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Technological Change in the Private and Public Sectors

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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.

User information

Symbols

The following standard symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
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

The Science and Innovation Information Program

The purpose of this program is to develop **useful indicators of science and technology activity** in Canada based on a framework that ties them together into a coherent picture. To achieve the purpose, statistical indicators are being developed in five key entities:

- **Actors**: are persons and institutions engaged in S&T activities. Measures include distinguishing R&D performers, identifying universities that license their technologies, and determining the field of study of graduates.
- **Activities**: include the creation, transmission or use of S&T knowledge including research and development, innovation, and use of technologies.
- **Linkages**: are the means by which S&T knowledge is transferred among actors. Measures include the flow of graduates to industries, the licensing of a university's technology to a company, co-authorship of scientific papers, and the source of ideas for innovation in industry.
- **Outcomes**: are the medium-term consequences of activities. An outcome of an innovation in a firm may be more highly skilled jobs. An outcome of a firm adopting a new technology may be a greater market share for that firm.
- **Impacts**: are the longer-term consequences of activities, linkages and outcomes. Wireless telephony is the result of many activities, linkages and outcomes. It has wide-ranging economic and social impacts such as increased connectedness.

The development of these indicators and their further elaboration is being done at Statistics Canada, in collaboration with other government departments and agencies, and a network of contractors.

Prior to the start of this work, the ongoing measurements of S&T activities were limited to the investment of money and human resources in research and development (R&D). For governments, there were also measures of related scientific activity (RSA) such as surveys and routine testing. These measures presented a limited picture of science and technology in Canada. More measures were needed to improve the picture and the science and innovation program have sought these out.

Innovation makes firms competitive and we are continuing with our efforts to understand the characteristics of innovative and non-innovative firms. The capacity to innovate resides in people and measures are being developed of the characteristics of people in those industries that lead science and technology activity. In these same industries, measures are being made of the creation and the loss of jobs as part of understanding the impact of technological change.

The federal government is a principal player in science and technology. In 2006/2007, preliminary figures showed that government spent over nine billion dollars on S&T. In the past, it has been possible to say only *how much* the federal government spends and *where* it spends it. However, since 1998 our report, **Federal Scientific Activities (Cat. No. 88-204)** has published socio-economic objectives indicators to show *what* the S&T money is spent on. As well as offering a basis for a public debate on the priorities of government spending, this information has been used to provide a context for performance reports of individual departments and agencies.

Through this vehicle, it is now possible to report on the Canadian system on science and technology and show the role of the federal government in that system.

The working papers and research papers of the former Science, Innovation and Electronic Information Division are available at no cost on the Statistics Canada Internet site at *http://www.statcan.ca/cgi-bin/downpub/research.cgi?subject=193*.

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Finally, the authors would also like to thank the 12,899 firms and organizations that completed the questionnaire. Without their good will, this paper and related work would not be possible.

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1 Introduction

To remain globally competitive, today's firm must always be ready to adapt and evolve. Public organizations must also evolve in order to provide more effective and efficient services. Through adoption of newer, more advanced, technologies and practices, private sector firms and public organizations can increase their production capabilities, improve their productivity, and expand their lines of goods and services. The extent of the acquisition of new technology is an indicator that is important to measure and analyze.

The contribution of technological change to the economy has long been of interest to academics and policy analysts. This paper will provide an analysis of technological change within the Canadian economy based on data from the 2006 Survey of Electronic Commerce and Technology where firms indicated how they introduced significantly improved technologies.

The paper will explore differences in the use of methods of introduction of significantly improved technologies by firm/organization size and by industry in both the private and public sectors and will contribute to a better understanding of use of methods of introducing these significantly improved technologies within the Canadian economy.

The paper will begin with a brief presentation of previous work carried out on technology introduction. The methodology used in this paper will be described. A description of concepts used in the analysis will follow. Analytic results examining technological change in the private sector overall, by industry and by size, and the public sector overall, by industry and by size will be presented. A comparison of technological change in the private and public sectors will follow. The paper will conclude with a discussion of analytic results and further analytic work that could be undertaken.

Literature review

Technology introduction and adoption is an important innovation activity. Studies of manufacturing survey results have found that manufacturing establishments that use advanced technologies outperform establishments that do not (Baldwin, Diverty and Sabourin, 1995; Baldwin and Sabourin, 2001, 2004; Baldwin et al., 2003). These studies also found that advanced technology adoption in manufacturing leads to better jobs and higher salaries/wages than those of non-adopters. Gains in market share at the expense of non-adopters and growth in labour productivity advantage were other findings. Adoption of advanced technologies affects firm performance.

The Survey of Electronic Commerce and Technology has provided data on technology use and, as a result, technological change in private industries and public organizations. Research has found that four out of five public sector organizations introduced significantly improved technologies (Earl, 2001, 2002a, 2002b, 2004b, 2004c). In contrast, less than half of private sector firms introduced significantly improved technologies (Earl, 2002a, 2002b, 2004a and 2004b). In other words, the percentage of public sector organizations introducing significantly improved technologies is twice that of private sector firms (Earl, 2002a, 2004b, 2004c). Within the private sector, the goods producing sector was just as likely as the services producing sector to acquire significantly improved technologies (Earl, 2002b, 2004a, 2004b).

Even if technologies are purchased off the shelf a firm must have the internal capabilities to successfully integrate these new technologies or risk failure (Montgomery and Levine, 1996). In their study of advanced manufacturing

technologies, Arundel and Sonntag (2001) found that the method of introduction of advanced technologies into a firm was an indicator of the firm's internal capabilities, in particular, process engineering capabilities. They found that about half of advanced manufacturing technology users only purchased their advanced technologies off the shelf (46.1%), one quarter customized or significantly modified existing technologies (25.7%) and one quarter (28.2%) developed new technologies.

The adoption and use of advanced technologies has been the subject of study for decades (von Hippel, 1988). Statistics Canada conducted its first survey of technology use and planned use in 1987 (Statistics Canada, 1987) and there were similar surveys in the United States, Australia and some other countries (Ducharme and Gault, 1992). Since 1989, there have been survey questions on the methods of adoption of technologies that have illustrated the role of the user in the process of adoption. As users can adopt by purchasing technology, by modifying it, or by creating it, adopting firms can be classified as innovative at the level of new to the firm, the market or the world (OECD/Eurostat, 2005).

