Catalogue no. 88F0006XIE — No. 012
ISSN: 1706-8967
ISBN: 0-662-35107-X

Working Paper

Science, Innovation and Electronic Information Division working papers

Survey of intellectual property commercialization in the higher education sector, 2001

By Cathy Read

Science, Innovation and Electronic Information Division (SIEID)
7-A, R.H. Coats Building, Ottawa, K1A 0T6

Telephone: 1 800 263-1136

This paper represents the views of the author and does not necessarily reflect the opinions of Statistics Canada.

Statistics Canada Statistique Canada

Canada

Survey of intellectual property commercialization in the higher education sector, 2001

88F0006XIE2003012
ISSN: 1706-8967
ISBN: 0-662-35107-X

Science, Innovation and Electronic Information Division (SIEID)
7-A, R.H. Coats Building
Statistics Canada
Ottawa, ON K1A 0T6

How to obtain more information:
National inquiries line: 1 800 263-1136
E-Mail inquiries: infostats@statcan.ca

October 2003

Prepared by:

Cathy Read
Knowledge Indicators Section
Science, Innovation and Electronic Information Division (SIEID)
Statistics Canada

ST-03-12

Symbols

The following symbols are used in Statistics Canada publications:

..	figures not available
…	figures not appropriate or not applicable
-	nil or zero
--	amount too small to be expressed
e	estimated figure
i	spending intentions
p	preliminary figure
r	revised figure
x	confidential to meet the secrecy requirements of the Statistics Act

Note: Due to rounding, components may not add to totals.

Published by authority of the Minister responsible for Statistics Canada

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, 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.

Innovation makes firms competitive and we are continuing with our efforts to understand the characteristics of innovative and non-innovative firms, especially in the service sector that dominates the Canadian Economy. 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 which it invests over five billion dollars each year. In the past, it has been possible to say only *how much* the federal government spends and *where* it spends it. Our report **Federal Scientific Activities, 1998 (Cat. No. 88-204)** first 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, all of this information has been used to provide a context for performance reports of individual departments and agencies.

As of April 1999, the Program has been established as a part of Statistics Canada's Science, Innovation and Electronic Information Division.

The final version of the framework that guides the future elaboration of indicators was published in December, 1998 (**Science and Technology Activities and Impacts: A Framework for a Statistical Information System,** Cat. No. 88-522). The framework has given rise to **A Five-Year Strategic Plan for the Development of an Information System for Science and Technology** (Cat. No. 88-523).

It is now possible to report on the Canadian system on science and technology and to show the role of the federal government in that system.

Our working papers and research papers are available at no cost on the Statistics Canada Internet site at http://www.statcan.ca/cgi-bin/downpub/research.cgi?subject=193.

Contacts for more information

Science, Innovation and Electronic Information Division

Director Dr. F.D. Gault (613-951-2198)

Assistant Director Craig Kuntz (613-951-7092)

The Science and Innovation Information Program

Special Advisor, Science and Technology
Dr. Frances Anderson (613-951-6307)

Chief, Knowledge Indicators
Michael Bordt (613-951-8585)

Chief, Innovation, Technology and Jobs
Daood Hamdani (613-951-3490)

Special Advisor, Life Sciences
Antoine Rose (613-951-9919)

Science and Innovation Surveys Section

Chief, Science and Technology Surveys
Antoine Rose (613-951-9919)

FAX: (613-951-9920)

E-Mail: Sieidinfo@statcan.ca

Working Papers

The Working Papers publish research related to science and technology issues. All papers are subject to internal review. The views expressed in the articles are those of the authors and do not necessarily reflect the views of Statistics Canada.

Highlights

In 2001, Statistics Canada conducted the third Survey of Intellectual Property Commercialization in the Higher Education Sector. This voluntary survey was mailed out in the fall of 2001 to:

- all members of the Association of Universities and Colleges of Canada (AUCC)
- all known university-affiliated research hospitals.

The tables below summarize the results.

Table 1. Key statistics on intellectual property (IP) management in the Canadian higher education sector, 2001

Revenues from IP management

	Universities[2]		Hospitals		Total	
	No. reporting	$ '000	No. reporting	$ '000	No. reporting	$ '000
Royalties from licensing[1]	28	44,397	8	3,187	36	47,584
Grants, etc. (Table 32)	13	4,926	2	X	15	X
Dividends	5	160	1	X	6	X
Total	…	49,483	…	X	…	X

[1]Income before distribution to researchers, administrative units within the institution, etc.

[2] Several universities include their affiliated hospitals in their statistics.

Expenditures on IP management

	Universities		Hospitals		Total	
	Number reporting	$'000	Number reporting	$'000	Number reporting	$'000
Operational expenditures	50	25,691	11	2,814	61	28,505
Expenditures on research parks/business incubators	11	1,939	1	X	12	X
Total	…	27,630	…	X	…	X

Assets

	Universities		Hospitals		Total	
	Number reporting	$'000	Number reporting	$ '000	Number reporting	$ '000
Equity cashed in, in 2001	7	X	-	-	7	X
Equity remaining (held by the institutions) in spin-off companies	13	45,120	1	X	14	X

Other key statistics, 2001

	Universities		Hospitals		Total	
	Number reporting	Number	Number reporting	Number	Number reporting	Number
Institutions in survey	85	…	31	…	116	…
Institutions actively managing IP	58	…	19	…	77	…
Inventions disclosed	42	1,005	13	100	55	1,105
Inventions protected	34	625	12	57	46	682
New patent applications	34	867	12	65	46	932
Patents issued	29	339[r]	9	42	38	381[r]
Total patents held	37	1,994[r]	9	139	46	2,133[r]
New licenses	28	320	9	34	37	354
Total active licenses	31	1,338	9	86	40	1,424
Spin-off companies	36	655	7	25	43	680

Table 2. 1999-2001 Data comparison: universities

	Unit of measure	1999	2001	% change
Universities in survey	number	84	85	1
Actively managing IP	number	52	58	12
Inventions disclosed	number	829	1,005	21
Inventions protected	number	509	625	23
New patent applications	number	616	867	41
Patents issued	number	325	339	4
Total patents held	number	1,826	1,994	9
New licenses	number	218	320	47
Total active licenses	number	1,109	1,338	21
Royalties from licensing	$ thousands	18,900	44,397	135
Spin-off companies (cumulative)	number	454	655[1]	44
Sponsored research[2]	$ millions	2,241	3,329	49

[1]Some of the spin-off companies reported in 2001 were created prior to 1999.
[2]Source: Statistics Canada, Center for Education Statistics

Table 3. 1999-2001 Data comparison: hospitals

	Unit of measure	1999	2001	% change
Hospitals in survey	number	19	31	63
Actively managing IP	number	11	19	73
Inventions disclosed	number	64	100	56
Inventions protected	number	40	57	43
New patent applications	number	40	65	63
Patents issued	number	24	42	75
Total patents held	number	89	139	56
New licenses	number	14	34	143
Total active licenses	number	56	86	54
Royalties from licensing	$ thousands	2,200	3,187	45
Spin-off companies (cumulative)	number	17	25	47

The response rate for universities was similar for 1999 and 2001. Therefore, the increases shown in Table 2 reflect real changes in IP commercialization outcomes. In contrast, the number of hospitals participating in the survey increased from 19 to 31, which partly explains the increases in Table 3.

Table of Contents

Tables

1 Background

The focus on improving national performance and competitiveness in the "knowledge-based economy" has stimulated a new interest in the role of the higher education sector and its contribution to the future economy. The essential roles of universities are still to prepare students for the future and to advance knowledge in the general interest of the community. Nevertheless, the institutions themselves have also taken on an important role as developers of new technologies with commercial applications.

One of the keys to exploiting the knowledge being generated in universities is the appropriate management of the institutions' IP[1]. If inventions, ideas and creations are identified and protected, their benefits may be shared by the institution that originated them. Commercializing this IP further ensures that the creators/inventors and their institutions share in the benefits of the work.

Canadian universities and research hospitals have developed their own unique approaches to IP management. This diversity poses challenges to measurement and requires both an understanding of what the institutions do and how.

Prior to this survey, the main source of statistical information on IP commercialization by universities and hospitals was the survey conducted by the Association of University Technology Managers (AUTM). This US-based organization has surveyed major Canadian and US institutions since 1991. Between 12 and 16 major Canadian universities have responded regularly. The survey focuses on licensing but also includes questions on technology transfer personnel and patents.

Several universities have produced studies on their economic benefit. The University of Calgary released a study on its economic benefits (Chrisman, 1994) and another on the influence of its faculty on policy (Unrau, 1995). Both studies were conducted using extensive interviews with faculty and staff.

The University of British Columbia website provides statistics on its spin-off companies. The 2000 report (www.ubc.ca) lists 91 companies accounting for 2,432 jobs.

In early 1997, Statistics Canada commissioned a report by The Impact Group, which was entitled "Commercialization of Intellectual Property in the Higher Education Sector: A Feasibility Study" and is available at www.statcan.ca. It recommended a set of 50 indicators to measure the components of the commercialization process. These indicators and the framework from which they were derived (Creating IP, Identifying IP, Protecting and Managing IP, Exploiting IP, Faculty IP Transfer, Company Support and IP Transfer Impacts) served as the basis for the subsequent work.

The Association of Universities and Colleges of Canada (AUCC) recommended additional indicators and facilitated consultations with university representatives. The resulting recommendations were used to produce a draft questionnaire, which was subsequently discussed with IP managers in eight universities. The results of the 1998 survey were released in October 1998 and a working paper was published in early 1999.

Also in October 1998, the Prime Minister's Advisory Council on Science and Technology (ACST) established the Expert Panel on the Commercialization of University Research. The Expert Panel used the 1998 survey results in the development of its recommendations. A number of recommendations were also directed at Statistics Canada and many were implemented in the design of the 1999 survey.

---

[1] For the purposes of this report, **intellectual property** is defined as any creation of the human mind that can be protected by law. It includes inventions, works of literature, art, drama and music, computer software and databases, educational materials, industrial designs, integrated circuit topographies, new plant varieties and know-how.

Regarding the 2001 survey, several new questions were added following consultations with data users.

For each survey cycle, respondent comments and observed difficulties in completing particular questions are routinely gathered and used to make (mostly minor) changes to next questionnaire and the survey handbook.

In recent years, the Government of Canada has made significant investments in university research, which include the establishment of the Canada Foundation for Innovation (CFI), Genome Canada and the Canada Research Chairs (CRC) Program, along with increased funding for the three granting agencies and funding of the indirect costs of research. The government has also committed to increase its investments in university research. This was done as part of Canada's *Innovation Strategy: Achieving Excellence.*

In November 2002, the Government of Canada and the AUCC unveiled the Framework Agreement on federally funded research whereby:

- universities agreed to double the amount of research they perform and to triple their commercialization performance by 2010.
- the parties also agreed on the importance of the universities' participation in the Statistics Canada survey of university commercialization every two years.

The full text of the Framework Agreement is available at www.aucc.ca.

The AUCC has been studying how universities will meet their commitment to triple commercialization performance e.g., which statistical indicators will be used.

In addition, in 2003, a working group consisting of the AUCC, STC, Industry Canada and AUTM was established with a view to improving the current questions in the Statistics Canada survey and to provide institutions with the complete range of information that they need to assess and report commercialization performance both internally and to the government. The next (2003) survey will be conducted for the year 2002-3 and a number of changes to the questionnaire are foreseen.

2 Methodology and response rate

This report presents the results of the 2001 Survey of Intellectual Property Commercialization in the Higher Education Sector. The survey has been conducted three times: in 1998, 1999 and 2001. The next survey will be conducted for the year 2003.

The survey year refers to the year ending. For example, the "2001 survey" covers the fiscal year ending in 2001.

Universities have a variety of fiscal year-ends, ranging from March 31 to June 30. For example, a year-end of April 30 may better reflect the academic year. For the 2001 survey, institutions were asked to report for their own fiscal year ending between April 1, 2000 and March 31, 2001.

The 2001 survey was mailed out in the fall of 2001 to:

- all members of the Association of Universities and Colleges of Canada (AUCC)
- all known university-affiliated research hospitals.

The AUCC represents degree-granting universities and colleges, which will be referred to throughout simply as "universities." A list of AUCC members is available at www.aucc.ca.

