KNOWLEDGE FLOWS IN CANADA AS MEASURED BY BIBLIOMETRICS

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THE INFORMATION SYSTEM FOR SCIENCE AND TECHNOLOGY PROJECT

The purpose of this project is to develop useful indicators of activity and a framework to tie them together into a coherent picture of science and technology in Canada.

To achieve the purpose, statistical measurements are being developed in five key areas: innovation systems; innovation; government S&T activities; industry; and human resources, including employment and higher education. The work is being done at Statistics Canada, in collaboration with Industry Canada and with 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 and potentially misleading picture of science and technology in Canada. More measures were needed to improve the picture.

Innovation makes firms competitive and more work has to be done to understand the characteristics of innovative, and non-innovative firms, especially in the service sector which dominates the Canadian Economy. The capacity to innovate resides in people and measures are being developed of the characteristics of people in those industries which 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 how much the federal government spends and where it spends it. The current report, Federal Scientific Activities (Catalogue 88-204), released early in 1997, begins to show what the S&T money is spent on with the new Socio-Economic Objectives indicators. As well as offering a basis for a public debate on the priorities of government spending, all of this information will provide a context for reports of individual departments and agencies on performance measures which focus on outcomes at the level of individual projects.

By the final year of the Project in 1998-99, there will be enough information in place to report on the Canadian system on innovation and show the role of the federal government in that system. As well, there will be new measures in place that will provide a more complete and realistic picture of science and technology activity in Canada.

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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.

PREFACE

This paper, **Knowledge Flows in Canada as Measured by Bibliometrics,** by Benoît Godin, Yves Gingras and Louis Davignon, uses the database developed, with Statistics Canada support, by the *Observatoire des Sciences et des Technologies.* It develops statistical indicators of Canadian production and knowledge flow in the natural sciences and engineering. This working paper is a companion document to two other working papers. The first, **Bibliometric Analysis of Scientific and Technological Research: A User's Guide to the Methodology**, by Élaine Gauthier**,** provides an overview of current usage of bibliometric methods and techniques, including an extensive bibliography. It also provides technical specifications on the database of the *Observatoire des Sciences et des Technologies***.** The second, **The Use of Bibliometric Data to Measure Scientific Production in the Arts, Humanities and Social Sciences: A Methodological Note,** also by Benoît Godin, Yves Gingras and Louis Davignon, examines the issues involved in the use of bibliometrics for the social sciences, arts and humanities.

The objective of the Information System for Science and Technology Project at Statistics Canada is to develop useful indicators of activity and a framework to tie them together into a coherent picture of science and technology in Canada. Bibliometric indicators of science and technology provide an important contribution to the understanding of the production of science and technology, as measured by the production of scientific publications, and of knowledge flows within the science and technology system, as measured by co-authorships in scientific publications. Bibliometric indicators can shed light on science and technology production and knowledge flow at the international, national, provincial, sub-regional, municipal and institutional levels and thus constitute a critical component of the information system on science and technology for Canada.

The bibliometric project, supported by Statistics Canada, created a Canadian database of bibliometric information. This involved the cleaning the 1995 data from the selected indexes (*Science Citation Index, Social Sciences Citation Index,* and *Arts and Humanities Citation Index*) to ensure that all institutional addresses were standardized and assigning a sector code (university, government, business, etc.) to each institution. The three working papers are part of the project. In order to facilitate the use of bibliometric information for policy and decision-making a series of regional workshops is being held to introduce the database and to discuss uses of it.

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INTRODUCTION

This report profiles knowledge production as measured by the volume of scientific publications. Our objective is twofold:

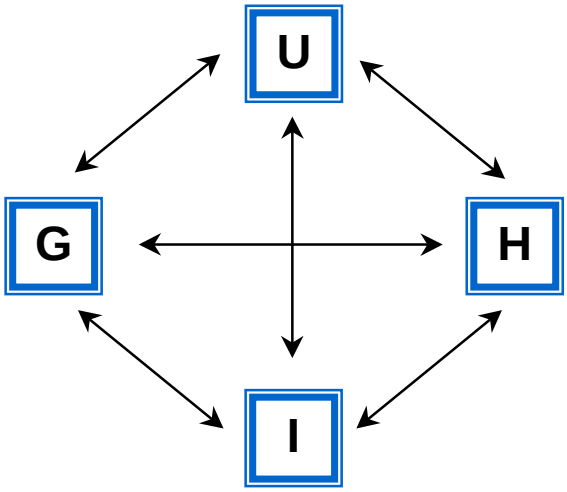
(1) to measure the state of knowledge production in Canada, by province and by sector;

(2) to identify the knowledge flows between the major players in the Canadian research system:

- intersectoral flows,
- interprovincial flows,
- international flows.

Section 1 provides a portrait of Canadian scientific production, particularly in comparison with world production. Special attention is paid to provinces and sectors. Section 2 describes the development of measures of knowledge flow between the major players in the Canadian research system. We will deal exclusively with natural sciences, engineering and biomedical sciences[1].

FIGURE 1: THE MAJOR INSTITUTIONAL PLAYERS AND THEIR INTERACTION IN CANADA



U : Universities
I : Industries
G : Governments
H : Hospitals

[1] For details on the database used to generate the statistics in this working paper and on bibliometric methodological issues see : Élaine Gauthier, *Bibliometric Analysis of Scientific and Technological Research : A User's Guide to the Methodology,* Working paper, Science and Technology Redesign Project, Statistics Canada, 1998.

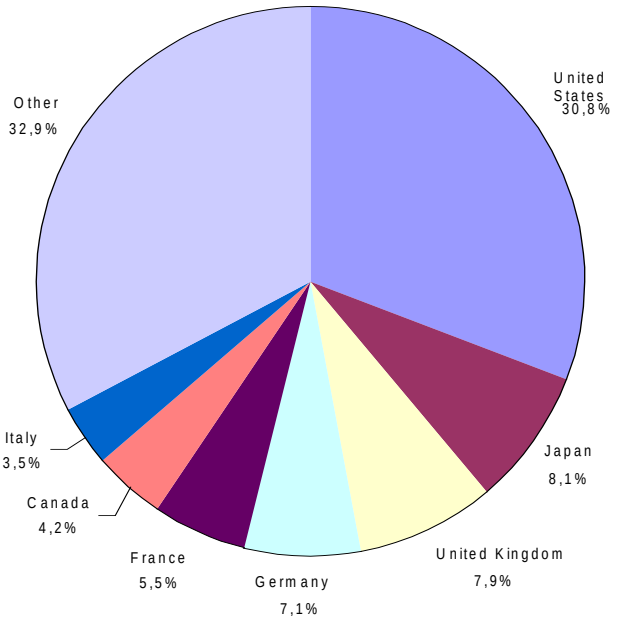
1. CANADIAN SCIENTIFIC PRODUCTION

In this section, we describe Canada's place in world scientific production, its fields of specialization and the sectorial origin of publications.

1.1 Canadian scientific production

In 1995, Canada produced 25,882 publications, or 4.2% of the world's scientific production (Figure 2). Canada ranked sixth in the list of major producers of scientific knowledge. In the 15 years from 1980 to 1995, Canadian scientific production increased by 61.3%.

FIGURE 2: DISTRIBUTION OF PUBLICATIONS BY COUNTRY (1995)



* See also Table A1, Appendix 3.

Documents used

The Science Citation Index (SCI) surveys 14 types of documents published in scientific journals (Appendix 1). For the present analysis, we chose the three types that reflect the production of new scientific knowledge: the article, the note and the review. Together they make up 90% of all documents that appear in scientific journals surveyed by the SCI.

The documents were classified by subject area, in a classification system developed by Computer Horizon Inc. (CHI). CHI's system, unlike the SCI's, never places an article in more than one subject area, thus avoiding double counting. The classification system consists of eight major subject areas that are divided into more than 100 specialties. A complete list of subject areas and specialties is provided in Appendix A.

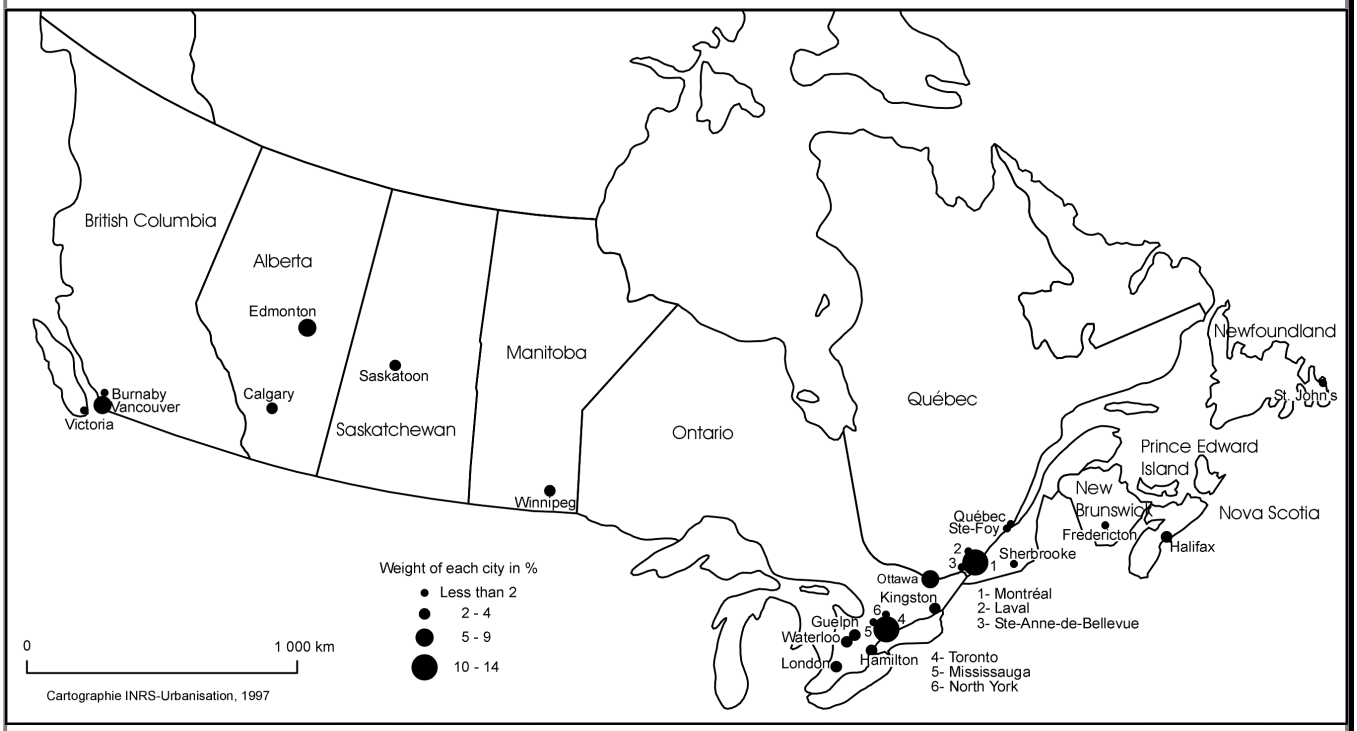
Canadian publications are unevenly distributed among the provinces (Figure 4). Ontario leads with 40.9%,[2] followed by Quebec (22.9%) and two Western provinces, British Columbia and Alberta. The Atlantic provinces close the list. Between 1980 and 1995, Quebec's, British Columbia's and Alberta's shares rose slightly, while Ontario's declined from 46.6% to 40.9% (Table A2, Appendix 3).

[2] The National Capital and its universities and laboratories contribute a large portion of Ontario's leading share. In 1995, the city of Ottawa alone accounted for 8.1% of new Canadian publications, and the federal government produced 13.2% of Ontario's publications.

Canadian cities that produce most publications

Twenty-five cities produce 87.4% of Canada's publications. Montréal leads with 13.8%, followed closely by Toronto (12.2%) and more distantly by Ottawa (8.1%) and Vancouver (7.5%).

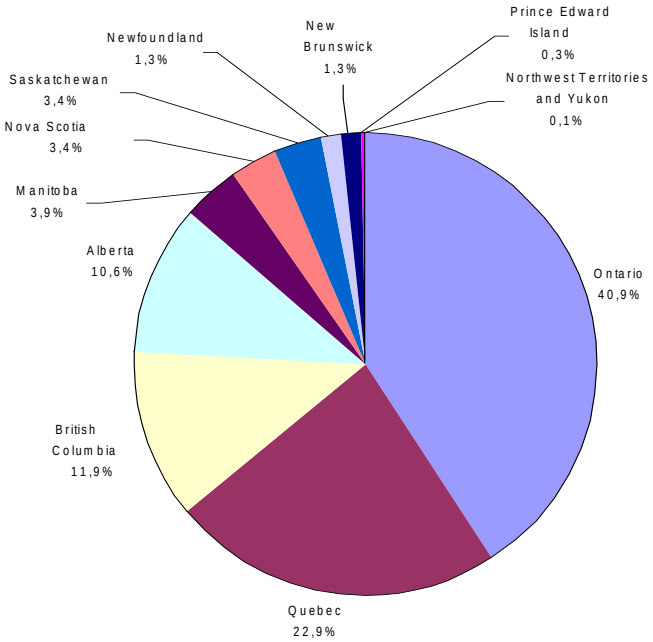
FIGURE 3: THE 25 CANADIAN CITIES THAT PUBLISH THE MOST (1995)



City	Total	City	Total
Montréal	4,223	*Waterloo*	745
Toronto	3,739	*Quebec City*	566
Ottawa	2,464	*Ste-Foy*	543
Vancouver	2,305	*Victoria*	542
Edmonton	1,797	*Sherbrooke*	401
Hamilton	1,175	*Burnaby*	392
London	1,109	*North York*	360
Calgary	995	*St. John's*	354
Winnipeg	993	*Fredericton*	221
Saskatoon	830	*Ste-Anne-de-Bellevue*	217
Guelph	827	*Mississauga*	193
Kingston	767	*Laval*	192
Halifax	759		
Total, 25 cities	26,709		
Total, all cities	30,565		
Number of cities	359		

Source: Observatoire des Sciences et des Technologies (CIRST)

FIGURE 4: DISTRIBUTION OF PUBLICATIONS BY PROVINCE (1995)

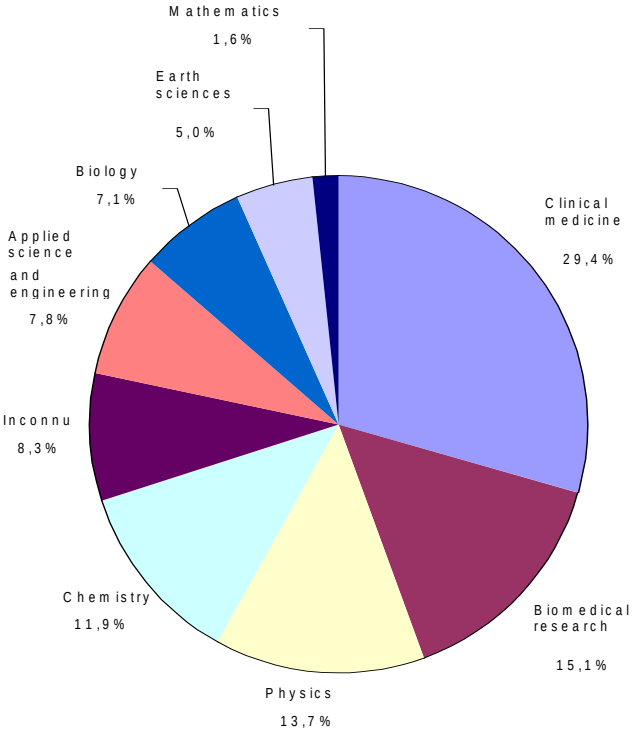


* See also Table A 2, Appendix 3.

1.2 Canada's fields of specialization

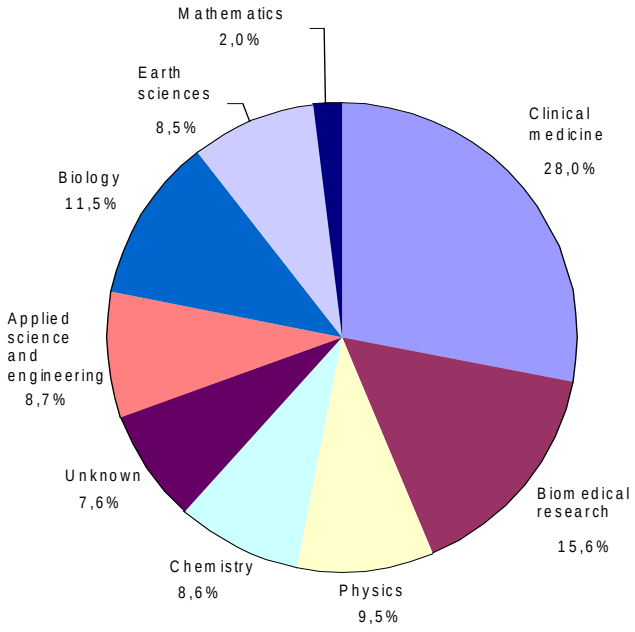
Publications are not evenly spread across the subject areas. Some subject areas produce far more publications. That is especially true for the natural sciences (Figure 5). Internationally, for example, clinical medicine and biomedical research rank first with 44.5% of all publications, whereas mathematics is at the bottom of the list with 1.6%. These differences are due to a number of factors, including the following: (1) governments and businesses invest heavily in health research, thereby supporting a large community of researchers in related disiplines, and (2) division of effort and co-operation, highly developed in the experimental sciences, lead to greater production of publications.

FIGURE 5: DISTRIBUTION OF PUBLICATIONS BY SUBJECT AREA, WORLD (1995)



See also Table A3, Appendix 3.

FIGURE 6: DISTRIBUTION OF PUBLICATIONS BY SUBJECT AREA, CANADA (1995)



*See also Table A 3, Appendix 3.

Overall, the Canadian distribution of publications by subject area is very similar to the world distribution (Yet there are some important differences, which point to what could be referred to as the specialization of Canada's scientific production.) Every country produces, relatively speaking, a larger proportion of its publications in some subjects than in others. For example, 11.5% of Canada's scientific publications deal with biology, compared with the world average of 7.1%. Thus, Canada produces a larger percentage of biology-related publications than the world does. The ratio between the two percentages (11.5% / 7.1%) is what we call the **specialization index**.

Specialization Index

This indicator provides an estimate of each country's relative presence in each discipline. In Canada's case, it is the ratio between the percentage of Canadian publications in a particular subject area and the percentage of world publications in the same subject area. This index compares the actual percentage to the expected percentage. The following formula is used to compute it:

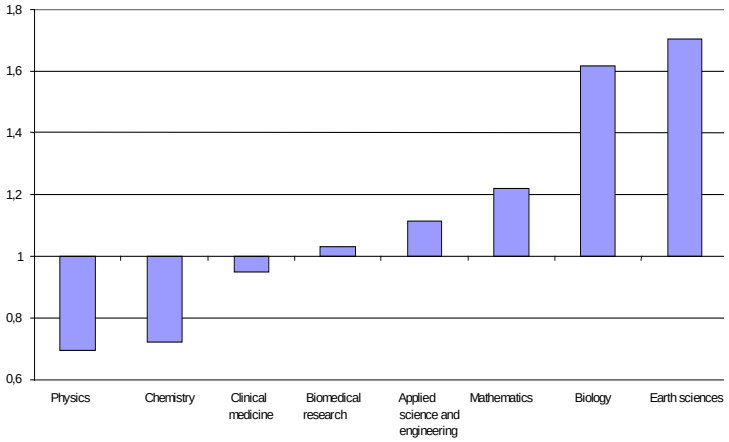
$$\frac{\%\text{ of articles in Canada in discipline X}}{\%\text{ of articles in the world in discipline X}} = \text{Specialization Index}$$

An index greater than 1 means that Canada produces a larger percentage of its publications in that subject area than the world average. For example, 11.5% of Canada's publications deal with biology, while the corresponding world figure is 7.1%. Canada's index in this case is 1.62, which indicates that Canada specializes in biology (the world index is 1.00).

The same formula can be used to calculate specialization indexes for the provinces. The percentage of publications produced by a particular province in a particular subject area is the numerator, and the percentage of Canadian publications in the same subject area is the denominator.

Canada's specialization indexes are shown in Figure 7. Canada specializes most in earth sciences (1.7), followed by biology (1.62), mathematics (1.22) and applied science and engineering (1.11). It is under specialized in physics (0.7), and chemistry (0.72), and follows closely the world average in clinical medicine (0.95) and biomedical research (1.03).

FIGURE 7: SPECIALIZATION INDEXES, CANADA (1995)



* See Table A 4, Appendix 3.

It is interesting to compare these figures with the results for other countries (Table A4, Appendix 3). The United States and the United Kingdom specialize in clinical medicine, biomedical research and earth sciences. France, Germany and Japan, on the other hand, have high indexes in physics and chemistry. France is also particularly strong in mathematics, Japan in applied science and engineering.

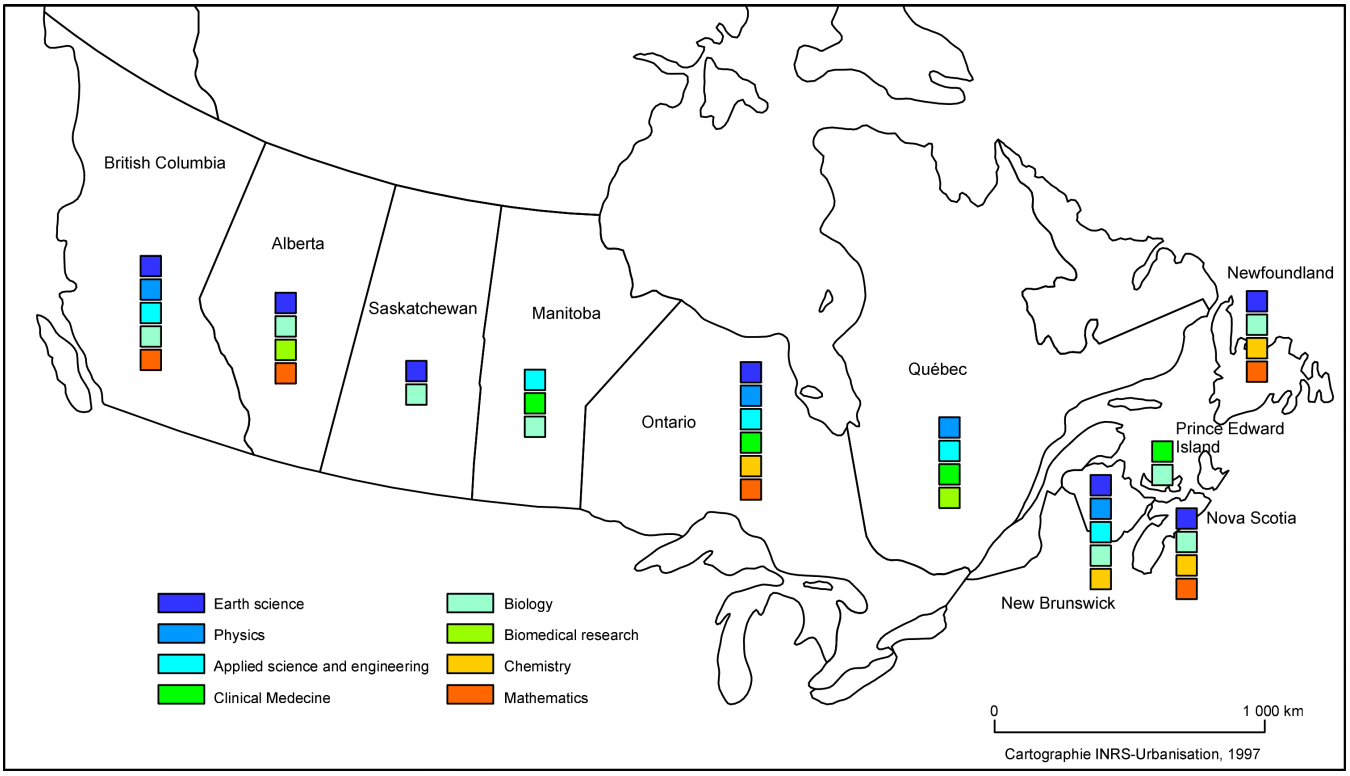
We can also compute a specialization index for each province by comparing its production to the total production for Canada. The provinces' specialties are shown in Figure 8. In general, the smallest producers of scientific knowledge are highly specialized in specific subject areas. For example, Prince Edward Island, New Brunswick, Newfoundland, Nova Scotia, Saskatchewan and Manitoba have high indexes in biology and much lower indexes in biomedical research. New Brunswick also specializes in chemistry (1.5) and applied science and engineering (1.45); Newfoundland in earth sciences (2.18), mathematics (1.65) and chemistry (1.31); Nova Scotia in earth sciences (1.8).

