



## Service Bulletin

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## Industrial Research and Development, 2000 to 2004

### Highlights

- Industrial research and development (R&D) spending intentions indicate an increase of 1.6% to \$12.5 billion in 2004 but remain 9.5% below the record level of expenditures (of \$13.8 billion) that was observed in 2001. Industrial R&D spending fell 10.5% to \$12.4 billion in 2002 and continued to edge down to \$12.3 billion in 2003.
- Communications equipment remains the largest R&D performing industry based on 2004 intentions, despite a reduction in R&D spending of 38% in 2002. Other industries were not exempt from the 2002 downturn in R&D spending. The Computer system design and related services, and Electrical equipment, appliance and components industries witnessed the largest decreases after Communications equipment in 2002, and they have yet to recover. On the other hand both Architectural, engineering and related services, and Wholesale trade will have fully rebounded from substantial declines in 2002 based on 2004 intentions. While many industries reduced R&D spending in the period, thirteen of the 46 industries listed showed growth in 2002, with Pharmaceutical and medicine; Health care and social assistance; Scientific research and development services; and Information and cultural industries leading the way. Table 2 provides a more comprehensive look of these industries.
- The decline in R&D expenditures in 2002 was felt throughout the country with nine of the ten provinces showing decreases in R&D spending; the exception, Saskatchewan, increased 14.1%. Proportionately the largest declines were seen in Manitoba (-22.9%); Atlantic Canada (-17.5%); Ontario (-14.2%); British Columbia (-8.1%); Quebec (-5.7%) and Alberta (-1.4%).

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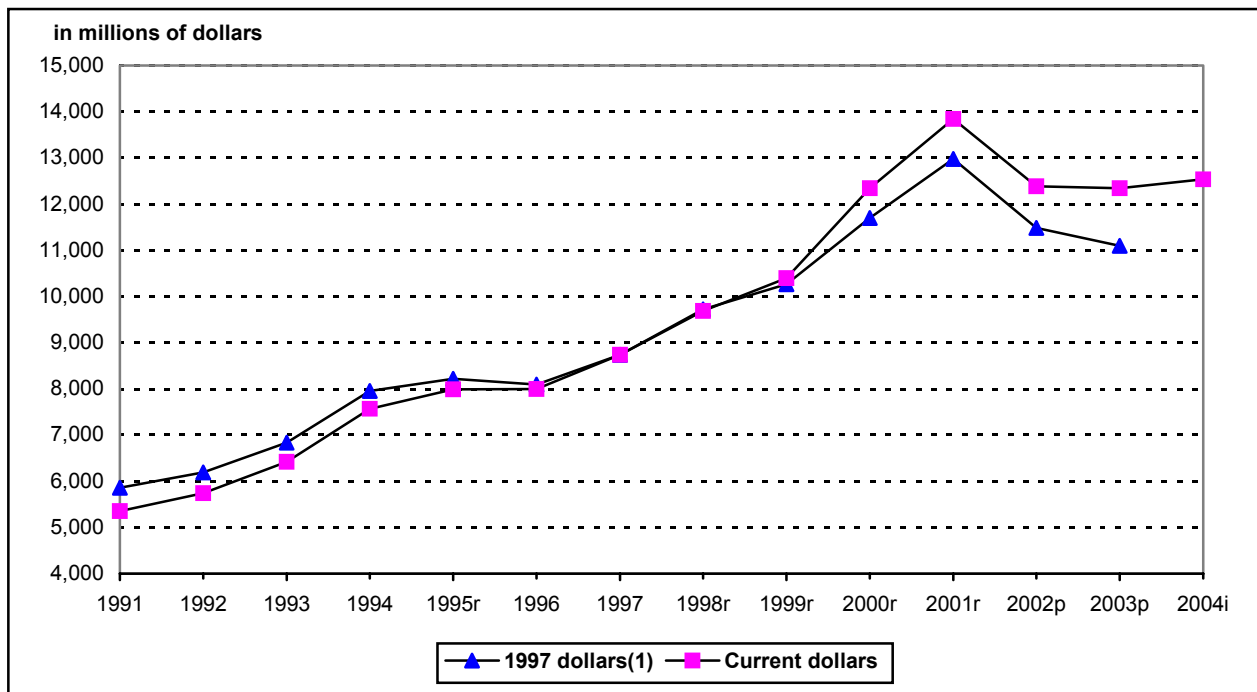
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The statistics in this bulletin are derived from the 2002 survey of industrial R&D activities in Canada, which covers firms spending a million dollars or more on the performance or funding of R&D in Canada, and from the administrative data of the Canada Customs and Revenue Agency (CCRA) for firms which spend less than a million dollars on the performance or funding of R&D in Canada. The use of CCRA data results in a small understatement in total figures for the most recent years reported and this is explained in the note on Methodology on page 9. The 2002 survey conducted in 2003 collects data on actual R&D spending in 2002, on preliminary figures for 2003, and on spending intentions for 2004.