There has been a growth in the literature on the phenomenon of "user innovation". Von Hippel (2005) has argued that traditional models of innovation place consumers as the final link in a value chain. In this model, users can choose between products but have little influence on design or the creation of these products. Manufacturers create products and service industries provide services based on needs identified by the suppliers of these goods and services. However user needs are heterogeneous creating a dilemma for mass manufacturers, standard service providers and the users that rely on these suppliers to conduct business. In cases where existing goods and services do not meet their needs, users must search for their own solutions which include customizing existing technologies or developing new technologies. When these technologies are produced for use as part of the plant's operation as opposed to having the new technology created with the prime purpose of being a product for sale this phenomenon has been referred as "user innovation" (von Hippel, 2005).

This paper will contribute to a better understanding of technology introduction by developing statistical indicators of different methods of introduction of technologies and whether these methods differ by size or industry or between private sector firms and public sector organizations.

2 Methodology

2.1 About the Survey of Electronic Commerce and Technology

This paper uses data from the Survey of Electronic Commerce and Technology (SECT), a cross-economy survey that covers most industrial sectors of the North American Industrial Classification System (NAICS) with the exception of local governments. The collection entity for the survey is the statistical enterprise and the survey uses Statistics Canada's Business Register as its frame. In 2006, the survey was sent to about 19,000 enterprises with income more than a specified limit (either $100,000 or $250,000, depending on the sector). The quality of estimates has been assessed based on a combination of standard error and imputation rates. Only estimates of publishable quality have been used in this analysis.[1]

In this paper, three size classes have been created for the private sector: small (0 to 19 employees); medium (20 to 249 employees) and large (at least 250 employees). For the public sector, size classes include: small (1 to 99 employees); medium (100 to 499 employees); and large (at least 500 employees).

In this paper, eighteen industrial sectors contribute to the estimates for private firms. These eighteen sectors are divided into two major aggregations, the goods producing sector and the services producing sector. Within the services producing sector, there are two further breakouts, one for goods related services and another for intangible services.[2] Public sector organizations include those in one of three sectors: Educational services (NAICS 61), health care and social assistance (NAICS 62), and public administration (NAICS 91).

1. Further information on the methodology of the Survey of Electronic Commerce and Technology, including information on quality indicators, is available at: *http://www.statcan.ca/english/sdds/4225.htm*.
2. For a complete listing of surveyed industries see Appendix I.

All comparisons of estimates made within this paper have been evaluated for statistically significant differences. The value of the standard error of each estimate provides a confidence interval of the estimate, the likelihood that the estimate falls within the given range 95 times out of 100. Where confidence intervals for individual estimates overlap, these estimates are said to not be statistically significantly different from each other. The confidence intervals for estimates presented in the charts included in this paper are represented by bars that extend above and below the estimate itself.

3 Measuring technological change

The Survey of Electronic Commerce and Technology 2006 asked firms if they introduced significantly improved technologies during the years 2004 to 2006. If significantly improved technologies were introduced, firms were asked to indicate how they were introduced. Four options were provided including: by purchasing off-the-shelf technologies; by licensing new technologies; by customizing or significantly modifying existing technologies; and by developing new technologies (either alone or in conjunction with others). Respondents were asked to check all that applied.

The analysis approach used in this paper is based on that of Arundel and Sonntag (2001) which categorizes technology introduction by highest level of use. This approach considers that the degree of effort required for each method increases as the complexity of the introduction method, and resulting need for internal capabilities, increases. These range from minimal for purchasing off-the-shelf technologies to extensive in the case of developing new technologies. All responses were then assigned to one of three classes depending on the highest level of required internal capabilities to create a taxonomy of type of firm or organization:

- **Technology purchaser:** These firms or organizations either purchase technologies off-the-shelf or license new technologies;
- **Technology modifier**: These firms or organizations customize or significantly modifiy existing technologies; or
- **Technology developer**: These firms or organizations develop new technologies, either alone or in conjunction with others.

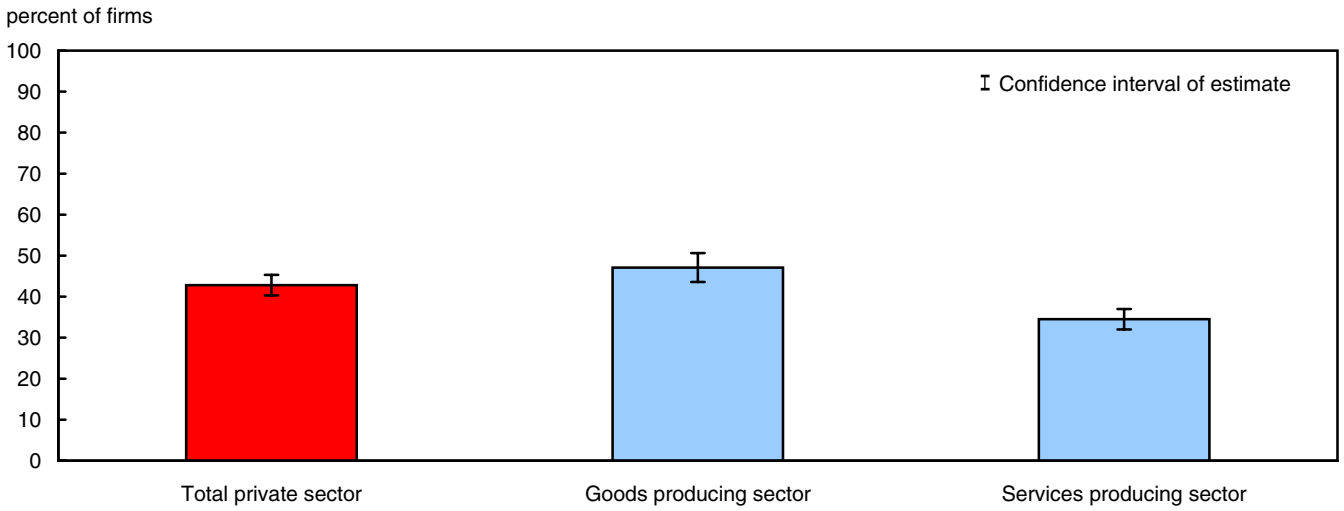
For example, an organization that indicated it both customized or significantly modified existing technologies and that they developed new technologies were classified in the category technology developer. A firm classified to the category of technology purchaser used only this method and neither customized nor developed new technologies.

4 Technological change in the private sector

This section examines the introduction of significantly improved technologies in private sector firms. During the three years 2004 to 2006, 42.8% of private sector firms indicated that they had introduced significantly improved technologies.

Half (47.1%) of private sector firms in goods producing industries introduced significantly improved technologies, a significantly higher percentage than the one-third (34.5%) of firms in services producing industries (Chart 1).[3]

Chart 1
Percentage of firms introducing significantly improved technologies during the period 2004 to 2006, by sector



Source(s): Statistics Canada, Survey of Electronic Commerce and Technology 2006.

