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Industrial Research and Development : Intentions

2006



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^p	preliminary
^r	revised
x	suppressed to meet the confidentiality requirements of the <i>Statistics Act</i>
^E	use with caution
F	too unreliable to be published

Other symbols

^e	estimates, as a complete survey was not conducted
ⁱ	pending intentions



Statistics Canada

Science and Technology Surveys Section

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Foreword

Innovation is essential to economic progress. Properly applied in developing new products and services, innovation may also conserve resources, preserve the environment, and add to our quality of life. The innovation process involves a number of elements concerned with the generation, dissemination and application of new knowledge: research and development (R&D) to provide new ideas; education and information services to develop the required personnel; and design, engineering and marketing services to incorporate the new ideas into the production and distribution systems.

R&D statistics, therefore, measure only part of the effort necessary for innovation. However, R&D is at the heart of the innovation process.

While R&D is also carried out by other sectors, such as governments and universities, industrial R&D is most clearly linked to technological innovation and, hence, economic growth. Canada does not, of course, rely only on domestic R&D for new ideas and innovation. A great deal of information comes from abroad in the form of information embodied in new machinery and equipment, in the minds of scientists and engineers, in scientific and technical journals, and in designs, drawings, tooling and manufacturing specifications. Some data are presented on the acquisition of R&D from abroad, but much of the flow of technological information cannot be measured.

In many ways it is more efficient to acquire the results of R&D performed by others since the cost of securing such information is usually less than the cost of duplicating it. However, some indigenous R&D is necessary not only to ensure that new inventions are appropriate to Canadian industry and market conditions, but also to ensure that foreign R&D can be properly assimilated, i.e., understood and adapted. It also provides Canadian firms with a better bargaining position for exchanges of technological information. Domestic performance of R&D is, therefore, necessary even if we wish only to be effective imitators and adapters.

Statistics Canada has collected data on R&D in Canadian industry for more than 50 years. Maintaining the continuity and comparability of these data over time is of considerable importance. This publication, the twentieth issue of an annual series, summarizes industrial R&D activities in Canada. It presents historical and current statistical information on industrial research and development activities for the years 1985 to 2006. Actual data for 2004 expenditures, 2005 preliminary estimates, and 2006 spending intentions are derived from the survey "Research and Development in Canadian Industry" conducted in 2005.

We are grateful to the responding firms who cooperated in this survey. We realize that the data requested are generally not readily available and require considerable effort to prepare. Any suggestions from these firms, or other users, for modifications to either the questionnaire or publication will be carefully considered.

This publication was prepared by Devin MacKay, Analyst and Shannon MacKinnon, Senior Statistical Officer under the direction of Louise Earl, Chief, Science and Technology Surveys Section of the Science, Innovation and Electronic Information Division.

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Highlights

- At just over 1.0% of Gross Domestic Product (GDP) in 2004, Canada's business enterprise expenditures on research and development (BERD) fell within the middle rank of the OECD, comparable to other countries such as the United Kingdom and the Netherlands (see table 1.1).
- Total industrial research and development (R&D) spending is set to rise 1.3% to \$14.9 billion in 2006 according to reported intentions. While this signals a fourth consecutive annual increase, industrial R&D spending has not yet returned to its 2001 peak after accounting for inflation (see table 1.3).
- In 2006, the business enterprise sector continued to be the largest performing sector in Canada with 52% of all Canadian R&D, followed by Higher Education (38%) and the Federal Government (8%) (see table 1.2).
- R&D spending in 2006 includes several industries reporting growth: scientific research and development services (+5.4%); semiconductor and other electronic components (+3.8%); aerospace products and parts (+2.5%); and communications equipment (+1.7%) (see table 1.18).
- Quebec and Ontario remained the most heavily concentrated regions for R&D activity in 2004. Together they accounted for 81% of total intramural expenditures. These two provinces continued to particularly dominate both the aerospace products and parts and the communications equipment industries. While 81% of communications equipment R&D was performed in Ontario, Quebec performed 58% of all Canadian R&D on aerospace products and parts (see table 1.14).
- R&D personnel in 2004 were heavily concentrated in four industries: computer system design and related services; information and cultural industries; communications equipment; and scientific research and development services. These industries accounted for just more than one-third of the 126,671 full-time equivalent personnel engaged in R&D activities in 2004 (see table 2.1).
- The average level-of-education of "Professional" R&D personnel, which includes scientists and engineers, has been rising in recent years. Meanwhile, the role of support staff such as technicians and technologists has also been increasing, accounting for almost 40% of full-time equivalent R&D staff in 2004 (see table 2.2).
- Substantial funds continue to be spent on energy R&D, with R&D funded by the performing-companies themselves tending to focus on fossil fuels. The government sector, on the other hand, directed nearly one-half of its industrial R&D funding towards areas such as energy systems analysis, and R&D on the environment, climate change, energy storage and alternative transportation fuels (see table 4.3).
- After a decline in R&D expenditures on therapeutic health products in 2004, preliminary data for 2005 and 2006 show a healthy recovery, with a net growth of 17.6% since 2003. Particularly strong growth has been observed among contract research organizations, whose R&D expenditures in this field have grown by 53% (see table 5.2).

1. R&D expenditures

International comparisons

- Canada's business enterprise spending on R&D (BERD) was just over 1.0% of Gross Domestic Product (GDP) in 2004. This places Canada in the middle rank of the 30 OECD member countries, with a BERD:GDP ratio similar to the United Kingdom and the Netherlands. The countries with the top 5 BERD:GDP ratios continue to be Sweden, Finland, Japan, Korea, and Switzerland.
- Many countries, including Canada, have increased their industrial R&D effort (as measured by the BERD:GDP ratio) since 1995. Most noteworthy is Finland, which has realized an increase of 72%, while Japan, Korea and Germany also made substantial gains of over 20%. Though the growth of Canada's industrial R&D effort substantially outpaced the total OECD between 1995 and 2001, recent losses have left Canada's cumulative growth to 2004 at 7%, less than the total OECD's growth of 11%.
- Canada is not the only country to find the past few years particularly challenging on R&D levels. While Canada's BERD:GDP ratio fell steadily from 1.31% to 1.07% between 2001 and 2004, the United States also suffered a notable decline in 2002, as did the United Kingdom in 2004. Several countries, namely the United Kingdom, France and Norway actually suffered net losses over the decade preceding 2005.

Table 1.1 International comparison of business enterprise expenditures on research and development (BERD) as a percentage of GDP, by selected OECD countries

	2004 ^f	2003 ^f	2002 ^f	2001	1995
	percent				
Sweden	2.73	2.93	..	3.28	2.46
Finland	2.42	2.42	2.34	2.35	1.43
Japan	2.38	2.40	2.36	2.30	1.90
Korea	2.18	2.00	1.90	1.97	1.75
Switzerland	2.16	..	..	..	..
United States	1.79	1.84	1.86	2.00	1.77
Germany	1.74	1.76	1.72	1.72	1.45
Denmark	1.70	1.78	1.73	1.64	1.04
Austria	1.51	..	1.42	..	..
Luxembourg	1.46	1.48	..	..	..
France	1.34	1.36	1.41	1.39	1.39
Belgium	1.29	1.31	1.37	1.51	1.19
Canada	1.12	1.13	1.17	1.29	0.99
United Kingdom	1.09	1.14	1.19	1.20	1.27
Netherlands	1.03	1.01	0.98	1.05	1.03
Australia	0.94	0.91	0.89	0.84	0.84
Norway	0.87	0.98	0.95	0.95	0.96
Ireland	0.82	0.80	0.76	0.77	0.88
Czech Republic	0.80	0.76	0.73	0.72	0.62
<i>Total OECD</i>	<i>1.49</i>	<i>1.51</i>	<i>1.51</i>	<i>1.57</i>	<i>1.38</i>

Source: OECD, Main Science and Technology Indicators, volume 2007/1

Note: Countries are presented in descending order of BERD as a percentage of GDP based on their information for the most recent year reported on the table.

Compared to GERD

- As in previous years, the business enterprise sector continues to be the largest performing sector of R&D. In 2006, this sector is expected to perform about 52% of total Canadian R&D, often referred to as GERD (gross domestic expenditures on research and development).
- The business enterprise sector's participation (natural sciences and engineering only) in GERD has fallen in recent years from its historical peak of 62% in 2001. Compensating for this has been substantial growth in the higher education sector's share of GERD, from 28% to 38%. The federal government's share of R&D has been gradually declining over the past 20 years, though this is actually the result of the increasing strength of other sectors. The federal government's R&D performance has remained relatively stable at approximately \$1.9 billion (1997 constant dollars). For research and development expenditures by performing sector in both current and constant dollars, see tables 1.15 and 1.16.

	Federal government	Provincial government	Business enterprise ¹	Higher education	Private non-profit organizations	Total
	percent					
2006 ⁱ	8	1	52	38	0 ^s	100
2005 ^p	8	1	54	36	0 ^s	100
2004 ^p	8	1	56	35	0 ^s	100
2003 ^p	9	1	56	33	0 ^s	100
2002 ^r	9	1	57	32	0 ^s	100
2001 ^r	9	1	62	28	0 ^s	100
2000	10	1	60	28	0 ^s	100
1999	11	1	59	29	0 ^s	100
1998	11	1	60	27	0 ^s	100
1997	12	1	60	27	1	100
1996	13	2	58	27	1	100
1995	13	2	58	27	1	100
1994	13	2	57	28	1	100
1993	14	2	53	30	1	100
1992	15	3	51	31	1	100
1991	16	3	50	31	1	100
1990	16	3	50	30	1	100
1989	16	3	50	30	1	100
1988	16	3	51	30	1	100
1987	17	3	55	24	1	100
1986	19	3	53	24	1	100
1985	19	3	52	25	1	100
1984	22	3	48	26	1	100

1. Excludes R&D in the social sciences and humanities.

Note: Components may not add to totals due to rounding.

Trends

- Total intramural R&D expenditures are composed of both current intramural expenditures and capital expenditures. Current intramural expenditures include both labour costs of R&D personnel, and other non-capital purchases of materials, supplies and equipment to support R&D activities in a given year. In contrast, capital expenditures include items such as land, buildings, and major instruments and equipment acquired for use in the performance of R&D. Both current and capital expenditures are fully reported in the year they take place.
- Chart 1.1 shows that, prior to 1999, current intramural R&D expenditures generally grew with the only exception being a slight decline in 1996. However, following a period of particularly rapid growth from 1999 to 2001, current intramural R&D expenditures suffered a loss in 2002, with little progress since, after accounting for the rate of inflation.
- Table 1.3 shows that capital expenditures also suffered a substantial decline in 2002. This downward trend continues through to 2005 planned expenditures. However, for the first time since 2001, reported intentions for 2006 are up, rising 12.9% in nominal terms from 2005 planned expenditures. This forecasted increase may be indicative of a general tooling-up by firms as a result of increasing confidence in the marketplace.

Chart 1.1 Current intramural research and development (R&D) expenditures

millions of dollars

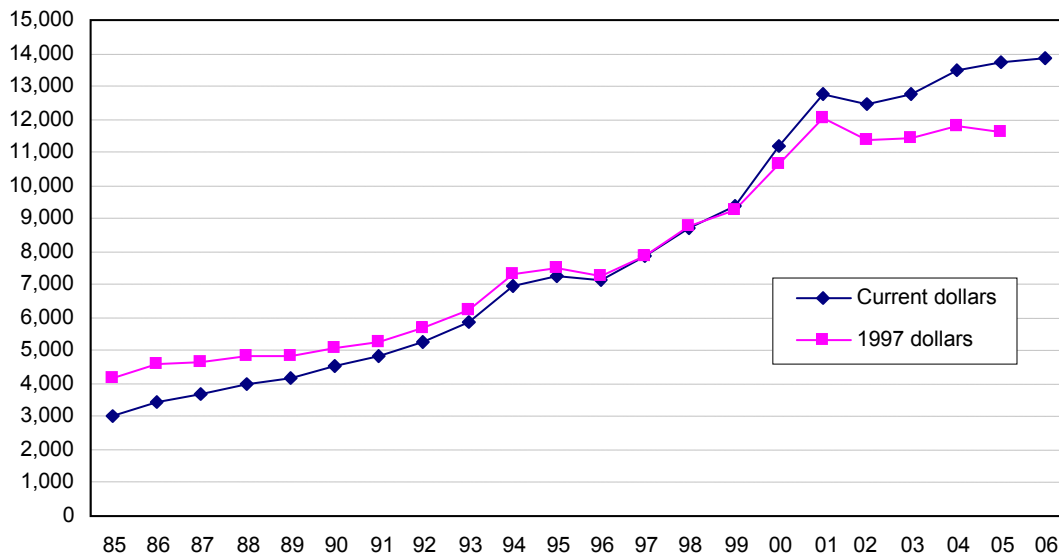


Table 1.3 Summary of industrial research and development (R&D) expenditures

	current dollars			GDP Implicit price index (1997) ²	1997 constant dollars	
	Current intramural expenditures ¹	Capital expenditures ¹	Total intramural expenditures ¹		Current intramural expenditures	Capital expenditures
	millions of dollars			percent	millions of dollars	
2006 ⁱ	13,832	1,018	14,850	..	..	..
2005 ^p	13,753	902	14,655	118.4	11,616	762
2004 ^p	13,514	927	14,441	114.8	11,772	807
2003 ^r	12,739	965	13,704	111.5	11,425	865
2002 ^r	12,461	1,055	13,516	107.8	11,370	979
2001 ^r	12,771	1,501	14,272	106.7	12,015	1,407
2000 ^r	11,201	1,194	12,395	105.5	10,668	1,132
1999	9,361	1,039	10,400	101.3	9,241	1,026
1998	8,727	955	9,682	99.6	8,762	959
1997	7,874	865	8,739	100.0	7,874	865
1996	7,159	838	7,997	98.8	7,246	848
1995	7,286	705	7,991	97.2	7,496	725
1994 ^e	6,938	629	7,567	95.1	7,296	661
1993	5,878	546	6,424	94.0	6,253	580
1992 ^e	5,286	457	5,742	92.7	5,702	493
1991	4,812	543	5,355	91.5	5,259	593
1990	4,541	628	5,169	88.9	5,108	706
1989	4,155	624	4,779	86.1	4,826	724
1988	3,980	643	4,623	82.4	4,831	780
1987	3,691	649	4,340	78.8	4,684	824
1986	3,447	575	4,022	75.4	4,572	763
1985	3,054	579	3,633	73.2	4,172	791

1. Source: CANSIM table 358-0024

2. Source: CANSIM table 380-0056

Note: Components may not add to totals due to rounding.

Concentration among companies

- Over half of the industrial R&D in Canada is performed by a relatively small number of companies. Of the 14,324 companies reporting R&D expenditures in 2003, 100 accounted for 55% of the total R&D performed (see table 1.4).
- The concentration of industrial R&D within these top 100 performers has shifted somewhat in recent years, as smaller participants are playing a greater role. Comparing 2000 with 2006, one finds that though the proportion of industrial R&D expenditures spent by the top 25 performers declined by 11 percentage points, the proportion has only fallen by 8 percentage points for the top 100. That is, the 26th largest to the 100th largest performers inclusively, have actually increased their proportion of Canada's total intramural R&D by 3 percentage points (see table 1.4).
- There has also been a more general shift in R&D concentration, as the smaller performers outside of the top 100 have begun to perform a greater share of Canada's total. Though total intramural expenditures are still dominated by the top 100 performers, those outside of this small group are now performing almost 45% of Canada's industrial R&D, a substantial advance when compared with their share of 32% in 1985 (see table 1.4).

Table 1.4 Concentration of industrial research and development (R&D) among companies						
	Top 25	Top 50	Top 75	Top 100	Total intramural expenditures	
	percent of total intramural expenditures				millions of dollars	
2006 ⁱ	35	45	52	56	14,850	
2005 ^p	35	46	52	56	14,655	
2004 ^p	35	46	52	56	14,441	
2003 ^r	34	45	51	55	13,704	
2002 ^r	34	44	50	54	13,516	
2001 ^r	41	49	55	59	14,272	
2000 ^r	46	54	60	64	12,395	
1999	44	54	59	63	10,400	
1998	46	55	60	64	9,682	
1997	44	53	59	63	8,739	
1996	41	50	56	61	7,997	
1995	39	48	54	58	7,991	
1994 ^e	39	49	54	58	7,567	
1993	43	54	60	64	6,424	
1992 ^e	45	55	60	64	5,742	
1991	47	57	63	67	5,355	
1990	47	58	64	68	5,169	
1989	48	59	64	68	4,779	
1988	49	59	64	68	4,623	
1987	49	58	64	67	4,340	
1986	47	57	63	67	4,022	
1985 ^r	48	58	64	68	3,633	

Concentration among industries

- When R&D performers are classified using NAICS 2002 (North American Industry Classification System), many industrial categories have only a small number of performers (see table A.2 in Appendix A for the 2003 counts). To maintain the confidentiality of individual returns, this report regroups firms into 46 broader industrial categories. Further R&D expenditure data by industry can be found in the supplementary tables at the end of the chapter.
- Resulting from the substantial concentration of R&D performance, the decisions of a few performers can substantially alter overall R&D expenditures and particularly industry totals. In addition to their own financial positions, performers' R&D decisions may be affected by the taxation climate, government policies on defence, transportation and communications, as well as by national and international economic trends.
- The top five industries of communications equipment; information and cultural industries; pharmaceutical and medicine; scientific research and development services; and computer system design and related services, have consistently dominated the industrial R&D sector in recent years, as demonstrated in table 1.5. In 2006, these top five industries represented \$6,589 million or 44% of all intramural R&D. This proportion rises to 61% for the top eight industries. While the proportion of R&D performed by communication equipment firms has fallen in the past five years, there has been simultaneous growth in the information and cultural industries. This increasingly important industrial category includes industries such as publishing, motion picture and sound recording, broadcasting, internet service providers and telecommunications.

	2006 ⁱ	2005 ^p	2004 ^p	2003 ^f	2002 ^f	2001 ^f
	millions of dollars					
Total expenditures, all industries	14,850	14,655	14,441	13,704	13,516	14,272
	percent of total intramural expenditures					
Communications equipment	11	11	10	12	15	22
Information and cultural industries	10	10	9	8	5	4
Pharmaceutical and medicine	9	9	8	8	9	6
Scientific research and development services	8	7	8	7	7	5
Computer system design and related services	7	8	8	8	8	8
Aerospace products and parts	6	6	6	6	6	7
Semiconductor and other electronic components	6	6	6	5	6	6
Wholesale trade	5	5	5	5	5	4
Other industries	38	38	40	41	39	38

By company size

- The amount that a company can afford to spend on research and development is, up to a point, dependent on its size; on average, companies with higher revenue figures also show higher R&D expenditures. As shown in table 1.6, the average total intramural R&D expenditure of companies with revenues greater than \$400 million was \$32.3 million in 2003. This category included only 185 (or 1.3%) of all firms reporting R&D in the year, yet it accounted for 44% of R&D expenditures. At the other end of the spectrum, companies with less than \$1 million in revenues spent an average of \$0.2 million on intramural R&D in 2003. This category represents 5,423 (or 37.9%) of all reporting firms and 7% of total intramural R&D expenditures.
- Though small in number, non-commercial firms are considerable spenders, with average R&D expenditures of \$10.3 million. This group is composed of all performers without a directly affiliated Canadian commercial base, including industrial non-profit organizations and trade associations, R&D establishments set up by consortia, and R&D establishments set-up by non-residents without associated commercial establishments and funded principally from abroad.
- Though performers with high revenues do invest more resources into R&D in absolute terms, this does not necessarily imply that their relative commitment to R&D is greater. In fact, smaller performers tend to spend a greater proportion of their revenues on R&D than do larger performers. Further evidence on this point is given later in this chapter, in the section entitled “Compared to performing company revenues.”