R&D statistics are provided for 46 industries falling under 6 sub-groups: Agriculture, forestry, fishing and hunting; Mining and oil and gas extraction; Utilities; Construction; Manufacturing and Services industries. The industry breakdown is in accordance with the 2002 North American Industry Classification System (NAICS) (Catalogue no. 12-501-XPE) and is necessary to preserve the confidentiality of the respondents. In a small number of cases, adjustments to the NAICS classification was necessary in order to adhere to the international guidelines for science and technological surveys as defined in the OECD (Organisation for Economic Co-operation and Development) Frascati Manual.

**Chart 1. Research and development in Canadian industry, 1991 to 2004**



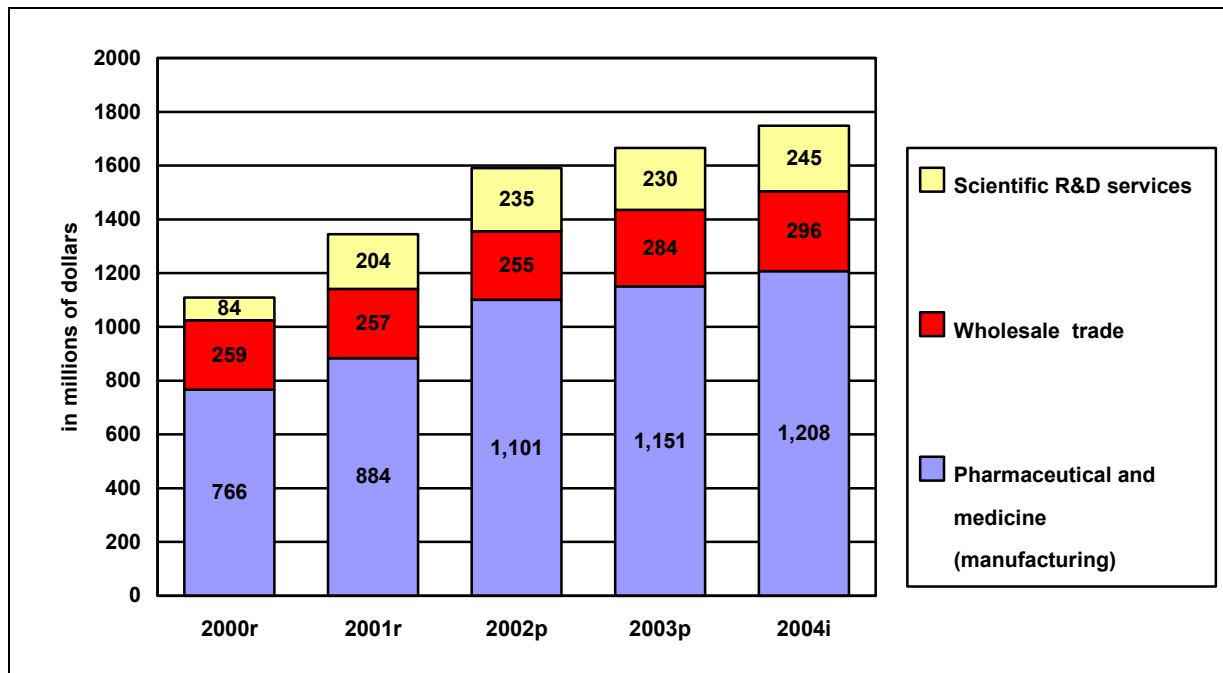
1. The deflator for 1991-2003 is the implicit price index of the GDP: 1997=100.

