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# Science Statistics

Industrial Research and  
Development, 2005 to 2009



July 2009 Edition



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# Science Statistics

## Industrial Research and Development, 2005 to 2009

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

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## 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

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# Highlights

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## Spending on industrial research and development 2009 (preliminary)

- Data are now available on preliminary intentions for spending in 2009 on industrial research and development by firms in the private sector.
- In total, companies anticipated that their spending (in current dollars) on industrial R&D would amount to \$16.1 billion in 2009.
- Firms in the information and communications technologies (ICT) sector anticipated total R&D performance at \$6.2 billion, or 38.5% of the total in 2009. Those performing R&D related to pharmaceuticals and medicine anticipated investment of \$1.7 billion, or 10% of the total. Both proportions are in line with historical levels.
- Also available are data on revised intentions for 2008. Preliminary actual data are available for 2007 on employment in R&D, the nature of R&D activities and industrial spending distributed by provinces.
- In 2007, firms in Ontario accounted for 48% of total industrial spending on R&D, while those in Quebec accounted for 30%. R&D spending in Ontario declined by 4.0% to \$7.6 billion, while investment in Quebec rose 3.2% to \$4.7 billion.

### Note

Spending intentions for 2008 and 2009 are preliminary indications of the direction of R&D investment intentions. They are not absolute levels of R&D spending so they should be used with caution. In response to the global economic downturn, survey respondents may have adjusted their R&D spending for the last two quarters of 2008 and for all of 2009 after providing their intentions. In addition, estimates of R&D spending for 2007 represent the latest year of actual spending data in the time series released today. However, these data will be revised when Statistics Canada has received processed tax credit forms for scientific research and experimental development outstanding at the time these estimates were finalized or revised after audit by the Canada Revenue Agency.

## Analysis

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Research and development (R&D) performing firms anticipate that their spending (in current dollars) on R&D will be \$16.1 billion in 2009 (table 1-1), essentially unchanged over the previous two years. The data collection of R&D spending intentions for 2008 and 2009 began in August 2008, prior to the onset of the current global financial downturn, and continued until March 2009. It is anticipated that firms will adjust their R&D spending according to their individual responses to the global financial crisis.

In constant dollars, industrial R&D spending has yet to recover from the technology downturn of the start of the millennium which became more apparent with the 2002 industrial R&D spending.

Information and cultural industries became the most important industrial group performing R&D in Canada in 2005 taking over from communications equipment. The main components of information and cultural industries are software publishing including computer games, motion picture and sound recording, broadcasting, telecommunications including voice over Internet protocol, Internet access, publishing, broadcasting and web search portals and data processing.

Over the past decade, the share of industrial R&D performed by the manufacturing sector has declined from 68% in 2000 to 52% in 2009. Between 2000 and 2002, the R&D performance by the manufacturing sector fell from 68% to 61% of total industrial R&D performance. Since 2004 when the manufacturing sector's share of industrial R&D performance was 54%, the rate of loss of share has slowed (table 1-1 and CANSIM table 358-0024).

The information communications technology (ICT) sector continues as an important contributor to R&D performance. This sector spans industries in both the manufacturing and service sectors and includes representation from the leading R&D industrial performers. R&D expenditures by the ICT sector are expected to reach \$6.2 billion or 38.5% of total industrial R&D spending intentions in 2009 (table 2).

When viewed by firm size measures such as employment and revenues, industrial R&D expenditures are concentrated in the largest firms, those with 2,000 or more employees or revenues exceeding \$400 million. Small firms with between 1 and 49 employees account for almost one-fifth of total industrial investment in R&D performance; however this share of industrial R&D spending has remained steady while the share for the largest firms by employment size continues at about one-third (table 1-13). On the other hand, when viewed by revenue size group, firms with revenues of at least \$400 million continue to account for two-fifths of industrial R&D expenditures while firms with less than \$1 million in revenues remain at less than one-tenth (table 1-12).

When R&D concentration is measured by the spending intentions of the top 100 R&D performing firms, these R&D performers represent just over half of all industrial R&D performance down from around four-fifths recorded in the 1970s and early 1980s.

Capital expenditures related to industrial intramural R&D expenditures generally represent about 7% of total expenditures; however extraordinary situations including starting or completing construction of new research and development facilities or test plants will impact the share of capital expenditures over total expenditures (table 2 and CANSIM table 358-0024).

Current intramural expenditures for industrial R&D include wages and salaries and other current expenditures. In recent years, on average wages and salaries represent 60% of current intramural industrial R&D expenditures (CANSIM table 358-0024).