Table 1.6 Average total intramural research and development (R&D) expenditures, by revenue size, 2003

	Firms	Expenditures	Average expenditures
	number	millions of dollars	millions of dollars
Total	14,324	13,704	1.0
Non-commercial firms	18	185	10.3
Less than \$1,000,000 dollars	5,423	958	0.2
\$1,000,000 to \$9,999,999 dollars	6,135	2,102	0.3
\$10,000,000 to \$49,999,999 dollars	1,877	1,549	0.8
\$50,000,000 to \$99,999,999 dollars	348	874	2.5
\$100,000,000 to \$399,999,999 dollars	338	2,057	6.1
\$400,000,000 dollars or greater	185	5,979	32.3

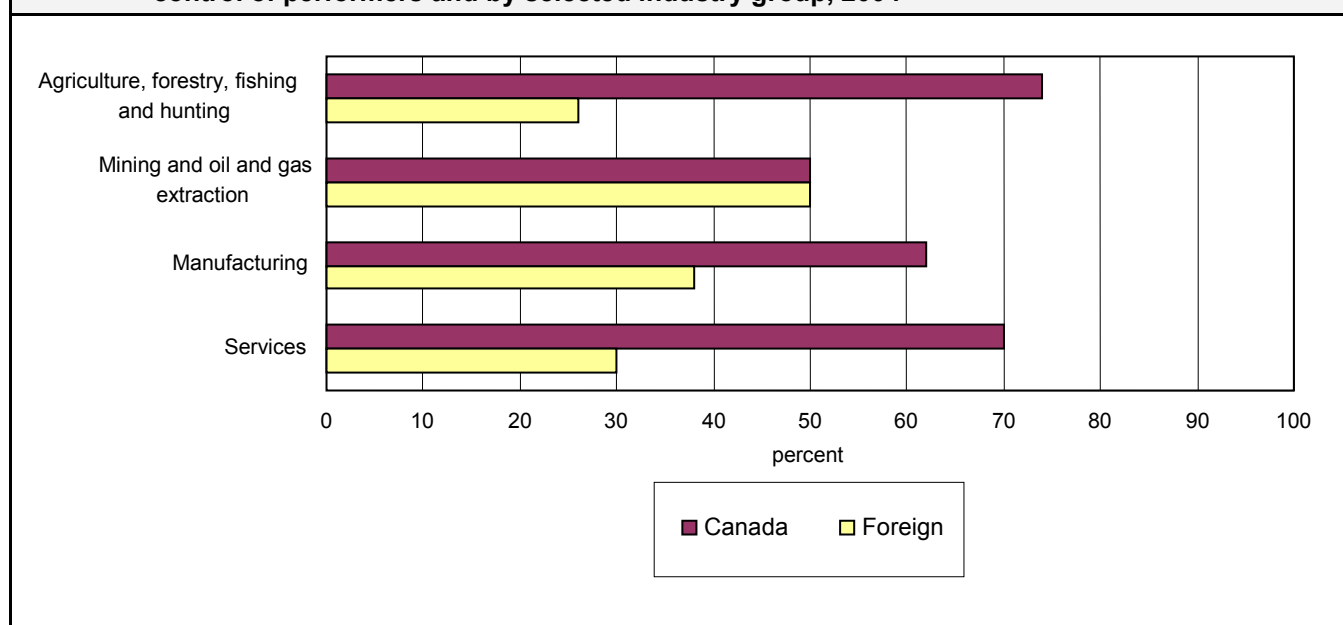
By country of control of performers

- The existence, size and nature of an R&D program in a company may be affected by who controls the company and the links which may exist with affiliated firms.
- The percentage of total intramural R&D performed by Canadian controlled firms has declined somewhat in the past several years, with 2004 preliminary data showing a slight drop to 66% (see table 1.7). In terms of total R&D expenditures, the manufacturing industry group is by far the largest group, accounting for a majority of intramural R&D expenditures in Canada (see table 1.18). However, in recent years, its concentration of R&D performed by Canadian-controlled companies has been below average (at 62% of total intramural expenditures in 2004).

Table 1.7 Total intramural research and development (R&D) expenditures of Canadian-controlled companies compared to industry totals, by industry group

	2004 ^p	2003 ^p	2002 ^f	2001 ^f	2000
	percent				
Total	66	68	68	71	71
Agriculture, forestry, fishing and hunting	74	76	77	73	65
Mining and oil and gas extraction	50	68	69	71	80
Utilities	x	x	x	x	x
Construction	x	x	x	x	x
Manufacturing	62	63	64	69	69
Services	70	74	73	74	72

Chart 1.2 Distribution of total intramural research and development (R&D) expenditures, by country of control of performers and by selected industry group, 2004



By size of R&D program

- The proportion of R&D activities performed by the smaller performers, i.e., those with R&D expenditures of less than \$1 million, has generally increased from 2000 to 2004. This group represented 12% of total intramural R&D expenditures in 2000, but 15% in 2004 (see table 1.8).
- Table 1.9 reviews the sources of funds for intramural R&D in accordance with the size of R&D expenditures of each company. As in prior years, the 2004 results indicate that larger R&D performers obtained a greater proportion of their funding from external sources than did smaller performers, who tend to fund their R&D activities internally. Most notably, while the smallest performers received no funding from foreign sources, performers with more than \$1 million of R&D expenditures acquired nearly one-fifth of their funding from abroad.

	2004 ^p	2003 ^f	2002 ^f	2001 ^f	2000 ^f
	millions of dollars				
Total	14,441	13,704	13,535	14,272	12,395
Less than \$50,000	129	124	116	107	100
\$50,000 to \$99,999	239	219	200	175	163
\$100,000 to \$199,999	404	378	351	314	286
\$200,000 to \$399,999	565	515	459	440	387
\$400,000 to \$999,999	833	763	788	722	607
\$1,000,000 or greater	12,272	11,705	11,601	12,514	10,853

1. R&D program size is based on current intramural expenditures.

Note: Components may not add to totals due to rounding.

	Performing company	Federal government	Provincial governments	Other Canadian sources	Foreign sources	Total
	percent					
Total	79	2	0^s	4	15	100
Less than \$50,000	97	1	0	2	0	100
\$50,000 to \$99,999	97	1	0	1	0	100
\$100,000 to \$199,999	96	1	0	2	1	100
\$200,000 to \$399,999	95	1	0 ^s	2	1	100
\$400,000 to \$999,999	92	2	1	4	2	100
\$1,000,000 or greater	76	2	0 ^s	4	18	100

1. R&D program size is based on current intramural expenditures.

Note: Components may not add to totals due to rounding.

Compared to performing company revenues

- The ratio of current intramural R&D expenditures to company revenues has averaged approximately 2% in recent years (see table 1.10). However, R&D performers' relative commitment to their R&D program seems to greatly depend upon their revenue size. While small performers with revenues of under \$1 million spend approximately half of their revenues on R&D, those with revenues over \$400 million have had R&D-to-revenue ratios of closer to 1% for the last five years.
- Table 1.11 demonstrates that Canadian-controlled performers had, on average, a higher R&D-to-revenue ratio than foreign-controlled performers, though table 1.24 further indicates that the disparity is smaller for U.S.-controlled performers than for others. Nevertheless, foreign-control does not always imply a reduced effort on R&D.
- Table 1.22 shows that in a number of industries, foreign-controlled firms actually spend more on current intramural R&D as a proportion of revenues than their Canadian-controlled counterparts. Notable examples include agriculture, computer system design and related services, and scientific research and development.

Table 1.10 Current intramural research and development (R&D) expenditures as a percentage of performing company revenues, by company revenue size					
	2004 ^p	2003 ^r	2002 ^r	2001 ^r	2000 ^r
	percent				
Total	2.1	2.0	1.9	2.1	1.9
Less than \$1,000,000	53.6	47.3	50.2	49.7	57.9
\$1,000,000 to \$9,999,999	7.7	9.0	9.4	9.8	8.2
\$10,000,000 to \$49,999,999	3.9	3.6	4.1	4.4	3.8
\$50,000,000 to \$99,999,999	3.0	3.4	3.1	3.3	3.2
\$100,000,000 to \$399,999,999	3.4	2.9	2.5	2.5	2.1
\$400,000,000 or greater	1.2	1.1	1.1	1.4	1.3

Table 1.11 Current intramural research and development (R&D) expenditures of company revenues, by country of control					
	2004 ^p	2003 ^r	2002 ^r	2001 ^r	2000 ^r
	percent				
Total	2.1	2.0	1.9	2.1	1.9
Canada	2.5	2.1	2.0	2.6	2.3
Foreign	1.6	1.7	1.7	1.5	1.3

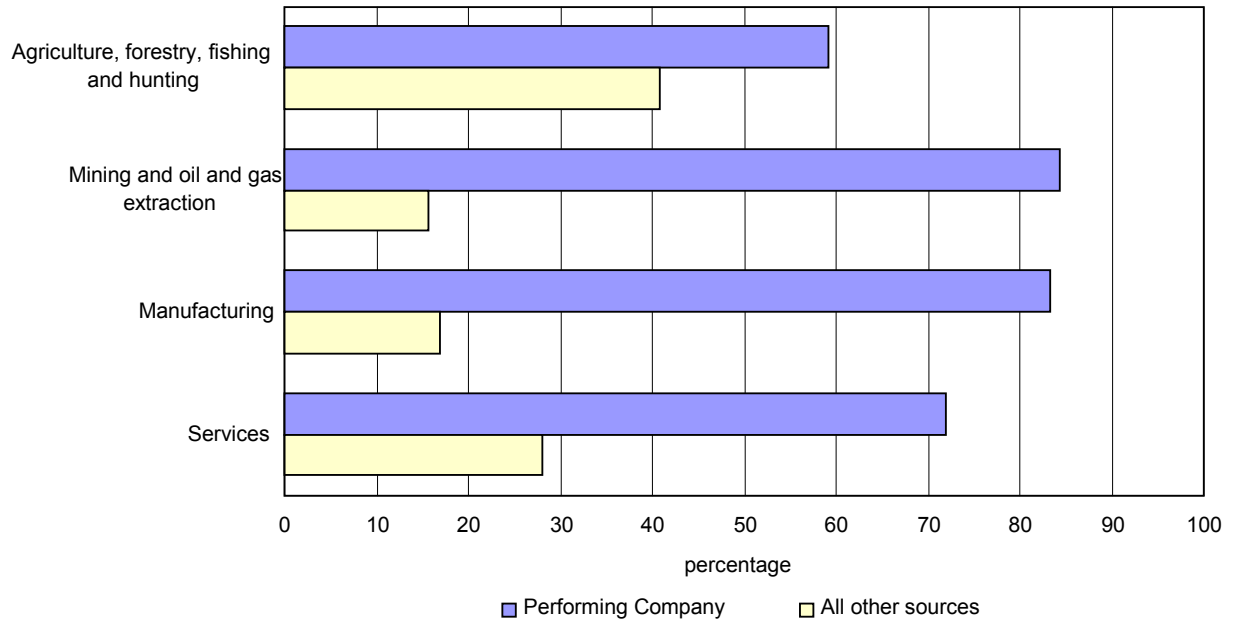
By sources of funds

- Table 1.12 shows the proportion of total intramural R&D expenditures funded by various stakeholders from 2000 to 2004. The largest source of funds continues to be the performing companies themselves, with 79% of funding in 2004 coming from within the performing firm. A breakdown by major industrial groups is shown in Chart 1.3. Examining individual industries in table 1.27 reveals that the percentage of funds originating from the performing company ranges between one third to almost 100%.
- The second largest source of funds for industrial R&D continues to be foreign sources, which financed 15% of the total intramural R&D in 2004. Several industries are especially reliant on foreign funding; in particular, more than 30% of intramural R&D is foreign-funded in the industries of wholesale trade, scientific research and development, and health care and social services (see table 1.27).
- The federal and provincial governments and other Canadian sources funded a total of 6% of the country's intramural R&D funding in 2004. These other Canadian sources include: parent, affiliated and subsidiary companies, contracts from other Canadian companies, and Canadian universities. Taxes foregone as a result of income tax incentives for R&D (e.g., the federal government's Scientific Research and Experimental Development Tax Incentive program) are not considered direct government support and are not attributed to the government sector. While government and other Canadian sources are relatively minor providers of funding for most industries, they prove particularly vital for health care and social assistance and management, scientific and technical consulting services, for which they fund one-fifth of intramural R&D (see table 1.27).

	2004 ^p	2003 ^r	2002 ^r	2001 ^r	2000 ^r
	percent				
Total	100	100	100	100	100
Canadian	85	85	87	80	72
Performing firm	79	78	79	73	66
Federal government	2	2	2	3	2
Provincial governments	0	1	0	0	0
Other	4	4	5	3	4
Foreign	15	15	13	20	28

Note: Components may not add to totals due to rounding.

Chart 1.3 Sources of funds for total intramural research and development (R&D), by industry group, 2004



By province

- R&D performers are heavily concentrated in Ontario and Quebec, with these two provinces responsible for \$11.8 billion or 81% of Canada’s total intramural R&D expenditures in 2004. The majority of the remaining R&D spending was in the western provinces of Alberta and British Columbia, which accounted for a further \$2.2 billion or 15% of R&D. The remaining six provinces and three territories performed just under half a billion dollars of total intramural R&D.
- In table 1.14, one can observe the relative strengths of the two most R&D-intensive provinces. Quebec accounted for almost 30% of total intramural R&D expenditures in 2004, but was even stronger in the industries of pharmaceutical and medicine, and aerospace products and parts, for which it accounted for about 39% and 58% of the country’s R&D, respectively. Similarly, Ontario accounted for almost 52% of total intramural R&D, but prevailed further in communications equipment, and semiconductor and other electronic components, for which it performed about 81% and 75% of the country’s R&D.

Table 1.13 Provincial distribution of intramural research and development (R&D) expenditures, 2004

	Current expenditures	Capital expenditures	Total expenditures
millions of dollars			
Total	13,514	927	14,441
Newfoundland and Labrador	26	0 ^s	26
Prince Edward Island	x	x	6
Nova Scotia	85	4	89
New Brunswick	70	5	75
Quebec	4,042	265	4,307
Ontario	7,080	377	7,457
Manitoba	155	10	165
Saskatchewan	91	20	111
Alberta	739	153	892
British Columbia	1,218	92	1,309
Yukon Territory, Northwest Territories and Nunavut	x	x	3

Note: Components may not add to totals due to rounding.

Table 1.14 Distribution of intramural research and development (R&D) expenditures for Quebec and Ontario, for selected industries, 2004				
	Quebec	Ontario	Other provinces	Canada
	millions of dollars			
Total	4,307	7,457	2,677	14,441
Communications equipment	177	1,224	104	1,504
Pharmaceutical and medicine	460	x	x	1,185
Computer system design and related services	255	634	237	1,126
Scientific research and development services	278	502	330	1,110
Aerospace products and parts	517	x	x	886
Information and cultural industries	363	750	248	1,316
Semiconductor and other electronic components	92	603	107	802
Other industries	2,166	2,835	1,468	6,468

Note: Components may not add to totals due to rounding.

Supplementary tables

- Tables 1.15 to 1.32 present additional R&D expenditure data.

Table 1.15 Gross domestic expenditures on research and development (GERD) by performing sector, current dollars						
	Federal government	Provincial government	Business enterprise ¹	Higher education	Private non-profit organizations	Total
millions of dollars						
2006 ⁱ	2,145	345	14,850	10,890	127	28,357
2005 ^p	2,162	336	14,655	9,900	121	27,174
2004 ^p	2,083	326	14,441	9,037	116	26,003
2003 ^p	2,083	315	13,704	8,143	92	24,337
2002 ^r	2,190	315	13,516	7,455	63	23,539
2001 ^r	2,103	307	14,272	6,424	63	23,169
2000	2,080	255	12,395	5,793	57	20,580
1999	1,859	233	10,400	5,082	63	17,637
1998	1,743	216	9,682	4,370	77	16,088
1997	1,720	214	8,739	3,879	82	14,634
1996	1,792	242	7,997	3,697	89	13,817
1995	1,727	254	7,991	3,691	91	13,754
1994	1,753	260	7,567	3,675	86	13,341
1993	1,757	269	6,424	3,660	74	12,184
1992	1,716	293	5,742	3,519	68	11,338
1991	1,685	328	5,355	3,289	110	10,767
1990	1,654	302	5,169	3,033	102	10,260
1989	1,533	272	4,779	2,844	89	9,517
1988	1,429	242	4,623	2,669	82	9,045
1987	1,383	228	4,341	1,934	64	7,950
1986	1,407	217	4,022	1,839	61	7,546
1985	1,356	213	3,635	1,722	59	6,985
1984	1,389	206	3,022	1,604	52	6,273
1983	1,219	201	2,602	1,452	43	5,517
1982	1,103	194	2,489	1,373	39	5,198
1981	916	162	2,124	1,177	36	4,415
1980	779	140	1,571	1,055	30	3,575
1979	717	113	1,266	921	27	3,044
1978	711	98	1,006	769	25	2,609
1977	638	93	857	713	21	2,322
1976	593	82	755	624	17	2,071
1975	545	72	700	568	16	1,901
1974	508	68	613	485	15	1,689
1973	450	55	503	449	13	1,470
1972	414	50	462	434	12	1,372
1971	383	43	413	436	10	1,285

Note: Components may not add to totals due to rounding.

Source: CANSIM Table 358-0001

Table 1.16 Gross domestic expenditures on research and development (GERD) by performing sector, constant 1997 dollars						
	Federal government	Provincial government	Business enterprise ¹	Higher education	Private non-profit organizations	Total
	millions of dollars					
2006 ⁱ	..	..	..	..	..	..
2005 ^p	1,827	284	12,388	8,369	103	22,971
2004 ^p	1,816	284	12,591	7,879	101	22,670
2003 ^p	1,871	284	12,313	7,317	83	21,866
2002 ^r	2,031	292	12,538	6,916	59	21,836
2001 ^r	1,971	287	13,376	6,021	59	21,714
2000	1,972	242	11,749	5,491	54	19,507
1999	1,836	230	10,269	5,018	62	17,415
1998	1,751	217	9,726	4,390	77	16,161
1997	1,720	214	8,739	3,879	82	14,634
1996	1,814	245	8,095	3,743	90	13,987
1995	1,776	261	8,219	3,796	94	14,147
1994	1,844	273	7,959	3,865	90	14,032
1993	1,869	286	6,834	3,894	79	12,962
1992	1,852	316	6,196	3,797	73	12,234
1991	1,843	358	5,856	3,597	120	11,774
1990	1,862	340	5,818	3,414	115	11,548
1989	1,780	316	5,551	3,303	103	11,053
1988	1,735	294	5,614	3,241	100	10,984
1987	1,755	290	5,509	2,454	81	10,089
1986	1,867	288	5,338	2,441	81	10,015
1985	1,854	291	4,969	2,354	81	9,549
1984	1,958	290	4,261	2,262	73	8,845
1983	1,775	292	3,789	2,114	63	8,033
1982	1,694	298	3,822	2,108	60	7,982
1981	1,525	270	3,537	1,960	60	7,352
1980	1,437	258	2,899	1,946	55	6,596
1979	1,457	230	2,572	1,871	55	6,184
1978	1,587	219	2,246	1,717	56	5,824
1977	1,519	221	2,040	1,698	50	5,529
1976	1,508	208	1,920	1,587	43	5,266
1975	1,517	201	1,949	1,581	45	5,292
1974	1,567	209	1,891	1,496	46	5,209
1973	1,599	196	1,787	1,595	46	5,222
1972	1,612	195	1,799	1,690	47	5,344
1971	1,579	177	1,703	1,798	41	5,299

Note: Components may not add to totals due to rounding.

