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Size and Persistence of R&D Performance in Canadian Firms 1994 to 2002

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Note

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This report was prepared by Robert Schellings, Subject Matter Manager of Science, Innovation and Electronic Information Division.



Statistics Canada
Science and Technology Surveys Section
Science, Innovation and Electronic Information Division (SIEID)

Size and Persistence of R&D Performance in Canadian Firms

1994 to 2002

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Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses and governments. Accurate and timely statistical information could not be produced without their continued cooperation and goodwill.

The science and innovation information program

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

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

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

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

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

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

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

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

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

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

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Highlights

- Between 1994 and 2002 a total of 31,190 enterprises, or firms, undertook research and development (R&D) activities for at least one year. About one in twenty (1,699) of these R&D performers constituted on-going performance, appearing on the Research and Development in Canadian Industry database for nine years. These R&D performers most likely approached R&D as a program rather than as a short term project. (Table 1)
- These 1,699 persistent R&D performers accounted for 57.5% (\$53,233 million) of the accumulated total expenditure of \$92,511 million (current dollars) on R&D by the 31,190 firms between 1994 and 2002. (Table 2)
- The largest group of R&D performers (7,772) reported spending less than \$100,000, in the last year in which the firm reported R&D expenditures, and performed R&D for one year only. This suggests that these R&D performers undertook specific short term projects. (Table 1)
- The short-term R&D project performers (10,092) comprised almost one-third of the R&D performers between 1994 and 2002 but spent less than 2% (\$1,669 million) of the accumulated total expenditure on R&D during this period. (Tables 1 & 2)
- The number of R&D performing firms dropped between 1994 and 1997 but then increased so that by 2001 the total number of firms was greater than in 1994. The number of R&D performers in the largest R&D expenditure group (\$10,000,000 or more) almost doubled between 1994 and 2002 going from 104 firms to 205 in 2002. (Table 3)
- Over the time period studied, the proportion represented by firms in the largest R&D expenditure group increased from 0.9% to 1.7%. Only the smallest R&D expenditure group, those firms spending less than \$100,000, recorded a decline in their proportional share of R&D performers. (Table 4)
- Amongst the largest R&D performers, those firms spending \$10,000,000 or more, the greatest share reported R&D activities in all nine years and over one-half reported performing R&D in at least six of the nine years. On the other hand, of the smallest performers, over three-quarters continued their R&D projects for three years or less with 39% undertaking R&D for just one year. (Table 5)
- The highest average R&D spending per firm was reported for R&D performers with programs lasting at least nine years and spending \$10 million or more. For all R&D performers the average expenditure increased as the number of years undertaking R&D increased, beginning at \$165,000 for one year performance and rising to \$3,481,000 for at least nine years of R&D performance. (Table 6)
- Of the 11,312 firms that performed R&D in 1994 only 2,838 were still performing in 2002. In all size categories except the largest, less than one-half of the R&D performers persisted over the nine year period. (Tables 7.1-12.1)
- By 2002, 5,236 (79.8%) of the 6,561 R&D performers that spent less than \$100,000 on R&D in 1994 had stopped conducting R&D. The largest share of the persistent R&D performers that began dedicating less than \$100,000 in 1994 continued in this size category – 808 R&D performers or 60.9% of the 1,325 continuing performers but spending just \$35 million in 2002 (13.2%) of the \$266,000 million of R&D performed by these firms. (Tables 7.1 and 7.2)
- The on-going spending patterns for the next size group, R&D performers spending between \$100,000 and \$199,999 on R&D in 1994 differed from that of the first size group. The first difference is reflected in the fact that the R&D performers could scale back their level of performance but still continue to undertake R&D. However, just 516 (29.2%) of the 1,766 that began performing R&D in this size category continued, of which 31.2% (161 R&D performers) registered a decline in R&D performance and 26.9% (139 R&D performers) continued at the same level. The remaining 216 (or 41.9%) R&D performers increased their R&D spending over the nine year period. (Tables 8.1 and 8.2)