Other current expenditures include supplies and materials consumed in the process of conducting R&D as well as contracts for services to carry out R&D such as drilling needed for heavy oil R&D. For example, in 2009 wages and salaries comprise one-quarter or less of current intramural expenditures in two industries: pharmaceutical and medicine manufacturing and mining and oil and gas extraction indicating the importance of other current expenditures

to these industries. Contracts related to conducting R&D are part of extramural R&D payments and are not included in current intramural expenditures (CANSIM table 358-0024).

In 2007, the most recent year for which counts of R&D personnel are available, 147,599 full-time equivalents were performing tasks related to industrial R&D, a 14% increase in research effort over 2003 (127, 205) (table 4).

Professionals, researchers and managers with university degrees continue to represent six out of every ten full-time equivalent performing R&D while technicians account for three out of every ten and support staff the remaining full-time equivalent (table 4).

#### **Distribution of industrial R&D expenditures by province is available to 2007.**

Industrial R&D expenditures (in current dollars) remain concentrated in Canada's most populous provinces: Ontario (\$7.6 billion), Quebec (\$4.7 billion), British Columbia (\$1.7 billion) and Alberta (\$1.1 billion). Together the firms performing R&D in the four Atlantic provinces spent \$310 million or 2% of the national industrial R&D expenditures in current dollars (table 1-3).

In constant dollars, industrial R&D performance in Ontario declined by 8.9% between 2003 and 2007 while Quebec saw negligible growth over the same period. Due to the importance of the two central provinces to national industrial R&D performance, the strong positive growth in industrial R&D experienced in the other provinces and territories did not offset their influence on national R&D performance which when measured in constant dollars was practically unchanged between 2003 and 2007 (table 1-3).

#### **Provinces varied with respect to the types of industries performing R&D.**

In 2007, Alberta and British Columbia were the only provinces in which industrial R&D performance in the services sector exceeded the R&D performance of the manufacturing firms. The majority of industrial R&D in British Columbia (62%) was performed by the service sector in 2007. In Alberta the service sector represented one-third (33%) of industrial R&D performance just edging out mining and oil and gas extraction (30%) and manufacturing (29%) as the most important provincial industrial R&D performing sector (tables 1-10 and 1-11).

The distribution of industrial R&D by performing sector in the Atlantic provinces, Ontario and Manitoba were similar in 2007. In Ontario, manufacturing represented 61% of the industrial R&D effort while services accounted for 37% (table 1-7). In Manitoba manufacturing represented two-thirds (65%) with services one-third (33%) of industrial R&D performance (table 1-8). For Atlantic Canada the shares of industrial R&D performance were 57% manufacturing sector and 35% services sector (table 1-5).

In Quebec, the manufacturing sector represented 49% of industrial R&D performance closely followed by the services sector at 46% (table 1-6).

#### **Sources of funds for industrial R&D spending are now available for 2007.**

Funds for performing industrial R&D can come from a variety of sources: from within the firm, from the federal government, from foreign sources (which includes intra-corporate transfer by multi-national corporations) and "other" which includes funds from provincial governments, higher education organizations and private non-profit organizations.

In 2007, the majority (77%) of funding for industrial R&D came from within Canadian firms. Industrial R&D performers received 16% of their funding from foreign sources. Funds from the federal government accounted for 2% of R&D financing while the remainder came from "other" sources (table 3).

Industrial sectors rely in varying degrees upon different sources of funds for financing their R&D performance. Firms performing R&D in utilities (89%), and mining and oil and gas extraction (88%) depend heavily upon self-financing for their R&D performance (table 3).

While manufacturing (79%) and services (73%) self-finance the majority of their R&D performance, foreign sources are the second most important source of funds for these sectors (table 3).

#### **The nature of research and development activities for 2007 are now available.**



Research and development, as defined by the *Frascati Manual* (OECD, 2002), is executed as one of three main activities: basic research, applied research and experimental development. Basic research is focused on discoveries of new knowledge of underlying phenomena, without consideration of how this knowledge could be used in practice. Applied research, as the name implies, is research that is more focused on a specific practical purpose or application. Experimental development is typically “closest to the market”, that is, work that is focused on adapting scientific discoveries to a very particular application, typically a new or significantly improved product or process.

Emphasis on the nature of the R&D activity will vary according to the sector performing the R&D. Typically, universities and affiliated institutions such as teaching hospitals, and non-profit organizations focus on basic or applied research. Businesses tend to concentrate on more experimental development activities. In 2007, the majority of current intramural industrial R&D expenditures continued to be directed towards experimental development activities such as new product development or improvement (62%) (table 5).

The proportion of basic research was 5% with applied research representing 13% of current intramural industrial R&D expenditures in 2007 (table 5).

