

Catalogue no. 88-001-X

# Science Statistics

Research and Development  
Personnel, 1999 to 2008

February 2011 Edition



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Statistics Canada  
Business Special Surveys and Technology Statistics Division

# Science Statistics

Research and Development Personnel, 1999 to 2008

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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

Additional symbols used in this publication:

- A excellent (0 to 4.9% coefficient of variation)
- B very good (5.0% to 9.9% coefficient of variation)
- C good (10.0% to 14.9% coefficient of variation)
- D acceptable (15.0% to 24.9% coefficient of variation)

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# Highlights

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## Research and Development Personnel, 1999 to 2008

- In 2008, a total of 242,680 full-time equivalent personnel were engaged in research and development (R&D) activities in Canada, down 1.0% from the previous year. (Table 1-1)
- Nearly two-thirds (65%) of R&D personnel were employed by business enterprises in 2008, followed by 26% in the higher education sector, 8% in government (combined federal and provincial) and 1% in private non-profit organizations. (Table 1-1)
- About three-quarters of total R&D personnel worked in two provinces combined: Ontario (45%) and Quebec (31%). Most of the remaining R&D personnel were engaged in British Columbia (9%) and Alberta (7%). (Table 2-1)
- Researchers accounted for 61% of total R&D personnel, while technicians comprised 25% and support staff 14%. In 2008 there were 148,980 researchers working in Canada, this remained relatively flat from the previous year but was a 20.8% increase from five years earlier (2003). (Table 3-2)

## Analysis

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Research and development (R&D) personnel are instrumental in the advancement of R&D. This edition of the Science Statistics Bulletin reports on the number of full-time equivalent personnel performing R&D activities in Canada from 1999 to 2008. R&D personnel encompass a variety of occupations which are classified into three categories according to the International Standard Classification of Occupation (ISCO): researchers, technicians and support staff. Researchers generally include scientists and engineers who engage in the conception and creation of new knowledge, products, processes, methods and systems. Technicians are individuals whose main tasks require technical knowledge and experience in R&D related fields such as engineering or physical and life sciences. Support staff encompass skilled and unskilled craftsmen, secretarial and clerical staff that participate in R&D projects. Additional details on these occupational categories can be found in the Data quality, concepts and methodology section of this publication.

### International comparisons

This publication incorporates ISCO so that Canadian data can be compared internationally. The Organisation for Economic Cooperation and Development (OECD) disseminates international R&D personnel data in its publication Main Science and Technology Indicators (MSTI). At the time of this publication the latest volume available of MSTI was 2010/1 which provides comprehensive data for 2008.

In many countries the business enterprise sector is the largest employer of full time equivalent (FTE) R&D personnel when compared to the sectors of government and higher education. From a select group of OECD countries, the business enterprise sector employed the most R&D personnel in FTEs in Japan, Germany, France, Italy, Canada, the Netherlands and Sweden. However, in the United Kingdom the higher education sector is where the largest number of FTEs for R&D personnel are found. The United States does not report R&D personnel by sector to the OECD. (Table 3-1)

Total researchers per thousand total employment is an indicator of R&D intensity within a country. Employed persons are those who, during the reference week, did any work at all or had a job but were not at work. In 2008 both Japan and Sweden recorded 10.6 full time equivalent R&D personnel per thousand total employment in their respective countries. Comparatively, data from this publication places Canada at 8.8 R&D personnel per thousand employed. The United States of America recorded 9.5 for 2007 (the latest year of available data from the OECD). (Table 4-1)

### Canadian Data

#### Researchers

In 2008, there were 148,980 researchers working in Canada. Compared to 2007, the change in number of researchers remained flat (-0.2%), while there was a 20.8% increase in researchers from 2003. (Table 4-3)

Researchers are the predominant R&D personnel group. In 2008 doctoral students formed 73% of the 49,300 researchers in the higher education sector. Fifty-four percent of these doctoral students focused on natural science and engineering work, while the remaining 46% worked within the social sciences and humanities sector. (Table 4-2)

Between 1999 and 2008 the count of researchers in the field of natural sciences and engineering increased 52.1%, while the number in social sciences and humanities increased 45.7%. (Table 3-2)



Comparing all performing sectors in 2008, Prince Edward Island, Quebec, Ontario, Alberta and British Columbia held the largest count of full-time equivalent researchers in the business enterprise sector. For the remaining provinces the higher education sector employed the most researchers. (Table 2-1)

The government sector employed 6.0% of total researchers in 2008. Eighty-two percent of government researchers work with the federal government. The National Research Council employed 1,635; the largest number of researchers among all federal departments. The majority of federal researchers, 90% in 2008, work in the natural sciences and engineering field. However, in the past decade the share of federal research personnel in the social sciences and humanities has grown from 4% to 10% in 2008. (Tables 1-2, 4-3, 7)

### **Technicians**

In 2008, a total of 60,450 technicians worked in Canada, down 5.8% from 2007. Over the five year period from 2003 to 2008 the number of technicians increased 31.2%. (Table 2-2)

Over the past decade, the number of technicians in the field of natural sciences and engineering increased 81.2% while technicians in the social sciences and humanities field increased 25.1%. (Table 3-2)

The business enterprise sector employed the largest number of technicians among all provinces in 2008. (Table 2-1)

### **Other Support Staff**

In 2008 a total of 33,250 R&D support staff worked in Canada, an increase of 4.8% from the previous year. Between 2003 and 2008 other R&D support staff increased 22.5%. (Table 2-2)

During the ten year period between 1999 and 2008, the number of other R&D support staff in the field of natural sciences and engineering increased 63.5%, while the count in the social sciences and humanities increased 31.8%. (Table 3-2)

In Prince Edward Island, New Brunswick, Quebec, Ontario, Manitoba, Alberta and British Columbia the business enterprise sector employed the greatest number of support staff. In Nova Scotia the count of R&D support staff were the same in the business enterprise sector and the higher education sector. For the remaining provinces the higher education sector employed the most support staff. (Table 2-1)

## 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 (GERD), and the Provinces
88-522-X	Science and Technology Activities and Impacts: A Framework for a Statistical Information
88F0006X	Business Special Surveys and Technology Statistics 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
358-0142	Federal expenditures on science and technology and its components in current dollars and 2002 constant dollars, annual
358-0143	Federal expenditures on science and technology and its components, by type of science and performing sector, annual
358-0144	Federal expenditures on science and technology and its components, by activity and performing sector, annual
358-0145	Federal intramural expenditures on science and technology and its components, by type of science for the National Capital Region, annual
358-0146	Federal personnel engaged in science and technology activities, by type of science and personnel category, annual
358-0147	Federal personnel engaged in science and technology and its components, by type of science and personnel category, annual
358-0148	Federal personnel engaged in science and technology and its components, by type of science, personnel category, Canada, provinces and territories, annual

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358-0149	Federal expenditures on science and technology and its components, by type of science, performing sector, Canada, provinces and territories, annual
358-0150	Federal extramural expenditures on science and technology and its components, by type of science, performing sector, type of payment, Canada, provinces and territories, annual
358-0151	Federal expenditures on science and technology and its components, by socio-economic objectives, 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
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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- *Domestic spending on research and development (GERD), performing sector, by province*
- *Domestic spending on research and development (GERD)*
- *Research and development performed by the business enterprise sector*
- *Domestic spending on research and development (GERD), funding sector, by province*