The 1998 survey covered universities only; research hospitals were added in 1999 and included again in 2001. In some provinces, hospitals are administered through a regional health authority, so this is where the survey is sent.

Unlike most Statistics Canada business surveys, this one is conducted on a voluntary basis, which has an impact on the response rate.

The 2001 survey was mailed out to:

- 89 universities, with a response rate of 72%
- 73 hospitals, with a response rate of 56%.

Further details on the response rate can be found in Appendices A and B.

3 Comparisons between 1999 and 2001

The number of universities participating in the survey has stabilized and therefore, comparisons of data between 1999 and 2001 can be legitimately made.

However, the same cannot be said for hospitals, with 14 new survey participants in 2001. This makes most numbers higher but it is at least partly due to increased reporting. Hence, there are few year-over-year data comparisons for hospitals in the text.

In the case of percentages, data comparisons can be made. For example, in 1999, 58% of hospitals were actively managing their IP versus 61% in 2001.

4 Imputation/data quality

Surveys are subject to certain types of errors: coverage, non-response, interpretation and processing errors. The methodology of this survey has been designed to minimize errors and to reduce their potential impact.

Limited imputation or estimation of missing information is done for this survey. Due to the small number of institutions, imputation is done manually. Below is a summary of the method.

Firstly, imputation is closely tied to editing. Any missing information that can be filled in based on related answers is so completed.

Secondly, for larger institutions, some of the information is available from public sources, such as university websites, the AUTM survey, annual reports, press releases and even conference presentations.

Thirdly, certain types of questions have a logical default answer:

- YES/NO questions: The default is NO unless external information or the corresponding previous response was YES.
- YES/NO/DON'T KNOW questions: The default is DON'T KNOW unless external information or the previous year's response is available.

Fourthly, some information is logically carried forward from the previous year's response, for example:

- Policy questions: If the policy questions are not answered and the information is not available on the institution's website, the latest year's response is carried forward. This is because institutional policies are fairly constant. To assist in this regard, a file of all previous questionnaires and attachments is kept.
- Spin-off companies: The survey requests a cumulative list of spin-off companies. Therefore, the previous year's information for all spin-off variables is automatically carried forward. For each spin-off, the incorporation year, status and technology field are compared to the STC Business

Register (BR) and may also be updated accordingly. The BR is an administrative data source based on Canada Customs and Revenue Agency records.

At the end of these procedures, a certain amount of information is still missing. One of the most common cases is information provided in aggregate only and not broken down into the categories requested. In these cases, an "unallocated" category is created and published. This allows data users to see and assess the extent of non-response.

Another slightly different case involves sets of related numbers, such as number of intellectual properties promoted and promotion expenditures. If only one number in a set is completed with the other left blank and the numbers do not resemble the previous year's response, no imputation is done.

If no information whatsoever is available, the field is left blank and no estimation is done.

A table with the percent estimated for selected variables is provided in Appendix C.

5 University versus hospital statistics

This survey finds a variety of technology transfer arrangements among universities and research hospitals:

- some universities commercialize the IP from other universities under contract
- some universities commercialize IP for their affiliated hospitals
- some hospitals have their own technology transfer offices (TTOs) and commercialize independently
- some hospitals perform certain IP management functions and leave others to the affiliated university
- at least one hospital commercializes IP for another hospital.

Needless to say, this complicates the reporting for the survey and the analysis of the results, especially combined with a less-than-perfect response rate.

For universities with a Faculty of Medicine, these professors are often cross-appointed to the university and the hospital and their research may take place in the affiliated hospital.

Throughout this report, separate statistics have been provided for universities and hospitals. However, the line between the two types of institutions is blurred. Despite this, for the 1999 and 2001 surveys, care was taken to eliminate any double-reporting of invention disclosures, patent applications, patents held, etc.

6 Results

6.1 IP management infrastructure and university degrees

Table 4 shows that 61% of hospitals and 68% of universities are actively managing (identifying, protecting, promoting or commercializing) their IP, up from 58% and 62% respectively in 1999.

Table 4. IP management infrastructure and university degrees

	Institutions					Number of central offices	
	Total number	Actively managing IP		With central office(s) for IP management		Total	With personnel with a university degree in technology management
		Number	%	Number	%		
Hospitals	31	19	61	12	39	12	1
Universities	85	58	68	53	62	64	6
Total	116	77	66	65	56	76	7

Furthermore, 39% of hospitals and 62% of universities have central offices for IP management, up from 32% and 60% respectively in 1999.

Four universities indicated that they are actively managing their IP but have no central office for this function. In these cases, any IP with commercial potential is generally referred to another institution with which they have an agreement.

Examples of central offices include:

- Office of Research Services
- Industry Liaison Office
- Business Development Office and
- Office of Technology Transfer

One hospital reported a small amount of resources in its library as a central office for IP management.

Six of the 53 universities and one of the 12 hospitals with central office(s) for IP management have personnel with a degree in technology management. The survey handbook provided the following definition.

> University degrees in technology management have a variety of names. In Canada and the United States, they are typically Bachelor's or Master's degrees in science, applied science or business, with a specialization in technology management, technology transfer, management in science and technology, engineering management or similar wording. Law degrees with a specialization in IP would also be counted.

This question was asked as an initial attempt to understand the training completed by technology transfer officers. The feedback to the survey was that most technology transfer officers have some combination of MSc., PH.D., MBA, LL.B, etc. as opposed to one of the degrees specified above.

6.2 Expenditures on IP management

Table 5. Expenditures on IP management

	Employees dedicated to IP management	Salaries (correspond-ing to FTEs)	Patent application expenditures	Legal costs	Other operational expenditures	Total operational expenditures for IP management
	FTEs[1]	$ thousands				
Hospitals	19	1,368	X	X	304	2,814
Universities	202	11,896	8,292	1,194	4,309	25,691
Total	221	13,264	X	X	4,613	28,505

[1] Full Time Equivalents

In 2001, universities had $25.7 million in total operational expenditures for IP management, up from $21.0 million in 1999. Patent application expenditures also increased to $8.3 million, compared to $5.7 million in

1999. The average salary was $59 thousand for university and $72 thousand for hospital technology transfer employees.

Note that some institutions could not separate legal costs from patent application expenditures. In these cases, the amount was reported under the latter.

6.3 Research parks and business incubators

There is some variation from year to year in what is being reported as a research park or business incubator, perhaps due to lack of a clear definition. The US Association of University Research Parks (AURP)[2] defines a university research park or technology incubator as a property-based venture that has:

> -Existing or planned land and buildings designed primarily for private and public research and development facilities, high technology and science based companies, and support services;
>
> -A contractual and/or formal ownership or operational relationship with one or more universities or other institutions of higher education and science research;
>
> -A role in promoting research and development by the university in partnership with industry, assisting in the growth of new ventures, and promoting economic development;
>
> -A role in aiding the transfer of technology and business skills between the university and industry tenants.
>
> The park or incubator may be a not-for-profit or for-profit entity owned wholly or partially by a university or a university-related entity. Alternatively, the park or incubator may be owned by a non-university entity but have a contractual or other formal relationship with a university, including joint or cooperative ventures between a privately developed research park and a university.

Overall however, the AURP has concluded that there is no simple definition for "research park" or "technology incubator." In terms of physical infrastructure, it can be anything from a single building to a venture as large as the North Carolina Research Triangle.

Table 6 provides comparative statistics on research parks and business incubators.

Table 6. Research parks and business incubators

	1999		2001	
	Number reporting	Number of parks/ incubators	Number reporting	Number of parks/ incubators
Hospitals	3	3	2	2
Universities[1]	15	14	16	15
Total	18	17	18	17

[1] One park/incubator is operated by two universities.

Universities reported two new parks/incubators in 2001 compared to 1999 but one of the previous ventures was insignificant to begin with and is no longer being reported. Hence, universities reported one net new park/incubator.

Regarding hospitals, one previously-reported park/incubator ceased operations because the few companies in it grew and moved out. Hence the number declined from 3 to 2.

[2] www.AURP.net

The total number of parks/incubators was unchanged at 17 in 2001.

The research park/business incubator question was expanded in 2001 to obtain new data on salaries and other expenditures and to obtain better data overall . Table 7 provides the results.

Table 7. Resources devoted to research parks and business incubators

	Number of employees of the institution engaged in park/incubator activities (FTEs)	Expenditures by the institution on research parks and business incubators ($ thousands)		
		Salaries	Other expenditures	Total expenditures
Hospitals	-	-	X	X
Universities	24	1,010	929	1,939
Total	24	1,010	X	X

Between 1999 and 2001, the number of university employees engaged in park/incubator activities increased from 21 to 24 while expenditures on research parks decreased from $2.4 million to $1.9 million. The decline in expenditures is largely due to one university, which indicated that research park expenditures are not part of its budget. This raises certain questions:

- how are research parks funded ?
- is it important whether the funding is from an institution or from another public sources (e.g., province, municipality)?

6.4 IP policies

Table 8 provides the latest results for universities on researcher requirement to report IP to the institution.

Table 8. Researcher requirement to report IP: universities

	Always	Sometimes	Never	No policy on reporting	No such IP at the institution	Total
	Number					
Inventions	28	21	10	14	12	85
Software or databases	13	34	14	19	5	85
Literary, artistic works, etc.	13	22	24	23	3	85
Educational materials	13	32	18	21	1	85
Industrial designs	14	15	15	19	22	85
Trademarks	14	13	11	22	25	85
Integrated circuit topographies	14	14	14	18	25	85
New plant varieties	11	17	7	19	31	85
Know how	7	18	13	32	15	85

The wording of this question was the same in 1999 and 2001 and therefore, a comparison of the results should be possible. The “always” and “sometimes” totals are comparable. However, there was a large decrease in the “never” category and a shift to the “no policy on reporting” and “no such IP at the institution” categories. This was observed between 1998 and 1999 as well. The “never” category was likely misconceived from the beginning. That is, an organization’s policies don’t tend to dictate what doesn’t have to be done but rather what has to be done.

Another finding was that the policy questions can have multiple interpretations. For example, a small university reported that certain types of IP are owned by the institution, others by the researcher and others jointly. Upon follow-up however, it was found that this university had no formal policies concerning IP ownership. The university was reporting “practices” that had been in effect for several decades. This raises the question of what is intended by the IP policy questions: to capture only formal (written) policies or in their absence, to capture practices (unwritten policies). What is the significance of practices?

The requirement to report literary works and educational materials is also subject to interpretation. In 1999, a small university reported no policy on requirement to report but then, in 2001, changed its responses to "always" and "sometimes" must report. Upon questioning, it was found that nothing had changed in the interim. Professors always had to report literary works as part of their annual review in order to be fully considered for promotion and tenure. There are incentives to report IP to the university but not necessarily a strict requirement. This could also be described as a practice as opposed to a formal policy.

An earlier assumption concerning this survey was that all universities produce certain basic types of IP: software or databases, literary works and educational materials. This now appears to be incorrect. The survey includes divinity and liberal arts colleges and a few other highly-specialized institutions. For example, those offering only humanities may not produce software or databases. Some do no sponsored research whatsoever or not every year. This leads to minor variation in the types of IP applicable to the institution that are reported from year to year.

Finally, regarding policies, it was found that between 1999 and 2001, some universities did negotiate a new faculty collective agreement that included changes to their IP policies.

Table 9 provides the latest results for universities on ownership of IP created at the institution.

Table 9. Ownership of IP created at the institution: universities

	Institution owns	Researcher owns	Joint ownership	No policy on ownership	Other ownership [1]	No such IP at the institution	Total
	Number						
Inventions	13	34	12	11	3	12	85
Software or databases	10	39	11	15	5	5	85
Literary, artistic works, etc.	-	66	3	10	3	3	85
Educational materials	7	54	7	13	3	1	85
Industrial designs	9	29	6	17	2	22	85
Trademarks	12	22	4	19	3	25	85
Integrated circuit topographies	9	24	7	18	2	25	85
New plant varieties	10	22	5	16	1	31	85
Know-how	4	33	8	22	3	15	85

[1] Includes "the Crown owns the IP" and "varies".

