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Innovation Analysis Bulletin

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

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

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[Federal science activities 2001-2002^e \(page 3\)](#)

Federal science expenditures increased by 8% and personnel went up by 1.1% over the previous year. These and more details were released in the annual publication *Federal Science Activities*, Catalogue No. 88-204-XIE on April 12, 2002

[Lessons learned from cognitive testing, part 2: No neutral position: The issue of neutrals in opinion questions \(page 4\)](#)

Eliminating the “neutral” response in an opinion question not only encourages the respondent to take sides, it gently persuades them to read the question. Learn how we used this to our advantage in the *Knowledge Management Practices Survey*, 2001.

[Knowledge management practices survey, 2001: The results are out \(page 5\)](#)

Canadian firms are well aware of the benefits of using knowledge management practices and most of them incorporate some aspects of KM in their management toolkit. Knowledge sharing, creation, generation and maintenance are perceived as important to a firm’s productivity.

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[Organizational and technological change in Canada \(page 7\)](#)

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[Evolution of services as knowledge suppliers and innovators \(page 9\)](#)

The manufacturing sector is looked upon as the source of innovation and technological change, but the sheer size of service activity in the economy means that the competitive advantage will increasingly depend upon this sector’s ability to produce technologies and innovate.

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Our work was certainly front and centre at Statistics Canada’s annual Economic Conference this year. Eleven papers at the May gathering were derived from our surveys.

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Innovation analysis bulletin

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Editor: Michael Bordt

E-mail: Michael.Bordt@statcan.ca
 Telephone: (613) 951-8585
 Fax: (613) 951-9920
 Post: SIEID
 Statistics Canada
 7th Floor R.H. Coats Building
 Tunney's Pasture
 Ottawa, Ontario
 Canada K1A 0T6

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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 <i>Statistics Act</i>
e	estimated figures
E	use with caution
F	too unreliable to be published

Downloadable publications

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

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2. *Free publications*

Documents are under the category: *Science and Technology* and *Communications*

3. *Research papers (free)*

Our documents are in the category *Science, Innovation and Electronic Information Division*. This page contains a list of all free research papers, and working papers.

- Sample questionnaires are in the section
 - *Statistical Methods* in the area
 - *Questionnaires* under
 - *Science Innovation and Electronic Information*.

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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, most of the questionnaires we have used to collect the information are available for research purposes.

As of May 2002, there were:

- 11 publications for sale
- 4 free publications
- 12 research papers,
- 53 working papers, and
- 29 questionnaires.



Federal science activities 2001-2002^e

The Federal Government's budgetary Science & Technology (S&T) estimates for 2001-2002 were \$7.4 billion, an increase of 8.0% over 2000-2001. The preliminary expenditures for 2000-2001 were \$6.8 billion.

The Federal Government's spending on S&T including Research and Development (R&D) remained a stable 3.6% of the total federal budget through most of the 1990's, then climbed to 4% in 1998-99 and is estimated at 4.5% for 2001-2002.

The total \$7.4 billion in federal S&T expenditures do not include federal R&D tax credits. According to Canada Customs and Revenue Agency, the value of these tax credits is approximately \$1.3 billion annually.

The central activity of S&T is scientific research and experimental development (R&D). In 2001-2002, the Federal Government was expected to spend \$4.6 billion on R&D, an increase of 10% from 2000-2001. This includes both intramural performance and extramural funding of R&D. The increased federal expenditures were due to the funding of the Canada Foundation of Innovation (CFI). Established in 1997, CFI's mandate is to increase the capability of Canadian universities, colleges and hospitals to carry out world class R&D by investing in the research infrastructure.

In 2001-2002, the Federal Government planned to perform 42% of its own R&D and 78% of its own RSA for a total of 56% of its own S&T.

In 2001-2002, 31,681 person-years were involved in federal S&T activities, a 1.1% increase from 2000-2001. Fifty-five percent, or 17,559 person-years, were engaged in related scientific activities (RSA).

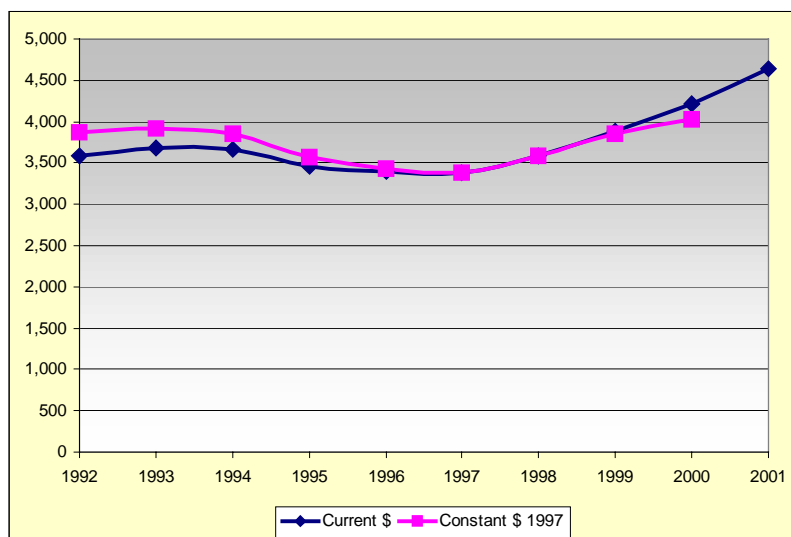
The government also funds science activities performed in other sectors: business enterprise, higher education, provincial governments, private non-profit organizations and other Canadian and foreign organi-

zations. Of these extramural sectors, the business enterprise sector received 16% and the higher education sectors received 22% of total federal S&T expenditures in 2001-2002.