### **The counts of R&D performers are available until 2006.**

The number of firms performing R&D continues to post annual increases, reaching 20,154 in 2006 up by 3.2% from 19,515 in 2005 and more than double the count of 9,648 for 1997. Measured in constant dollars, the average R&D expenditure by performing firm declined from \$977 thousand in 1997 to \$704 thousand in 2006.

R&D firms may choose to perform their R&D activities in multiple locations and therefore performance may be counted in more than one province. For 2006, the count of R&D performers including those making expenditures in more than one province was 20,489. Based on location of the R&D performance, the majority of R&D performers are located in the two central provinces, Quebec, 8,078 (39%) and Ontario, 8,057 (39%). There were 680 (3%) R&D performers in the Atlantic Canada; 375 (2%) in Manitoba; 199 (1%) in Saskatchewan; 1,188 (6%) in Alberta; and 1,912 (9%) in British Columbia and the Territories.

## Related products

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### Selected publications from Statistics Canada

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88-202-X	Industrial Research and Development: Intentions
88-204-X	Federal Scientific Activities
88-221-X	Gross Domestic Expenditures on Research and Development in Canada and the Provinces
88-522-X	Science and Technology Activities and Impacts: A Framework for a Statistical Information
88F0006X	Science, Innovation and Electronic Information Division Working Papers
88F0017M	Science, Innovation and Electronic Information Division Research Papers

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### Selected CANSIM tables from Statistics Canada

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358-0001	Gross domestic expenditures on research and development, by science type and by funder and performer sector, annual
358-0024	Business enterprise research and development (BERD) characteristics, by industry group based on the North American Industry Classification System (NAICS), annual
358-0026	Intellectual property management, by federal departments and agencies indicators, annual

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### Selected surveys from Statistics Canada

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4201	Research and Development in Canadian Industry
4204	Research and Development of Canadian Private Non-Profit Organizations
4208	Provincial Research Organizations (PRO)
4209	Provincial Government Activities in the Natural Sciences
4210	Provincial Government Activities in the Social Sciences
4212	Federal Science Expenditures and Personnel, Activities in the Social Sciences and Natural Sciences
5109	Higher Education Research and Development Estimates

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## **Selected summary tables from Statistics Canada**

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- *Research and development performed by the business enterprise sector*
- *Domestic spending on research and development (GERD), funding sector, by province*
- *Domestic spending on research and development (GERD), performing sector, by province*
- *Domestic spending on research and development (GERD)*

# Statistical tables

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**Table 1-1**  
**Total intramural research and development expenditures — By industry**