Compared with 1999, there was a substantial decrease in the category "researcher owns" along with increases in the categories "no policy on ownership" and "no such IP at the institution. These were due primarily to a change in the question. In 1999, there were only three ownership categories on the questionnaire: institution owns, researcher owns and other ownership. However, due to the variety of responses received, the table in the 1999 publication included the same categories as above. In 2001, the questionnaire was expanded to include: joint ownership and no policy on ownership. Because of the greater range of choices, respondents that had previously answered "researcher owns" changed their response to "no policy on ownership." Their 1999 response was effectively that the researcher owned the IP by default due to lack of a policy. The 2001 results are thus a more accurate reflection of IP ownership.

Table 10. Researcher requirement to report IP: hospitals

	Always	Sometimes	Never	No policy on reporting	No such IP at the institution	Total
	Number					
Inventions	9	4	-	15	3	31
Software or databases	7	5	1	17	1	31
Literary, artistic works, etc.	3	3	2	15	8	31
Educational materials	4	4	1	17	5	31
Industrial designs	2	5	-	13	11	31
Trademarks	4	5	-	13	9	31
Integrated circuit topographies	1	4	-	11	15	31
New plant varieties	-	-	-	-	31	31
Know-how	4	5	-	15	7	31

Table 11. Ownership of IP created at the institution: hospitals

	Institution owns	Researcher owns	Joint ownership	No policy on ownership	Variable ownership	No such IP at the institution	Total
	Number						
Inventions	7	4	5	11	1	3	31
Software or databases	10	4	4	11	1	1	31
Literary, artistic works, etc.	5	6	2	9	1	8	31
Educational materials	8	4	2	11	1	5	31
Industrial designs	5	3	2	10	-	11	31
Trademarks	8	3	1	9	1	9	31
Integrated circuit topographies	4	3	-	9	-	15	31
New plant varieties	-	-	-	-	-	31	31
Know-how	5	5	1	12	1	7	31

Regarding Table 11, the biggest increases over 1999 were in the "no policy on ownership" and "no such IP" categories. That is, the 14 hospitals reporting for the first time tended to be in these categories.

For university policies, "joint ownership" usually means the researcher and the institution. However, where a hospital refers any IP to a university TTO for commercialization, "joint ownership" may mean the researcher, the university and the hospital. (This was pointed out by one hospital.)

6.5 Inventions created by students

The 2001 survey included two new questions:

- During the reference year, were any inventions created by students reported to the institution (yes, no or don't know) ?
- How does the institution manage inventions created by students (5 choices)?

Table 12 shows the results.

Table 12. Inventions created by students: universities

		Inventions created by students were reported to the university during 2001.		
No.	Student invention policy	Yes	No or don't know	Total
		Number of universities		
1	The institution has no policies on inventions created by either faculty or students.	-	22	22
2	The university has policies for faculty but not for students.	6	17	23
3	The university has policies for students but not for faculty.	-	-	-
4	The same policies apply to both faculty and students.	13	8	21
5	Different policies apply to student-created inventions.	4	1	5
6	Unknown/unreported	-	14	14
	Total number	23	62	85

In 2001, invention(s) created by students were reported to 23 of the 85 universities (27%). The 23 universities include small, medium and large. Note that six of the 23 universities had policies for faculty only and hence did not have a policy in place to address the situation.

Not surprisingly, the larger universities are more likely to have policies in place regarding student inventions. Most of the work in this area needs to be done by the small and medium-sized universities.

The term "student" was left very general in the question. However, there are several types of students, including undergraduate, graduate, post-doctoral and employed student. Also, co-invention by student(s) and faculty member(s) seems to be one of the main issues. Below are some examples of comments.

> *"We do not yet have a formal policy but if a student is merely carrying our research under supervision, the faculty member would own the IP. If the student made a significant contribution to the research, he/she would be a co-owner of any IP."*

> *"At present, graduate students share in royalties when they are co-inventors of patentable inventions. A policy is currently being developed to address IP developed by students."*

> *"Students who are recognized as co-inventors are treated the same as professors."*

> "*Policy for graduate students is the same as for faculty. No official policy for undergraduate students but, by default, students own their inventions (if not employed by the university). However, students are encouraged to use the services of the TTO to commercialize their inventions and we will strongly support student initiatives."*

Table 13. Inventions created by students: hospitals

		Inventions created by students were reported to the institution during 2001.		
No.	Student invention policy	Yes	No or don't know	Total number
		Number of hospitals		
1	The institution has no policies on inventions created by either faculty or students.	-	14	14
2	The institution has policies for faculty but not for students.	-	1	1
3	The institution has policies for students but not for faculty.	-	-	-
4	The same policies apply to both faculty and students.	4	2	6
5	Different policies apply to student-created inventions.	-	2	2
6	Unknown/unreported	-	8	8
	Total number	4	27	31

In 2001, invention(s) created by students were reported to four of the 31 hospitals (13%) and all four had policies to address the situation.

6.6 Research contracts

Research at an institution may be funded by either grant or contract. In the case of grants, the researcher receives funding to investigate a certain field but there are no deliverables attached to it. The federal government provides most grant funding although some is received from other levels of government, individual donations, private industry, etc.

In contrast, a research contract specifies that certain deliverable(s) must be provided in exchange for the funding. Deliverables may include a book, invention, report on the outcome of the research, etc.

Another important distinction between research grants and contracts is that any IP resulting from grants is generally owned within the institutional community, whether it is 100% owned by the researcher, jointly owned by the university and the researcher, etc. It all depends on the policies of the institution. Section 6.4 provided information on institutional IP policies, excluding IP resulting from research contracts.

In contrast, the sponsor of the research contract may own the resulting IP. The ownership is typically specified in the contract.

Faculty collective agreements often specify that the terms of any research contract supercede the provisions of the collective agreement.

Table 14 provides the latest summary of research contract policies at hospitals and universities.

Table 14. Research contract policies: hospitals and universities

	Who owns the IP?		Who has the first right to license the IP?	
	Hospitals	Universities	Hospitals	Universities
	Number			
Sponsor	7	3	12	16
Institution	4	14	1	10
Researcher	1	22	2	18
Shared	2	5	-	2
Negotiable/varies/ per contract	6	24	5	19
Not applicable/no policy	8	10	8	10
Other	-	1	-	1
No response	3	6	3	9
Total	31	85	31	85

Since the survey began, there has been a decrease in the number of universities reporting that any IP resulting from research contracts is typically owned by the sponsor. The number went from eight in 1998 to five in 1999 to three in 2001.

For 2001, note that the sponsor typically owns the IP for seven of the 31 hospitals (23%) compared to three of the 85 universities (3%). One explanation may be that hospitals are referring to clinical research contracts, in which a pharmaceutical company has developed a drug or other IP and the hospital's role is simply to test it.

One comment was that this question is meaningless because "anything is negotiable."

6.7 Research contract funding

Table 15 provides the latest results regarding the number and value of research contracts undertaken by hospitals and universities.

Table 15. Number and value of research contracts: hospitals and universities

	Hospitals		Universities		Total	
	Number	Value ($'000)	Number	Value ($'000)	Number	Value ($'000)
Federal government	75	10,509	1,095	75,938	1,170	86,447
Provincial or other levels of government	57	X	1,243	66,256	1,300	X
Canadian businesses	695	33,843	2,241	122,017	2,936	155,860
Canadian organizations	242	9,568	391	16,132	633	25,700
Foreign governments	X	X	90	8,265	X	X
Foreign businesses	166	7,024	567	35,177	733	42,201
Foreign organizations	X	1,928	157	6,092	X	8,020
Other	X	X	63	30,032	X	X
Unallocated	..	X	1,116	61,166	..	X
Total	1,284	105,976	6,963	421,075	8,247	527,051

Between 1999 and 2001, for universities, the total number of research contracts rose from 5,049 to 6,963 and the value of those contracts rose from $315 million to $421 million. For hospitals, the total number of research contracts increased from 699 to 1,284 and the value increased from $78 million to $106 million. For both universities and hospitals, the increases are mainly due to increased reporting. However, a number of major universities also reported substantial increases in their research contracts, indicating that this activity is on the rise.

It was noted that at least some universities and hospitals are including clinical research contracts for this question.

Table 16. 1999-2001 Research funding comparison: universities

	1999	2001	% change
Number of universities reporting research contracts	48	53	10
Total number of research contracts	5,049	6,963	38
Total value of research contracts ($ thousands)	315,246	421,075	34
Average value per contract ($ thousands)	62	60	-3
Total sponsored research -grants and contracts ($ thousands)[1]	2,241,052	3,328,976	49
Research contracts as a percentage of total sponsored research	14%	13%	..

[1] Source: Statistics Canada, Centre for Education Statistics, CAUBO and non-CAUBO data

Table 16 show that research contracts represented 14% of total university funding in 1999 and 13% in 2001.

In the feedback to the survey, it was suggested that one issue that needs to be addressed here is the amount of industry involvement in research. This information is available. Table 17 provides a summary.

Table 17. Industry involvement in university research

Year	2000	2001
Type of industry contribution:	$ thousands	
A-Donations, including bequests	79,187	78,349
B-Grants and contracts	373,083	459,983
C-Contracts only (Canadian and foreign businesses)	..	157,194
D-Total donations, grants and contracts (A+B)	452,270	538,332
E-Total sponsored research	2,778,964	3,328,976
F- % of research funding provided by industry (D/E*100)	16%	16%

Source (Lines A, B, E): Statistics Canada, Centre for Education Statistics, CAUBO and non-CAUBO data

For both 2000 and 2001, private industry provided 16% of university research funding through donations, grants and contracts.

6.8 Barriers to IP commercialization

One hospital and 11 universities are aware of at least one instance where the benefit from IP developed at the institution was realized by a foreign country. Below are the major new examples provided by respondents.

- "*A technology developed by a researcher was transferred to a European company for development and commercialization purposes, after significant efforts had been made to commercialize the technology in Canada. This transaction occurred prior to the recent development of the University's technology transfer program. The University is presently working with the European company to license the technology for commercialization in Canada."*
- *"In past, joint patents filed and/or patents filed by faculty while on sabbatical abroad."*

Ten hospitals and 33 universities are aware of other instances where the institution has not gained the maximum benefit from IP developed within. Below are the major new examples provided by respondents, grouped by theme where appropriate.

Hospitals

- *"No current, effective policy regarding intellectual property developed by the institution (e.g., telemedicine)"*
- *"Premature public disclosure"*
- *"We have insufficient staff to properly exploit all our IP."*
- *"Researchers signed away IP rights without realizing it. (Advice was not sought from our office.)"*
- *"Past policies led to assignment or sale of IP, rather than licensing. (Assignment was to the affiliated university, the research sponsor or the inventor.) Often royalties were not received. This policy has now changed - IP is licensed with sublicensing and royalty issues addressed."*

The following general comment also relates to this question.

- "*The single largest impediment to commercialization is access to early stage seed capital to develop technologies from a crude lab bench concept to a point where industry/financial interest can be attracted. There is a huge gap between the discovery made at lab bench funded by a national granting agency and a technology that is sufficiently "polished" to be licensed to a health product company. There are few Canadian "early stage" venture capital companies to invest at this stage*."

Universities

Inadequate IP policies

- *"The 'non-disclosure/inventor owns' policy guarantees that the institution misses the majority of IP developed."*
- *"A few years ago, faculty members could and sometimes did take their inventions and license them to start-ups independently of the university and with no compensation flowing to the university. Staff and students can still do this."*

Non-compliance with IP policies

- *"Faculty member did not declare (IP)."*
- *"A business software was developed independently of the university by the Department of Computer Science."*

Conferences/premature disclosure of IP

- *"An invention was disclosed at a conference."*
- *"We often discover the potential of a research project after the individual has presented the research at a conference or published data."*

Lack of technology transfer capability

- *"Disclosure not officially made as no technology transfer office present on campus."*
- *"We don't have a full tech transfer office to know the extent of IP developed in the institution."*

Lack of funds

- *"Undoubtedly, disclosures have been missed due to lack of resources in the technology transfer office. Since 2001 however, we have boosted our numbers.*
- *"Due to lack of resources, the technology transfer office was unable to properly identify, protect and commercialize IP."*
- *"Lack of resources prevents the technology transfer office from taking on some projects."*
- *"In instances where funds are not available to protect in all desired countries, (patent) applications must be abandoned due to low potential of return."*
- *"Insufficient resources to pursue optimal commercialization strategies"*
- *"Limited funds to pursue patenting, to defend against patent infringement and for prototype development and testing."*

Copyright infringement

- *"Consultants sometimes use material developed by the institution for their own benefit."*
- *"Photocopying infringement, course designs copied"*

Industry research contracts

- *"When research has been funded by industry, the industry partner may benefit to a greater extent than the university."*
- *"Preferential rights demanded by companies supporting sponsored research"*

6.9 Faculty consulting activities

In most employment situations, employees are not permitted to do consulting on the side and particularly not in the same line of business as their employer. However, university faculty are different in that consulting is generally permitted and even encouraged. Consulting may result in a conflict of interest and/or the transfer of IP with commercial potential outside the institution without due consideration for the latter. An important issue is whether faculty are required to report their consulting activities to the institution. Table 18 summarizes the policies.