<b>Table 1. Total intramural R&amp;D expenditures, by industry, 2000 to 2004</b>					
<b>Industries</b>	<b>2000<sup>f</sup></b>	<b>2001<sup>f</sup></b>	<b>2002<sup>f</sup></b>	<b>2003<sup>p</sup></b>	<b>2004<sup>i</sup></b>
in millions of dollars					
<b>Agriculture, forestry, fishing and hunting</b>					
Agriculture	51	66	71	73	71
Forestry and logging	18	15	16	17	18
Fishing, hunting and trapping	8	7	4	3	3
<b>Total agriculture, forestry, fishing and hunting</b>	<b>77</b>	<b>89</b>	<b>90</b>	<b>94</b>	<b>93</b>
<b>Mining and oil and gas extraction</b>					
Oil and gas extraction	129	164	162	166	161
Mining	53	50	31	31	31
<b>Total mining and oil and gas extraction</b>	<b>182</b>	<b>213</b>	<b>193</b>	<b>198</b>	<b>192</b>
<b>Utilities</b>					
Electric power	181	154	157	154	154
Other utilities	6	6	3	3	3
<b>Total utilities</b>	<b>187</b>	<b>161</b>	<b>160</b>	<b>157</b>	<b>156</b>
<b>Construction</b>					
<b>Construction</b>	<b>45</b>	<b>48</b>	<b>33</b>	<b>31</b>	<b>31</b>
<b>Manufacturing</b>					
Food	75	68	63	61	61
Beverage and tobacco	23	22	27	28	26
Textile	46	47	33	35	36
Wood products	42	43	39	37	40
Paper	154	266	282	294	296
Printing	11	16	11	11	11
Petroleum and coal products	41	54	87	76	73
Pharmaceutical and medicine	766	884	1,101	1,151	1,208
Other chemicals	269	270	250	229	231
Plastic products	69	66	55	54	58
Rubber products	32	22	13	13	13
Non-metallic mineral products	19	19	8	8	8
Primary metal (ferrous)	26	31	23	22	23
Primary metal (non-ferrous)	140	159	179	179	181
Fabricated metal products	93	104	86	88	90
Machinery	405	425	378	373	393
Computer and peripheral equipment	207	202	197	195	200
Communications equipment	3,160	3,186	1,988	1,989	1,977
Semiconductor and other electronic components	826	890	848	787	849
Navig., measuring, medical and control instruments	411	423	400	378	356
Other computer and electronic products	20	21	18	18	18
Electrical equipment, appliance and components	210	287	167	143	140
Motor vehicle and parts	380	351	350	307	313
Aerospace products and parts	883	946	900	883	898
All other transportation equipment	23	25	14	14	14
Furniture and related products	9	13	14	15	16
Other manufacturing industries	120	134	115	119	111
<b>Total manufacturing</b>	<b>8,460</b>	<b>8,974</b>	<b>7,648</b>	<b>7,507</b>	<b>7,638</b>
<b>Services</b>					
Wholesale trade	734	612	552	595	614
Retail trade	27	43	29	29	30
Transportation and warehousing	34	32	28	27	27
Information and cultural industries	311	561	622	589	585
Finance, insurance and real estate	142	164	191	192	159
Architectural, engineering and related services	412	530	454	539	542
Computer system design and related services	785	1,080	932	885	891
Management, scientific and technical consulting	63	81	75	64	78
Scientific research and development services	399	711	816	849	884
Health care and social assistance	306	324	366	405	435
All other services	184	222	193	183	178
<b>Total services</b>	<b>3,396</b>	<b>4,361</b>	<b>4,258</b>	<b>4,356</b>	<b>4,424</b>
<b>Total all industries</b>	<b>12,346</b>	<b>13,847</b>	<b>12,383</b>	<b>12,343</b>	<b>12,535</b>