	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>	2008 <sup>p</sup>	2009 <sup>p</sup>
	millions of dollars				
<b>Total all industries</b>	<b>15,774</b>	<b>16,021</b>	<b>15,882</b>	<b>15,980</b>	<b>16,146<sup>E</sup></b>
<b>Total agriculture, forestry, fishing and hunting</b>	<b>111</b>	<b>111</b>	<b>114</b>	<b>118<sup>E</sup></b>	<b>115<sup>E</sup></b>
Agriculture	81	87	80	x	82 <sup>E</sup>
Forestry and logging	19	20	x	F	x
Fishing, hunting and trapping	10	4	x	x	x
<b>Total mining and oil and gas extraction</b>	<b>481</b>	<b>588</b>	<b>547</b>	<b>449</b>	<b>459</b>
Oil and gas extraction	440	525	476	376	385
Mining	41	63	71	73 <sup>E</sup>	74 <sup>E</sup>
<b>Total utilities</b>	<b>270</b>	<b>308</b>	<b>x</b>	<b>x</b>	<b>x</b>
Electric power	257	292	x	x	x
Other utilities	13	16	21	F	F
<b>Construction</b>	<b>72</b>	<b>80</b>	<b>x</b>	<b>x</b>	<b>x</b>
<b>Total manufacturing</b>	<b>8,367</b>	<b>8,504</b>	<b>8,211</b>	<b>8,496</b>	<b>8,437</b>
Food	141	141	145	150 <sup>E</sup>	157 <sup>E</sup>
Beverage and tobacco	19	18	x	x	x
Textile	57	56	43	38 <sup>E</sup>	37 <sup>E</sup>
Wood products	135	x	102	x	87 <sup>E</sup>
Paper	314	359	259 <sup>E</sup>	257 <sup>E</sup>	F
Printing	40	38	38	F	F
Petroleum and coal products	214	209	258	263	246 <sup>E</sup>
Pharmaceutical and medicine	1,065	1,048	1,046	1,072	1,057
Other chemicals	165	183	224	241	203
Plastic products	133	136	116	F	x
Rubber products	32	31	24	21 <sup>E</sup>	18 <sup>E</sup>
Non-metallic mineral products	73	69	65	64 <sup>E</sup>	62 <sup>E</sup>
Primary metal (ferrous)	x	x	x	x	51 <sup>E</sup>
Primary metal (non-ferrous)	257	261	x	195	201
Fabricated metal products	211	222	218	F	F
Machinery	561	544	530	605 <sup>E</sup>	618 <sup>E</sup>
Computer and peripheral equipment	156	110	104	x	x
Communications equipment	1,405	1,501	1,485	1,606	x
Semiconductor and other electronic components	849	844	847	931	829
Navigational, measuring, medical and control instruments	482	450	380	435	434
Other computer and electronic products	19	15	24	23 <sup>E</sup>	21 <sup>E</sup>
Electrical equipment, appliance and components	173	207	247	F	F
Motor vehicle and parts	631	612	495	447	432
Aerospace products and parts	860	x	942	x	x
All other transportation equipment	x	67	x	x	61 <sup>E</sup>
Furniture and related products	33	x	35	F	F
Other manufacturing industries	x	212	190	188	184 <sup>E</sup>
<b>Total services</b>	<b>6,474</b>	<b>6,429</b>	<b>6,670</b>	<b>6,559<sup>E</sup></b>	<b>6,772<sup>E</sup></b>
Wholesale trade	816	792	851	871	844 <sup>E</sup>
Retail trade	40	33	50	55 <sup>E</sup>	F
Transportation and warehousing	59	69	67	57	59
Information and cultural industries	1,566	1,637	1,571	1,502	1,734
Finance, insurance and real estate	412	435	408	391 <sup>E</sup>	F
Architectural, engineering and related services	454	439	454	455	463
Computer system design and related services	1,152	1,188	1,240	1,232 <sup>E</sup>	1,150 <sup>E</sup>
Management, scientific and technical consulting	66	55	62	F	F
Scientific research and development services	1,230	1,153	1,261	1,365	1,413 <sup>E</sup>
Health care and social assistance	400	339	341	284	290
All other services	280	289	365	295 <sup>E</sup>	288 <sup>E</sup>

**Table 1-2**  
**Total intramural research and development expenditures — In the pharmaceutical and medicine industries**

	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>	2008 <sup>p</sup>	2009 <sup>p</sup>
	millions of dollars				
<b>Total pharmaceutical and medicine research and development</b>	<b>1,813</b>	<b>1,714</b>	<b>1,614</b>	<b>1,665</b>	<b>1,657</b>
Pharmaceutical and medicine (manufacturing)	1,065	1,048	1,046	1,072	1,057
Wholesale trade (pharmaceutical)	312	303	259	251	250 <sup>E</sup>
Scientific research and development services (pharmaceutical)	436	364	309	342	350 <sup>E</sup>

**Table 1-3**  
**Total intramural research and development expenditures — By provinces**

	2003 <sup>r</sup>	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>
	millions of current dollars				
<b>Canada</b>	<b>14,095</b>	<b>15,249</b>	<b>15,774</b>	<b>16,021</b>	<b>15,882</b>
<b>Sub-total, Atlantic Provinces</b>	<b>179</b>	<b>213</b>	<b>292</b>	<b>302</b>	<b>310</b>
Newfoundland and Labrador	31	30	86	96	90
Prince Edward Island	7	7	11	11	11
Nova Scotia	78	94	97	92	98
New Brunswick	63	82	99	104	112
Quebec	4,174	4,323	4,168	4,570	4,714
Ontario	7,447	7,833	8,205	7,968	7,648
Manitoba	150	182	200	175	193
Saskatchewan	88	113	153	168	136
Alberta	884	1,139	1,210	1,226	1,142
British Columbia <sup>1</sup>	1,172	1,446	1,547	1,611	1,738
	millions of 2002 constant dollars				
<b>Canada</b>	<b>13,645</b>	<b>14,305</b>	<b>14,314</b>	<b>14,190</b>	<b>13,644</b>
<b>Sub-total, Atlantic Provinces</b>	<b>173</b>	<b>200</b>	<b>265</b>	<b>267</b>	<b>266</b>
Newfoundland and Labrador	30	28	78	85	77
Prince Edward Island	7	7	10	10	9
Nova Scotia	76	88	88	81	84
New Brunswick	61	77	90	92	96
Quebec	4,041	4,055	3,782	4,048	4,050
Ontario	7,209	7,348	7,446	7,058	6,570
Manitoba	145	171	181	155	166
Saskatchewan	85	106	139	149	117
Alberta	856	1,068	1,098	1,086	981
British Columbia <sup>1</sup>	1,135	1,356	1,404	1,427	1,493