Table 18. Requirement of faculty to report consulting

Required to report faculty consulting	Hospitals		Universities		Total
	Number reporting	%	Number reporting	%	Number reporting
Always	9	29	25	30	34
Sometimes	5	16	36	42	41
Never	10	32	16	19	26
Consulting not permitted	-	-	1	1	1
Unknown	7	23	7	8	14
Total	31	100	85	100	116

For universities, the results are similar to 1999. The same is true for hospitals on a percentage-basis. Some examples of conditions related to "sometimes required to report" are as follows:

- "major paid professional activity"
- "if ongoing and significant"
- "during regular working hours"
- "on university time or using university resources"
- "upon request of Dean."

One institution commented that the real questions that need to be asked here are: what does reporting mean? reporting what? to whom? who can decide to stop a consulting mandate? and how many were stopped?

6.10 Identification of new IP

The survey asks how new IP is identified at the institution. Table 19 provides the results.

Table 19. Identification of new IP

		Hospitals	Universities	Total
		Number		
1	The researcher is primarily responsible for recognizing the discovery and its potential, reporting it to the institution and requesting consideration for protection and commercialization.	13	51	64
2	The institution strictly monitors the activities of researchers and notes which discoveries should be considered for protection and commercialization.	-	1	1
3	The institution actively solicits opportunities for commercialization and promotes the IP by providing advice and assistance to researchers at various stages.	5	9	14
4	Other means/multiple approaches	3	9	12
5	Not applicable/no response	10	15	25
	Total number of institutions	31	85	116

The 2001 results for hospitals are similar to 1999 in terms of percentages. With regard to universities, there was a slight shift away from approach 1 toward the other approaches, particularly number 4.

This question is generally viewed as one on institutional policies. However, another way of looking at the matter is how does IP come to light within the institution. Having a policy on identification may be inadequate to uncover all IP with commercial potential. Rather, what is needed is a series of nets so that what is not caught in one is caught in another.

Another issue is whether approaches 1 to 3 are actually formal policies or rather, practices within the institution.

Below is a list of all the parties that may recognize the IP with commercial potential, as reported so far to this survey:

- the researcher alone (faculty member, graduate or post-doctoral student)
- the researcher's peers/ through peer interaction
- the institution (e.g., in advance of creation of materials for in-house use)
- the TTO (through selective monitoring, solicitation and promotion of its services)
- the patent agent
- the research contract sponsor
- outside parties seeking specialists to help solve a problem
- outside parties attending presentations or conferences.

6.11 IP management activities

Table 20. IP management activities summary: hospitals

IP type	Applicable IP protection activity	Hospitals reporting this IP protection activity in the last 5 years		Hospitals that had disclosures of this IP type in 2000/01	Disclosures in 2000/01	Hospitals engaging in protection activities in 2000/01	Intellectual properties protected in 2000/01
		Number	%	Number			
Inventions	Patent application	14	45	13	100	12	57
Software or databases	Copyright registration	5	16	6	10	3	4
Literary, artistic works, etc.	Copyright registration	7	23	3	X	3	40
Educational materials	Copyright registration	7	23	1	X	1	X
Industrial designs	Registration	1	3	-	-	-	-
Trademarks	Registration	9	29	3	X	3	X
Integrated circuit topographies	Registration	-	-	-	-	-	-
New plant varieties	Registration (Canada) Patent (US)	-	-	-	-	-	-
Know-how	License	..	..	1	X	1	X
Cell lines		..	..	1	X	1	X
Various	Non-disclosure or confidential-ity agreement	14	45	..	..	..	..
Biological material	Transfer agreement	2	6	..	..	..	..

Table 21. IP management activities summary: universities

IP type	Applicable IP protection activity	Universities reporting this IP protection activity in the last 5 years		Universities that had disclosures of this IP type in 2000/01	Disclosures in 2000/01	Universities engaging in protection activities in 2000/01	Intellectual properties protected in 2000/01
		No.	%	Number			
Inventions	Patent application	41	48	42	1,005	34	625
Software or databases	Copyright registration	20	24	22	77	12	16
Literary, artistic works, etc.	Copyright registration	25	29	16	964	6	52
Education-al materials	Copyright registration	22	26	15	144	4	X
Industrial designs	Registration	5	6	-	-	-	-
Trade-marks	Registration	28	33	6	13	9	17
Integrated circuit topo-graphies	Registration	1	1	1	X	-	-
New plant varieties	Registration (Canada) Patent (US)	5	6	6	18	5	16
Know-how	License	..	..	5	9	3	X
Genes	Registration	1	1	-	-	1	X
Biological materials	Transfer agreement	3	4	..	..	..	..
Various	Trade secret agreement	1	1	..	..	..	..
	Non-disclosure or confidentiality agreement	43	51	..	..	..	..

Inventions

In 2001, 42 universities received disclosures of 1,005 inventions while 34 universities protected a total of 625 inventions. By comparison, in 1999, 33 universities received disclosures of 829 inventions and 32 universities protected 509 inventions.

Also in 2001, 13 hospitals received reports or disclosures of 100 inventions while 12 hospitals protected a total of 57 inventions. By comparison, in 1999, nine hospitals received disclosures of 64 inventions and eight hospitals protected 40 inventions.

The number of disclosures of inventions and other types of IP reflects only those that were actually reported to the institution. At some institutions, there is no requirement for faculty to disclose IP.

"Protected" means that a protection activity was started. For inventions, "protected" means that a patent application was started. The number of new patent applications (see Tables 22 and 23) will usually be higher than the number of inventions protected because one invention may have several patent applications (e.g., for Canada, the US, European countries). However, the number of inventions protected includes some that were disclosed to the institution but patented and commercialized independently by the inventor(s) and hence not counted in the number of patent applications filed by, issued to or held by the institution.

In these statistics, it is important to note that the year in which the IP was disclosed to the institution is not necessarily the year in which it was protected. Aside from the rigorous process to which reported IP is subjected, the institution may also decide to keep the matter confidential and defer the protection decision until more information can be gathered.

Copyrights

The survey covers three different types of copyrightable IP:

- literary, artistic, dramatic or musical works, books, papers
- educational materials
- software or databases.

Literary, artistic, dramatic or musical works, books, papers

Note that this title has been shortened to "literary, artistic works, etc." in the tables. Also, this IP type includes scientific articles. The survey asks about registration of copyright of these works, which is not necessary under most circumstances.

In 2001, 16 of the smaller universities reported disclosures of 964 literary works compared to 360 works reported by eight universities in 1999. One university obtained this information through self-reporting in a newsletter. However, most universities don't keep records of the number of literary works produced and hence, for all years, disclosures have been greatly underreported.

Three hospitals also reported the disclosure and protection of literary works in 2001.

Educational materials

In 2001, 15 universities had disclosures of 144 educational materials whereas in 1999, 10 universities reported disclosures of 157 educational materials. In both years, four universities protected their educational materials. A large portion of these materials are for distance education.

In 2001 and 1999, the same hospital reported disclosures and protection of educational materials. Regarding literary works and educational materials, one hospital said that its primary mandate is dissemination of information and that staff are continuously developing (presumably health-related) materials.

Software or databases

In 2001, 22 universities had disclosures of 77 softwares/databases and 12 universities protected 16 softwares/databases. These numbers are higher than in 1999, when 21 universities had 56 such disclosures and 6 universities protected 11 softwares/databases.

Also in 2001, six hospitals had disclosures of ten softwares/databases and three hospitals protected four softwares/databases.

Industrial designs

In 2001, there were no disclosures or registrations of industrial designs by either hospitals or universities. In the previous five years, industrial designs were registered by one hospital and five universities.

In 1999, two universities had disclosures only of industrial designs. There was no such activity in hospitals.

Trademarks

In 2001, six universities had disclosures of 13 trademarks and nine universities registered 17 trademarks. One-third of universities have registered trademark(s) in the last five years, of which some are institutional trademarks.

In 2001, 3 hospitals had disclosures of and registered trademarks.

Integrated circuit topographies

Only one university and no hospitals have registered an integrated circuit topography in the last 5 years.

New plant varieties

In Canada, new plant varieties are protected by filing an application for plant breeders' rights. A claim for protection of plant varieties is preceded by publication of a description of the plant variety in the Plant Varieties Journal. In the US, new plant varieties are protected by patent.

In 2001, six universities received disclosures of 18 new plant varieties and five universities proceeded to register and/or patent 16 of them.

Other IP types

Gene registration was reported by one university for the first time in 2001.

Table 22. Patenting activities by field of study: hospitals

Field of study	New patent applications	Patents issued in			
		Canada	US	Other countries	Total
	Number				
Commerce, management and business administration	-	-	-	-	-
Agriculture and biological sciences	X	X	X	X	X
Engineering and applied sciences	-	-	-	-	-
Health sciences and technologies	X	X	X	X	X
Mathematics and physical sciences	-	-	-	-	-
All other not elsewhere classified	-	-	-	-	-
Total	65	X	30	X	42

In 2001, 12 hospitals filed 65 new patent applications. Nine of the same group were issued 42 patents, of which 30 were US patents. Also, all activity was in the biology and health fields.

Table 23. Patenting activities by field of study: universities

Field of study	New patent applications	Patents issued in				
		Canada	US	Other countries	Unallocated by country	Total
	Number					
Agriculture and biological sciences	114	X	19	5	-	X
Engineering and applied sciences	170	9	38	10	-	57
Health sciences and technologies	201	X	25	X	-	44
Mathematics and physical sciences	82	X	20	X	-	28
All other not elsewhere classified (incl. business)	8	-	-	X	-	X
Unallocated by field of study	292	45	92	12	33	182
Total	867	65	194	47	33	339

In 2001, 34 universities filed 867 new patent applications and 29 of the same group were issued 339 patents. Of the 339 patents issued, the majority (194 or 57%) were US patents, 65 were Canadian patents, 47 were patents from other countries and 33 were unclassified.

It should be noted that there are timing differences between invention disclosure, patent application and patent issue and hence the 339 patents issued cannot be directly correlated with the 867 patent applications.

By comparison, in 1999, universities filed 616 new patent applications and were issued 325 patents.

Table 24. Total patents held by country of issue: hospitals and universities

	Canada	US	Other	Total
	Number			
Hospitals	29	80	30	139
Universities	344	1,007	643	1,994
Total	373	1,087	673	2,133

In 2001, nine hospitals held 139 patents while 37 universities held 1,994 patents. The grand total was 2,133 patents held by hospitals and universities for all countries.

By comparison, in 1999, hospitals held 89 patents and universities held 1,826, for a total of 1,915.

6.12 IP promotion

The 2001 survey included a new question to better identify the types of activities undertaken by hospitals and universities to promote their IP. Table 25 gives the results. Note that institutions could indicate multiple activities.

Table 25. Types of IP promotion activities: hospitals and universities

Code	Type of IP promotion activity		Number of institutions engaging in the activity		
			Hospitals	Universities	Total
1	Developing or implementing business plans or similar studies (market, feasibility, licensing, etc.)		10	29	39
2	Developing or demonstrating prototypes, scale-up projects or similar activities		6	24	30
3	Advertising licensing or other collaborative opportunities on the Internet		3	20	23
4	Contacting potential licensees or other collaborators directly		8	31	39
6	Other IP promotion activities		3	22	25
	Summary	Reporting any of the above	14	44	58
		Reporting none of the above	17	41	58
		Total number of institutions	31	85	116

Table 26. IP promotion expenditures

2001	Number of intellectual properties promoted	Number of institutions reporting	Expenditures on IP promotion ($ thousands)	Number of institutions reporting
Hospitals	107	11	461	7
Universities	538	38	1,203	31
Total	645	49	1,664	38

The numbers for universities are similar to 1999.