- For 1,443 R&D performers spending between \$200,000 and \$499,999 on R&D in 1994, only one-third (32.8%) persisted over the nine year period. The shares indicating declining, increasing and consistent R&D performance for these 474 on-going R&D performers were very similar: 36.9% declined; 30.4% continued at the same level and 32.7% increased. (Table 9.1)
- Indicating that as R&D spending levels increased, so did persistence, for the 605 R&D performers spending \$500,000 to \$999,999 in 1994, 37.7% or 228 were still performing in 2002. For this group of on-going performers, the largest share (42.9%) had scaled back their R&D spending; the smallest share (22.4%) continued at the same level and last share (34.7%) had increased their R&D performance. (Table 10.1)
- The R&D performers that began by spending between one million dollars and \$9,999,999 on R&D in 1994 continued at the same level of R&D persistence (37.5% or 245 R&D performers). Of these R&D performers, perhaps reflecting the broadening R&D expenditure categories as spending levels increase, two thirds (163) continued at the same R&D intensity, 13.9% (34 R&D performers) climbed into the highest R&D spending category and the remainder scaled-back their R&D spending. (Table 11.1)
- Finally, the 104 R&D performers that began in the largest expenditure group of \$10,000,000 or more in 1994, showed the greatest propensity to persist with their R&D programs: 57.7% (60 firms) continued to perform R&D over the entire nine year period, and almost all of these firms (50 R&D performers) continued at this high level of intensity. (Table 12.1)

Introduction

Each year Statistics Canada publishes information on industrial research and development (R&D) performers that includes the number of such firms and their total R&D expenditures. What has not been done to date is to look at R&D performers over time. The information on R&D activities comes from the Research and Development in Canadian Industry (RDCI) survey.

The Research and Development in Canadian Industry survey collects statistics on research and development (R&D) activities performed and funded by Canadian business enterprises. Data are collected for natural sciences and engineering only.

This paper looks at R&D performance in three ways. First it looks at all firms that performed R&D at any point between 1994 and 2002. These firms are classified by their R&D expenditure groups by the last year of their appearance in the RDCI survey's database and according to the number of years that they appeared. These first two tables provide an overview of persistence of R&D performance. It is important to note that these tables provide cumulative counts of R&D performers and R&D expenditures over time. The R&D expenditures are in the dollars of the years of occurrence and are provided solely as indicators of the total cumulative amounts spent.

The second section looks at R&D performing firms by R&D expenditure group for each year between 1994 and 2002. It shows the counts and distribution of these firms and provides a picture of R&D performers over time. The counts for 1994 provided in Table 3 become the baseline counts by R&D expenditure group in the third section's tables 7.1 through 12.2.

Finally, the third section of the study follows firms that began to perform R&D in 1994 and documents their R&D performance through time until 2002. The categorization by R&D expenditure groups is used to document increases or decreases in R&D expenditures over time. The purpose of this section is to document the persistence of these 1994 R&D performers showing the direction of their R&D expenditures.

For this study firms were divided into six R&D expenditure groups based on the amount of money they spent on R&D. These R&D expenditure groups are:

- \$10 million or more;
- \$1,000,000 to \$9,999,999;
- \$500,000 to \$999,999;
- \$200,000 to \$499,999;
- \$100,000 to \$199,999; and
- Less than \$100,000.

Firms were also classified by the number of years they reported R&D performance during the interval 1994 to 2002. Firms could be classified as performing from one year through nine years of R&D during this period.

All R&D expenditures are recorded in current dollars.

Section 1: Overview of all firms performing R&D for any time interval between 1994 and 2002

In this first section the R&D firms are classified by their R&D expenditure groups by the last year of their appearance in the RDCI survey's database and by the number of years that they appeared. These two tables provide an overview of persistence of R&D performance. It is important to note that these tables provide cumulative counts of R&D performers and R&D expenditures over time. The R&D expenditures are in the dollars of the years of occurrence and are provided solely as indicators of the total cumulative amounts spent.

Between 1994 and 2002 a total of 31,190 enterprises or firms reported R&D performance for at least one year. Each R&D performing firm appears only once in Table 1 below. Each R&D performer is classified according to the number of years of its R&D performance and by the R&D expenditure group of its last year on the RDCI survey's database. Table 1 shows that the largest single group of firms (7,772) reported spending less than \$100,000 on R&D activities and reported R&D activities in only one year. This group of firms account for one quarter of all firms that reported R&D at any point from 1994 to 2002.