# Statistical tables

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**Table 1-1**  
**Personnel engaged in research and development — Sector of performance**

	1999	2000	2001	2002	2003	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>r</sup>	2008
	number									
<b>Total</b>	<b>153,340</b>	<b>168,120</b>	<b>179,380</b>	<b>183,420</b>	<b>196,510</b>	<b>210,590</b>	<b>218,610</b>	<b>229,160</b>	<b>245,170</b>	<b>242,680</b>
Federal government	14,080	14,700	13,740	13,960	13,580	13,720	15,250	15,140	15,630	16,270
Provincial governments <sup>1</sup>	2,520	2,710	2,730	2,820	2,560	2,550	2,620	2,820	3,120	3,150
Business enterprise <sup>2</sup>	91,300	104,710	115,720	118,460	127,210	138,210	142,030	151,730	164,100	158,930 <sup>D</sup>
Higher education	44,590	45,150	46,300	47,340	51,880	54,730	56,950	57,270	60,140	62,330
Private non-profit organizations <sup>3</sup>	850	850	890	840	1,280	1,380	1,760	2,200	2,180	2,000
	percent change									
<b>Total</b>	...	<b>9.6</b>	<b>6.7</b>	<b>2.3</b>	<b>7.1</b>	<b>7.2</b>	<b>3.8</b>	<b>4.8</b>	<b>7.0</b>	<b>-1.0</b>
Federal government	...	4.4	-6.5	1.6	-2.7	1.0	11.2	-0.7	3.2	4.1
Provincial governments <sup>1</sup>	...	7.5	0.7	3.3	-9.2	-0.4	2.7	7.6	10.6	1.0
Business enterprise <sup>2</sup>	...	14.7	10.5	2.4	7.4	8.6	2.8	6.8	8.2	-3.2
Higher education	...	1.3	2.5	2.2	9.6	5.5	4.1	0.6	5.0	3.6
Private non-profit organizations <sup>3</sup>	...	0.0	4.7	-5.6	52.4	7.8	27.5	25.0	-0.9	-8.3

1. Provincial government data includes provincial research organizations data.

2. Natural sciences and engineering only.

3. Private non-profit organization's personnel counts may fluctuate due to these organization's intramural research and development activities.

**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.

**Table 1-2**  
**Personnel engaged in research and development — Federal government, occupational category**

	Researchers			Technicians			Support staff			Total
	Natural sciences and engineering	Social sciences and humanities	Total	Natural sciences and engineering	Social sciences and humanities	Total	Natural sciences and engineering	Social sciences and humanities	Total	
	number									
1999	5,750	270	<b>6,020</b>	3,790	70	<b>3,860</b>	3,950	250	<b>4,200</b>	<b>14,080</b>
2000	5,840	280	<b>6,120</b>	3,750	70	<b>3,820</b>	4,530	230	<b>4,760</b>	<b>14,700</b>
2001	5,250	360	<b>5,610</b>	3,700	80	<b>3,780</b>	4,090	260	<b>4,350</b>	<b>13,740</b>
2002	5,800	390	<b>6,190</b>	3,700	70	<b>3,770</b>	3,720	280	<b>4,000</b>	<b>13,960</b>
2003	5,740	370	<b>6,110</b>	3,690	70	<b>3,760</b>	3,440	270	<b>3,710</b>	<b>13,580</b>
2004	5,620	360	<b>5,980</b>	3,640	90	<b>3,730</b>	3,740	270	<b>4,010</b>	<b>13,720</b>
2005	6,710	380	<b>7,090</b>	3,870	90	<b>3,960</b>	3,890	310	<b>4,200</b>	<b>15,250</b>
2006	6,320	430	<b>6,750</b>	4,060	130	<b>4,190</b>	3,780	420	<b>4,200</b>	<b>15,140</b>
2007	6,640	460	<b>7,100</b>	4,490	170	<b>4,660</b>	3,540	330	<b>3,870</b>	<b>15,630</b>
2008	6,590	730	<b>7,320</b>	4,610	90	<b>4,700</b>	3,800	450	<b>4,250</b>	<b>16,270</b>

**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.

**Table 1-3**  
**Personnel engaged in research and development — Provincial government sector<sup>1</sup>, by occupational category**

	Researchers			Technicians			Support staff			Total
	Natural sciences and engineering	Social sciences and humanities	Total	Natural sciences and engineering	Social sciences and humanities	Total	Natural sciences and engineering	Social sciences and humanities	Total	
	number									
1999	1,140	130	<b>1,270</b>	820	20	<b>840</b>	390	20	<b>410</b>	<b>2,520</b>
2000	1,210	170	<b>1,380</b>	870	50	<b>920</b>	380	30	<b>410</b>	<b>2,710</b>
2001	1,160	170	<b>1,330</b>	830	30	<b>860</b>	510	30	<b>540</b>	<b>2,730</b>
2002	1,170	190	<b>1,360</b>	880	40	<b>920</b>	510	30	<b>540</b>	<b>2,820</b>
2003	1,030	230	<b>1,260</b>	730	50	<b>780</b>	480	40	<b>520</b>	<b>2,560</b>
2004	1,010	220	<b>1,230</b>	800	40	<b>840</b>	440	40	<b>480</b>	<b>2,550</b>
2005	1,060	270	<b>1,330</b>	790	40	<b>830</b>	410	50	<b>460</b>	<b>2,620</b>
2006	1,140	290	<b>1,430</b>	900	50	<b>950</b>	410	30	<b>440</b>	<b>2,820</b>
2007	1,300	310	<b>1,610</b>	980	60	<b>1,040</b>	430	40	<b>470</b>	<b>3,120</b>
2008	1,230	340	<b>1,570</b>	1,000	60	<b>1,060</b>	470	50	<b>520</b>	<b>3,150</b>

1. Provincial government data includes provincial research organizations data. Provincial research organizations data are in natural sciences and engineering only.  
**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.

**Table 1-4**  
**Personnel engaged in research and development — Business enterprise sector, by occupational category**

	Researchers	Technicians	Support staff	Total
	number			
1999	58,000	22,810	10,490	<b>91,300</b>
2000	66,870	26,740	11,100	<b>104,710</b>
2001	73,140	29,660	12,920	<b>115,720</b>
2002	73,290	31,590	13,580	<b>118,460</b>
2003	76,600	34,570	16,040	<b>127,210</b>
2004 r	82,350	39,870	16,990	<b>138,210</b>
2005 r	74,410	40,410	17,210	<b>142,030</b>
2006 r	88,230	44,510	18,990	<b>151,730</b>
2007 r	92,760	50,820	20,530	<b>164,100</b>
2008	90,300 A	47,170 A	21,450 A	<b>158,930 D</b>