Below are some of the other promotion activities reported:

- creation of promotional materials e.g., newsletters, bulletins, brochures, product sheets
- creation of a prototype development fund and a venture fund
- launching the works written by teaching staff once per year
- holding educational seminars for faculty and students (of both the university and the affiliated hospital)
- development of technology transfer partnerships among institutions
- liaising with other technology transfer offices in region
- participation in/ presentation at tradeshows, conferences, colloquiums, forums, etc.
- hosting demonstrations, inventor showcases, commercialization events, investors' forums
- hosting investment meetings with venture capitalists and angels
- visiting corporate partners
- development of industry partnerships.

6.13 Exploiting IP: licensing versus spin-off company formation

When a university or hospital has developed a technology with market potential, there are two basic choices with regard to commercialization:

- license the technology to an existing company
- create a company (a spin-off) to license or further develop the technology.

The decision is based on a variety of factors, such as whether the technology fits into an existing business and the availability of a licensee. A spin-off may be formed if the technology requires further development or prototyping to demonstrate its commercial viability. Licensing can bring in a stable flow of revenues in the short term. However, an institution that spins off a company may take an equity stake in the company in lieu of licensing fees, which can be more profitable over the long term. In general, there is more risk in spinning off a company than in licensing to an existing company but the potential for reward is greater.

6.13.1 Licensing

About one-third of institutions (9/31 hospitals and 31/85 universities) have licensed their technologies. Table 27 provides the details.

Table 27. 2001 licenses: hospitals and universities

	New licenses	Active licenses	New licenses	Active licenses
	Number		Number reporting	
Hospitals	34	86	9	9
Universities	320	1,338	28	31
Total	354	1,424	37	40

Between 1999 and 2001, the number of new licenses executed by universities rose 47% from 218 to 320 and the total number of active licenses increased 21% from 1,109 to 1,338. Table 28 provides the licenses numbers gathered so far in this survey.

Table 28. Licenses historical data: universities

	Number of new licenses	Number of active licenses	Number of universities reporting active licenses
1998	243	788	26
1999	218	1,109	28
2001	320	1,338	31

Table 29 provides a detailed breakdown of the new and total active licenses executed by universities in 2001.

Table 29. Detailed licenses data: universities

	Exclusive and sole licenses	Non-exclusive licenses	Unclassified (as to exclusive, sole or non-exclusive)	Total
a) New licenses executed with Canadian licensees that were: i) Sponsors of research contracts or participants in collaborative activities ("Sponsors")	44	13	-	57
ii) Not involved in generating the technology licensed ("Non-sponsors)	46	13	-	59
iii) Unclassified (as to sponsor or non-sponsor)	14	3	-	17
iv) Total new licenses with Canadian licensees (a.i.+a.ii.+a.iii)	104	29	-	133
b) i) New licenses with foreign licensees	37	82	-	119
ii) New licenses (unclassified as to Canadian or foreign)	-	-	68	68
iii)Total new licenses (a.iv+b.i.+b.ii)	141	111	68	320
c) Active licenses with Canadian licensees that were: i) Sponsors of research contracts or participants in collaborative activities ("Sponsors")	140	21	-	161
ii) Not involved in generating the technology licensed ("Non-sponsors")	108	24	-	132
iii) Unclassified (as to sponsor or non-sponsor)	157	45	11	213
iv) Total active licenses with Canadian licensees (c.i.+c.ii+c.iii)	405	90	11	506
d) i) Active licenses with foreign licensees	116	212	-	328
ii) Active licenses (unclassified as to Canadian or foreign)	113	-	391	504
iii) Total active licenses (c.iv.+d.i.+d.ii)	634	302	402	1,338

One university indicated that the figures it provided for the licenses question greatly understate the actual number of licenses. This is because its research contracts usually include licensing provisions that grant some level of IP access to the research sponsor. Hence, there may be some limitations to only counting the licenses executed in separate licensing contracts.

Regarding Table 29, column 2, the term "sole license" means that there is only one license granted for the associated patent. "Exclusive license" refers to one granted that is e.g., exclusive for a territory or exclusive for a field of use worldwide. Hence, there may be multiple exclusive licenses for a single patent.

Table 30 provides details on the types of licenses executed by hospitals.

Table 30. Detailed licenses data: hospitals

	Exclusive and sole licenses	Non-exclusive licenses	Total
a) New licenses executed with Canadian licensees that were: i) Sponsors of research contracts or participants in collaborative activities	X	X	X
ii) Not involved in generating the technology licensed	X	X	X
iii) Total new licenses with Canadian licensees (a.i + a.ii)	X	X	27
b) i) New licenses with foreign licensees	X	X	7
ii) Total new licenses (a.iii + b.i)	13	21	34
c) Active licenses with Canadian licensees that were: i) sponsors of research contracts or participants in collaborative activities	11	13	24
ii) Not involved in generating the technology licensed	X	X	18
iii) Total active licenses with Canadian licensees (c.i +c.ii)	X	X	42
d) i) Active licenses with foreign licensees	X	X	44
ii) Total active licenses (c.iii + d.i)	50	36	86

Note that of the 86 active licenses executed by hospitals:

- 50 were exclusive/sole licenses and 36 were non-exclusive
- 42 were with Canadian and 44 were with foreign licensees.

Table 31 shows the royalties from licensing received by hospitals and universities.

Table 31. Royalties from licensing: hospitals and universities

	Sources			
	Canadian	Foreign	Unallocated	Total
	$ thousands			
Hospitals	427	1,810	950	3,187
Universities	11,065	21,377	11,955	44,397
Total	11,492	23,187	12,905	47,584

Universities received royalties of $44.4 million in 2001, up 135% from $18.9 million in 1999. In the AUTM statistics, the comparable number would be total licensing income less cashed in equity. For the year 2000, the comparable AUTM number for 16 universities was $32.7 million. The significant increase since 1999 in the amount of royalties received by universities is partly due to some major success(es) in the area of IP commercialization.

The royalties received by institutions are largely paid out to various parties with a claim on the invention: inventor(s) and co-inventor(s), administrative units within the institution, affiliated institutions, etc.

One university said that it was owed royalties but received none due to “problems with a partner.”

Table 32. Other substantial sources of income from IP commercialization

	Hospitals		Universities		Total	
	Number reporting	$'000	Number reporting	$'000	Number reporting	$'000
Patent reimbursement	-	-	7	2,217	7	2,217
Grants and R&D agreements	1	X	6	2,405	7	X
Other or unspecified	2	X	3	304	5	X
Total	2[1]	X	13[1]	4,926	15[1]	X

[1] The total is less than the sum (vertically) because one hospital and three universities reported more than one other source of income.

"Patent reimbursement" refers to the royalties received by the institution that are first used to recoup patent/legal expenditures related to the particular invention. These were reported separately from the royalties in Table 31.

6.13.2 Spin-off Companies

The following section provides information from two sources: the STC survey and the STC Business Register (BR). In the survey, institutions were asked to provide a list of all spin-off companies created to date, along with the incorporation year, status, technology sector, institutional link and the % owned for each company.

The names of all spin-off companies were looked up on the BR to obtain any information of interest, such as the revenues, employment, industry and country of control. This information is based on recent filings by the actual businesses with the Canada Customs and Revenue Agency (CCRA) of:

- corporate income tax
- payroll taxes
- GST/HST (Goods and Services Tax/ Harmonized Sales Tax).

To find the correct match for each spin-off, all relevant information on both the BR and the survey was used. For example, when a match on the spin-off name was found, the business address on the BR was reviewed. In most cases, the spin-off was in the same province (and even in the same city) as the related institution. The same address sometimes appeared for several spin-offs from the same institution. Also, in a noticeable number of cases, the business address was or appeared to be a campus address.

The 2001 survey shows that Canadian universities and their affiliated research hospitals have created a total of 680 spin-off companies. Of these, 612 were found on the BR, representing a high match rate of 90%.

For the purposes of the survey, a spin-off was defined as a company established for one or more of the following reasons:

Type 1: to license the institution's technology

Type 2: to fund research at the institution in order to develop technology that will be licensed by the company

Type 3: to provide a service that was originally offered through an institution's department or unit.

The spin-off concept includes start-ups, which are defined as those dependent on licensing the institution's IP.

Table 33 shows the type distribution as reported on the survey.

Table 33. Institutional linkage

	License (Type 1)	R&D (Type 2)	Service (Type 3)	License and R&D	Other combinations	Unknown	Total
Number	275	101	23	45	6	230	680
%	41	15	3	7	0	34	100

The institutional linkage data are similar to 1999, except for a slight decrease in the licensing type (from 46% to 41%) and a slight increase in the R&D type (from 10% to 15%). For some spin-offs, the institutional link may no longer exist, which would explain the lack of information on institutional link for over one-third of them. The survey shows that licensing the institution's technology continues to be the predominant reason for establishing spin-off companies.

The 680 spin-offs recorded in the 2001 survey appear to represent a substantial increase over the 471 spin-offs in 1999. However, as shown in Table 34, only 62 spin-offs were actually created (incorporated) in the 2000-2001 period. The remainder of the increase was due to the submission of historical list(s) of spin-offs. Despite this, 50% of the spin-offs on record have been created since 1995, as shown in Table 34.

Table 34. Year of incorporation

	Before 1980	1980 to 1984	1985 to 1989	1990 to 1994	1995 to 1999	2000 to 2001	Unknown	Total
Number	39	56	75	154	281	62	13	680
%	6	8	11	23	41	9	2	100

As indicated previously, survey respondents were asked to report the name of each spin-off along with the year of incorporation. The incorporation year provided on the survey was used to help find the correct BR record(s) for each spin-off. In some cases, the incorporation year information did not agree. Below is a partial explanation.

1) Some universities are reporting "year founded" as opposed to incorporation year and in the final analysis, this is the information sought. The intent of the question is to determine when the whole commercialization endeavor started and the incorporation year is only asked as an approximation of the latter.

2) When a spin-off (A) is merged into an existing company (B), which may or may not be another spin-off, in some cases company B is being reported as a spin-off. In this case, there are two possible incorporation years: for companies A and B. Clarification is required on what to report on the survey in this case.

Table 35 provides information on the status of the spin-offs.

Table 35. Status of spin-off companies

	Conceptual stage	Early stage	Active	Merged	Inactive	Closed	Unknown	Total
Number	11	106	384	33	71	59	16	680
%	2	15	57	5	10	9	2	100

The percentage of active spin-offs is lower and the percentage of merged spin-offs is higher in 2001 than in 1999. The percentage of closed spin-offs is also higher due to the addition of the historical list(s).

Table 36. Technology field, all spin-offs

	Agri-culture/ biology	Health sciences	Engin-eering/ Applied sciences	Infor-ma-tion	Mathe-matics/ Physical sciences	Business/ manage-ment	Other/ Unknown	Total
Number	90	226	122	131	78	8	25	680
%	13	33	18	19	12	1	4	100

The 2001 results show a shift from agriculture/biology to health compared to 1999 but this is largely due to recoding based on the additional information in the BR. There are two types of biotechnology: medical and agricultural. Originally, if "medical biotechnology" was specified or if the biotechnology spin-off was reported by a hospital, these were coded under "health sciences." Otherwise, "biotechnology" with no qualification was coded as "agriculture/biology." However, the spin-offs were looked up on the BR for the first time in 2001 and this database includes a one-line description of the business. Where appropriate, this information was used to update the technology field of the spin-off in 2001.

Table 37. Technology field of spin-offs incorporated in 2000 and 2001

	Agricul-ture/ Biology	Health sciences	Engin-eering/ Applied sciences	Infor-ma-tion	Mathe-matics/ Physical sciences	Business/ manage-ment	Other/ Unknown	Total
Number	5	25	8	12	8	-	4	62
%	8	40	13	19	13	-	7	100

Table 37 shows that regarding new spin-off formation, health sciences (including health biotechnology) is the fastest growing field.

Table 38. Equity held in spin-offs

Spin-offs	With equity held by the institution	No equity held by the institution	Unknown	Total
Number	182	202	296	680
%	27	30	43	100

On a percentage-basis, the results in Table 38 are similar to 1999.