Table 1 Firms present in the RDCI survey from 1994 to 2002 by years of R&D performance and R&D expenditure group of last appearance										
Years on RDCI	1	2	3	4	5	6	7	8	9	Total
R&D Expenditure Group ¹	number of firms									
\$10,000,000 or more	15	27	29	21	29	24	24	19	87	275
\$1,000,000 to 9,999,999	153	231	208	166	155	132	92	116	312	1,565
\$500,000 to \$999,999	248	272	214	146	105	86	73	74	171	1,389
\$200,000 to 499,999	712	761	466	363	250	207	160	239	333	3,491
\$100,000 to \$199,999	1,192	1,061	645	434	302	217	189	216	281	4,537
Less than \$100,000	7,772	4,966	2,540	1,501	1,026	671	504	438	515	19,933
Total	10,092	7,318	4,102	2,631	1,867	1,337	1,042	1,102	1,699	31,190

1. R&D expenditure group is based on total intramural expenditures in the last year in which the firm reported R&D expenditures.

There were 87 firms that spent more than \$10M on R&D and that were present for all nine years of the study. These firms accounted for half of all R&D expenditure in the entire period (Table 2).

Table 2 R&D expenditures by firms present in the survey by number of years of R&D performance and R&D expenditure group of last appearance										
Years on RDCI	1	2	3	4	5	6	7	8	9	Total
R&D Expenditure Group ¹	millions of dollars									
\$10,000,000 or more	459	1,138	1,756	1,873	2,499	2,766	3,703	2,710	43,358	60,262
\$1,000,000 to 9,999,999	387	1,183	1,290	1,681	1,899	2,002	1,382	1,996	7,124	18,944
\$500,000 to \$999,999	167	326	374	342	301	490	247	324	1,020	3,592
\$200,000 to 499,999	216	437	431	433	364	439	328	551	941	4,140
\$100,000 to \$199,999	165	295	279	259	220	224	215	271	373	2,301
Less than \$100,000	274	443	455	373	385	366	300	258	417	3,272
Total	1,669	3,821	4,585	4,960	5,670	6,288	6,175	6,111	53,233	92,511

1. R&D expenditure group is based on total intramural expenditures in the last year in which the firm reported R&D expenditures.

Section 2: R&D performance by R&D expenditure groups based on first year of appearance, 1994 to 2002

This second section looks at R&D performing firms by R&D expenditure group for each year between 1994 and 2002. It shows the counts and distribution of these firms and provides a picture of R&D performers over time based upon their first year of appearance between 1994 and 2002.

The number of R&D performing firms dropped between 1994 and 1997 but began regaining ground so that by 2001 the total number of firms was greater than in 1994. The final year of the data series, 2002, recorded the highest number of R&D performing firms. Each of the size categories reported overall increases in numbers of R&D performers between 1994 and 2002, except for the smallest size category, those who reported less than \$100,000 in R&D expenditures (Table 3).

	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group ¹	number of firms								
\$10,000,000 or more	104	110	117	121	123	130	149	192	205
\$1,000,000 to 9,999,999	653	706	700	691	700	760	855	991	966
\$500,000 to \$999,999	605	594	431	442	469	521	671	766	734
\$200,000 to 499,999	1,443	1,467	1,214	1,161	1,283	1,433	1,576	1,833	1,754
\$100,000 to \$199,999	1,766	1,670	1,454	1,483	1,565	1,625	1,885	2,115	2,182
Less than \$100,000	6,561	6,224	5,889	5,751	5,644	5,498	5,713	6,190	6,431
Total	11,132	10,771	9,805	9,649	9,784	9,967	10,849	12,087	12,272

1. R&D expenditure group is based on total intramural expenditures in current dollars.

Although the smallest R&D performers accounted for the majority of all R&D performing firms in all years of the study, their proportionate share of all R&D performers dropped from a high of 60% in 1996 to a low of 51% in 2001. By contrast, each of the other performance groups reported an increase in its share of all R&D performers (Table 4).