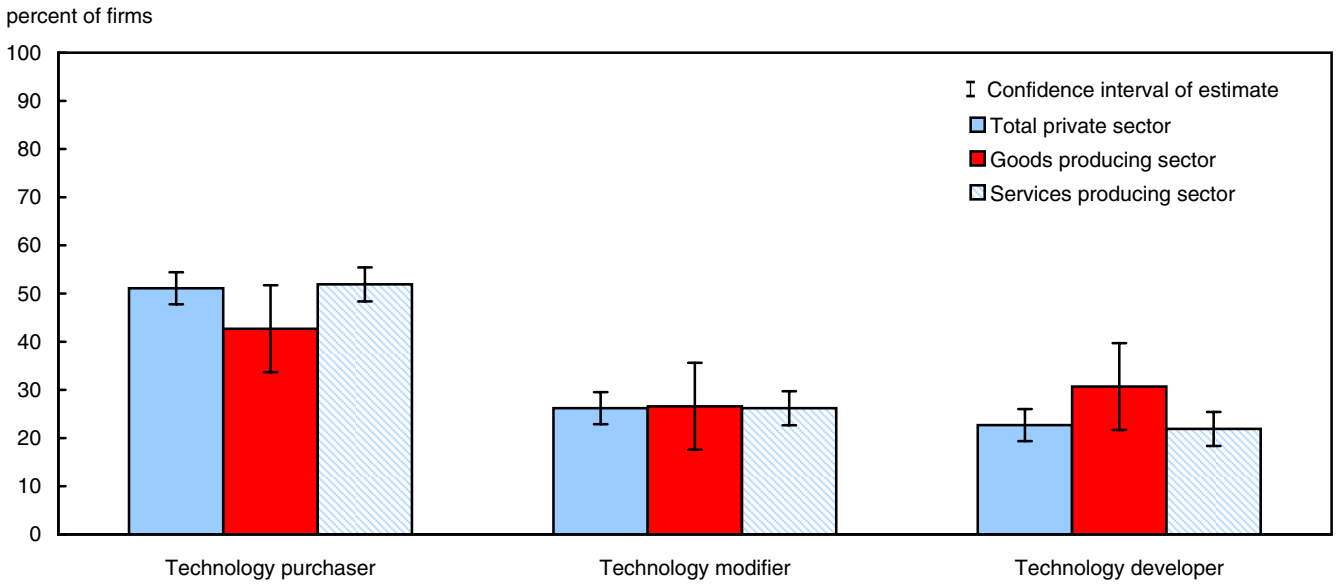
3. For details of percentage of each private sector industry that introduced significantly improved technologies see the table in Appendix II.

4.1 Method of introduction of significantly improved technologies by private sector industry

Among the 42.8% of private sector firms that introduced significantly improved technologies during the period 2004 to 2006, one-quarter of private sector firms were technology developers (22.7%), one-quarter were technology modifiers (26.2%), and one-half were only technology purchasers (51.1%) (Chart 2). These findings are consistent with those of Arundel and Sonntag (2001) who analyzed manufacturing industries using the Survey of Advanced Technology in Canadian Manufacturing 1998.

There are no differences in the percentage of each type of firm between the private sector overall and its components: the goods producing sector and the services producing sector.

Chart 2
Percentage of private sector firms indicating methods of introduction of significantly improved technologies by type of firm, 2004 to 2006

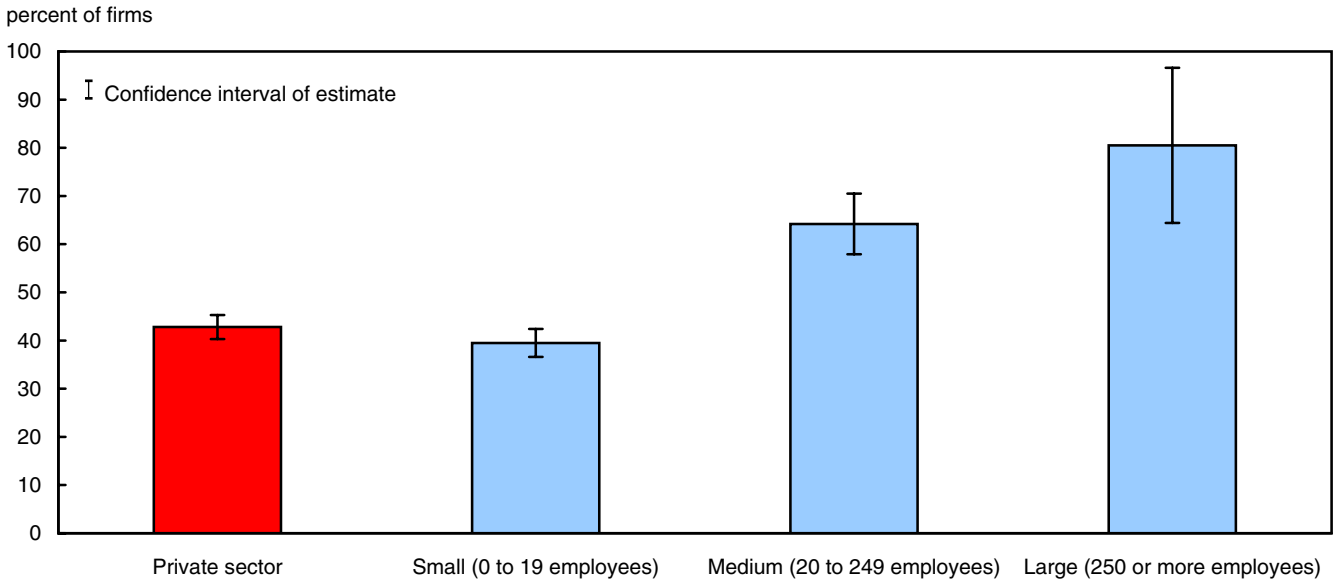


Source(s): Statistics Canada, Survey of Electronic Commerce and Technology 2006.

4.2 Method of introduction of significantly improved technologies by size of private sector industry

Four out of five large private sector firms (80.5%) introduced significantly improved technologies during the period 2004 to 2006, double the percentage of small firms (39.5%). Medium-sized firms were no more likely than large firms to have introduced a significantly improved technology (64.2%), but were more likely than small firms to do so (Chart 3).