**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.

**Table 1-5**  
**Personnel engaged in research and development — Higher education sector, by occupational category**

	Researchers			Technicians			Support staff			Total
	Natural sciences and engineering	Social sciences and humanities	Total	Natural sciences and engineering	Social sciences and humanities	Total	Natural sciences and engineering	Social sciences and humanities	Total	
	number									
1999	17,400	15,620	<b>33,020</b>	4,400	1,660	<b>6,060</b>	3,330	2,180	<b>5,510</b>	<b>44,590</b>
2000	17,440	15,860	<b>33,300</b>	4,490	1,710	<b>6,200</b>	3,400	2,250	<b>5,650</b>	<b>45,150</b>
2001	18,110	16,090	<b>34,200</b>	4,440	1,540	<b>5,980</b>	3,640	2,480	<b>6,120</b>	<b>46,300</b>
2002	18,530	16,380	<b>34,910</b>	4,560	1,580	<b>6,140</b>	3,730	2,560	<b>6,290</b>	<b>47,340</b>
2003	21,160	17,740	<b>38,900</b>	4,750	1,660	<b>6,410</b>	3,900	2,670	<b>6,570</b>	<b>51,880</b>
2004	22,500	18,880	<b>41,380</b>	4,850	1,730	<b>6,580</b>	3,980	2,790	<b>6,770</b>	<b>54,730</b>
2005	23,720	19,700	<b>43,420</b>	4,920	1,750	<b>6,670</b>	4,030	2,830	<b>6,860</b>	<b>56,950</b>
2006	23,540	19,990	<b>43,530</b>	4,980	1,790	<b>6,770</b>	4,080	2,890	<b>6,970</b>	<b>57,270</b>
2007	25,700	21,610	<b>47,310</b>	4,670	2,010	<b>6,680</b>	3,420	2,730	<b>6,150</b>	<b>60,140</b>
2008	27,030	22,270	<b>49,300</b>	4,750	2,040	<b>6,790</b>	3,480	2,770	<b>6,250</b>	<b>62,330</b>

**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.

**Table 1-6**  
**Personnel engaged in research and development — Private non-profit sector<sup>1</sup>, by occupational category**

	Researchers	Technicians	Support staff	Total
	number			
1999	330	340	180	<b>850</b>
2000	300	300	250	<b>850</b>
2001	310	300	280	<b>890</b>
2002	280	260	300	<b>840</b>
2003	430	540	310	<b>1,280</b>
2004	460	610	310	<b>1,380</b>
2005	520	890	350	<b>1,760</b>
2006 <sup>r</sup>	720	1,020	460	<b>2,200</b>
2007 <sup>r</sup>	520	940	720	<b>2,180</b>
2008	490	730	780	<b>2,000</b>

1. Private non-profit organization's personnel counts may fluctuate due to these organization's intramural research and development activities.

**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.

**Table 2-1**  
**Provincial distribution of personnel engaged in research and development — Sector of performance, by occupational category**

	2008										Canada <sup>1</sup>
	Newfoundland and Labrador	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	
	number										
<b>Total<sup>2</sup></b>	<b>1,780</b>	<b>460</b>	<b>4,270</b>	<b>2,540</b>	<b>75,180</b>	<b>108,650</b>	<b>4,270</b>	<b>3,730</b>	<b>16,920</b>	<b>22,850</b>	<b>242,680</b>
Researchers	1,100	210	2,440	1,390	43,300	68,910	2,260	2,100	11,130	15,630	148,980
Technicians	400	150	1,110	710	21,290	25,540	1,250	1,030	3,590	4,650	60,450
Other	280	100	720	440	10,590	14,200	760	600	2,200	2,570	33,250
<b>Federal government</b>	<b>180</b>	<b>100</b>	<b>500</b>	<b>270</b>	<b>2,310</b>	<b>3,440</b>	<b>510</b>	<b>470</b>	<b>890</b>	<b>710</b>	<b>9,390</b>
Researchers	80	40	210	130	1,040	1,560	210	200	390	330	4,200
Technicians	50	30	150	70	670	990	160	140	260	200	2,720
Other	50	30	140	70	600	890	140	130	240	180	2,470
<b>Federal government (National Capital Region)</b>	...	...	...	...	<b>650</b>	<b>6,220</b>	...	...	...	...	<b>6,880</b>
Researchers	...	...	...	...	350	2,760	...	...	...	...	3,120
Technicians	...	...	...	...	160	1,820	...	...	...	...	1,980
Other	...	...	...	...	140	1,640	...	...	...	...	1,780
<b>Provincial governments<sup>3</sup></b>	..	..	..	<b>170</b>	<b>890</b>	<b>540</b>	<b>140</b>	<b>360</b>	<b>810</b>	<b>210</b>	<b>3,150</b>
Researchers	..	..	..	60	500	340	80	120	310	150	1,570
Technicians	..	..	..	70	300	140	30	200	260	50	1,060
Other	..	..	..	40	90	60	30	40	240	10	520
<b>Business enterprise</b>	<b>560</b>	<b>220</b>	<b>1,960</b>	<b>1,120</b>	<b>55,470</b>	<b>73,040</b>	<b>2,040</b>	<b>1,250</b>	<b>8,770</b>	<b>14,500</b>	<b>158,930<sup>D</sup></b>
Researchers	300	100	1,030	530	27,990	44,230	830	650	5,380	9,260	90,300 <sup>A</sup>
Technicians	180	80	640	410	18,890	19,810	830	410	2,330	3,600	47,170 <sup>A</sup>
Other <sup>4</sup>	80	40	290	180	8,590	9,000	380	190	1,060	1,640	21,450 <sup>A</sup>
<b>Higher education</b>	<b>1,040</b>	<b>140</b>	<b>1,810</b>	<b>980</b>	<b>15,860</b>	<b>25,410</b>	<b>1,580</b>	<b>1,650</b>	<b>6,450</b>	<b>7,430</b>	<b>62,340</b>
Researchers	720	70	1,200	670	13,420	20,020	1,140	1,130	5,050	5,890	49,300
Technicians	170	40	320	160	1,270	2,780	230	280	740	800	6,790
Other	150	30	290	150	1,170	2,610	210	240	660	740	6,250

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

2. The data for the private non-profit sector (PNP) performing research and development (R&D) are not distributed by provinces, territories or the National Capital Region. The national totals of R&D, by performing sector include the PNP.

3. Provincial government data includes provincial research organizations data.

4. No provincial distribution between technicians and other, estimated proportionally according to national total.

5. Data for business R&D personnel at the provincial level are collected for "Professionals" (researchers and administrators) and "Other R&D personnel". The "Other R&D personnel" data are then used to model estimates for "Technicians" and "Support staff" by province. Since these data are modeled no quality indicators are provided. Where the actual data points for "Other R&D personnel" for the province or territory are deemed to be too unreliable to be published, no modeled estimates for "Technicians" and "Support staff" are published. These estimates are indicated as "too unreliable to be published".