R&D planned payments in 2001-2002 to business enterprises amounted to \$924 million, up from 2000-2001 forecasted expenditures of \$854 million.

Higher education received funding of \$1,426 million for R&D and \$172 million for RSA in 2001-2002. The three granting councils, the Canadian Institutes of Health Research, the Natural

Federal expenditures on R&D 1991 to 2001^e



Source: Statistics Canada, 2002, Federal Science Activities 2001-2002^e, Catalogue No. 88-204-XIE.

Federal Budgetary Main Estimates and Expenditures on R&D and S&T in Current Dollars and in Constant 1997 Dollars, 1992 to 2001^e

	Current dollars						GDP implicit price index	Constant dollars		
	Budgetary main estimates	S&T			R&D			Budgetary main estimates	R&D	
		\$ millions	\$ millions	%	\$ millions	%			\$ millions	\$ millions
1992	160,517	5,780	3.6	3,587	2.2	92.6	173,344	6,242	3,874	
1993	161,089	5,951	3.7	3,677	2.3	94.0	171,371	6,331	3,912	
1994	160,738	5,827	3.6	3,657	2.3	95.1	169,020	6,127	3,845	
1995	164,191	5,693	3.5	3,465	2.1	97.2	168,921	5,857	3,565	
1996 ^f	156,985	5,694	3.6	3,391	2.2	98.9	158,731	5,757	3,429	
1997 ^f	149,555	5,509	3.7	3,379	2.3	100.0	149,555	5,509	3,379	
1998 ^f	145,457	5,802	4.0	3,578	2.5	99.6	146,041	5,825	3,592	
1999 ^f	151,559	6,252	4.1	3,890	2.6	100.9	150,207	6,196	3,855	
2000 ^g	156,157	6,846	4.4	4,211	2.7	104.6	149,290	6,545	4,026	
2001 ^e	165,236	7,391	4.5	4,646	2.8	

Sources: Part 1, Government Expenditures Plan, Estimates.

Statistics Canada, 2001, *Canadian Economic Observer*, Catalogue No. 11-010-XPB, Monthly, August 2001.

Sciences and Engineering Research Council, and the Social Sciences and Humanities Research Council, as well as the Canada Foundation for Innovation are the major Federal Government funders of R&D performed in Canadian universities.

These data can be found in the annual publication *Federal Science Activities*, Catalogue No. 88-204-XIE. The most recent

issue was released on April 12, 2002. Please refer to page 2 for instructions on downloading publications for sale.

Further information: Bert Plaus, SIEID, Statistics Canada, (613) 951-6347, Bert.Plaus@statcan.ca



Lessons learned from cognitive testing, part 2: No neutral position: The issue of neutrals in opinion questions

Eliminating the “neutral” response in an opinion question not only encourages the respondent to take sides, it gently persuades them to read the question.

This is the second in a series of short articles on lessons learned from cognitive testing of the pilot Knowledge Management Practices Survey (KMPS), 2001. The first article in the series looked at the importance of targeting the right respondent was presented in the January 2002 issue of the *Innovation Analysis Bulletin*.

Questions that solicit respondents’ opinions or attitudes often employ scales. In the case of the KMPS, respondents were asked to rate the reasons they employed their set of knowledge management practices. For example:

Reasons knowledge management practices are used in your firm or organisation	
To improve worker retention:	<input type="checkbox"/> Critical
	<input type="checkbox"/> Important
	<input type="checkbox"/> Somewhat important
	<input type="checkbox"/> Not at all important

In this scale, the neutral position of “Neither Important nor Unimportant” was deliberately eliminated. As one respondent indicated during cognitive testing, by eliminating the neutral position we had forced him to read the questions. His natural tendency would have been to check the neutral response category throughout the question without reading any of the statements. While eliminating the neutral response may ensure that respondents read the entire question, it is not without other risks to data quality.

Analysts often exclude neutral responses from their analysis, thereby risking the exclusion of valid responses. By not providing a neutral category, the KMPS questionnaire avoids this necessity.

One of the difficulties with the four-point scale used in the example above is that it does not provide a category to indicate “do not know” or that the question was “not applicable”. In these cases, respondents could opt to skip the question or indicate that the question was not applicable or that they did not know. For the KMPS, interviewers were instructed to accept and code “Do Not Know / Not Applicable” responses to the scale questions, although these response categories did not appear on the questionnaire.

One of the objectives of the cognitive questionnaire testing was to try to minimise the number of questions that respondents found themselves incapable of answering. The success of the cognitive testing for the questions on reasons, and the questionnaire in general, can be measured by the non-response rate for the questions. The individual statement non-response for the question on reasons was 1.5% or less before interviewer follow-up. Also, the “Do Not Know / Not Applicable” valid response code was not used.

Cognitive questionnaire testing allow us to refine our questions on reasons so that respondents could comfortably use the response categories provided.

The questionnaire is available on Statistics Canada’s Web site. Please see page 2 for instructions on downloading questionnaires.