<b>Industries</b>	<b>2000<sup>r</sup></b>	<b>2001<sup>r</sup></b>	<b>2002<sup>p</sup></b>	<b>2003<sup>p</sup></b>	<b>2004<sup>i</sup></b>
in millions of dollars					
Pharmaceutical and medicine (manufacturing)	766	884	1,101	1,151	1,208
Wholesale trade (pharmaceutical)	259	257	255	284	296
Scientific research and development services (pharmaceutical)	84	204	235	230	245
<b>Total pharmaceutical and medicine R&amp;D</b>	<b>1,109</b>	<b>1,345</b>	<b>1,591</b>	<b>1,665</b>	<b>1,749</b>

The Pharmaceutical and medicine manufacturing industry was the second largest industry in terms of R&D expenditures in 2002. Because of the nature of our classification of firms, which is based on the principal source of revenue, rather than R&D objective, pharmaceutical R&D can be found in several industries, most significantly in Wholesale trade and Scientific research and development services. NAICS code 414510 identified the pharmaceutical industries within Wholesale trade. In the Scientific research and development services industry, major performers of pharmaceutical R&D were identified on a case by case basis. Table 2 identifies the value of the pharmaceutical R&D from these industry classifications. When we combine these values, the impact this industry has in Canada accounted for 12.8% of all R&D in 2002.

**Chart 2. Total intramural expenditures on pharmaceutical and medicine R&D, 2000 to 2004**



**Table 3. Total intramural R&D expenditures, by employment size, 2000 to 2004**

Employment size	2000 <sup>r</sup>	2001 <sup>r</sup>	2002 <sup>p</sup>	2003 <sup>E(1)</sup>	2004 <sup>E(1)</sup>
in millions of dollars					
Non-Commercial Enterprise	157	177	163	190	179
1 to 49	1,452	1,700	1,489	1,510	1,539
50 to 99	772	1,074	1,042	1,010	1,065
100 to 199	1,100	1,287	1,109	1,079	1,103
200 to 499	1,018	1,155	1,201	1,158	1,196
500 to 999	1,136	1,299	1,165	1,170	1,195
1,000 to 1,999	1,487	1,602	1,815	1,976	2,047
2,000 to 4,999	1,075	1,080	1,120	1,068	1,046
Greater than 4,999	4,150	4,473	3,279	3,182	3,165
<b>Total</b>	<b>12,346</b>	<b>13,847</b>	<b>12,383</b>	<b>12,343</b>	<b>12,535</b>

1. 2003 and 2004 values are estimated based on employment size as reported for 2002 fiscal year.

The decline in R&D expenditures between 2001 and 2002 can be mostly attributed to the larger firms, as shown in tables 3 and 4. Subsequently, the increase in 2004 can be seen in most size groups except for the two largest employment size groups, which continue to show a slight decline.

Fifty percent of all R&D performed by pharmaceutical firms fall within the 1,000 to 1,999 employment size group, accounting also for approximately half of the R&D expenditures in this size group. Interestingly this is the only size group (employment or revenue) to show consistent growth over the five years. The strength and continuing growth of the pharmaceutical industry is evident as 49% of the increase between 2000 and 2001 can be attributed to the pharmaceutical industry, while 31% of the 2002 increase is accounted for by this industry.

**Table 4. Total intramural R&D expenditures, by performing company revenue size, 2000 to 2004**

Revenue size	2000 <sup>r</sup>	2001 <sup>r</sup>	2002 <sup>p</sup>	2003 <sup>E(1)</sup>	2004 <sup>E(1)</sup>
in millions of dollars					
Non-commercial firms	157	177	163	190	179
< \$ 1,000,000	1,015	911	857	793	797
\$ 1,000,000 – 9,999,999	1,392	1,888	1,628	1,628	1,696
\$ 10,000,000 – 49,999,999	1,316	1,726	1,486	1,482	1,523
\$ 50,000,000 – 99,999,999	776	762	911	866	900
\$ 100,000,000 - \$399,999,999	1,445	1,797	1,594	1,606	1,632
> \$ 399,999,999	6,246	6,587	5,744	5,778	5,808
<b>Total</b>	<b>12,346</b>	<b>13,847</b>	<b>12,383</b>	<b>12,343</b>	<b>12,535</b>

1. 2003 and 2004 values are estimated based on revenue size as reported for 2002 fiscal year.