Chart 3
Percentage of private firms that introduced significantly improved technologies during the years 2004 to 2006, by size

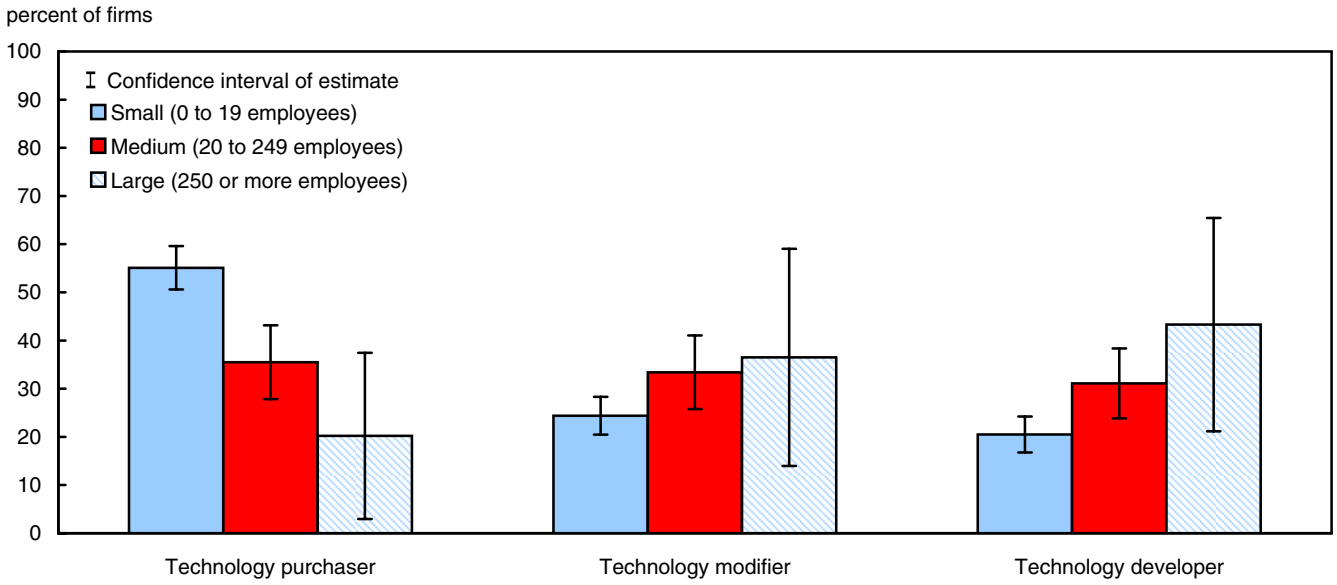


Source(s): Statistics Canada, Survey of Electronic Commerce and Technology 2006.

Firms in each private sector firm size class were equally likely to be technology developers as technology modifiers; however technology purchasers were most likely small firms (Chart 4). Small firms were the only size class that show a propensity towards one method of technology introduction with one-half (55.1%) of firms being technology purchasers. Both medium and large firms were no more likely to be technology purchasers than they were to be technology modifiers or developers.[4]

Chart 4

Percentage of private sector firms indicating methods of introduction of significantly improved technologies by type of firm and size, 2004 to 2006



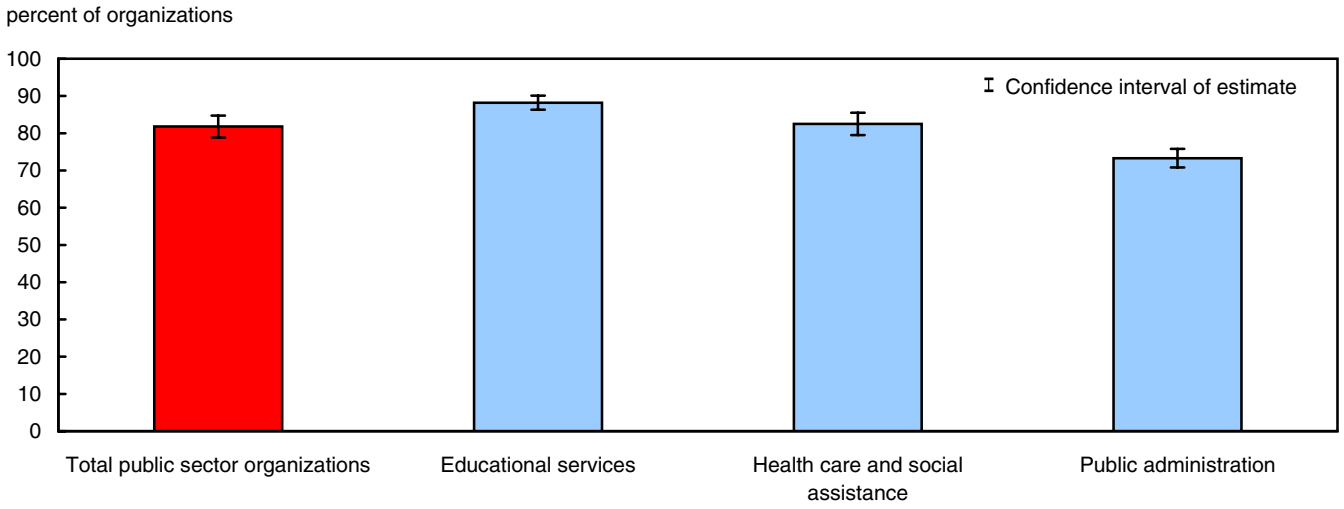
Source(s): Statistics Canada, Survey of Electronic Commerce and Technology 2006.

4. Although their size categories (small: 10 to 49 employees; medium: 50 to 99 employees; large: at least 100 employees) were different than those used for SECT analysis, Arundel and Sonntag, (2001) also found that smaller firms were more likely to only acquire off-the-shelf technologies.

5 Technological change in public sector organizations

This section examines the introduction of significantly improved technologies in public sector organizations. During the three years 2004 to 2006, four out of five (81.8%) public sector organizations indicated that they had introduced significantly improved technologies (Chart 5). Educational services (88.2%) organizations are the mostly likely public sector organizations to introduce significantly improved technologies followed closely by health care and social assistance (82.5%) and public administration organizations (73.3%).