	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group ¹	percentage								
\$10,000,000 or more	0.9	1.0	1.2	1.3	1.3	1.3	1.4	1.6	1.7
\$1,000,000 to 9,999,999	5.9	6.6	7.1	7.2	7.2	7.6	7.9	8.2	7.9
\$500,000 to \$999,999	5.4	5.5	4.4	4.6	4.8	5.2	6.2	6.3	6.0
\$200,000 to 499,999	13.0	13.6	12.4	12.0	13.1	14.4	14.5	15.2	14.3
\$100,000 to \$199,999	15.9	15.5	14.8	15.4	16.0	16.3	17.4	17.5	17.8
Less than \$100,000	58.9	57.8	60.1	59.6	57.7	55.2	52.7	51.2	52.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1. R&D expenditure group is based on total intramural expenditures in current dollars.

Amongst the largest R&D performers, the greatest share reported R&D activities in all nine years and over one half reported performing R&D in at least six years of the nine years. As the level of R&D expenditures dropped, so did the proportion reporting continuous R&D activities throughout the period. Of those reporting the lowest levels of R&D spending only 2.6% reported performing R&D in all nine years. On the other hand, almost one third of this group of firms reported R&D in only one year and over half reported R&D in only one or two of the nine years from 1994 to 2002 (Table 5).

Years on RDCI	1	2	3	4	5	6	7	8	9	Total
R&D Expenditure Group ¹	percentage									
\$10,000,000 or more	5.5	9.8	10.5	7.6	10.5	8.7	8.7	6.9	31.6	100.0
\$1,000,000 to 9,999,999	9.8	14.8	13.3	10.6	9.9	8.4	5.9	7.4	19.9	100.0
\$500,000 to \$999,999	17.9	19.6	15.4	10.5	7.6	6.2	5.3	5.3	12.3	100.0
\$200,000 to 499,999	20.4	21.8	13.3	10.4	7.2	5.9	4.6	6.8	9.5	100.0
\$100,000 to \$199,999	26.3	23.4	14.2	9.6	6.7	4.8	4.2	4.8	6.2	100.0
Less than \$100,000	39.0	24.9	12.7	7.5	5.1	3.4	2.5	2.2	2.6	100.0
Total	32.4	23.5	13.2	8.4	6.0	4.3	3.3	3.5	5.4	100.0

1. R&D expenditure group is based on total intramural expenditures in current dollars.

The highest average R&D spending per firm was reported by those firms with R&D expenditures of \$10 million or more in 1994 and R&D activities in all nine years. The second highest average R&D expenditure was reported by the 15 firms with R&D expenditures over \$10 million but for only one year. This observation appears contradictory to a traditional model of high spending, long-term R&D programs. It may be that these firms were re-identified as new administrative records due to mergers and acquisitions. Also large firms may strategically determine to move R&D resources to other organizations either within Canada or abroad (Table 6).

Table 6 Average expenditures of R&D performers, by numbers of years of R&D performance and R&D expenditure group									
Years on RDCI	1	2	3	4	5	6	7	8	9
R&D Expenditure Group ¹	thousands of dollars								
\$10,000,000 or more	30,617	21,066	20,185	22,292	17,238	19,212	22,039	17,829	55,375
\$1,000,000 to 9,999,999	2,530	2,560	2,068	2,532	2,451	2,528	2,147	2,150	2,537
\$500,000 to \$999,999	674	600	582	585	574	950	483	548	663
\$200,000 to 499,999	303	287	308	298	291	353	293	288	314
\$100,000 to \$199,999	139	139	144	149	146	172	162	157	148
Less than \$100,000	35	45	60	62	75	91	85	74	90
Total	165	261	373	471	607	784	847	693	3,481

1. R&D expenditure group is based on total intramural expenditures in current dollars.

Section 3: Tracking the R&D persistence of 1994 R&D performers

The third part of this report looks at the persistence of R&D performance of those firms that reported performing R&D in the reference year, 1994. The categorization by R&D expenditure groups is used to document increases or decreases in R&D expenditures over time. The purpose of this section is to document the persistence of these 1994 R&D performers showing the direction of their R&D expenditures.