**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.



**Table 2-2**  
**Provincial distribution of personnel engaged in research and development — Occupational category**

	Newfoundland and Labrador	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Yukon, Northwest Territories and Nunavut	Canada
	number											
<b>Researchers <sup>1</sup></b>												
2003	870	160	1,940	1,130	36,270	58,160	2,120	1,790	8,500	11,890	40	<b>123,300</b>
2004 r	920	160	2,110	1,180	37,810	60,440	2,210	1,870	9,520	13,660	50	<b>130,390</b>
2005 r	980	200	2,210	1,370	38,720	63,640	2,370	1,840	9,610	15,210	70	<b>136,770</b>
2006 r	1,060	230	2,290	1,590	41,040	66,010	2,370	1,900	10,050	13,330	70	<b>140,660</b>
2007 r	1,100	220	2,270	1,700	43,000	69,060	2,540	1,960	11,130	15,740	70	<b>149,300</b>
2008	1,100	210	2,440	1,390	43,300	68,910	2,260	2,100	11,130	15,630	30	<b>148,980</b>
<b>Technicians <sup>1</sup></b>												
2003	340	100	790	530	15,760	19,900	980	860	2,680	3,550	30	<b>46,060</b>
2004 r	370	100	980	610	17,310	22,250	1,130	960	3,140	4,130	50	<b>51,640</b>
2005 r	400	120	950	570	17,230	22,880	1,230	1,000	3,120	4,340	40	<b>52,760</b>
2006 r	560	150	910	720	18,550	25,480	1,220	1,090	3,070	4,630	40	<b>57,440</b>
2007 r	570	150	980	850	20,570	28,560	1,240	1,130	3,480	5,650	30	<b>64,140</b>
2008	400	150	1,110	710	21,290	25,540	1,250	1,030	3,590	4,650	10	<b>60,450</b>
<b>Other support staff <sup>1</sup></b>												
2003	260	80	600	390	8,680	11,810	630	580	1,760	2,040	10	<b>27,150</b>
2004 r	270	70	680	400	8,840	12,570	690	480	1,930	2,220	10	<b>28,560</b>
2005 r	290	80	650	380	8,890	12,810	720	610	1,920	2,380	10	<b>29,080</b>
2006 r	340	90	640	430	9,380	14,070	680	610	1,860	2,490	10	<b>31,060</b>
2007 r	320	80	620	450	9,840	13,800	630	580	1,920	2,720	30	<b>31,730</b>
2008	280	100	720	440	10,590	14,200	760	600	2,200	2,570	30	<b>33,250</b>

1. The data for the private non-profit sector (PNP) performing research and development (R&D) are not distributed by provinces, territories or the National Capital Region. The national totals of R&D, by performing sector include the PNP.

**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.

**Table 3-1  
 Personnel engaged in research and development — Selected OECD countries and by major sector**

	1999	2000	2001	2002	2003	2004	2005	2006	2007 <sup>r</sup>	2008
	thousands									
<b>Total research and development personnel</b>										
Japan <sup>1</sup>	919	897	892	857	882	896	921	935	938	909
Germany	480	485	481	480	473	471	475	488	506	522
United Kingdom	290	289	299	309	316	319	325	335	344	341
France	314	327	334	340	342	352	350	366	372	..
Italy	143	150	154	164	162	164	175	192	208	236
<b>Canada</b>	<b>153</b>	<b>168</b>	<b>179</b>	<b>183</b>	<b>196</b>	<b>211</b>	<b>219</b>	<b>224</b>	<b>229</b>	..
Netherlands	87	88	89	87	86	91	88	93	94	93
Sweden	67	..	72	..	73	72	78	79	77	78
<b>Governments</b>										
Japan <sup>1</sup>	59	59	63	64	62	62	63	63	63	62
Germany	71	71	72	73	74	76	76	78	81	81
United Kingdom	30	30	23	21	21	21	20	21	18	19
France	53	53	49	48	48	48	50	51	51	..
Italy	31	31	30	31	31	32	33	36	35	36
<b>Canada</b>	<b>17</b>	<b>17</b>	<b>16</b>	<b>17</b>	<b>16</b>	<b>16</b>	<b>18</b>	<b>18</b>	<b>19</b>	..
Netherlands	17	13	13	13	14	14	13	13	12	12
Sweden	3	..	3	..	3	3	4	4	3	3
<b>Business enterprise</b>										
Japan <sup>1</sup>	605	582	562	556	581	587	610	619	620	625
Germany	307	312	307	303	298	299	305	312	322	333
United Kingdom	153	145	154	158	156	150	145	149	157	152
France	172	178	185	191	193	201	195	208	213	..
Italy	60	64	65	70	68	68	71	80	94	101
<b>Canada</b>	<b>91</b>	<b>105</b>	<b>116</b>	<b>118</b>	<b>127</b>	<b>138</b>	<b>142</b>	<b>147</b>	<b>148</b>	..
Netherlands	45	48	48	47	44	50	49	53	49	48
Sweden	44	..	49	..	48	47	56	58	56	59
<b>Higher education</b>										
Japan <sup>1</sup>	228	228	250	221	224	232	234	239	241	208
Germany	101	101	101	105	101	96	95	97	104	108
United Kingdom	..	..	..	..	..	..	153	158	161	164
France	83	90	92	94	95	97	99	101	103	..
Italy	52	55	59	60	59	61	67	68	71	91
<b>Canada</b>	<b>45</b>	<b>45</b>	<b>46</b>	<b>47</b>	<b>52</b>	<b>55</b>	<b>57</b>	<b>57</b>	<b>60</b>	..
Netherlands	24	27	27	27	27	27	27	27	32	33
Sweden	19	..	20	..	21	22	18	17	18	16

1. Overestimated (not in full-time equivalent).

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

**Source(s):** OECD, Main Science and Technology Indicators, Volume 2009/2.

**Table 3-2**  
**Personnel engaged in research and development — All sectors, by occupational category**

	Researchers			Technicians			Support staff			Total, all sectors
	Natural sciences and engineering	Social sciences and humanities	Total	Natural sciences and engineering	Social sciences and humanities	Total	Natural sciences and engineering	Social sciences and humanities	Total	
	number									
1999	82,620	16,020	<b>98,640</b>	32,160	1,750	<b>33,910</b>	18,340	2,450	<b>20,790</b>	<b>153,340</b>
2000	91,660	16,310	<b>107,970</b>	36,150	1,830	<b>37,980</b>	19,660	2,510	<b>22,170</b>	<b>168,120</b>
2001	97,970	16,620	<b>114,590</b>	38,930	1,650	<b>40,580</b>	21,440	2,770	<b>24,210</b>	<b>179,380</b>
2002	99,070	16,960	<b>116,030</b>	40,990	1,690	<b>42,680</b>	21,840	2,870	<b>24,710</b>	<b>183,420</b>
2003	104,960	18,340	<b>123,300</b>	44,280	1,780	<b>46,060</b>	24,170	2,980	<b>27,150</b>	<b>196,510</b>
2004 <sup>r</sup>	110,920	19,460	<b>130,390</b>	49,770	1,860	<b>51,630</b>	25,460	3,100	<b>28,560</b>	<b>210,590</b>
2005 <sup>r</sup>	116,400	20,350	<b>136,770</b>	50,880	1,880	<b>52,760</b>	25,890	3,190	<b>29,080</b>	<b>218,610</b>
2006 <sup>r</sup>	118,300	20,710	<b>140,660</b>	55,470	1,970	<b>57,440</b>	27,720	3,340	<b>31,060</b>	<b>229,160</b>
2007 <sup>r</sup>	120,560	22,380	<b>149,300</b>	61,900	2,240	<b>64,140</b>	28,640	3,100	<b>31,730</b>	<b>245,170</b>
2008	125,640	23,340	<b>148,980</b>	58,260	2,190	<b>60,450</b>	29,980	3,230	<b>33,250</b>	<b>242,680</b>