Table 39. Spin-offs with equity held by the institution, by percentage owned

	1 to 10%	11 to 20%	21 to 49%	50%	51 to 99%	100%	Total
Number	110	20	23	14	1	14	182
%	60	11	13	8	0	8	100

On a percentage basis, the results in Table 39 are slightly different from 1999. The percentage of equity that any party holds in a company may change from year to year if, for example, some equity is cashed or new shares are issued or repurchased by the company.

Table 40. Dividends, equity disposition and remaining equity

	Dividends received by institutions	Equity disposed of (cashed in) by institutions	Remaining equity in spin-offs (held by the institutions)
	$ thousands		
Hospitals	X	-	X
Universities	160	X	45,120
Total	X	X	X

At March 31, 2001, the value of remaining equity in spin-offs held by universities was $45.1 million, down 17% from $54.6 million in 1999. The decline reflects the beginning of a bear market in stocks, especially for high tech companies.

One university reported that through licensing deals, it has acquired equity in companies that it does not consider to be spin-offs. This amount was included with remaining equity in spin-offs.

There have been comments to the effect that the amount of dividends ($160 thousand) is too low compared to the amount of equity owned ($45 million). One reason is that high-tech start-ups tend not to pay dividends. Also, some institutions have made agreements not to cash in the equity in their spin-off(s) for a certain number of years and in this respect, the reported equity is not totally liquid.

Dividends received and equity disposed of by institutions are concrete amounts that can be easily reported. The value of remaining equity in a spin-off is more difficult to determine and is subject to change. Essentially, it is the total value of the company multiplied by the percentage owned by the institution. Because some of these spin-offs (particularly the start-ups) have not had an initial public offering (IPO) or are not publicly-traded, the institutions are not willing or able to report the value of their equity stake. Table 41 provides further information on the reporting of equity owned.

Table 41. Reporting of equity owned: hospitals and universities

	Number of institutions			
	With spin-offs	With open spin-offs and reporting equity owned in at least some of them	Reporting a value of remaining equity on the survey	
			Yes	No
Hospitals	7	6	1	5
Universities	36	25	13	12
Total	43	31	14	17

Regarding the seven hospitals that have created spin-offs, of these six have spin-offs that are still open and in which they own equity. However, only one of the six reported a value of equity on the survey. The remainder responded with a question mark or left the question blank.

Similarly, only one half (13/25) of universities to which the question on equity owned was applicable reported a value of equity. Hence the value of remaining equity reported on the survey is incomplete and could be referred to as the "known" value of equity in spin-offs.

The most basic way of valuing any company is to subtract the liabilities from the assets. However, as one institution noted, many of its spin-offs are "virtual" and therefore not based on physical assets.

Another institution indicated how it determined the value of equity held for each of its spin-offs. The methods were as follows:

- investor valuation of company
- value of product to external buyer and investor valuation
- sales history
- sales volume and value of new IP in company
- value of patents
- value of transfer of technology to third party buyers
- value of IP vested in companies
- value of IP to third party and future earnings
- value of partnership between two companies.

The AUTM survey includes a question on the value of equity cashed in by the institution but not the remaining value of equity. It also specifies that the value of equity cashed in should be reduced by any cost to acquire the equity. This instruction would also apply to the related questions in the STC survey.

In summary, it may not be feasible for institutions to assign a value to their holdings in spin-off companies that have not had an initial public offering (IPO) or are not publicly traded. The numbers provided are incomplete at best.

For the first time in 2001, statistics on the revenues and employment in spin-offs have been provided.

Table 42. 2002 Revenues and employment in spin-offs: hospitals and universities

	Hospitals	Universities	Total
No. institutions reporting spin-offs	7	36	43
Total no. spin-offs	25	655	680
No. spin-offs with revenues but no employment	5	81	86
No. spin-offs with employment but no revenues	-	-	-
No. spin-offs with both revenues and employment[1]	10	317	327
Total revenues of spin-offs ($ millions)	44	2,536	2,580
Total employment in spin-offs	506	18,737	19,243

[1] The remaining spin-offs are new, inactive, closed, no information is available, etc.

In 2002, the 655 university spin-offs had revenues of $2.5 billion and employed 18,737 people while the 25 hospital spin-offs had revenues of $44 million and employed 506 people.

As discussed earlier, the revenues and employment in spin-offs were obtained from the BR, as the parent institution would not have ready access to such information on outside companies. STC receives updates to its BR from the CCRA. An algorithm is used to estimate the total revenues and employment for each company based on its latest filings of :

- corporate income tax
- payroll deductions
- GST/HST (Goods and Services Tax/ Harmonized Sales Tax).

The revenues and employment figures are best described as 2002 approximations.

The spin-offs range in size from small to large. Tables 43 and 44 provide the breakdowns.

Table 43. Spin-offs by revenue range

Revenue range	$1 to $9,999	$10,000 to $49,999	$50,000 to $99,999	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 to $4,999,999
No. spin-offs	42	30	21	90	42	103
% spin-offs	10	7	5	22	10	25

	$5,000,000 to $9,999,999	$10,000,000 to $49,999,999	$50,000,000 or greater	Total spin-offs with revenues
No. spin-offs	34	42	9	413
% spin-offs	8	10	2	99

Table 44. Spin-offs by employment range

No. employees	1	2 to 9	10 to 19	20 to 49	50 to 99	100 to 499	500+	Total*
No. spin-offs	34	95	32	75	41	43	7	327
% spin-offs	10	29	10	23	13	13	2	100

*Total spin-offs with employees

Table 44 shows that the spin-offs with employees are mainly small employers.

Another important piece of information found on the BR that helps to describe the spin-offs is the NAICS code. Statistics Canada uses the North American Industry Classification System (NAICS) to classify companies by industry. Table 45 provides a breakdown of the spin-offs by industry.

Table 45. Industry of Spin-offs

NAICS Code(s)	Industry Name	No. spin-offs
	Services - 59%	
541710	R&D in the physical, engineering and life sciences	182
541510	Computer systems design and related services	86
541330	Professional engineers	31
5416	Management, scientific and technical consulting services	33
541380	Testing laboratories	16
621510	Medical and diagnostic laboratories	6
511210	Software publishers	5
551113	Holding companies	5
611420	Computer training	4
5239	Other financial investment activities	4
621110	Offices of physicians	2
	All other services (e.g., theatre company, museum, recording studio, physiotherapist, veterinarian)	30
	Total services	**404**
	Manufacturing – 12%	
334512	Measuring, medical and controlling devices manufacturing	18
339110	Medical equipment and supplies manufacturing	12
325410	Pharmaceutical and medicine manufacturing	6
335	Electrical equipment, appliance and component manufacturing	9
334220	Radio and television broadcasting and wireless communications equipment manufacturing	3
334310	Audio and video equipment manufacturing	3
334110	Computer and peripheral equipment manufacturing	2
	All other manufacturing	30
	Total manufacturing	**83**
	Wholesale trade – 3%	
417930	Professional machinery, equipment and supplies wholesaler-distributors	9
417310	Computer, computer peripheral and pre-packaged software wholesaler-distributors	2
	All other wholesaler-distributors	7
	Total wholesale trade	**18**
	Other industries – 2%	
44-45	Retail trade	6
23	Construction	5
111-112	Agriculture	3
	Total other industries	**14**
	No industry information available– 24%	**161**
	Total spin-offs – 100%	**680**

Table 45 shows that over one-quarter (27%) of the spin-offs have R&D as the predominant activity. (Companies may be engaged in more than one activity e.g., R&D and manufacturing but the predominant activity determines the industry classification.) Overall, the services sector accounts for the majority of spin-offs, at 59%.

Table 46. Technology field of R&D spin-offs

	Agriculture/ Biology	Health sciences	Engineering/ Applied sciences	Information	Mathematics/ physical sciences	Total
No. spin-offs	33	105	21	7	16	182
%	18	58	11	4	9	100

Table 46 provides the technology sector (from the survey) for the 182 spin-offs in the "R&D in the physical, engineering and life sciences" industry (from the BR). Note that 58% of the R&D spin-offs are in the health sciences field, followed by 18% in agriculture/ biology.

Finally, the BR includes limited information on country of control. Of the 680 spin-offs, 11 are known to be controlled outside Canada: seven in the United States and one in each of Great Britain, France, Switzerland and Japan. (The foreign-controlled spin-offs are all university spin-offs.)

6.13.3 Further information on spin-offs

This section provides further information on how spin-offs are being reported.

In a few cases, the same spin-off was reported by up to three institutions. Where both a university and a hospital were involved, the spin-off was attributed to the hospital since this is presumably where the related technology originated. Where one institution provides commercialization services for another, the spin-off was attributed to the client institution. Multiple institutions reporting the same spin-off may also have been research collaborators. In any event, to avoid double-counting, the spin-off was attributed to only one institution. Also, the percentage owned by the institution that is retained on the STC database is the sum of the percentages owned by each institution.

Given that the survey was conducted in 1998, 1999 and 2001, some institutions have sent in an updated list of spin-offs each time. In some cases, previously reported spin-offs have been dropped. Upon looking them up in the BR, some were found to be inactive or closed or there had been a name change. Others can't be explained so easily. Statistics Canada is keeping a cumulative list of all spin-offs.

Companies may undergo name changes for a variety of reasons. Many institutions are reporting the same spin-off on successive surveys but with a new name. In this case, the new name is added to the existing record. As an additional complication, a company may also have an operating name that is different from the legal name.

Some respondents are reporting "acquired" for the spin-off status but the real issue is whether the spin-off has been merged into the acquiring company. A merger is defined as an acquisition followed by an operating name change.

It should be clarified that a company is still a spin-off even if the original ownership changes. For example, one university reported that one of its start-ups had been "bought out" by a large US corporation.

In this study, the revenues and employment of the spin-off were counted even in cases where there had been a legal name change. Also, if a spin-off is merged into a multi-national corporation, the revenues and employment of the original spin-off establishment are counted in these totals (but obviously not the world-wide totals).

The computer search for the spin-off sometimes resulted in multiple matches with the same business address. A fictitious example for illustration purposes only would be "XYZ R&D Inc" (incorporated earlier but now inactive) and "XYZ Inc" (with significant revenues). In this case, the revenues and employment for the latter company were the ones counted in the totals.

Several universities have also reported what they term "second generation spin-off" or "successor to failed spin-off."

It is clear that the creation of a university start-up is only the beginning. Those that are successful evolve into larger and more complex entities. Overall, this information was intended to demonstrate that the spin-off concept is not entirely straight forward.

6.14 Regional information: universities

Table 47. Regional differences in IP commercialization: universities

	Univer-sities	Sponsored research 2000/01	Royalties from licensing	Inventions		Patents held	Licenses		Spin-offs
				Reported	Protected		New	Total active	
	No.	$ millions		Number					
Atlantic	16	157	X	54	X	X	X	X	X
Quebec	18	917	X	221	136	348	94	417	81
Ontario	25	1,349	9.8	303	157	557	93	305	198
Prairies	15	638	11.0	227	133	466	67	329	134
BC	11	267	X	200	X	X	X	X	X
Total	**85**	**3,328**	**44.4**	**1,005**	**625**	**1,994**	**320**	**1,338**	**655**
	Percentage of national total								
Atlantic	19	5	X	5	X	X	X	X	X
Quebec	21	28	X	22	22	18	29	31	12
Ontario	29	40	22	30	25	28	29	23	30
Prairies	18	19	25	23	21	23	21	24	21
BC	13	8	X	20	X	X	X	X	X
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Regional differences in IP commercialization may be studied in proportion to research funding. For example, universities in the Prairie Provinces received 19% of total research funding but a disproportionate 25% of royalties from licensing (Table 47). The Prairie universities also accounted for 23% of inventions reported, 21% of inventions protected, 23% of patents held, 21% of new licenses, 24% of total active licenses and 21% of spin-off companies created to date. In summary, on every indicator, they had better than 19%.

In contrast, Ontario universities received 40% of all research funding but had a lesser proportion of all indicators: 22% of royalties, 30% of inventions reported, 25% of inventions protected, 28% of patents held, 29% of new licenses, 23% of total active licenses and 30% of spin-off companies created to date.