Source: CANSIM Table 358-0001

Table 1.17 Business expenditures on research and development (BERD) compared to gross domestic expenditures on research and development (GERD) and GDP

	BERD ¹	GERD ¹	GDP ²	BERD/GERD	BERD/GDP
	millions of dollars			percent	
2006 ⁱ	14,850	28,357	1,439,291	52.37	1.03
2005 ^p	14,655	27,174	1,371,425	53.93	1.07
2004 ^p	14,441	26,003	1,290,788	55.54	1.12
2003 ^p	13,704	24,337	1,213,408	56.31	1.13
2002 ^r	13,516	23,539	1,152,905	57.42	1.17
2001 ^r	14,272	23,169	1,108,048	61.60	1.29
2000	12,395	20,580	1,076,577	60.23	1.15
1999	10,400	17,637	982,441	58.97	1.06
1998	9,682	16,088	914,973	60.18	1.06
1997	8,739	14,634	882,733	59.72	0.99
1996	7,997	13,817	836,864	57.88	0.96
1995	7,991	13,754	810,426	58.10	0.99
1994	7,567	13,341	770,873	56.72	0.98
1993	6,424	12,184	727,184	52.72	0.88
1992	5,742	11,338	700,480	50.64	0.82
1991	5,355	10,767	685,367	49.74	0.78
1990	5,169	10,260	679,921	50.38	0.76
1989	4,779	9,517	657,728	50.22	0.73
1988	4,623	9,045	613,094	51.11	0.75
1987	4,341	7,950	558,949	54.60	0.78
1986	4,022	7,546	512,541	53.30	0.78
1985	3,635	6,985	485,714	52.04	0.75
1984	3,022	6,273	449,582	48.17	0.67
1983	2,602	5,517	411,386	47.16	0.63
1982	2,489	5,198	379,859	47.88	0.66

1. Source: CANSIM 358-0001

2. Source: CANSIM 380-0017

Table 1.18 Total intramural research and development (R&D) expenditures, by industry					
	2006 ⁱ	2005 ^p	2004 ^p	2003 ^f	2002 ^r
	millions of dollars				
Total	14,850	14,655	14,441	13,704	13,516
Agriculture, forestry, fishing and hunting	80	85	88	86	107
Agriculture	56	61	64	59	84
Forestry and logging	19	18	19	20	17
Fishing, hunting and trapping	5	5	5	6	6
Mining and oil and gas extraction	261	245	274	268	254
Oil and gas extraction	191	178	208	215	209
Mining	70	67	66	53	45
Utilities	197	195	244	130	131
Electric power	186	184	233	121	125
Other utilities	11	11	11	9	6
Construction	46	46	46	43	47
Manufacturing	8,273	8,092	7,986	7,973	8,257
Food	117	117	123	108	89
Beverage and tobacco	29	30	26	42	27
Textile	48	51	54	51	48
Wood products	59	59	61	58	56
Paper	468	468	468	403	405
Printing	25	25	25	22	22
Petroleum and coal products	143	131	135	139	99
Pharmaceutical and medicine	1,293	1,251	1,185	1,121	1,163
Other chemicals	178	185	201	260	260
Plastic products	131	127	116	110	88
Rubber products	23	23	23	23	16
Non-metallic mineral products	52	52	50	45	46
Primary metal (ferrous)	36	35	37	31	42
Primary metal (non-ferrous)	203	205	214	231	192
Fabricated metal products	177	172	175	171	156
Machinery	488	470	446	452	456
Computer and peripheral equipment	170	167	165	191	206
Communications equipment	1,580	1,553	1,504	1,698	1,995
Semiconductor and other electronic components	869	837	802	740	811
Navigational, measuring, medical and control instruments	345	330	365	346	364
Other computer and electronic products	22	22	22	19	18
Electrical equipment, appliance and components	129	134	136	167	212
Motor vehicle and parts	537	523	533	451	432
Aerospace products and parts	912	890	886	889	867
All other transportation equipment	45	44	44	24	17
Furniture and related products	26	26	26	23	21
Other manufacturing industries	167	162	165	161	149
Services	5,993	5,992	5,803	5,205	4,720
Wholesale trade	757	770	729	633	628
Retail trade	24	24	24	33	46
Transportation and warehousing	40	40	37	35	45
Information and cultural industries	1,518	1,456	1,361	1,115	624
Finance, insurance and real estate	356	331	303	235	215
Architectural, engineering and related services	442	478	497	487	499
Computer system design and related services	1,056	1,163	1,126	1,077	1,076
Management, scientific and technical consulting services	69	66	65	74	88
Scientific research and development	1,142	1,083	1,110	922	888
Health care and social assistance	364	365	347	381	383
All other services	225	215	206	212	229

Note: Components may not add to totals due to rounding.

Table 1.19 Current intramural research and development (R&D) expenditures, by industry					
	2006 ⁱ	2005 ^p	2004 ^p	2003 ^r	2002 ^r
	millions of dollars				
Total	13,832	13,753	13,514	12,739	12,461
Agriculture, forestry, fishing and hunting	77	81	84	82	102
Agriculture	53	58	61	57	80
Forestry and logging	19	18	19	20	17
Fishing, hunting and trapping	5	5	5	5	5
Mining and oil and gas extraction	223	216	245	199	182
Oil and gas extraction	154	151	180	150	138
Mining	69	66	65	49	44
Utilities	x	x	x	x	122
Electric power	x	x	x	x	116
Other utilities	x	x	x	x	5
Construction	x	x	x	x	46
Manufacturing	7,835	7,685	7,611	7,552	7,699
Food	115	115	115	103	87
Beverage and tobacco	28	29	25	x	26
Textile	47	49	52	48	47
Wood products	52	52	52	54	54
Paper	459	459	459	397	399
Printing	25	25	25	21	21
Petroleum and coal products	123	117	124	131	x
Pharmaceutical and medicine	1,242	1,203	1,127	1,052	1,033
Other chemicals	166	171	188	240	233
Plastic products	123	119	108	101	84
Rubber products	23	23	22	22	16
Non-metallic mineral products	51	51	50	44	44
Primary metal (ferrous)	34	34	35	27	40
Primary metal (non-ferrous)	182	184	185	x	x
Fabricated metal products	172	169	171	168	152
Machinery	474	459	434	436	440
Computer and peripheral equipment	163	161	158	175	187
Communications equipment	1,480	1,465	1,431	1,620	1,894
Semiconductor and other electronic components	808	781	748	679	700
Navigational, measuring, medical and control instruments	336	321	357	337	353
Other computer and electronic products	20	20	20	18	18
Electrical equipment, appliance and components	126	130	133	158	188
Motor vehicle and parts	500	486	510	426	401
Aerospace products and parts	862	842	863	865	849
All other transportation equipment	44	44	44	23	17
Furniture and related products	26	26	26	23	20
Other manufacturing industries	153	149	150	145	141
Services	5,508	5,584	5,400	4,742	4,310
Wholesale trade	710	723	685	585	591
Retail trade	23	23	x	32	44
Transportation and warehousing	38	37	35	34	42
Information and cultural industries	1,308	1,323	x	945	577
Finance, insurance and real estate	348	322	296	229	207
Architectural, engineering and related services	395	433	x	423	425
Computer system design and related services	1,011	1,117	1,078	1,030	999
Management, scientific and technical consulting services	65	64	x	68	74
Scientific research and development	1,070	1,007	1,041	852	783
Health care and social assistance	335	336	x	344	353
All other services	206	198	194	199	215

Note: Components may not add to totals due to rounding.

Table 1.20 Capital intramural research and development (R&D) expenditures, by industry					
	2006 ⁱ	2005 ^p	2004 ^p	2003 ^r	2002 ^r
	millions of dollars				
Total	1,018	902	927	965	1,055
Agriculture, forestry, fishing and hunting	3	4	3	4	5
Agriculture	2	3	3	3	4
Forestry and logging	0 ^s	0 ^s	0 ^s	0 ^s	1
Fishing, hunting and trapping	0 ^s	0 ^s	0 ^s	1	1
Mining and oil and gas extraction	38	29	30	69	71
Oil and gas extraction	38	28	28	65	70
Mining	1	1	1	4	1
Utilities	x	x	x	x	9
Electric power	x	x	x	x	9
Other utilities	x	x	x	x	0 ^s
Construction	x	x	x	x	1
Manufacturing	438	407	376	421	558
Food	2	2	8	5	2
Beverage and tobacco	1	1	1	x	1
Textile	2	2	2	2	1
Wood products	7	8	8	4	2
Paper	9	9	9	6	6
Printing	0 ^s	0 ^s	0 ^s	0 ^s	0 ^s
Petroleum and coal products	20	14	11	8	x
Pharmaceutical and medicine	51	48	58	69	130
Other chemicals	12	14	13	20	27
Plastic products	8	8	8	9	3
Rubber products	0 ^s	0 ^s	0 ^s	0 ^s	0 ^s
Non-metallic mineral products	1	1	1	1	1
Primary metal (ferrous)	2	2	2	3	2
Primary metal (non-ferrous)	21	21	29	x	x
Fabricated metal products	5	4	4	3	3
Machinery	15	11	12	16	17
Computer and peripheral equipment	6	6	7	17	19
Communications equipment	100	88	73	78	101
Semiconductor and other electronic components	61	55	54	61	111
Navigational, measuring, medical and control instruments	8	9	8	9	11
Other computer and electronic products	1	1	1	1	1
Electrical equipment, appliance and components	3	3	3	9	24
Motor vehicle and parts	37	38	23	25	31
Aerospace products and parts	50	48	23	23	18
All other transportation equipment	1	1	1	0 ^s	0 ^s
Furniture and related products	0 ^s	0 ^s	0 ^s	0 ^s	1
Other manufacturing industries	13	13	15	16	8
Services	485	409	403	463	410
Wholesale trade	48	47	44	48	36
Retail trade	1	1	x	1	2
Transportation and warehousing	3	3	2	1	3
Information and cultural industries	209	133	x	170	47
Finance, insurance and real estate	9	9	7	6	8
Architectural, engineering and related services	46	45	59	64	74
Computer system design and related services	45	46	47	46	76
Management, scientific and technical consulting services	4	3	3	6	14
Scientific research and development	73	75	69	70	105
Health care and social assistance	28	30	29	37	31
All other services	19	17	11	13	13

Note: Components may not add to totals due to rounding.

Table 1.21 Current intramural research and development (R&D) expenditures, by industry and by type of expenditure, 2004			
	Wages and salaries	Other costs	Total
millions of dollars			
Total	7,645	5,870	13,514
Agriculture, forestry, fishing and hunting	52	33	84
Agriculture	36	25	61
Forestry and logging	13	6	19
Fishing, hunting and trapping	2	3	5
Mining and oil and gas extraction	61	184	245
Oil and gas extraction	38	142	180
Mining	23	42	65
Utilities	x	61	x
Electric power	x	58	x
Other utilities	x	3	x
Construction	x	11	x
Manufacturing	4,074	3,537	7,611
Food	73	42	115
Beverage and tobacco	15	10	25
Textile	34	18	52
Wood products	33	20	52
Paper	118	341	459
Printing	22	3	25
Petroleum and coal products	30	94	124
Pharmaceutical and medicine	389	737	1,127
Other chemicals	110	78	188
Plastic products	72	36	108
Rubber products	13	9	22
Non-metallic mineral products	25	24	50
Primary metal (ferrous)	21	13	35
Primary metal (non-ferrous)	99	86	185
Fabricated metal products	129	42	171
Machinery	313	121	434
Computer and peripheral equipment	101	57	158
Communications equipment	840	591	1,431
Semiconductor and other electronic components	494	255	748
Navigational, measuring, medical and control instruments	257	101	357
Other computer and electronic products	15	6	20
Electrical equipment, appliance and components	81	52	133
Motor vehicle and parts	277	233	510
Aerospace products and parts	372	491	863
All other transportation equipment	23	20	44
Furniture and related products	20	5	26
Other manufacturing industries	96	53	150
Services	3,356	2,044	5,400
Wholesale trade	378	307	685
Retail trade	x	x	x
Transportation and warehousing	20	16	35
Information and cultural industries	x	x	x
Finance, insurance and real estate	184	112	296
Architectural, engineering and related services	x	80	x
Computer system design and related services	861	217	1,078
Management, scientific and technical consulting services	x	9	x
Scientific research and development	512	529	1,041
Health care and social assistance	x	x	x
All other services	158	36	194

Note: Components may not add to totals due to rounding.

Table 1.22 Current intramural research and development (R&D) expenditures of performing company revenues, by industry and by country of control, 2004

	Canada	Foreign	Total
	percent		
Total	2.5	1.6	2.1
Agriculture, forestry, fishing and hunting	1.7	8.7	2.3
Agriculture	2.1	9.1	2.9
Forestry and logging	0.6	...	0.6
Fishing, hunting and trapping	x	x	8.2
Mining and oil and gas extraction	0.7	0.5	0.5
Oil and gas extraction	0.9	0.4	0.5
Mining	0.6	1.8	0.8
Utilities	x	x	x
Electric power	x	x	x
Other utilities	x	x	x
Construction	x	x	1.7
Manufacturing	2.6	1.4	1.9
Food	0.4	0.2	0.3
Beverage and tobacco	0.4	0.1	0.3
Textile	1.9	1.4	1.7
Wood products	0.4	0.2	0.4
Paper	1.5	1.0	1.4
Printing	1.3	0.4	1.1
Petroleum and coal products	x	x	0.2
Pharmaceutical and medicine	12.7	9.5	10.3
Other chemicals	1.4	0.5	0.8
Plastic products	1.6	0.8	1.3
Rubber products	1.4	0.5	0.7
Non-metallic mineral products	1.6	0.8	1.1
Primary metal (ferrous)	0.4	0.5	0.4
Primary metal (non-ferrous)	1.2	1.2	1.2
Fabricated metal products	2.0	0.9	1.9
Machinery	3.5	2.3	3.2
Computer and peripheral equipment	6.5	5.8	6.0
Communications equipment	40.4	6.3	24.3
Semiconductor and other electronic components	x	x	8.2
Navigational, measuring, medical and control instruments	12.1	3.7	8.7
Other computer and electronic products	7.0	0.0	7.0
Electrical equipment, appliance and components	3.9	1.3	2.1
Motor vehicle and parts	2.1	0.5	0.6
Aerospace products and parts	x	x	5.9
All other transportation equipment	1.9	2.3	2.1
Furniture and related products	x	x	0.8
Other manufacturing industries	3.4	1.3	3.0
Services	2.9	4.1	3.2
Wholesale trade	1.2	1.9	1.6
Retail trade	x	x	x
Transportation and warehousing	x	x	0.4
Information and cultural industries	4.4	x	x
Finance, insurance and real estate	0.5	0.5	0.5
Architectural, engineering and related services	x	x	x
Computer system design and related services	14.6	24.4	15.9
Management, scientific and technical consulting services	x	x	x
Scientific research and development	36.7	42.0	38.1
Health care and social assistance	x	x	x
All other services	2.0	1.3	1.8

Table 1.23 Current intramural research and development (R&D) expenditures of performing company revenues, by country of control			
	2004 ^p	2003 ^r	2002 ^r
	percent		
Total	2.1	2.0	1.9
Canada	2.5	2.1	2.0
United States	1.8	1.7	1.8
Other	1.4	1.5	1.6

Table 1.24 Total intramural research and development (R&D) expenditures, by country of control			
	2004 ^p	2003 ^r	2002 ^r
	millions of dollars		
Total	14,441	13,704	13,516
Canada	9,499	9,267	9,202
United States	3,335	3,062	2,965
Other	1,608	1,375	1,349

Note: Components may not add to totals due to rounding.

Table 1.25 Total intramural research and development (R&D) expenditures of Canadian-controlled firms of all intramural R&D expenditures, by industry

	2004 ^p	2003 ^r	2002 ^r
	percent		
Total	66	68	68
Agriculture, forestry, fishing and hunting	74	76	77
Agriculture	x	66	x
Forestry and logging	100	100	100
Fishing, hunting and trapping	x	100	x
Mining and oil and gas extraction	50	68	69
Oil and gas extraction	45	67	70
Mining	63	72	63
Utilities	x	x	x
Electric power	x	x	x
Other utilities	x	x	x
Construction	x	x	x
Manufacturing	62	63	64
Food	80	86	82
Beverage and tobacco	x	x	79
Textile	66	71	68
Wood products	97	x	x
Paper	76	61	74
Printing	93	x	x
Petroleum and coal products	21	32	26
Pharmaceutical and medicine	31	29	30
Other chemicals	55	47	41
Plastic products	75	88	89
Rubber products	50	46	x
Non-metallic mineral products	48	40	39
Primary metal (ferrous)	72	87	91
Primary metal (non-ferrous)	85	89	90
Fabricated metal products	92	95	96
Machinery	81	81	81
Computer and peripheral equipment	35	40	50
Communications equipment	88	87	87
Semiconductor and other electronic components	x	x	x
Navigational, measuring, medical and control instruments	82	86	84
Other computer and electronic products	100	x	x
Electrical equipment, appliance and components	55	57	62
Motor vehicle and parts	30	36	33
Aerospace products and parts	32	35	x
All other transportation equipment	41	x	72
Furniture and related products	x	x	100
Other manufacturing industries	94	92	89
Services	70	74	73
Wholesale trade	31	39	41
Retail trade	x	x	x
Transportation and warehousing	x	x	x
Information and cultural industries	77	80	78
Finance, insurance and real estate	93	98	x
Architectural, engineering and related services	x	x	58
Computer system design and related services	80	84	83
Management, scientific and technical consulting services	x	x	x
Scientific research and development	72	75	79
Health care and social assistance	x	x	x
All other services	87	87	85

Note: Components may not add to totals due to rounding.

Table 1.26 Sources of funds for intramural research and development (R&D)

	Business enterprises			Federal sources		Provincial sources	Other Canadian sources	Foreign sources	Total
	Canadian performing companies	Related companies	R&D contracts for other companies	Grants	Contracts				
	millions of dollars								
2004	11,362	355	158	218	39	59	27	2,223	14,441
2003	10,740	376	150	256	46	75	17	2,045	13,704
2002	10,727	429	165	234	69	53	17	1,821	13,516
2001	10,444	302	178	345	112	51	14	2,826	14,272
2000	8,132	269	181	165	74	45	8	3,522	12,395
1999	6,968	201	214	241	68	58	8	2,642	10,400
1998	6,396	294	167	179	84	56	8	2,499	9,682
1997	6,124	268	156	253	103	77	8	1,750	8,739
1996	5,450	297	186	185	107	102	8	1,662	7,997
1995	5,383	286	259	259	152	87	10	1,555	7,991
1994	4,922	337	266	267	200	99	10	1,466	7,567
1993	4,073	347	242	266	250	105	7	1,134	6,424
1992	3,639	266	188	261	271	86	12	1,019	5,742
1991	3,388	275	162	204	212	114	11	988	5,355
1990	3,280	304	167	215	176	93	13	923	5,169
1989	2,981	325	164	239	177	69	6	819	4,779
1988	2,855	285	123	272	181	63	5	840	4,623
1987	2,714	255	125	287	155	60	9	734	4,340
1986	2,610	257	112	251	160	63	18	551	4,022
1985	2,323	241	97	215	168	60	12	518	3,633
1984	1,829	212	71	183	152	52	7	516	3,022
1983	1,608	158	76	175	106	46	3	431	2,602
1982	1,698	142	69	177	89	44	4	266	2,489
1981	1,543	123	70	132	58	37	3	158	2,124

Note: Components may not add to totals due to rounding.

Table 1.27 Sources of funds for intramural research and development (R&D), by industry, 2004

	Canadian performing companies	Federal government and other Canadian sources	Foreign sources	Total
millions of dollars				
Total	11,362	856	2,223	14,441
Agriculture, forestry, fishing and hunting	52	x	x	88
Agriculture	42	x	x	64
Forestry and logging	6	x	x	19
Fishing, hunting and trapping	4	x	x	5
Mining and oil and gas extraction	231	x	x	274
Oil and gas extraction	168	x	x	208
Mining	64	x	x	66
Utilities	x	x	x	244
Electric power	x	x	x	233
Other utilities	x	x	x	11
Construction	x	x	x	46
Manufacturing	6,645	392	950	7,986
Food	121	x	x	123
Beverage and tobacco	x	x	x	26
Textile	x	x	x	54
Wood products	33	x	x	61
Paper	407	x	x	468
Printing	x	x	x	25
Petroleum and coal products	85	x	x	135
Pharmaceutical and medicine	745	91	349	1,185
Other chemicals	155	15	32	201
Plastic products	115	x	x	116
Rubber products	x	x	x	23
Non-metallic mineral products	49	x	x	50
Primary metal (ferrous)	x	x	x	37
Primary metal (non-ferrous)	198	x	x	214
Fabricated metal products	171	x	x	175
Machinery	418	21	7	446
Computer and peripheral equipment	121	3	41	165
Communications equipment	1,427	7	70	1,504
Semiconductor and other electronic components	533	x	x	802
Navigational, measuring, medical and control instruments	290	42	33	365
Other computer and electronic products	21	x	x	22
Electrical equipment, appliance and components	130	x	x	136
Motor vehicle and parts	508	7	18	533
Aerospace products and parts	767	61	58	886
All other transportation equipment	34	x	x	44
Furniture and related products	23	x	x	26
Other manufacturing industries	129	x	x	165
Services	4,171	379	1,253	5,803
Wholesale trade	456	43	229	729
Retail trade	21	x	x	24
Transportation and warehousing	36	x	x	37
Information and cultural industries	1,117	36	208	1,361
Finance, insurance and real estate	301	x	x	303
Architectural, engineering and related services	404	65	28	497
Computer system design and related services	872	35	218	1,126
Management, scientific and technical consulting services	45	13	6	65
Scientific research and development	591	89	430	1,110
Health care and social assistance	153	76	118	347
All other services	174	18	13	206

Note: Components may not add to totals due to rounding.

