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Science Statistics

Research and
Development Personnel in
Canada, 1997 to 2006



June 2009 Edition



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Statistics Canada
Science, Innovation and Electronic Information Division

Science Statistics

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Symbols

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- . 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^s 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

Research and Development Personnel, 1997 to 2006

- In 2006, a total of 226,250 full-time personnel were engaged in research and development (R&D) activities in Canada, up 4.2% over the previous year. Between 1997 and 2006, this number increased by 55.3% (Table 1-1).
- Researchers accounted for 62% of total R&D personnel, while technicians comprised one-quarter and support staff 13% (Table 3-2).
- The business enterprise sector employed the majority of R&D personnel in Canada. In 2006, 66% of R&D personnel were employed by business enterprises, followed by 25% in the higher education sector and 8% in government (combined federal and provincial) (Table 1-1).
- The vast majority (90%) of the increase in R&D personnel from 2005 to 2006 occurred in the business enterprise sector. Technicians accounted for over half (56%) of the 9,060 additional R&D personnel in 2006 (Table 1-1 and 3-2).
- Ontario and Quebec have the largest number of R&D personnel in Canada. In 2006, three-quarters of total R&D personnel were located in Ontario (45%) and Quebec (31%). The majority of the remaining R&D personnel worked in British Columbia (9%) and Alberta (7%) (Table 2-1).

Analysis

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 1997 to 2006. R&D personnel are divided into three groups: researchers, technicians and support staff.

In 2006, the total number of people engaged in R&D in Canada was 226,250; a 4.2% increase from 2005. Between 1997 and 2006, R&D personnel counts expanded by 55.3% (Table 1-1).

The business enterprise sector is the largest Canadian employer of R&D personnel. Personnel in the business enterprise sector formed 66% of total R&D personnel in 2006. Ninety percent of the increase in R&D personnel from 2005 to 2006, or 8,200 full-time equivalents came from this sector. The second largest employer of R&D personnel is the higher education sector, which accounted for one-quarter of total R&D personnel in 2006. The federal government followed, representing 7% of total R&D personnel (Table 1-1, 1-2, 1-4 and 1-5).

Ontario and Quebec have the largest number of R&D personnel in Canada. In 2006, just under half of total R&D personnel were located in Ontario (45%) followed by Quebec (31%), British Columbia (9%) and Alberta (7%). (Table 2-1)

Compared to 1997, the mix of R&D personnel in 2006 shifted slightly in favour of more technicians at the expense of researchers, as support staff remained constant. However, researchers continue to be the majority of R&D personnel. In 2006, researchers accounted for 62%, while technicians comprised one-quarter and support staff 13% of the total R&D personnel population (Table 3-2).

The majority of Canadian R&D personnel work in the field of natural sciences and engineering. Since 1997, the share of R&D personnel in this field has been increasing, reaching nearly 90% in 2006. This is primarily due to the business enterprise sector which is restricted to natural sciences and engineering. Meanwhile, the share of R&D personnel in the social sciences and humanities decreased from 15% in 1997 to 12% in 2006. (Table 3-3).

In 2006, federal researchers comprised 45% of the total federal R&D personnel population with the remaining 55% split among technicians and support staff. The majority of federal R&D personnel work in the natural sciences and engineering field. However, in the past decade the share of federal R&D personnel in the social sciences and humanities has grown from 4% to 6% (Table 1-2).

In 2006, the business enterprise sector provided employment to 63% of researcher positions, 77% of technician jobs and 58% of all other support staff. During the same year the higher education sector employed 31% of researchers, 12% of technicians and 24% of other support staff (Table 1-4, 1-5 and 3-2).

The number of full-time equivalent researchers increased 3% between 2005 and 2006, adding 3,960 positions (Table 3-2).

Doctoral students formed 71% of total researchers in the higher education sector in 2006. Fifty-two percent of these doctoral students focused on natural science and engineering work, while the remaining 48% worked within the social sciences and humanities sector (Table 4-3).

In comparison with selected OECD countries, in 2005, the number of researchers per 1,000 employed in Canada's labour force was 8.2 while the United States and Sweden posted higher ratios of 9.6 and 12.7 respectively. On the other hand, Canada outranked the 7.3 OECD average (Table 4-1).