**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.

**Table 3-3  
Personnel engaged in research and development — Major field of science and sector of performance**

	Business enterprise			Higher education			Federal government		
	Natural sciences and engineering	Social sciences and humanities	Total	Natural sciences and engineering	Social sciences and humanities	Total	Natural sciences and engineering	Social sciences and humanities	Total
	number								
1999	91,300	..	<b>91,300</b>	25,130	19,460	<b>44,590</b>	13,490	590	<b>14,080</b>
2000	104,710	..	<b>104,710</b>	25,330	19,820	<b>45,150</b>	14,120	580	<b>14,700</b>
2001	115,720	..	<b>115,720</b>	26,190	20,110	<b>46,300</b>	13,040	700	<b>13,740</b>
2002	118,460	..	<b>118,460</b>	26,820	20,520	<b>47,340</b>	13,220	740	<b>13,960</b>
2003	127,210	..	<b>127,210</b>	29,810	22,070	<b>51,880</b>	12,870	710	<b>13,580</b>
2004 r	138,210	..	<b>138,210</b>	31,330	23,400	<b>54,730</b>	13,000	720	<b>13,720</b>
2005 r	142,030	..	<b>142,030</b>	32,670	24,280	<b>56,950</b>	14,470	780	<b>15,250</b>
2006 r	151,730	..	<b>151,730</b>	32,600	24,670	<b>57,270</b>	14,160	980	<b>15,140</b>
2007 r	164,100	..	<b>164,100</b>	33,790	26,350	<b>60,140</b>	14,670	960	<b>15,630</b>
2008	158,930 D	..	<b>158,930 D</b>	35,260	27,070	<b>62,340</b>	15,000	1,270	<b>16,270</b>

  

	Provincial governments <sup>1</sup>			Private non-profit			Canada		
	Natural sciences and engineering	Social sciences and humanities	Total	Natural sciences and engineering	Social sciences and humanities	Total	Natural sciences and engineering	Social sciences and humanities	Total
	number								
1999	2,350	170	<b>2,520</b>	850	..	<b>850</b>	133,120	20,220	<b>153,340</b>
2000	2,460	250	<b>2,710</b>	850	..	<b>850</b>	147,470	20,650	<b>168,120</b>
2001	2,500	230	<b>2,730</b>	890	..	<b>890</b>	158,340	21,040	<b>179,380</b>
2002	2,560	260	<b>2,820</b>	840	..	<b>840</b>	161,900	21,520	<b>183,420</b>
2003	2,240	320	<b>2,560</b>	1,280	..	<b>1,280</b>	173,410	23,100	<b>196,510</b>
2004 r	2,250	300	<b>2,550</b>	1,380	..	<b>1,380</b>	186,130	24,420	<b>210,590</b>
2005 r	2,260	360	<b>2,620</b>	1,760	..	<b>1,760</b>	193,190	25,420	<b>218,610</b>
2006 r	2,450	370	<b>2,820</b>	2,210	..	<b>2,210</b>	198,090	26,020	<b>229,160</b>
2007 r	2,710	410	<b>3,120</b>	2,180	..	<b>2,180</b>	200,960	27,720	<b>245,170</b>
2008	2,700	450	<b>3,150</b>	2,000	..	<b>2,000</b>	213,890	28,790	<b>242,680</b>

1. Provincial government data includes provincial research organizations data. Provincial research organizations data are in natural sciences and engineering only.  
**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.

**Table 4-1**  
**Researchers engaged in research and development — Selected OECD countries**

	1999	2000	2001	2002	2003 <sup>r</sup>	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>r</sup>	2008
	thousands									
<b>Researchers</b>										
United States	1,261	1,290	1,320	1,342	1,431	1,385	1,375	1,414	1,413	..
Japan <sup>1</sup>	659	648	676	647	675	677	705	710	710	683
Germany	255	258	264	266	269	270	272	280	291	301
United Kingdom	168	171	182	198	217	229	249	254	253	252
France	160	172	177	186	193	202	203	211	216	..
Italy	65	66	67	71	70	72	82	88	93	96
<b>Canada</b>	<b>99</b>	<b>108</b>	<b>115</b>	<b>116</b>	<b>123</b>	<b>130</b>	<b>137</b>	<b>139</b>	<b>143</b>	<b>..</b>
Netherlands	40	42	46	38	37	47	47	52	51	51
Sweden	40	..	46	..	48	49	55	56	48	48
	millions									
<b>Total employment</b>										
United States	141	144	145	146	148	142	144	147	148	148
Japan <sup>1</sup>	68	68	68	67	67	64	64	64	64	64
Germany	40	40	40	40	40	39	39	39	40	40
United Kingdom	29	29	29	29	29	31	31	31	32	32
France	27	27	27	27	28	25	25	25	26	26
Italy	24	24	24	24	24	24	24	25	25	25
<b>Canada</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>17</b>	<b>17</b>	<b>16</b>	<b>16</b>	<b>17</b>	<b>17</b>	<b>17</b>
Netherlands	8	8	8	8	8	8	8	8	9	9
Sweden	4	4	4	4	4	4	4	4	5	5
	ratio									
<b>Total researchers in full time equivalent per thousand total employment</b>										
United States	9.0	9.0	9.1	9.2	10.2	9.8	9.6	9.6	9.5	..
Japan <sup>1</sup>	9.7	9.6	10.0	9.7	10.6	10.6	11.0	11.1	11.0	10.6
Germany	6.4	6.5	6.7	6.7	6.8	7.0	7.0	7.2	7.3	7.5
United Kingdom	5.9	5.9	6.3	6.8	7.1	7.5	8.0	8.1	8.0	8.0
France	6.0	6.4	6.5	6.8	7.7	8.1	8.1	8.3	8.4	..
Italy	2.8	2.8	2.8	3.0	2.9	3.0	3.4	3.6	3.7	3.8
<b>Canada</b>	<b>6.3</b>	<b>6.8</b>	<b>7.1</b>	<b>7.0</b>	<b>7.7</b>	<b>8.1</b>	<b>8.3</b>	<b>8.3</b>	<b>8.3</b>	<b>..</b>
Netherlands	5.1	5.2	5.5	4.5	4.5	5.8	5.7	6.2	5.9	5.8
Sweden	9.1	..	10.3	..	11	11.2	12.7	12.6	10.6	10.6

1. Overestimated (not in full-time equivalent).

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

**Source(s):** OECD, Main Science and Technology Indicators, Volume 2010/1, Tables 07, 08 and F.

**Table 4-2**  
**Researchers engaged in research and development — Higher education sector, by occupation**

	Full-time teachers		Part-time teachers		Doctoral students		Postdoctoral fellowships		Total researchers	
	Natural sciences and engineering	Social sciences and humanities	Natural sciences and engineering	Social sciences and humanities	Natural sciences and engineering	Social sciences and humanities	Natural sciences and engineering	Social sciences and humanities	Natural sciences and engineering	Social sciences and humanities
	number									
1999	5,051	3,692	758	480	11,156	11,363	434	89	17,399	15,624
2000	5,156	3,806	773	495	11,092	11,487	422	73	17,443	15,861
2001	5,349	3,942	749	473	11,625	11,614	391	65	18,114	16,094
2002	5,489	4,061	768	487	11,877	11,753	398	81	18,532	16,382
2003	5,731	4,247	802	510	14,148	12,899	478	86	21,159	17,741
2004	5,849	4,429	819	531	15,366	13,826	471	90	22,505	18,876
2005	5,932	4,491	831	539	16,422	14,583	532	83	23,717	19,696
2006	5,999	4,592	840	551	16,236	14,757	462	91	23,536	19,991
2007	6,220	4,791	1,120	575	17,919	16,147	444	94	25,703	21,607
2008	6,334	4,853	1,140	582	19,305	16,723	246	111	27,026	22,269