Further information: Louise Earl, SIEID, Statistics Canada, (613) 951-2880, Louise.Earl@statcan.ca.



Knowledge management practices survey, 2001: The results are out

Canadian firms are well aware of the benefits of using knowledge management practices and most of them incorporate some aspects of KM in their management toolkit. Knowledge sharing, creation, generation and maintenance are perceived as important to a firm’s productivity. Almost nine out of 10 firms reported that the most effective result of using knowledge management practices was improving worker skills and knowledge. The second most effective result was increased worker efficiency and/or productivity.

After 14 months of intense work, the results of the pilot Knowledge Management Practices Survey are now available. The progress of this Organisation for Economic Co-operation and Development (OECD) initiative have been well-documented in this bulletin (see Volume 4, No. 1) and today marks the penultimate stage of the project. Steps completed include extensive international consultation during questionnaire design; cognitive questionnaire testing in both official languages and three centres in Canada; data collection and processing; and release of the results. All that remains is to undertake a record linkage exercise to acquire productivity variables and, in conjunction with our OECD and policy departments partners, an assessment of the project and future directions. So there still remains quite a bit of work, in relation to where we were just over a year ago, it doesn’t seem insurmountable.

Almost every firm surveyed in the Knowledge Management Practices Survey indicated that they used at least one of the twenty-three practices listed on the questionnaire. The most

widely used practices included capturing and using knowledge obtained from other industry sources such as industrial associations, competitors, clients and suppliers and encouraging experienced workers to transfer their knowledge to new or less experienced workers (see Table 1 for the most common knowledge management practices).

On average, the firms used 11 knowledge management practices. Larger firms used more practices on average than smaller firms. The results suggest that for Canada, firms begin to employ more knowledge management practices when they attain at least 100 workers. Of the five sub-sectors surveyed, the one with the highest average number of knowledge management practices in use was management, scientific and technical consulting services. Firms in services depend largely upon marketing the knowledge of their workers and are therefore tend to employ a broader range of practice. They averaged 14 knowledge management practices in place.

Amongst other reasons, knowledge management practices were

Knowledge management practices in use – users of knowledge management practices	
Knowledge Management Practices	Firms using practice
	%
Most common	
• Knowledge management practices were a responsibility of managers and executives	94
• Firm captured and used knowledge obtained from other industry sources such as industrial associations, competitors, clients and suppliers	92
• Firm encouraged experienced workers to transfer their knowledge to new or less experienced workers	82
• Firm provided informal training related to knowledge management	81
• Used partnerships or strategic alliances to acquire knowledge	68
• Policies or programs intended to improve worker retention	66
• Firm encouraged workers to continue their education by reimbursing tuition fees for successfully completed work-related courses	63
• Values system or culture intended to promote knowledge sharing	59
• Firm offered off-site training to workers in order to keep skills current	51
Least common	
• Workers shared knowledge by preparing written documentation such as lessons learned, training manuals, good work practices, articles for publication, etc. (organisational memory)	44
• Firm captured and used knowledge obtained from public research institutions including universities and government laboratories	43
• Firm dedicated resources to detecting and obtaining external knowledge and communicating it within the firm	43
• Firm encouraged workers to participate in project teams with external experts	41
• Workers shared knowledge by regularly updating databases of good work practices, lessons learned or listings of experts	41
• Written knowledge management policy or strategy	36
• Knowledge sharing was rewarded with non-monetary incentives	36
• Knowledge management practices were explicit criteria for assessing worker performance	35
• Knowledge management practices were a responsibility of non-management workers	34
• Firm provided formal training related to knowledge management practices	32
• Knowledge sharing was rewarded with monetary incentives	32
• Firm used formal mentoring practices, including apprenticeships	28
• Knowledge management practices were a responsibility of the knowledge officer or knowledge management unit	22
• Workers shared knowledge in collaborative work by project teams that are physically separated (“virtual teams”)	17

Note: Users are defined as having used at least one of the knowledge management practices listed.

put into place to improve the competitive advantage of firms and to train workers to meet strategic objectives of the firm. These management practices were most effective for improving workers' skills and knowledge. Firms looking for reasons to employ more knowledge management practices would be prompted by loss of key personnel followed by loss of market share.

The results of the pilot Knowledge Management Practices Survey indicate that firms within the sub-sectors are adopting knowledge management practices. The firms' strengths appear to be internalising their knowledge and their weakness may be not looking outside for sources of knowledge and expertise.

*For more information please see our working paper **Are we managing our knowledge? Results from the pilot Knowledge Management Practices Survey, 2001**, Catalogue No. 88F0006XIE No. 6. See page 2 for instructions on downloading our working paper.*

Further information: Louise Earl, SIEID, Statistics Canada, (613) 951-2880, Louise.Earl@statcan.ca.



Lessons learned from cognitive testing, part 3: Have you heard of KISS?

When constructing questions for questionnaires one of the rules of thumb has always been Keep it Short and Simple. This article is the third in a series of lessons learned during cognitive testing of the pilot Knowledge Management Practices Survey. It reflects upon the response given to long questions, thick questionnaires and too many response boxes.

When testing a questionnaire, the test instruments are often a fair bit longer and hence thicker than what is normal practice for a final questionnaire. Questionnaire testers may include a number of questions on the same theme that are worded differently to check how respondents answer these questions. Entire themes may be modelled twice in test questionnaires as the designers search for whether respondents understand better, for example, the significance of introducing selected management practices or the effectiveness of using the practices.