Chart 5
Percentage of public sector organizations introducing significantly improved technologies during the three years, 2004 to 2006

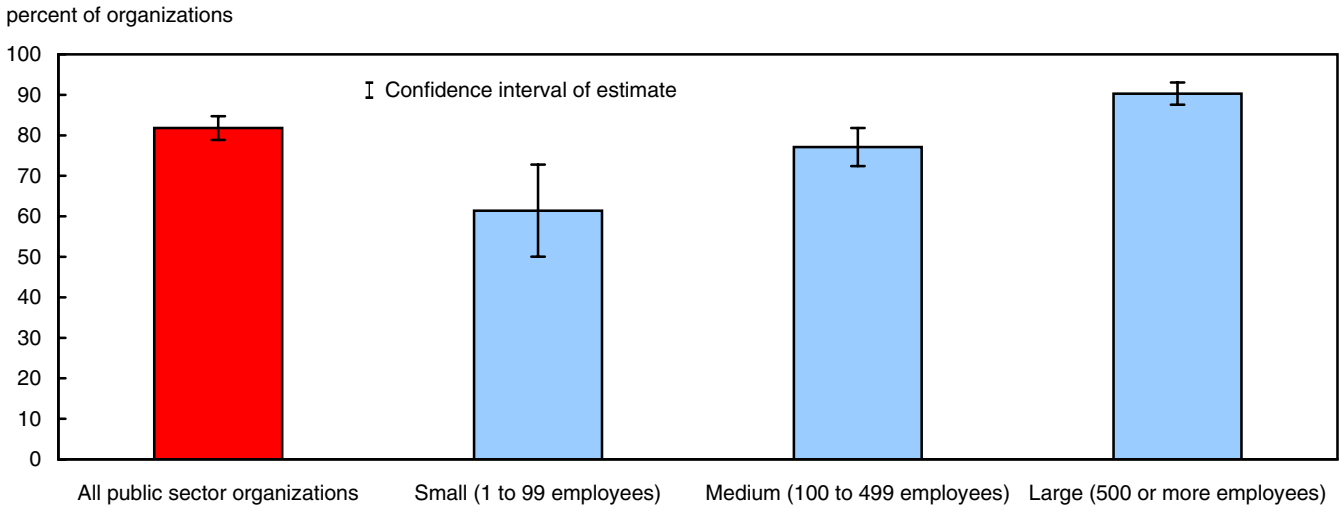


Source(s): Statistics Canada, Survey of Electronic Commerce and Technology 2006.

The percentage of organizations that introduced significantly improved technologies varies by size of public sector organization. Large public sector organizations (90.3%) were most likely to introduce significantly improved technologies (Chart 6). Medium (77.1%) and small (61.4%) organizations had an equal likelihood of introducing significantly improved technologies.

Chart 6

Percentage of public sector organizations introducing significantly improved technologies during the three years, 2004 to 2006 by size



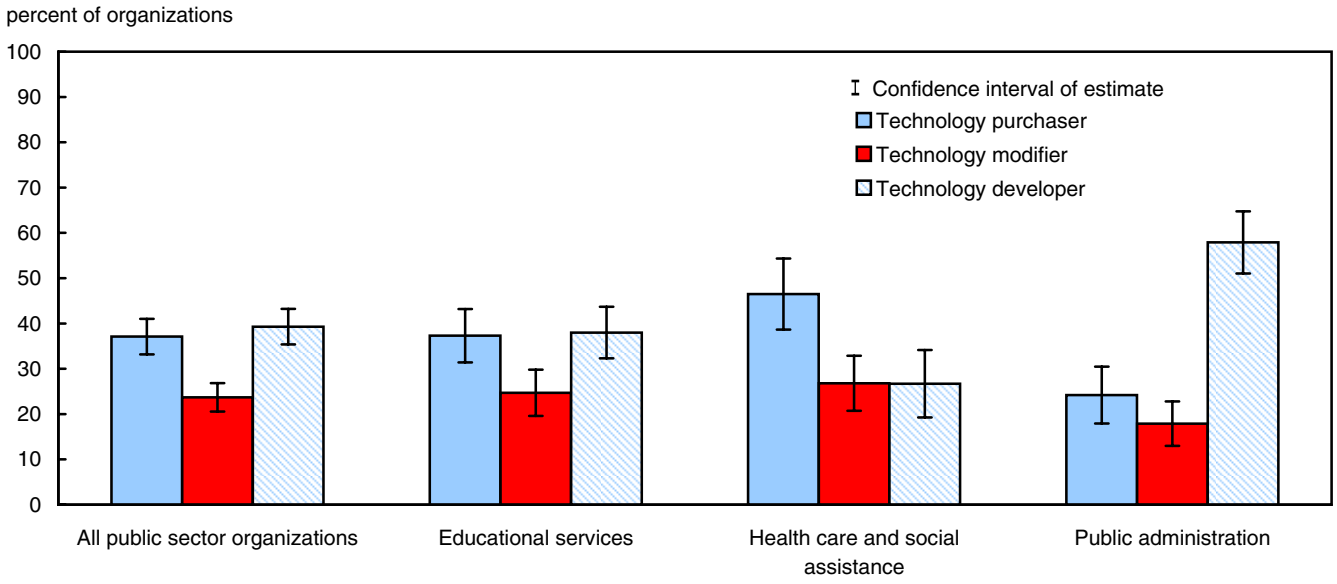
Source(s): Statistics Canada, Survey of Electronic Commerce and Technology 2006.

5.1 Method of introduction of significantly improved technologies by public sector industry

Among the four out of five (81.8%) of public sector organizations that introduced significantly improved technologies during the years 2004 to 2006, public sector organizations were more likely to be either technology purchasers or technology developers than they were to be technology modifiers. More than one third (37.1%) were only technology purchasers, one quarter (23.7%) indicated they were technology modifiers and more than one third (39.3%) indicated they were technology developers (Chart 7).

Educational services (37.3%) and health care and social assistance organizations (46.5%) had equal likelihood of being only technology purchasers. Organizations in each of these two public sector industries were more likely than public administration organizations (24.2%) to be technology purchasers.

Chart 7
Percentage of public sector organizations indicating methods of introduction of significantly improved technologies by type of organization, 2004 to 2006



Source(s): Statistics Canada, Survey of Electronic Commerce and Technology 2006.

Organizations in all three public sector industries were equally likely to indicate that they were technology modifiers.