Provinces that produce larger volumes of publications do not have such high specialization

indexes. In general, they have a more diversified pattern of research, as indicated by their presence in several different subject areas. Nevertheless, each one has its own particular strengths. For example, Ontario specializes somewhat in physics (1.17) and marginally in chemistry (1.09) and earth sciences (1.07). Quebec specializes to some degree in biomedical research (1.18) and very slightly in clinical medicine (1.07). Alberta shows strength in biology (1.26) and mathematics (1.19). British Columbia has a high index in earth sciences (1.35), physics (1.21) and mathematics (1.14).

In short, the provinces that produce the most publications also have the most diversified production. Conversely, the smallest provinces are highly specialized and less diversified.

FIGURE 8: AREAS OF SPECIALIZATION OF THE PROVINCES (INDEXES GREATER THAN 1.0) (1995)



* See also Table A 5 and Table A 6, Appendix 3.

1.3 A sectoral perspective

To gauge the role that various institutions play in the production of scientific knowledge, we developed a system for classifying publications by their sector of origin. Using the institutional addresses of the authors, we assigned each publication to one of four sectors: university, corporate, government (federal and provincial) and hospital. A publication is assigned to each sector represented by its authors. There is also an "other" category, which includes not-for-profit organizations and other college-level institutions.

The university sector leads by a wide margin in producing scientific publications in Canada (65%) and in every province. Nevertheless, other sectors account for a significant proportion of publications (35%), including the hospital sector with 14.9% and the federal government with 10.8%. Moreover, the shares of some sectors have grown steadily since the 1970s (Table 1)).[3] Hospitals, corporations and provincial governments have gained ground at the expense of the universities and the federal government.

[3] This is a worldwide trend. See the box (p. 8) on the sectors of origin of scientific articles in the United States and the United Kingdom.

TABLE 1: PRODUCTION OF PUBLICATIONS BY SECTOR, CANADA

	1974	1995
University	71.7%	65.0%
Hospital	9.9%	14.9%
Federal government	13.6%	10.8%
Provincial government	1.3%	2.4%
Corporate	2.2%	4.0%
Other	1.3%	2.9%

* The 1974 data are taken from a 1985 Statistics Canada study entitled "An indicator of excellence in Canadian science".

The hospital sector is prominent in three provinces: Ontario, Quebec and British Columbia (Figure 9). The federal government is particularly important in the remaining provinces, where it ranks second. This is due to the presence of federal research institutions in those provinces. For example, Agriculture Canada has facilities in the Prairie provinces, New Brunswick and Prince Edward Island,[4] while the Department of Fisheries and Oceans has laboratories in the Atlantic provinces. Provincial government research institutions produce 2.4% of all publications.

Sectors originating scientific articles in the United States and the United Kingdom

In the United States, the university sector publishes 71% of all publications, according to the NSF. Trailing far behind are industry (8%), the federal government (8%), R&D centres funded by the federal government (3%) and non-profit organizations (7%). Since the *hospital sector* is not used as a category in the NSF, it is difficult to draw an exact comparison between American and Canadian data.

The data for the United Kingdom, on the other hand, are more like the data presented here (Katz et al., 1995): the university sector (58%), the hospital sector (22%), research councils (11 %), business (8%), the SHA & BPG institutes (5%), central and local governments (4%), non-profit organizations (2%) and the polytechnical sector, which was combined with the university sector in the 1990s (2%).

The corporate sector produces 4% of scientific publications. Of these publications, 47.2% originate in Ontario, 24.1% in Quebec. The pharmaceutical sector, electric power and telecommunications account for much of the production (Table 2).

TABLE 2: CORPORATIONS THAT PUBLISH THE MOST IN CANADA (1995)

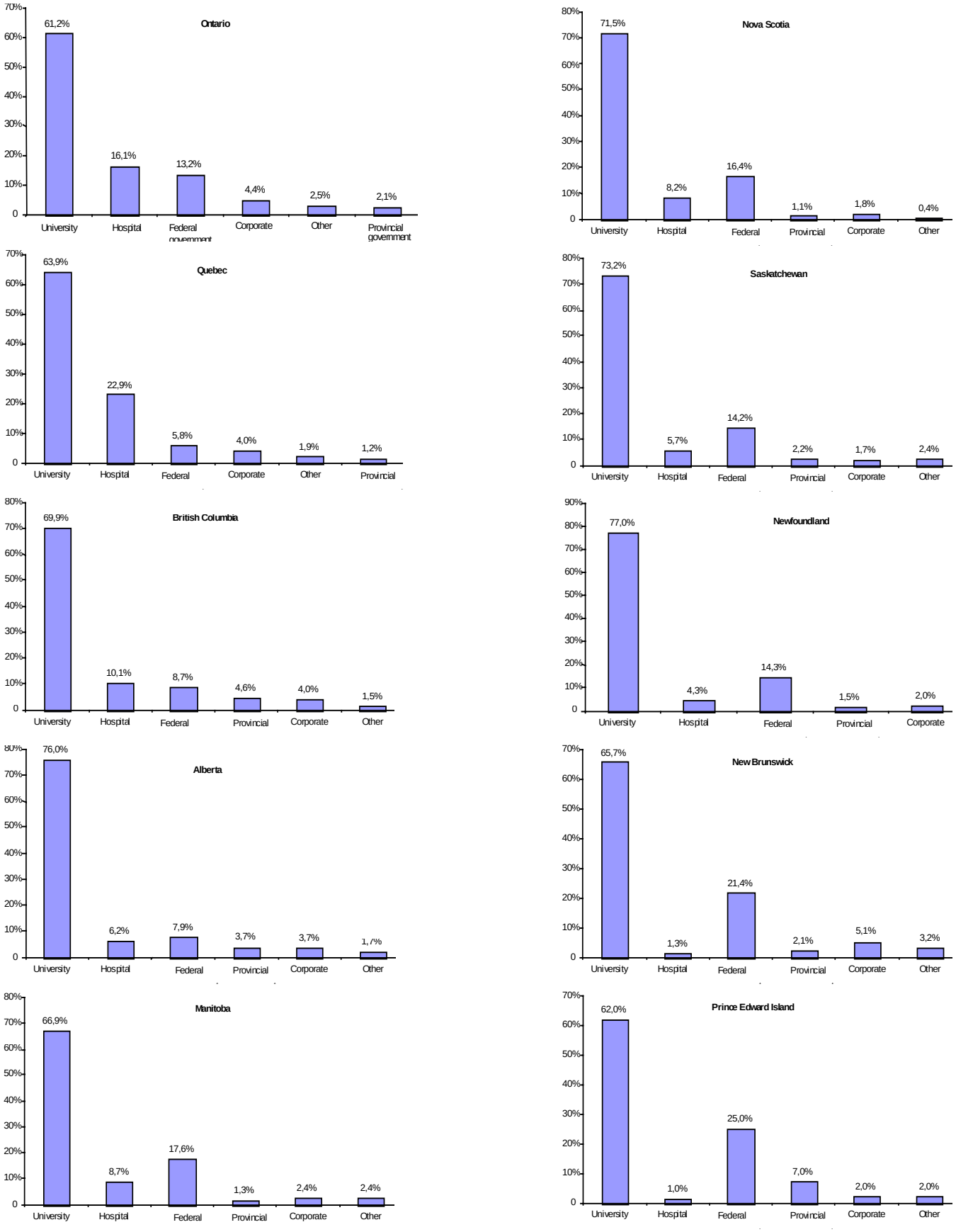
Corporation	Total	Part
Bell-Northern	86	*6.5%*
Merck-Frosst Canada	80	*6.0%*
Hydro-Ontario	75	*5.6%*
Hydro-Québec	64	*4.8%*
Xerox	29	*2.2%*
Connaught Biotechnology	15	*1.1%*
Biomega Boehringer Ingelheim Res Inc.	14	*1.1%*
Cominco Ltd	14	*1.1%*
Biochem Therapeut Inc.	13	*1.0%*
Biomira Inc.	13	*1.0%*
Allelix Biopharmaceutical Inc.	12	*0.9%*
Syncrude Canada Ltd	12	*0.9%*
Total, companies listed above	**427**	*32.1%*
Total, all companies	**1,331**	
Total number of companies	**474**	

Source: Observatoire des Sciences et des Technologies (CIRST).

Like the provinces, sectors specialize in particular subject areas (Table 3). The university sector focuses a large part of its production on clinical medicine and biomedical research (41.9%) (Table A8, Appendix 3), but it specializes in mathematics (1.5), physics (1.25) and chemistry (1.24). Not surprisingly, the hospital sector favours clinical medicine and biomedical research (89.5%); in fact, it produces over one third of all clinical medicine publications in Canada. Businesses devote a significant proportion of their publications to clinical medicine (16.6%), but they produce more in applied science and engineering (30.2%) and chemistry (9.3%), with specialization indexes of 3.6 and 1.23 respectively.

[4] Agriculture Canada is responsible for 25% of the articles produced by Prince Edward Island.

FIGURE 9: DISTRIBUTION OF PUBLICATIONS BY SECTOR, PROVINCES (1995)



There are also differences between the federal and provincial levels of government. Clinical medicine (1.3) accounts for 39.7% of provincial government publications, followed by biology (2.07) with 23.8%, biomedical research (0.85) with 13.4%, and earth sciences (1.23) with 10.2%. In contrast, biology (2.56) ranks first in federal publications with 29.3%, and earth sciences (2.51) comes second with 20.9%; clinical medicine is down in sixth place with 7.8% of publications and a specialization index of 0.26. It is worth noting that federal government publications in biology and earth sciences make up more than 27% of all Canadian publications in each subject area, even though the federal government produces only 10.8% of all Canadian scientific articles.

We have seen that the university sector is the leading source of publications in all provinces. That being the case, it would be interesting to know to what extent the university sector's specialization determines the specialization index of Canada or a province. Analysis of the data shows that at the Canada level, it is governments that tip the balance toward specialization in earth sciences and biology. On the other hand, the university sector alone is responsible for specialization in mathematics. Similarly, the research activities of federal government institutions appear to play a key role in determining the specialization indexes of all provinces except Quebec, whose specialization in biomedical research and clinical medicine stems more from the strong contribution of the hospital and corporate sectors.

In conclusion, the universities, as we have seen, are not the only institutions that produce scientific knowledge. Hospitals and the federal government also play a meaningful role. As we will see in the next section, all sectors are actively cooperating with one another.

TABLE 3: SPECIALIZATION INDEXES BY SECTOR, CANADA (1995)

	Clinical medicine	Biomedical research	Biology	Physics	Applied science and engineering	Earth sciences	Chemistry	Mathematics
University	0.84	1.04	0.93	1.25	1.08	0.96	1.24	1.50
Hospital	2.29	1.25	0.04	0.02	0.02	0.01	0.04	0.04
Federal government	0.26	0.68	2.56	1.10	0.89	2.51	1.08	0.07
Provincial government	1.30	0.85	2.07	0.09	0.50	1.23	0.20	0.08
Corporate	0.55	0.56	0.71	0.95	3.60	1.06	1.23	0.09
Other	1.12	0.59	1.11	0.95	1.82	1.24	0.49	0.35

* See also Table A 8, Appendix 3.

2. KNOWLEDGE FLOWS IN CANADA

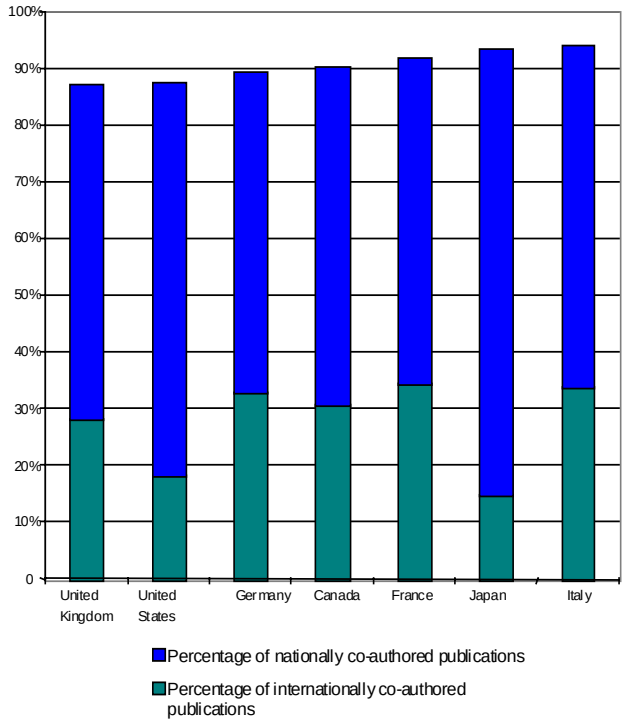
In this section, we will identify Canada's knowledge flows. To do so, we selected multiple-author publications and analysed the profiles of the co-authors. We will look at those collaborations as indicators of provincial, sectoral and international flows.

2.1 Scientific collaboration

It is often said that the majority of scientific articles are collaborative efforts. In general, that means that the publications were written by more than one author.

Figure 10 shows at a glance the extent of scientific collaboration as measured by this indicator. Worldwide, 86.5% of publications are co-authored by two or more researchers (Table A9, Appendix 3). Canada is slightly above the world average (90.2%).

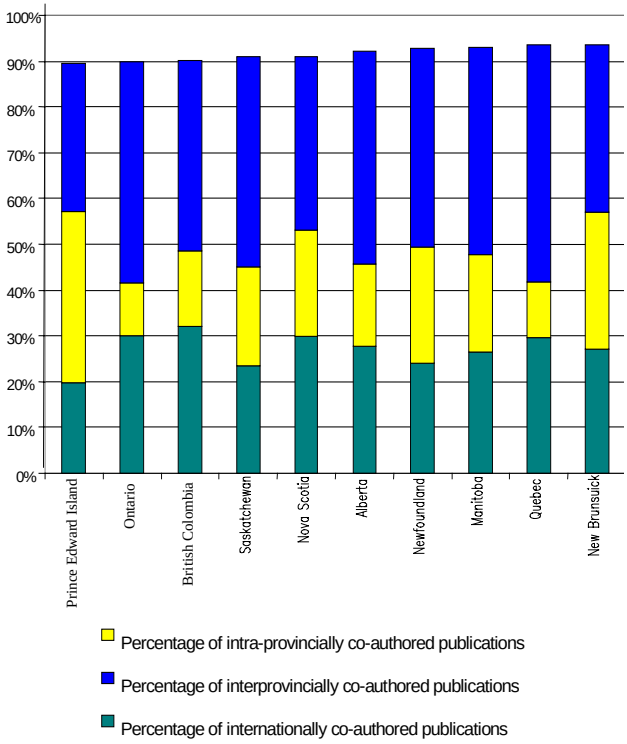
FIGURE 10: PERCENTAGE DISTRIBUTION OF CO-AUTHORED PUBLICATIONS, SELECTED COUNTRIES (1995)



* See also Table A16, Appendix 3.

A majority of publications produced in Canadian provinces are also collaborative works (Figure 11). In Quebec and New Brunswick, 95.5% and 93.9% of publications have more than one author. Collaboration is slightly less common in Ontario (92.6%) and Prince Edward Island (90.1%). The differences among the provinces in collaboration rates are fairly small, comparable to the differences among countries.

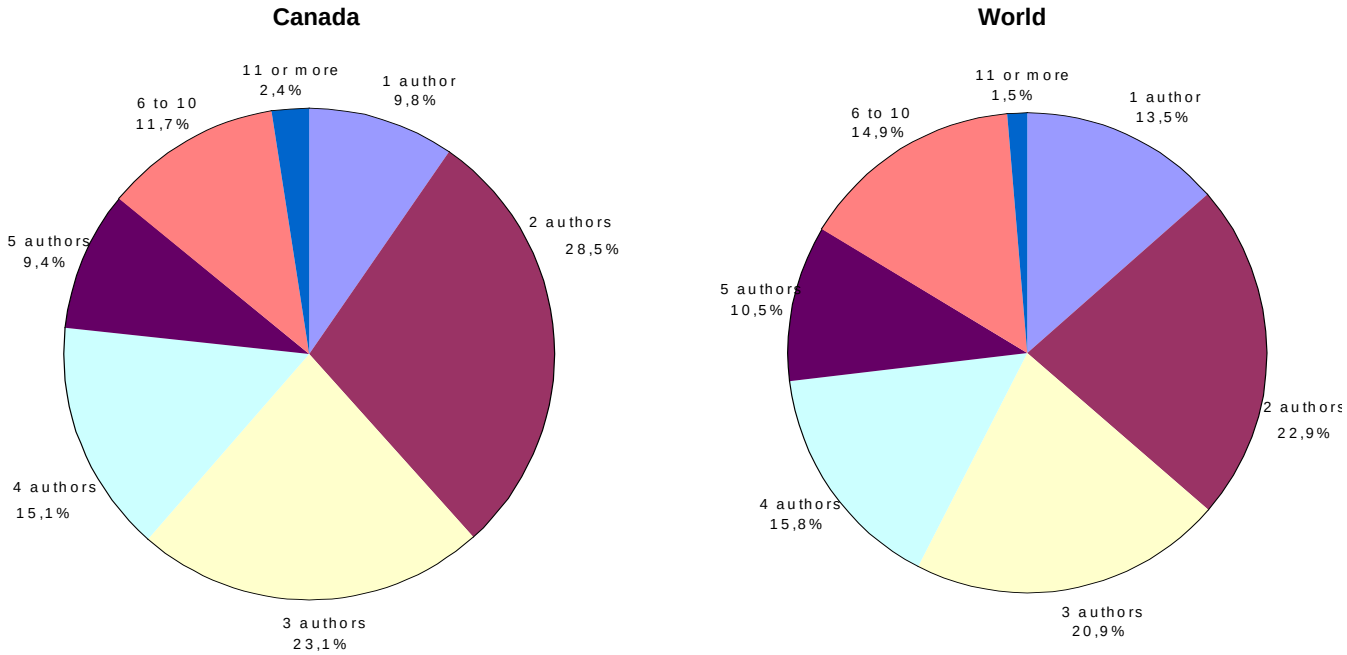
FIGURE 11: PERCENTAGE DISTRIBUTION OF CO-AUTHORED PUBLICATIONS, BY PROVINCE (1995)



* See also Table A16, Appendix 3.

Collaboration has increased considerably over the past ten years, both internationally and in Canada. In 1985, the proportion of publications with a single author was 20.7% worldwide and 18.3% in Canada (Table A9, Appendix 3); in 1995, the corresponding figures were 13.5% and 9.8% (Figure 12). The collaboration rate varies by subject area (Figure 13). It is highest in chemistry (94.6%) and lowest in mathematics (67.8%).

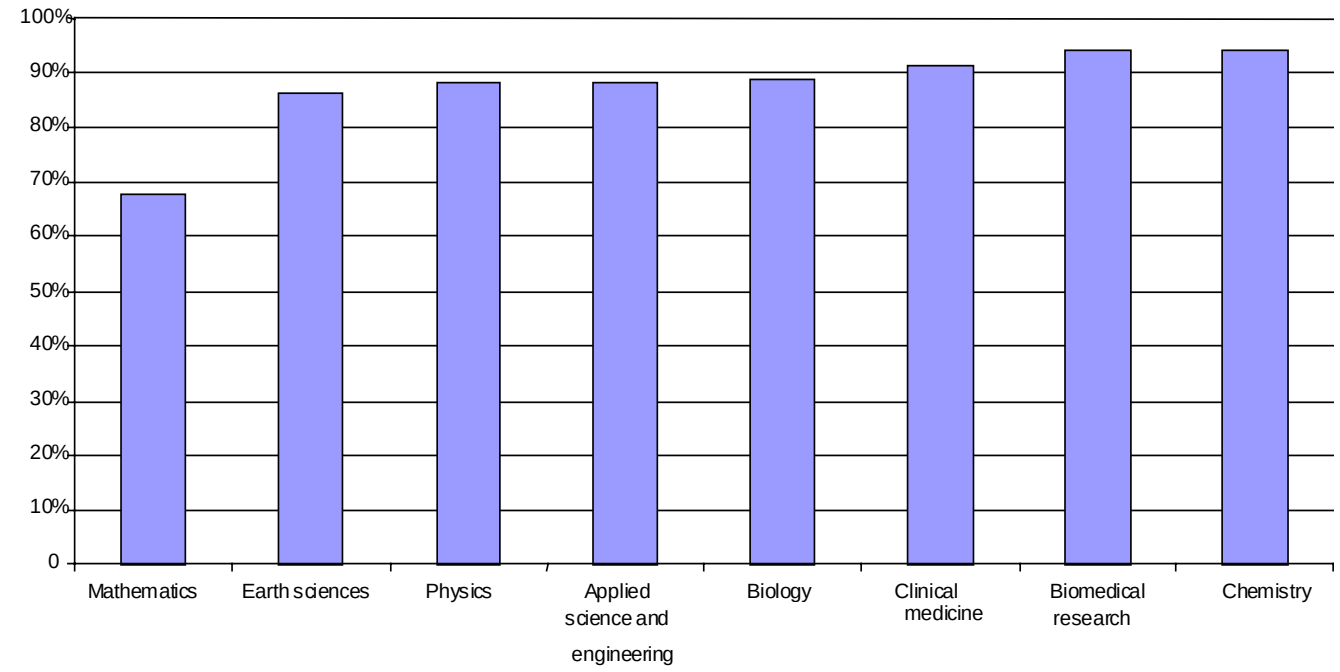
FIGURE 12: NUMBER OF AUTHORS BY PUBLICATION, CANADA AND THE WORLD (1995)



* See Table A 9, Appendix 3.

* See Table A 10, Appendix 3.

FIGURE 13: COLLABORATION RATE IN CANADA, BY SUBJECT AREA (1995)



* See Table A 10, Appendix 3.

Measuring collaboration

A publication is generally considered to be a collaborative effort if it has more than one author. Using this definition yields collaboration rates in the 90% range. However, since we are interested in specific forms of collaboration – international, interprovincial and intersectoral collaboration – we use the authors' institutional addresses, rather than the number of authors, to measure collaboration. For the purposes of this study, an article is regarded as a collaboration if there are at least two authors with at least two different addresses. Thus, a publication is an international collaboration if the authors' addresses are in different countries.

When collaboration is measured in this fashion, a publication is attributed to each different address on it. For example, an article with one British, two American and two Canadian addresses is attributed once to the United Kingdom, once to the United States and once to Canada. The same method is used in measuring interprovincial an intersectoral collaboration.

Care must be exercised in interpreting the results. When the number of publications is added up, the total is greater than the actual number of publications. The larger total must be used in all subsequent calculations with respect to specific dimensions.

