of total ICT sector	20.6	15.9	16.1	16	16.5	16.5
ICT, services ($ millions 1997)	42,349	44,982	47,522	49,037	51,325	53,528
% of total ICT sector	78.6	82.9	82.7	82.7	82.3	82.3
Total ICT sector ($ millions 1997)	53,857	54,288	57,482	59,298	62,359	65,075
Total economy GDP ($ millions 1997)	957,258	982,843	1,002,936	1,034,024	1,062,951	1,091,480
ICT as a % of total economy	5.6	5.5	5.7	5.7	5.9	6.0
Total business sector GDP ($ millions 1997)	808,810	831,293	847,701	875,777	902,519	927,731
ICT as a % of business sector	6.7	6.5	6.8	6.8	6.9	7.0

1 Data are in basic prices using chained-Fisher methods of deflation (1997 chained dollars), CANSIM Tables 379-0017 "Gross Domestic Product (GDP) at basic prices, by North American Industry Classification System (NAICS), annual" and 379-0020 "GDP at basic prices, special industry aggregations based on NAICS, annual", www.statcan.ca.

Data sources: Statistics Canada, Canadian Internet Use Survey; Survey of Electronic Commerce and Technology; Telecommunications statistics (various years).

Table 1d Information and communications technology (ICT) access and use	2001	2002	2003	2004	2005
ICT adoption rates (private sector)			**% of enterprises**		
Personal computer	83.9	85.5	87.4	88.6	..
E-mail	66.0	71.2	73.8	76.6	76.2
Internet	70.8	75.7	78.2	81.6	81.6
Have a website	28.6	31.5	34.0	36.8	38.3
Use the Internet to purchase goods or services	22.4	31.7	37.2	42.5	43.4
Use the Internet to sell goods or services	6.7	7.5	7.1	7.4	7.3
Value of sales over the Internet ($ millions)	10,389	13,339	18,598	26,438	36,268
ICT adoption rates (public sector)					
Personal computer	100.0	99.9	100.0	100.0	..
E-mail	99.7	99.6	99.8	99.9	99.6
Internet	99.7	99.6	100.0	99.9	99.6
Have a website	86.2	87.9	92.7	92.4	94.9
Use the Internet to purchase goods or services	54.5	65.2	68.2	77.4	82.5
Use the Internet to sell goods or services	12.8	14.2	15.9	14.0	15.2
Value of sales over the Internet ($ millions current)	354.8	327.2	511.4	1,881.5	2,924.7
ICT adoption rates (individuals aged 18 years and over)			**% of individuals**		
Personal (non-business) Internet use from any location	..	..	..	..	67.9
Personal (non-business) Internet use from home	..	..	..	..	60.9
Use the Internet to order or purchase goods or services (% of Internet users)	..	..	..	..	41.1
Total value of e-commerce orders or purchases ($ billions)	..	..	..	..	7.9
Average value of e-commerce orders or purchases (dollars per consumer)	..	..	..	..	1,150

Data sources: Statistics Canada, Canadian Internet Use Survey; Survey of Electronic Commerce and Technology.

Table 1e Telecommunications services indicators	2001	2002	2003	2004	2005
Teledensity indicators			**per 100 inhabitants**		
Wired access - Voice Grade Equivalent (VGE)	67.1	64.7	63.4	60.7	58.6
Wireless access (VGE)	34.3	37.9	41.8	46.5	51.4
Total public switched telephone network (PSTN) (VGE)	101.4	102.6	105.2	107.2	110.0
			thousands		
Homes with access to cable	11,068.6	11,378.9	11,694.4	11,908.2	12,119.0
Homes with access to Internet by cable	9,339.3	10,046.0	10,685.9	11,124.2	11,504.8
Access indicators					
Total wired access lines (VGE)	20,805.1	20,300.8	20,067.6	19,470.5	18,976.1
Residential access lines (VGE)	12,854.2	12,752.1	12,648.2	12,488.1	11,947.9
Business access lines (VGE)	7,950.9	7,548.7	7,419.3	6,982.4	7,028.1
Total mobile subscribers	10,648.8	11,872.0	13,227.9	14,912.5	16,663.8
Digital cable television subscribers	808.4	1,146.5	1,403.9	1,810.5	2,281.1
Satellite and MDS subscribers	1,609.2	2,018.6	2,205.2	2,324.6	2,494.8
High speed Internet by cable subscribers	1,384.8	1,868.8	2,363.2	2,838.8	3,375.7
Investment indicators					
Investments by the telecommunications services industries (NAICS 517) ($ millions current)	10,720.5	7,310.4	6,181.0	6,984.3	7,365.9
Investments by the telecommunications services industries (NAICS 517) ($ millions constant)	11,146.5	7,586.8	6,977.5	8,074.8	8,782.1

MDS - multipoint distribution system

Data source: Statistics Canada, Telecommunications statistics (various years).

Table 1f Characteristics of biotechnology innovative firms	2001	2002	2003	2004	2005
			number		
Firms	375	..	496	..	532
Total biotechnology employees	11,897	..	11,931	..	13,433
Firms that were successful in raising capital	134	..	178	..	..
Existing patents	4,661	..	5,199	..	..
Pending patents	5,921	..	8,670	..	..
Products on the market	9,661	..	11,046[E]	..	..
Products/processes in pre-market stages	8,359	..	6,021	..	..
			$ millions		
Total biotechnology revenues	3,569	..	3,820	..	4,191
Expenditures on biotechnology research and development	1,337	..	1,487	..	1,703
Export biotechnology revenues	763	..	882	..	..
Import biotechnology expenses	433	..	422[E]	..	..
Amount of capital raised	980	..	1,695	..	..

Data source: Statistics Canada, Biotechnology Use and Development Survey (various years).

Table 1g Intellectual property commercialization	2001	2002	2003	2004	2005
Federal government					
Number of new patents received	109[r]	133[p]	142[r]	..	..
Royalties on licenses ($ thousands)	16,467	16,284[r]	15,509[r]	..	..
Universities and hospitals					
Number of new patents received	381	..	347	396	..
Income from intellectual property ($ thousands)	52,510	..	55,525	51,235	..

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