Related products

Selected publications from Statistics Canada

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

Selected CANSIM tables from Statistics Canada

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

Selected surveys from Statistics Canada

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

Selected summary tables from Statistics Canada

- *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

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

	1997	1998 ^r	1999 ^r	2000 ^r	2001 ^r	2002 ^r	2003 ^r	2004 ^r	2005 ^r	2006
	number									
Total	145,690	147,860	153,350	168,130	179,360	183,330	196,360	210,490	217,190	226,250
Federal government	13,950	13,730	14,080	14,700	13,740	13,960	13,580	13,720	15,250	15,140
Provincial governments ¹	2,970	2,850	2,520	2,710	2,730	2,820	2,560	2,550	2,620	2,820
Business enterprise ²	82,640	85,930	91,310	104,720	115,700	118,370	127,060	138,110	140,610	148,810
Higher education	44,920	44,320	44,590	45,150	46,300	47,340	51,880	54,730	56,950	57,270
Private non-profit organizations ³	1,210	1,030	850	850	890	840	1,280	1,380	1,760	2,210
Total	1.3	1.5	3.7	9.6	6.7	2.2	7.1	7.2	3.2	4.2
Federal government	-6.0	-1.6	2.5	4.4	-6.5	1.6	-2.7	1.0	11.2	-0.7
Provincial governments ¹	3.1	-4.0	-11.6	7.5	0.7	3.3	-9.2	-0.4	2.7	7.6
Business enterprise ²	4.1	4.0	6.3	14.7	10.5	2.3	7.3	8.7	1.8	5.8
Higher education	-1.1	-1.3	0.6	1.3	2.5	2.2	9.6	5.5	4.1	0.6
Private non-profit organizations ³	-1.6	-14.9	-17.5	0.0	4.7	-5.6	52.4	7.8	27.5	25.6

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, by occupational category**

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	number									
Total	13,950	13,730	14,080	14,700	13,740	13,960	13,580	13,720	15,250	15,140
Researchers	5,850	5,850	6,020	6,120	5,610	6,190	6,110	5,990	7,090	6,750
Technicians	3,900	3,820	3,860	3,820	3,780	3,770	3,760	3,730	3,960	4,190
Support staff	4,200	4,060	4,200	4,760	4,350	4,000	3,710	4,010	4,200	4,200
Natural sciences and engineering	13,420	13,220	13,490	14,120	13,040	13,220	12,870	13,000	14,470	14,160
Researchers	5,610	5,620	5,750	5,840	5,250	5,800	5,740	5,620	6,710	6,320
Technicians	3,830	3,760	3,790	3,750	3,700	3,690	3,640	3,640	3,870	4,060
Support staff	3,980	3,840	3,950	4,530	4,090	3,720	3,440	3,740	3,890	3,780
Social sciences and humanities	530	510	590	580	700	740	710	720	780	980
Researchers	240	230	270	280	360	390	370	360	380	430
Technicians	70	60	70	70	80	70	70	90	90	130
Support staff	220	220	250	230	260	280	270	270	310	420

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, by occupational category**

	1997	1998	1999 ^r	2000 ^r	2001 ^r	2002 ^r	2003 ^r	2004 ^r	2005	2006
	number									
Government departments ¹										
Total	2,970	2,850	2,520	2,710	2,730	2,820	2,560	2,550	2,620	2,820
Researchers	1,490	1,460	1,280	1,380	1,340	1,360	1,260	1,230	1,330	1,430
Technicians	960	910	830	910	850	920	780	840	830	950
Support staff	520	480	410	420	540	540	520	480	460	440
Natural sciences and engineering	1,740	1,690	1,400	1,510	2,020	2,080	1,780	1,770	1,790	1,980
Researchers	860	890	740	800	960	980	840	820	880	960
Technicians	590	520	450	500	670	700	560	590	580	660
Support staff	290	280	210	210	390	400	380	360	330	360
Social sciences and humanities	260	240	170	250	230	260	320	300	360	370
Researchers	200	180	130	170	180	190	230	220	270	290
Technicians	20	20	20	50	20	40	50	40	40	50
Support staff	40	40	20	30	30	30	40	40	50	30
Sub-total	2,000	1,930	1,570	1,760	2,250	2,340	2,100	2,070	2,150	2,350
Provincial research organizations ²	970	920	950	950	480	480	460	480	470	470
Researchers	430	390	410	410	200	190	190	190	180	180
Technicians	350	370	360	360	160	180	170	210	210	240
Support staff	190	160	180	180	120	110	100	80	80	50

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

	1997	1998	1999 ^r	2000 ^r	2001 ^r	2002 ^r	2003 ^r	2004 ^r	2005 ^r	2006
	number									
Total	82,640	85,930	91,310	104,720	115,700	118,370	127,060	138,110	140,610	148,810
Researchers	51,960	54,680	58,000	66,870	73,120	73,200	76,460	81,300	83,690	87,580
Technicians	21,570	22,010	22,810	26,740	29,660	31,590	34,570	39,820	39,800	44,280
Support staff	9,110	9,240	10,500	11,110	12,920	13,580	16,030	16,990	17,120	16,950