Table 1.28 Sources of funds for intramural research and development (R&D), by country-of-control of performer, 2004						
	Canadian performing companies	Federal government	Provincial government	Other Canadian sources	Foreign sources	Total
millions of dollars						
Total	11,362	257	59	540	2,223	14,441
Canada	8,227	176	49	407	640	9,499
United States	2,043	x	x	105	1,125	3,335
Other	1,093	x	x	29	459	1,608

Note: Components may not add to totals due to rounding.

Table 1.29 Total intramural research and development (R&D) expenditures, by province			
	2004 ^p	2003 ^r	2002 ^r
millions of dollars			
Total	14,441	13,704	13,516
Newfoundland and Labrador	26	26	22
Prince Edward Island	6	7	x
Nova Scotia	89	77	95
New Brunswick	75	62	64
Quebec	4,307	4,153	4,132
Ontario	7,457	7,241	7,063
Manitoba	165	136	149
Saskatchewan	111	84	112
Alberta	892	790	782
British Columbia	1,309	1,127	1,092
Yukon Territory, Northwest Territories and Nunavut	3	0	x

Note: Components may not add to totals due to rounding.

Table 1.30 Current intramural research and development (R&D) expenditures, by province			
	2004 ^p	2003 ^r	2002 ^r
millions of dollars			
Total	13,514	12,739	12,461
Newfoundland and Labrador	26	25	21
Prince Edward Island	x	6	x
Nova Scotia	85	73	90
New Brunswick	70	61	61
Quebec	4,042	3,867	3,866
Ontario	7,080	6,757	6,540
Manitoba	155	130	142
Saskatchewan	91	78	93
Alberta	739	700	684
British Columbia	1,218	1,042	960
Yukon Territory, Northwest Territories and Nunavut	x	0	x

Note: Components may not add to totals due to rounding.

Table 1.31 Total intramural research and development (R&D) expenditures for Quebec, by selected industry			
	2004 ^p	2003 ^r	2002 ^r
	millions of dollars		
Total	4,307	4,153	4,132
Agriculture, forestry, fishing and hunting	33	32	37
Mining and oil and gas extraction	x	x	x
Utilities	x	x	x
Construction	23	19	18
Manufacturing	2,400	2,374	2,434
Food, beverages and tobacco	53	50	45
Textile	35	33	31
Wood products	29	30	29
Paper	242	238	252
Printing	13	12	10
Pharmaceutical and medicine	460	406	422
Other chemicals	42	49	61
Rubber and plastic products	31	30	26
Non-metallic mineral products	11	11	10
Primary metals	150	138	108
Fabricated metal products	52	53	46
Machinery	109	116	121
Computer and peripheral equipment	12	21	32
Communications equipment	177	202	239
Semiconductor and other electronic components	92	85	118
Navigational, measuring, medical and control instruments	167	171	169
Other computer and electronic products	6	3	2
Electrical equipment, appliance and components	44	60	40
Motor vehicle and parts	38	23	24
Aerospace products and parts	517	x	x
All other transportation equipment	18	15	11
Furniture and related products	12	13	12
Other manufacturing industries	89	x	x
Services	1,747	1,621	1,533
Wholesale trade	200	172	179
Retail trade	9	10	x
Transportation and warehousing	16	13	x
Information and cultural industries	363	312	186
Finance, insurance and real estate	32	15	19
Architectural, engineering and related services	256	260	246
Computer system design and related services	255	247	235
Management, scientific and technical consulting services	16	21	25
Scientific research and development	278	237	241
Health care and social assistance	259	265	276
All other services	64	69	91

Note: Components may not add to totals due to rounding.

Table 1.32 Total intramural research and development (R&D) expenditures for Ontario, by selected industry			
	2004 ^p	2003 ^f	2002 ^f
	millions of dollars		
Total	7,457	7,241	7,063
Agriculture, forestry, fishing and hunting	26	25	28
Mining and oil and gas extraction	x	x	x
Utilities	x	x	x
Construction	16	16	20
Manufacturing	4,620	4,700	4,878
Food, beverages and tobacco	65	73	56
Textile	18	16	15
Wood products	12	7	9
Paper	141	116	82
Printing	10	9	10
Pharmaceutical and medicine	x	541	520
Other chemicals	123	183	166
Rubber and plastic products	102	97	73
Non-metallic mineral products	36	31	33
Primary metals	92	116	116
Fabricated metal products	106	98	92
Machinery	278	284	290
Computer and peripheral equipment	68	94	93
Communications equipment	1,224	1,397	1,646
Semiconductor and other electronic components	603	556	611
Navigational, measuring, medical and control instruments	157	138	145
Other computer and electronic products	14	13	15
Electrical equipment, appliance and components	70	75	126
Motor vehicle and parts	471	405	383
Aerospace products and parts	354	345	297
All other transportation equipment	x	x	2
Furniture and related products	12	7	7
Other manufacturing industries	x	x	90
Services	2,750	2,457	2,111
Wholesale trade	361	296	291
Retail trade	8	17	22
Transportation and warehousing	7	7	7
Information and cultural industries	750	621	319
Finance, insurance and real estate	251	193	169
Architectural, engineering and related services	123	116	138
Computer system design and related services	634	616	639
Management, scientific and technical consulting services	25	25	30
Scientific research and development	502	446	387
Health care and social assistance	16	40	33
All other services	73	80	75

Note: Components may not add to totals due to rounding.

2. R&D personnel

Due to standard financial accounting practices, it is generally easier for respondents to collect precise expenditure data than personnel data, necessitating some estimation of the latter.

By industry of employer

- Examining table 2.7 at the end of the chapter reveals that one-half of all Canadian R&D personnel are employed by seven major industries. In order of magnitude, these are computer system design and related services; information and cultural industries; communications equipment; scientific research and development; architectural, engineering and related services; machinery; and wholesale trade.
- Historical trends for a select group of industries are presented below in table 2.1.

	2004 ^p	2003 ^r	2002 ^r	2001 ^r	2000 ^r
	full-time equivalents				
Total, all industries	126,671	120,220	118,278	115,791	104,721
	percent of total R&D personnel				
Computer system design and related services	13	13	13	15	12
Information and cultural industries	8	8	7	6	5
Communications equipment	7	8	10	13	15
Scientific research and development	7	7	6	5	4
Pharmaceutical and medicine	5	5	4	4	4
Semiconductor and other electronic components	5	4	5	5	5
Aerospace products and parts	3	4	4	4	6
<i>Subtotal: Selected industries</i>	<i>48</i>	<i>49</i>	<i>49</i>	<i>52</i>	<i>51</i>
Other industries	52	51	51	49	49

Note: Components may not add to totals due to rounding.

By occupational category

- Table 2.2 shows the number of persons engaged in R&D by occupational category. Unlike the substantial decline of 2002 R&D expenditures, the number of personnel engaged in R&D has continued to increase in recent years, though at a substantially reduced pace. Year-over-year gains in personnel data fell from 10.6% in 2001 to 2.1% in 2002. This downward trend continued with an increase of only 1.6% in 2003. However the pace appears to have reaccelerated in 2004, with R&D performers reporting a 5.4% rise in the number of R&D personnel.
- The proportion of R&D personnel who are “Professionals” i.e. scientists and engineers, or senior R&D administrators, has declined somewhat from 64% to 60% over 2000 to 2004, while the role of supporting staff has increased. This second group includes technicians and technologists, and other personnel directly engaged in the R&D program such as machinists and electricians involved in the construction of prototypes, and clerks, typists, accountants and storekeepers engaged in the administration or clerical support of R&D units.
- Table 2.3 breaks down the educational level of professional R&D personnel. There is a recent trend towards higher levels of education. Comparing 2002 with 2004, the proportion of professional personnel with a bachelor’s degree as their highest level-of-education has fallen from 81% to 74%. Meanwhile, the proportion with a master’s has risen by five percentage points, from 13% to 18% and the proportion with a doctorate has risen by two percentage points to 8%.
- Chart 2.1 illustrates the occupational and degree-level breakdowns for 2004.

	2004 ^P	2003 ^r	2002 ^r	2001 ^r	2000 ^r
	full-time equivalents				
Total	126,671	120,220	118,278	115,791	104,721
Professionals	76,281	72,158	73,120	73,179	66,876
Technicians	35,125	32,839	31,570	29,693	26,742
Other	15,265	15,223	13,588	12,919	11,103

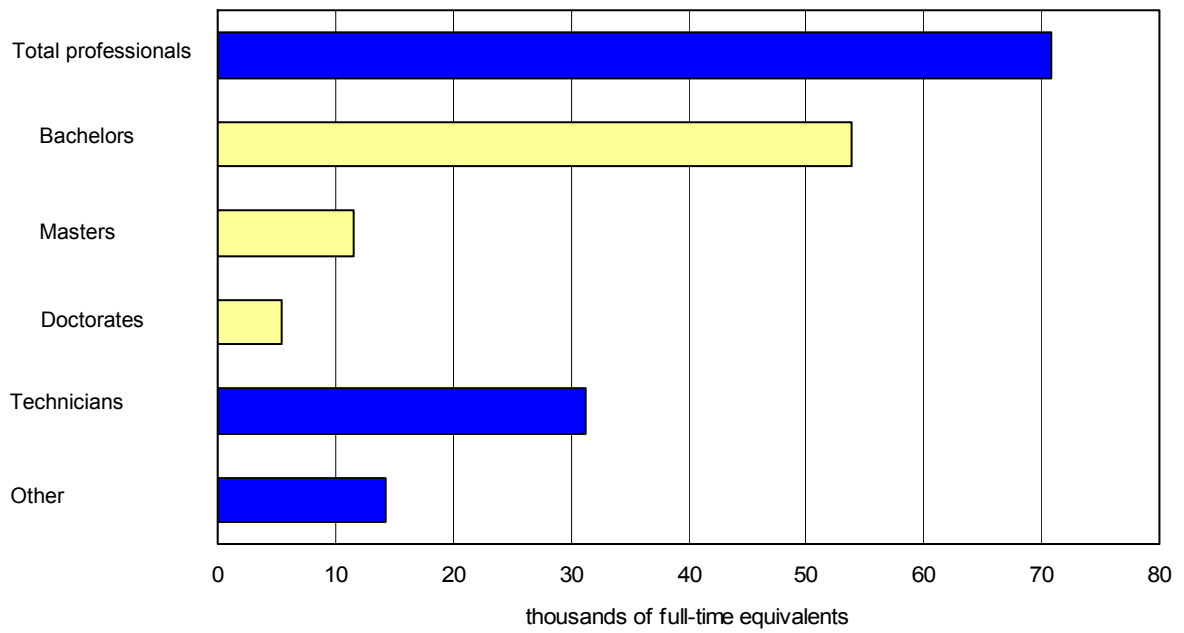
Note: Components may not add to totals due to rounding.

	Bachelors	Masters	Doctorates	Total
	full-time equivalents			
2004 ^P	56,426	14,108	5,747	76,281
2003 ^r	54,819	11,893	5,446	72,158
2002 ^r	58,959	9,564	4,597	73,120

1. Data is estimated for all performers not surveyed directly, i.e. performers whose data was obtained through the Canada Revenue Agency’s SR&ED program (see Appendix B, Survey Methodology).

Note: Components may not add to totals due to rounding.

Chart 2.1 Research and development (R&D) personnel, by occupational category and by degree level, 2004



By province

- Table 2.4 gives a provincial distribution of personnel engaged in R&D. Quebec and Ontario account for 82% of total R&D personnel, mirroring the high expenditure levels reported for these two provinces in table 1.13. British Columbia has 9% of total R&D personnel, while Alberta follows with 5%, leaving 4% for the remaining provinces and territories.
- Almost one-half of all Canadian R&D personnel are located in the province of Ontario. As shown in table 2.5, the dominant position of this province is particularly apparent in the communication equipment industry: 78% of this industry's R&D personnel are located there. The province of Quebec on the other hand, is predominant in the aerospace products and parts with 63% of that industry's R&D personnel.

Table 2.4 Provincial distribution of research and development (R&D) personnel, by occupational category, 2004

	Professionals	Other personnel	Total
full-time equivalents			
Total	76,281	50,390	126,671
Newfoundland and Labrador	233	158	391
Prince Edward Island	x	47	x
Nova Scotia	719	534	1,253
New Brunswick	380	400	780
Quebec	23,679	19,655	43,334
Ontario	37,993	22,181	60,174
Manitoba	853	668	1,521
Saskatchewan	504	520	1,024
Alberta	3,925	2,272	6,197
British Columbia	7,940	3,951	11,891
Yukon Territory, Northwest Territories and Nunavut	x	4	x

Note: Components may not add to totals due to rounding.

Table 2.5 Distribution of research and development (R&D) personnel for Quebec and Ontario, by selected industries, 2004

	Quebec	Ontario	Other provinces	Canada
full-time equivalents				
Total	43,334	60,174	23,163	126,671
Communications equipment	1,408	7,393	689	9,490
Information and cultural industries	2,969	4,147	2,868	9,984
Pharmaceutical and medicine	2,046	2,957	699	5,702
Computer system design and related services	4,912	7,886	3,304	16,102
Scientific research and development	3,461	3,100	2,411	8,972
Aerospace products and parts	2,771	1,547	46	4,364
Semiconductor and other electronic components	1,079	3,882	766	5,727
Other industries	24,688	29,262	12,380	66,330

Note: Components may not add to totals due to rounding.

Supplementary tables

- Tables 2.6 to 2.8 present additional R&D personnel data.

Table 2.6 Number of persons engaged in research and development (R&D), by industry group and by region, 2004						
	Quebec	Ontario	Alberta	British Columbia	Other provinces	Total
	full-time equivalents					
Total	43,334	60,174	6,197	11,891	5,075	126,671
Agriculture, forestry, fishing and hunting	533	432	29	195	104	1,293
Mining and oil and gas extraction	109	155	512	49	53	878
Utilities	631	113	72	51	28	895
Construction	517	284	44	78	27	950
Manufacturing	20,447	35,461	1,732	3,577	2,267	63,484
Services	21,097	23,729	3,808	7,941	2,596	59,171

Note: Components may not add to totals due to rounding.

Table 2.7 Number of persons engaged in research and development (R&D), by industry and by occupational category, 2004

	Professionals	Technicians	Other	Total
	full-time equivalents			
Total	76,281	35,125	15,265	126,671
Agriculture, forestry, fishing and hunting	488	423	382	1,293
Agriculture	349	313	337	999
Forestry and logging	111	82	25	218
Fishing, hunting and trapping	28	28	20	76
Mining and oil and gas extraction	524	257	97	878
Oil and gas extraction	334	135	55	524
Mining	190	122	42	354
Utilities	510	232	153	895
Electric power	402	197	129	728
Other utilities	108	35	24	167
Construction	439	392	119	950
Manufacturing	36,622	18,098	8,764	63,484
Food	806	503	326	1,635
Beverage and tobacco	208	96	27	331
Textile	256	322	227	805
Wood products	299	251	128	678
Paper	639	626	506	1,771
Printing	168	282	50	500
Petroleum and coal products	182	94	10	286
Pharmaceutical and medicine	3,123	1,509	1,070	5,702
Other chemicals	1,159	899	291	2,349
Plastic products	701	663	279	1,643
Rubber products	123	114	43	280
Non-metallic mineral products	241	188	104	533
Primary metal (ferrous)	194	170	60	424
Primary metal (non-ferrous)	722	426	211	1,359
Fabricated metal products	1,156	1,451	445	3,052
Machinery	3,098	2,466	759	6,323
Computer and peripheral equipment	866	349	277	1,492
Communications equipment	8,101	818	571	9,490
Semiconductor and other electronic components	4,582	839	306	5,727
Navigational, measuring, medical and control instruments	2,947	1,119	238	4,304
Other computer and electronic products	192	107	27	326
Electrical equipment, appliance and components	998	625	264	1,887
Motor vehicle and parts	2,179	1,645	1,011	4,835
Aerospace products and parts	2,206	1,049	1,109	4,364
All other transportation equipment	449	348	38	835
Furniture and related products	189	225	109	523
Other manufacturing industries	838	914	278	2,030
Services	37,698	15,723	5,750	59,171
Wholesale trade	3,945	1,665	693	6,303
Retail trade	258	200	70	528
Transportation and warehousing	230	108	55	393
Information and cultural industries	6,095	1,944	1,945	9,984
Finance, insurance and real estate	1,357	948	132	2,437
Architectural, engineering and related services	4,674	1,365	403	6,442
Computer system design and related services	11,287	4,079	736	16,102
Management, scientific and technical consulting services	820	338	84	1,242
Scientific research and development	5,739	2,420	813	8,972
Health care and social assistance	1,464	1,537	496	3,497
All other services	1,829	1,119	323	3,271

Note: Components may not add to totals due to rounding.

Table 2.8 Professional personnel engaged in research and development (R&D), by industry and by degree level, 2004

	Bachelors	Masters	Doctorates	Total
	full-time equivalents			
Total	56,426	14,108	5,747	76,281
Agriculture, forestry, fishing and hunting	404	x	x	488
Agriculture	292	x	x	349
Forestry and logging	84	x	x	111
Fishing, hunting and trapping	28	0	0	28
Mining and oil and gas extraction	326	126	72	524
Oil and gas extraction	215	79	40	334
Mining	111	47	32	190
Utilities	253	126	131	510
Electric power	145	126	131	402
Other utilities	108	0	0	108
Construction	406	x	x	439
Manufacturing	26,923	6,960	2,739	36,622
Food	677	80	49	806
Beverage and tobacco	173	25	10	208
Textile	235	17	4	256
Wood products	228	x	x	299
Paper	377	142	120	639
Printing	149	x	x	168
Petroleum and coal products	104	30	48	182
Pharmaceutical and medicine	1,694	800	629	3,123
Other chemicals	895	153	111	1,159
Plastic products	604	68	29	701
Rubber products	98	18	7	123
Non-metallic mineral products	204	x	x	241
Primary metal (ferrous)	150	28	16	194
Primary metal (non-ferrous)	467	130	125	722
Fabricated metal products	1,071	62	23	1,156
Machinery	2,495	462	141	3,098
Computer and peripheral equipment	617	170	79	866
Communications equipment	5,822	1,794	485	8,101
Semiconductor and other electronic components	3,268	1,069	245	4,582
Navigational, measuring, medical and control instruments	2,276	514	157	2,947
Other computer and electronic products	151	x	x	192
Electrical equipment, appliance and components	730	209	59	998
Motor vehicle and parts	1,743	334	102	2,179
Aerospace products and parts	1,568	531	107	2,206
All other transportation equipment	279	120	50	449
Furniture and related products	174	x	x	189
Other manufacturing industries	674	83	81	838
Services	28,114	6,834	2,750	37,698
Wholesale trade	2,972	653	320	3,945
Retail trade	255	x	x	258
Transportation and warehousing	168	x	x	230
Information and cultural industries	4,361	1,391	343	6,095
Finance, insurance and real estate	1,036	267	54	1,357
Architectural, engineering and related services	3,536	847	291	4,674
Computer system design and related services	9,033	1,757	497	11,287
Management, scientific and technical consulting services	749	55	16	820
Scientific research and development	3,695	1,194	850	5,739
Health care and social assistance	827	393	244	1,464
All other services	1,482	230	117	1,829

Note: Components may not add to totals due to rounding.