1. Includes the Yukon Territory, Northwest Territories and the Nunavut.

**Table 1-4**  
**Total intramural research and development expenditures — By major industrial sectors, Canada**

	2003 <sup>r</sup>	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>
	millions of dollars				
<b>Canada</b>	<b>14,095</b>	<b>15,249</b>	<b>15,774</b>	<b>16,021</b>	<b>15,882</b>
Agriculture, forestry, fishing and hunting	94	102	111	111	114
Mining and oil and gas extraction	300	389	481	588	547
Utilities	x	243	270	308	x
Construction	x	56	72	80	x
Manufacturing	8,172	8,278	8,367	8,504	8,211
Services	5,350	6,181	6,474	6,429	6,670

**Table 1-5**  
**Total intramural research and development expenditures — By major industrial sectors, Atlantic Canada**

	2003 <sup>r</sup>	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>
	millions of dollars				
<b>Atlantic Canada</b>	<b>179</b>	<b>213</b>	<b>292</b>	<b>302</b>	<b>310</b>
Agriculture, forestry, fishing and hunting	x	x	x	x	13
Mining and oil and gas extraction	x	x	1	x	x
Utilities	x	x	x	x	x
Construction	0 <sup>s</sup>	x	x	x	x
Manufacturing	97	x	178	175	178
Services	72	81	x	115	107

**Table 1-6**  
**Total intramural research and development expenditures — By major industrial sectors, Quebec**

	2003 <sup>r</sup>	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>
	millions of dollars				
<b>Quebec</b>	<b>4,174</b>	<b>4,323</b>	<b>4,168</b>	<b>4,570</b>	<b>4,714</b>
Agriculture, forestry, fishing and hunting	x	x	x	40	42
Mining and oil and gas extraction	x	x	x	x	35
Utilities	x	x	x	x	119
Construction	x	x	x	x	30
Manufacturing	2,373	2,347	2,244	2,466	2,323
Services	1,636	1,815	1,741	1,892	2,165

**Table 1-7**  
**Total intramural research and development expenditures — By major industrial sectors, Ontario**

	2003 <sup>r</sup>	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>
	millions of dollars				
<b>Ontario</b>	<b>7,447</b>	<b>7,833</b>	<b>8,205</b>	<b>7,968</b>	<b>7,648</b>
Agriculture, forestry, fishing and hunting	29	31	x	41	x
Mining and oil and gas extraction	30	33	x	20	x
Utilities	x	x	x	24	x
Construction	x	x	33	40	42
Manufacturing	4,836	4,865	4,926	4,870	4,666
Services	2,519	2,865	3,158	2,974	2,853

**Table 1-8**  
**Total intramural research and development expenditures — By major industrial sectors, Manitoba**

	2003 <sup>r</sup>	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>
	millions of dollars				
<b>Manitoba</b>	<b>150</b>	<b>182</b>	<b>200</b>	<b>175</b>	<b>193</b>
Agriculture, forestry, fishing and hunting	x	x	x	x	x
Mining and oil and gas extraction	x	x	x	x	x
Utilities	x	x	x	x	x
Construction	x	1	x	x	x
Manufacturing	88	x	117	107	125
Services	58	74	x	65	63

**Table 1-9**  
**Total intramural research and development expenditures — By major industrial sectors, Saskatchewan**

	2003 <sup>r</sup>	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>
	millions of dollars				
<b>Saskatchewan</b>	<b>88</b>	<b>113</b>	<b>153</b>	<b>168</b>	<b>136</b>
Agriculture, forestry, fishing and hunting	x	x	x	x	x
Mining and oil and gas extraction	x	13	x	x	38
Utilities	0	x	x	x	x
Construction	x	0 <sup>s</sup>	x	x	x
Manufacturing	33	x	53	48	60
Services	33	x	x	36	34

**Table 1-10**  
**Total intramural research and development expenditures — By major industrial sectors, Alberta**

	2003 <sup>r</sup>	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>
	millions of dollars				
<b>Alberta</b>	<b>884</b>	<b>1,139</b>	<b>1,210</b>	<b>1,226</b>	<b>1,142</b>
Agriculture, forestry, fishing and hunting	x	x	x	x	x
Mining and oil and gas extraction	229	x	377	445	345
Utilities	1	x	x	x	x
Construction	x	x	x	x	x
Manufacturing	320	x	362	304	332
Services	328	x	x	344	377



**Table 1-11**  
**Total intramural research and development expenditures — By major industrial sectors, British Columbia**