Of the 11,132 firms which reported performing R&D in 1994 only 2,838 were still performing R&D in 2002. In all size categories except the largest, less than one half of the firms continued to report R&D over the entire period.

Amongst firms with the lowest levels of R&D performance in 1994, over half had stopped by 1996. The next largest group continued R&D activities at this lower level throughout the full nine years. Over 500 firms, however, reported increases in R&D over time. The largest group of these moved up one category so that by 2002 they reported between \$100,000 and \$199,999 in R&D spending. A further 201 reported spending between \$200,000 and \$499,999 and 34 firms reported spending \$500,000 or more on R&D by 2002. The smallest group of firms reported spending more than \$1 million – but there were 43 firms which moved from spending less than \$100,000 per year in 1994 to more than \$1 million by 2002 (Table 7.1).

Tracking R&D Performers spending less than \$100,000 on R&D in 1994

	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group _____	number of firms								
\$10,000,000 or more	...	0	0	0	2	0	1	1	2
\$1,000,000 to 9,999,999	...	16	12	15	17	24	31	41	41
\$500,000 to \$999,999	...	22	29	30	32	44	52	49	34
\$200,000 to 499,999	...	160	153	134	154	165	169	207	201
\$100,000 to \$199,999	...	505	368	311	296	292	268	259	239
Less than \$100,000	6,561	3,463	2,338	1,819	1,493	1,203	1,100	952	808
<i>Sub-total: Ongoing performers</i>	<i>6,561</i>	<i>4,166</i>	<i>2,900</i>	<i>2,309</i>	<i>1,994</i>	<i>1,728</i>	<i>1,621</i>	<i>1,509</i>	<i>1,325</i>
No R&D reported ¹	...	2,395	3,661	4,252	4,567	4,833	4,940	5,052	5,236
Total	6,561	6,561	6,561	6,561	6,561	6,561	6,561	6,561	6,561

1. May include firms which have amalgamated or merged into other active entities.

The total amount of R&D spending by this group of firms shifted over time, ultimately ending up at a higher level than the reference year despite the attrition in overall number of firms (Table 7.2).

Table 7.2 Persistence of R&D performance of firms spending less than \$100,000 on R&D in 1994, showing amount of R&D expenditures within R&D expenditure group, 1994 to 2002									
	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group	millions of dollars								
\$10,000,000 or more	...	0	0	0	x	0	x	x	x
\$1,000,000 to 9,999,999	...	33	32	45	x	58	x	x	x
\$500,000 to \$999,999	...	16	20	20	22	30	35	33	23
\$200,000 to 499,999	...	47	45	39	45	49	52	62	62
\$100,000 to \$199,999	...	67	50	43	41	41	38	36	34
Less than \$100,000	238	129	87	68	57	47	46	41	35
Total	238	292	233	215	236	226	250	262	266

Tracking R&D Performers spending between \$100,000 and \$199,999 on R&D in 1994

Seven out of ten firms that reported spending from \$100,000 to \$199,999 on R&D in 1994 had stopped R&D spending by 2002. The second largest group (161 firms) had decreased the amount spent on R&D in 2002. The next two categories were almost equal in size – 139 firms continued to spend from \$100,000 to \$199,999 on R&D and 132 firms had moved up one category and were spending from \$200,000 to \$499,999 on R&D by 2002 (Table 8.1).

	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group	number of firms								
\$10,000,000 or more	...	0	0	0	0	0	0	1	1
\$1,000,000 to 9,999,999	...	14	17	16	13	19	23	26	28
\$500,000 to \$999,999	...	35	40	46	44	49	55	54	55
\$200,000 to 499,999	...	316	236	181	173	162	147	163	132
\$100,000 to \$199,999	1,766	603	400	285	230	206	195	151	139
Less than \$100,000	...	434	387	395	316	245	205	189	161
<i>Sub-total: Ongoing performers</i>	<i>1,766</i>	<i>1,402</i>	<i>1,080</i>	<i>923</i>	<i>776</i>	<i>681</i>	<i>625</i>	<i>584</i>	<i>516</i>
No R&D reported ¹	...	364	686	843	990	1,085	1,141	1,182	1,250
Total	1,766	1,766	1,766	1,766	1,766	1,766	1,766	1,766	1,766

1. May include firms which have amalgamated or merged into other active entities.

The amounts of funds spent on R&D by this cohort of firms dropped sharply by 1998, but began to rebound the next year. The total was still lower in 2002 as compared to 1994 (Table 8.2).