In Quebec, the indicators were mixed. Quebec universities received 28% of all research funding and reported a higher proportion of new and total active licenses (29% and 31% respectively). Although the exact numbers are confidential, Quebec universities also had better results in the area of royalties from licensing. However, on four indicators, Quebec universities had less than 28%: inventions reported and inventions protected (both 22%), patents held (18%) and spin-offs created to date (12%).

Further study would be necessary to determine why commercialization of intellectual property varies across the country. Some possible factors include years of experience in technology transfer, university policies and university size.

7 Conclusions

In recent years, the Government of Canada has made substantial new investment in university research. As a result, many of the indicators of IP commercialization performance, such as invention disclosures, new patent applications, new licenses, royalties received and spin-off companies created, have increased significantly.

Many different parties within the federal and provincial governments and outside the government are considering the issue of how to measure performance in IP commercialization. The focus is typically on how Canadian institutions have performed compared to their counterparts in the US and other countries. University and hospital technology transfer offices must also report internally on their performance. The issue of return on investment in university research is important if governments are to justify the continued flow of money into this area.

The 2001 edition of this survey included new work to better understand spin-off companies and to measure their revenues and employment. Suggestions as to other types of analysis are welcome at any time.

For the next (2003) edition of the survey, Statistics Canada will focus on improving the questionnaire to develop even more meaningful indicators of commercialization performance. As indicated earlier, this is being done with the input of AUTM, the AUCC, IC and other data users.

Since 2001, the high technology sector has lost its lustre as the engine of growth in the new economy. Also, the investment in skills has perhaps not delivered the expected benefits as quickly as anticipated. Since late 2001, security issues have also cast a pall on other endeavors. Nonetheless, R&D conducted by both the public and private sectors is considered key to the future prosperity of Canadians and requires the continued attention of governments, universities and other stakeholders.

References

Advisory Council on Science and Technology (ACST), 1999, *Public investments in university research: reaping the benefits; Report of the expert panel on the commercialization of university research*. May 4, 1999. http://www.acst-ccst.gc.ca

AUTM, *FY 00 Licensing Survey*, http://www.autm.net

Baldwin, John, 1997, *Innovation and intellectual property*, Statistics Canada Cat. No. 88-515-XPE, Ottawa, Canada.

Baldwin, John, Petr Hanel and David Sabourin, 2000, *Determinants of innovative activity in Canadian manufacturing firms: the role of intellectual property rights*. Statistics Canada, Analytical Studies Branch Research Paper Series No. 122, Ottawa, Canada.

Chrisman, James J., 1994, *Economic benefits provided to the province of Alberta by the faculty of the University of Calgary*, University of Calgary, Calgary, Alberta, Canada.

Framework of Agreed Principles on Federally Funded University Research between the Government of Canada and the Association of Universities and Colleges of Canada, November 18, 2002 (http://www.ic.gc.ca or http://www.aucc.ca)

Gu, Wulong and Lori Whewell, 1999*, University research and the commercialization of intellectual property in Canada*. Industry Canada (available on the ACST web site http://www.acst-ccst.gc.ca).

Link, Albert N., 1999, *A suggested method for assessing the economic impacts of university R&D: including identifying roles for technology transfer officers.* Journal of the Association of University Technology Managers (AUTM), Volume XI (1999).

Livingstone, Angus, 1997, *Report on UBC spin-off company formation and growth*. University of British Columbia, Vancouver.

OECD, 1999, *Science, technology and industry scoreboard 1999*. Paris, France.

Pressman, Lori, Sonia K. Guterman, Irene Abrams, David E. Geist and Lita L. Neilsen, 1995, *Pre-production investment and jobs induced by MIT exclusive patent licenses: a preliminary model to measure the economic impact of university licensing*. Journal of the Association of University Technology Managers (AUTM), Volume VII (1995).

Statistics Canada, 1997, *Commercialization of intellectual property in the higher education sector: a feasibility study*. Cat. No. 88F0006XIB No. 97-11, Ottawa, Canada. Available on the Internet at http://www.statcan.ca/english/research/88F0006XIB/97011.pdf

Statistics Canada, 1999, *Survey of intellectual property commercialization in the higher education sector, 1998*. Cat. No. 88F0006XIB No. 99-01. Ottawa, Canada. Available on the Internet at http://www.statcan.ca/english/research/88F0006XIB/99001.pdf

Statistics Canada, 2000, *Survey of intellectual property commercialization in the higher education sector, 1999*. Cat. No. 88F0006XIB No. 00-01. Ottawa, Canada. Available on the Internet at http://www.statcan.ca/english/research/88F0006XIB/00001.pdf

Unrau, Yvonne and Jack McDonald, 1995. *The frequency, nature, and impact of faculty influence on policy external to the University of Calgary*, University of Calgary , Calgary, Alberta, Canada.

Appendix A: University response rate

The 2001 survey was mailed out to 89 universities. The response rate was 72%. Table 48 provides a summary of the responses.

Table 48. Response Rate: Universities

Code	Type of response	Number
1	Completed or largely completed	58
2	Total refusal (declined, would not return telephone calls, etc.)[1]	21
3	Partial refusal (major sections relevant to the university not completed)	3
4	Respondent said to use the previous year's response (no change)	2
8	Minimal response	1
9	Affiliated colleges that have never responded	4
	Total number of universities	89

[1] Includes four small main institutions that have never responded in any year.

The 72% response rate was calculated using codes 1,3,4 and 8.

The 21 total refusals (24%) are mainly small universities, of which all but four responded in either 1998 or 1999. These small universities often do not see the need to complete the questionnaire every year, as they have minimal intellectual property (IP) commercialization activity and their IP policies are stable. For those universities that refused in 2001 but responded in 1998 and/or 1999, the latest year's data was carried forward as an estimate for 2001.

As noted, four small main institutions have never responded. For these, a default record was created on the database, with default IP policies, yes/no questions counted as no, etc.

Table 48 also shows that there are four affiliated colleges that have never responded to the survey. These are counted with the parent institution and hence they have no separate database record. The end result is that the total number of universities counted in the 2001 survey is 85 (89 minus the four non-responding affiliated colleges). The comparable number of universities counted in previous surveys was: 84 in 1999 and 81 in 1998.

Appendix B: Hospital response rate

The 1998 survey covered only universities but in 1999 and 2001, research hospitals were included.

In both 1999 and 2001, hospitals were sent an extra screening questionnaire, the answers to which determined whether the main IP questionnaire was to be completed.

The 2001 questionnaire package was sent only to those hospitals that had:

- met the 1999 screening criteria
- not responded at all in 1999.

In other words, the previously screened out hospitals were not surveyed again.

The 2001 screening questionnaire had only three basic questions and was therefore simpler than the 1999 version. The 2001 questions are shown in Table 49.

Table 49. 2001 Hospital screening questions

1) Does this institution perform research and development (R&D)? O Yes O No *Note: For the purposes of this survey, R&D excludes clinical trials performed under contract for another organization/business, where the institution does not own or manage the drug patent or other intellectual property.* 2) Is this institution affiliated with a university for teaching and/or research purposes? If yes, which university?_____ O Yes O No 3) Is this institution in the public sector (that is, <u>not</u> a private, non-profit organization)? O Yes O No	
If you answered YES to all three questions:	You are asked to complete the enclosed 12-page questionnaire and to mail back both parts….
If you answered NO to any of the three questions:	The 12-page questionnaire is not applicable to your institution. Please mail it back blank, along with this one completed page…

Regarding question 1, a more restrictive definition of R&D was used in 2001 than in 1999. In 1999, it was found that some hospitals that indicated that they performed R&D actually did only clinical research (e.g., testing of drugs under contract for a pharmaceutical company, where the latter owns the patent). If the hospital does only testing but no original investigation that could lead to e.g., the discovery of a new drug, there are no IP ownership issues for it to consider.

There has also been some feedback that the type of investigation done in certain medical specialties, such as psychiatry or palliative care, is not technology-oriented or likely to result in a patent.

Regarding question 2, several hospitals were found to have multiple university affiliations.

Regarding question 3, the intended question was "Is this institution publicly funded?" but generally this was how it was interpreted. In both 1999 and 2001, the intention was to screen out research institutes that receive the majority of their funding from private sources. In other words, the survey only covers the public higher education sector and not private universities or research institutes.

This is an important point because the STC survey is more precise in its coverage than that of AUTM.

Below is a summary of the types of responses for hospitals in 2001 and what is known about those that failed to respond.

Table 50. Response Rate: Hospitals

Code	Designation	Definition	Number
6	Fully completed	Both questionnaires were completed in 2001.	20
3	Partially completed	The institution met the three screening criteria but only partially completed the main IP questionnaire in 2001.	3
5	Ineligible	The 2001 screening questionnaire was returned but the institution did not meet the three criteria to complete the main IP questionnaire.	14
10	Refused but eligible based on 2001	The institution met the three criteria but returned only the 2001 screening questionnaire.	4
2	Refused but eligible based on 1999	The institution declined in 2001 but the 1999 screening questionnaire indicated eligibility and the: -1999 main IP questionnaire was completed	8
11		-1999 main IP questionnaire was not completed	4
0	Refused with eligibility unknown	Declined to answer the two questionnaires in both 2001 and 1999.	13
7	Invalid institution	Institution was found to be amalgamated, included with a regional health authority, etc. and will be removed from the mailing list.	7
X	Total mailed out	Total number of questionnaire packages mailed out	73

The 2001 response rate is calculated from Table 50 as the number of:

$$\frac{\text{Fully completed + partially completed + ineligible}}{\text{Total mailed out – invalid institutions}}$$

This amounts to 37/66 or a 56% response rate for hospitals in 2001.

In 1999, 19 hospitals returned a main IP questionnaire but of these, only nine did so again in 2001. Of the 10 that did not follow through, in two cases it was because the institution did not met the stricter criteria. The remaining eight cases are shown as code 2 in Table 50.

It is important to note that while eight of the 1999 respondents failed to respond in 2001, that 14 other hospitals completely or partially responded to the main IP questionnaire for the first time in 2001.

The final number of main IP records on the database is 31, which is the sum of the 20 fully complete, the 3 partially complete plus the eight records carried forward from 1999.

Appendix C: Summary of percentage estimated for selected fields

	Hospitals		Universities	
	Value	% estimated	Value	% estimated
Employees dedicated to IP management	19	16%	202	16%
Salaries	1,368	10%	11,896	13%
Expenditures on patent applications	X	…	8,292	4%
Legal costs	X	…	1,194	18%
Other operational expenditures	304	5%	4,309	5%
Total operational expenditures for IP management	2,814	7%	25,691	9%
Total research park expenditures	X	…	1,939	31%
Total number of research contracts	1,284	33%	6,963	14%
Total value of research contracts	105,976	42%	421,075	13%
Intellectual property disclosures:				
Inventions	100	11%	1,005	8%
Computer software and databases	10	50%	77	16%
Literary, artistic, dramatic or musical works, etc.	X	…	964	32%
Educational materials	X	…	144	10%
Industrial designs	-	-	-	-
Trademarks	X	…	13	-
Integrated circuit topographies	-	-	X	…
New plant varieties	-	-	18	11%
Know-how	X	…	9	77%
Intellectual properties protected:				
Inventions	57	12%	625	7%
Computer software and databases	4	25%	16	20%
Literary, artistic, dramatic or musical works, etc.	40	-	52	38%
Educational materials	X	…	X	…
Industrial designs	-	-	-	-
Trademarks	X	…	17	-
Integrated circuit topographies	-	-	-	-
New plant varieties	-	-	16	19%
Know-how	X	…	X	…
New patent applications	65	11%	867	8%
Total patents issued	42	14%	339	5%
Total patents held	139	50%	1,994	36%
Number of intellectual properties promoted	107	56%	538	17%
Promotion expenditures	461	-	1,203	29%
Total new licenses	34	35%	320	11%
Total active licenses	86	50%	1,338	7%
Royalties from licensing	3,187	55%	44,397	1%
Other income	X	…	4,926	9%
Dividends from spin-off companies	X	…	160	22%
Spin-off equity cashed in	-	-	X	…
Value of remaining equity in spin-off companies	X	…	45,120	10%

How to order catalogued publications

These and other Statistics Canada publications may be purchased from local authorized agents and other community bookstores, through the local Statistics Canada offices, or by mail order to:

Statistics Canada
Dissemination Division
Circulation Management
120 Parkdale Avenue
Ottawa, Ontario
K1A 0T6

Telephone: 1(613)951-7277
National toll free order line: 1-800-700-1033
Fax number: 1-(613)951-1584 or 1-800-889-9734
Toronto Credit Card only (416)973-8018
Internet: order@statcan.ca

Catalogued publications

Statistical publication

88-202-XIB Industrial Research and Development, 2002 Intentions (with 2001 preliminary estimates and 2000 actual expenditures)

88-204-XIE Federal Scientific Activities, 2002-2003[e] (annual)

88-001-XIB Science Statistics (monthly)

Volume 26

No. 1 The Provincial Research Organizations, 1999

No. 2 Biotechnology Scientific Activities Selected Federal Government Departments and Agencies, 2000-2001

No. 3 Estimates of Total Spending on Research and Development in the Health Field in Canada, 1988 to 2001[p]

No. 4 Industrial Research and Development, 1998 to 2002

No. 5 Federal Government Expenditures on Scientific Activities, 2002-2003[p]

No. 6 Estimation of Research and Development Expenditures in the Higher Education Sector, 2000-2001

No. 7 Total Spending on Research and Development in Canada, 1990 to 2002[p], and Provinces, 1990 to 2000

No. 8 The Provincial Research Organizations, 2000

No. 9 Research and Development (R&D) Expenditures of Private Non-Profit (PNP) Organizations, 2001

Volume 27

No. 1 Biotechnology Scientific Activities in Selected Federal Government Departments and Agencies, 2001-2002

No. 2 Scientific and Technological (S&T) Activities of Provincial Governments, 1993-94 to 2001-2002[e]

No. 3 Distribution of Federal Expenditures on Science and Technology, by Province and Territories, 2000-2001

No. 4 Biotechnology Research and Development (R&D) in Canadian Industry, 2000

No. 5 Industrial Research and Development, 1999 to 2003

No. 6 Estimates of total spending on research and development in the health field in Canada, 1988 to 2002[p]

Working papers - 1998

These working papers are available from the Science and Innovation Surveys Section of Statistics Canada. Please contact:

Science and Innovation Surveys Section
Science, Innovation and Electronic Information Division
Statistics Canada
Ottawa, Ontario
K1A 0T6
Internet: http://www.statcan.ca/english/research/scilist.htm
Tel: (613) 951-6309

ST-98-01 A Compendium of Science and Technology Statistics, February 1998

ST-98-02 Exports and Related Employment in Canadian Industries, February 1998

ST-98-03 Job Creation, Job Destruction and Job Reallocation in the Canadian Economy, February 1998

ST-98-04 A Dynamic Analysis of the Flows of Canadian Science and Technology Graduates into the Labour Market, February 1998

ST-98-05 Biotechnology Use by Canadian Industry – 1996, March 1998

ST-98-06 An Overview of Statistical Indicators of Regional Innovation in Canada: A Provincial Comparison, March 1998

ST-98-07 Federal Government Payments to Industry 1992-93, 1994-95 and 1995-96, September 1998

ST-98-08 Bibliometric Analysis of Scientific and Technological Research: A User's Guide to the Methodology, September 1998

ST-98-09 Federal Government Expenditures and Personnel on Activities in the Natural and Social Sciences, 1989-90 to 1998-99[e], September 1998

ST-98-10 Knowledge Flows in Canada as Measured by Bibliometrics, October 1998

ST-98-11 Estimates of Canadian Research and Development Expenditures (GERD), Canada, 1987 to 1998[e], and by Province 1987 to 1996, October 1998

ST-98-12 Estimation of Research and Development Expenditures in the Higher Education Sector, 1996-97, November 1998

Working papers - 1999

ST-99-01 Survey of Intellectual Property Commercialization in the Higher Education Sector, 1998, February 1999

ST-99-02 Provincial Distribution of Federal Expenditures and Personnel on Science and Technology, 1988-89 to 1996-97, June 1999

ST-99-03 An Analysis of Science and Technology Workers: Deployment in the Canadian Economy, June 1999

ST-99-04 Estimates of Gross Expenditures on Research and Development in the Health Field in Canada, 1970 to 1998[e] , July 1999

ST-99-05 Technology Adoption in Canadian Manufacturing, 1998, August 1999

ST-99-06 A Reality Check to Defining E-Commerce, 1999, August 1999

ST-99-07 Scientific and Technological Activities of Provincial Governments, 1990-1991 to 1998-1999[e], August 1999

ST-99-08 Estimates of Canadian Research and Development Expenditures (GERD), Canada, 1988 to 1999[e], and by Province, 1988 to 1997, November 1999

ST-99-09 Estimation of Research and Development Expenditures in the Higher Education Sector, 1997-98

ST-99-10 Measuring the Attractiveness of R&D Tax Incentives: Canada and Major Industrial Countries, December 1999

Working papers - 2000

ST-00-01 Survey of Intellectual Property Commercialization in the Higher Education Sector, 1999, April 2000

ST-00-02 Federal Government Expenditures and Personnel in the Natural and Social Sciences, 1990-91 to 1999-2000[e], July 2000

ST-00-03 A Framework for Enhanced Estimations of Higher Education and Health R&D Expenditures, by Mireille Brochu, July 2000

ST-00-04 Information and Communications Technologies and Electronic Commerce in Canadian Industry, 1999, November 2000

Working papers - 2001

ST-01-01 Estimates of Canadian Research and Development Expenditures (GERD), Canada, 1989 to 2000[e], and by Province 1989 to 1998, January 2001

ST-01-02 Estimation of Research and Development Expenditures in the Higher Education Sector, 1998-99, January 2001

ST-01-03 Innovation, Advanced Technologies and Practices in the Construction and Related Industries: Provincial Estimates, 1999, January 2001

ST-01-04 Innovation, Advanced Technologies and Practices in the Construction and Related Industries: National Estimates, 1999, February 2001

ST-01-05 Provincial Distribution of Federal Expenditures and Personnel on Science and Technology 1990-91 to 1998-99, February 2001

ST-01-06 Estimates of Total Expenditures on Research and Development in the Health Field in Canada, 1988 to 2000[e], March 2001

ST-01-07 Biotechnology Use and Development, 1999, March 2001

ST-01-08 Federal Government Expenditures and Personnel in the Natural and Social Sciences, 1991-92 to 2000-2001[e], April 2001

ST-01-09 Estimates of Research and Development Personnel in Canada, 1979 to 1999[e], June 2001

ST-01-10 Innovation in Canadian Manufacturing: National Estimates, 1999, June 2001

ST-01-11 Practices and Activities of Canadian Biotechnology Firms: Results from the Biotechnology Use & Development Survey -- 1999, August 2001

ST-01-12 Canadian Biotechnology Industrial Activities: Features from the 1997 Biotechnology Survey, September 2001

ST-01-13 Innovation in Canadian Manufacturing: Provincial Estimates, 1999, September 2001

ST-01-14 Estimates of Canadian Research and Development Expenditures (GERD), Canada, 1990 to 2001[e], and by Province, 1990 to 1999, November 2001

ST-01-15 Estimation of Research and Development Expenditures in the Higher Education Sector, 1999-2000, December 2001

Working papers - 2002

ST-02-01 Innovation and Change in the Public Sector: A Seeming Oxymoron, January 2002

ST-02-02 Measuring the Networked Economy, March 2002

ST-02-03 Use of Biotechnologies in the Canadian Industrial Sector: Results from the Biotechnology Use & Development Survey - 1999, March 2002

ST-02-04 Profile of Spin-off Firms in the Biotechnology Sector: Results from the Biotechnology Use and Development Survey - 1999, March 2002

ST-02-05 Scientific and Technological Activities of Provincial Governments 1992-1993 to 2000-2001[e], April 2002

ST-02-06 Are we Managing our Knowledge? Results from the Pilot Knowledge Management Practices Survey, 2001, April 2002

ST-02-07 Estimates of Total Expenditures on Research and Development in the Health Fields in Canada, 1988 to 2001[p], May 2002

ST-02-08 Provincial Distribution of Federal Expenditures and Personnel on Science and Technology, 1991-92 to 1999-2000, May 2002

ST-02-09 An Overview of Organisational and Technological Change in the Private Sector, 1998-2000, June 2002

ST-02-10 Federal Government Expenditures and Personnel in the Natural and Social Sciences, 1992-1993 to 2001-2002[p], June 2002

ST-02-11 Innovation in the Forest Sector, June 2002

ST-02-12 Survey of Innovation 1999, Methodological Framework: Decisions Taken and Lessons Learned, June 2002

ST-02-13 Innovation and the Use of Advanced Technologies in Canada's Mineral Sector: Metal Ore Mining, July 2002

ST-02-14 Estimation of Research and Development Expenditures in the Higher Education Sector, 2000-2001, December 2002

ST-02-15 Estimates of Canadian Research and Development Expenditures (GERD), Canada, 1991 to 2002[p], and by Province 1991 to 2000, December 2002

ST-02-16 Survey of Innovation 1999, Statistical Tables, Manufacturing Industries, Canada, December 2002

ST-02-17 Determinants of Product and Process Innovations in Canada's Dynamic Service Industries, December 2002

Working papers - 2003

ST-03-01 A Comparison of International R&D Performance: An Analysis of Countries That Have Significantly Increased Their GERD/GDP Ratios During the Period 1989-1999, February 2003

ST-03-02 Who's Sharing What With Whom? How Canadian Businesses Used Electronic Networks to Share Information in 2001, February 2003

ST-03-03 How is the Canadian Biotechnology Evolving: A Comparison of the 1997 and 1999 Biotechnology Use and Development Surveys, March 2003

ST-03-04 Scientific and Technological Activities of Provincial Governments, 1993-1994 to 2001-2002[e], March 2003

ST-03-05 Features of Canadian biotech innovative firms: results from the biotechnology use and development survey - 2001, March 2003

ST-03-06 Innovation is a social process, March 2003

ST-03-07 Knowledge management in practice in Canada, 2001, March 2003

ST-03-08 Provincial distribution of federal expenditures and personnel on science and technology, 1994-95 to 2000-2001, April 2003

ST-03-09 Federal government expenditures and personnel in the natural and social sciences, 1993-1994 to 2002-2003, April 2003

ST-03-10 Estimates of total expenditures on research and development in the health field in Canada, 1988 to 2002[p], September 2003

ST-03-11 Estimates of research and development personnel in Canada, 1979 to 2000, September 2003

ST-03-12 Survey of Intellectual Property Commercialization in the Higher Education Sector, 2001, October 2003

Research papers – 1996-2002

No. 1 The State of Science and Technology Indicators in the OECD Countries, by Benoit Godin, August 1996

No. 2 Knowledge as a Capacity for Action, by Nico Stehr, June 1996

No. 3	Linking Outcomes for Workers to Changes in Workplace Practices: An Experimental Canadian Workplace and Employee Survey, by Garnett Picot and Ted Wannell, June 1996
No. 4	Are the Costs and Benefits of Health Research Measurable?, by M.B. Wilk, February 1997
No. 5	Technology and Economic Growth: A Survey, by Petr Hanel and Jorge Niosi, April 1998
No. 6	Diffusion of Biotechnologies in Canada, by Anthony Arundel, February 1999
No. 7	Barriers to Innovation in Services Industries in Canada, by Pierre Mohnen and Julio Rosa, November 1999
No. 8	Explaining Rapid Growth in Canadian Biotechnology Firms, by Jorge Niosi, August 2000
No. 9	Internationally Comparable Indicators on Biotechnology: A Stocktaking, a Proposal for Work and Supporting Material, by W. Pattinson, B. Van Beuzekom and A. Wyckoff, January 2001
No. 10	Analysis of the Survey on Innovation, Advanced Technologies and Practices in the Construction and Related Industries, 1999, by George Seaden, Michael Guolla, Jérôme Doutriaux and John Nash, January 2001
No. 11	Capacity to Innovate, Innovation and Impact: The Canadian Engineering Services Industry, by Daood Hamdani, March 2001
No. 12	Patterns of Advanced Manufacturing Technology (AMT) Use in Canadian Manufacturing: 1998 AMT Survey Results, by Anthony Arundel and Viki Sonntag, November 2001