3. Payments for technological services

- The technological balance of payments (TBP) may be described as the summary of all transactions relating to the purchase and sale of technological services, information and rights which are recorded in a country's balance of payments. It is an indicator of the flow of proprietary technology into or from a country. Unfortunately, the operations associated with the transfer are not always recorded in the balance of payments statistics and the indicator can only be approximate.
- The statistics in tables 3.1 and 3.2 are acquired through the survey of industrial R&D rather than from balance of payments surveys. The payments and receipts for technology, other than R&D, are therefore incomplete, since data from firms not included in the R&D survey are not available.
- In the survey of industrial R&D, respondents spending at least \$1 million on R&D are reminded that payments should be recorded as R&D performed by others if they pay while the R&D is being carried out. The normal case is a levy to support a central R&D facility located abroad or a Canadian parent's support of the R&D of a foreign subsidiary. Payments for other technology may include reimbursement for R&D carried out in the past.
- For any industrialized country, there will be technology inflows and outflows. Some, such as the United States, have a net outflow of technology and hence receipts exceed payments.¹ Other countries import more technology than they export. Since the early 1980's, more money has been provided by foreigners for R&D performed by Canadian firms than has been paid out. In 2004, Canada continued to show a net outflow of technology (\$1,161 million), up from a sharp decline in 2002.
- Table 3.2 shows that there are differences in the balance of technological services by industry. For 2004, industries such as mining and oil and gas extraction, chemical products and communications equipment were all net importers of technology. On the other hand, industries such as computer and peripheral equipment, and petroleum and coal products were net exporters, or had a net outflow of technology for the same year. The larger dollar amounts found in the latter industries help to contribute to the overall net outflow of technology for Canada.

1. Bureau of Economic Analysis, U.S. International Services: Cross-Border Trade, Table 7: Business, professional and technical services, 1986-2004, <http://www.bea.gov/bea/di/1001serv/intlserv.htm>. Accessed March 2007.

Table 3.1 Foreign payments made and received for technological services¹							
	Payments		Receipts		Balance		Total
	R&D	Other	R&D	Other	R&D	Other	
millions of dollars							
2004 ^p	1,203	333	2,223	473	1,021	140	1,161
2003 ^f	1,172	402	2,045	432	873	31	903
2002 ^f	1,097	626	1,821	435	724	-191	533
2001 ^f	1,309	315	2,826	390	1,517	75	1,592
2000 ^f	1,374	523	3,522	339	2,148	-184	1,965
1999 ^f	1,490	523	2,642	320	1,152	-202	950
1998 ^f	1,045	694	2,499	296	1,453	-398	1,056
1997 ^f	912	698	1,750	184	837	-514	323

1. Data is only for firms engaged in R&D over \$1 million.

Table 3.2 Foreign payments made and received for technological services (R&D and other), by selected industries¹, 2004			
	Payments	Receipts	Balance
	millions of dollars		
Total	1,536	2,697	1,161
Mining and oil and gas extraction	32	0	-32
Manufacturing	1,037	1,152	115
Petroleum and coal products	40	48	8
Chemical products	57	39	-18
Computer and peripheral equipment	35	48	13
Communications equipment	73	70	-3
All other manufacturing industries	832	947	115
Other industries	466	1,544	1,078

1. Data is only for firms engaged in R&D over \$1 million.

4. Energy R&D expenditures

- The community of energy R&D performers is quite small, with only about 1% of all R&D performers reporting energy R&D expenditures in 2004. However, these companies spent \$714 million, or 4.9% of all industrial R&D, on energy research and development in 2004. In addition, these same companies performed \$554 million in non-energy areas for total expenditures of \$1,268 million, or about 9% of total R&D in 2004.
- In table 4.3, one observes that 76% of energy R&D is funded by the performing companies themselves. According to industrial R&D performers, the government sector funded a total of \$28 million on energy R&D, with much of this going towards nuclear R&D and other cross-cutting techniques or research. This latter category includes activities such as energy system analysis, as well as R&D on the environment, climate change, energy storage and alternative transportation fuels.
- The greatest proportion of energy R&D concerned fossil fuels, representing roughly half of all intramural energy R&D expenditures in 2004. Nuclear energy was the field of minimum inquiry, which accounted for only 6% of the 2004 total.

Table 4.1 Energy research and development (R&D) performers, by major industry group, 2004

	Energy R&D performers
	number
Total	145
Mining and oil and gas extraction	14
Manufacturing	68
Other	63

Table 4.2 Research and development (R&D) expenditures of energy R&D performers, by major industry group, 2004					
	Energy R&D performers			Non-energy R&D performers	Total
	Energy R&D expenditures	Other R&D expenditures	Total		
millions of dollars					
Total	714	554	1,268	13,173	14,441
Mining and oil and gas extraction	159	7	166	108	274
Manufacturing	269	484	753	7,234	7,986
Other	286	63	349	5,831	6,181

Note: Components may not add to totals due to rounding.

Table 4.3 Energy research and development (R&D) expenditures, by area of technology and by source of funds, 2004						
	Intramural R&D expenditures				Payments outside Canada	Total
	Self-funded	Government funded	Other sources	Total		
millions of dollars						
Total	576	28	110	714	41	755
Renewable resources	70	2	10	82	1	83
Transportation and transmission	60	0	19	79	2	80
Conservation	59	4	8	71	0	71
Fossil fuels	304	0	47	350	11	361
Nuclear	32	8	4	44	0	44
Other cross-cutting techniques or research	52	13	23	87	28	115

Note: Components may not add to totals due to rounding.

5. R&D expenditures on therapeutic health products

- According to table 5.1 below, brand name pharmaceutical and biotechnology or biopharmaceutical companies account for the majority of companies performing R&D related to the discovery and development of therapeutic health products for human use in 2004.
- Table 5.2 provides a breakdown of R&D expenditures on health therapeutics, by the type of organization performing the R&D. Reflective of their substantial numbers, brand name pharmaceutical companies and biotechnology or biopharmaceutical companies dominate expenditures in the field. Brand name pharmaceutical companies stand out in particular, as they are similar in number to biotechnology or biopharmaceutical companies, but have nearly triple the expenditures.
- Though total R&D expenditures on therapeutic health products fell in 2004, preliminary data for 2005 and 2006 show a healthy recovery, with a net growth of 17.6% from 2003 to 2006. Contract research organizations have seen particularly strong growth, with their health R&D expenditures rising by more than one-half over this same period.
- Table 5.3 provides a breakdown of R&D on therapeutic health products, by therapeutic class, for both 2003 and 2004. Anti-infective for systemic use is the most substantial therapeutic class, with about 20% of the total being spent on this class for both years under observation. This area of research encompasses those therapeutics capable of killing or inhibiting the growth or spread of infectious agents throughout the body, thus including treatments such as vaccines, antibacterials and antivirals. Other prominent classes include nervous system, cardiovascular system, and antineoplastic and immunomodulating agents. This final class incorporates both agents acting to prevent, inhibit or cease the development of tumours and those that modify the body's immune response or functioning.

Table 5.1 Companies performing research and development (R&D) expenditures related to therapeutic health products, by type of organization, 2004

	number
Total	87
Brand name pharmaceutical company	33
Generic pharmaceutical company	5
Contract research organization	10
Biotechnology or biopharmaceutical company	32
Other	7

Table 5.2 Research and development (R&D) expenditures on therapeutic health products, by type of organization				
	2006 ⁱ	2005 ^p	2004 ^p	2003
	thousands of dollars			
Total	742,175	706,472	601,288	631,175
Brand name pharmaceutical company	413,469	403,882	317,012	367,988
Generic pharmaceutical company	18,229	11,359	12,986	18,139
Contract research organization	61,569	61,946	53,601	40,174
Biotechnology or biopharmaceutical company	151,650	145,961	135,271	120,110
Other	97,258	83,324	82,418	84,764

Note: Components may not add to totals due to rounding.

Table 5.3 Research and development (R&D) expenditures on therapeutic health products, by therapeutic class		
	2004	2003
	thousands of dollars	
Total	601,288	631,175
Alimentary tract and metabolism	43,512	44,451
Blood and blood forming organs	29,415	32,324
Cardiovascular system	67,004	40,435
Dermatological	14,444	10,574
Genito-urinary systems and sex hormones	12,187	13,807
Systemic hormonal preparation excluding sex hormones and insulin	11,178	10,372
Anti-infective for systemic use	120,589	129,031
Antineoplastic and immunomodulating agents	71,941	53,236
Musculo-skeletal systems	19,595	50,251
Nervous system	84,241	76,516
Antiparasitic products, insecticides and repellents	x	x
Respiratory system	33,466	71,349
Sensory organs	x	x
Various others	91,719	96,033

Note: Components may not add to totals due to rounding.

Appendix A

Table A.1 – Number of research and development (R&D) performers 2003, by industry and by country of control

Table A.2 – Number of research and development (R&D) performers 2003, by NAICS 2002

Table A.1 Research and development (R&D) performers, by industry and by country of control, 2003

	Country of control			Total
	Canada	United States	Foreign	
	number			
Total	13,823	286	215	14,324
Agriculture, forestry, fishing and hunting	452	1	3	456
Agriculture	363	1	3	367
Forestry and logging	43	0	0	43
Fishing, hunting and trapping	46	0	0	46
Mining and oil and gas extraction	92	9	5	106
Oil and gas extraction	49	4	1	54
Mining	43	5	4	52
Utilities	69	0	0	69
Electric power	12	0	0	12
Other utilities	57	0	0	57
Construction	401	1	0	402
Manufacturing	6,020	194	137	6,351
Food	450	15	3	468
Beverage and tobacco	28	0	2	30
Textile	159	7	3	169
Wood products	225	0	2	227
Paper	103	11	7	121
Printing	155	1	0	156
Petroleum and coal products	24	5	4	33
Pharmaceutical and medicine	83	16	10	109
Other chemicals	302	21	21	344
Plastic products	370	9	5	384
Rubber products	49	5	1	55
Non-metallic mineral products	135	2	6	143
Primary metal (ferrous)	50	1	6	57
Primary metal (non-ferrous)	58	1	6	65
Fabricated metal products	845	8	7	860
Machinery	1,086	14	13	1,113
Computer and peripheral equipment	67	8	1	76
Communications equipment	129	11	4	144
Semiconductor and other electronic components	144	7	1	152
Navigational, measuring, medical and control instruments	257	6	8	271
Other computer and electronic products	44	1	0	45
Electrical equipment, appliance and components	199	14	10	223
Motor vehicle and parts	187	14	12	213
Aerospace products and parts	64	5	2	71
All other transportation equipment	84	3	0	87
Furniture and related products	211	1	0	212
Other manufacturing industries	512	8	3	523
Services	6,789	81	70	6,940
Wholesale trade	1,066	22	30	1,118
Retail trade	262	0	1	263
Transportation and warehousing	96	2	0	98
Information and cultural industries	489	9	8	506
Finance, insurance and real estate	157	2	1	160
Architectural, engineering and related services	726	4	8	738
Computer system design and related services	1,931	17	8	1,956
Management, scientific and technical consulting services	390	0	1	391
Scientific research and development	651	16	8	675
Health care and social assistance	119	2	1	122
All other services	902	7	4	913

Table A.2 Number of research and development (R&D) performers 2003, by NAICS 2002					
NAICS Code	Industry	Performers	NAICS Code	Industry	Performers
	Total, all industries	14,324			
	Agriculture, Forestry, Fishing and Hunting	456		Agriculture, forestry, fishing and hunting (continued)	
	Agriculture	367		Fishing, Hunting and Trapping	46
111110	Soybean Farming	1	112510	Animal Aquaculture	31
111120	Oilseed (except Soybean) Farming	0	114113	Salt Water Fishing	11
111130	Dry Pea and Bean Farming	2	114114	Inland Fishing	4
111140	Wheat Farming	1	114210	Hunting and Trapping	0
111150	Corn Farming	1			
111190	Other Grain Farming	2			
111211	Potato Farming	17		Mining and Oil and Gas Extraction	106
111219	Other Vegetable (except Potato) and Melon Farming	40			
111310	Orange Groves	0		Oil and Gas Extraction	54
111320	Citrus (except Orange) Groves	0	211113	Conventional Oil and Gas Extraction	14
111330	Non-Citrus Fruit and Tree Nut Farming	28	211114	Non-Conventional Oil Extraction	3
111411	Mushroom Production	10	213111	Oil and Gas Contract Drilling	7
111419	Other Food Crops Grown Under Cover	22	213118	Services to Oil and Gas Extraction	30
111421	Nursery and Tree Production	31			
111422	Floriculture Production	44		Mining	52
111910	Tobacco Farming	12	212114	Bituminous Coal Mining	0
111920	Cotton Farming	0	212115	Subbituminous Coal Mining	0
111930	Sugar-Cane Farming	0	212116	Lignite Coal Mining	0
111940	Hay Farming	4	212210	Iron Ore Mining	2
111993	Fruit and Vegetable Combination Farming	5	212220	Gold and Silver Ore Mining	3
111999	All Other Miscellaneous Crop Farming	23	212231	Lead-Zinc Ore Mining	0
112110	Beef Cattle Ranching and Farming, including Feedlots	8	212232	Nickel-Copper Ore Mining	1
112120	Dairy Cattle and Milk Production	18	212233	Copper-Zinc Ore Mining	3
112210	Hog and Pig Farming	23	212291	Uranium Ore Mining	3
112310	Chicken Egg Production	2	212299	All Other Metal Ore Mining	2
112320	Broiler and Other Meat-Type Chicken Production	7	212314	Granite Mining and Quarrying	2
112330	Turkey Production	1	212315	Limestone Mining and Quarrying	4
112340	Poultry Hatcheries	2	212316	Marble Mining and Quarrying	1
112391	Combination Poultry and Egg Production	1	212317	Sandstone Mining and Quarrying	0
112399	All Other Poultry Production	2	212323	Sand and Gravel Mining and Quarrying	4
112410	Sheep Farming	0	212326	Shale, Clay and Refractory Mineral Mining and Quarrying	0
112420	Goat Farming	0	212392	Diamond Mines	0
112910	Apiculture	3	212393	Salt Mines	0
112920	Horse and Other Equine Production	1	212394	Asbestos Mining	0
112930	Fur-Bearing Animal and Rabbit Production	0	212395	Gypsum Mining	0
112991	Livestock Combination Farming	20	212396	Potash Mining	3
112999	All Other Miscellaneous Animal Production	0	212397	Peat Extraction	7
115110	Support Activities for Crop Production	24	212398	All Other Non-Metallic Mineral Mining and Quarrying	2
115210	Support Activities for Animal Production	12	213117	Contract Drilling (except Oil and Gas)	5
			213119	Other Support Activities for Mining	10
	Forestry and Logging	43			
113210	Forest Nurseries and Gathering of Forest Products	2			
113311	Logging (except Contract)	8			
113312	Contract Logging	14			
115310	Support Activities for Forestry	19			

Table A.2 Number of research and development (R&D) performers 2003, by NAICS 2002 (continued)					
NAICS Code	Industry	Performers	NAICS Code	Industry	Performers
	Utilities	69		Construction (continued)	
	Electric Power	12	238330	Flooring Contractors	6
221111	Hydro-Electric Power Generation	8	238340	Tile and Terrazzo Contractors	1
221112	Fossil-Fuel Electric Power Generation	1	238350	Finish Carpentry Contractors	19
221113	Nuclear Electric Power Generation	0	238390	Other Building Finishing Contractors	5
221119	Other Electric Power Generation	0	238910	Site Preparation Contractors	14
221121	Electric Bulk Power Transmission and Control	1	238990	All Other Specialty Trade Contractors	13
221122	Electric Power Distribution	2			
	Other Utilities	57		Manufacturing	6,351
221210	Natural Gas Distribution	2			
221310	Water Supply and Irrigation Systems	9			
221320	Sewage Treatment Facilities	3		Food	468
221330	Steam and Air-Conditioning Supply	0	311111	Dog and Cat Food Manufacturing	4
562110	Waste Collection	6	311119	Other Animal Food Manufacturing	35
562210	Waste Treatment and Disposal	16	311211	Flour Milling	10
562910	Remediation Services	12	311214	Rice Milling and Malt Manufacturing	1
562920	Material Recovery Facilities	2	311221	Wet Corn Milling	2
562990	All Other Waste Management Services	7	311224	Oilseed Processing	6
			311225	Fat and Oil Refining and Blending	1
			311310	Sugar Manufacturing	2
	Construction	402	311320	Chocolate and Confectionery Manufacturing from Cacao Beans	4
236110	Residential Building Construction	43	311330	Confectionery Manufacturing from Purchased Chocolate	3
236210	Industrial Building and Structure Construction	13	311340	Non-Chocolate Confectionery Manufacturing	9
236220	Commercial and Institutional Building Construction	14	311410	Frozen Food Manufacturing	21
237110	Water and Sewer Line and Related Structures Construction	3	311420	Fruit and Vegetable Canning, Pickling and Drying	40
237120	Oil and Gas Pipeline and Related Structures Construction	5	311511	Fluid Milk Manufacturing	16
237130	Power and Communication Line and Related Structures Construction	3	311515	Butter, Cheese, and Dry and Condensed Dairy Products Manufacturing	41
237210	Land Subdivision	9	311520	Ice Cream and Frozen Dessert Manufacturing	5
237310	Highway, Street and Bridge Construction	25	311611	Animal (except Poultry) Slaughtering	17
237990	Other Heavy and Civil Engineering Construction	6	311614	Rendering and Meat Processing from Carcasses	33
238110	Poured Concrete Foundation and Structure Contractors	9	311615	Poultry Processing	17
238120	Structural Steel and Precast Concrete Contractors	12	311710	Seafood Product Preparation and Packaging	27
238130	Framing Contractors	4	311811	Retail Bakeries	12
238140	Masonry Contractors	9	311814	Commercial Bakeries and Frozen Bakery Product Manufacturing	47
238150	Glass and Glazing Contractors	6	311821	Cookie and Cracker Manufacturing	9
238160	Roofing Contractors	3	311822	Flour Mixes and Dough Manufacturing from Purchased Flour	11
238170	Siding Contractors	8	311823	Dry Pasta Manufacturing	4
238190	Other Foundation, Structure and Building Exterior Contractors	6	311830	Tortilla Manufacturing	0
238210	Electrical Contractors	71	311911	Roasted Nut and Peanut Butter Manufacturing	1
238220	Plumbing, Heating and Air-Conditioning Contractors	60	311919	Other Snack Food Manufacturing	9
238291	Elevator and Escalator Installation Contractors	2	311920	Coffee and Tea Manufacturing	11
238299	All Other Building Equipment Contractors	19	311930	Flavouring Syrup and Concentrate Manufacturing	5
238310	Drywall and Insulation Contractors	4	311940	Seasoning and Dressing Manufacturing	15
238320	Painting and Wall Covering Contractors	10	311990	All Other Food Manufacturing	47