The principal source of funding in 2002 came from the performing business enterprises themselves. They financed 78% of the total R&D expenditures. Funding of the industrial R&D from foreign sources was equivalent to 14% of the total industrial R&D while the Federal Government's contribution was 2% and other Canadian sources accounted for 6% (Table 5).

Federal Government financing was concentrated in the Aerospace products and parts industry which received \$75 million, Navigational, measuring, medical and control instruments which received \$30 million, Communications equipment which received \$17 million and Machinery which received \$15 million in federal funding. Foreign funding was particularly significant in the Pharmaceutical and medicine industry (\$350 million), the Semiconductor and other electronic component industry (\$319 million) and the Communications Equipment industry. Other Canadian sources of funds included \$428 million made available by Canadian corporations to their R&D affiliates, \$206 million paid by Canadian corporations for R&D undertaken by unaffiliated companies and research institutes, and \$52 million funded by provincial governments.

<b>Table 5. Sources of funds for intramural R&amp;D, by industrial sector 2002, with total values for 2001</b>					
Industrial sector	Canadian performing company	Federal Government <sup>1</sup>	Other Canadian sources <sup>2</sup>	Foreign sources	Total
in millions of dollars					
Agriculture, forestry, fishing and hunting	57	3	19	11	90
Mining and oil and gas extraction	160	0 <sup>s</sup>	32	0	193
Utilities	103	8	41	7	160
Construction	30	0 <sup>s</sup>	3	0	33
Manufacturing	6,150	190	296	1,013	7,648
Services	3,124	69	314	752	4,258
<b>Total 2002</b>	<b>9,624</b>	<b>271</b>	<b>705</b>	<b>1,782</b>	<b>12,383</b>
<b>Total 2001</b>	<b>10,009</b>	<b>459</b>	<b>563</b>	<b>2,816</b>	<b>13,847</b>

1. 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 according to international standards.

2. Includes funds from related companies, from R&D contracts for other firms and grants and contracts from the provincial governments.

Most of the industrial R&D in Canada is performed in Ontario and Quebec (Table 6). About 53% of all R&D in 2002 was performed in Ontario, where Computer and electronic product manufacturing industries are particularly prominent. In Quebec, the Aerospace products and parts industry is of major importance, with 67% of total R&D expenditures by this industry in 2002 occurring in that province. British Columbia and Alberta together account for 13.5% of all R&D performed in Canada in 2002. Alberta dominated the Mining and oil and gas extraction industries with 70% of the R&D performed in this sector, while British Columbia performs 75% of the R&D in Fishing, hunting and trapping.

**Table 6. Total intramural R&D expenditures, by province, 2000 to 2002**

Province	2000 <sup>r</sup>	2001 <sup>r</sup>	2002 <sup>p</sup>
in millions of dollars			
Newfoundland and Labrador	20	20	17
Prince Edward Island	5	5	4
Nova Scotia	67	79	65
New Brunswick	41	39	32
Quebec	3,586	4,061	3,828
Ontario	6,854	7,608	6,528
Manitoba	133	179	138
Saskatchewan	76	85	97
Alberta	593	704	694
British Columbia	971	1,065	979
Yukon, Northwest Territories and Nunavut	0 <sup>s</sup>	1	0 <sup>s</sup>
<b>Total</b>	<b>12,346</b>	<b>13,847</b>	<b>12,383</b>

The number of FTE's (full-time equivalent) engaged in industrial R&D in 2001 increased by 7% (7,638 workers) from the previous year. Those with a university degree increased by 6%, while technicians and others (others are those without a degree or technical certificate) increased by 9% (Table 7).

The preliminary R&D personnel for 2002 have 2,545 fewer firms than 2001 and thus data is understated. This is the result of the revised survey methodology as explained on page 9. The 2001 revised R&D personnel increased by 11% in comparison to the previously released 2001 data.