2.2 International collaboration

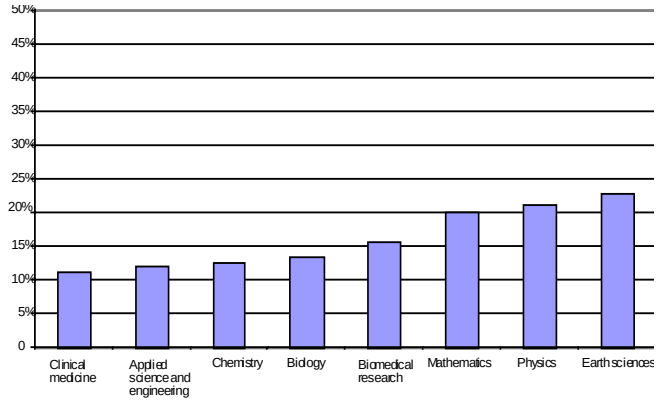
Collaboration between countries is related to a combination of factors: country size, geographic proximity, history and language (Luukonnen et al., 1993; 1992; Frame and Carpenter,1979). In general, small countries collaborate more; there is also greater collaboration between countries that are geographically or linguistically close, and between countries that, often for colonial reasons, have a common history.

Worldwide, 14.5% of all scientific publications involve international collaboration (Table A11, Appendix 3). Canada, like many small countries, has a much higher international collaboration rate (30.7%) in every subject area (Figure 14). In earth sciences, for example, 35.4% of Canada's publications are internationally co-authored, while the corresponding world figure is 22.8%. In mathematics, Canada's international collaboration rate is 45.2%, more than twice the world rate of 19.9%.

These results can be summarized with an international collaboration *index* (Table 4). Mathematics and physics, with indexes of 2.0 and 1.42 respectively, show much more international collaboration than one would expect. By contrast, clinical medicine, which produces the most publications, has a collaboration index of only 0.92.

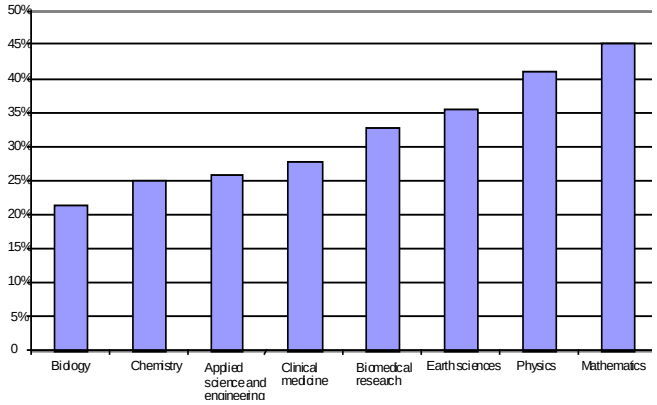
FIGURE 14: INTERNATIONAL COLLABORATION RATE BY SUBJECT AREA (1995)

World



* See also Table A 11, Appendix 3.

Canada



* See also Table A 14, Appendix 3.

TABLE 4: INTERNATIONAL COLLABORATION INDEXES (1995)

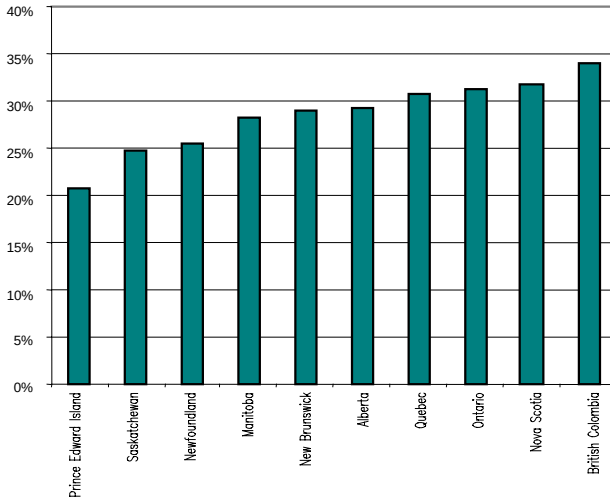
	(A) Percentage of total scientific production (%)	(B) International collaboration rate (%)	(B/A) International collaboration index
Clinical medicine	28	25.7	0.92
Biomedical research	15.6	16.9	1.08
Physics	9.5	13.5	1.42
Chemistry	8.6	7.1	0.86
Applied science and engineering	8.7	7.5	0.86
Biology	11.5	8.1	0.7
Earth sciencese	8.5	10.1	1.19
Mathematics	1.5	3	2.0

Thirty-nine per cent of Canada's internationally co-authored publications have American co-authors. The United States is also the leading collaborator of all provinces. The United Kingdom (7.9%) and France (7.1%)[5] rank second and third.

However, the foreign partner varies with the subject area. For example, the United States accounts for 45.5% of Canada's international collaboration in clinical medicine, compared with only 25.1% in physics. The latter rate is substantially different from the overall rate of collaboration with the United States (39.2%). This may be due to the fact that the United States specializes (i.e. has a high specialization index) in clinical medicine and consequently draws more Canadian collaboration in that subject area, whereas it specializes less heavily in physics. In fact, a comparison of Canada's subject-specific international collaboration rates[6] and the specialization indexes of countries[7] with which it collaborates reveals that Canada's rate of collaboration with country X in a given subject tends to be higher than the overall rate of collaboration with that country for all subjects combined, if the country has a high specialization index in that subject area.

With the exception of Nova Scotia, the provinces that produce the most scientific knowledge collaborate the most with other countries. British Columbia leads in international collaboration, followed by Ontario and Quebec in a near tie (Figure15).

FIGURE15: INTERNATIONAL COLLABORATION RATES, BY PROVINCE (1995)



* See also Table A 13, Appendix 3.

The United Kingdom ranks second after the United States in collaboration with the provinces, except for Quebec and New Brunswick, whose second most frequent partner is France. Then come various countries, whose level of collaboration varies by province. Germany, for example, is third on the list for five provinces. The United Kingdom ranks third among Quebec's partners, and fourth, behind Japan, among New Brunswick's collaborators.[8]

If we look at the provinces' international collaboration by subject area, we find that, as in the case of Canada as a whole, the percentage of collaboration with each country is often directly related to that country's specialization. For example, British Columbia's second-ranking collaborator, for all subjects combined, is the United Kingdom. In physics and chemistry, however, Germany occupies second place on the list. And Germany's highest specialization indexes are in precisely those subjects. Another example is France's collaboration with Ontario. France ranks fifth in overall collaboration with Ontario but moves to third place, ahead of the United Kingdom and Japan, in mathematics. France's specialization index is very high in mathematics (1.87).

5 See Table A-12, Appendix 3.
6 See Table A-12, Appendix 3.
7 See Table A 4, Appendix 3.
8 See Table A 14, Appendix 3.

2.3 Interprovincial collaboration

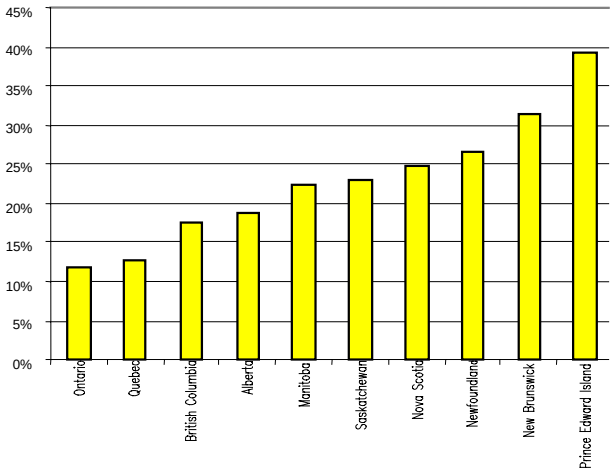
Although there is substantial international collaboration, all countries, including Canada, produce more nationally co-authored publications than internationally co-authored ones. In Canada, the percentage of nationally co-authored publications exceeds the percentage of internationally co-authored publications in every subject area.

The same is true for the provinces. They produce more nationally co-authored publications[9] (about 60%) than internationally co-authored publications (30.7%).

The bulk of collaboration occurs within provinces. Specifically, intraprovincial collaboration accounts for 53.9% of scientific production (Tableau A11, Appendix 3). Interprovincial collaboration accounts for only 7.7%.

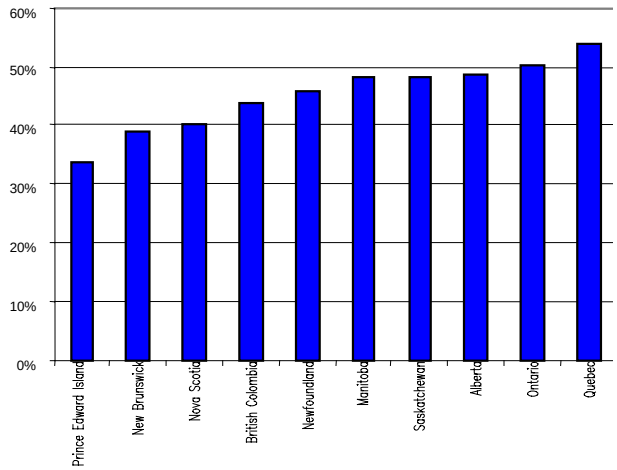
It is not unusual for international collaboration to exceed interprovincial collaboration (Figure15, Figure and Figure 1). In fact, it occurs in seven out of ten provinces; in Ontario and Quebec, for example, interprovincially co-authored publications make up 12% or 13% of total production (Figure), whereas internationally co-authored publications account for about 30%. Only Prince Edward Island, New Brunswick and Newfoundland collaborate more with other provinces than with other countries.

FIGURE 16: INTERPROVINCIAL COLLABORATION RATES BY PROVINCE (1995)



* See Table A 13, Appendix 3.

FIGURE 17: INTRAPROVINCIAL COLLABORATION RATES BY PROVINCE (1995)



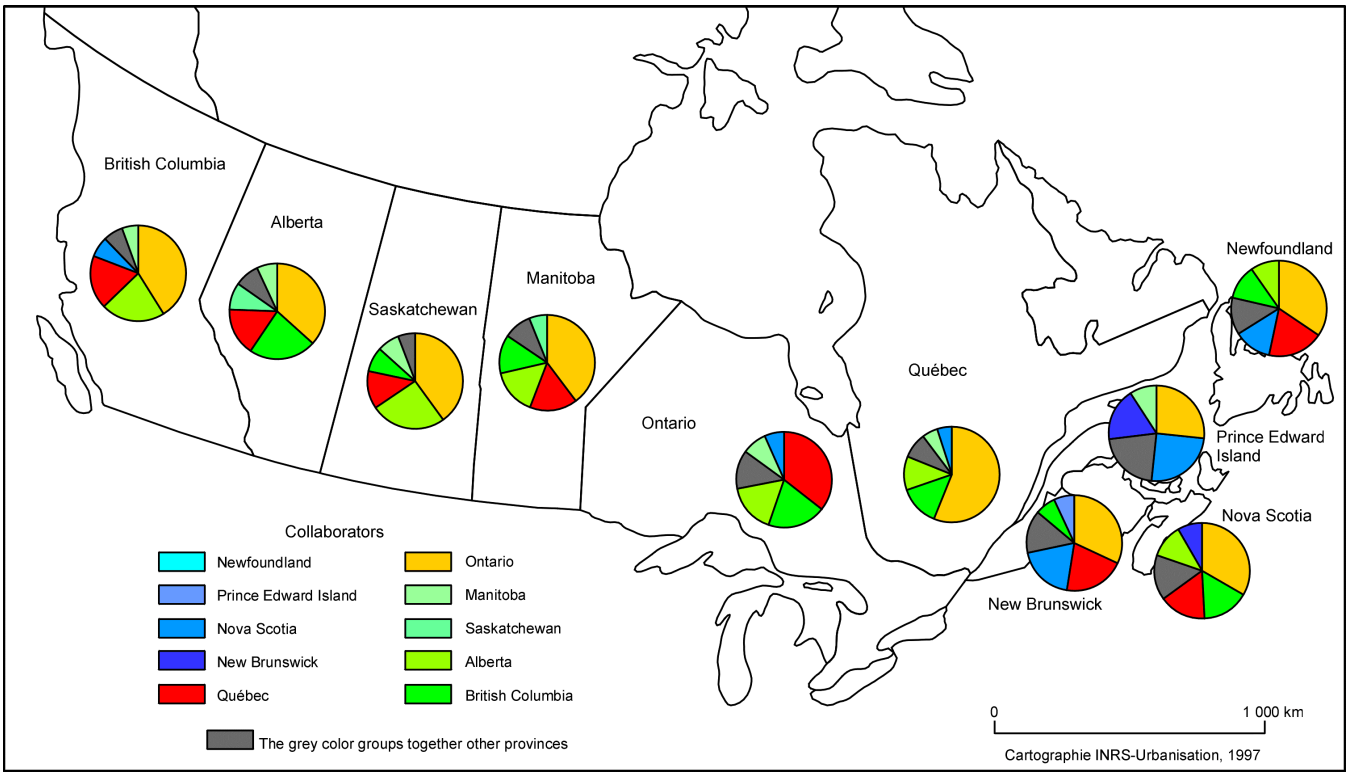
* See Tableau A11, Appendix 3.

Interprovincial collaboration is thus the least common form of collaboration in Canada. There are, however, wide variations between the provinces. In fact, there is an inverse relationship between the number of publications produced by a province and its percentage of interprovincially co-authored publications: the more publications a province produces, the fewer interprovincially co-authored publications it produces. Prince Edward Island is the only province that produces more publications with interprovincial collaboration (39.1%) than with intraprovincial collaboration (33.7%). This relationship, an indicator of relative dependance, also applies to countries.

Ontario is the top collaborator for every other province (Figure 18). For example, Quebec produces a large proportion (56.2%) of its publications in collaboration with Ontario, as does British Columbia (41.3%). Even Prince Edward Island, despite its geographic proximity to the other Atlantic provinces, produces more of its publications in collaboration with Ontario (26.8%) than with Nova Scotia (25.0%) or New Brunswick (17.9%).

[9] For the purposes of this study, national co-authorship is considered to be the sum of interprovincial and intraprovincial collaboration.

FIGURE 18: DISTRIBUTION OF INTERPROVINCIAL COLLABORATION (1995)



* See also Table A 15, Appendix 3.

Quebec is Ontario's top collaborator (35.7%) and ranks second for Manitoba, New Brunswick and Newfoundland. Geographic and linguistic proximity appear to be the key factors in determining the second-ranking collaborator. For example, British Columbia's second-ranking collaborator is Alberta, and vice versa; Saskatchewan's is Alberta, and Prince Edward Island's is Nova Scotia. Nevertheless, there are a few exceptions to the rule: Quebec's second-ranking collaborator is British Columbia, and Manitoba's is Quebec.

In summary, Ontario's size overrides geographic proximity as a factor in the establishment of collaborative relationships between provinces. Proximity's effects are visible, however, in the fact that there is more collaboration within three groups: the Atlantic provinces, the central provinces and the Western provinces.

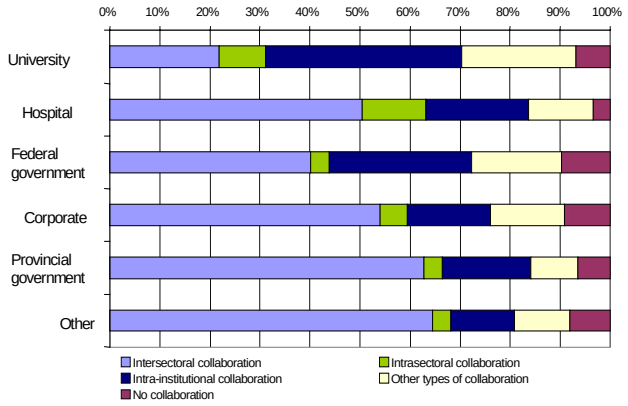
2.4 Intersectoral collaboration

Every sector produces a portion of its publications in collaboration with other sectors. In Canada, 31.8% of all publications involve intersectoral collaboration.

Were it not for the university sector's dominance in collaborative production, the percentages would be even higher. In Canada, and in every province, intra-institutional collaboration is involved in a larger percentage of articles in the university sector (39.1%) than in any other sector (Figure 19). Only federal research institutions exhibit similar behaviour in some provinces. In Saskatchewan, for example, 36.2% of federal government publications show intra-institutional collaboration, compared with 33.9% in Alberta, 27.2% in New Brunswick, 26.5% in Manitoba, and 24.8% in Ontario (Tableau A16, Appendix 3). Intersectoral collaboration is even more common in other sectors, as over 50% of their publications are produced collaboratively. For

example, at the national level 62.7% of publications originated by provincial government research institutions are produced in collaboration with other sectors.

FIGURE 19: RATES OF VARIOUS TYPES OF COLLABORATION, BY SECTOR, CANADA (1995)



* See Table A 16, Appendix 3.

The centrality of the university sector importance in the flow of scientific knowledge is evident in the fact that every other sector collaborates with the universities. In fact, the university sector is the leading partner of all other sectors.[10] The hospital sector, for instance, produces 86.7% of its publications in collaboration with the university sector. Conversely, the university sector collaborates with hospitals on 48.7% of its publications. The federal government also depends heavily on the university sector (76.2%), as do the corporate sector (65.4%) and provincial governments (56.3%). While governments have been emphasizing the need for stronger ties between the universities and the rest of society, especially business, the above figures suggest that there is already a considerable degree of synergy.

A few final points are worth making about intersectoral collaboration at the provincial level.[11] The university sector is not the leading collaborator of all other sectors in New Brunswick, Newfoundland and Prince Edward Island. In addition, the hospital sector is not the universities' primary partner in Saskatchewan and the three Atlantic provinces named above. In Prince Edward Island, the federal government is the other sector's only collaborator. It is also the leading collaborator of the university sector in Saskatchewan, New Brunswick and Newfoundland; of the corporate sector in Nova Scotia; and of the provincial government in New Brunswick.[12]

10 See Table A 17, Appendix 3.

11 See Table A 18, Appendix 3.

12 It is important to bear in mind that our collaboration indicators are affected by the small number of publications produced by those provinces.

CONCLUSION

Canada ranks sixth among OECD countries in total volume of publications. Over the past 15 years, Canada's share of world production has remained steady.

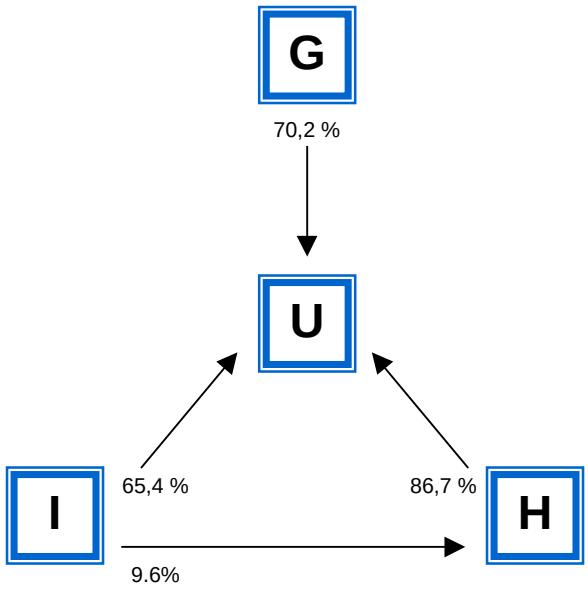
The distribution of production among the provinces has changed slightly during that period, as Quebec, British Columbia and Alberta have experienced more rapid growth than Ontario. Even so, Ontario remains the leader in national production. Ontario and Quebec together account for the bulk of Canadian output.

Canada specializes in earth sciences, biology, mathematics, and applied science and engineering. The provinces exhibit varying profiles. Those which publish the most have a diversified output, while the others tend to concentrate on specific subject areas.

The university sector remains the mainstay of the knowledge flow, originating about two thirds of all scientific publications. Nevertheless, a substantial portion is produced by the other sectors (hospitals, governments and business). Of particular note is the fact that these sectors' contribution to Canada's scientific production is often a collaborative effort, with the universities as key players in the knowledge flow.

Finally, the high percentage of Canadian publications produced with international collaboration reflects the open relationship between Canadian researchers and their counterparts around the world.

FIGURE 20: KNOWLEDGE FLOWS IN CANADA: RATES OF COLLABORATION WITH UNIVERSITIES (1995) (% OF PUBLICATIONS CO-AUTHORED WITH UNIVERSITIES)



U : Universities

I : Industries

G : Governments

H : Hospitals

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APPENDIX 1: DOCUMENTS LISTED IN THE SCI

Type of document (1995): Canada		
	Total	***%***
Article	22,997	*72.4*
Meeting-Abstract	3,851	*12.1*
Book-Review	3	*0.0*
Note	2,015	*6.3*
Letter	1,148	*3.6*
Review	870	*2.7*
Editorial-Material	646	*2.0*
Discussion	127	*0.4*
Correction	82	*0.3*
Biographical-Item	27	*0.1*
Bibliography	3	*0.0*
Software-Review	4	*0.0*
Reprint	8	*0.0*
News-Item	3	*0.0*

APPENDIX 2: LIST OF NATURAL SCIENCE, ENGINEERING AND BIOMEDICAL SCIENCE DISCIPLINES

Discipline: Biology
- Agriculture et agri-food
- Biology - miscellaneous
- Biology - general
- Botany
- Ecology
- Entomology
- Hydrobiology and marine biology
- Animal science
- Zoology - miscellaneous
- Zoology - general

Discipline: Biomedical research
- Anatomy and morphology
- Biochemistry and molecular biology
- Cell biology, cytology and histology
- Biophysics
- Embryology
- Biomedical engineering
- Genetics and heredity
- Microbiology
- Microscopy
- Nutrition and dietetics
- Parasitology
- Physiology
- Biomedical research - miscellaneous
- Biomedical research - general
- Virology

Discipline: Chemistry
- Chemistry - general
- Analytic chemistry
- Applied chemistry
- Polymer chemistry
- Nuclear and inorganic chemistry
- Organic chemistry
- Physical chemistry

Discipline: Clinical medicine
- Allergy
- Anaesthesiology
- Arthritis and rheumatism
- Cancer
- Surgery
- Dentistry
- Dermatology and venereal disease
- Endocrinology
- Fertility
- Gastro-enterology
- Geriatrics
- Hematology
- Public health and hygiene
- Immunology
- Disease and dependence
- Clinical medicine - miscellaneous
- General medicine
- Nuclear medicine and radiology
- Tropical medicine
- Veterinary medicine
- Neurology and neurosurgery
- Nephrology
- Obstetrics and gynecology
- Ophthalmology
- Orthopedics
- Oto-rhino-laryngology
- Pathology
- Pharmacy
- Pharmacology
- Psychiatry
- Psychology - miscellaneous
- Psychology - general
- Clinical psychology
- Human psychology
- Developmental and child psychology
- Experimental psychology
- Pediatrics
- Behavioural science
- Cardio-vascular system
- Respiratory system
- Urology

Discipline: Earth and space
- Astronomy and astrophysics
- Geography
- Geology
- Oceanology and limnology
- Atmospherics and meteorology
- Earth science
- Environmental science

Discipline: Applied science and engineering
- Aerospace
- Engineering - general
- Chemical engineering
- Civil engineering
- Engineering and technology - miscellaneous
- Industrial engineering
- Mechanical engineering
- Nuclear engineering
- Electrical and electronic engineering
- Informatics
- Metallurgy
- Operations and management research
- Information and documentation science
- Materials science

Discipline: Mathematics
- Mathematics - miscellaneous
- Mathematics - general
- Applied mathematics
- Probability and statistics

Discipline: Physics
- Acoustics
- Physical chemistry
- Fluid and plasma
- Optics
- Physics - miscellaneous
- Physics - general
- Applied physics
- Solid state physics
- Nuclear and particle physics

APPENDIX 3: TABLES

TABLE A 1: DISTRIBUTION AND GROWTH RATE OF PUBLICATIONS BY COUNTRY (1980-1995)