Table A.2 Number of research and development (R&D) performers 2003, by NAICS 2002 (continued)					
NAICS Code	Industry	Performers	NAICS Code	Industry	Performers
Manufacturing (continued)			Manufacturing (continued)		
Beverages and Tobacco			Paper (continued)		
312110	Soft Drink and Ice Manufacturing	3	322219	Other Paperboard Container Manufacturing	4
312120	Breweries	11	322220	Paper Bag and Coated and Treated Paper Manufacturing	29
312130	Wineries	9	322230	Stationery Product Manufacturing	4
312140	Distilleries	4	322291	Sanitary Paper Product Manufacturing	6
312210	Tobacco Stemming and Redrying	0	322299	All Other Converted Paper Product Manufacturing	14
312220	Tobacco Product Manufacturing	3	Printing		
			156		
Textile			323113	Commercial Screen Printing	13
313110	Fibre, Yarn and Thread Mills	12	323114	Quick Printing	0
313210	Broad-Woven Fabric Mills	26	323115	Digital Printing	7
313220	Narrow Fabric Mills and Schiffli Machine Embroidery	11	323116	Manifold Business Forms Printing	13
313230	Nonwoven Fabric Mills	9	323119	Other Printing	91
313240	Knit Fabric Mills	29	323120	Support Activities for Printing	32
313310	Textile and Fabric Finishing	26	Petroleum and Coal Products		
313320	Fabric Coating	5	33		
314110	Carpet and Rug Mills	5	324110	Petroleum Refineries	11
314120	Curtain and Linen Mills	8	324121	Asphalt Paving Mixture and Block Manufacturing	7
314910	Textile Bag and Canvas Mills	23	324122	Asphalt Shingle and Coating Material Manufacturing	1
314990	All Other Textile Product Mills	15	324190	Other Petroleum and Coal Products Manufacturing	14
Wood Products			Pharmaceutical and Medicine		
227			109		
321111	Sawmills (except Shingle and Shake Mills)	43	325410	Pharmaceutical and Medicine Manufacturing	109
321112	Shingle and Shake Mills	4	Other Chemical		
321114	Wood Preservation	9	344		
321211	Hardwood Veneer and Plywood Mills	9	325110	Petrochemical Manufacturing	2
321212	Softwood Veneer and Plywood Mills	4	325120	Industrial Gas Manufacturing	3
321215	Structural Wood Product Manufacturing	13	325130	Synthetic Dye and Pigment Manufacturing	7
321216	Particle Board and Fibreboard Mills	8	325181	Alkali and Chlorine Manufacturing	1
321217	Waferboard Mills	2	325189	All Other Basic Inorganic Chemical Manufacturing	18
321911	Wood Window and Door Manufacturing	37	325190	Other Basic Organic Chemical Manufacturing	15
321919	Other Millwork	51	325210	Resin and Synthetic Rubber Manufacturing	28
321920	Wood Container and Pallet Manufacturing	18	325220	Artificial and Synthetic Fibres and Filaments Manufacturing	6
321991	Manufactured (Mobile) Home Manufacturing	0	325313	Chemical Fertilizer (except Potash) Manufacturing	6
321992	Prefabricated Wood Building Manufacturing	10	325314	Mixed Fertilizer Manufacturing	8
321999	All Other Miscellaneous Wood Product Manufacturing	19	325320	Pesticide and Other Agricultural Chemical Manufacturing	7
			325510	Paint and Coating Manufacturing	48
Paper			325520	Adhesive Manufacturing	22
121			325610	Soap and Cleaning Compound Manufacturing	49
322111	Mechanical Pulp Mills	1	325620	Toilet Preparation Manufacturing	39
322112	Chemical Pulp Mills	9	325910	Printing Ink Manufacturing	12
322121	Paper (except Newsprint) Mills	20	325920	Explosives Manufacturing	3
322122	Newsprint Mills	7	325991	Custom Compounding of Purchased Resins	9
322130	Paperboard Mills	5	325999	All Other Miscellaneous Chemical Product Manufacturing	61
322211	Corrugated and Solid Fibre Box Manufacturing	9			
322212	Folding Paperboard Box Manufacturing	13			

Table A.2 Number of research and development (R&D) performers 2003, by NAICS 2002 (continued)					
NAICS Code	Industry	Performers	NAICS Code	Industry	Performers
	Manufacturing (continued)			Manufacturing (continued)	
	Plastic Product	384		Primary Metal (Non-Ferrous)	65
326111	Plastic Bag Manufacturing	27	331313	Primary Production of Alumina and Aluminium	5
326114	Plastic Film and Sheet Manufacturing	31	331317	Aluminium Rolling, Drawing, Extruding and Alloying	14
326121	Unlaminated Plastic Profile Shape Manufacturing	15	331410	Non-Ferrous Metal (except Aluminium) Smelting and Refining	8
326122	Plastic Pipe and Pipe Fitting Manufacturing	8	331420	Copper Rolling, Drawing, Extruding and Alloying	6
326130	Laminated Plastic Plate, Sheet and Shape Manufacturing	11	331490	Non-Ferrous Metal (except Copper and Aluminium) Rolling, Drawing, Extruding and Alloying	8
326140	Polystyrene Foam Product Manufacturing	15	331523	Non-Ferrous Die-Casting Foundries	12
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	15	331529	Non-Ferrous Foundries (except Die-Casting)	12
326160	Plastic Bottle Manufacturing	12			
326191	Plastic Plumbing Fixture Manufacturing	9		Fabricated Metal Product	860
326193	Motor Vehicle Plastic Parts Manufacturing	40	332113	Forging	28
326198	All Other Plastic Product Manufacturing	201	332118	Stamping	40
			332210	Cutlery and Hand Tool Manufacturing	39
	Rubber Product	55	332311	Prefabricated Metal Building and Component Manufacturing	12
326210	Tire Manufacturing	3	332314	Concrete Reinforcing Bar Manufacturing	2
326220	Rubber and Plastic Hose and Belting Manufacturing	9	332319	Other Plate Work and Fabricated Structural Product Manufacturing	64
326290	Other Rubber Product Manufacturing	43	332321	Metal Window and Door Manufacturing	54
			332329	Other Ornamental and Architectural Metal Products Manufacturing	53
	Non-Metallic Mineral Products	143	332410	Power Boiler and Heat Exchanger Manufacturing	9
327110	Pottery, Ceramics and Plumbing Fixture Manufacturing	1	332420	Metal Tank (Heavy Gauge) Manufacturing	32
327120	Clay Building Material and Refractory Manufacturing	10	332431	Metal Can Manufacturing	1
327214	Glass Manufacturing	14	332439	Other Metal Container Manufacturing	10
327215	Glass Product Manufacturing from Purchased Glass	19	332510	Hardware Manufacturing	19
327310	Cement Manufacturing	1	332611	Spring (Heavy Gauge) Manufacturing	2
327320	Ready-Mix Concrete Manufacturing	12	332619	Other Fabricated Wire Product Manufacturing	26
327330	Concrete Pipe, Brick and Block Manufacturing	11	332710	Machine Shops	267
327390	Other Concrete Product Manufacturing	26	332720	Turned Product and Screw, Nut and Bolt Manufacturing	24
327410	Lime Manufacturing	0	332810	Coating, Engraving, Heat Treating and Allied Activities	75
327420	Gypsum Product Manufacturing	6	332910	Metal Valve Manufacturing	21
327910	Abrasive Product Manufacturing	8	332991	Ball and Roller Bearing Manufacturing	4
327990	All Other Non-Metallic Mineral Product Manufacturing	35	332999	All Other Miscellaneous Fabricated Metal Product Manufacturing	78
	Primary Metal (Ferrous)	57		Machinery	1,113
331110	Iron and Steel Mills and Ferro-Alloy Manufacturing	10	333110	Agricultural Implement Manufacturing	86
331210	Iron and Steel Pipes and Tubes Manufacturing from Purchased Steel	15	333120	Construction Machinery Manufacturing	37
331221	Cold-Rolled Steel Shape Manufacturing	0	333130	Mining and Oil and Gas Field Machinery Manufacturing	38
331222	Steel Wire Drawing	6	333210	Sawmill and Woodworking Machinery Manufacturing	24
331511	Iron Foundries	14	333220	Rubber and Plastics Industry Machinery Manufacturing	19
331514	Steel Foundries	12	333291	Paper Industry Machinery Manufacturing	15
			333299	All Other Industrial Machinery Manufacturing	88

Table A.2 Number of research and development (R&D) performers 2003, by NAICS 2002 (continued)					
NAICS Code	Industry	Performers	NAICS Code	Industry	Performers
	Manufacturing (continued)			Manufacturing (continued)	
	Machinery (continued)			Electrical Equipment, Appliance and Component (continued)	
333310	Commercial and Service Industry Machinery Manufacturing	93	335311	Power, Distribution and Specialty Transformers Manufacturing	22
333413	Industrial and Commercial Fan and Blower and Air Purification Equipment Manufacturing	31	335312	Motor and Generator Manufacturing	13
333416	Heating Equipment and Commercial Refrigeration Equipment Manufacturing	67	335315	Switchgear and Switchboard, and Relay and Industrial Control Apparatus Manufacturing	42
333511	Industrial Mould Manufacturing	114	335910	Battery Manufacturing	6
333519	Other Metalworking Machinery Manufacturing	204	335920	Communication and Energy Wire and Cable Manufacturing	14
333611	Turbine and Turbine Generator Set Unit Manufacturing	12	335930	Wiring Device Manufacturing	16
333619	Other Engine and Power Transmission Equipment Manufacturing	12	335990	All Other Electrical Equipment and Component Manufacturing	33
333910	Pump and Compressor Manufacturing	26			
333920	Material Handling Equipment Manufacturing	107		Motor Vehicle and Parts	213
333990	All Other General-Purpose Machinery Manufacturing	140	336110	Automobile and Light-Duty Motor Vehicle Manufacturing	8
	Computer and Peripheral Equipment	76	336120	Heavy-Duty Truck Manufacturing	9
334110	Computer and Peripheral Equipment Manufacturing	76	336211	Motor Vehicle Body Manufacturing	33
			336212	Truck Trailer Manufacturing	20
	Communications Equipment	144	336215	Motor Home, Travel Trailer and Camper Manufacturing	7
334210	Telephone Apparatus Manufacturing	39	336310	Motor Vehicle Gasoline Engine and Engine Parts Manufacturing	16
334220	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	70	336320	Motor Vehicle Electrical and Electronic Equipment Manufacturing	20
334290	Other Communications Equipment Manufacturing	35	336330	Motor Vehicle Steering and Suspension Components (except Spring) Manufacturing	5
			336340	Motor Vehicle Brake System Manufacturing	16
	Semiconductor and Other Electronic Component	152	336350	Motor Vehicle Transmission and Power Train Parts Manufacturing	9
334410	Semiconductor and Other Electronic Component Manufacturing	152	336360	Motor Vehicle Seating and Interior Trim Manufacturing	13
			336370	Motor Vehicle Metal Stamping	16
	Navigational, Measuring, Medical and Control Instruments	271	336390	Other Motor Vehicle Parts Manufacturing	41
334511	Navigational and Guidance Instruments Manufacturing	41		Aerospace Product and Parts	71
334512	Measuring, Medical and Controlling Devices Manufacturing	230	336410	Aerospace Product and Parts Manufacturing	71
	Other Computer and Electronic Product	45		All Other Transportation Equipment	87
334310	Audio and Video Equipment Manufacturing	26	336510	Railroad Rolling Stock Manufacturing	8
334610	Manufacturing and Reproducing Magnetic and Optical Media	19	336611	Ship Building and Repairing	1
			336612	Boat Building	50
	Electrical Equipment, Appliance and Component	223	336990	Other Transportation Equipment Manufacturing	28
335110	Electric Lamp Bulb and Parts Manufacturing	3			
335120	Lighting Fixture Manufacturing	40		Furniture and Related Product	212
335210	Small Electrical Appliance Manufacturing	18	337110	Wood Kitchen Cabinet and Counter Top Manufacturing	32
335223	Major Kitchen Appliance Manufacturing	10	337121	Upholstered Household Furniture Manufacturing	11
335229	Other Major Appliance Manufacturing	6	337123	Other Wood Household Furniture Manufacturing	57
			337126	Household Furniture (except Wood and Upholstered) Manufacturing	10

Table A.2 Number of research and development (R&D) performers 2003, by NAICS 2002 (continued)					
NAICS Code	Industry	Performers	NAICS Code	Industry	Performers
	Manufacturing (continued)			Services	6,940
	Furniture and Related Product (continued)			Wholesale Trade	1,118
337127	Institutional Furniture Manufacturing	19	411110	Live Animal Wholesaler-Distributors	1
337213	Wood Office Furniture, including Custom Architectural Woodwork, Manufacturing	22	411120	Oilseed and Grain Wholesaler-Distributors	8
337214	Office Furniture (except Wood) Manufacturing	12	411130	Nursery Stock and Plant Wholesaler-Distributors	6
337215	Showcase, Partition, Shelving and Locker Manufacturing	33	411190	Other Farm Product Wholesaler-Distributors	0
337910	Mattress Manufacturing	12	412110	Petroleum Product Wholesaler-Distributors	7
337920	Blind and Shade Manufacturing	4	413110	General-Line Food Wholesaler-Distributors	7
			413120	Dairy and Milk Products Wholesaler-Distributors	6
	Other Manufacturing Industries	523	413130	Poultry and Egg Wholesaler-Distributors	0
315110	Hosiery and Sock Mills	7	413140	Fish and Seafood Product Wholesaler-Distributors	2
315190	Other Clothing Knitting Mills	22	413150	Fresh Fruit and Vegetable Wholesaler-Distributors	19
315210	Cut and Sew Clothing Contracting	15	413160	Red Meat and Meat Product Wholesaler-Distributors	13
315221	Men's and Boys' Cut and Sew Underwear and Nightwear Manufacturing	1	413190	Other Specialty-Line Food Wholesaler-Distributors	47
315222	Men's and Boys' Cut and Sew Suit, Coat and Overcoat Manufacturing	7	413210	Non-Alcoholic Beverage Wholesaler-Distributors	2
315226	Men's and Boys' Cut and Sew Shirt Manufacturing	1	413220	Alcoholic Beverage Wholesaler-Distributors	2
315227	Men's and Boys' Cut and Sew Trouser, Slack and Jean Manufacturing	4	413310	Cigarette and Tobacco Product Wholesaler-Distributors	0
315229	Other Men's and Boys' Cut and Sew Clothing Manufacturing	8	414110	Clothing and Clothing Accessories Wholesaler-Distributors	18
315231	Women's and Girls' Cut and Sew Lingerie, Loungewear and Nightwear Manufacturing	9	414120	Footwear Wholesaler-Distributors	1
315232	Women's and Girls' Cut and Sew Blouse and Shirt Manufacturing	0	414130	Piece Goods, Notions and Other Dry Goods Wholesaler-Distributors	15
315233	Women's and Girls' Cut and Sew Dress Manufacturing	6	414210	Home Entertainment Equipment Wholesaler-Distributors	8
315234	Women's and Girls' Cut and Sew Suit, Coat, Tailored Jacket and Skirt Manufacturing	4	414220	Household Appliance Wholesaler-Distributors	5
315239	Other Women's and Girls' Cut and Sew Clothing Manufacturing	20	414310	China, Glassware, Crockery and Pottery Wholesaler-Distributors	2
315291	Infants' Cut and Sew Clothing Manufacturing	1	414320	Floor Covering Wholesaler-Distributors	5
315292	Fur and Leather Clothing Manufacturing	7	414330	Linen, Drapery and Other Textile Furnishings Wholesaler-Distributors	0
315299	All Other Cut and Sew Clothing Manufacturing	1	414390	Other Home Furnishings Wholesaler-Distributors	4
315990	Clothing Accessories and Other Clothing Manufacturing	13	414410	Jewellery and Watch Wholesaler-Distributors	1
316110	Leather and Hide Tanning and Finishing	7	414420	Book, Periodical and Newspaper Wholesaler-Distributors	1
316210	Footwear Manufacturing	13	414430	Photographic Equipment and Supplies Wholesaler-Distributors	3
316990	Other Leather and Allied Product Manufacturing	8	414440	Sound Recording Wholesalers	0
339110	Medical Equipment and Supplies Manufacturing	116	414450	Video Cassette Wholesalers	0
339910	Jewellery and Silverware Manufacturing	21	414460	Toy and Hobby Goods Wholesaler-Distributors	5
339920	Sporting and Athletic Goods Manufacturing	61	414470	Amusement and Sporting Goods Wholesaler-Distributors	11
339930	Doll, Toy and Game Manufacturing	12	414510	Pharmaceuticals and Pharmacy Supplies Wholesaler-Distributors	35
339940	Office Supplies (except Paper) Manufacturing	7	414520	Toiletries, Cosmetics and Sundries Wholesaler-Distributors	19
339950	Sign Manufacturing	31	415110	New and Used Automobile and Light-Duty Truck Wholesaler-Distributors	1
339990	All Other Miscellaneous Manufacturing	121	415120	Truck, Truck Tractor and Bus Wholesaler-Distributors	6

Table A.2 Number of research and development (R&D) performers 2003, by NAICS 2002 (continued)					
NAICS Code	Industry	Performers	NAICS Code	Industry	Performers
	Services (continued)			Services (continued)	
	Wholesale Trade (continued)			Wholesale Trade (continued)	
415190	Recreational and Other Motor Vehicles Wholesaler-Distributors	3	418930	Second-Hand Goods (except Machinery and Automotive) Wholesaler-Distributors	0
415210	Tire Wholesaler-Distributors	2	418990	All Other Wholesaler-Distributors	68
415290	Other New Motor Vehicle Parts and Accessories Wholesaler-Distributors	19	419110	Farm Product Agents and Brokers	2
415310	Used Motor Vehicle Parts and Accessories Wholesaler-Distributors	1	419120	Petroleum Product Agents and Brokers	1
416110	Electrical Wiring and Construction Supplies Wholesaler-Distributors	29	419130	Food, Beverage and Tobacco Agents and Brokers	5
416120	Plumbing, Heating and Air-Conditioning Equipment and Supplies Wholesaler-Distributors	30	419140	Personal and Household Goods Agents and Brokers	3
416210	Metal Service Centres	17	419150	Motor Vehicle and Parts Agents and Brokers	1
416310	General-Line Building Supplies Wholesaler-Distributors	7	419160	Building Material and Supplies Agents and Brokers	4
416320	Lumber, Plywood and Millwork Wholesaler-Distributors	15	419170	Machinery, Equipment and Supplies Agents and Brokers	19
416330	Hardware Wholesaler-Distributors	20	419190	Other Wholesale Agents and Brokers	30
416340	Paint, Glass and Wallpaper Wholesaler-Distributors	5			
416390	Other Specialty-Line Building Supplies Wholesaler-Distributors	20		Retail Trade	263
417110	Farm, Lawn and Garden Machinery and Equipment Wholesaler-Distributors	32	441110	New Car Dealers	0
417210	Construction and Forestry Machinery, Equipment and Supplies Wholesaler-Distributors	15	441120	Used Car Dealers	0
417220	Mining and Oil and Gas Well Machinery, Equipment and Supplies Wholesaler-Distributors	14	441210	Recreational Vehicle Dealers	1
417230	Industrial Machinery, Equipment and Supplies Wholesaler-Distributors	97	441220	Motorcycle, Boat and Other Motor Vehicle Dealers	6
417310	Computer, Computer Peripheral and Pre-Packaged Software Wholesaler-Distributors	77	441310	Automotive Parts and Accessories Stores	4
417320	Electronic Components, Navigational and Communications Equipment and Supplies Wholesaler-Distributors	61	441320	Tire Dealers	0
417910	Office and Store Machinery and Equipment Wholesaler-Distributors	23	442110	Furniture Stores	3
417920	Service Establishment Machinery, Equipment and Supplies Wholesaler-Distributors	14	442210	Floor Covering Stores	1
417930	Professional Machinery, Equipment and Supplies Wholesaler-Distributors	69	442291	Window Treatment Stores	2
417990	All Other Machinery, Equipment and Supplies Wholesaler-Distributors	25	442292	Print and Picture Frame Stores	3
418110	Recyclable Metal Wholesaler-Distributors	9	442298	All Other Home Furnishings Stores	3
418120	Recyclable Paper and Paperboard Wholesaler-Distributors	3	443110	Appliance, Television and Other Electronics Stores	19
418190	Other Recyclable Material Wholesaler-Distributors	27	443120	Computer and Software Stores	70
418210	Stationery and Office Supplies Wholesaler-Distributors	4	443130	Camera and Photographic Supplies Stores	1
418220	Other Paper and Disposable Plastic Product Wholesaler-Distributors	7	444110	Home Centres	4
418310	Agricultural Feed Wholesaler-Distributors	15	444120	Paint and Wallpaper Stores	2
418320	Seed Wholesaler-Distributors	14	444130	Hardware Stores	5
418390	Agricultural Chemical and Other Farm Supplies Wholesaler-Distributors	13	444190	Other Building Material Dealers	9
418410	Chemical (except Agricultural) and Allied Product Wholesaler-Distributors	33	444210	Outdoor Power Equipment Stores	0
418910	Log and Wood Chip Wholesaler-Distributors	2	444220	Nursery and Garden Centres	9
418920	Mineral, Ore and Precious Metal Wholesaler-Distributors	3	445110	Supermarkets and Other Grocery (except Convenience) Stores	0