	2003 <sup>r</sup>	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>
millions of dollars					
<b>British Columbia<sup>1</sup></b>	<b>1,172</b>	<b>1,446</b>	<b>1,547</b>	<b>1,611</b>	<b>1,738</b>
Agriculture, forestry, fishing and hunting	20	21	x	16	x
Mining and oil and gas extraction	x	x	x	47	103
Utilities	x	x	4	5	x
Construction	x	x	x	4	x
Manufacturing	424	x	486	535	527
Services	704	919	1,008	1,005	1,071

1. Includes the Yukon Territory, Northwest Territories and Nunavut.

**Table 1-12**  
**Total intramural research and development expenditures — By performing company revenue size**

	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>	2008 <sup>1</sup>	2009 <sup>1</sup>
millions of dollars					
<b>Total</b>	<b>15,774</b>	<b>16,021</b>	<b>15,882</b>	<b>15,980</b>	<b>16,146<sup>E</sup></b>
Non-commercial firms	185	216	192	197 <sup>E</sup>	190 <sup>E</sup>
Less than \$1,000,000	1,085	1,106	1,200	1,230 <sup>E</sup>	1,218 <sup>E</sup>
\$1,000,000 to \$9,999,999	2,421	2,349	2,264	2,297 <sup>E</sup>	2,242 <sup>E</sup>
\$10,000,000 to \$49,999,999	1,834	2,028	2,082	2,063 <sup>E</sup>	2,044 <sup>E</sup>
\$50,000,000 to \$99,999,999	1,017	929	1,015	989 <sup>E</sup>	976 <sup>E</sup>
\$100,000,000 to \$399,999,999	2,418	2,214	2,312	2,202 <sup>E</sup>	2,467 <sup>E</sup>
Greater than \$399,999,999	6,814	7,179	6,816	7,003 <sup>E</sup>	7,009 <sup>E</sup>

1. Values for 2008 and 2009 are estimated based on revenue size as reported for 2007 fiscal year.

**Table 1-13**  
**Total intramural research and development expenditures — By performing company employment size**

	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>	2008 <sup>1</sup>	2009 <sup>1</sup>
millions of dollars					
<b>Total</b>	<b>15,774</b>	<b>16,021</b>	<b>15,882</b>	<b>15,980</b>	<b>16,146<sup>E</sup></b>
Non-commercial enterprise	185	216	192	197 <sup>E</sup>	190 <sup>E</sup>
1 to 49	2,748	2,840	2,772	2,836 <sup>E</sup>	2,789 <sup>E</sup>
50 to 99	1,304	1,226	1,273	1,292 <sup>E</sup>	1,252 <sup>E</sup>
100 to 199	1,261	1,191	1,287	1,304 <sup>E</sup>	1,269 <sup>E</sup>
200 to 499	1,335	1,420	1,757	1,750 <sup>E</sup>	1,784 <sup>E</sup>
500 to 999	1,486	1,522	1,368	1,260 <sup>E</sup>	1,283 <sup>E</sup>
1,000 to 1,999	1,844	1,789	1,992	1,943 <sup>E</sup>	2,206 <sup>E</sup>
Greater than 1,999	5,610	5,816	5,240	5,399 <sup>E</sup>	5,373 <sup>E</sup>

1. Values for 2008 and 2009 are estimated based on employment size as reported for 2007 fiscal year.

**Table 2**  
**Research and development expenditures and personnel in information and communications technology**

	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>p</sup>	2008 <sup>p</sup>	2009 <sup>p</sup>
	millions of dollars				
<b>All industries</b>					
<b>Total research and development expenditures</b>	<b>15,774</b>	<b>16,021</b>	<b>15,882</b>	<b>15,980</b>	<b>16,146<sup>E</sup></b>
Current	14,678	14,876	14,888	15,075	14,856 <sup>E</sup>
Capital	1,096	1,145	994	906	1,290 <sup>E</sup>
<b>Information and communications technology industries</b>					
<b>Total research and development expenditures</b>	<b>5,826</b>	<b>5,924</b>	<b>5,864</b>	<b>6,062</b>	<b>6,216</b>
Current	5,493	5,512	5,468	5,711	5,509
Capital	333	413	396	351	706
<b>Industries other than information and communications technology</b>					
<b>Total research and development expenditures</b>	<b>9,949</b>	<b>10,096</b>	<b>10,017</b>	<b>9,918</b>	<b>9,931<sup>E</sup></b>
Current	9,186	9,364	9,420	9,363	9,347 <sup>E</sup>
Capital	763	732	598	555	584 <sup>E</sup>
	number				
<b>All industries</b>					
<b>Total research and development personnel</b>	<b>142,032</b>	<b>146,666</b>	<b>147,599</b>	..	..
Professional	84,399	86,581	86,368	..	..
Technicians	40,421	42,206	44,057	..	..
Other	17,212	17,879	17,174	..	..
<b>Information and communications technology industries</b>					
<b>Total research and development personnel</b>	<b>53,791</b>	<b>55,492</b>	<b>56,906</b>	..	..
Professional	39,057	40,376	40,652	..	..
Technicians	10,628	10,835	11,793	..	..
Other	4,106	4,281	4,461	..	..
<b>Industries other than information and communications technology</b>					
<b>Total research and development personnel</b>	<b>88,241</b>	<b>91,174</b>	<b>90,693</b>	..	..
Professional	45,342	46,205	45,716	..	..
Technicians	29,793	31,371	32,264	..	..
Other	13,106	13,598	12,713	..	..