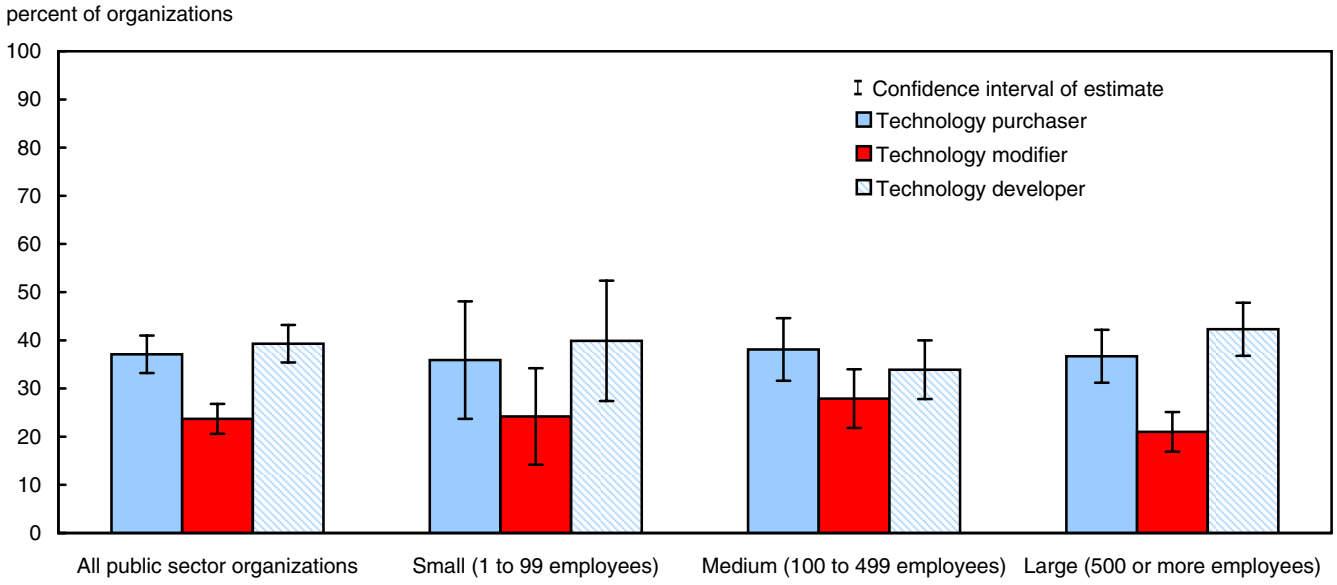
Among the three public sector industries, public administration organizations were the most likely to indicate that they were technology developers. More than half (57.9%) of public administration organizations indicated that they were technology developers compared to one third (38.0%) and one quarter (26.7%) of educational services and health care and social assistance organizations respectively.

A comparison of type of organization in each public sector industry shows that educational services organizations were more likely to be technology purchasers (37.3%) or developers (38.0%) than to be technology modifiers (24.7%). Half of health care and social assistance organizations were technology purchasers (46.5%) compared to one quarter that were technology modifiers (26.8%) and one quarter that were technology developers (26.7%). More than half of public administration organizations (57.9%) were technology developers with the remainder having equal likelihood of either being technology modifiers (17.9%) or only technology purchasers (24.7%).

5.2 Method of introduction of significantly improved technologies by size of public sector organization

A comparison of the methods of technology introduction by each size class among organizations that introduced significantly improved technologies shows that small and medium sized public sector organizations show no affinity for one method of technology introduction over another (Chart 8). Large public sector organizations are more likely to be technology purchasers (36.7%) or to be technology developers (42.3%) than they are to be technology modifiers (21.0%).

Chart 8
Percentage of public sector organizations that introduced significantly improved technologies by type of firm and size, 2004 to 2006



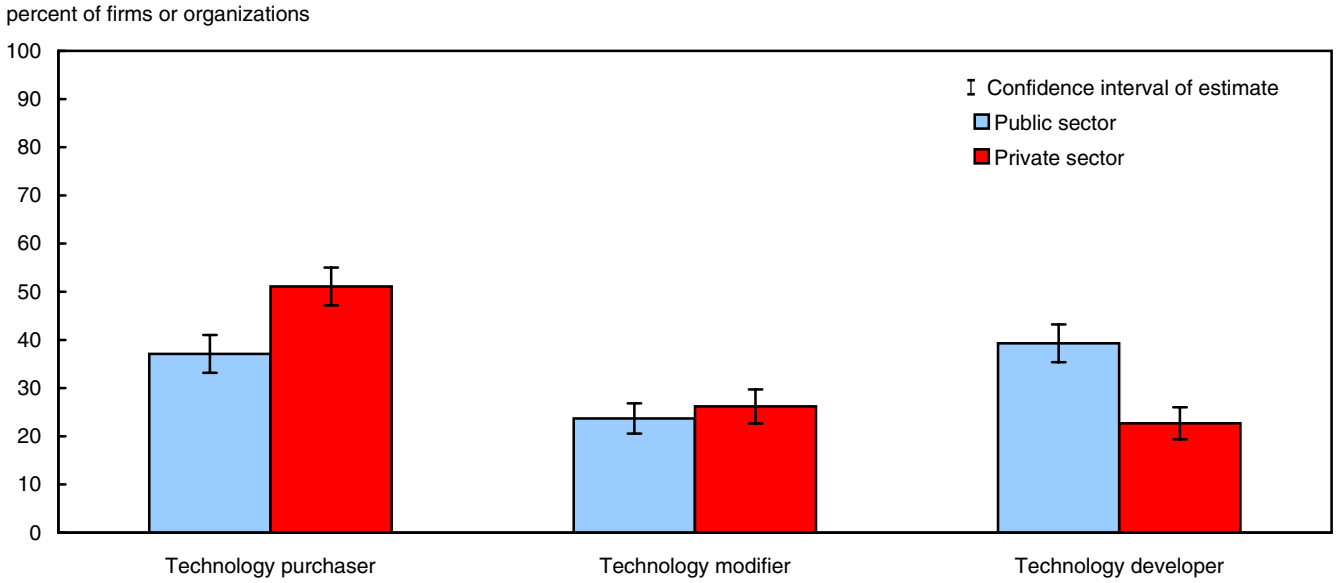
Source(s): Statistics Canada, Survey of Electronic Commerce and Technology 2006.

6 A comparison of technological change in the private and public sectors

Public sector organizations (81.8%) were twice as likely as private sector firms (42.8%) to introduce significantly improved technologies during the years 2004 to 2006.

Private sector firms (51.1%) were more likely to be technology purchasers than public sector organizations (37.1%) (Chart 9). The inverse is observed for technology developers where more than one third (39.3%) of public sector organizations are technology developers compared to one quarter (22.7%) of private sector firms. There is no difference in the propensity for either sector to be technology modifiers (23.7% private, 26.2% public).

Chart 9
Percentage of different types of private sector firms and public sector organizations, 2004 to 2006



Source(s): Statistics Canada, Survey of Electronic Commerce and Technology 2006.

Private sector firms were not compared to public sector organizations by size class as the size classes for these two sectors are not comparable.

7 Key findings and discussion

Data from the 2006 Survey of Electronic Commerce and Technology has provided information on the methods used by private sector firms and public sector organizations to introduce significantly improved technologies during the years 2004 to 2006.