Table A.2 Number of research and development (R&D) performers 2003, by NAICS 2002 (continued)					
NAICS Code	Industry	Performers	NAICS Code	Industry	Performers
	Services (continued)			Services (continued)	
	Retail Trade (continued)			Retail Trade (continued)	
445120	Convenience Stores	1	454110	Electronic Shopping and Mail-Order Houses	22
445210	Meat Markets	2	454210	Vending Machine Operators	2
445220	Fish and Seafood Markets	2	454310	Fuel Dealers	2
445230	Fruit and Vegetable Markets	0	454390	Other Direct Selling Establishments	4
445291	Baked Goods Stores	11			
445292	Confectionery and Nut Stores	2		Transportation and Warehousing	98
445299	All Other Specialty Food Stores	6	481110	Scheduled Air Transportation	2
445310	Beer, Wine and Liquor Stores	0	481214	Non-Scheduled Chartered Air Transportation	7
446110	Pharmacies and Drug Stores	4	481215	Non-Scheduled Specialty Flying Services	2
446120	Cosmetics, Beauty Supplies and Perfume Stores	3	482112	Short-Haul Freight Rail Transportation	1
446130	Optical Goods Stores	2	482113	Mainline Freight Rail Transportation	4
446191	Food (Health) Supplement Stores	1	482114	Passenger Rail Transportation	0
446199	All Other Health and Personal Care Stores	1	483115	Deep Sea, Coastal and Great Lakes Water Transportation (except by Ferries)	2
447110	Gasoline Stations with Convenience Stores	1	483116	Deep Sea, Coastal and Great Lakes Water Transportation by Ferries	0
447190	Other Gasoline Stations	1	483213	Inland Water Transportation (except by Ferries)	0
448110	Men's Clothing Stores	1	483214	Inland Water Transportation by Ferries	0
448120	Women's Clothing Stores	1	484110	General Freight Trucking, Local	6
448130	Children's and Infants' Clothing Stores	0	484121	General Freight Trucking, Long Distance, Truck-Load	7
448140	Family Clothing Stores	1	484122	General Freight Trucking, Long Distance, Less Than Truck-Load	1
448150	Clothing Accessories Stores	0	484210	Used Household and Office Goods Moving	2
448191	Fur Stores	0	484221	Bulk Liquids Trucking, Local	1
448199	All Other Clothing Stores	2	484222	Dry Bulk Materials Trucking, Local	5
448210	Shoe Stores	3	484223	Forest Products Trucking, Local	2
448310	Jewellery Stores	2	484229	Other Specialized Freight (except Used Goods) Trucking, Local	0
448320	Luggage and Leather Goods Stores	0	484231	Bulk Liquids Trucking, Long Distance	0
451110	Sporting Goods Stores	8	484232	Dry Bulk Materials Trucking, Long Distance	5
451120	Hobby, Toy and Game Stores	3	484233	Forest Products Trucking, Long Distance	1
451130	Sewing, Needlework and Piece Goods Stores	0	484239	Other Specialized Freight (except Used Goods) Trucking, Long Distance	0
451140	Musical Instrument and Supplies Stores	3	485110	Urban Transit Systems	0
451210	Book Stores and News Dealers	0	485210	Interurban and Rural Bus Transportation	0
451220	Pre-Recorded Tape, Compact Disc and Record Stores	0	485310	Taxi Service	0
452110	Department Stores	1	485320	Limousine Service	0
452910	Warehouse Clubs and Superstores	0	485410	School and Employee Bus Transportation	0
452991	Home and Auto Supplies Stores	1	485510	Charter Bus Industry	0
452999	All Other Miscellaneous General Merchandise Stores	5	485990	Other Transit and Ground Passenger Transportation	0
453110	Florists	0	486110	Pipeline Transportation of Crude Oil	0
453210	Office Supplies and Stationery Stores	1	486210	Pipeline Transportation of Natural Gas	2
453220	Gift, Novelty and Souvenir Stores	4	486910	Pipeline Transportation of Refined Petroleum Products	1
453310	Used Merchandise Stores	1	486990	All Other Pipeline Transportation	0
453910	Pet and Pet Supplies Stores	1	487110	Scenic and Sightseeing Transportation, Land	0
453920	Art Dealers	0	487210	Scenic and Sightseeing Transportation, Water	0
453930	Manufactured (Mobile) Home Dealers	0	487990	Scenic and Sightseeing Transportation, Other	0
453992	Beer and Wine-Making Supplies Stores	3	488111	Air Traffic Control	0
453999	All Other Miscellaneous Store Retailers (except Beer and Wine-Making Supplies Stores)	13	488119	Other Airport Operations	1

Table A.2 Number of research and development (R&D) performers 2003, by NAICS 2002 (continued)					
NAICS Code	Industry	Performers	NAICS Code	Industry	Performers
	Services (continued)			Services (continued)	
	Transportation and Warehousing (continued)			Information and Cultural Industries (continued)	
488190	Other Support Activities for Air Transportation	11	517510	Cable and Other Program Distribution	3
488210	Support Activities for Rail Transportation	1	517910	Other Telecommunications	1
488310	Port and Harbour Operations	2	518111	Internet Service Providers	36
488320	Marine Cargo Handling	1	518112	Web Search Portals	6
488331	Marine Salvage Services	0	518210	Data Processing, Hosting, and Related Services	34
488332	Ship Piloting Services	0	519110	News Syndicates	3
488339	Other Navigational Services to Shipping	0	519121	Libraries	1
488390	Other Support Activities for Water Transportation	1	519122	Archives	2
488410	Motor Vehicle Towing	1	519190	All Other Information Services	10
488490	Other Support Activities for Road Transportation	5			
488511	Marine Shipping Agencies	1		Finance, Insurance and Real Estate	160
488519	Other Freight Transportation Arrangement	8	521110	Monetary Authorities - Central Bank	0
488990	Other Support Activities for Transportation	1	522111	Personal and Commercial Banking Industry	5
491110	Postal Service	1	522112	Corporate and Institutional Banking Industry	0
492110	Couriers	1	522130	Local Credit Unions	0
492210	Local Messengers and Local Delivery	1	522190	Other Depository Credit Intermediation	0
493110	General Warehousing and Storage	4	522210	Credit Card Issuing	0
493120	Refrigerated Warehousing and Storage	2	522220	Sales Financing	0
493130	Farm Product Warehousing and Storage	3	522291	Consumer Lending	0
493190	Other Warehousing and Storage	2	522299	All Other Non-Depository Credit Intermediation	6
	Information and Cultural Industries	506	522310	Mortgage and Non-mortgage Loan Brokers	0
511110	Newspaper Publishers	6	522321	Central Credit Unions	1
511120	Periodical Publishers	7	522329	Other Financial Transactions Processing and Clearing House Activities	5
511130	Book Publishers	9	522390	Other Activities Related to Credit Intermediation	0
511140	Database and Directory Publishers	7	523110	Investment Banking and Securities Dealing	4
511190	Other Publishers	3	523120	Securities Brokerage	2
511210	Software Publishers	280	523130	Commodity Contracts Dealing	1
512110	Motion Picture and Video Production	26	523140	Commodity Contracts Brokerage	0
512120	Motion Picture and Video Distribution	1	523210	Securities and Commodity Exchanges	1
512130	Motion Picture and Video Exhibition	0	523910	Miscellaneous Intermediation	3
512190	Post-Production and Other Motion Picture and Video Industries	5	523920	Portfolio Management	35
512210	Record Production	1	523930	Investment Advice	1
512220	Integrated Record Production/Distribution	0	523990	All Other Financial Investment Activities	6
512230	Music Publishers	0	524111	Direct Individual Life, Health and Medical Insurance Carriers	2
512240	Sound Recording Studios	4	524112	Direct Group Life, Health and Medical Insurance Carriers	1
512290	Other Sound Recording Industries	0	524121	Direct General Property and Casualty Insurance Carriers	1
515110	Radio Broadcasting	3	524122	Direct, Private, Automobile Insurance Carriers	1
515120	Television Broadcasting	1	524123	Direct, Public, Automobile Insurance Carriers	0
515210	Pay and Specialty Television	1	524124	Direct Property Insurance Carriers	0
516110	Internet Publishing and Broadcasting	9	524125	Direct Liability Insurance Carriers	0
517110	Wired Telecommunications Carriers	17	524129	Other Direct Insurance (except Life, Health and Medical) Carriers	1
517210	Wireless Telecommunications Carriers (except Satellite)	9	524131	Life Reinsurance Carriers	0
517310	Telecommunications Resellers	13	524132	Accident and Sickness Reinsurance Carriers	0
517410	Satellite Telecommunications	8	524133	Automobile Reinsurance Carriers	0
			524134	Property Reinsurance Carriers	0

Table A.2 Number of research and development (R&D) performers 2003, by NAICS 2002 (continued)					
NAICS Code	Industry	Performers	NAICS Code	Industry	Performers
	Services (continued)			Services (continued)	
	Finance, Insurance and Real Estate (continued)			Architectural, Engineering and Related Services	738
524135	Liability Reinsurance Carriers	0	541310	Architectural Services	15
524139	General and Other Reinsurance Carriers	0	541320	Landscape Architectural Services	1
524210	Insurance Agencies and Brokerages	5	541330	Engineering Services	574
524291	Claims Adjusters	1	541340	Drafting Services	10
524299	All Other Insurance Related Activities	1	541350	Building Inspection Services	3
526111	Trusteed Pension Funds	0	541360	Geophysical Surveying and Mapping Services	20
526112	Non-Trusteed Pension Funds	0	541370	Surveying and Mapping (except Geophysical) Services	26
526911	Equity Funds - Canadian	0	541380	Testing Laboratories	89
526912	Equity Funds - Foreign	0			
526913	Mortgage Funds	0		Computer System Design and Related	1,956
526914	Money Market Funds	0	541510	Computer Systems Design and Related Services	1,956
526915	Bond and Income / Dividend Funds - Canadian	0			
526916	Bond and Income / Dividend Funds - Foreign	0		Management, Scientific and Technical Consulting	391
526917	Balanced Funds / Asset Allocation Funds	0	541611	Administrative Management and General Management Consulting Services	139
526919	Other Open-Ended Funds	1	541612	Human Resource and Executive Search Consulting Services	12
526920	Mortgage Investment Funds	0	541619	Other Management Consulting Services	43
526930	Segregated (except Pension) Funds	0	541620	Environmental Consulting Services	61
526981	Securitization Vehicles	0	541690	Other Scientific and Technical Consulting Services	136
526989	All Other Miscellaneous Funds and Financial Vehicles	0			
531111	Lessors of Residential Buildings and Dwellings (except Social Housing Projects)	0		Scientific Research and Development	675
531112	Lessors of Social Housing Projects	0	541710	Research and Development in the Physical, Engineering and Life Sciences	642
531120	Lessors of Non-Residential Buildings (except Mini-Warehouses)	13	541720	Research and Development in the Social Sciences and Humanities	33
531130	Self-Storage Mini-Warehouses	0			
531190	Lessors of Other Real Estate Property	2		Health Care and Social Assistance	122
531210	Offices of Real Estate Agents and Brokers	5	621110	Offices of Physicians	17
531310	Real Estate Property Managers	7	621210	Offices of Dentists	5
531320	Offices of Real Estate Appraisers	2	621310	Offices of Chiropractors	3
531390	Other Activities Related to Real Estate	0	621320	Offices of Optometrists	3
532111	Passenger Car Rental	1	621330	Offices of Mental Health Practitioners (except Physicians)	4
532112	Passenger Car Leasing	1	621340	Offices of Physical, Occupational, and Speech Therapists and Audiologists	6
532120	Truck, Utility Trailer and RV (Recreational Vehicle) Rental and Leasing	0	621390	Offices of All Other Health Practitioners	2
532210	Consumer Electronics and Appliance Rental	1	621410	Family Planning Centres	1
532220	Formal Wear and Costume Rental	0	621420	Out-Patient Mental Health and Substance Abuse Centres	0
532230	Video Tape and Disc Rental	1	621494	Community Health Centres	1
532290	Other Consumer Goods Rental	2	621499	All Other Out-Patient Care Centres	1
532310	General Rental Centres	3	621510	Medical and Diagnostic Laboratories	64
532410	Construction, Transportation, Mining, and Forestry Machinery and Equipment Rental and Leasing	13	621610	Home Health Care Services	2
532420	Office Machinery and Equipment Rental and Leasing	1	621911	Ambulance (except Air Ambulance) Services	0
532490	Other Commercial and Industrial Machinery and Equipment Rental and Leasing	14	621912	Air Ambulance Services	0
533110	Lessors of Non-Financial Intangible Assets (Except Copyrighted Works)	10	621990	All Other Ambulatory Health Care Services	2

Table A.2 Number of research and development (R&D) performers 2003, by NAICS 2002 (continued)					
NAICS Code	Industry	Performers	NAICS Code	Industry	Performers
	Services (continued)			Services (continued)	
	Health Care and Social Assistance (continued)			All Other Services (continued)	
622111	General (except Paediatric) Hospitals	0	551113	Holding Companies	101
622112	Paediatric Hospitals	0	551114	Head Offices	0
622210	Psychiatric and Substance Abuse Hospitals	0	561110	Office Administrative Services	32
622310	Specialty (except Psychiatric and Substance Abuse) Hospitals	2	561210	Facilities Support Services	0
623110	Nursing Care Facilities	0	561310	Employment Placement Agencies	7
623210	Residential Developmental Handicap Facilities	0	561320	Temporary Help Services	4
623221	Residential Substance Abuse Facilities	1	561330	Employee Leasing Services	0
623222	Homes for the Psychiatrically Disabled	0	561410	Document Preparation Services	7
623310	Community Care Facilities for the Elderly	0	561420	Telephone Call Centres	8
623991	Transition Homes for Women	0	561430	Business Service Centres	5
623992	Homes for Emotionally Disturbed Children	0	561440	Collection Agencies	1
623993	Homes for the Physically Handicapped or Disabled	0	561450	Credit Bureaus	2
623999	All Other Residential Care Facilities	1	561490	Other Business Support Services	2
624110	Child and Youth Services	0	561510	Travel Agencies	3
624120	Services for the Elderly and Persons with Disabilities	1	561520	Tour Operators	2
624190	Other Individual and Family Services	3	561590	Other Travel Arrangement and Reservation Services	4
624210	Community Food Services	0	561611	Investigation Services	3
624220	Community Housing Services	0	561612	Security Guard and Patrol Services	0
624230	Emergency and Other Relief Services	0	561613	Armoured Car Services	1
624310	Vocational Rehabilitation Services	2	561621	Security Systems Services (except Locksmiths)	28
624410	Child Day-Care Services	1	561622	Locksmiths	1
			561710	Exterminating and Pest Control Services	1
	All Other Services	913	561721	Window Cleaning Services	0
541110	Offices of Lawyers	1	561722	Janitorial Services (except Window Cleaning)	9
541120	Offices of Notaries	0	561730	Landscaping Services	11
541190	Other Legal Services	7	561740	Carpet and Upholstery Cleaning Services	1
541212	Offices of Accountants	7	561791	Duct and Chimney Cleaning Services	1
541213	Tax Preparation Services	1	561799	All Other Services to Buildings and Dwellings	8
541215	Bookkeeping, Payroll and Related Services	9	561910	Packaging and Labelling Services	16
541410	Interior Design Services	0	561920	Convention and Trade Show Organizers	1
541420	Industrial Design Services	60	561990	All Other Support Services	64
541430	Graphic Design Services	28	611110	Elementary and Secondary Schools	1
541490	Other Specialized Design Services	6	611210	Community Colleges and C.E.G.E.P.s	6
541810	Advertising Agencies	27	611310	Universities	0
541820	Public Relations Services	0	611410	Business and Secretarial Schools	0
541830	Media Buying Agencies	0	611420	Computer Training	11
541840	Media Representatives	6	611430	Professional and Management Development Training	5
541850	Display Advertising	8	611510	Technical and Trade Schools	4
541860	Direct Mail Advertising	4	611610	Fine Arts Schools	0
541870	Advertising Material Distribution Services	1	611620	Athletic Instruction	1
541891	Specialty Advertising Distributors	3	611630	Language Schools	1
541899	All Other Services Related to Advertising	9	611690	All Other Schools and Instruction	7
541910	Marketing Research and Public Opinion Polling	20	611710	Educational Support Services	3
541920	Photographic Services	11	711111	Theatre (except Musical) Companies	0
541930	Translation and Interpretation Services	1	711112	Musical Theatre and Opera Companies	0
541940	Veterinary Services	6	711120	Dance Companies	0
541990	All Other Professional, Scientific and Technical Services	33	711130	Musical Groups and Artists	0

Table A.2 Number of research and development (R&D) performers 2003, by NAICS 2002 (continued)					
NAICS Code	Industry	Performers	NAICS Code	Industry	Performers
	Services (continued)			Services (continued)	
	All Other Services (continued)			All Other Services (continued)	
711190	Other Performing Arts Companies	0	722320	Caterers	5
711211	Sports Teams and Clubs	0	722330	Mobile Food Services	0
711213	Horse Race Tracks	0	722410	Drinking Places (Alcoholic Beverages)	1
711218	Other Spectator Sports	1	811111	General Automotive Repair	16
711311	Live Theatres and Other Performing Arts Presenters with Facilities	1	811112	Automotive Exhaust System Repair	0
711319	Sports Stadiums and Other Presenters with Facilities	1	811119	Other Automotive Mechanical and Electrical Repair and Maintenance	8
711321	Performing Arts Promoters (Presenters) without Facilities	2	811121	Automotive Body, Paint and Interior Repair and Maintenance	13
711322	Festivals without Facilities	0	811122	Automotive Glass Replacement Shops	0
711329	Sports Presenters and Other Presenters without Facilities	2	811192	Car Washes	2
711410	Agents and Managers for Artists, Athletes, Entertainers and Other Public Figures	0	811199	All Other Automotive Repair and Maintenance	1
711510	Independent Artists, Writers and Performers	10	811210	Electronic and Precision Equipment Repair and Maintenance	39
712111	Non-Commercial Art Museums and Galleries	0	811310	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	114
712119	Museums (except Art Museums and Galleries)	1	811411	Home and Garden Equipment Repair and Maintenance	8
712120	Historic and Heritage Sites	1	811412	Appliance Repair and Maintenance	4
712130	Zoos and Botanical Gardens	2	811420	Reupholstery and Furniture Repair	4
712190	Other Heritage Institutions	1	811430	Footwear and Leather Goods Repair	0
713110	Amusement and Theme Parks	3	811490	Other Personal and Household Goods Repair and Maintenance	11
713120	Amusement Arcades	0	812114	Barber Shops	0
713210	Casinos (except Casino Hotels)	0	812115	Beauty Salons	2
713291	Lotteries	1	812116	Unisex Hair Salons	0
713299	All Other Gambling Industries	1	812190	Other Personal Care Services	4
713910	Golf Courses and Country Clubs	0	812210	Funeral Homes	0
713920	Skiing Facilities	3	812220	Cemeteries and Crematoria	0
713930	Marinas	0	812310	Coin-Operated Laundries and Dry Cleaners	0
713940	Fitness and Recreational Sports Centres	1	812320	Dry Cleaning and Laundry Services (except Coin-Operated)	3
713950	Bowling Centres	0	812330	Linen and Uniform Supply	0
713990	All Other Amusement and Recreation Industries	1	812910	Pet Care (except Veterinary) Services	0
721111	Hotels	0	812921	Photo Finishing Laboratories (except One-Hour)	2
721112	Motor Hotels	1	812922	One-Hour Photo Finishing	0
721113	Resorts	0	812930	Parking Lots and Garages	0
721114	Motels	1	812990	All Other Personal Services	0
721120	Casino Hotels	0	813110	Religious Organizations	0
721191	Bed and Breakfast	0	813210	Grant-Making and Giving Services	1
721192	Housekeeping Cottages and Cabins	0	813310	Social Advocacy Organizations	3
721198	All Other Traveller Accommodation	1	813410	Civic and Social Organizations	3
721211	RV (Recreational Vehicle) Parks and Campgrounds	1	813910	Business Associations	5
721212	Hunting and Fishing Camps	0	813920	Professional Organizations	2
721213	Recreational (except Hunting and Fishing) and Vacation Camps	0	813930	Labour Organizations	0
721310	Rooming and Boarding Houses	0	813940	Political Organizations	0
722110	Full-Service Restaurants	3	813990	Other Membership Organizations	2
722210	Limited-Service Eating Places	11	814110	Private Households	0
722310	Food Service Contractors	0	911110	Defence Services	0

Table A.2 Number of research and development (R&D) performers 2003, by NAICS 2002 (continued)

NAICS Code	Industry	Performers	NAICS Code	Industry	Performers
Services (continued)					
All Other Services (continued)					
911210	Federal Courts of Law	0			
911220	Federal Correctional Services	0			
911230	Federal Police Services	0			
911240	Federal Regulatory Services	0			
911290	Other Federal Protective Services	0			
911310	Federal Labour and Employment Services	0			
911320	Immigration Services	0			
911390	Other Federal Labour, Employment and Immigration Services	0			
911410	Foreign Affairs	0			
911420	International Assistance	0			
911910	Other Federal Government Public Administration	0			
912110	Provincial Courts of Law	0			
912120	Provincial Correctional Services	0			
912130	Provincial Police Services	0			
912140	Provincial Fire-Fighting Services	0			
912150	Provincial Regulatory Services	0			
912190	Other Provincial Protective Services	0			
912210	Provincial Labour and Employment Services	0			
912910	Other Provincial and Territorial Public Administration	0			
913110	Municipal Courts of Law	0			
913120	Municipal Correctional Services	0			
913130	Municipal Police Services	0			
913140	Municipal Fire-Fighting Services	0			
913150	Municipal Regulatory Services	0			
913190	Other Municipal Protective Services	0			
913910	Other Local, Municipal and Regional Public Administration	0			
914110	Aboriginal Public Administration	0			
919110	International and Other Extra-Territorial Public Administration	0			

Appendix B

Survey methodology and reliability of the data

Survey methodology

The survey's history

Data on R&D in the business enterprise sector, covering commercially oriented enterprises (privately or publicly owned), industrial non-profit organizations and trade associations, have been collected since 1955. Until 1969, the survey was biennial. From 1970 to 1981, all known performers or funders of industrial R&D were surveyed for odd-numbered years and a sample, including the leading performers, were surveyed for even-numbered years. From 1982 to 1991, a full survey was conducted annually.