	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group	millions of dollars								
\$10,000,000 or more	...	0	0	0	0	0	0	x	x
\$1,000,000 to 9,999,999	...	26	39	33	30	43	45	49	50
\$500,000 to \$999,999	...	25	26	31	29	33	38	37	37
\$200,000 to 499,999	...	89	68	54	51	49	45	50	42
\$100,000 to \$199,999	248	88	57	41	33	29	28	22	20
Less than \$100,000	...	26	21	21	17	12	11	x	x
Total	248	254	211	179	160	167	167	184	173

Tracking R&D Performers spending between \$200,000 and \$499,999 on R&D in 1994

Firms that spent between \$200,000 and \$499,999 in 1994 reported changes in R&D performance that were similar to those seen in the previous group in that by 2002 about seven out of ten had stopped performing R&D. Of the 474 on-going R&D performers in this group, 175 (37%) had decreased their R&D spending; 144 (30%) continued funding R&D at the same level and the remaining 155 (33%) had increased their R&D spending by 2002 (Table 9.1).

	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group	number of firms								
\$10,000,000 or more	...	0	0	1	0	0	0	3	4
\$1,000,000 to 9,999,999	...	27	39	34	46	53	70	74	68
\$500,000 to \$999,999	...	159	98	90	82	80	84	93	83
\$200,000 to 499,999	1,443	679	405	295	238	222	188	159	144
\$100,000 to \$199,999	...	243	195	211	171	122	120	111	82
Less than \$100,000	...	120	197	175	160	123	103	103	93
<i>Sub-total: Ongoing performers</i>	<i>1,443</i>	<i>1,228</i>	<i>934</i>	<i>806</i>	<i>697</i>	<i>600</i>	<i>565</i>	<i>543</i>	<i>474</i>
No R&D reported ¹	...	215	509	637	746	843	878	900	969
Total	1,443	1,443	1,443	1,443	1,443	1,443	1,443	1,443	1,443

1. May include firms which have amalgamated or merged into other active entities.

The overall amount of R&D spending by firms in this group declined steadily to 1999 and then began to increase again but did not reach the levels reported in 1994 (Table 9.2).

	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group	millions of dollars								
\$10,000,000 or more	...	0	0	x	0	0	0	40	61
\$1,000,000 to 9,999,999	...	38	58	63	99	113	160	175	157
\$500,000 to \$999,999	...	103	65	59	56	55	58	65	56
\$200,000 to 499,999	443	217	127	93	78	71	62	53	47
\$100,000 to \$199,999	...	36	29	31	25	19	18	16	12
Less than \$100,000	...	6	11	x	8	7	6	5	5
Total	443	401	291	282	267	265	303	355	338

Tracking R&D Performers spending between \$500,000 and \$999,999 on R&D in 1994

Firms that reported R&D spending of between \$500,000 and \$999,999 dollars continued performing R&D one year longer than the previous two categories. Of those that continued to perform R&D, 79 were spending more by 2002; 51 remained in the same spending category; and 98 were spending less on R&D by 2002 (Tables 10.1 and 10.2).

Table 10.1 Persistence of R&D performance of firms spending from \$500,000 to \$999,999 on R&D in 1994, showing counts, 1994 to 2002									
	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group	number of firms								
\$10,000,000 or more	...	0	0	0	0	0	2	6	9
\$1,000,000 to 9,999,999	...	93	97	101	80	79	74	73	70
\$500,000 to \$999,999	605	274	123	84	79	72	67	63	51
\$200,000 to 499,999	...	120	105	112	87	77	66	67	57
\$100,000 to \$199,999	...	30	47	43	27	29	29	23	25
Less than \$100,000	...	24	36	40	38	28	30	21	16
<i>Sub-total: Ongoing performers</i>	605	541	408	380	311	285	268	253	228
No R&D reported ¹	...	64	197	225	294	320	337	352	377
Total	605	605	605	605	605	605	605	605	605

1. May include firms which have amalgamated or merged into other active entities.

Overall R&D spending by this group of firms dropped through to 1999 but began to increase rapidly from 2000 through 2002 such that by 2002, the amounts spent by firms that continued with R&D activities was greater in 2002 than 1994 (Table 10.2).