This paper has adopted the approach of Arundel and Sonntag (2001) for looking at types of firms that introduced technology. It has found that private firms were most likely to be technology purchasers, and had an equal likelihood to be either technology modifiers or developers. This pattern of technology adoption is similar to that found in a study of manufacturing firms by Arundel and Sonntag based on the Survey of Advanced Technology in Canadian Manufacturing 1998. It would be interesting to analyze a more detailed breakdown of the eighteen component private sector industries to explore whether this pattern is exhibited at this level of industry detail. It would also allow comparison of the pattern for the manufacturing industry over time.

Perhaps the most interesting finding is that half of private sector firms and almost two thirds of public sector organizations do not simply purchase the technologies but modify or develop the technologies they need. This is evidence that technology users, and not only manufacturers of technology, are involved in a significant way in process innovation. This evidence supports the arguments of researchers who have begun to study issues of user innovation.

This study also found that public sector organizations were more likely to be technology developers than their private sector counterparts, similar to the findings of Earl (2004b, 2004c). Conversely, private sector firms were more likely to be technology purchasers than public sector organizations. Before drawing conclusions on the extent of technology developers in the private and public sector it would be interesting to examine the extent to which size distribution within each sector, private and public, can explain the difference.

Contrary to what may be expected, the size of a private firm does not appear to be a critical determinant as to whether a firm will be a technology modifier or technology developer. Large firms are no more likely than small firms to be technology modifiers or technology developers.

Similarly, the industrial classification of a firm does not appear to have an effect on the type of technology adoption used by a firm. Private firms in the goods producing sector and the services producing sector were equally likely to be technology purchasers, technology modifiers and technology developers. It would be interesting to explore whether differences exist at the level of individual industries.

With the exception of information and cultural services (71.8%), there are no differences in the percentage of firms that introduced significantly improved technologies. Information and cultural services has a higher percentage of firms that introduced significantly improved technologies than: wholesale trade (45.1%); retail trade (42.4%); transportation and warehousing (34.5%); real estate and rental and leasing (34.0%); administrative and support, waste management and remediation services (42.9%); arts, entertainment and recreation (36.7%); accommodation and food services (37.6%); and other services (excluding public administration) (38.3%). The percentage of firms that introduced significantly improved technologies in information and cultural services was not significantly different than the percentage of firms in: finance and insurance (47.6%); professional, scientific and technical services (49.0%); management of companies and enterprises (40.1%); educational services (excluding public administration) (44.5%); and health care and social assistance (excluding public administration) (49.1%).

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Appendix I — List of industries surveyed

Text table I
List of industries surveyed

Industry	NAICS
Private sector	
Goods producing sector	
Forestry, fishing and hunting	11
Mining and oil and gas extraction	21
Utilities	22
Manufacturing	31-33
Services producing sector	
Goods related services	
Wholesale trade	41
Retail trade	44-45
Transportation and warehousing	48-49
Intangible services	
Information and cultural services	51
Finance and insurance	52
Real estate and rental and leasing	53
Professional, scientific and technical services	54
Management of companies and enterprises	55
Administrative and support, waste management and remediation services	56
Educational services (excluding public administration)	61
Health care and social assistance (excluding public administration)	62
Arts, entertainment and recreation	71
Accommodation and food services	72
Other services (excluding public administration)	81
Public sector	
Educational services	61
Health care and social assistance	62
Public administration	91

Appendix II — Percentage of private sector industries introducing significantly improved technologies, 2004 to 2006

Text table I

Percentage of private sector industries introducing significantly improved technologies, 2004 to 2006

	percent	reliability
Industry		
Total private sector	42.8	A
Goods producing sector	47.1	B
Forestry, fishing and hunting	24.9	C
Mining and oil and gas extraction	38.8	C
Utilities	58.2	D
Manufacturing	54.3	A
Services producing sector	34.5	A
Goods related services	34.3	B
Wholesale trade	45.1	A
Retail trade	42.4	A
Transportation and warehousing	34.5	A
Intangible services	34.6	B
Information and cultural services	71.8	C
Finance and insurance	47.6	B
Real estate and rental and leasing	34.0	B
Professional, scientific and technical services	49.0	A
Management of companies and enterprises	40.1	B
Administrative and support, waste management and remediation services	42.9	B
Educational services (excluding public administration)	44.5	C
Health care and social assistance (excluding public administration)	49.1	A
Arts, entertainment and recreation	36.7	B
Accommodation and food services	37.6	B
Other services (excluding public administration)	38.3	A

Appendix III — Catalogued publications

Science, Technology and Innovation statistical publications

88-001-X	*Science statistics*
88-003-X	*Innovation analysis bulletin*
88-202-X	*Industrial research and development, intentions (with 2004 preliminary estimates and 2003 actual expenditures) (annual)*
88-204-X	*Federal scientific activities (annual)*
88F0006X	*Business Special Surveys and Technology Statistics Division working papers*
88F0017M	*Science, Innovation and Electronic Information Division research papers*

88-001-X Volume 33 – 2009

No. 1	Biotechnology scientific activities in federal government departments and agencies, 2007/2008 (March)
No. 2	Estimates of Total Spending on Research and Development in the Health Field in Canada, 1997 to 2008 (March)
No. 3	Research and Development Personnel in Canada, 1997 to 2006 (June)
No. 4	Industrial Research and Development, 2005 to 2009 (July)
No. 5	Estimates of Research and Development Expenditures in the Higher Education Sector, 2007/2008 (September)

88-001-X Volume 32 – 2008

No. 1	Research and Development Personnel (R&D) - 1996 to 2005 (May)
No. 2	Biotechnology Scientific Activities in Federal Government Departments and Agencies, 2006/2007 June)
No. 3	Estimates of Total Spending on Research and Development in the Health Field in Canada, 1996 to 2007(July)
No. 4	Estimation of Research and Development Expenditures in the Higher Education sector, 2006/2007 (August)
No. 5	Industrial Research and Development, 2004 to 2008 (September)
No. 6	Scientific and Technological Activities of Provincial Governments and Provincial Research Organizations, 2002/2003 to 2006/2007 (October)
No. 7	Federal Government Expenditures on Scientific Activities, 2008/2009 Intentions (November)

88-001-X Volume 31 – 2007

No. 1	Research and development (R&D) personnel in Canada, 1995 to 2004 (January)
No. 2	Estimates of total spending on research and development (R&D) in the health field in Canada, 1989 to 2006 (March)
No. 3	Biotechnology scientific activities in federal government departments and agencies, 2005/2006 (May)
No. 4	Estimation of research and development expenditures in the higher education sector, 2005/2006 (August)