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

**Table 4-3**  
**Researchers engaged in research and development — Sector of performance**

	1999	2000	2001	2002	2003	2004 <sup>r</sup>	2005 <sup>r</sup>	2006 <sup>r</sup>	2007 <sup>r</sup>	2008
<b>Total</b>	<b>98,640</b>	<b>107,970</b>	<b>114,590</b>	<b>116,030</b>	<b>123,300</b>	<b>130,390</b>	<b>136,770</b>	<b>140,660</b>	<b>149,300</b>	<b>148,980</b>
Federal government	6,020	6,120	5,610	6,190	6,110	5,980	7,090	6,750	7,100	7,320
Provincial governments	870	970	1,140	1,170	1,070	1,040	1,150	1,260	1,470	1,420
Provincial research organizations <sup>1</sup>	400	410	190	190	190	190	180	180	150	150
Business enterprise	58,000	66,870	73,140	73,290	76,600	81,350	84,410	88,230	92,760	90,300 <sup>A</sup>
Higher education	33,020	33,300	34,200	34,910	38,900	41,380	43,420	43,530	47,310	49,300
Private non-profit organizations	330	300	310	280	430	460	520	720	520	490

1. In 2001, the Alberta Research Council Inc. became an agency of the provincial government, and is therefore included in that sector of performance.

**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.

**Table 5-1**  
**Technicians engaged in research and development — Natural sciences and engineering, by sector of performance**

	Federal government	Provincial <sup>1</sup> governments	Business enterprise	Higher education	Private non-profit	Total
	number					
1999	3,790	820	22,810	4,400	340	32,160
2000	3,750	870	26,740	4,490	300	36,150
2001	3,700	830	29,660	4,440	300	38,930
2002	3,700	880	31,590	4,560	260	40,990
2003	3,690	730	34,570	4,750	540	44,280
2004 <sup>r</sup>	3,640	800	39,870	4,850	610	49,770
2005 <sup>r</sup>	3,870	790	40,410	4,920	890	50,880
2006 <sup>r</sup>	4,060	900	44,510	4,980	1,020	55,470
2007 <sup>r</sup>	4,490	980	50,820	4,670	940	61,900
2008	4,610	1,000	47,170 <sup>A</sup>	4,750	730	58,260

1. Provincial government data includes provincial research organizations data. Provincial research organizations data are in natural sciences and engineering only.

**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.

**Table 5-2**  
**Technicians engaged in research and development — Social sciences and humanities, by sector of performance**

	Federal government	Provincial governments	Business enterprise <sup>1</sup>	Higher education	Private non-profit <sup>1</sup>	Total
	number					
1999	70	20	...	1,660	...	1,750
2000	70	50	...	1,710	...	1,830
2001	80	30	...	1,540	...	1,650
2002	70	40	...	1,580	...	1,690
2003	70	50	...	1,660	...	1,780
2004	90	40	...	1,730	...	1,860
2005	90	40	...	1,750	...	1,880
2006	130	50	...	1,790	...	1,970
2007	170	60	...	2,010	...	2,240
2008	90	60	...	2,040	...	2,190

1. Research and development surveys of the business enterprise and private non-profit sectors collect only natural science and engineering data.

**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.

**Table 6**  
**Support staff in research and development, by major field of science and sector of performance**

	Federal government	Provincial governments <sup>1</sup>	Business enterprise	Higher education	Private non-profit organization	Total
	number					
<b>All sciences</b>						
1999	4,200	410	10,490	5,510	180	20,790
2000	4,760	410	11,100	5,650	250	22,170
2001	4,350	540	12,920	6,120	280	24,210
2002	4,000	540	13,580	6,290	300	24,710
2003	3,710	520	16,040	6,570	310	27,150
2004 r	4,010	480	16,990	6,770	310	28,560
2005 r	4,200	460	17,210	6,860	350	29,080
2006 r	4,200	440	18,990	6,970	470	31,070
2007 r	3,870	470	20,530	6,150	720	31,740
2008	4,250	520	21,450 A	6,250	780	33,250
<b>Natural sciences and engineering</b>						
1999	3,950	390	10,490	3,330	180	18,340
2000	4,530	380	11,100	3,400	250	19,660
2001	4,090	510	12,920	3,640	280	21,440
2002	3,720	510	13,580	3,730	300	21,840
2003	3,440	480	16,040	3,900	310	24,170
2004 r	3,740	440	16,990	3,980	310	25,460
2005 r	3,890	410	17,210	4,030	350	25,890
2006 r	3,780	410	18,990	4,080	470	27,720
2007 r	3,540	430	20,530	3,420	720	28,640
2008	3,800	470	21,450 A	3,480	780	29,980

1. Provincial government data includes provincial research organizations data. Provincial research organizations data are in natural sciences and engineering only.

**Note(s):** Personnel counts are reported as full-time equivalents (rounded to the nearest 10). Due to rounding, components may not add to the totals.

**Table 7**  
**Natural sciences and engineering and social sciences and humanities, by occupational category and department or agency**

	2008			Total
	Researchers	Technicians	Support staff	
	number			
<b>Natural sciences and engineering</b>	<b>6,593</b>	<b>4,612</b>	<b>3,798</b>	<b>15,003</b>
Agriculture and Agri-Food Canada	681	887	413	1,982
Atomic Energy of Canada Limited	845	1,030	185	2,061
Canadian Space Agency	283	42	264	589
Environment Canada	586	242	133	961
Fisheries and Oceans Canada	35	34	15	84
Health Canada	239	173	25	437
Industry Canada	237	51	43	331
National Defence	717	433	467	1,617
National Research Council	1,635	1,064	1,290	3,989
Natural Resources Canada	875	381	155	1,411
Other Departments or Agencies	460	275	808	1,541
<b>Social sciences and humanities</b>	<b>726</b>	<b>93</b>	<b>450</b>	<b>1,269</b>
Bank of Canada	103	0	59	162
Canadian Museum of Civilization	42	5	6	53
International Development Research Centre	107	0	48	155
National Defence	58	2	2	61
National Gallery of Canada	16	18	19	53
Social Sciences and Humanities Research Council	11	0	128	139
Statistics Canada	206	62	158	426
Other departments or agencies	183	6	30	220

**Table 8**  
**Occupational coefficients, by category and field of science**

	Natural sciences and engineering				Social sciences and humanities			
	Full-time university teachers	Part-time university teachers	Technicians	Other support staff	Full-time university teachers	Part-time university teachers	Technicians	Other support staff
	number							
2004	1.00	0.14	0.83	0.68	1.00	0.12	0.39	0.63
2005	1.00	0.14	0.83	0.68	1.00	0.12	0.39	0.63
2006	1.00	0.14	0.83	0.68	1.00	0.12	0.39	0.63
2007	1.00	0.18	0.75	0.55	1.00	0.12	0.42	0.57
2008	1.00	0.18	0.75	0.55	1.00	0.12	0.42	0.57

**Note(s):** For example, in 2003, in the Natural sciences and engineering, for every 1.00 full-time teacher doing research and development, there was 0.14 part-time teacher, 0.83 technician and 0.68 other support staff.