Country	1980	1985	1990	1995	Rate ↗ 80-95	Rate ↗ 85-95	Rate ↗ 90-95
United States	134,232	159,117	174,622	191,509	*42.7%*	*20.4%*	*9.7%*
World share	*35.3%*	*35.0%*	*33.6%*	*30.8%*			
Japan	24,017	32,110	40,063	50,582	*110.6%*	*57.5%*	*26.3%*
World share	*6.3%*	*7.1%*	*7.7%*	*8.1%*			
United Kingdom	31,936	37,822	40,196	49,340	*54.5%*	*30.5%*	*22.7%*
World share	*8.4%*	*8.3%*	*7.7%*	*7.9%*			
Germany	27,920	32,114	36,428	44,376	*58.9%*	*38.2%*	*21.8%*
World share	*7.3%*	*7.1%*	*7.0%*	*7.1%*			
France	20,278	21,984	25,780	34,529	*70.3%*	*57.1%*	*33.9%*
World share	*5.3%*	*4.8%*	*5.0%*	*5.5%*			
Canada	16,048	20,113	22,979	25,882	*61.3%*	*28.7%*	*12.6%*
World share	*4.2%*	*4.4%*	*4.4%*	*4.2%*			
Italy	7,900	11,404	14,859	21,477	*171.9%*	*88.3%*	*44.5%*
World share	*2.1%*	*2.5%*	*2.9%*	*3.5%*			
Netherlands	6,094	8,577	10,984	14,103	*131.4%*	*64.4%*	*28.4%*
World share	*1.6%*	*1.9%*	*2.1%*	*2.3%*			
Australia	8,316	9,637	10,668	13,911	*67.3%*	*44.3%*	*30.4%*
World share	*2.2%*	*2.1%*	*2.1%*	*2.2%*			
Spain	2,296	4,566	7,706	13,317	*480.0%*	*191.7%*	*72.8%*
World share	*0.6%*	*1.0%*	*1.5%*	*2.1%*			
Sweden	6,189	8,151	9,199	11,337	*83.2%*	*39.1%*	*23.2%*
World share	*1.6%*	*1.8%*	*1.8%*	*1.8%*			
India	11,689	10,407	9,456	9,985	*-14.6%*	*-4.1%*	*5.6%*
World share	*3.1%*	*2.3%*	*1.8%*	*1.6%*			
Switzerland	5,609	6,353	7,467	9,874	*76.0%*	*55.4%*	*32.2%*
World share	*1.5%*	*1.4%*	*1.4%*	*1.6%*			
Belgium	3,490	4,187	4,831	6,780	*94.3%*	*61.9%*	*40.3%*
World share	*0.9%*	*0.9%*	*0.9%*	*1.1%*			
Israel	4,085	5,152	5,339	6,638	*62.5%*	*28.8%*	*24.3%*
World share	*1.1%*	*1.1%*	*1.0%*	*1.1%*			
Poland	4,351	4,343	4,798	6,064	*39.4%*	*39.6%*	*26.4%*
World share	*1.1%*	*1.0%*	*0.9%*	*1.0%*			
Denmark	3,371	3,906	4,294	5,601	*66.2%*	*43.4%*	*30.4%*
World share	*0.9%*	*0.9%*	*0.8%*	*0.9%*			
Taiwan	411	868	2,251	5,195	*1164.0%*	*498.5%*	*130.8%*
World share	*0.1%*	*0.2%*	*0.4%*	*0.8%*			
South Korea	125	535	1,374	4,465	*3472.0%*	*734.6%*	*225.0%*
World share	*0.0%*	*0.1%*	*0.3%*	*0.7%*			
South Africa	1,870	2,396	2,464	2,525	*35.0%*	*5.4%*	*2.5%*
World share	*0.5%*	*0.5%*	*0.5%*	*0.4%*			
Hong Kong	276	522	845	1,691	*512.7%*	*223.9%*	*100.1%*
World share	*0.1%*	*0.1%*	*0.2%*	*0.3%*			
Portugal	191	347	746	1,337	*600.0%*	*285.3%*	*79.2%*
World share	*0.1%*	*0.1%*	*0.1%*	*0.2%*			
Other	59,196	69,590	82,058	91,686	*54.9%*	*31.8%*	*11.7%*
World share	*15.6%*	*15.3%*	*15.8%*	*14.7%*			
Total	**379,890**	**454,201**	**519,407**	**622,204**	***63.8%***	***37.0%***	***19.8%***
World	**373,988**	**434,144**	**477,816**	**539,157**	***44.2%***	***24.2%***	***12.8%***

* The last line in the table shows the number of different articles published worldwide. The second last line shows the total number of articles attributed to the countries in the table. The difference between the two figures is due to the fact that some articles may be attributed to more than one country if the collaborating institutions with which the authors are affiliated are located in different countries. In such cases, articles may be counted more than once. For more information, see the box on collaboration.

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 2: DISTRIBUTION AND GROWTH RATE OF PUBLICATIONS BY PROVINCE (1980-1995)

Province	1980	1985	1990	1995	Rate ↗ 80-95	Rate ↗ 85-95	Rate ↗ 90-95
Ontario	7,762	9,404	10,363	11,547	*48.8%*	*22.8%*	*11.4%*
Canadian share	*46.6%*	*44.4%*	*42.3%*	*40.9%*			
Quebec	2,986	3,820	4,937	6,471	*116.7%*	*69.4%*	*31.1%*
Canadian share	*17.9%*	*18.1%*	*20.1%*	*22.9%*			
British Columbia	1,803	2,423	2,779	3,363	*86.5%*	*38.8%*	*21.0%*
Canadian share	*10.8%*	*11.4%*	*11.3%*	*11.9%*			
Alberta	1,533	2,150	2,714	2,980	*94.4%*	*38.6%*	*9.8%*
Canadian share	*9.2%*	*10.2%*	*11.1%*	*10.6%*			
Manitoba	819	971	1,092	1,088	*32.8%*	*12.0%*	*-0.4%*
Canadian share	*4.9%*	*4.6%*	*4.5%*	*3.9%*			
Nova Scotia	587	915	932	964	*64.2%*	*5.4%*	*3.4%*
Canadian share	*3.5%*	*4.3%*	*3.8%*	*3.4%*			
Saskatchewan	620	768	921	959	*54.7%*	*24.9%*	*4.1%*
Canadian share	*3.7%*	*3.6%*	*3.8%*	*3.4%*			
Newfoundland	280	345	368	364	*30.0%*	*5.5%*	*-1.1%*
Canadian share	*1.7%*	*1.6%*	*1.5%*	*1.3%*			
New Brunswick	230	323	323	356	*54.8%*	*10.2%*	*10.2%*
Canadian share	*1.4%*	*1.5%*	*1.3%*	*1.3%*			
Prince Edward Island	31	32	71	92	*196.8%*	*187.5%*	*29.6%*
Canadian share	*0.2%*	*0.2%*	*0.3%*	*0.3%*			
Total	**16,655**	**21,163**	**24,509**	**28,208**	***69.4%***	***33.3%***	***15.1%***
Canada	**16,048**	**20,113**	**22,979**	**25,882**	***61.3%***	***28.7%***	***12.6%***

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 3: DISTRIBUTION OF PUBLICATIONS BY SUBJECT AND COUNTRY (1995)

	World	Canada	United States	Japan	United Kingdom	Germany	France	Italy
Clinical medicine	158,389	7,242	63,052	13,626	16,786	11,289	8,652	6,946
	29.4%	*28.0%*	*32.9%*	*26.9%*	*34.0%*	*25.4%*	*25.1%*	*32.3%*
Biomedical research	81,487	4,036	35,118	7,259	7,934	6,565	5,361	2,793
	15.1%	*15.6%*	*18.3%*	*14.4%*	*16.1%*	*14.8%*	*15.5%*	*13.0%*
Physics	73,756	2,465	20,898	8,950	5,636	8,680	5,978	3,711
	13.7%	*9.5%*	*10.9%*	*17.7%*	*11.4%*	*19.6%*	*17.3%*	*17.3%*
Chemistry	64,320	2,229	15,035	7,517	4,526	6,320	4,759	2,424
	11.9%	*8.6%*	*7.9%*	*14.9%*	*9.2%*	*14.2%*	*13.8%*	*11.3%*
Applied science and engineering	42,282	2,261	13,947	4,637	3,296	2,882	2,048	1,270
	7.8%	*8.7%*	*7.3%*	*9.2%*	*6.7%*	*6.5%*	*5.9%*	*5.9%*
Biology	38,285	2,971	13,090	2,911	3,387	2,363	1,780	877
	7.1%	*11.5%*	*6.8%*	*5.8%*	*6.9%*	*5.3%*	*5.2%*	*4.1%*
Earth sciences	26,770	2,188	11,802	1,180	3,045	2,103	1,915	1,061
	5.0%	*8.5%*	*6.2%*	*2.3%*	*6.2%*	*4.7%*	*5.5%*	*4.9%*
Mathematics	8,865	518	3,483	338	672	754	1,059	407
	1.6%	*2.0%*	*1.8%*	*0.7%*	*1.4%*	*1.7%*	*3.1%*	*1.9%*
Unknown	45,003	1,972	15,084	4,164	4,058	3,420	2,977	1,988
	8.3%	*7.6%*	*7.9%*	*8.2%*	*8.2%*	*7.7%*	*8.6%*	*9.3%*
Total	**539,157**	**25,882**	**191,509**	**50,582**	**49,340**	**44,376**	**34,529**	**21,477**

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 4: SPECIALIZATION INDEXES OF G7 COUNTRIES (1995)

	Canada	United States	Japan	United Kingdom	Germany	France	Italy
Physics	0.70	0.80	1.29	0.84	1.43	1.27	1.26
Chemistry	0.72	0.66	1.25	0.77	1.19	1.16	0.95
Clinical medicine	0.95	1.12	0.92	1.16	0.87	0.85	1.10
Biomedical research	1.03	1.21	0.95	1.06	0.98	1.03	0.86
Applied science and engineering	1.11	0.93	1.17	0.85	0.83	0.76	0.75
Mathematics	1.22	1.11	0.41	0.83	1.03	1.87	1.15
Biology	1.62	0.96	0.81	0.97	0.75	0.73	0.58
Earth sciences	1.70	1.24	0.47	1.24	0.95	1.12	0.99

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 5: DISTRIBUTION OF PUBLICATIONS BY SUBJECT AND PROVINCE (1995)

	Ontario	Quebec	British Columbia	Alberta	Manitoba	Nova Scotia	Saskat-chewan	Newfoundland	New Brunswick	Prince Edward Island	Northwest Territories	Yukon	Total	Canada
Clinical medicine	3,303	1,940	836	803	337	231	258	56	17	31	2	1	**7,815**	**7,242**
	42.3%	*24.8%*	*10.7%*	*10.3%*	*4.3%*	*3.0%*	*3.3%*	*0.7%*	*0.2%*	*0.4%*	*0.0%*	*0.0%*	***100%***	
	28.6%	*30.0%*	*24.9%*	*26.9%*	*31.0%*	*24.0%*	*26.9%*	*15.4%*	*4.8%*	*33.7%*	*11.1%*	*16.7%*	***27.7%***	***28.0%***
Biomedical research	1,653	1,190	476	504	151	131	108	48	22	12	0	0	**4,295**	**4,036**
	38.5%	*27.7%*	*11.1%*	*11.7%*	*3.5%*	*3.1%*	*2.5%*	*1.1%*	*0.5%*	*0.3%*	*0.0%*	*0.0%*		
	14.3%	*18.4%*	*14.2%*	*16.9%*	*13.9%*	*13.6%*	*11.3%*	*13.2%*	*6.2%*	*13.0%*	*0.0%*	*0.0%*	***15.2%***	***15.6%***
Biology	1,030	562	421	431	199	154	256	78	111	42	13	2	**3,299**	**2,971**
	31.2%	*17.0%*	*12.8%*	*13.1%*	*6.0%*	*4.7%*	*7.8%*	*2.4%*	*3.4%*	*1.3%*	*0.4%*	*0.1%*		
	8.9%	*8.7%*	*12.5%*	*14.5%*	*18.3%*	*16.0%*	*26.7%*	*21.4%*	*31.2%*	*45.7%*	*72.2%*	*33.3%*	***11.7%***	***11.5%***
Physics	1,286	655	387	195	89	77	49	21	45	3	0	0	**2,807**	**2,465**
	45.8%	*23.3%*	*13.8%*	*6.9%*	*3.2%*	*2.7%*	*1.7%*	*0.7%*	*1.6%*	*0.1%*	*0.0%*	*0.0%*		
	11.1%	*10.1%*	*11.5%*	*6.5%*	*8.2%*	*8.0%*	*5.1%*	*5.8%*	*12.6%*	*3.3%*	*0.0%*	*0.0%*	***10.0%***	***9.5%***
Earth sciences	1,042	402	384	267	84	147	94	67	40	0	3	3	**2,533**	**2,188**
	41.1%	*15.9%*	*15.2%*	*10.5%*	*3.3%*	*5.8%*	*3.7%*	*2.6%*	*1.6%*	*0.0%*	*0.1%*	*0.1%*		
	9.0%	*6.2%*	*11.4%*	*9.0%*	*7.7%*	*15.2%*	*9.8%*	*18.4%*	*11.2%*	*0.0%*	*16.7%*	*50.0%*	***9.0%***	***8.5%***
Applied science and	1,063	582	316	227	97	34	73	19	45	0	0	0	**2,456**	**2,261**
	43.3%	*23.7%*	*12.9%*	*9.2%*	*3.9%*	*1.4%*	*3.0%*	*0.8%*	*1.8%*	*0.0%*	*0.0%*	*0.0%*		
	9.2%	*9.0%*	*9.4%*	*7.6%*	*8.9%*	*3.5%*	*7.6%*	*5.2%*	*12.6%*	*0.0%*	*0.0%*	*0.0%*	***8.7%***	***8.7%***
Chemistry	1,084	485	236	232	53	93	48	41	46	1	0	0	**2,319**	**2,229**
	46.7%	*20.9%*	*10.2%*	*10.0%*	*2.3%*	*4.0%*	*2.1%*	*1.8%*	*2.0%*	*0.0%*	*0.0%*	*0.0%*		
	9.4%	*7.5%*	*7.0%*	*7.8%*	*4.9%*	*9.6%*	*5.0%*	*11.3%*	*12.9%*	*1.1%*	*0.0%*	*0.0%*	***8.2%***	***8.6%***
Mathematics	235	109	77	71	12	20	13	12	2	1	0	0	**552**	**518**
	42.6%	*19.7%*	*13.9%*	*12.9%*	*2.2%*	*3.6%*	*2.4%*	*2.2%*	*0.4%*	*0.2%*	*0.0%*	*0.0%*		
	2.0%	*1.7%*	*2.3%*	*2.4%*	*1.1%*	*2.1%*	*1.4%*	*3.3%*	*0.6%*	*1.1%*	*0.0%*	*0.0%*	***2.0%***	***2.0%***
Unknown	851	546	230	250	66	77	60	22	28	2	0	0	**2,132**	**1,972**
	39.9%	*25.6%*	*10.8%*	*11.7%*	*3.1%*	*3.6%*	*2.8%*	*1.0%*	*1.3%*	*0.1%*	*0.0%*	*0.0%*		
	7.4%	*8.4%*	*6.8%*	*8.4%*	*6.1%*	*8.0%*	*6.3%*	*6.0%*	*7.9%*	*2.2%*	*0.0%*	*0.0%*	***7.6%***	***7.6%***
Total	**11,547**	**6,471**	**3,363**	**2,980**	**1,088**	**964**	**959**	**364**	**356**	**92**	**18**	**6**	**28,208**	**25,882**

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 6: SPECIALIZATION INDEXES OF THE PROVINCES (1995)

	Ontario	Quebec	British Columbia	Alberta	Manitoba	Nova Scotia	Saskat-chewan	Newfound-land	New Brunswick	Prince Edward Island
Biology	*0.78*	*0.76*	*1.09*	*1.26*	*1.59*	*1.39*	*2.33*	*1.87*	*2.72*	*3.98*
Biomedical research	*0.92*	*1.18*	*0.91*	*1.08*	*0.89*	*0.87*	*0.72*	*0.85*	*0.40*	*0.84*
Mathematics	*1.02*	*0.84*	*1.14*	*1.19*	*0.55*	*1.04*	*0.68*	*1.65*	*0.28*	*0.54*
Clinical medicine	*1.02*	*1.07*	*0.89*	*0.96*	*1.11*	*0.86*	*0.96*	*0.55*	*0.17*	*1.20*
Applied science and engineering	*1.05*	*1.03*	*1.08*	*0.87*	*1.02*	*0.40*	*0.87*	*0.60*	*1.45*	
Earth sciences	*1.07*	*0.73*	*1.35*	*1.06*	*0.91*	*1.80*	*1.16*	*2.18*	*1.33*	
Chemistry	*1.09*	*0.87*	*0.81*	*0.90*	*0.57*	*1.12*	*0.58*	*1.31*	*1.50*	*0.13*
Physics	*1.17*	*1.06*	*1.21*	*0.69*	*0.86*	*0.84*	*0.54*	*0.61*	*1.33*	*0.34*

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 7: DISTRIBUTION OF PUBLICATIONS BY SECTOR – PROVINCES (1995)

	Ontario	Quebec	British Columbia	Alberta	Manitoba	Nova Scotia	Saskat-chewan	Newfound-land	New Brunswick	Prince Edward Island	Total	Canada
University	8,377	4,974	2,651	2,488	829	763	768	308	245	62	**21,465**	**20,312**
	39.0%	*23.2%*	*12.4%*	*11.6%*	*3.9%*	*3.6%*	*3.6%*	*1.4%*	*1.1%*	*0.3%*		
	61.2%	*63.9%*	*69.9%*	*76.0%*	*66.9%*	*71.5%*	*73.2%*	*77.0%*	*65.7%*	*62.0%*	***65.5%***	***65.0%***
Hospital	2,198	1,781	385	204	108	88	60	17	5	1	**4,847**	**4,656**
	45.3%	*36.7%*	*7.9%*	*4.2%*	*2.2%*	*1.8%*	*1.2%*	*0.4%*	*0.1%*	*0.0%*		
	16.1%	*22.9%*	*10.1%*	*6.2%*	*8.7%*	*8.2%*	*5.7%*	*4.3%*	*1.3%*	*1.0%*	***14.8%***	***14.9%***
Federal government	1,802	449	331	257	218	175	149	57	80	25	**3,543**	**3,376**
	50.9%	*12.7%*	*9.3%*	*7.3%*	*6.2%*	*4.9%*	*4.2%*	*1.6%*	*2.3%*	*0.7%*		
	13.2%	*5.8%*	*8.7%*	*7.9%*	*17.6%*	*16.4%*	*14.2%*	*14.3%*	*21.4%*	*25.0%*	***10.8%***	***10.8%***
Corporate	606	309	153	120	30	19	18	8	19	2	**1,284**	**1,256**
	47.2%	*24.1%*	*11.9%*	*9.3%*	*2.3%*	*1.5%*	*1.4%*	*0.6%*	*1.5%*	*0.2%*		
	4.4%	*4.0%*	*4.0%*	*3.7%*	*2.4%*	*1.8%*	*1.7%*	*2.0%*	*5.1%*	*2.0%*	***3.9%***	***4.0%***
Provincial government	287	92	176	121	16	12	23	6	8	7	**748**	**745**
	38.4%	*12.3%*	*23.5%*	*16.2%*	*2.1%*	*1.6%*	*3.1%*	*0.8%*	*1.1%*	*0.9%*		
	2.1%	*1.2%*	*4.6%*	*3.7%*	*1.3%*	*1.1%*	*2.2%*	*1.5%*	*2.1%*	*7.0%*	***2.3%***	***2.4%***
Other	346	148	57	57	30	4	25	0	12	2	**681**	**676**
	50.8%	*21.7%*	*8.4%*	*8.4%*	*4.4%*	*0.6%*	*3.7%*	*0.0%*	*1.8%*	*0.3%*		
	2.5%	*1.9%*	*1.5%*	*1.7%*	*2.4%*	*0.4%*	*2.4%*	*0.0%*	*3.2%*	*2.0%*	***2.1%***	***2.2%***
Unknown	75	29	42	26	8	6	6	4	4	1	**201**	**205**
	37.3%	*14.4%*	*20.9%*	*12.9%*	*4.0%*	*3.0%*	*3.0%*	*2.0%*	*2.0%*	*0.5%*		
	0.5%	*0.4%*	*1.1%*	*0.8%*	*0.6%*	*0.6%*	*0.6%*	*1.0%*	*1.1%*	*1.0%*	***0.6%***	***0.7%***
Total	**13,691**	**7,782**	**3,795**	**3,273**	**1,239**	**1,067**	**1,049**	**400**	**373**	**100**	**32,794**	**31,226**
	41.7%	***23.7%***	***11.6%***	***10.0%***	***3.8%***	***3.3%***	***3.2%***	***1.2%***	***1.1%***	***0.3%***		

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 8: DISTRIBUTION OF PUBLICATIONS BY SECTOR AND SUBJECT, CANADA (1995)

	Clinical medicine	Biomedical research	Biology	Physics	Applied science and engi-neering	Earth sciences	Chemistry	Mathe-matics	Unknown	Total
University	5,181	3,333	2,170	2,202	1,836	1,616	1,913	515	1,546	**20,312**
	25.5%	*16.4%*	*10.7%*	*10.8%*	*9.0%*	*8.0%*	*9.4%*	*2.5%*	*7.6%*	
	54.4%	*67.9%*	*60.6%*	*81.3%*	*70.2%*	*62.2%*	*80.9%*	*97.4%*	*64.4%*	***65.0%***
Hospital	3,248	918	23	9	6	3	14	3	432	**4,656**
	69.8%	*19.7%*	*0.5%*	*0.2%*	*0.1%*	*0.1%*	*0.3%*	*0.1%*	*9.3%*	
	34.1%	*18.7%*	*0.6%*	*0.3%*	*0.2%*	*0.1%*	*0.6%*	*0.6%*	*18.0%*	***14.9%***
Federal government	264	361	990	323	252	705	277	4	200	**3,376**
	7.8%	*10.7%*	*29.3%*	*9.6%*	*7.5%*	*20.9%*	*8.2%*	*0.1%*	*5.9%*	
	2.8%	*7.4%*	*27.7%*	*11.9%*	*9.6%*	*27.1%*	*11.7%*	*0.8%*	*8.3%*	***10.8%***
Corporate	209	111	102	104	379	111	117	2	121	**1,256**
	16.6%	*8.8%*	*8.1%*	*8.3%*	*30.2%*	*8.8%*	*9.3%*	*0.2%*	*9.6%*	
	2.2%	*2.3%*	*2.8%*	*3.8%*	*14.5%*	*4.3%*	*4.9%*	*0.4%*	*5.0%*	***4.0%***
Provincial government	296	100	177	6	31	76	11	1	47	**745**
	39.7%	*13.4%*	*23.8%*	*0.8%*	*4.2%*	*10.2%*	*1.5%*	*0.1%*	*6.3%*	
	3.1%	*2.0%*	*4.9%*	*0.2%*	*1.2%*	*2.9%*	*0.5%*	*0.2%*	*2.0%*	***2.4%***
Other	231	63	86	56	103	70	25	4	38	**676**
	34.2%	*9.3%*	*12.7%*	*8.3%*	*15.2%*	*10.4%*	*3.7%*	*0.6%*	*5.6%*	
	2.4%	*1.3%*	*2.4%*	*2.1%*	*3.9%*	*2.7%*	*1.1%*	*0.8%*	*1.6%*	***2.2%***
Unknown	92	21	32	9	10	19	7	0	15	**205**
	44.9%	*10.2%*	*15.6%*	*4.4%*	*4.9%*	*9.3%*	*3.4%*	*0.0%*	*7.3%*	
	1.0%	*0.4%*	*0.9%*	*0.3%*	*0.4%*	*0.7%*	*0.3%*	*0.0%*	*0.6%*	***0.7%***
Total	**9,521**	**4,907**	**3,580**	**2,709**	**2,617**	**2,600**	**2,364**	**529**	**2,399**	**31,226**
	30.5%	***15.7%***	***11.5%***	***8.7%***	***8.4%***	***8.3%***	***7.6%***	***1.7%***	***7.7%***	

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 9: NUMBER OF AUTHORS PER PUBLICATION, CANADA AND THE WORLD (1985 -1995)