<b>Table 7. Number of FTE's engaged in R&amp;D, by occupational category and by degree level, 2000 to 2002</b>			
Occupation/degree level	2000 <sup>r</sup>	2001 <sup>r</sup>	2002 <sup>p</sup>
	full-time equivalent		
<b>Professionals</b>			
Bachelor's	55,014	58,972	51,489
Master's	8,147	8,276	8,068
Doctorate	4,001	4,114	4,048
<b>Sub-total, Professionals</b>	<b>67,162</b>	<b>71,362</b>	<b>63,605</b>
Technicians	26,680	28,645	25,518
Other	10,189	11,662	11,627
<b>Total</b>	<b>104,031</b>	<b>111,669</b>	<b>100,750</b>



## Methodology

The Annual survey "Research & Development in Canadian Industry, 2002" was mailed out in June 2003, to all companies known to be performing or funding \$1 million or more in R&D. The data collected from this survey are augmented by tax data for those companies falling below the \$1 million threshold.

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 CCRA in order to claim tax benefits under the Scientific Research and Experimental Development (SR&ED) program. For the survey year 1996, Statistics Canada stopped surveying the small performers (less than \$1 million) and funders of R&D in Canada, to reduce the reporting burden on firms and it replaced the data previously gathered by the survey with administrative data from CCRA.

While this initiative reduced reporting burden, it resulted in a small understatement of the total value of intramural expenditure and of the total number of R&D personnel for the most recent years reported. The figures are revised each year and any understatement is eliminated in subsequent years.

The reason for the understatement is the different time frame for the collection of the survey and the administrative data. The 2002 survey collected data on four years. The four years were: 2001 for which the data are expected to be final; the 2002, for which the data are expected to be close to final, 2003 for which the data are planned expenditures; and, 2004 for which the data are a forecast of spending intentions. CCRA collects data only on actual expenditures and it allows 18 months for the submission. Since 1997, the understatement has been about 4% of total value from when the figures were first published. This may change for the year 2002 where there was an overall decline in sectors of the economy that are leading performers of R&D. A similar understatement occurs in the personnel data.

The data for 2002 also influence the totals for the years 2003 and 2004. For these years the survey data, which account for 92% of the total, are combined with estimates for the data for firms spending less than a million dollars on R&D. These estimates are arrived at by determining the change in the survey data between the current survey year (2002) and the two subsequent years (2003 or 2004). These changes are then applied to the administrative data for the year 2002 to arrive at estimates for the contribution of small R&D performers for the years 2003 and 2004.

Trends in R&D spending are important economic signals and the trends are not seriously affected by a small understatement resulting from the CCRA data. For this reason, the R&D data are published as soon as possible after the survey is conducted.

## Symbols

The following standard symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0 <sup>s</sup>	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
P	preliminary
r	revised
X	suppressed to meet the confidentiality requirements of the Statistics Act
E	use with caution
F	too unreliable to be published

## Other symbols

i	intentions
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**NOTE:** Due to rounding, components may not add to totals

This publication was prepared by **Robert Schellings**, under the direction of **Antoine Rose**, Science, Innovation and Electronic Information Division.

<http://www.statcan.ca/english/IPS/Data/88-001-XIE.htm>

Current publications of the Science and Innovation Surveys Section include:

### **Industrial Research and Development, 2004 Intentions**

(with 2003 preliminary estimates and 2002 actual expenditures), to be released in the fall of 2004 Catalogue No. 88-202-XIE. It presents statistics on research and development (R&D) activities performed and funded by Canadian business enterprises. The report covers current and capital expenditures on R&D, R&D as a percent of performing company revenues, R&D expenditures by province, the company's country of control, personnel engaged in R&D and payments for technological services.

<http://www.statcan.ca/english/IPS/Data/88-202-XIE.htm>

For information on concepts, survey methodology and data quality, for the industrial R&D survey, please refer to the above publication.

### **Federal Scientific Activities, 2003-2004**

Catalogue No. 88-204-XIE, Annual. It presents statistics on the Federal Government's activities in science and technology (S&T). It covers expenditures and person-years by type of science, performing sectors, provinces, Federal departments and agencies.

<http://www.statcan.ca/english/IPS/Data/88-204-XIE.htm>

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