# Estimates of research and development personnel in Canada

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Canada's economic growth and competitiveness, like that of every other industrialized country, is tied to the development of its scientific and technological base. Of all the factors needed for a country's scientific and industrial development, the supply of suitable human resources is unquestionably one of the most vital. Thus, the formulation of science and technology policy requires reliable information on these human resources, especially those engaged in research and development (R&D). "... unless people with certain training and qualifications are available, organized R&D is almost impossible. Education and training are lengthy processes; personnel data are, therefore, essential to realistic science policy planning".<sup>1</sup>

The number of R&D personnel is also considered a supplementary measure to intramural expenditures on R&D. The Frascati Manual states that "... personnel provide concrete measurements for international comparisons of resources devoted to R&D".<sup>2</sup>

It is important to determine the status of these resources on a regular basis. In this report, we present some statistical estimates and definitions concerning R&D personnel. Data on R&D personnel are derived from surveys conducted by the Science and Technology Surveys Section, Business Special Surveys and Technology Statistics Division (BSSTSD) and from estimates based on various data sources.

## Classification by occupation

R&D personnel are drawn from a wide variety of occupations "... from the Nobel prize-winner to the winner's secretary, from the designer of space experiments to the breeder of laboratory animals".<sup>3</sup> In order to assist analysis on needs and supplies of highly qualified S&T personnel, R&D personnel are classified into three categories. The International Standard Classification of Occupation (ISCO) distinguishes three occupational levels: researchers, technicians and equivalent staff, and other support staff.

- Researchers (scientists and engineers) are engaged in the conception or creation of new knowledge, products, processes, methods and systems. This level also includes managers and administrators engaged in the planning and management of the scientific and technical aspects of a researcher's work. They are usually equal in rank to the researchers and are often former or part-time researchers themselves. Post-graduate students, in particular those performing significant amounts of R&D, are included in this category.
- Technicians and equivalent staff are persons whose main tasks require technical knowledge and experience in one or more fields of engineering, physical and life sciences, or social sciences and humanities. They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods, normally under the supervision of researchers. Equivalent staff performs the corresponding R&D tasks under the supervision of researchers in the social sciences and humanities.
- Support staff includes skilled and unskilled craftsmen, secretarial and clerical staff participating in R&D projects or directly associated with such projects. Also included are all managers and administrators dealing mainly with financial and personnel matters and general administration given that their activities are directly supporting R&D. Those providing an indirect service, such as canteen and cleaning staff, should be excluded.

1. OECD, Frascati Manual 1980, Proposed standard practice for surveys on research and experimental development, (Paris), page 19, paragraph 23.

2. OECD, Frascati Manual 2002, Proposed standard practice for surveys on research and experimental development, (Paris), page 20, paragraph 30.

3. OECD, Frascati Manual 2002, Proposed standard practice for surveys on research and experimental development, (Paris), page 20, paragraph 32.

## Institutional classification

R&D data are classified into five sectors of performance. This method facilitates the collection of data and also provides information that can be cross referenced between sectors.

The sectors are:

- federal government
- provincial governments (includes provincial research organizations)
- business enterprise
- higher education
- private non-profit organizations

## Measurement and data collection

Scientific research and experimental development (R&D): comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society and the use of this stock of knowledge to devise new applications.

Whenever possible, the data are also classified by major field of science; natural sciences and engineering (NSE) or social sciences and humanities (SSH).

Natural Sciences and Engineering (NSE): The NSE consists of disciplines concerned with understanding, exploring, developing or utilizing the natural world. Included are engineering, mathematical, life and physical sciences.

Social Sciences and Humanities: (SSH): The SSH embraces all disciplines involving the study of human actions and conditions and the social, economic and institutional mechanisms affecting humans. Included are such disciplines as anthropology, business administration and commerce, information and knowledge management, criminology, demography, economics, geography, history, languages, literature and linguistics, law, library science, philosophy, political science, psychology, religious studies, social work, sociology, and urban and regional studies.

Since most workers do not all spend the same amount of time on R&D, it is necessary to express the number of persons performing R&D in terms of full-time equivalents (FTE). If only those persons employed in pure R&D are counted, the number of R&D personnel will be understated, just as counting every person who spends part of his/her time on R&D will result in an overstatement. On a full-time equivalence basis then, a person devoting a third of his/her time to R&D will be counted as 0.3 of a full-time equivalent.

In Canada with the exception of the higher education sector, each of the sectors mentioned above are surveyed on an annual basis in order to collect R&D data (both expenditures and personnel). Questionnaires used to collect R&D data can be viewed on the *Statistics Canada website* (<http://www.statcan.ca/english/concepts/index.htm>).

The higher education sector R&D activities are estimated by Statistics Canada. Modifications were made to the estimation procedures in 2005. Data were revised back to 1991. A description of the estimation procedure is found in the section on the higher education sector.

## Related information available from Statistics Canada

Information derived from surveys on scientific activities in Canada is available from the Science and Technology Surveys Section, Science Innovation and Electronic Information Division. Catalogue no. 88-001-X presents highlights of each survey once the survey has been completed. Three annual publications, catalogue no. 88-202-X, Industrial Research and Development, catalogue no. 88-204-X, Federal Scientific Activities and catalogue no. 88-221-X, Gross Domestic Expenditures on Research and Development in Canada and the Provinces are also

available. You may contact Catherine ten Den at 613-951-2188; [Catherine.tenDen@statcan.gc.ca](mailto:Catherine.tenDen@statcan.gc.ca) or Cindy Carter at 613-951-1856; [Cindy.Carter@statcan.gc.ca](mailto:Cindy.Carter@statcan.gc.ca) to obtain more information or visit our website at [www.statcan.gc.ca](http://www.statcan.gc.ca).

## **R&D personnel by sector**

### **Federal government**

This sector comprises all federal departments and organizations. All employees are included (indefinite, temporary and casual status). The data on persons engaged in R&D in the federal government are taken from the annual survey of the federal science expenditures and personnel. These data are classified into three occupational categories: researchers (scientists and engineers), technicians and support staff. The allocation of personnel to these classes is based on their public service classifications. Due to the nature of the work in the social sciences and humanities it is sometimes difficult to distinguish between technicians and other support staff; for convenience, these two categories have been combined and are shown as support staff up until 1990. From 1991 on, technicians involved in social science activities have been identified.

### **Provincial governments**

The provincial government sector consists of all provincial government departments, ministries and agencies and provincial research organizations.

### **Government departments and agencies**

Each year, Science and Technology Surveys Section, BSSTSD assists provincial governments to carry out surveys of resources devoted to their scientific and technological activities.

The statistics presented are aggregates of the provincial government science surveys conducted by Statistics Canada under contract with the provinces, and cover the period 1979-1980 to 2007-2008. The surveys currently cover six provinces: Newfoundland and Labrador, New Brunswick, Ontario, Manitoba, Alberta and British Columbia. Scientific expenditures for Newfoundland and Labrador are based on last year's survey and therefore their data for 2007/2008 are indicated as preliminary. Quebec conducts their own survey and shares the information with Statistics Canada.