	1 author	2 authors	3 authors	4 authors	5 authors	6 to 10	11 or more	N/A	Total
Canada									
1985	3,682	7,065	4,633	2,398	1,161	1,063	111		**20,113**
	18.3%	*35.1%*	*23.0%*	*11.9%*	*5.8%*	*5.3%*	*0.6%*		
1995	2,542	7,389	5,985	3,897	2,421	3,018	630		**25,882**
	9.8%	*28.5%*	*23.1%*	*15.1%*	*9.4%*	*11.7%*	*2.4%*		
World									
1985	89,955	122,569	95,871	58,771	31,740	31,707	2,108	1,423	**434,144**
	20.7%	*28.2%*	*22.1%*	*13.5%*	*7.3%*	*7.3%*	*0.5%*	*0.3%*	
1995	72,611	123,207	112,531	84,882	56,238	80,022	8,032	1,634	**539,157**
	13.5%	*22.9%*	*20.9%*	*15.7%*	*10.4%*	*14.8%*	*1.5%*	*0.3%*	

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 10: CO-AUTHORSHIP RATE BY SUBJECT, CANADA AND THE WORLD (1995)

	Mathematics	Earth sciences	Physics	Applied science and engineering	Biology	Clinical medicine	Biomedical research	Chemistry
Canada	**518**	**2,188**	**2,465**	**2,261**	**2,971**	**7,242**	**4,036**	**2,229**
Without collaboration	167	296	290	262	334	623	239	121
With collaboration	351	1,892	2,175	1,999	2,637	6,619	3,797	2,108
Collaboration percentage	67.8%	86.5%	88.2%	88.4%	88.8%	91.4%	94.1%	94.6%
World	**8,865**	**26,770**	**73,756**	**42,282**	**38,285**	**158,389**	**81,487**	**64,320**
Without collaboration	4,288	4,972	11,035	7,166	6,384	14,150	6,489	5,425
With collaboration	4,577	21,798	62,721	35,116	31,901	144,239	74,998	58,895
Collaboration percentage	51.6%	81.4%	85.0%	83.1%	83.3%	91.1%	92.0%	91.6%

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 11: INTERNATIONAL, INTERPROVINCIAL AND INTRAPROVINCIAL COLLABORATION BY SUBJECT, CANADA AND THE WORLD (1995)

	Clinical medicine	Biomedical research	Biology	Physics	Applied science and engineering	Chemistry	Earth sciences	Mathe-matics	Unknown	Total
Canada										
International collaboration	27.7%	32.9%	21.3%	41.1%	25.9%	25.1%	35.4%	45.2%	32.7%	30.7%
Interprovincial collaboration	6.3%	5.8%	9.9%	9.7%	7.9%	3.4%	13.7%	6.0%	7.0%	7.7%
Intraprovincial collaboration	57.6%	55.5%	57.7%	38.1%	54.7%	66.1%	37.8%	17.2%	49.9%	53.9%
Without collaboration	8.4%	5.8%	11.1%	11.1%	11.4%	5.4%	13.1%	31.6%	10.4%	9.8%
World										
International collaboration	11.1%	15.7%	13.3%	20.9%	11.8%	12.3%	22.8%	19.9%	14.6%	14.5%
Collaboration nationale	80.0%	76.3%	70.0%	64.1%	71.3%	79.2%	58.6%	31.7%	71.5%	73.2%
Without collaboration	8.9%	8.0%	16.7%	15.0%	16.9%	8.4%	18.6%	48.4%	13.9%	12.3%

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 12: CANADA'S INTERNATIONAL COLLABORATION, BY COUNTRY AND SUBJECT (1995)

	Clinical medicine	Physics	Biomedical research	Earth sciences	Biology	Applied science and engineering	Chemistry	Mathematics	Unknown	Total
United States	1,250	482	816	443	311	238	182	101	329	**4,152**
	30.1%	*11.6%*	*19.7%*	*10.7%*	*7.5%*	*5.7%*	*4.4%*	*2.4%*	*7.9%*	
	45.5%	*25.1%*	*48.1%*	*41.2%*	*43.7%*	*34.7%*	*27.8%*	*36.6%*	*40.0%*	***39.2%***
United Kingdom	259	152	125	100	48	33	46	17	52	**832**
	31.1%	*18.3%*	*15.0%*	*12.0%*	*5.8%*	*4.0%*	*5.5%*	*2.0%*	*6.3%*	
	9.4%	*7.9%*	*7.4%*	*9.3%*	*6.8%*	*4.8%*	*7.0%*	*6.2%*	*6.3%*	***7.9%***
France	163	140	140	82	37	43	51	17	82	**755**
	21.6%	*18.5%*	*18.5%*	*10.9%*	*4.9%*	*5.7%*	*6.8%*	*2.3%*	*10.9%*	
	5.9%	*7.3%*	*8.2%*	*7.6%*	*5.2%*	*6.3%*	*7.8%*	*6.2%*	*10.0%*	***7.1%***
Germany	106	154	97	62	19	30	49	17	41	**575**
	18.4%	*26.8%*	*16.9%*	*10.8%*	*3.3%*	*5.2%*	*8.5%*	*3.0%*	*7.1%*	
	3.9%	*8.0%*	*5.7%*	*5.8%*	*2.7%*	*4.4%*	*7.5%*	*6.2%*	*5.0%*	***5.4%***
Japan	95	135	66	40	22	44	48	0	38	**488**
	19.5%	*27.7%*	*13.5%*	*8.2%*	*4.5%*	*9.0%*	*9.8%*	*0.0%*	*7.8%*	
	3.5%	*7.0%*	*3.9%*	*3.7%*	*3.1%*	*6.4%*	*7.3%*	*0.0%*	*4.6%*	***4.6%***
Italy	78	126	32	26	7	14	20	8	19	**330**
	23.6%	*38.2%*	*9.7%*	*7.9%*	*2.1%*	*4.2%*	*6.1%*	*2.4%*	*5.8%*	
	2.8%	*6.6%*	*1.9%*	*2.4%*	*1.0%*	*2.0%*	*3.1%*	*2.9%*	*2.3%*	***3.1%***
Australia	90	23	41	43	30	17	16	11	19	**290**
	31.0%	*7.9%*	*14.1%*	*14.8%*	*10.3%*	*5.9%*	*5.5%*	*3.8%*	*6.6%*	
	3.3%	*1.2%*	*2.4%*	*4.0%*	*4.2%*	*2.5%*	*2.4%*	*4.0%*	*2.3%*	***2.7%***
Netherlands	66	42	55	20	12	16	12	1	24	**248**
	26.6%	*16.9%*	*22.2%*	*8.1%*	*4.8%*	*6.5%*	*4.8%*	*0.4%*	*9.7%*	
	2.4%	*2.2%*	*3.2%*	*1.9%*	*1.7%*	*2.3%*	*1.8%*	*0.4%*	*2.9%*	***2.3%***
Switzerland	50	76	23	14	3	10	14	2	14	**206**
	24.3%	*36.9%*	*11.2%*	*6.8%*	*1.5%*	*4.9%*	*6.8%*	*1.0%*	*6.8%*	
	1.8%	*4.0%*	*1.4%*	*1.3%*	*0.4%*	*1.5%*	*2.1%*	*0.7%*	*1.7%*	***1.9%***
Russia	7	85	20	33	4	13	14	10	19	**205**
	3.4%	*41.5%*	*9.8%*	*16.1%*	*2.0%*	*6.3%*	*6.8%*	*4.9%*	*9.3%*	
	0.3%	*4.4%*	*1.2%*	*3.1%*	*0.6%*	*1.9%*	*2.1%*	*3.6%*	*2.3%*	***1.9%***
Sweden	58	26	37	24	18	7	7	1	25	**203**
	28.6%	*12.8%*	*18.2%*	*11.8%*	*8.9%*	*3.4%*	*3.4%*	*0.5%*	*12.3%*	
	2.1%	*1.4%*	*2.2%*	*2.2%*	*2.5%*	*1.0%*	*1.1%*	*0.4%*	*3.0%*	***1.9%***
Israel	35	77	11	8	7	6	5	4	14	**167**
	21.0%	*46.1%*	*6.6%*	*4.8%*	*4.2%*	*3.6%*	*3.0%*	*2.4%*	*8.4%*	
	1.3%	*4.0%*	*0.6%*	*0.7%*	*1.0%*	*0.9%*	*0.8%*	*1.4%*	*1.7%*	***1.6%***
China	11	38	13	7	17	33	18	18	9	**164**
	6.7%	*23.2%*	*7.9%*	*4.3%*	*10.4%*	*20.1%*	*11.0%*	*11.0%*	*5.5%*	
	0.4%	*2.0%*	*0.8%*	*0.7%*	*2.4%*	*4.8%*	*2.7%*	*6.5%*	*1.1%*	***1.5%***
Spain	27	45	17	9	14	8	14	3	11	**148**
	18.2%	*30.4%*	*11.5%*	*6.1%*	*9.5%*	*5.4%*	*9.5%*	*2.0%*	*7.4%*	
	1.0%	*2.3%*	*1.0%*	*0.8%*	*2.0%*	*1.2%*	*2.1%*	*1.1%*	*1.3%*	***1.4%***
Poland	11	44	2	7	6	12	19	6	3	**110**
	10.0%	*40.0%*	*1.8%*	*6.4%*	*5.5%*	*10.9%*	*17.3%*	*5.5%*	*2.7%*	
	0.4%	*2.3%*	*0.1%*	*0.7%*	*0.8%*	*1.7%*	*2.9%*	*2.2%*	*0.4%*	***1.0%***
Other countries	441	274	202	156	156	162	140	60	123	**1,714**
	25.7%	*16.0%*	*11.8%*	*9.1%*	*9.1%*	*9.5%*	*8.2%*	*3.5%*	*7.2%*	
	16.1%	*14.3%*	*11.9%*	*14.5%*	*21.9%*	*23.6%*	*21.4%*	*21.7%*	*15.0%*	***16.2%***
Total	**2,747**	**1,919**	**1,697**	**1,074**	**711**	**686**	**655**	**276**	**822**	**10,587**
	25.9%	***18.1%***	***16.0%***	***10.1%***	***6.7%***	***6.5%***	***6.2%***	***2.6%***	***7.8%***	

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 13: INTERNATIONAL, INTERPROVINCIAL AND INTRAPROVINCIAL COLLABORATION BY SUBJECT, PROVINCES (1995)

	Clinical medicine	Biomedical research	Biology	Physics	Applied science and engineering	Chemistry	Earth sciences	Mathematics	Unknown	Total
Ontario										
International collaboration	26.8%	33.8%	22.2%	39.1%	26.2%	26.9%	33.5%	40.6%	32.0%	31.2%
Interprovincial collaboration	9.6%	9.5%	13.9%	14.8%	12.3%	5.1%	21.0%	9.0%	10.9%	12.0%
Intraprovincial collaboration	54.4%	50.0%	51.0%	35.4%	49.9%	62.4%	32.9%	18.0%	46.5%	50.0%
Without collaboration	9.1%	6.7%	12.9%	10.7%	11.6%	5.6%	12.6%	32.4%	10.5%	10.4%
Quebec										
International collaboration	28.2%	30.4%	17.4%	43.5%	24.6%	24.9%	29.9%	43.2%	32.5%	30.8%
Interprovincial collaboration	9.8%	10.0%	14.4%	19.9%	14.5%	6.3%	21.4%	7.2%	10.4%	12.8%
Intraprovincial collaboration	56.0%	55.3%	62.3%	31.3%	53.1%	64.1%	38.3%	20.7%	50.0%	54.0%
Without collaboration	6.0%	4.3%	6.0%	5.2%	7.8%	4.7%	10.4%	28.8%	7.1%	6.7%
British Columbia										
International collaboration	28.2%	35.6%	25.9%	42.5%	25.1%	23.4%	37.3%	49.4%	33.3%	33.9%
Interprovincial collaboration	15.5%	9.5%	16.4%	21.3%	16.1%	7.1%	27.0%	11.1%	19.3%	17.5%
Intraprovincial collaboration	49.0%	49.4%	46.5%	24.0%	45.8%	64.4%	21.3%	17.3%	36.2%	43.9%
Without collaboration	7.3%	5.5%	11.1%	12.1%	13.0%	5.0%	14.4%	22.2%	11.1%	10.5%
Alberta										
International collaboration	28.8%	31.7%	17.3%	42.2%	20.3%	17.2%	31.3%	39.7%	31.3%	29.2%
Interprovincial collaboration	18.6%	13.3%	21.2%	28.3%	12.6%	5.2%	27.8%	16.4%	15.2%	18.8%
Intraprovincial collaboration	46.2%	50.6%	52.0%	19.0%	58.4%	73.8%	33.3%	11.0%	43.8%	48.8%
Without collaboration	6.4%	4.4%	9.5%	10.5%	8.7%	3.9%	7.6%	32.9%	9.8%	8.2%
Manitoba										
International collaboration	29.6%	20.3%	18.2%	37.7%	32.0%	23.6%	22.2%	46.7%	26.1%	28.2%
Interprovincial collaboration	18.2%	14.4%	24.6%	28.9%	21.0%	16.4%	33.3%	26.7%	15.9%	22.5%
Intraprovincial collaboration	46.1%	61.4%	45.3%	29.8%	37.0%	56.4%	36.7%	6.7%	53.6%	48.2%
Without collaboration	6.1%	3.9%	11.8%	3.5%	10.0%	3.6%	7.8%	20.0%	4.3%	7.4%
Nova Scotia										
International collaboration	23.9%	34.0%	26.5%	42.1%	28.6%	22.9%	35.0%	60.9%	25.6%	31.7%
Interprovincial collaboration	22.0%	22.7%	24.1%	13.2%	40.0%	20.8%	27.4%	26.1%	23.2%	24.8%
Intraprovincial collaboration	42.7%	38.3%	42.0%	31.6%	20.0%	52.1%	28.7%	0.0%	39.0%	40.4%
Without collaboration	11.4%	5.0%	7.4%	13.2%	11.4%	4.2%	8.9%	13.0%	12.2%	9.6%
Saskatchewan										
International collaboration	20.9%	25.5%	14.8%	50.9%	18.4%	14.3%	35.6%	40.0%	30.3%	24.6%
Interprovincial collaboration	23.4%	20.0%	20.5%	26.3%	22.4%	6.1%	27.7%	20.0%	21.2%	22.9%
Intraprovincial collaboration	46.2%	49.1%	56.7%	21.1%	46.1%	65.3%	31.7%	0.0%	33.3%	48.2%
Without collaboration	9.5%	5.5%	8.0%	1.8%	13.2%	14.3%	5.0%	40.0%	15.2%	9.6%
Newfoundland										
International collaboration	30.5%	28.8%	11.3%	9.5%	28.6%	20.9%	29.7%	58.3%	21.7%	25.5%
Interprovincial collaboration	30.5%	23.1%	23.8%	23.8%	23.8%	18.6%	29.7%	8.3%	30.4%	26.6%
Intraprovincial collaboration	39.0%	46.2%	57.5%	38.1%	38.1%	58.1%	31.1%	8.3%	39.1%	45.9%
Without collaboration	0.0%	1.9%	7.5%	28.6%	9.5%	2.3%	9.5%	25.0%	8.7%	7.7%
New Brunswick										
International collaboration	35.0%	29.2%	25.6%	36.2%	10.9%	32.7%	23.3%	50.0%	33.3%	28.9%
Interprovincial collaboration	35.0%	16.7%	34.2%	17.0%	39.1%	18.4%	41.9%	50.0%	23.3%	31.5%
Intraprovincial collaboration	20.0%	45.8%	33.3%	42.6%	43.5%	44.9%	27.9%	0.0%	36.7%	39.0%
Without collaboration	10.0%	8.3%	6.8%	4.3%	6.5%	4.1%	7.0%	0.0%	6.7%	6.7%
Prince Edward Island										
International collaboration	31.3%	8.3%	9.5%	60.0%	0.0%	50.0%	0.0%	0.0%	0.0%	20.7%
Interprovincial collaboration	21.9%	33.3%	50.0%	40.0%	0.0%	50.0%	0.0%	0.0%	50.0%	39.1%
Intraprovincial collaboration	37.5%	41.7%	31.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	33.7%
Without collaboration	9.4%	16.7%	9.5%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	10.9%
Northwest Territories										
International collaboration	0.0%	0.0%	18.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.7%
Interprovincial collaboration	100.0%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	55.6%
Intraprovincial collaboration	0.0%	0.0%	12.5%	0.0%	0.0%	0.0%	66.7%	0.0%	0.0%	22.2%
Without collaboration	0.0%	0.0%	18.8%	0.0%	0.0%	0.0%	33.3%	0.0%	0.0%	22.2%
Yukon										
International collaboration	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.7%
Interprovincial collaboration	100.0%	0.0%	50.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	83.3%
Intraprovincial collaboration	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Without collaboration	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 13A: COLLABORATION BY THE PROVINCES (1995)

	Number of publications	Percentage of Canada's total production	Percentage of internationally co-authored publications	Percentage of interprovincially co-authored publications	Percentage of intraprovincially co-authored publications	Percentage of co-authored publications
Prince Edward Island	92	*0.3%*	*19.8%*	*37.5%*	*32.3%*	*89.6%*
Ontario	11,547	*40.9%*	*30.1%*	*11.5%*	*48.3%*	*89.9%*
British Columbia	3,363	*11.9%*	*32.1%*	*16.5%*	*41.5%*	*90.1%*
Saskatchewan	959	*3.4%*	*23.4%*	*21.8%*	*45.7%*	*90.9%*
Nova Scotia	964	*3.4%*	*29.8%*	*23.3%*	*37.9%*	*90.9%*
Alberta	2,980	*10.6%*	*27.8%*	*17.9%*	*46.5%*	*92.2%*
Newfoundland	364	*1.3%*	*24.2%*	*25.2%*	*43.4%*	*92.7%*
Manitoba	1,088	*3.9%*	*26.6%*	*21.2%*	*45.2%*	*93.0%*
Quebec	6,471	*22.9%*	*29.6%*	*12.2%*	*51.8%*	*93.6%*
New Brunswick	356	*1.3%*	*27.2%*	*29.6%*	*36.8%*	*93.7%*
Northwest Territories and Yukon	24	*0.1%*				
Total	28,208					
Canada	25,882	*4.2%*	*30.1%*	*7.5%*	*52.7%*	*90.4%*

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 14: INTERNATIONAL COLLABORATION OF PROVINCES, BY COUNTRY AND SUBJECT (1995)

a) Ontario

	Clinical medicine	Physics	Biomedical research	Earth sciences	Chemistry	Applied science and engi-neering	Biology	Mathe-matics	Unknown	Total
United States	595	281	364	206	100	125	128	50	149	**1,998**
	29.8%	*14.1%*	*18.2%*	*10.3%*	*5.0%*	*6.3%*	*6.4%*	*2.5%*	*7.5%*	
	45.8%	*23.7%*	*48.7%*	*42.6%*	*28.7%*	*36.9%*	*50.2%*	*42.4%*	*39.5%*	***38.8%***
United Kingdom	137	105	71	50	36	20	16	3	30	**468**
	29.3%	*22.4%*	*15.2%*	*10.7%*	*7.7%*	*4.3%*	*3.4%*	*0.6%*	*6.4%*	
	10.5%	*8.9%*	*9.5%*	*10.3%*	*10.3%*	*5.9%*	*6.3%*	*2.5%*	*8.0%*	***9.1%***
Germany	61	90	38	31	17	21	8	10	21	**297**
	20.5%	*30.3%*	*12.8%*	*10.4%*	*5.7%*	*7.1%*	*2.7%*	*3.4%*	*7.1%*	
	4.7%	*7.6%*	*5.1%*	*6.4%*	*4.9%*	*6.2%*	*3.1%*	*8.5%*	*5.6%*	***5.8%***
Japan	43	104	38	15	21	34	3	0	21	**279**
	15.4%	*37.3%*	*13.6%*	*5.4%*	*7.5%*	*12.2%*	*1.1%*	*0.0%*	*7.5%*	
	3.3%	*8.8%*	*5.1%*	*3.1%*	*6.0%*	*10.0%*	*1.2%*	*0.0%*	*5.6%*	***5.4%***
France	50	62	45	30	27	16	5	7	27	**269**
	18.6%	*23.0%*	*16.7%*	*11.2%*	*10.0%*	*5.9%*	*1.9%*	*2.6%*	*10.0%*	
	3.8%	*5.2%*	*6.0%*	*6.2%*	*7.8%*	*4.7%*	*2.0%*	*5.9%*	*7.2%*	***5.2%***
Italy	41	95	19	9	11	5	3	3	11	**197**
	20.8%	*48.2%*	*9.6%*	*4.6%*	*5.6%*	*2.5%*	*1.5%*	*1.5%*	*5.6%*	
	3.2%	*8.0%*	*2.5%*	*1.9%*	*3.2%*	*1.5%*	*1.2%*	*2.5%*	*2.9%*	***3.8%***
Netherlands	44	31	23	9	7	6	5	1	12	**138**
	31.9%	*22.5%*	*16.7%*	*6.5%*	*5.1%*	*4.3%*	*3.6%*	*0.7%*	*8.7%*	
	3.4%	*2.6%*	*3.1%*	*1.9%*	*2.0%*	*1.8%*	*2.0%*	*0.8%*	*3.2%*	***2.7%***
Australia	49	12	16	15	12	6	12	3	12	**137**
	35.8%	*8.8%*	*11.7%*	*10.9%*	*8.8%*	*4.4%*	*8.8%*	*2.2%*	*8.8%*	
	3.8%	*1.0%*	*2.1%*	*3.1%*	*3.4%*	*1.8%*	*4.7%*	*2.5%*	*3.2%*	***2.7%***
Israel	18	59	6	5	1	2	4	3	5	**103**
	17.5%	*57.3%*	*5.8%*	*4.9%*	*1.0%*	*1.9%*	*3.9%*	*2.9%*	*4.9%*	
	1.4%	*5.0%*	*0.8%*	*1.0%*	*0.3%*	*0.6%*	*1.6%*	*2.5%*	*1.3%*	***2.0%***
Switzerland	28	40	9	11	4	3	2	1	5	**103**
	27.2%	*38.8%*	*8.7%*	*10.7%*	*3.9%*	*2.9%*	*1.9%*	*1.0%*	*4.9%*	
	2.2%	*3.4%*	*1.2%*	*2.3%*	*1.1%*	*0.9%*	*0.8%*	*0.8%*	*1.3%*	***2.0%***
Russia	3	45	8	12	6	6	1	5	9	**95**
	3.2%	*47.4%*	*8.4%*	*12.6%*	*6.3%*	*6.3%*	*1.1%*	*5.3%*	*9.5%*	
	0.2%	*3.8%*	*1.1%*	*2.5%*	*1.7%*	*1.8%*	*0.4%*	*4.2%*	*2.4%*	***1.8%***
Sweden	27	13	14	7	2	4	6	0	10	**83**
	32.5%	*15.7%*	*16.9%*	*8.4%*	*2.4%*	*4.8%*	*7.2%*	*0.0%*	*12.0%*	
	2.1%	*1.1%*	*1.9%*	*1.4%*	*0.6%*	*1.2%*	*2.4%*	*0.0%*	*2.7%*	***1.6%***
China	6	24	8	5	7	12	6	7	4	**79**
	7.6%	*30.4%*	*10.1%*	*6.3%*	*8.9%*	*15.2%*	*7.6%*	*8.9%*	*5.1%*	
	0.5%	*2.0%*	*1.1%*	*1.0%*	*2.0%*	*3.5%*	*2.4%*	*5.9%*	*1.1%*	***1.5%***
Spain	9	31	9	3	12	6	3	0	6	**79**
	11.4%	*39.2%*	*11.4%*	*3.8%*	*15.2%*	*7.6%*	*3.8%*	*0.0%*	*7.6%*	
	0.7%	*2.6%*	*1.2%*	*0.6%*	*3.4%*	*1.8%*	*1.2%*	*0.0%*	*1.6%*	***1.5%***
Poland	6	32	1	5	8	4	4	3	2	**65**
	9.2%	*49.2%*	*1.5%*	*7.7%*	*12.3%*	*6.2%*	*6.2%*	*4.6%*	*3.1%*	
	0.5%	*2.7%*	*0.1%*	*1.0%*	*2.3%*	*1.2%*	*1.6%*	*2.5%*	*0.5%*	***1.3%***
Other countries	183	162	79	71	77	69	49	22	53	**765**
	23.9%	*21.2%*	*10.3%*	*9.3%*	*10.1%*	*9.0%*	*6.4%*	*2.9%*	*6.9%*	
	14.1%	*13.7%*	*10.6%*	*14.7%*	*22.1%*	*20.4%*	*19.2%*	*18.6%*	*14.1%*	***14.8%***
Total	**1,300**	**1,186**	**748**	**484**	**348**	**339**	**255**	**118**	**377**	**5,155**
	25.2%	***23.0%***	***14.5%***	***9.4%***	***6.8%***	***6.6%***	***4.9%***	***2.3%***	***7.3%***	