**Note(s):** Personnel counts are reported as full-time equivalents.

**Table 3**  
Sources of funds for intramural research and development, by industrial sector 2007, with total values for 2006

	Canadian performing company	Federal government <sup>1</sup>	Other Canadian sources <sup>2</sup>	Foreign sources	Total
millions of dollars					
<b>Total 2007 <sup>P</sup></b>	<b>12,279</b>	<b>263</b>	<b>720</b>	<b>2,619</b>	<b>15,882</b>
Agriculture, forestry, fishing and hunting	x	x	x	x	<b>114</b>
Mining and oil and gas extraction	480	0 <sup>s</sup>	x	x	<b>547</b>
Utilities	227	1	x	x	<b>x</b>
Construction	x	x	x	0	<b>x</b>
Manufacturing	6,527	195	363	1,125	<b>8,211</b>
Services	4,901	59	244	1,467	<b>6,670</b>
<b>Total 2006 <sup>r</sup></b>	<b>12,591</b>	<b>258</b>	<b>743</b>	<b>2,429</b>	<b>16,021</b>

1. Taxes foregone as a result of income tax incentives for research and development 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 research and development contracts for other firms and grants and contracts from the provincial governments.

**Table 4**  
Number of full time equivalent personnel engaged in research and development, by occupational category and by degree level

	2003 <sup>r</sup>	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>P</sup>
number					
<b>Total</b>	<b>127,205</b>	<b>138,177</b>	<b>142,032</b>	<b>146,666</b>	<b>147,599</b>
<b>Professionals</b>	<b>76,601</b>	<b>81,333</b>	<b>84,399</b>	<b>86,581</b>	<b>86,368</b>
Bachelor's	58,370	61,455	64,283	66,547	67,105
Master's	12,589	14,101	14,315	14,289	13,727
Doctorate	5,642	5,777	5,801	5,745	5,536
<b>Supporting staff</b>	<b>50,604</b>	<b>56,844</b>	<b>57,633</b>	<b>60,085</b>	<b>61,231</b>
Technicians	34,567	39,852	40,421	42,206	44,057
Other	16,037	16,992	17,212	17,879	17,174

**Note(s):** Personnel counts are reported as full-time equivalents.

**Table 5**  
Distribution of current intramural research and development expenditures by type of activity

	2003 <sup>r</sup>	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>P</sup>
millions of dollars					
<b>Total</b>	<b>13,110</b>	<b>14,170</b>	<b>14,678</b>	<b>14,876</b>	<b>14,888</b>
Basic research	496	584	586	666	670
Applied research	1,686	1,771	1,951	1,933	1,940
New product development	5,738	6,029	5,941	6,167	6,284
Existing product improvement	2,425	2,829	3,161	3,010	2,909
New process development	908	1,164	947	1,002	823
Existing process improvement	1,172	1,091	1,133	1,193	1,410
New technical services development	491	464	687	682	639
Existing technical services improvement	194	237	272	223	213

**Note(s):** Due to rounding, components may not add to the totals.

# Data quality, concepts and methodology

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## Survey methodology

### The 2007 survey

The 2007 survey collected data on four years. The four years were: 2006 for which the data are expected to be final; 2007, for which the data are expected to be close to final, 2008 for which the data are planned expenditures, and 2009 for which the data are a forecast of spending intentions.

Data from the surveyed firms in 2007 represent approximately 80% of the total expenditures. Estimates are not available for administrative data for 2008 and 2009. 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 2007 survey was mailed out in September 2008. All companies believed to be performing or funding one and a half 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 2007, of firms reported by government respondents as R&D contractors or grantees for 2007 to 2008, 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, 2006, 2007, 2008 and 2009.