Respondents who are carefully reading the questionnaire during testing will sometimes point out the repetitive questions or themes with comments such as: "Are you trying to trick me?" or "I get it, you want to see if I'll respond the same way now I understand the questions better." One respondent who was particularly good at spotting repetitive questions and themes, however, also proved very good at showing other details that respondents might overlook.

During questionnaire testing, "mock-ups" were created solely to give the illusion of a real questionnaire. Some of the key elements of a paper questionnaire such as cell numbers and response coding were missing. Other more obvious elements that were missing included a degree of sophistication in the formatting. The primary questionnaire designer decided for her peace of mind to employ fully the concept of keep it simple to the layout. This philosophy, while of benefit to the typist, made the questionnaire a bit thick as fancy page layout caused undue distress. It also meant that once an item, such as a check mark in a circle (rather than a check mark in a box) was found it was used, although as respondents correctly commented, the check box example did not exactly match the check box that they were given!

Ah! The details, there is a saying about the devil is in the details, and in questionnaire testing, this is often the case!

Respondents agreed that they could overlook these formatting glitches as a sign of costs savings and an indication that we really were willing to make changes. One of the many changes was to shorten the questionnaire – it was too thick! Respondents picked up the questionnaire and immediately thumbed through, counting the number of pages. It was the page count rather than the clumsy formatting that caused respondents to immediately react negatively to the perceived amount of time that they would spend completing the questionnaire, no matter what the cover letter said about the average time spent to complete the questionnaire!

Appearances ran deeper than thickness. Respondents stated that they preferred consistency in response categories, for example having the last response category for a series of responses as "Don't know / Not applicable". They also commented that they liked the space provided for them to write-in their own responses, although they doubted that they would use this space. For respondents, the write-in response space suggested that we were aware that we did not have all of the answers, that each respondent was unique and that their thoughts were of importance. Leaving space for comments, and using any comments provided, is always valuable in questionnaire design even if the comment space does lengthen the questionnaire.

Keeping the questions short serves two obvious purposes: it saves respondents' time and questionnaire's space. Also, as one respondent stated "I'm a lazy reader. I just don't have time to read every word. I never read beyond the comma." Although I do not consider myself a lazy reader, I share some of this respondent's reading traits. He commented that he didn't read instructions, making it a joke about a weakness shared by many of his sex.

Glancing quickly through boxed materials, not reading headings, skipping sub-titles are reading traits or habits that are shared by many regardless of sex. When writing, I often spend time thinking of catchy or boring sub-titles that will provide the reader with some idea of what the following paragraphs are about. When I'm

reading, if I want to read the article I happily skip over all of this sub-titling work and concentrate on the text. However, if I'm just glancing through, I'll read the sub-titles and skip the text. And sometimes, I'll skip both and read the tables. My habits are not unique. Everyone reads differently.

Questionnaires need to be designed so that while the parts work in harmony to create a whole, each part can also stand on its own. That being said, a bit of repetition within your questionnaire modules and keeping to the same format and flow, while it can lull respondents into sleep, can also assure you of consistency in response and help respondents to complete the questionnaire expeditiously.

The final word on keeping it simple and short, which this article now is not: everyone suggested that we put in examples to clarify concepts. For instance, "formal mentoring practices" might be called apprenticeships, partnering, buddy programs, counselling or career tracking. In this case, we provided one example: "apprenticeships". However, it is possible that organizations with

"buddy programs" may not have interpreted their practice as formal mentoring.

Examples can work well providing that they are generic enough to apply to your entire universe or all of your respondents. Business management practices that apply to a large manufacturer such as just-in-time delivery and warehousing may not transfer to a micro consulting agency specialising in public image. When providing examples, remember that they must be written in such a way as to be respondent friendly and flexible – a very challenging task indeed!

The questionnaire is available on Statistics Canada's Web site. Please see page 2 for instructions on downloading questionnaires.

Further information: Louise Earl, SIEID, Statistics Canada, (613) 951-2880, Louise.Earl@statcan.ca.



Organizational and technological change in Canada

The public sector is often considered staid and unchanging. Based on recent findings from the *Survey of Electronic Commerce and Technology (SECT), 2000*, this perception may need to be updated. Four-fifths of Canadian public sector organizations introduced significantly improved organisational structures or management techniques between 1998-2000. This rate of introduction of organisational change is twice that recorded by the private sector (38%). The public sector also led the private sector overall in the introduction of significantly improved technologies: 85% versus 44%.

Although the public sector shows higher rates of organizational and technological change, many of the differences may be because, on average, public sector organizations are larger than private firms. In 2000, about one-tenth of private sector firms employed more than 20 people whereas the opposite was true for the public sector in which about nine-tenths of organisations employed more than 20 people.