b) Quebec

	Physics	Clinical medicine	Biomedical research	Applied science and engineering	Earth sciences	Chemistry	Biology	Mathe-matics	Unknown	Total
United States	174	321	215	49	58	38	38	19	79	**991**
	17.6%	*32.4%*	*21.7%*	*4.9%*	*5.9%*	*3.8%*	*3.8%*	*1.9%*	*8.0%*	
	18.7%	*42.2%*	*46.1%*	*29.2%*	*35.2%*	*26.2%*	*33.0%*	*35.8%*	*34.8%*	***32.7%***
France	96	88	78	23	29	20	24	7	47	**412**
	23.3%	*21.4%*	*18.9%*	*5.6%*	*7.0%*	*4.9%*	*5.8%*	*1.7%*	*11.4%*	
	10.3%	*11.6%*	*16.7%*	*13.7%*	*17.6%*	*13.8%*	*20.9%*	*13.2%*	*20.7%*	***13.6%***
United Kingdom	68	59	26	6	14	4	5	3	11	**196**
	34.7%	*30.1%*	*13.3%*	*3.1%*	*7.1%*	*2.0%*	*2.6%*	*1.5%*	*5.6%*	
	7.3%	*7.8%*	*5.6%*	*3.6%*	*8.5%*	*2.8%*	*4.3%*	*5.7%*	*4.8%*	***6.5%***
Germany	77	28	25	7	6	8	4	2	9	**166**
	46.4%	*16.9%*	*15.1%*	*4.2%*	*3.6%*	*4.8%*	*2.4%*	*1.2%*	*5.4%*	
	8.3%	*3.7%*	*5.4%*	*4.2%*	*3.6%*	*5.5%*	*3.5%*	*3.8%*	*4.0%*	***5.5%***
Japan	80	28	14	7	3	10	2	0	6	**150**
	53.3%	*18.7%*	*9.3%*	*4.7%*	*2.0%*	*6.7%*	*1.3%*	*0.0%*	*4.0%*	
	8.6%	*3.7%*	*3.0%*	*4.2%*	*1.8%*	*6.9%*	*1.7%*	*0.0%*	*2.6%*	***5.0%***
Italy	92	22	7	3	2	8	1	3	6	**144**
	63.9%	*15.3%*	*4.9%*	*2.1%*	*1.4%*	*5.6%*	*0.7%*	*2.1%*	*4.2%*	
	9.9%	*2.9%*	*1.5%*	*1.8%*	*1.2%*	*5.5%*	*0.9%*	*5.7%*	*2.6%*	***4.8%***
Switzerland	59	14	9	4	0	3	1	1	4	**95**
	62.1%	*14.7%*	*9.5%*	*4.2%*	*0.0%*	*3.2%*	*1.1%*	*1.1%*	*4.2%*	
	6.3%	*1.8%*	*1.9%*	*2.4%*	*0.0%*	*2.1%*	*0.9%*	*1.9%*	*1.8%*	***3.1%***
Israel	59	6	4	1	1	3	0	0	5	**79**
	74.7%	*7.6%*	*5.1%*	*1.3%*	*1.3%*	*3.8%*	*0.0%*	*0.0%*	*6.3%*	
	6.3%	*0.8%*	*0.9%*	*0.6%*	*0.6%*	*2.1%*	*0.0%*	*0.0%*	*2.2%*	***2.6%***
Netherlands	23	12	15	6	2	0	2	0	5	**65**
	35.4%	*18.5%*	*23.1%*	*9.2%*	*3.1%*	*0.0%*	*3.1%*	*0.0%*	*7.7%*	
	2.5%	*1.6%*	*3.2%*	*3.6%*	*1.2%*	*0.0%*	*1.7%*	*0.0%*	*2.2%*	***2.1%***
Russia	33	4	6	3	7	3	0	3	4	**63**
	52.4%	*6.3%*	*9.5%*	*4.8%*	*11.1%*	*4.8%*	*0.0%*	*4.8%*	*6.3%*	
	3.5%	*0.5%*	*1.3%*	*1.8%*	*4.2%*	*2.1%*	*0.0%*	*5.7%*	*1.8%*	***2.1%***
Spain	25	12	2	2	4	1	4	2	1	**53**
	47.2%	*22.6%*	*3.8%*	*3.8%*	*7.5%*	*1.9%*	*7.5%*	*3.8%*	*1.9%*	
	2.7%	*1.6%*	*0.4%*	*1.2%*	*2.4%*	*0.7%*	*3.5%*	*3.8%*	*0.4%*	***1.7%***
Australia	2	20	7	7	6	2	2	1	2	**49**
	4.1%	*40.8%*	*14.3%*	*14.3%*	*12.2%*	*4.1%*	*4.1%*	*2.0%*	*4.1%*	
	0.2%	*2.6%*	*1.5%*	*4.2%*	*3.6%*	*1.4%*	*1.7%*	*1.9%*	*0.9%*	***1.6%***
Sweden	4	23	9	2	3	1	1	0	5	**48**
	8.3%	*47.9%*	*18.8%*	*4.2%*	*6.3%*	*2.1%*	*2.1%*	*0.0%*	*10.4%*	
	0.4%	*3.0%*	*1.9%*	*1.2%*	*1.8%*	*0.7%*	*0.9%*	*0.0%*	*2.2%*	***1.6%***
Poland	23	2	1	8	0	4	0	0	1	**39**
	59.0%	*5.1%*	*2.6%*	*20.5%*	*0.0%*	*10.3%*	*0.0%*	*0.0%*	*2.6%*	
	2.5%	*0.3%*	*0.2%*	*4.8%*	*0.0%*	*2.8%*	*0.0%*	*0.0%*	*0.4%*	***1.3%***
China	6	1	0	10	0	6	0	0	3	**26**
	23.1%	*3.8%*	*0.0%*	*38.5%*	*0.0%*	*23.1%*	*0.0%*	*0.0%*	*11.5%*	
	0.6%	*0.1%*	*0.0%*	*6.0%*	*0.0%*	*4.1%*	*0.0%*	*0.0%*	*1.3%*	***0.9%***
Other countries	110	120	48	30	30	34	31	12	39	**454**
	24.2%	*26.4%*	*10.6%*	*6.6%*	*6.6%*	*7.5%*	*6.8%*	*2.6%*	*8.6%*	
	11.8%	*15.8%*	*10.3%*	*17.9%*	*18.2%*	*23.4%*	*27.0%*	*22.6%*	*17.2%*	***15.0%***
Total	**931**	**760**	**466**	**168**	**165**	**145**	**115**	**53**	**227**	**3,030**
	30.7%	***25.1%***	***15.4%***	***5.5%***	***5.4%***	***4.8%***	***3.8%***	***1.7%***	***7.5%***	

c) British Columbia

	Physics	Clinical medicine	Biomedical research	Earth sciences	Biology	Applied science and engi-neering	Chemistry	Mathe-matics	Unknown	Total
United States	110	166	111	100	51	36	12	16	38	**640**
	17.2%	*25.9%*	*17.3%*	*15.6%*	*8.0%*	*5.6%*	*1.9%*	*2.5%*	*5.9%*	
	22.8%	*46.9%*	*48.9%*	*46.1%*	*40.5%*	*39.6%*	*19.0%*	*34.8%*	*36.5%*	***37.4%***
United Kingdom	49	32	18	17	10	7	1	4	7	**145**
	33.8%	*22.1%*	*12.4%*	*11.7%*	*6.9%*	*4.8%*	*0.7%*	*2.8%*	*4.8%*	
	10.1%	*9.0%*	*7.9%*	*7.8%*	*7.9%*	*7.7%*	*1.6%*	*8.7%*	*6.7%*	***8.5%***
Germany	53	10	9	8	3	1	11	2	8	**105**
	50.5%	*9.5%*	*8.6%*	*7.6%*	*2.9%*	*1.0%*	*10.5%*	*1.9%*	*7.6%*	
	11.0%	*2.8%*	*4.0%*	*3.7%*	*2.4%*	*1.1%*	*17.5%*	*4.3%*	*7.7%*	***6.1%***
France	45	18	8	20	2	2	1	2	4	**102**
	44.1%	*17.6%*	*7.8%*	*19.6%*	*2.0%*	*2.0%*	*1.0%*	*2.0%*	*3.9%*	
	9.3%	*5.1%*	*3.5%*	*9.2%*	*1.6%*	*2.2%*	*1.6%*	*4.3%*	*3.8%*	***6.0%***
Japan	45	16	7	10	6	2	5	0	5	**96**
	46.9%	*16.7%*	*7.3%*	*10.4%*	*6.3%*	*2.1%*	*5.2%*	*0.0%*	*5.2%*	
	9.3%	*4.5%*	*3.1%*	*4.6%*	*4.8%*	*2.2%*	*7.9%*	*0.0%*	*4.8%*	***5.6%***
Italy	37	7	3	8	0	4	1	0	2	**62**
	59.7%	*11.3%*	*4.8%*	*12.9%*	*0.0%*	*6.5%*	*1.6%*	*0.0%*	*3.2%*	
	7.7%	*2.0%*	*1.3%*	*3.7%*	*0.0%*	*4.4%*	*1.6%*	*0.0%*	*1.9%*	***3.6%***
Switzerland	39	6	4	2	1	1	5	0	2	**60**
	65.0%	*10.0%*	*6.7%*	*3.3%*	*1.7%*	*1.7%*	*8.3%*	*0.0%*	*3.3%*	
	8.1%	*1.7%*	*1.8%*	*0.9%*	*0.8%*	*1.1%*	*7.9%*	*0.0%*	*1.9%*	***3.5%***
Israel	40	3	1	2	1	1	1	1	3	**53**
	75.5%	*5.7%*	*1.9%*	*3.8%*	*1.9%*	*1.9%*	*1.9%*	*1.9%*	*5.7%*	
	8.3%	*0.8%*	*0.4%*	*0.9%*	*0.8%*	*1.1%*	*1.6%*	*2.2%*	*2.9%*	***3.1%***
Australia	4	14	7	9	6	3	0	4	5	**52**
	7.7%	*26.9%*	*13.5%*	*17.3%*	*11.5%*	*5.8%*	*0.0%*	*7.7%*	*9.6%*	
	0.8%	*4.0%*	*3.1%*	*4.1%*	*4.8%*	*3.3%*	*0.0%*	*8.7%*	*4.8%*	***3.0%***
Netherlands	4	9	7	7	1	2	2	0	5	**37**
	10.8%	*24.3%*	*18.9%*	*18.9%*	*2.7%*	*5.4%*	*5.4%*	*0.0%*	*13.5%*	
	0.8%	*2.5%*	*3.1%*	*3.2%*	*0.8%*	*2.2%*	*3.2%*	*0.0%*	*4.8%*	***2.2%***
Sweden	6	6	8	3	4	0	1	1	6	**35**
	17.1%	*17.1%*	*22.9%*	*8.6%*	*11.4%*	*0.0%*	*2.9%*	*2.9%*	*17.1%*	
	1.2%	*1.7%*	*3.5%*	*1.4%*	*3.2%*	*0.0%*	*1.6%*	*2.2%*	*5.8%*	***2.0%***
Russia	14	0	2	3	2	0	0	0	2	**23**
	60.9%	*0.0%*	*8.7%*	*13.0%*	*8.7%*	*0.0%*	*0.0%*	*0.0%*	*8.7%*	
	2.9%	*0.0%*	*0.9%*	*1.4%*	*1.6%*	*0.0%*	*0.0%*	*0.0%*	*1.9%*	***1.3%***
Spain	4	4	3	3	3	0	0	1	1	**19**
	21.1%	*21.1%*	*15.8%*	*15.8%*	*15.8%*	*0.0%*	*0.0%*	*5.3%*	*5.3%*	
	0.8%	*1.1%*	*1.3%*	*1.4%*	*2.4%*	*0.0%*	*0.0%*	*2.2%*	*1.0%*	***1.1%***
China	2	1	2	1	3	2	2	2	0	**15**
	13.3%	*6.7%*	*13.3%*	*6.7%*	*20.0%*	*13.3%*	*13.3%*	*13.3%*	*0.0%*	
	0.4%	*0.3%*	*0.9%*	*0.5%*	*2.4%*	*2.2%*	*3.2%*	*4.3%*	*0.0%*	***0.9%***
Poland	2	2	0	1	0	1	7	0	0	**13**
	15.4%	*15.4%*	*0.0%*	*7.7%*	*0.0%*	*7.7%*	*53.8%*	*0.0%*	*0.0%*	
	0.4%	*0.6%*	*0.0%*	*0.5%*	*0.0%*	*1.1%*	*11.1%*	*0.0%*	*0.0%*	***0.8%***
Other countries	29	60	37	23	33	29	14	13	16	**254**
	11.4%	*23.6%*	*14.6%*	*9.1%*	*13.0%*	*11.4%*	*5.5%*	*5.1%*	*6.3%*	
	6.0%	*16.9%*	*16.3%*	*10.6%*	*26.2%*	*31.9%*	*22.2%*	*28.3%*	*15.4%*	***14.8%***
Total	**483**	**354**	**227**	**217**	**126**	**91**	**63**	**46**	**104**	**1,711**
	28.2%	***20.7%***	***13.3%***	***12.7%***	***7.4%***	***5.3%***	***3.7%***	***2.7%***	***6.1%***	

d) Alberta

	Physics	Clinical medicine	Biomedical research	Earth sciences	Biology	Applied science and engi-neering	Chemistry	Mathe-matics	Unknown	Total
United States	49	144	91	50	39	21	17	10	41	**462**
	10.6%	*31.2%*	*19.7%*	*10.8%*	*8.4%*	*4.5%*	*3.7%*	*2.2%*	*8.9%*	
	14.5%	*45.0%*	*47.6%*	*33.6%*	*48.8%*	*37.5%*	*34.7%*	*31.3%*	*48.2%*	***35.5%***
United Kingdom	40	30	8	16	6	2	2	5	5	**114**
	35.1%	*26.3%*	*7.0%*	*14.0%*	*5.3%*	*1.8%*	*1.8%*	*4.4%*	*4.4%*	
	11.8%	*9.4%*	*4.2%*	*10.7%*	*7.5%*	*3.6%*	*4.1%*	*15.6%*	*5.9%*	***8.8%***
Germany	35	17	17	14	3	1	5	4	3	**99**
	35.4%	*17.2%*	*17.2%*	*14.1%*	*3.0%*	*1.0%*	*5.1%*	*4.0%*	*3.0%*	
	10.4%	*5.3%*	*8.9%*	*9.4%*	*3.8%*	*1.8%*	*10.2%*	*12.5%*	*3.5%*	***7.6%***
Japan	35	9	8	8	2	0	5	0	9	**76**
	46.1%	*11.8%*	*10.5%*	*10.5%*	*2.6%*	*0.0%*	*6.6%*	*0.0%*	*11.8%*	
	10.4%	*2.8%*	*4.2%*	*5.4%*	*2.5%*	*0.0%*	*10.2%*	*0.0%*	*10.6%*	***5.8%***
France	37	14	5	7	3	3	2	1	3	**75**
	49.3%	*18.7%*	*6.7%*	*9.3%*	*4.0%*	*4.0%*	*2.7%*	*1.3%*	*4.0%*	
	10.9%	*4.4%*	*2.6%*	*4.7%*	*3.8%*	*5.4%*	*4.1%*	*3.1%*	*3.5%*	***5.8%***
Italy	37	9	1	3	1	1	0	2	0	**54**
	68.5%	*16.7%*	*1.9%*	*5.6%*	*1.9%*	*1.9%*	*0.0%*	*3.7%*	*0.0%*	
	10.9%	*2.8%*	*0.5%*	*2.0%*	*1.3%*	*1.8%*	*0.0%*	*6.3%*	*0.0%*	***4.2%***
Israel	31	10	0	1	1	0	3	1	2	**49**
	63.3%	*20.4%*	*0.0%*	*2.0%*	*2.0%*	*0.0%*	*6.1%*	*2.0%*	*4.1%*	
	9.2%	*3.1%*	*0.0%*	*0.7%*	*1.3%*	*0.0%*	*6.1%*	*3.1%*	*2.4%*	***3.8%***
Switzerland	33	5	0	1	1	2	1	0	3	**46**
	71.7%	*10.9%*	*0.0%*	*2.2%*	*2.2%*	*4.3%*	*2.2%*	*0.0%*	*6.5%*	
	9.8%	*1.6%*	*0.0%*	*0.7%*	*1.3%*	*3.6%*	*2.0%*	*0.0%*	*3.5%*	***3.5%***
Australia	3	9	9	6	6	0	0	2	1	**36**
	8.3%	*25.0%*	*25.0%*	*16.7%*	*16.7%*	*0.0%*	*0.0%*	*5.6%*	*2.8%*	
	0.9%	*2.8%*	*4.7%*	*4.0%*	*7.5%*	*0.0%*	*0.0%*	*6.3%*	*1.2%*	***2.8%***
Netherlands	1	9	9	3	0	2	2	0	1	**27**
	3.7%	*33.3%*	*33.3%*	*11.1%*	*0.0%*	*7.4%*	*7.4%*	*0.0%*	*3.7%*	
	0.3%	*2.8%*	*4.7%*	*2.0%*	*0.0%*	*3.6%*	*4.1%*	*0.0%*	*1.2%*	***2.1%***
China	5	2	3	2	2	4	1	3	2	**24**
	20.8%	*8.3%*	*12.5%*	*8.3%*	*8.3%*	*16.7%*	*4.2%*	*12.5%*	*8.3%*	
	1.5%	*0.6%*	*1.6%*	*1.3%*	*2.5%*	*7.1%*	*2.0%*	*9.4%*	*2.4%*	***1.8%***
Russia	9	0	2	5	0	1	5	0	1	**23**
	39.1%	*0.0%*	*8.7%*	*21.7%*	*0.0%*	*4.3%*	*21.7%*	*0.0%*	*4.3%*	
	2.7%	*0.0%*	*1.0%*	*3.4%*	*0.0%*	*1.8%*	*10.2%*	*0.0%*	*1.2%*	***1.8%***
Sweden	3	4	4	7	2	0	0	0	1	**21**
	14.3%	*19.0%*	*19.0%*	*33.3%*	*9.5%*	*0.0%*	*0.0%*	*0.0%*	*4.8%*	
	0.9%	*1.3%*	*2.1%*	*4.7%*	*2.5%*	*0.0%*	*0.0%*	*0.0%*	*1.2%*	***1.6%***
Spain	6	1	1	2	1	0	1	0	1	**13**
	46.2%	*7.7%*	*7.7%*	*15.4%*	*7.7%*	*0.0%*	*7.7%*	*0.0%*	*7.7%*	
	1.8%	*0.3%*	*0.5%*	*1.3%*	*1.3%*	*0.0%*	*2.0%*	*0.0%*	*1.2%*	***1.0%***
Poland	3	1	0	1	0	0	0	1	0	**6**
	50.0%	*16.7%*	*0.0%*	*16.7%*	*0.0%*	*0.0%*	*0.0%*	*16.7%*	*0.0%*	
	0.9%	*0.3%*	*0.0%*	*0.7%*	*0.0%*	*0.0%*	*0.0%*	*3.1%*	*0.0%*	***0.5%***
Other countries	11	56	33	23	13	19	5	3	12	**175**
	6.3%	*32.0%*	*18.9%*	*13.1%*	*7.4%*	*10.9%*	*2.9%*	*1.7%*	*6.9%*	
	3.3%	*17.5%*	*17.3%*	*15.4%*	*16.3%*	*33.9%*	*10.2%*	*9.4%*	*14.1%*	***13.5%***
Total	**338**	**320**	**191**	**149**	**80**	**56**	**49**	**32**	**85**	**1,300**
	26.0%	***24.6%***	***14.7%***	***11.5%***	***6.2%***	***4.3%***	***3.8%***	***2.5%***	***6.5%***	

e) Manitoba

	Physics	Clinical medicine	Biology	Applied science and engi-neering	Biomedical research	Earth sciences	Chemistry	Mathe-matics	Unknown	Total
United States	34	64	17	10	20	7	7	1	12	**172**
	19.8%	*37.2%*	*9.9%*	*5.8%*	*11.6%*	*4.1%*	*4.1%*	*0.6%*	*7.0%*	
	13.7%	*49.6%*	*44.7%*	*27.8%*	*57.1%*	*24.1%*	*43.8%*	*14.3%*	*60.0%*	***30.8%***
United Kingdom	22	10	2	1	1	3	0	0	0	**39**
	56.4%	*25.6%*	*5.1%*	*2.6%*	*2.6%*	*7.7%*	*0.0%*	*0.0%*	*0.0%*	
	8.8%	*7.8%*	*5.3%*	*2.8%*	*2.9%*	*10.3%*	*0.0%*	*0.0%*	*0.0%*	***7.0%***
Germany	25	1	0	0	4	2	1	0	2	**35**
	71.4%	*2.9%*	*0.0%*	*0.0%*	*11.4%*	*5.7%*	*2.9%*	*0.0%*	*5.7%*	
	10.0%	*0.8%*	*0.0%*	*0.0%*	*11.4%*	*6.9%*	*6.3%*	*0.0%*	*10.0%*	***6.3%***
Italy	20	2	1	2	1	6	0	0	1	**33**
	60.6%	*6.1%*	*3.0%*	*6.1%*	*3.0%*	*18.2%*	*0.0%*	*0.0%*	*3.0%*	
	8.0%	*1.6%*	*2.6%*	*5.6%*	*2.9%*	*20.7%*	*0.0%*	*0.0%*	*5.0%*	***5.9%***
Japan	21	2	5	3	1	0	1	0	0	**33**
	63.6%	*6.1%*	*15.2%*	*9.1%*	*3.0%*	*0.0%*	*3.0%*	*0.0%*	*0.0%*	
	8.4%	*1.6%*	*13.2%*	*8.3%*	*2.9%*	*0.0%*	*6.3%*	*0.0%*	*0.0%*	***5.9%***
Russia	21	0	0	3	0	0	0	2	1	**27**
	77.8%	*0.0%*	*0.0%*	*11.1%*	*0.0%*	*0.0%*	*0.0%*	*7.4%*	*3.7%*	
	8.4%	*0.0%*	*0.0%*	*8.3%*	*0.0%*	*0.0%*	*0.0%*	*28.6%*	*5.0%*	***4.8%***
Netherlands	21	1	1	0	0	0	1	0	1	**25**
	84.0%	*4.0%*	*4.0%*	*0.0%*	*0.0%*	*0.0%*	*4.0%*	*0.0%*	*4.0%*	
	8.4%	*0.8%*	*2.6%*	*0.0%*	*0.0%*	*0.0%*	*6.3%*	*0.0%*	*5.0%*	***4.5%***
Spain	20	2	1	0	0	0	0	0	1	**24**
	83.3%	*8.3%*	*4.2%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*4.2%*	
	8.0%	*1.6%*	*2.6%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*5.0%*	***4.3%***
Israel	19	0	0	0	0	0	1	0	0	**20**
	95.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*5.0%*	*0.0%*	*0.0%*	
	7.6%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*6.3%*	*0.0%*	*0.0%*	***3.6%***
Poland	19	0	0	0	0	0	0	0	0	**19**
	100.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	7.6%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***3.4%***
France	3	4	0	1	2	1	0	1	0	**12**
	25.0%	*33.3%*	*0.0%*	*8.3%*	*16.7%*	*8.3%*	*0.0%*	*8.3%*	*0.0%*	
	1.2%	*3.1%*	*0.0%*	*2.8%*	*5.7%*	*3.4%*	*0.0%*	*14.3%*	*0.0%*	***2.1%***
China	1	1	3	4	0	0	0	0	0	**9**
	11.1%	*11.1%*	*33.3%*	*44.4%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.4%	*0.8%*	*7.9%*	*11.1%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***1.6%***
Sweden	0	5	0	1	1	2	0	0	0	**9**
	0.0%	*55.6%*	*0.0%*	*11.1%*	*11.1%*	*22.2%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*3.9%*	*0.0%*	*2.8%*	*2.9%*	*6.9%*	*0.0%*	*0.0%*	*0.0%*	***1.6%***
Australia	0	4	1	0	2	1	0	0	0	**8**
	0.0%	*50.0%*	*12.5%*	*0.0%*	*25.0%*	*12.5%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*3.1%*	*2.6%*	*0.0%*	*5.7%*	*3.4%*	*0.0%*	*0.0%*	*0.0%*	***1.4%***
Switzerland	2	1	0	0	0	0	0	0	0	**3**
	66.7%	*33.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.8%	*0.8%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***0.5%***
Other countries	21	32	7	11	3	7	5	3	2	**91**
	23.1%	*35.2%*	*7.7%*	*12.1%*	*3.3%*	*7.7%*	*5.5%*	*3.3%*	*2.2%*	
	8.4%	*24.8%*	*18.4%*	*30.6%*	*8.6%*	*24.1%*	*31.3%*	*42.9%*	*10.0%*	***16.3%***
Total	**249**	**129**	**38**	**36**	**35**	**29**	**16**	**7**	**20**	**559**
	44.5%	***23.1%***	***6.8%***	***6.4%***	***6.3%***	***5.2%***	***2.9%***	***1.3%***	***3.6%***	