### **Provincial research organizations**

Statistics on the R&D personnel of provincial research organizations are estimated on the basis of an annual survey of the resources of the provincial research foundations and councils.

R&D is only one of the activities of these provincial research organizations. In the survey conducted by BSSTSD, the organizations are asked to allocate their expenditures by a number of activities, including R&D. The total number of personnel for all organizations is multiplied by the ratio of R&D to total expenditures in order to produce an estimate of R&D personnel. Since the three occupational categories are already specified in the survey, their relative proportions are applied to the R&D full-time equivalence total.

It should be noted that provincial research organizations data pertain to activities in the natural sciences and engineering only

### **Business enterprise**

The term "business enterprise" encompasses all commercially oriented enterprises (privately or publicly owned), industrial non-profit organizations and industrial research institutes.

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. Estimates for the 1980 R&D personnel were computed by averaging data for 1979 and 1981. From 1982 to 1991, a full survey was conducted annually.

Because of reductions in the science and technology program, in the even-years starting with the 1992 reference year, only the top 100 R&D performers (accounting for 64% of all industrial R&D), were surveyed. However, as a result of a cost-sharing agreement with the province of Quebec, the 1992 and 1994 surveys also include firms having R&D activities in the province of Quebec. In 1995 the industrial R&D survey was re-established annually under the new S&T project "An information system for science and technology".

The 1998 data reflects a new methodology for estimating R&D expenditure in the business sector in Canada. The essence of the new approach was the use of administrative data from the Canada Revenue Agency (CRA), in place of survey data, for any firm funding or performing less than \$1 million worth of R&D. To relieve respondent burden, the survey threshold was raised from one million dollars to one and one half million dollars in the survey year 2006, 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.

Under the current regulations, firms have up to 18 months to submit a claim for R&D tax credits to CRA. This means that when survey data are ready for publication, not all of the CRA data for that year will have been received. At the time this bulletin is released, a portion of the R&D tax credit is still outstanding and their value is estimated. This bulletin provides preliminary estimates of R&D personnel in the business enterprise sector. 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 new forms request R&D personnel data by head count, which may impact the R&D full-time equivalent personnel counts in this sector for the next edition of this publication.

It should be noted that business enterprise data pertain to activities in the natural sciences and engineering only. For further information, see Industrial Research and Development, catalogue no. 88-202-X.

## Higher education

This sector includes universities, colleges of technology and other institutions of post-secondary education. Since existing surveys of this sector do not provide information on the R&D activities of staff, it is necessary to estimate R&D personnel.

As in other sectors of performance, we are interested in determining the full-time equivalence by three occupational categories (researchers, technicians and support staff) and by science type (NSE and SSH). The first step we take is to determine "researchers".

It is common knowledge that university professors are involved in other activities besides research (teaching and community service work). Doctoral students and postdoctoral research fellows also do research. The level of education held by these persons would qualify them as researchers. But, how much of their time is actually spent doing R&D?

When estimating R&D expenditures in the higher education sector, universities are classified into small, medium and large based on

- sponsored research expenditures;
- sponsored research as a percentage of general operating expenditures and
- the number of doctoral programs. This is based on the assumption that, depending on the size of the university, some universities spend more time on R&D than others. The same size classification is used to estimate R&D personnel.

Also, when estimating R&D expenditures, we use the full-time teachers field of study to determine science type. Science type of R&D personnel is based on the same field of study classification. Crossing the size classification of institutions with the science type and personnel category, we arrive at percentages used to determine how much time is spent on R&D (table 8).

Now, we apply this methodology to full-time teacher, doctoral student and Ph.D. fellows information. The Centre for Education Statistics provides us with full-time teacher and doctoral students data by institution and by field of study. Postdoctoral fellows information is received from the three granting councils, Natural Sciences and Engineering Research Council, Social Sciences and Humanities Research Council and the Canadian Institutes for Health Research. These data are organized by university size and by field of study. To arrive at the amount of time these persons spend doing R&D in FTE's, we multiply the full-time teachers, doctoral students and Ph.D. fellows by the percentages in Table 8 . As mentioned before, these persons are all considered to be researchers.

In addition to full-time university professors, doctorate students and Ph.D. fellows; there are part-time teachers, technicians and other support staff involved in R&D. Estimates for these classifications of R&D personnel are based on information provided by the Census.

The Census labour market statistics provide data on sector of employment, occupation (based on the National Occupational Classification for Statistics, 2001 (NOC-S), level of education and gender of the employed labour force. The division was able to purchase 1991, 1996 and 2001 Census data with funds made available through our memorandum of understanding (MOU) with Industry Canada. Census data prior to 1991 was not purchased and therefore no revisions to the higher education R&D personnel were made prior to 1991. Estimates previous to 1991 used coefficients based on the older Standard Occupational Classification, 1980 (SOC).

In order to use the Census data, the occupations had to be classified into our three categories – Researchers, Technicians and Other. In order to do this, we have attempted a concordance of NOCS 2001 to the Frascati Manual's (2002) categories of R&D personnel by occupation, which are based on the International Standard Classification of Occupations, 1988 (ISCO). Once this concordance was completed, detailed analysis was made on Canada's employed labour force who work in the university industry (SIC 8531) in order to arrive at the Occupational Coefficients listed in table 9 . What the coefficients imply are that for every full-time teacher, there is 0.14 part-time teachers, 0.83 technicians and 0.68 other support staff doing R&D.

We have determined that "researchers" constitute the R&D full-time equivalent of full-time teachers, doctoral students and Ph.D. fellows. In addition to these we add part-time teachers using the appropriate occupational coefficient provided by the Census data (table 9 ). The total of these occupations equal "Researchers".

Technicians and Other Support staff are determined by applying the coefficient derived from the census data. That coefficient considers both the occupation specified, the highest level of education achieved as well as the field in which the person works (natural sciences and engineering or social sciences and humanities).

As a result of the analysis completed on the Census data, we have been able to identify technicians in the social sciences and humanities back as far as 1991. Previous to that year the distinction between technicians and other support staff is unclear in the social sciences and humanities, these two categories have been combined and are shown as support staff.

The use of large-scale estimates naturally causes data reliability problems. Nevertheless, in the absence of more reliable data, these estimates provide us with a general idea of the situation in this sector, given certain assumptions. Caution should be used when comparing them with other sectors or with expenditure estimates.

## Private non-profit organizations

This sector is comprised of private and semipublic organizations and entities for which profit-making is not a primary goal. There are four main types of organizations included: private philanthropic foundations, scientific societies and associations, voluntary health organizations, and research institutes which do not belong to other sectors.

Since 1983, BSSTSD has been collecting personnel data through its survey of R&D performed by private non-profit organizations in Canada. In this survey, respondents are asked to estimate the number of employees engaged in R&D by occupational category.

Since no statistics on R&D personnel in these organizations for the years prior to 1983 are available, estimates were made on the 1983 relationships of personnel, R&D expenditures and occupational categories. Finally, since R&D in this sector is carried out basically in the health sciences, there are no estimates for personnel engaged in R&D in the social sciences and humanities.

The PNP sector appears in both the performing and funding sector for the GERD for Canada. Commencing with reference year 2000, the data for the PNP sector performing research and development are not distributed by provinces, territories or the national capital region. However, the national totals of research and development by performing sector include the PNP sector. The PNP sector continues to be distributed for the funding sector.