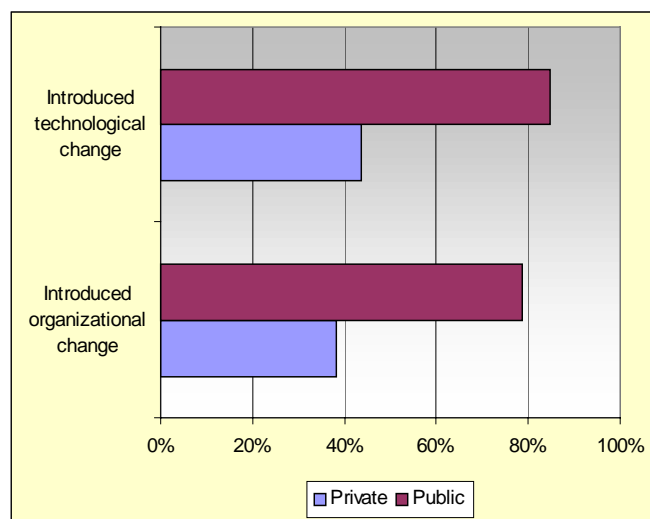
Introduction of change—either organisational or technological—was almost double in larger firms or organisations. The introduction of improved technologies in the private sector generally lagged that of the public sector (Chart 1). However, the lower overall rate for technological change recorded in the private sector reflects the low adoption rates for small firms that represent the majority of firms. When firms and organisations of the same size are compared, the rates of introduction of technological change for firms and organisations of at least 500 employees varied little between the private and public sectors (Chart 2).

Training for technological change

Introducing change, either technological or organisational, often requires training. In the period 1998-2000, four-fifths of the public sector enterprises that introduced organisational change provided training related to these changes. Similarly, public sector enterprises found that technological change also required

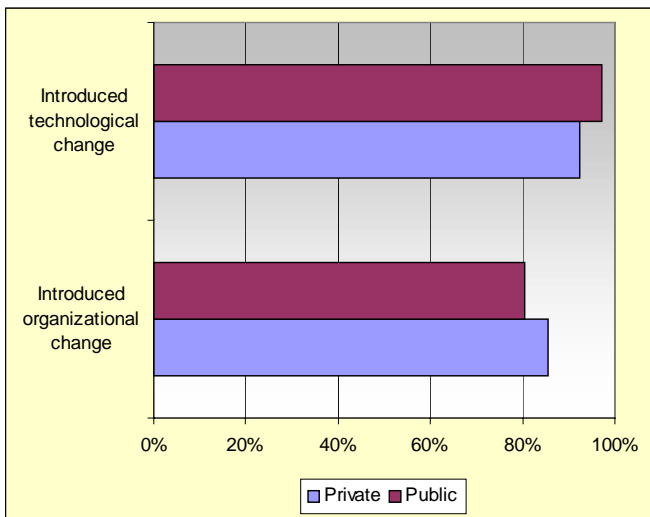
training. In fact almost every technological change introduced included the extra cost of training with 98% of those public sector institutions that introduced technological change

Chart 1. Introduction of organizational and technological change, 1998-2000, all organizations



Source: Statistics Canada, 2002, *Innovation and Change in the Public Sector: A Seeming Oxymoron*, Catalogue no. 88F0006XIE02001.

Chart 2. Introduction of organizational and technological change, 1998-2000, organizations with 500 or more employees



Source: Statistics Canada, 2002, *Innovation and Change in the Public Sector: A Seeming Oxymoron*, Catalogue no. 88F0006XIE02001.

accompanying the change with training. The rate of training provided by private sector firms again lagged at 74% for organisational change and 72% for technological change.

There was some fluctuation between the training rates in support of organisational change between the goods producing and services producing sectors by employment size group with the goods producing sector generally trailing the services producing sector in provision of training to accompany this type of change. However, there was very little variation in the rates for training due to organisational change between goods related services and intangible services. The goods producing sector and the services producing sector showed little variation in training rates in support of technological change. Within the services producing sector, goods related services showed a slightly higher tendency to train to accompany new technologies (77%) than intangible services (71%).

As with the propensity to introduce change, differences in training between the public and private sector could reflect operating environments. Training is costly. Whether or not employees are trained depends to a certain extent upon the costs and benefits of the training. For smaller firms, the introduction of organisational change was less likely to have been accompanied by training.

Introducing technological change

Four methods of introducing technological change are available from the Survey of Electronic Commerce and Technology, 2000. These are

- purchasing off-the-shelf technologies;
- licensing of new technologies;
- customising or significantly modifying existing technologies; and
- developing new technologies (either alone or in conjunction with others).

Defining Organisational and Technological Change

Organisational change is defined by a positive response to this question from *Survey of Electronic Commerce and Technology (SECT), 2000*:

“During the last three years, 1998 to 2000, did your organisation introduce significantly improved organisational structures or implement improved management techniques?”

An additional question on training due to organisational change was asked.

“If yes, did these improvements require training?”

The following two questions determined if firms were involved in technological change and, if so, how were they involved:

“During the last three years, 1998 to 2000, did your organisation introduce significantly improved technologies?”

“If yes, how did you introduce significantly improved technologies? (Check all that apply)

- by purchasing off-the-shelf technologies?
- by licensing new technologies?
- by customising or significantly modifying existing technologies?
- by developing new technologies? (either alone or in conjunction with others)”

An additional question on training due to technological change overall was asked. (The question did not refer specifically to the type of technological change.)

“Did any of these improvements require training?”