Because of reductions in the science and technology program, only the top 100 R&D performers (accounting for 64% of all industrial R&D) were surveyed for the 1992 and 1994 reference years. However, as a result of a cost-sharing agreement with the province of Quebec, the 1992 and 1994 industrial R&D survey results also included small firms having R&D activities in the province of Quebec.

Prior to 1997, Statistics Canada surveyed all firms that performed or funded R&D in Canada. Virtually all of these firms also provided information to CRA in order to claim tax benefits under the Scientific Research and Experimental Development (SR&ED) program. In an effort to reduce respondent burden, Statistics Canada stopped surveying the small performers and funders (those with less than \$1 million of R&D in Canada) and instead, imputes their R&D data using CRA administrative data from the SR&ED program.

When first implemented, this initiative resulted in an understatement of the total value of intramural expenditure and of the total number of R&D personnel. Under the current tax regulations, firms must file their application to the SR&ED program within 18 months of expenditure. Once claims are submitted, they are processed and forwarded to Statistics Canada. As a result, data may not arrive for up to two years after the incurrence of expenditures. To remedy the situation, an estimation system was subsequently put into place to impute values for outstanding administrative data. This estimation system confirms the company is active using Statistics Canada's extensive Business Register, and then applies an estimate based on industry trends.

Recent developments in R&D spending are important economic signals, desired promptly by a variety of users. Because the small estimation of outstanding CRA data does not seriously influence overall trends, the R&D data are published as soon as possible after the survey is conducted, and revised in subsequent publications.

Recent changes to survey methodology

In the 2005 collection year, changes were made to the survey methodology to improve the quality of R&D performers' revenue data. Revenue figures for the SR&ED tax filers were adjusted to reflect corporate income tax data for the corresponding filer. To provide a time series, data were revised as far back as possible. It is believed the revisions have substantially improved the quality of the revenue variable. Within the publication, the revisions have had impact on the ratios of research and development expenditures to revenues, revenue size groups and total revenues by survey year.

The 2004 survey

The 2004 survey collected data on four years. The four years were: 2003 for which the data are expected to be final; 2004, for which the data are expected to be close to final, 2005 for which the data are planned expenditures, and 2006 for which the data are a forecast of spending intentions.

Data from the surveyed firms in 2004 represent approximately 86% of the total expenditures. Estimates are not available for administrative data for 2005 and 2006. Therefore, based on the percentage increase or decrease by industry reported by the surveyed firms, forecasts are made for planned expenditures and spending intentions based on the administrative data.

The 2004 survey was mailed out in June 2005. All companies believed to be performing or funding one million dollars or more in R&D were sent a questionnaire. The mailing list of companies was made up of firms which had reported R&D in the previous survey, of firms claiming an R&D income tax incentive for 2004, of firms reported by government respondents as R&D contractors or grantees for 2004 to 2005, of firms reported by other companies as funders or performers of R&D, and of firms indicated in some other way, such as newspaper or journal articles or provincial directories. These larger performers and funders received "long forms", covering four years, 2003, 2004, 2005 and 2006.

Data quality

One of the problems in a survey of this type is to ensure that the quality of the data is satisfactory. It cannot be expected that all firms funding R&D will be surveyed, will respond and will report correctly. There are sources of information such as federal government grant and contract lists to aid in identifying firms and editing returns. In addition, complete coverage cannot be assured. This is especially true for the smaller companies in the service industries. The term, R&D, in spite of survey guidelines, can be misinterpreted.

Different interpretations of the definition of R&D also result in discrepancies between federal government reporting of funds to industry (the business enterprise sector) for R&D and industry's reporting of such funds. For example, a federal government department may regard a contract to industry for the building of a prototype (e.g., communications satellite) as R&D. The contractors and subcontractors, however, may only use a portion of the R&D contract and even that portion may not be reported because the contract is considered as part of the firm's "routine" contract work. Differences may also arise for contracts awarded to industry for services or equipment required for a government in-house project which are reported by the federal sponsor as industrial R&D contracts. Therefore, the totals for R&D grants and contracts from the federal government to industry shown in this publication do not agree with those reported in *Federal Science Activities, 2004/2005*, (Catalogue no. 88-204-XIE).

Other notes

The business enterprise sector is the only sector in which data are not collected on R&D in the social sciences and humanities.

In this survey, the reporting unit is generally the company or enterprise. This unit has been used because a company, which may have several establishments or subsidiaries, will often have a centralized research unit. In the case of a company with decentralized research units, the reporting unit may be the division, if the accounting system enables divisions to supply the required data. This procedure creates a problem when classifying data by industry. A company can only be assigned to one industry although that company may have establishments in several industries. The assignment is based on the activity from which the firm derived the greatest portion of its income. Thus, comparisons between R&D data collected at the company level and other data collected at the establishment level, such as "census value added", may be misleading. Since industrial R&D is highly concentrated, the use of the company/enterprise as the main reporting unit also means that classification cannot be very detailed, to avoid disclosing individual company data.

The survey response

The response for the 2004 “base year” survey is shown below.

Survey Group	Responded R&D	No R&D	Deleted ¹	Did not Respond ²	Total
	number				
Total	12,876	15	14	386	13,291
Long form	1,007 ³	15	14	386	1,422
Administrative data ⁴	11,869	...	...	...	11,869

1. Inactive, out of business and unallocated.
2. Includes estimates made for 386 long form delinquents.
3. Includes 237 companies added from T661.
4. Data from Canada Revenue Agency.

Technical notes

Statistics for even years

Data for the reference year 2004 are available for all tables with the exception of counts of companies. However, in the even years prior to 1982 and for 1992 and 1994, our estimation procedures did not permit the preparation of tables based on revenue size, employment size, sources of funds and country of control of companies.

Regional data on research and development (R&D) expenditures and personnel are only available for 1977, 1979 and 1981 to 2004.

Terminology

The following terminology is used within the publication:

Performing company: The organization which carried out the R&D and submitted the return. In the case of a consolidated return, performing company could include several companies. It also includes divisions of an enterprise which send separate returns or organizations such as industrial non-profit organizations.

Related companies: Includes parent, subsidiary and other affiliated companies. In the case where a consolidated return is submitted, "related companies" would exclude companies included in the consolidation.

R&D contracts for other companies: R&D contract work performed by the reporting company for other companies.

Federal grants: Federal R&D grants and the R&D portion of any other federal grants; it excludes funds or tax credits for R&D tax incentives.

Federal contracts: Federal R&D contracts and the R&D portion of any other federal contracts.

Provincial sources: Provincial R&D grants and contracts, and the R&D portion of any provincial grants and contracts; it excludes funds or tax credits for R&D tax incentives.

Other Canadian sources: Includes funds from universities and from levels of government other than federal and provincial.

Intramural expenditures: Expenditures for R&D work performed within the reporting company, including work financed by others.

Current intramural expenditures: Labour costs, fringe benefits and other current costs for R&D, including non-capital purchases of materials, supplies and equipment but excluding capital depreciation. Current intramural expenditures also include contracts for services required to carry out R&D (e.g. contracts awarded for drilling needed for heavy oil R&D).

Capital expenditures: Expenditures on fixed assets used in the R&D program, classified into land, buildings, and equipment.

Technological payments: Payments made for R&D and other technology.

Technological receipts: Payments received for R&D and other technology.

Other technology: Technology acquired through patents (sale/purchase, licensing), "know-how" (unpatented), inventions, trademarks (including franchising), patterns, design, and R&D technical assistance.

Revenues: Revenues resulting from the sale of products and services (after deducting sales and excise taxes), and other revenues such as those generated from investment and rentals.

Non-commercial firms: R&D performers without a directly affiliated Canadian commercial base. Includes industrial non-profit organizations and trade associations, R&D establishments set up by consortia, and R&D establishments set up by non-residents without associated commercial establishments and funded principally from abroad.

R&D personnel: Calculated in full-time equivalent (FTE). R&D may be carried out by persons who work solely on R&D projects or by persons who devote only part of their time to R&D, and the balance to other activities such as testing, quality control and production engineering. To arrive at the total effort devoted to R&D in terms of person-years, it is necessary to estimate the full-time equivalent of these persons working only part-time in R&D.

FTE = number of persons who work solely on R&D projects + estimate of time of persons working only part of their time on R&D.

Example calculation:

If out of five scientists engaged in R&D work, one works solely on R&D projects and the remaining four devote only one quarter of their working time to R&D, then: $FTE = 1 + 1/4 + 1/4 + 1/4 + 1/4 = 2$ scientists.

Federal government funds for industrial R&D: Federal support consists of grants and contracts for R&D to be performed by business enterprises. Taxes foregone as a result of income tax incentives for R&D are not considered direct government support and are not attributed to the federal government.

Industrial classification

The natural classification to use within the business enterprise sector is the North American Industry Classification System (NAICS). There are, however, problems with its use. A major problem is caused by companies with establishments in more than one industry (e.g., companies which both refine petroleum and extract oil). Another is caused by the concentration of the R&D activity among a few companies. In order to prevent disclosure of individual respondents many industries must be grouped together to provide sufficient observations for publication.

A third problem is that the classification, chosen to represent general industrial activity, may not be entirely suitable for identifying companies chosen only for their involvement in R&D.

There are some restrictions on the application of the NAICS, for example, industrial non-profit organizations will be assigned to the industry they support.

The R&D activities of other sectors such as the federal government, provincial governments, higher education, and private non-profit organizations are covered in other reports.

Definitions

Research and development

Research and development (R&D) is systematic investigation carried out in the natural and engineering sciences by means of experiment or analysis to achieve a scientific or commercial advance.

Research is original investigation undertaken on a systematic basis to gain new knowledge.

Development is the application of research findings or other scientific knowledge for the creation of new or significantly improved products or processes. If successful, development will usually result in devices or processes which represent an improvement in the “state of the art” and are likely to be patentable.

Example:

The investigation of electrical conduction in crystals was research. The application of this knowledge to the creation of a new amplifying device - the transistor - was development. The application of the device to the construction of new electrical circuits for television receivers was development. The formulation of new plastic cases for a television receiver is design, not development.

Research and development may be carried out either by a permanent R&D unit (e.g., R&D division) or by a unit generally engaged in any non-R&D activity such as engineering or production. In the first case, the R&D unit may spend part of its time on routine testing or trouble shooting or on some other activities which should not be included in R&D. In the second, only the R&D portion of such units' total activity should be considered.

Research and development should be considered to be “Scientific Research and Experimental Development” as defined in Section 37, Regulation 2900 of the Income Tax Act; this section specifically excludes the following:

- (i) market research, sales promotion,
- (ii) quality control or routine analysis and testing of materials, devices or products,
- (iii) research in the social sciences or the humanities,
- (iv) prospecting, exploring or drilling for or producing minerals, petroleum or natural gas,
- (v) the commercial production of a new or improved material, device or product or the commercial use of a new or improved process,
- (vi) style changes, or routine data collection,

Note:

Although the definition of “Scientific Research and Experimental Development” is considered to be the same as R&D, certain expenditures for scientific research cannot be claimed for income tax purposes (e.g., land, building). All expenditures attributable to R&D are included in this report.

Interpretation of R&D

Generally speaking, industrial R&D is intended to result in an invention which may subsequently become a technological innovation. An essential requirement is that the outcome of the work is uncertain, i.e., that the possibility of obtaining a given technical objective cannot be known in advance on the basis of current knowledge or experience. Hence much of the work done by scientists and engineers is not R&D, since they are primarily engaged in “routine” production, engineering, quality control or testing. Although they apply scientific or engineering principles their work is not directed towards the discovery of new knowledge or the development of new products and processes. However, work elements which are not considered R&D by themselves but which directly support R&D projects, should be included with R&D in these cases. Examples of such work elements are design and engineering, shop work, computer programming, and secretarial work.

If the primary objective is to make further technical improvements to the product or process, then the work comes within the definition of R&D. If however, the product, process or approach is substantially set and the primary objective is to develop markets, to do pre-production planning or to get a production or control system working smoothly, then the activity can no longer be considered as part of R&D even though it could be regarded as an important part of the total innovation process. Thus, the design, construction and testing of prototypes, models and pilot plants are part of R&D. But, when necessary modifications have been made and testing has been satisfactorily completed, the boundary of R&D has been reached. Hence, the costs of tooling (design and try-out), construction drawings and manufacturing blueprints, and production start-up are not included in development costs.

Pilot plants may be included in development only if the main purpose is to acquire experience and compile data. As soon as they begin operating as normal production units, their costs can no longer be attributed to R&D. Similarly, once the original prototype has been found satisfactory, the cost of other “prototypes” built to meet a special need or fill a very small order are not to be considered as part of R&D.

Specific cases and their treatment		
Activity	Treatment	Remarks
Economic research, market research, management studies	Exclude	All activities in the social sciences.
Quality control, routine testing, style changes, minor adaptation of a product to meet a customer's specific requirements	Exclude	Even if carried out by staff normally engaged in R&D.
Prospecting, exploratory drilling, development of mines, oil or gas wells	Exclude	Except for R&D projects concerned with new equipment or techniques in these activities, such as in-situ and tertiary recovery research.
Engineering	Exclude	Engineering unless it is in direct support of R&D.
Design and drawing	Exclude	Design and drawing unless it is in direct support of R&D.
Prototypes, pilot plants	Include	As long as the primary objective is to make further improvements.
Contracts for R&D	Include	All contracts for R&D. For contracts which include other work, report only the R&D costs.
Tooling up, trial production, trouble shooting	Exclude	Although R&D may be required as a result of these steps.
Patent and licence work	Exclude	All administrative and legal work connected with patents and licences.

Reliability of the data

All the possible sources of error are examined below.

Coverage

“Coverage errors are introduced whenever the sampling frame...does not adequately represent the target population at the time of the survey.”¹

Coverage is a minor source of error. Surveys are of all known and suspected, large R&D performers and funders i.e., those believed to have R&D expenditures of at least \$1,000,000.

Administrative data are used for the small R&D performers or funders. Companies have up to 18 months after their fiscal year end to claim a tax credit for their R&D expenditures. Underreporting due to this time lag is estimated to be less than 8%, and is largely corrected by imputing estimates based on industry trends for all known performers who have not yet submitted their claim.

Response

“A response error occurs whenever a characteristic is misreported in a census or a survey.”¹

As a result of a reconciliation of federal and industrial accounts of government grants and contracts, we think that industrial R&D performance estimates may be slightly low. This is caused by the non-reporting of industrial R&D funded by contract. Such work is sometimes not distinguishable from non-R&D contract work.

The accuracy of the company’s estimates of future expenditures has also been a problem in the past, particularly in the wells and petroleum products industries.

Non-response

“Non-response occurs when information required for a survey unit is missing. This could happen because the unit cannot be contacted, because the unit is unable to provide the information requested, or because the unit refuses to cooperate in the survey.”¹

Non-response is a potential problem in four areas. One is the estimate of R&D expenditures two years past the base year. If no estimate is made, editors make one - based usually on the expenditure of the preceding year or a slight increase in expenditures.

The second involves the administrative data used for the smaller R&D performers. These represent 10% of all R&D performed by businesses. Certain information is not asked of them. However, the missing data are imputed from the replies of the larger performers in the same industry.

The third concerns companies inadvertently not included in the survey. A number of sources are used to create the mailing lists and it is unlikely that major performers would be overlooked.

Failure of surveyed companies to reply is the fourth type of non-response. We believe non-response error to be minor and may result in a minor under-estimation of R&D expenditures.

1. “A compendium of methods of error evaluation in censuses and surveys.” Statistics Canada, Statistical Services Field, November 1978, Catalogue No. 13-564E

Coding

“A coding operation in a survey or census is defined as the operation where data on questionnaires or source documents are transformed into a format which is suitable for input to the data capture operation. This often involves the assignment of codes for ‘write-in’ entries but may also be a fairly straightforward transcription operation.”¹

Uncorrected coding errors are unlikely because of the examination of numerous tables and listings prepared for data analysis before publication tables are created.

Data capture

“The data capture operation in a census or survey consists of converting the data received on questionnaires (e.g., respondent answers) to a machine readable format.”¹

All data capture for science statistics is through manual intervention: key-edit or typed entry at a computer terminal.

Significant uncorrected data capture errors are unlikely because of the examination of numerous tables and listings prepared for data analysis before publication tables are created.

Edit and imputation

“The edit procedure usually consists of: (i) checking each field of every record to ascertain whether it contains a valid code or entry; (ii) checking codes or entries in certain predetermined combinations of fields to ascertain whether codes or entries are consistent with one another... The imputation procedure consists of changing values in some of the fields in records which failed the edit rules with a view to ensuring that the resultant data records satisfy all edit rules.”¹

Although there are a number of edits, all cases of failed edit checks are corrected after consideration by editors. Automatic imputations are made only for the smaller R&D performers and funders.

Sampling

“Sampling error occurs whenever survey results are based on a sample of units from a survey frame... Obviously there is no sampling error in complete enumeration surveys.”¹

Although a complete enumeration is carried out of known and suspected R&D performers and funders, records received from the administrative data do not provide as much information as do those completing the long form. Certain data are imputed for records from the administrative file based on the patterns of long form respondents in the same industry. Thus, as a result of the 2004 survey, the 2004 business enterprise sector R&D expenditures would be based on full enumeration but about 10% of the expenditures for 2005 and 2006 would have been imputed.

1. “A compendium of methods of error evaluation in censuses and surveys.” Statistics Canada, Statistical Services Field, November 1978, Catalogue No. 13-564E

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- 88-001-XIE [Science statistics](#)
- 88-003-XIE [Innovation analysis bulletin](#)
- 88-202-XIE [Industrial research and development, intentions \(with 2005 preliminary estimates and 2004 actual expenditures\) \(annual\)](#)
- 88-204-XIE [Federal scientific activities \(annual\)](#)
- 88F0006XIE [Science, Innovation and Electronic Information Division working papers](#)
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- No. 1 Research and development (R&D) personnel in Canada, 1995 to 2004 (January)
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- No. 3 Biotechnology scientific activities in federal government departments and agencies, 2004/2005 (May)

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- No. 1 Distribution of federal expenditures on science and technology, by province and territories, 2003/2004 (February)
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- No. 6 Federal government expenditures on scientific activities, 2006/2007 (September)
- No. 7 Total spending on research and development in Canada, 1990 to 2006, and provinces, 1990 to 2004 (September)
- No. 8 Nature of Research and Development, 2000 to 2004 (December)
- No. 9 Distribution of federal expenditures on science and technology by province and territories, 2004/2005 (December)

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- No. 8 [Size and Persistence of R&D Performance in Canadian Firms, 1994 to 2002 \(August\)](#)
- No. 9 [Estimates of Canadian Research and Development Expenditures \(GERD\), Canada, 1995 to 2006, and by Province 1995 to 2004 \(September\)](#)
- No. 10 [Are Small Businesses Positioning Themselves for Growth? A Comparative Look at the Use of Selected Management Practices by Firm Size \(October\)](#)
- No. 11 [Survey of Intellectual Property Commercialization in the Higher Education Sector, 2004 \(October\)](#)