f) Nova Scotia

	Earth sciences	Clinical medicine	Biomedical research	Biology	Physics	Chemistry	Mathe-matics	Applied science and engi-neering	Unknown	Total
United States	36	40	25	24	7	7	7	3	12	**161**
	22.4%	*24.8%*	*15.5%*	*14.9%*	*4.3%*	*4.3%*	*4.3%*	*1.9%*	*7.5%*	
	53.7%	*59.7%*	*43.1%*	*51.1%*	*17.5%*	*26.9%*	*43.8%*	*25.0%*	*44.4%*	***44.7%***
United Kingdom	3	9	4	8	1	2	2	0	2	**31**
	9.7%	*29.0%*	*12.9%*	*25.8%*	*3.2%*	*6.5%*	*6.5%*	*0.0%*	*6.5%*	
	4.5%	*13.4%*	*6.9%*	*17.0%*	*2.5%*	*7.7%*	*12.5%*	*0.0%*	*7.4%*	***8.6%***
France	3	1	6	2	1	1	0	2	1	**17**
	17.6%	*5.9%*	*35.3%*	*11.8%*	*5.9%*	*5.9%*	*0.0%*	*11.8%*	*5.9%*	
	4.5%	*1.5%*	*10.3%*	*4.3%*	*2.5%*	*3.8%*	*0.0%*	*16.7%*	*3.7%*	***4.7%***
Germany	4	1	1	1	4	4	0	0	1	**16**
	25.0%	*6.3%*	*6.3%*	*6.3%*	*25.0%*	*25.0%*	*0.0%*	*0.0%*	*6.3%*	
	6.0%	*1.5%*	*1.7%*	*2.1%*	*10.0%*	*15.4%*	*0.0%*	*0.0%*	*3.7%*	***4.4%***
Sweden	4	0	1	1	6	3	0	0	1	**16**
	25.0%	*0.0%*	*6.3%*	*6.3%*	*37.5%*	*18.8%*	*0.0%*	*0.0%*	*6.3%*	
	6.0%	*0.0%*	*1.7%*	*2.1%*	*15.0%*	*11.5%*	*0.0%*	*0.0%*	*3.7%*	***4.4%***
Russia	5	0	3	1	5	0	0	0	1	**15**
	33.3%	*0.0%*	*20.0%*	*6.7%*	*33.3%*	*0.0%*	*0.0%*	*0.0%*	*6.7%*	
	7.5%	*0.0%*	*5.2%*	*2.1%*	*12.5%*	*0.0%*	*0.0%*	*0.0%*	*3.7%*	***4.2%***
China	1	0	0	2	2	0	5	1	0	**11**
	9.1%	*0.0%*	*0.0%*	*18.2%*	*18.2%*	*0.0%*	*45.5%*	*9.1%*	*0.0%*	
	1.5%	*0.0%*	*0.0%*	*4.3%*	*5.0%*	*0.0%*	*31.3%*	*8.3%*	*0.0%*	***3.1%***
Australia	2	1	2	1	1	1	1	0	0	**9**
	22.2%	*11.1%*	*22.2%*	*11.1%*	*11.1%*	*11.1%*	*11.1%*	*0.0%*	*0.0%*	
	3.0%	*1.5%*	*3.4%*	*2.1%*	*2.5%*	*3.8%*	*6.3%*	*0.0%*	*0.0%*	***2.5%***
Japan	1	0	1	2	2	2	0	0	1	**9**
	11.1%	*0.0%*	*11.1%*	*22.2%*	*22.2%*	*22.2%*	*0.0%*	*0.0%*	*11.1%*	
	1.5%	*0.0%*	*1.7%*	*4.3%*	*5.0%*	*7.7%*	*0.0%*	*0.0%*	*3.7%*	***2.5%***
Netherlands	1	3	2	0	1	0	0	0	2	**9**
	11.1%	*33.3%*	*22.2%*	*0.0%*	*11.1%*	*0.0%*	*0.0%*	*0.0%*	*22.2%*	
	1.5%	*4.5%*	*3.4%*	*0.0%*	*2.5%*	*0.0%*	*0.0%*	*0.0%*	*7.4%*	***2.5%***
Israel	0	0	1	1	1	1	0	2	2	**8**
	0.0%	*0.0%*	*12.5%*	*12.5%*	*12.5%*	*12.5%*	*0.0%*	*25.0%*	*25.0%*	
	0.0%	*0.0%*	*1.7%*	*2.1%*	*2.5%*	*3.8%*	*0.0%*	*16.7%*	*7.4%*	***2.2%***
Switzerland	0	0	1	2	1	1	0	0	0	**5**
	0.0%	*0.0%*	*20.0%*	*40.0%*	*20.0%*	*20.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*0.0%*	*1.7%*	*4.3%*	*2.5%*	*3.8%*	*0.0%*	*0.0%*	*0.0%*	***1.4%***
Italy	0	2	2	0	0	0	0	0	0	**4**
	0.0%	*50.0%*	*50.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*3.0%*	*3.4%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***1.1%***
Spain	0	0	2	0	1	0	0	0	0	**3**
	0.0%	*0.0%*	*66.7%*	*0.0%*	*33.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*0.0%*	*3.4%*	*0.0%*	*2.5%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***0.8%***
Poland	0	1	0	0	1	0	0	0	0	**2**
	0.0%	*50.0%*	*0.0%*	*0.0%*	*50.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*1.5%*	*0.0%*	*0.0%*	*2.5%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***0.6%***
Other countries	7	9	7	2	6	4	1	4	4	**44**
	15.9%	*20.5%*	*15.9%*	*4.5%*	*13.6%*	*9.1%*	*2.3%*	*9.1%*	*9.1%*	
	10.4%	*13.4%*	*12.1%*	*4.3%*	*15.0%*	*15.4%*	*6.3%*	*33.3%*	*14.8%*	***12.2%***
Total	**67**	**67**	**58**	**47**	**40**	**26**	**16**	**12**	**27**	**360**
	18.6%	***18.6%***	***16.1%***	***13.1%***	***11.1%***	***7.2%***	***4.4%***	***3.3%***	***7.5%***	

g) Saskatchewan

	Clinical medicine	Physics	Earth sciences	Biology	Biomedical research	Applied science and engi-neering	Chemistry	Mathe-matics	Unknown	Total
United States	39	17	20	20	17	7	3	2	14	**139**
	28.1%	*12.2%*	*14.4%*	*14.4%*	*12.2%*	*5.0%*	*2.2%*	*1.4%*	*10.1%*	
	37.5%	*32.7%*	*39.2%*	*45.5%*	*53.1%*	*46.7%*	*33.3%*	*25.0%*	*56.0%*	***40.9%***
United Kingdom	7	1	4	2	3	1	0	0	1	**19**
	36.8%	*5.3%*	*21.1%*	*10.5%*	*15.8%*	*5.3%*	*0.0%*	*0.0%*	*5.3%*	
	6.7%	*1.9%*	*7.8%*	*4.5%*	*9.4%*	*6.7%*	*0.0%*	*0.0%*	*4.0%*	***5.6%***
Germany	4	8	1	1	2	0	0	1	0	**17**
	23.5%	*47.1%*	*5.9%*	*5.9%*	*11.8%*	*0.0%*	*0.0%*	*5.9%*	*0.0%*	
	3.8%	*15.4%*	*2.0%*	*2.3%*	*6.3%*	*0.0%*	*0.0%*	*12.5%*	*0.0%*	***5.0%***
Japan	1	3	6	1	1	0	2	0	0	**14**
	7.1%	*21.4%*	*42.9%*	*7.1%*	*7.1%*	*0.0%*	*14.3%*	*0.0%*	*0.0%*	
	1.0%	*5.8%*	*11.8%*	*2.3%*	*3.1%*	*0.0%*	*22.2%*	*0.0%*	*0.0%*	***4.1%***
Italy	3	6	1	1	0	0	0	0	1	**12**
	25.0%	*50.0%*	*8.3%*	*8.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*8.3%*	
	2.9%	*11.5%*	*2.0%*	*2.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*4.0%*	***3.5%***
Australia	4	1	1	1	0	2	0	0	0	**9**
	44.4%	*11.1%*	*11.1%*	*11.1%*	*0.0%*	*22.2%*	*0.0%*	*0.0%*	*0.0%*	
	3.8%	*1.9%*	*2.0%*	*2.3%*	*0.0%*	*13.3%*	*0.0%*	*0.0%*	*0.0%*	***2.6%***
France	1	0	4	0	2	0	0	0	1	**8**
	12.5%	*0.0%*	*50.0%*	*0.0%*	*25.0%*	*0.0%*	*0.0%*	*0.0%*	*12.5%*	
	1.0%	*0.0%*	*7.8%*	*0.0%*	*6.3%*	*0.0%*	*0.0%*	*0.0%*	*4.0%*	***2.4%***
Russia	0	2	5	0	0	0	0	0	1	**8**
	0.0%	*25.0%*	*62.5%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*12.5%*	
	0.0%	*3.8%*	*9.8%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*4.0%*	***2.4%***
Netherlands	1	4	0	0	0	0	0	0	1	**6**
	16.7%	*66.7%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*16.7%*	
	1.0%	*7.7%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*4.0%*	***1.8%***
Spain	3	1	0	1	0	0	0	0	1	**6**
	50.0%	*16.7%*	*0.0%*	*16.7%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*16.7%*	
	2.9%	*1.9%*	*0.0%*	*2.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*4.0%*	***1.8%***
Israel	3	0	1	0	0	0	1	0	0	**5**
	60.0%	*0.0%*	*20.0%*	*0.0%*	*0.0%*	*0.0%*	*20.0%*	*0.0%*	*0.0%*	
	2.9%	*0.0%*	*2.0%*	*0.0%*	*0.0%*	*0.0%*	*11.1%*	*0.0%*	*0.0%*	***1.5%***
China	0	0	0	2	0	1	0	1	0	**4**
	0.0%	*0.0%*	*0.0%*	*50.0%*	*0.0%*	*25.0%*	*0.0%*	*25.0%*	*0.0%*	
	0.0%	*0.0%*	*0.0%*	*4.5%*	*0.0%*	*6.7%*	*0.0%*	*12.5%*	*0.0%*	***1.2%***
Sweden	2	0	0	0	1	0	0	0	0	**3**
	66.7%	*0.0%*	*0.0%*	*0.0%*	*33.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	1.9%	*0.0%*	*0.0%*	*0.0%*	*3.1%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***0.9%***
Poland	1	0	0	1	0	0	0	0	0	**2**
	50.0%	*0.0%*	*0.0%*	*50.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	1.0%	*0.0%*	*0.0%*	*2.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***0.6%***
Switzerland	1	0	0	0	0	0	0	0	0	**1**
	100.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	1.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***0.3%***
Other countries	34	9	8	14	6	4	3	4	5	**87**
	39.1%	*10.3%*	*9.2%*	*16.1%*	*6.9%*	*4.6%*	*3.4%*	*4.6%*	*5.7%*	
	32.7%	*17.3%*	*15.7%*	*31.8%*	*18.8%*	*26.7%*	*33.3%*	*50.0%*	*20.0%*	***25.6%***
Total	**104**	**52**	**51**	**44**	**32**	**15**	**9**	**8**	**25**	**340**
	30.6%	***15.3%***	***15.0%***	***12.9%***	***9.4%***	***4.4%***	***2.6%***	***2.4%***	***7.4%***	

h) New Brunswick

	Biology	Physics	Earth sciences	Chemistry	Biomedical research	Clinical medicine	Applied science and engi-neering	Mathe-matics	Unknown	Total
United States	15	8	8	7	2	5	1	1	4	**51**
	29.4%	*15.7%*	*15.7%*	*13.7%*	*3.9%*	*9.8%*	*2.0%*	*2.0%*	*7.8%*	
	41.7%	*32.0%*	*38.1%*	*36.8%*	*28.6%*	*71.4%*	*20.0%*	*100.0%*	*36.4%*	***38.6%***
France	2	0	2	1	3	1	0	0	1	**10**
	20.0%	*0.0%*	*20.0%*	*10.0%*	*30.0%*	*10.0%*	*0.0%*	*0.0%*	*10.0%*	
	5.6%	*0.0%*	*9.5%*	*5.3%*	*42.9%*	*14.3%*	*0.0%*	*0.0%*	*9.1%*	***7.6%***
Japan	1	2	0	4	0	0	0	0	0	**7**
	14.3%	*28.6%*	*0.0%*	*57.1%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	2.8%	*8.0%*	*0.0%*	*21.1%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***5.3%***
United Kingdom	1	4	1	0	1	0	0	0	0	**7**
	14.3%	*57.1%*	*14.3%*	*0.0%*	*14.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	2.8%	*16.0%*	*4.8%*	*0.0%*	*14.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***5.3%***
Germany	0	1	2	3	0	0	0	0	0	**6**
	0.0%	*16.7%*	*33.3%*	*50.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*4.0%*	*9.5%*	*15.8%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***4.5%***
Sweden	3	0	0	0	0	0	1	0	2	**6**
	50.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*16.7%*	*0.0%*	*33.3%*	
	8.3%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*20.0%*	*0.0%*	*18.2%*	***4.5%***
Netherlands	2	0	2	0	0	0	0	0	0	**4**
	50.0%	*0.0%*	*50.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	5.6%	*0.0%*	*9.5%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***3.0%***
Australia	0	1	1	1	0	0	0	0	0	**3**
	0.0%	*33.3%*	*33.3%*	*33.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*4.0%*	*4.8%*	*5.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***2.3%***
Poland	1	2	0	0	0	0	0	0	0	**3**
	33.3%	*66.7%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	2.8%	*8.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***2.3%***
Russia	0	0	0	0	0	0	0	0	2	**2**
	0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*100.0%*	
	0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*18.2%*	***1.5%***
Israel	0	0	0	1	0	0	0	0	0	**1**
	0.0%	*0.0%*	*0.0%*	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*0.0%*	*0.0%*	*5.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***0.8%***
Italy	0	0	1	0	0	0	0	0	0	**1**
	0.0%	*0.0%*	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*0.0%*	*4.8%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***0.8%***
China	0	0	0	0	0	0	1	0	0	**1**
	0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*100.0%*	*0.0%*	*0.0%*	
	0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*20.0%*	*0.0%*	*0.0%*	***0.8%***
Spain	1	0	0	0	0	0	0	0	0	**1**
	100.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	2.8%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***0.8%***
Switzerland	0	0	1	0	0	0	0	0	0	**1**
	0.0%	*0.0%*	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*0.0%*	*4.8%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***0.8%***
Other countries	10	7	3	2	1	1	2	0	2	**28**
	35.7%	*25.0%*	*10.7%*	*7.1%*	*3.6%*	*3.6%*	*7.1%*	*0.0%*	*7.1%*	
	27.8%	*28.0%*	*14.3%*	*10.5%*	*14.3%*	*14.3%*	*40.0%*	*0.0%*	*18.2%*	***21.2%***
Total	**36**	**25**	**21**	**19**	**7**	**7**	**5**	**1**	**11**	**132**
	27.3%	***18.9%***	***15.9%***	***14.4%***	***5.3%***	***5.3%***	***3.8%***	***0.8%***	***8.3%***	

i) Newfoundland

	Clinical medicine	Earth sciences	Biomedical research	Chemistry	Biology	Mathe-matics	Applied science and engi-neering	Unknown	Total
United States	13	7	11	1	4	0	0	2	**38**
	34.2%	*18.4%*	*28.9%*	*2.6%*	*10.5%*	*0.0%*	*0.0%*	*5.3%*	
	52.0%	*30.4%*	*64.7%*	*7.7%*	*44.4%*	*0.0%*	*0.0%*	*33.3%*	***35.5%***
United Kingdom	4	2	1	1	1	0	0	0	**9**
	44.4%	*22.2%*	*11.1%*	*11.1%*	*11.1%*	*0.0%*	*0.0%*	*0.0%*	
	16.0%	*8.7%*	*5.9%*	*7.7%*	*11.1%*	*0.0%*	*0.0%*	*0.0%*	***8.4%***
France	3	3	1	1	0	0	0	0	**8**
	37.5%	*37.5%*	*12.5%*	*12.5%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	12.0%	*13.0%*	*5.9%*	*7.7%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***7.5%***
Australia	1	4	0	0	1	0	0	0	**6**
	16.7%	*66.7%*	*0.0%*	*0.0%*	*16.7%*	*0.0%*	*0.0%*	*0.0%*	
	4.0%	*17.4%*	*0.0%*	*0.0%*	*11.1%*	*0.0%*	*0.0%*	*0.0%*	***5.6%***
Sweden	1	0	0	0	1	0	1	2	**5**
	20.0%	*0.0%*	*0.0%*	*0.0%*	*20.0%*	*0.0%*	*20.0%*	*40.0%*	
	4.0%	*0.0%*	*0.0%*	*0.0%*	*11.1%*	*0.0%*	*16.7%*	*33.3%*	***4.7%***
China	1	0	0	2	0	0	1	0	**4**
	25.0%	*0.0%*	*0.0%*	*50.0%*	*0.0%*	*0.0%*	*25.0%*	*0.0%*	
	4.0%	*0.0%*	*0.0%*	*15.4%*	*0.0%*	*0.0%*	*16.7%*	*0.0%*	***3.7%***
Germany	0	1	2	0	0	0	0	0	**3**
	0.0%	*33.3%*	*66.7%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*4.3%*	*11.8%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***2.8%***
Poland	0	0	0	0	0	2	0	0	**2**
	0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*100.0%*	*0.0%*	*0.0%*	
	0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*25.0%*	*0.0%*	*0.0%*	***1.9%***
Israel	0	0	0	1	0	0	0	0	**1**
	0.0%	*0.0%*	*0.0%*	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*0.0%*	*0.0%*	*7.7%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***0.9%***
Italy	0	0	0	1	0	0	0	0	**1**
	0.0%	*0.0%*	*0.0%*	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*0.0%*	*0.0%*	*7.7%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***0.9%***
Japan	0	0	0	0	0	0	1	0	**1**
	0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*100.0%*	*0.0%*	
	0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*16.7%*	*0.0%*	***0.9%***
Netherlands	0	1	0	0	0	0	0	0	**1**
	0.0%	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*4.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	***0.9%***
Other countries	2	5	2	6	2	6	3	2	**28**
	7.1%	*17.9%*	*7.1%*	*21.4%*	*7.1%*	*21.4%*	*10.7%*	*7.1%*	
	8.0%	*21.7%*	*11.8%*	*46.2%*	*22.2%*	*75.0%*	*50.0%*	*33.3%*	***26.2%***
Total	**25**	**23**	**17**	**13**	**9**	**8**	**6**	**6**	**107**
	23.4%	**21.5%**	**15.9%**	**12.1%**	**8.4%**	**7.5%**	**5.6%**	**5.6%**	

j) Prince Edward Island

	Clinical medicine	Biology	Chemistry	Physics	Biomedical research	Total
United States	9	1	1	0	0	**11**
	81.8%	*9.1%*	*9.1%*	*0.0%*	*0.0%*	
	90.0%	*16.7%*	*33.3%*	*0.0%*	*0.0%*	***47.8%***
United Kingdom	0	0	0	3	0	**3**
	0.0%	*0.0%*	*0.0%*	*100.0%*	*0.0%*	
	0.0%	*0.0%*	*0.0%*	*100.0%*	*0.0%*	***13.0%***
Netherlands	0	1	0	0	1	**2**
	0.0%	*50.0%*	*0.0%*	*0.0%*	*50.0%*	
	0.0%	*16.7%*	*0.0%*	*0.0%*	*100.0%*	***8.7%***
Australia	0	1	0	0	0	**1**
	0.0%	*100.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*16.7%*	*0.0%*	*0.0%*	*0.0%*	***4.3%***
Germany	0	1	0	0	0	**1**
	0.0%	*100.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*16.7%*	*0.0%*	*0.0%*	*0.0%*	***4.3%***
Israel	0	0	1	0	0	**1**
	0.0%	*0.0%*	*100.0%*	*0.0%*	*0.0%*	
	0.0%	*0.0%*	*33.3%*	*0.0%*	*0.0%*	***4.3%***
Japan	0	1	0	0	0	**1**
	0.0%	*100.0%*	*0.0%*	*0.0%*	*0.0%*	
	0.0%	*16.7%*	*0.0%*	*0.0%*	*0.0%*	***4.3%***
Other countries	1	1	1	0	0	**3**
	33.3%	*33.3%*	*33.3%*	*0.0%*	*0.0%*	
	10.0%	*16.7%*	*33.3%*	*0.0%*	*0.0%*	***13.0%***
Total	**10**	**6**	**3**	**3**	**1**	**23**
	43.5%	***26.1%***	***13.0%***	***13.0%***	***4.3%***	

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 15: RATE OF INTERPROVINCIAL COLLABORATION (1995)