No. 5 Scientific and Technological (S&T) Activities of Provincial Governments and Provincial Research Organizations, 2001/2002 to 2005/2006 (October)
No. 6 Industrial research and development, 2003 to 2007 (November)
No. 7 Federal government expenditures on scientific activities, 2007/2008 (intentions) (December)
No. 8 Gross Domestic Expenditure on Research and Development, 2007 intentions (December)

88-001-X Volume 30 – 2006

No. 1 Distribution of federal expenditures on science and technology, by province and territories, 2003/2004 (February)
No. 2 Biotechnology scientific activities in federal government departments and agencies, 2004/2005 (March)
No. 3 Estimates of total spending on research and development in the health field in Canada, 1988 to 2005 (May)
No. 4 Industrial Research and Development, 2002 to 2006 (August)
No. 5 Estimation of research and development expenditures in the higher education sector, 2004/2005 (August)
No. 6 Federal government expenditures on scientific activities, 2006/2007 (September)
No. 7 Total spending on research and development in Canada, 1990 to 2006, and provinces, 1990 to 2004 (September)
No. 8 Nature of Research and Development, 2000 to 2004 (December)
No. 9 Distribution of federal expenditures on science and technology by province and territories, 2004/2005 (December)

88-001-X Volume 29 – 2005

No. 1 Distribution of federal expenditures on science and technology by province and territories, 2002-2003 (January)
No. 2 Research and development (R&D) personnel in Canada, 1993 to 2002 (May)
No. 3 Biotechnology scientific activities in federal government departments and agencies, 2003-2004 (May)
No. 4 Industrial research and development, 2001 to 2005 (June)
No. 5 Estimates of total spending on research and development in the health field in Canada, 1988 to 2004 (July)
No. 6 Estimation of research and development expenditures in the higher education sector, 2003-04 (December)
No. 7 Federal government expenditures on scientific activities, 2005/2006(December)
No. 8 Total spending on research and development in Canada, 1990 to 2005p, and provinces, 1990 to 2003 (December)

88F0006X Working papers – 2009

No. 1 *Results from the Functional Foods and Natural Health Products Survey – 2007 (July)*
No. 2 *Innovation in the Canadian Manufacturing Sector: Results from the Survey of Innovation 2005 (August)*
No. 3 *Measuring User Innovation in Canadian Manufacturing, 2007 (October)*

88F0006X Working papers – 2008

No. 1 *Innovative Exporters and Intellectual Property Regimes in Selected Service Industries: Evidence from the Canadian Survey of Innovation 2003 (February)*
No. 2 *The Business of Nurturing Businesses (March)*
No. 3 *Understanding Internet Usage Among Broadband Households: A Study of Household Internet Use Survey Data*

88F0006X Working papers – 2007

No. 1 *Innovativeness and Export Orientation Among Establishments in Knowledge-Intensive Business Services (KIBS), 2003 (April)*
No. 2 *Where Are the Scientists and Engineers? (April)*
No. 3 *Results from the Functional Foods and Nutraceuticals Survey - 2005 (May)*

88F0006X Working papers – 2006

No. 1 *Provincial distribution of federal expenditures and personnel on science and technology, 1997/1998 to 2003/2004 (April)*
No. 2 *Buying and selling research and development services, 1997 to 2002 (May)*
No. 3 *Characteristics of Growth Firms, 2004/2005 (May)*
No. 4 *Scientific and Technological Activities of Provincial Governments and Provincial Research Organizations, 2000/2001 to 2004/2005 (July)*
No. 5 *Research and Development in the Field of Advanced Materials, 2001 to 2003 (July)*
No. 6 *Conceptualizing and Measuring Business Incubation (July)*
No. 7 *Characteristics of Business Incubation in Canada, 2005 (July)*
No. 8 *Size and Persistence of R&D Performance in Canadian Firms, 1994 to 2002 (August)*
No. 9 *Estimates of Canadian Research and Development Expenditures (GERD), Canada, 1995 to 2006, and by Province 1995 to 2004 (September)*
No. 10 *Are Small Businesses Positioning Themselves for Growth? A Comparative Look at the Use of Selected Management Practices by Firm Size (October)*
No. 11 *Survey of Intellectual Property Commercialization in the Higher Education Sector, 2004 (October)*
No. 12 *Provincial Distribution of Federal Expenditures and Personnel on Science and Technology (December)*

88F0006X Working papers – 2005

No. 1 *Federal government expenditures and personnel in the natural and social sciences, 1995/96 to 2004/05 (January)*
No. 2 *Provincial distribution of federal expenditures and personnel on science and technology, 1996-97 to 2002-03 (January)*
No. 3 *Industrial R&D statistics by region, 1994 to 2002 (January)*
No. 4 *Knowledge sharing succeeds: how selected service industries rated the importance of using knowledge management practices to their success (February)*
No. 5 *Characteristics of firms that grow from small to medium size: Industrial and geographic distribution of small high-growth firms (February)*
No. 6 *Summary: Joint Statistics Canada – University of Windsor workshop on intellectual property commercialization indicators, Windsor, November 2004 (March)*
No. 7 *Summary: Meeting on commercialization measurement, indicators, gaps and frameworks, Ottawa, December 2004 (March)*
No. 8 *Estimates of research and development personnel in Canada, 1979 to 2002 (May)*
No. 9 *Overview of the biotechnology use and development survey – 2003 (April)*

No. 10 *Access to financing capital by Canadian innovative biotechnology firms (April)*
No. 11 *Scientific and technological activities of provincial governments and provincial research organizations, 1995-96 to 2003-04 (September)*
No. 12 *Innovation in Information and Communication Technology (ICT) sector service industries: Results from the Survey of Innovation 2003 (October)*
No. 13 *Innovation in selected professional, scientific and technical services: Results from the Survey of Innovation 2003 (October)*
No. 14 *Innovation in selected transportation industries: Results from the Survey of Innovation 2003 (November)*
No. 15 *Innovation in selected industries serving the mining and forestry sectors: Results from the Survey of Innovation 2003 (November)*
No. 16 *Functional foods and nutraceuticals: The development of value-added food by Canadian firms (September)*
No. 17 *Industrial R&D statistics by region 1994 to 2003 (November)*
No. 18 *Survey of intellectual property commercialization in the higher education sector, 2003 (November)*
No. 19 *Estimation of research and development expenditures in the higher education sector, 2003-2004 (December)*
No. 20 *Estimates of Canadian research and development expenditures (GERD), Canada, 1994 to 2005, and by province 1994 to 2003 (December)*