### Recent changes to survey methodology

To further relieve respondent burden, in 2006, survey threshold was raised from one million dollars to one and one half million dollars, thereby reducing the number of surveyed firms. These firms continue to be included in our tabulations as their R&D data is imputed using CRA administrative data from the SR&ED program.

To improve data quality for two of the survey's classification variables - Revenues in Canada and Number of Employees in Canada - administrative sources were used to replace missing or inconsistent data.

Revenue figures for the SR&ED tax filers were adjusted to reflect corporate income tax data for the corresponding filer. These tax data are from T2 corporate income tax data mapped to the Statistics Canada Chart of Accounts (COA) classification, by firm, from Tax Data Division. The variable COA4 comprises (Total) Revenue for firms. COA4 values were used to improve data quality for missing total revenues data from reference year 1997 through the current year. Inconsistent reported total revenue data were also examined by subject matter experts with reference to COA4 data. Within the publication, the revisions have impacted the revenue size groups. It is believed the revisions have substantially improved the quality of the revenue variable.

Canada Revenue Agency (CRA) Payroll Deductions total employment data (PD7) was used to improve the quality of missing or inconsistent total employment data for survey years 2001 through the current survey year. Payroll Deduction data are monthly data, therefore an annual average is calculated from CRA monthly Payroll Deduction data for all business enterprises that reported having one or more employees in at least one of the twelve months of the tax year.

## 2008 Canada Revenue Agency (CRA) changes to the Scientific Research and Experimental Development (SR&ED) tax forms

In 2008, the Canada Revenue Agency (CRA) introduced new tax forms for applicants to the Scientific Research and Experimental Development (SR&ED) investment tax credit program. These changes will impact the data produced from the Research and Development in Canadian Industry (RDCI) survey. The new forms went into effect in November 2008. SR&ED applicants have been given the opportunity to use either the new or the old forms for their financial years ending in 2008. Please see the CRA's web-site for copies of the new and old SR&ED tax forms (<http://www.cra-arc.gc.ca/E/pbg/tf/t661/README.html>).

The CRA changes that impact data continuity include:

- February 25, 2008, the federal budget provided for a change in the SR&ED tax qualified expenditures for wages and salaries of R&D activities performed outside of Canada that was directly performed by employee(s) of the applicant; "the employee who performed the SR&ED work was a resident of Canada at the time the expense was incurred; the SR&ED work carried on by the employees outside Canada was an integral part and solely in support of the SR&ED work for a project carried on in Canada; and salary or wages paid were not subject to income or profits tax from another country." (Guide to Form T661 – Scientific Research and Experimental Development (SR&ED) Expenditures Claim, <http://www.cra-arc.gc.ca/E/pub/tg/t4088/t4088-e.html>, accessed December 09, 2008).
- The nature of R&D activities that are found in table 5 of this bulletin, are no longer available.
- The area of specialization of R&D activities (biotechnology, software development, and environmental protection, found in 88-202 in tables 15-1 15-2 and 15-3) are no longer available.
- R&D personnel are given by number (head count) rather than full-time equivalent which will impact tables 2 & 4.

Other changes to the SR&ED forms which may impact data processing for 2008 reference year are:

- R&D expenditures are by project rather than program.
- Selected type of R&D activity by project is included.
- Science type has been added.
- Type of location used for R&D has been added.

For the 2008 R&D expenditures, SR&ED tax data will be processed from two forms, therefore, data availability for 2008 will be limited.

### 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. In the 2006 survey year this threshold was raised to \$1.5 million thereby further reducing respondent burden.

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.

## 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, 2007/2008*, (Catalogue no. 88-204-X).

## 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 2007 “base year” survey is shown below.

For 2007 the response rate was 68 %. Survey questionnaires were mailed to 1,122 firms: 759 were returned; 603 were data captured as long forms, 74 were data captured and changed to short forms, 30 indicated no research and development activity; 29 were out of business; 5 were included with another respondent; and 363 were estimated.

An additional 157 firms were added to the survey universe from the 2007 Scientific Research & Experimental Development tax file.

## Technical notes

Data for the reference year 2007 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, the 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 2007.

## 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.

**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.

**Country of control:** In most cases of foreign control, the country of control is the country of residence of the ultimate foreign controlling parent corporation, family, trust, estate or related group. Each subsidiary within the global enterprise is assigned the same country of control as its parent. A company whose voting rights are equally owned by Canadian-controlled and foreign-controlled corporations is Canadian-controlled. If two foreign-controlled corporations jointly own an equal amount of the voting rights of a Canadian resident company, the country of control is assigned according to an order of precedence based on their aggregate level of foreign control in Canada. For example, United States takes precedence over all other foreign countries because it has the highest level of aggregate foreign control in Canada.

**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.