	Ontario	Quebec	British Columbia	Alberta	Manitoba	Nova Scotia	Saskat-chewan	New Brunswick	Newfound-land	Prince Edward Island	Northwest Territories	Yukon	Total
Ontario		601	331	281	136	112	110	47	44	15	3	2	**1,682**
		35.7%	*19.7%*	*16.7%*	*8.1%*	*6.7%*	*6.5%*	*2.8%*	*2.6%*	*0.9%*	*0.2%*	*0.1%*	
Quebec	601		145	123	55	53	35	30	24	2	1	0	**1,069**
	56.2%		*13.6%*	*11.5%*	*5.1%*	*5.0%*	*3.3%*	*2.8%*	*2.2%*	*0.2%*	*0.1%*	*0.0%*	
British Columbia	331	145		174	44	54	23	10	15	4	0	2	**802**
	41.3%	*18.1%*		*21.7%*	*5.5%*	*6.7%*	*2.9%*	*1.2%*	*1.9%*	*0.5%*	*0.0%*	*0.2%*	
Alberta	281	123	174		53	38	71	4	12	4	2	3	**765**
	36.7%	*16.1%*	*22.7%*		*6.9%*	*5.0%*	*9.3%*	*0.5%*	*1.6%*	*0.5%*	*0.3%*	*0.4%*	
Manitoba	136	55	44	53		14	20	8	4	5	2	0	**341**
	39.9%	*16.1%*	*12.9%*	*15.5%*		*4.1%*	*5.9%*	*2.3%*	*1.2%*	*1.5%*	*0.6%*	*0.0%*	
Nova Scotia	112	53	54	38	14		7	28	16	14	0	0	**336**
	33.3%	*15.8%*	*16.1%*	*11.3%*	*4.2%*		*2.1%*	*8.3%*	*4.8%*	*4.2%*	*0.0%*	*0.0%*	
Saskatchewan	110	35	23	71	20	7		2	3	1	3	0	**275**
	40.0%	*12.7%*	*8.4%*	*25.8%*	*7.3%*	*2.5%*		*0.7%*	*1.1%*	*0.4%*	*1.1%*	*0.0%*	
New Brunswick	47	30	10	4	8	28	2		7	10	0	0	**146**
	32.2%	*20.5%*	*6.8%*	*2.7%*	*5.5%*	*19.2%*	*1.4%*		*4.8%*	*6.8%*	*0.0%*	*0.0%*	
Newfoundland	44	24	15	12	4	16	3	7		1	0	1	**127**
	34.6%	*18.9%*	*11.8%*	*9.4%*	*3.1%*	*12.6%*	*2.4%*	*5.5%*		*0.8%*	*0.0%*	*0.8%*	
Prince Edward Island	15	2	4	4	5	14	1	10	1		0	0	**56**
	26.8%	*3.6%*	*7.1%*	*7.1%*	*8.9%*	*25.0%*	*1.8%*	*17.9%*	*1.8%*		*0.0%*	*0.0%*	
Northwest Territories	3	1	0	2	2	0	3	0	0	0		0	**11**
	27.3%	*9.1%*	*0.0%*	*18.2%*	*18.2%*	*0.0%*	*27.3%*	*0.0%*	*0.0%*	*0.0%*		*0.0%*	
Yukon	2	0	2	3	0	0	0	0	1	0	0		**8**
	25.0%	*0.0%*	*25.0%*	*37.5%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*12.5%*	*0.0%*	*0.0%*		
Total	**1,682**	**1,069**	**802**	**765**	**341**	**336**	**275**	**146**	**127**	**56**	**11**	**8**	**5,618**

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 16: INTERSECTORAL, INTRASECTORAL AND INTRA-INSTITUTIONAL COLLABORATION BY SECTOR, CANADA AND PROVINCES (1995)

	University	Hospital	Federal government	Corporate	Provincial government	Other	Unknown	Total
Canada								
Intersectoral collaboration	21.9%	50.4%	40.1%	54.1%	62.7%	64.6%	68.1%	31.8%
Intrasectoral collaboration	9.3%	12.7%	3.8%	5.3%	3.8%	3.6%	2.8%	8.8%
Intra-institutional collaboration	39.1%	20.5%	28.4%	16.8%	17.5%	12.6%	8.5%	32.9%
Other types of collaboration	22.8%	12.9%	17.9%	14.8%	9.4%	11.0%	11.7%	19.8%
Without collaboration	6.9%	3.4%	9.7%	9.1%	6.5%	8.2%	8.9%	6.8%
British Columbia								
Intersectoral collaboration	13.5%	42.1%	25.1%	47.8%	44.4%	47.4%	66.7%	21.4%
Intrasectoral collaboration	4.5%	9.5%	2.1%	5.7%	2.8%	0.0%	0.0%	4.7%
Intra-institutional collaboration	36.1%	21.8%	21.2%	8.3%	20.8%	15.8%	2.4%	30.8%
Other types of collaboration	37.7%	24.4%	40.1%	22.3%	25.8%	24.6%	19.0%	35.0%
Without collaboration	8.2%	2.2%	11.5%	15.9%	6.2%	12.3%	11.9%	8.1%
Alberta								
Intersectoral collaboration	9.3%	48.0%	24.5%	44.6%	47.6%	56.9%	53.8%	17.0%
Intrasectoral collaboration	1.5%	11.6%	1.2%	1.7%	3.2%	5.2%	0.0%	2.3%
Intra-institutional collaboration	43.5%	18.7%	33.9%	15.7%	22.6%	17.2%	15.4%	38.6%
Other types of collaboration	39.0%	17.3%	32.3%	29.8%	21.8%	17.2%	23.1%	35.5%
Without collaboration	6.8%	4.4%	8.2%	8.3%	4.8%	3.4%	7.7%	6.7%
Saskatchewan								
Intersectoral collaboration	10.0%	40.0%	24.3%	47.4%	56.5%	44.0%	66.7%	16.6%
Intrasectoral collaboration	0.4%	0.0%	2.6%	10.5%	0.0%	0.0%	0.0%	0.9%
Intra-institutional collaboration	42.7%	30.0%	36.2%	0.0%	4.3%	20.0%	16.7%	38.8%
Other types of collaboration	39.6%	23.3%	27.0%	42.1%	34.8%	28.0%	0.0%	36.3%
Without collaboration	7.3%	6.7%	9.9%	0.0%	4.3%	8.0%	16.7%	7.5%
Manitoba								
Intersectoral collaboration	17.1%	60.0%	21.0%	40.0%	52.9%	58.1%	50.0%	23.8%
Intrasectoral collaboration	1.2%	1.8%	0.9%	0.0%	5.9%	6.5%	0.0%	1.4%
Intra-institutional collaboration	41.2%	16.4%	26.5%	6.7%	5.9%	0.0%	12.5%	33.9%
Other types of collaboration	35.6%	19.1%	41.1%	50.0%	35.3%	32.3%	37.5%	35.4%
Without collaboration	4.9%	2.7%	10.5%	3.3%	0.0%	3.2%	0.0%	5.5%
Ontario								
Intersectoral collaboration	21.2%	48.0%	23.8%	47.2%	60.8%	60.7%	61.0%	29.2%
Intrasectoral collaboration	6.0%	12.1%	3.8%	4.2%	2.7%	3.6%	6.1%	6.5%
Intra-institutional collaboration	36.7%	19.6%	24.8%	15.0%	17.1%	5.8%	6.1%	30.0%
Other types of collaboration	28.6%	16.3%	37.1%	23.7%	13.3%	21.2%	15.9%	26.8%
Without collaboration	7.5%	4.0%	10.6%	9.9%	6.1%	8.6%	11.0%	7.4%
Quebec								
Intersectoral collaboration	23.7%	47.5%	44.4%	36.2%	63.2%	48.0%	65.5%	32.0%
Intrasectoral collaboration	8.0%	10.0%	1.3%	3.5%	5.3%	0.7%	0.0%	7.7%
Intra-institutional collaboration	34.7%	21.1%	23.8%	26.1%	14.7%	28.4%	13.8%	30.1%
Other types of collaboration	28.7%	18.9%	24.3%	28.9%	9.5%	14.9%	17.2%	25.7%
Without collaboration	4.9%	2.5%	6.2%	5.3%	7.4%	8.1%	3.4%	4.5%
Newfoundland								
Intersectoral collaboration	10.3%	70.6%	33.3%	62.5%	50.0%	0.0%	25.0%	17.9%
Intrasectoral collaboration	0.3%	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	0.5%
Intra-institutional collaboration	40.3%	5.9%	29.8%	25.0%	0.0%	0.0%	0.0%	36.1%
Other types of collaboration	42.3%	23.5%	29.8%	12.5%	33.3%	0.0%	75.0%	39.3%
Without collaboration	6.8%	0.0%	5.3%	0.0%	16.7%	0.0%	0.0%	6.2%
Prince Edward Island								
Intersectoral collaboration	4.8%	0.0%	32.0%	100.0%	42.9%	0.0%	0.0%	15.8%
Intrasectoral collaboration	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Intra-institutional collaboration	33.3%	0.0%	24.0%	0.0%	0.0%	0.0%	0.0%	26.7%
Other types of collaboration	55.6%	100.0%	36.0%	0.0%	14.3%	50.0%	100.0%	47.5%
Without collaboration	6.3%	0.0%	8.0%	0.0%	42.9%	50.0%	0.0%	9.9%
New Brunswick								
Intersectoral collaboration	4.5%	20.0%	11.1%	26.3%	50.0%	15.4%	25.0%	8.8%
Intrasectoral collaboration	0.4%	0.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.5%
Intra-institutional collaboration	42.0%	0.0%	27.2%	5.3%	0.0%	7.7%	25.0%	34.1%
Other types of collaboration	48.6%	80.0%	54.3%	47.4%	37.5%	61.5%	50.0%	50.4%
Without collaboration	4.5%	0.0%	6.2%	21.1%	12.5%	15.4%	0.0%	6.1%
Nova Scotia								
Intersectoral collaboration	11.9%	53.9%	24.6%	15.8%	66.7%	75.0%	66.7%	18.7%
Intrasectoral collaboration	2.0%	2.2%	2.3%	0.0%	0.0%	0.0%	0.0%	2.0%
Intra-institutional collaboration	35.0%	11.2%	24.6%	15.8%	0.0%	0.0%	0.0%	30.3%
Other types of collaboration	43.6%	27.0%	40.6%	57.9%	25.0%	25.0%	33.3%	41.6%
Without collaboration	7.6%	5.6%	8.0%	10.5%	8.3%	0.0%	0.0%	7.5%

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 17: RATE OF COLLABORATION BETWEEN SECTORS IN CANADA (1995)

	University	Hospital	Federal government	Corporate	Provincial government	Other	Unknown	Total
University	0	2,410	1,164	553	371	365	88	**4,951**
	0.0%	*48.7%*	*23.5%*	*11.2%*	*7.5%*	*7.4%*	*1.8%*	
Hospital	2,410	0	61	81	93	86	50	**2,781**
	86.7%	*0.0%*	*2.2%*	*2.9%*	*3.3%*	*3.1%*	*1.8%*	
Federal government	1,164	61	0	128	98	51	25	**1,527**
	76.2%	*4.0%*	*0.0%*	*8.4%*	*6.4%*	*3.3%*	*1.6%*	
Corporate	553	81	128	0	39	34	11	**846**
	65.4%	*9.6%*	*15.1%*	*0.0%*	*4.6%*	*4.0%*	*1.3%*	
Provincial government	371	93	98	39	0	37	21	**659**
	56.3%	*14.1%*	*14.9%*	*5.9%*	*0.0%*	*5.6%*	*3.2%*	
Other	365	86	51	34	37	0	16	**589**
	62.0%	*14.6%*	*8.7%*	*5.8%*	*6.3%*	*0.0%*	*2.7%*	
Unknown	88	50	25	11	21	16	0	**211**
	41.7%	*23.7%*	*11.8%*	*5.2%*	*10.0%*	*7.6%*	*0.0%*	
Total	**4,951**	**2,781**	**1,527**	**846**	**659**	**589**	**211**	**11,564**
	42.8%	***24.0%***	***13.2%***	***7.3%***	***5.7%***	***5.1%***	***1.8%***	

Source: Observatoire des Sciences et des Technologies (CIRST).

TABLE A 18: RATE OF COLLABORATION BETWEEN SECTORS BY PROVINCE (1995)

a) British Columbia

	University	Hospital	Provincial government	Federal government	Corporate	Other	Unknown	Total
University	0	161	66	67	63	20	18	**395**
	0.0%	*40.8%*	*16.7%*	*17.0%*	*15.9%*	*5.1%*	*4.6%*	
Hospital	161	0	15	3	1	7	8	**195**
	82.6%	*0.0%*	*7.7%*	*1.5%*	*0.5%*	*3.6%*	*4.1%*	
Provincial government	66	15	0	7	6	0	1	**95**
	69.5%	*15.8%*	*0.0%*	*7.4%*	*6.3%*	*0.0%*	*1.1%*	
Federal government	67	3	7	0	12	1	4	**94**
	71.3%	*3.2%*	*7.4%*	*0.0%*	*12.8%*	*1.1%*	*4.3%*	
Corporate	63	1	6	12	0	2	1	**85**
	74.1%	*1.2%*	*7.1%*	*14.1%*	*0.0%*	*2.4%*	*1.2%*	
Other	20	7	0	1	2	0	7	**37**
	54.1%	*18.9%*	*0.0%*	*2.7%*	*5.4%*	*0.0%*	*18.9%*	
Unknown	18	8	1	4	1	7	0	**39**
	46.2%	*20.5%*	*2.6%*	*10.3%*	*2.6%*	*17.9%*	*0.0%*	
Total	**395**	**195**	**95**	**94**	**85**	**37**	**39**	**940**
	42.0%	***20.7%***	***10.1%***	***10.0%***	***9.0%***	***3.9%***	***4.1%***	

b) Alberta

	University	Hospital	Provincial government	Federal government	Corporate	Other	Unknown	Total
University	0	98	39	43	43	21	8	**252**
	0.0%	*38.9%*	*15.5%*	*17.1%*	*17.1%*	*8.3%*	*3.2%*	
Hospital	98	0	4	0	2	8	4	**116**
	84.5%	*0.0%*	*3.4%*	*0.0%*	*1.7%*	*6.9%*	*3.4%*	
Provincial government	39	4	0	19	7	1	3	**73**
	53.4%	*5.5%*	*0.0%*	*26.0%*	*9.6%*	*1.4%*	*4.1%*	
Federal government	43	0	19	0	5	3	2	**72**
	59.7%	*0.0%*	*26.4%*	*0.0%*	*6.9%*	*4.2%*	*2.8%*	
Corporate	43	2	7	5	0	6	0	**63**
	68.3%	*3.2%*	*11.1%*	*7.9%*	*0.0%*	*9.5%*	*0.0%*	
Other	21	8	1	3	6	0	1	**40**
	52.5%	*20.0%*	*2.5%*	*7.5%*	*15.0%*	*0.0%*	*2.5%*	
Unknown	8	4	3	2	0	1	0	**18**
	44.4%	*22.2%*	*16.7%*	*11.1%*	*0.0%*	*5.6%*	*0.0%*	
Total	**252**	**116**	**73**	**72**	**63**	**40**	**18**	**634**
	39.7%	***18.3%***	***11.5%***	***11.4%***	***9.9%***	***6.3%***	***2.8%***	

c) Saskatchewan

	University	Federal government	Hospital	Provincial government	Corporate	Other	Unknown	Total
University	0	34	21	9	9	8	1	**82**
	0.0%	*41.5%*	*25.6%*	*11.0%*	*11.0%*	*9.8%*	*1.2%*	
Federal government	34	0	0	1	2	2	1	**40**
	85.0%	*0.0%*	*0.0%*	*2.5%*	*5.0%*	*5.0%*	*2.5%*	
Hospital	21	0	0	2	0	1	0	**24**
	87.5%	*0.0%*	*0.0%*	*8.3%*	*0.0%*	*4.2%*	*0.0%*	
Provincial government	9	1	2	0	3	0	2	**17**
	52.9%	*5.9%*	*11.8%*	*0.0%*	*17.6%*	*0.0%*	*11.8%*	
Corporate	9	2	0	3	0	0	0	**14**
	64.3%	*14.3%*	*0.0%*	*21.4%*	*0.0%*	*0.0%*	*0.0%*	
Other	8	2	1	0	0	0	0	**11**
	72.7%	*18.2%*	*9.1%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Unknown	1	1	0	2	0	0	0	**4**
	25.0%	*25.0%*	*0.0%*	*50.0%*	*0.0%*	*0.0%*	*0.0%*	
Total	**82**	**40**	**24**	**17**	**14**	**11**	**4**	**192**
	42.7%	***20.8%***	***12.5%***	***8.9%***	***7.3%***	***5.7%***	***2.1%***	

d) Manitoba

	University	Hospital	Federal government	Other	Corporate	Provincial government	Unknown	Total
University	0	63	43	18	12	8	1	**145**
	0.0%	*43.4%*	*29.7%*	*12.4%*	*8.3%*	*5.5%*	*0.7%*	
Hospital	63	0	4	0	0	0	2	**69**
	91.3%	*0.0%*	*5.8%*	*0.0%*	*0.0%*	*0.0%*	*2.9%*	
Federal government	43	4	0	0	0	1	1	**49**
	87.8%	*8.2%*	*0.0%*	*0.0%*	*0.0%*	*2.0%*	*2.0%*	
Other	18	0	0	0	0	0	0	**18**
	100.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Corporate	12	0	0	0	0	0	0	**12**
	100.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Provincial government	8	0	1	0	0	0	0	**9**
	88.9%	*0.0%*	*11.1%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Unknown	1	2	1	0	0	0	0	**4**
	25.0%	*50.0%*	*25.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Total	**145**	**69**	**49**	**18**	**12**	**9**	**4**	**306**
	47.4%	***22.5%***	***16.0%***	***5.9%***	***3.9%***	***2.9%***	***1.3%***	

e) Ontario

	University	Hospital	Federal government	Corporate	Other	Provincial government	Unknown	Total
University	0	1,070	346	223	171	137	26	**1,973**
	0.0%	*54.2%*	*17.5%*	*11.3%*	*8.7%*	*6.9%*	*1.3%*	
Hospital	1,070	0	23	43	52	46	20	**1,254**
	85.3%	*0.0%*	*1.8%*	*3.4%*	*4.1%*	*3.7%*	*1.6%*	
Federal government	346	23	0	46	25	28	10	**478**
	72.4%	*4.8%*	*0.0%*	*9.6%*	*5.2%*	*5.9%*	*2.1%*	
Corporate	223	43	46	0	11	13	4	**340**
	65.6%	*12.6%*	*13.5%*	*0.0%*	*3.2%*	*3.8%*	*1.2%*	
Other	171	52	25	11	0	22	5	**286**
	59.8%	*18.2%*	*8.7%*	*3.8%*	*0.0%*	*7.7%*	*1.7%*	
Provincial government	137	46	28	13	22	0	9	**255**
	53.7%	*18.0%*	*11.0%*	*5.1%*	*8.6%*	*0.0%*	*3.5%*	
Unknown	26	20	10	4	5	9	0	**74**
	35.1%	*27.0%*	*13.5%*	*5.4%*	*6.8%*	*12.2%*	*0.0%*	
Total	**1,973**	**1,254**	**478**	**340**	**286**	**255**	**74**	**4,660**
	42.3%	***26.9%***	***10.3%***	***7.3%***	***6.1%***	***5.5%***	***1.6%***	

f) Quebec

	University	Hospital	Federal government	Corporate	Other	Provincial government	Unknown	Total
University	0	864	175	96	58	47	12	**1,252**
	0.0%	*69.0%*	*14.0%*	*7.7%*	*4.6%*	*3.8%*	*1.0%*	
Hospital	864	0	17	12	10	13	7	**923**
	93.6%	*0.0%*	*1.8%*	*1.3%*	*1.1%*	*1.4%*	*0.8%*	
Federal government	175	17	0	12	5	11	1	**221**
	79.2%	*7.7%*	*0.0%*	*5.4%*	*2.3%*	*5.0%*	*0.5%*	
Corporate	96	12	12	0	7	4	3	**134**
	71.6%	*9.0%*	*9.0%*	*0.0%*	*5.2%*	*3.0%*	*2.2%*	
Other	58	10	5	7	0	0	0	**80**
	72.5%	*12.5%*	*6.3%*	*8.8%*	*0.0%*	*0.0%*	*0.0%*	
Provincial government	47	13	11	4	0	0	2	**77**
	61.0%	*16.9%*	*14.3%*	*5.2%*	*0.0%*	*0.0%*	*2.6%*	
Unknown	12	7	1	3	0	2	0	**25**
	48.0%	*28.0%*	*4.0%*	*12.0%*	*0.0%*	*8.0%*	*0.0%*	
Total	**1,252**	**923**	**221**	**134**	**80**	**77**	**25**	**2,712**
	46.2%	***34.0%***	***8.1%***	***4.9%***	***2.9%***	***2.8%***	***0.9%***	

g) New Brunswick

	University	Federal government	Corporate	Provincial government	Other	Hospital	Unknown	Total
University	0	4	3	0	2	1	1	**11**
	0.0%	*36.4%*	*27.3%*	*0.0%*	*18.2%*	*9.1%*	*9.1%*	
Federal government	4	0	2	4	0	0	0	**10**
	40.0%	*0.0%*	*20.0%*	*40.0%*	*0.0%*	*0.0%*	*0.0%*	
Corporate	3	2	0	1	0	0	0	**6**
	50.0%	*33.3%*	*0.0%*	*16.7%*	*0.0%*	*0.0%*	*0.0%*	
Provincial government	0	4	1	0	0	0	0	**5**
	0.0%	*80.0%*	*20.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Other	2	0	0	0	0	0	0	**2**
	100.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Hospital	1	0	0	0	0	0	0	**1**
	100.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Unknown	1	0	0	0	0	0	0	**1**
	100.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Total	**11**	**10**	**6**	**5**	**2**	**1**	**1**	**36**
	30.6%	***27.8%***	***16.7%***	***13.9%***	***5.6%***	***2.8%***	***2.8%***	

h) Nova Scotia

	University	Hospital	Federal government	Provincial government	Other	Corporate	Unknown	Total
University	0	47	38	6	2	1	2	**96**
	0.0%	*49.0%*	*39.6%*	*6.3%*	*2.1%*	*1.0%*	*2.1%*	
Hospital	47	0	0	1	1	0	1	**50**
	94.0%	*0.0%*	*0.0%*	*2.0%*	*2.0%*	*0.0%*	*2.0%*	
Federal government	38	0	0	3	1	2	2	**46**
	82.6%	*0.0%*	*0.0%*	*6.5%*	*2.2%*	*4.3%*	*4.3%*	
Provincial government	6	1	3	0	2	0	0	**12**
	50.0%	*8.3%*	*25.0%*	*0.0%*	*16.7%*	*0.0%*	*0.0%*	
Other	2	1	1	2	0	0	0	**6**
	33.3%	*16.7%*	*16.7%*	*33.3%*	*0.0%*	*0.0%*	*0.0%*	
Corporate	1	0	2	0	0	0	0	**3**
	33.3%	*0.0%*	*66.7%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Unknown	2	1	2	0	0	0	0	**5**
	40.0%	*20.0%*	*40.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Total	**96**	**50**	**46**	**12**	**6**	**3**	**5**	**218**
	44.0%	***22.9%***	***21.1%***	***5.5%***	***2.8%***	***1.4%***	***2.3%***	

i) Newfoundland

	University	Federal government	Hospital	Corporate	Provincial government	Unknown	Total
University	0	15	12	1	3	1	**32**
	0.0%	*46.9%*	*37.5%*	*3.1%*	*9.4%*	*3.1%*	
Federal government	15	0	0	4	0	0	**19**
	78.9%	*0.0%*	*0.0%*	*21.1%*	*0.0%*	*0.0%*	
Hospital	12	0	0	0	0	0	**12**
	100.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Corporate	1	4	0	0	0	0	**5**
	20.0%	*80.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Provincial government	3	0	0	0	0	0	**3**
	100.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Unknown	1	0	0	0	0	0	**1**
	100.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	
Total	**32**	**19**	**12**	**5**	**3**	**1**	**72**
	44.4%	***26.4%***	***16.7%***	***6.9%***	***4.2%***	***1.4%***	

j) Prince Edward Island

	Federal government	University	Provincial government	Corporate	Total
Federal government	0	3	3	2	**8**
	0.0%	*37.5%*	*37.5%*	*25.0%*	
University	3	0	0	0	**3**
	100.0%	*0.0%*	*0.0%*	*0.0%*	
Provincial government	3	0	0	0	**3**
	100.0%	*0.0%*	*0.0%*	*0.0%*	
Corporate	2	0	0	0	**2**
	100.0%	*0.0%*	*0.0%*	*0.0%*	
Total	**8**	**3**	**3**	**2**	**16**
	50.0%	***18.8%***	***18.8%***	***12.5%***	

Source: Observatoire des Sciences et des Technologies (CIRST).

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