Table 10.2 Persistence of R&D performance of firms spending from \$500,000 to \$999,999 on R&D in 1994, showing amount of R&D expenditures within R&D expenditure group, 1994 to 2002									
	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group	millions of dollars								
\$10,000,000 or more	...	0	0	0	0	0	x	112	204
\$1,000,000 to 9,999,999	...	132	152	174	159	154	171	184	178
\$500,000 to \$999,999	418	199	93	60	55	48	47	45	38
\$200,000 to 499,999	...	43	36	38	29	26	24	23	19
\$100,000 to \$199,999	...	4	7	6	4	4	4	4	4
Less than \$100,000	...	1	2	2	2	2	x	1	1
Total	418	379	290	280	249	235	284	368	444

Tracking R&D Performers spending between \$1,000,000 and \$9,999,999 on R&D in 1994

Of the 653 firms that reported R&D spending between \$1 million and \$9,999,999 in 1994, over half had stopped performing R&D by 2000. In 2002, 34 (5%) were spending more on R&D, 163 (25%) were in the same spending category and 48 (7%) were spending less (Table 11.1).

Table 11.1 Persistence of R&D performance of firms spending from \$1,000,000 to \$9,999,999 on R&D in 1994, showing counts, 1994 to 2002									
	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group	number of firms								
\$10,000,000 or more	...	11	19	24	22	22	26	28	34
\$1,000,000 to 9,999,999	653	487	397	324	277	229	206	189	163
\$500,000 to \$999,999	...	54	50	44	31	31	24	30	23
\$200,000 to 499,999	...	20	24	27	27	28	23	19	15
\$100,000 to \$199,999	...	5	5	4	9	6	10	5	5
Less than \$100,000	...	4	7	11	9	6	7	6	5
<i>Sub-total: Ongoing performers</i>	653	581	502	434	375	322	296	277	245
No R&D reported ¹	...	72	151	219	278	331	357	376	408
Total	653	653	653	653	653	653	653	653	653

1. May include firms which have amalgamated or merged into other active entities.

The amount spent on R&D activities by this group of firms dropped steadily through to 2000 but increased again in 2001 and 2002 (Table 11.2).

Table 11.2 Persistence of R&D performance of firms spending from \$1,000,000 to \$9,999,999 on R&D in 1994 showing amount of R&D expenditures within R&D expenditure group, 1994 to 2002									
	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group	millions of dollars								
\$10,000,000 or more	...	151	280	423	480	595	677	765	832
\$1,000,000 to 9,999,999	1,763	1,443	1,176	998	940	783	692	679	584
\$500,000 to \$999,999	...	42	39	31	23	23	18	22	17
\$200,000 to 499,999	...	7	8	9	10	10	8	6	5
\$100,000 to \$199,999	...	1	1	1	1	1	2	1	1
Less than \$100,000	...	0 ^s	0 ^s	1	0 ^s	0 ^s	0 ^s	0 ^s	0 ^s
Total	1,763	1,644	1,505	1,461	1,456	1,412	1,398	1,474	1,440

Tracking R&D Performers spending \$10,000,000 or more on R&D in 1994

The largest R&D performers reported declines in their number but at a slower rate than the other performance size categories. This was the only group of firms in the study in which more than one half were still performing R&D nine years later (Table 12.1).