Source: Statistics Canada, 2000, from *Survey of Electronic Commerce and Technology (SECT), 2000*:

Not surprisingly, introducing off-the-shelf technologies was the most popular of the methods employed to introduce technological change with both the public and the private sectors. In fact, 85% of public sector organisations that introduced technological change purchased off-the-shelf technologies (73% for the private sector). Customising or significantly modifying existing technologies ranked second at 52% for the public sector and 41% for the private sector. Overall, the public sector’s use of licensing new technologies at 43% far outstripped that of the private sector at 15%. Finally for the public sector, developing new technologies was the last choice at 31% (18% in the private sector).

For more information on organisational and technological change in the private and public sectors, see *An Overview of Organisational and Technological Change in the Private Sector* (forthcoming in SIEID’s working papers series) and *Innovation and Change in the Public Sector: A Seeming Oxymoron*, Catalogue no. 88F0006XIE02001. Please see page 2 for instructions on downloading our working papers.

Further information: Louise Earl, SIEID, Statistics Canada, (613) 951-2880, Louise.Earl@statcan.ca.



Evolution of services as knowledge suppliers and innovators

The manufacturing sector is looked upon as the source of innovation and technological change, but the sheer size of service activity in the economy means that the competitive advantage will increasingly depend upon this sector’s ability to produce technologies and innovate.

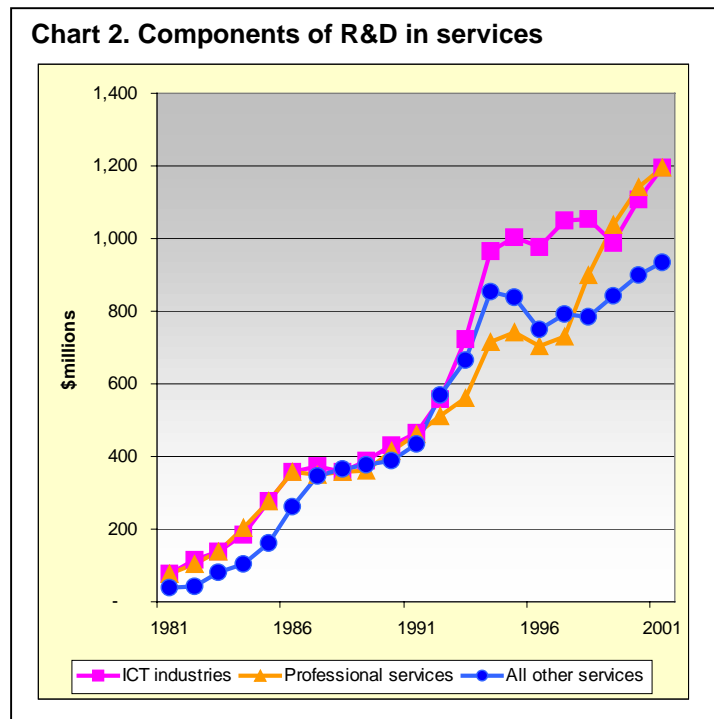
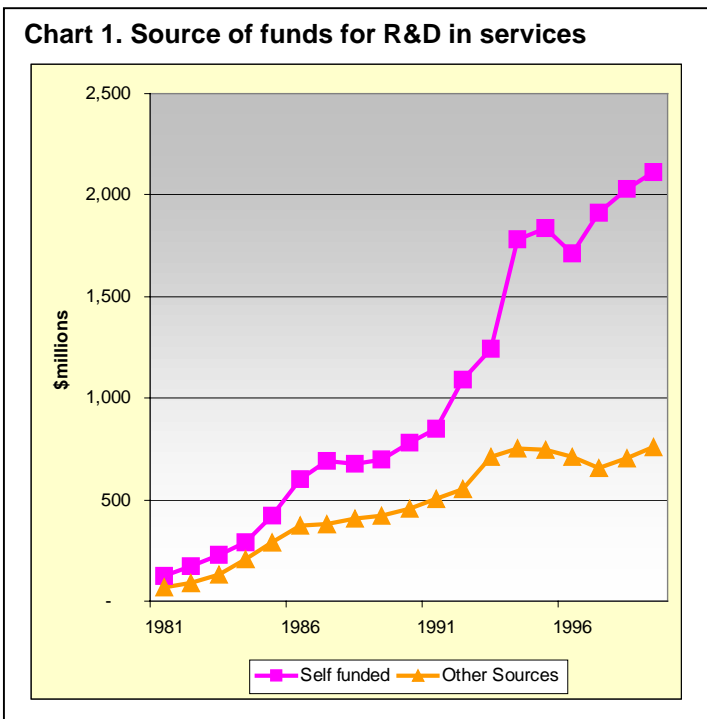
This study analyzes the factors contributing to the rapid growth in scientific research and development (R&D) work done in the service sector. It concludes that, although some analysts note the contribution of statistical artifacts and privatization, the real story is the growing role of the service sector as an active player in an economy in which information and knowledge are increasingly becoming the strategic assets. As well as providing knowledge-based solutions to others, service firms also undertake R&D themselves to enhance their own innovative capacity. This is becoming increasingly strategic in order to cope with competitive pressures arising from the increased tradability of services, the globalization of markets and the growing interdependence between goods and services in the New Economy.

“Services came of age in the economic landscape of the advanced economies decades ago”, says Daood Hamdani, the author of the study, “their influence on technology has been evolving over the last two decades. In the old economy, services enhanced the value of goods by expanding the geographical boundaries of the market; in the New Economy, goods and services are viewed as complements to each other. Software and hardware in the information and communication technologies (ICTs) is an example of this symbiotic relationship between goods and services.”