	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group	number of firms								
\$10,000,000 or more	104	95	80	69	60	54	55	51	50
\$1,000,000 to 9,999,999	...	6	9	12	16	12	8	12	10
\$500,000 to \$999,999	...	0	0	0	0	2	3	0	0
\$200,000 to 499,999	...	0	1	1	0	0	0	0	0
\$100,000 to \$199,999	...	0	0	0	1	0	0	0	0
Less than \$100,000	...	0	0	0	0	1	0	0	0
<i>Sub-total: Ongoing performers</i>	<i>104</i>	<i>101</i>	<i>90</i>	<i>82</i>	<i>77</i>	<i>69</i>	<i>66</i>	<i>63</i>	<i>60</i>
No R&D reported ¹	...	3	14	22	27	35	38	41	44
Total	104	104	104	104	104	104	104	104	104

1. May include firms which have amalgamated or merged into other active entities.

The total amount expended on R&D by firms in this category peaked in 2001 but remained higher than levels reported in 1994. Only one year, 1996, had lower levels of R&D spending than the reference year of 1994 (Table 12.2).

	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group	millions of dollars								
\$10,000,000 or more	4,457	4,480	4,309	4,624	5,037	4,968	5,820	6,109	4,854
\$1,000,000 to 9,999,999	...	32	x	x	x	x	x	50	45
\$500,000 to \$999,999	...	0	0	0	0	x	x	0	0
\$200,000 to 499,999	...	0	x	x	0	0	0	0	0
\$100,000 to \$199,999	...	0	0	0	x	0	0	0	0
Less than \$100,000	...	0	0	0	0	x	0	0	0
Total	4,457	4,512	4,364	4,698	5,118	5,030	5,856	6,158	4,899

Section 4: Average annual R&D spending by firms present in 1994

In 1994, average R&D spending per firm was \$576,000. Each year subsequent the average R&D spending of firm engaged in R&D in 1994 and continuing to perform R&D increased (with the exception of the last year). By 2002, the average firm was spending almost three times as much. This is because those that spent more were more likely to continue to perform R&D.

Average R&D spending of ongoing performers in each size category increased as well (with the exception of the largest performers in the last year). By 2002 firms that continued performing R&D were, on average, exceeding their spending category by 2002 for all but the two highest categories.

Firms that had begun in 1994 with R&D spending of under \$100,000 were spending \$201,000 on average by 2002, those that began at between \$100,000 and \$199,000 were averaging \$335,000, those that began with between \$200,000 and \$499,000 in 1994 averaged \$713,000 by 2002 and those that were spending between \$500,000 and \$999,999 in 1994 were averaging almost \$2 million in R&D spending by 2002. Firms with ongoing R&D programs in the highest spending categories did not exceed the boundaries of their size category by 2002 although average R&D spending per firm doubled in both cases (Table 13).

	1994	1995	1996	1997	1998	1999	2000	2001	2002
R&D Expenditure Group	thousands of dollars								
\$10,000,000 or more	42,856	44,673	48,489	57,293	66,468	72,899	88,727	97,746	81,650
\$1,000,000 to 9,999,999	2,700	2,830	2,998	3,366	3,883	4,385	4,723	5,321	5,878
\$500,000 to \$999,999	691	701	711	737	801	825	1,060	1,455	1,947
\$200,000 to 499,999	307	327	312	350	383	442	536	654	713
\$100,000 to \$199,999	140	181	195	194	206	245	267	315	335
Less than \$100,000	36	70	80	93	118	131	154	174	201
Total	576	747	872	1,027	1,202	1,290	1,518	1,683	1,559

Conclusion

Firms can select amongst a variety of R&D strategies. Most firms in Canada chose not to perform or fund R&D, while some chose to fund others to do the work. The firms that appeared in this study were those who chose to undertake R&D activities themselves. The data reflect different R&D strategies. Most of the firms studied performed R&D for a few years and then stopped while a few continued with long term R&D activities and generally increasing average R&D spending.

Amongst these firms there are two principle approaches to R&D activities. Some firms chose to engage in R&D on what can be characterized as a “project” basis – that is they identify an issue for resolution, apply the resources for a short interval and then stop once they have completed the project. These firms are those that dropped out of the database after a few years.

Other firms engage in a strategy based on a longer term “program” approach. Under this approach firms engage in R&D continuously over a series of years engaging in multiple projects. These are the firms which continued to perform R&D across the full time interval.

Firms may also switch from one approach to the other, but doing so would entail significant organizational changes and costs and reflect profound changes in the firms’ R&D strategies.

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