The study, which is in progress and scheduled for release in July, is based on analysis of the investment in scientific research and development. This is a leading indicator of technological change and innovation in that R&D leads to discoveries, which in turn, lead to innovations.

Since commercialization is an essential condition of innovation (bringing a new product to market), the analysis focuses on business enterprises. To analyze the evolving role of services, the study divides R&D performed in this sector between 1981 and 2001 according to the sources of funds: government; parent, subsidiary and affiliated companies; other companies; and performing companies’ own funds.

According to this analysis, the services’ role as passive knowledge suppliers, facilitating and mediating innovation in other sectors of the economy, has diminished considerably. Service firms do a much smaller proportion of their work for governments and affiliated companies than they did in the past. On the other hand, they receive more contracts from other business firms because of the intellectual depth, economies of scale and a faster turn around they offer.



Moreover, service firms are moving from applying ICTs to their established practices to undertaking much more dramatic product and process innovation. Professionals are no longer simply adopting and installing technologies, they are actively generating new applications. Software development industry barely existed three decades ago when most computer users wrote their own programs. As the computer is fast becoming a universal appli-

ance and the Internet technology is proliferating, software development industry is investing more heavily in research and development.

Further information: Daood Hamdani, Chief, Innovation, Technology and Jobs, SIEID, Statistics Canada, (613) 951-3490 daood.hamdani@statcan.ca



Innovation in an evolving economy

Statistics Canada's annual Economic Conference provides a forum for the exchange of empirical research among business, government, research and labour communities. The conference is also a means to promote economic and socio-economic analysis while subjecting existing data to critical assessment as part of an ongoing process of statistical development and review. This year's theme is Innovation in an Evolving Economy. At the May 6-7, 2002 conference, there were twelve presentations based on directly on the analysis of SIEID data. These presentations were given by SIEID analysts, Statistics Canada analysts in other groups, facilitated access researchers, and analysts using published or commissioned estimates.

Innovation and the use of advanced technologies in Canada's mineral sector, by Susan Schaan, SIEID, Statistics Canada.

Understanding innovation in the natural resource sector, by Rob Dunn, John Hector, Tim Norris and A. Jai Persaud, Natural Resources Canada.

Canadian biotech firms' performance: on the role of absorptive capacity, relational labour, learning and firm characteristics, by Namatie Traoré, SIEID, Statistics Canada.

L'importance de l'innovation et du capital humain dans le processus d'adaptation des entreprises manufacturières au Canada atlantique, by Maurice Beaudin and Samuel Le Blanc, Moncton University, Moncton, NB.

*Results from the **Biotechnology Use and Development Survey-1999**: profile of spin-off firms in the biotechnology sector*, by Craig Byrd, SIEID, Statistics Canada.

Impediments to innovation faced by Canadian manufacturing firms, by Can. D. Lee and Dominique Tourigny, Industry Canada.

Skill shortages and advanced technology adoption, by David J. Sabourin, MEAD, Statistics Canada.

Importance of skills for innovation and productivity, by Someshwar Rao, Jianmin Tang and Weimin Wang, Industry Canada.

Market shares and performance in the Canadian telecommunication industry, by Heidi Ertl and Haig McCarrell, SIEID, Statistics Canada.

Organizational innovation and competitive advantage in the construction industry, by Frances Anderson, SIEID, Statistics Canada, Cathy Bakker, National Research Council of Canada, and André Manseau, National Research Council of Canada.

Competition and innovation activities: a firm level analysis, by Jianmin Tang, Industry Canada.

Innovative regions: a new perspective on territorial disparity of economic performance, by Alessandro Alasia and Ray D. Bollman.

The complete program is available on Statistics Canada's Web site (under Our products and services, then Seminars and conferences). For copies of the papers or further information, please contact the presenters directly.



What's new?

Recent and upcoming events in connectedness and innovation analysis.

Connectedness

Status: A working paper *Measuring the networked economy* by Fred Gault and Hans Messinger Catalogue No. 88F0006XIE02002, was published on March 20, 2002.

Contact: George Sciadas (613) 951-6389
George.Sciadas@statcan.ca

Telecommunications

Annual survey of telecommunications service providers

Status: The 2000 annual data is being processed. The 2001 survey is in the field for collection.

Quarterly survey of telecommunications service providers

Status: *Telecommunications statistics, Fourth Quarter 2001*, Catalogue No. 56-002-XIE was released on April 24, 2002.

Contact: Haig McCarrell (613) 951-5948
Haig.McCarrell@statcan.ca

Broadcasting

Status: Radio and television broadcasting, 2000, Catalogue No. 56-204 is expected to be released in May 2002. Two issues of the service bulletin *Broadcasting and Telecommunications*, Catalogue No. 56-001 are expected before the end of June 2002. One issue will cover private television broadcasters and the other, private radio broadcasters.

Contact: Daniel April (613) 951-3177
Daniel.April@statcan.ca

Household Internet use

Status: Release of the results for the Household Internet Use survey, for reference year 2001, is anticipated for summer 2002.

Contact: Jonathan Ellison (613) 951-5882
Jonathan.Ellison@statcan.ca

Business e-commerce

Survey of electronic commerce and technology

Status: Results of the 2001 Survey of Electronic Commerce and Technology were released on April 2, 2002. See the *Statistics Canada Daily* for that date for a summary.

Contact: Bryan van Tol (613) 951-6663
Bryan.VanTol@statcan.ca

Science and innovation

S&T activities

Research and development in Canada

Contact: Bert Plaus (613) 951-6347,
Bert.Plaus@statcan.ca

Federal and provincial S&T

Status: Volume 26, No. 1 of *Science Statistics*, released on February 14, 2002 was on the topic *The provincial research organizations, 1999*.

Federal Science Activities, 2001-2002^e, Catalogue No. 88-204-XIE was released on April 12, 2002.

Volume 26, No. 2 of *Science Statistics*, also released on April 12, 2002 covered *Biotechnology scientific activities selected federal government departments and agencies, 2000-2001*.

A working paper *Provincial distribution of federal expenditures and personnel on science and technology 1991-92 to 1999-00* is expected to be released in May 2002.

Contact: Bert Plaus (613) 951-6347,
Bert.Plaus@statcan.ca

or: Lloyd Lizotte (613) 951-2188
Lloyd.Lizotte@statcan.ca

Industrial R&D

Research and development in Canadian industry (RDCI)

Contact: Bert Plaus (613) 951-6347
Bert.Plaus@statcan.ca

or: Robert Schellings (613) 951-6675
Robert.Schellings@statcan.ca

Research and development in the higher education sector and in the health field

Status: Volume 26, No. 3 of *Science Statistics*, released on May 1, 2002 was on the topic *Estimates of total expenditures on research and development in the health field in Canada, 1988 to 2001^p*. A working paper is expected later in the month.

Contact: Janet Thompson (613) 951-2580
Janet.Thompson@statcan.ca

Human resources and intellectual property

The higher education sector

Intellectual property commercialization in the higher education sector

Status: The 2001 survey is in the field. Results are expected to be available in the fall of 2002.

Contact: Cathy Read (613) 951-3838
Cathy.Read@statcan.ca

Federal intellectual property management

Federal science expenditures and personnel 2001-2002, intellectual property management, fiscal year 2000/2001

Status: The 2001 survey is in the field. Results are expected to be available in the fall of 2002.

Contact: Michael Bordt (613) 951-8585
Michael.Bordt@statcan.ca

Innovation

Status: A paper entitled *Innovation and change in the public sector: a seeming oxymoron*, based on the organizational and technological change questions in the 2000 Survey of Electronic Commerce and Technology (SECT), was released on January 31, 2002.

Another working paper *An Overview of Organisational and Technological Change in the Private Sector* is expected to be released in May 2002.

Innovation in manufacturing

Status: Data from the 1999 survey are available for special tabulations. We are developing the methodology for sub-provincial aggregates of the survey data.

Contact: Frances Anderson (613) 951-6307
Frances.Anderson@statcan.ca

Innovation in natural resources

Status: Susan Schaan and Frances Anderson co-authored *Innovation in the Forest Sector* in *The Forestry Chronicle*, Volume 78, No. 1, January/February 2002, pp.60-63.

Contact: Frances Anderson (613) 951-6307
Frances.Anderson@statcan.ca

Innovation in services

Status: A report *Evolution of Services as Knowledge Suppliers and Innovators* is in progress and scheduled for release in July 2002.

Contact: Daood Hamdani (613) 951-3490
Daood.Hamdani@statcan.ca

Biotechnology

Biotechnology use and development survey

Status: The *Biotechnology use and development survey 2001* is in the field. Results are expected in the fall of 2002.

Two papers: *Use of biotechnologies in the Canadian industrial sector: Results from the Biotechnology Use and Development Survey, 1999* and *Profile of spin-off firms in the biotechnology sector: Results from the Biotechnology Use and Development Survey, 1999* were released on March 28, 2002.

Contact: Antoine Rose (613) 951-9919
Antoine.Rose@statcan.ca

Knowledge management practices

Survey of knowledge management practices, 2001

Status: Results were released on March 21, 2002. The working paper *Are we managing our knowledge? Results from the pilot Knowledge Management Practices Survey, 2001* was released on April 19, 2002.

Contact: Louise Earl, (613) 951-2880, Louise.Earl@statcan.ca

National and international

National Science Foundation–Statistics Canada Workshop on Innovation, partnerships and alliances in the innovation process.

As the name implies, Statistics Canada co-hosted this workshop, held on February 28 to March 1, 2002 with the US National Science Foundation. The purpose of the Workshop was to examine the influence of alliances, networks and partnerships on the innovation process. The topic, Alliances, Networks and Partnerships in the Innovation Process, means, in the context of the Workshop, how firms align themselves, use networks and enter into partnerships to develop new or radically improved processes or to introduce new or radically improved products to the market. The presented papers will be published in the fall.

This represents the fifth in a series of joint research projects, organized by the Program of Research on Innovation, Management and the Economy (PRIME) and Statistics Canada. The research projects have examined key aspects of the innovation process. In the first volume, *Local and regional systems of innovation* (1998), studied locational issues related to innovation. The second and third volumes, *Information, Innovation and Impacts* (1999) and *Economics and Social Dynamics of Biotechnology* (2000), looked at two different transformational technologies. The fourth, *Knowledge Management in the Innovation Process* (2001) documents our current understanding of how knowledge management contributes to innovation. All four volumes were published by Kluwer Academic Publishers.