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**

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	number									
Total	44,920	44,320	44,590	45,150	46,300	47,340	51,880	54,730	56,950	57,270
Researchers	33,430	32,840	33,020	33,300	34,200	34,910	38,900	41,380	43,420	43,530
Technicians	6,010	6,010	6,060	6,200	5,980	6,140	6,410	6,580	6,670	6,770
Support staff	5,480	5,470	5,510	5,650	6,120	6,290	6,570	6,770	6,860	6,970
Natural sciences and engineering	24,190	23,940	25,130	25,330	26,190	26,820	29,810	31,330	32,670	32,600
Researchers	16,550	16,250	17,400	17,440	18,110	18,530	21,160	22,500	23,720	23,540
Technicians	4,340	4,370	4,400	4,490	4,440	4,560	4,750	4,850	4,920	4,980
Support staff	3,300	3,320	3,330	3,400	3,640	3,730	3,900	3,980	4,030	4,080
Social sciences and humanities	20,730	20,380	19,460	19,820	20,110	20,520	22,070	23,400	24,280	24,670
Researchers	16,880	16,590	15,620	15,860	16,090	16,380	17,740	18,880	19,700	19,990
Technicians	1,670	1,640	1,660	1,710	1,540	1,580	1,660	1,730	1,750	1,790
Support staff	2,180	2,150	2,180	2,250	2,480	2,560	2,670	2,790	2,830	2,890

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 (R & D) — Sector of performance, by occupational category

	2006										Canada ¹
	Newfoundland and Labrador	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	
	number										
Total²	1,960	470	3,770	2,620	69,100	101,970	4,440	3,480	15,200	20,850	226,250
Researchers	1,080	230	2,230	1,520	41,460	64,260	2,440	1,810	10,140	13,980	140,010
Technicians	560	150	910	700	18,840	24,810	1,310	1,080	3,230	4,570	57,220
Other	320	90	630	400	8,800	12,900	690	590	1,830	2,300	29,020
Federal government	210	100	590	250	2,280	2,660	560	530	830	800	8,830
Researchers	100	40	260	130	1,050	1,250	230	200	360	400	4,030
Technicians	70	40	190	80	530	770	220	200	290	260	2,660
Other	40	20	140	40	700	640	110	130	180	140	2,140
Federal government (National Capital Region)	...	...	...	...	490	5,820	...	...	...	...	6,310
Researchers	...	...	...	...	240	2,480	...	...	...	...	2,720
Technicians	...	...	...	...	110	1,420	...	...	...	...	1,530
Other	...	...	...	...	140	1,920	...	...	...	...	2,060
Provincial governments³	20	..	..	100	900	550	70	240	740	180	2,820
Researchers	10	..	..	50	490	250	40	70	390	120	1,430
Technicians	10	..	..	30	310	170	20	160	190	50	950
Other	0	..	..	20	100	130	10	10	160	10	440
Business enterprise	720	200	1,350	1,210	49,070	70,460	2,200	1,210	7,610	14,640	148,810
Researchers	310	100	820	650	26,510	42,750	1,080	580	4,780	9,880	87,580
Technicians	300	70	380	410	16,310	20,040	810	450	2,050	3,450	44,280
Other ⁴	110	30	150	150	6,250	7,670	310	180	780	1,310	16,950
Higher education	1,010	170	1,830	1,060	16,360	22,480	1,610	1,500	6,020	5,230	57,270
Researchers	660	90	1,150	690	13,170	17,530	1,090	960	4,610	3,580	43,530
Technicians	180	40	340	180	1,580	2,410	260	270	700	810	6,770
Other	170	40	340	190	1,610	2,540	260	270	710	840	6,970

1. Includes the Yukon, Northwest Territories and the Nunavut.
 2. The data for the private non-profit sector performing research and development are not distributed by provinces, territories or the National Capital Region. The national totals of research and development, by performing sector include the private non-profit sector.
 3. Provincial government data includes provincial research organizations data.
 4. No provincial distribution between technicians and other; estimated proportionally according to national total.
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 (R & D) — Occupational category

	Newfoundland and Labrador	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskat- chewan	Alberta	British Columbia	Yukon, Northwest Territories and Nunavut	Canada
	number											
Researchers¹												
2001 r	760	140	1,750	950	33,190	56,000	1,880	1,600	7,270	10,700	20	114,570
2002 r	770	130	1,840	970	34,630	55,920	2,020	1,580	7,640	10,140	20	115,940
2003 r	870	160	1,940	1,130	36,280	58,160	2,120	1,790	8,350	11,890	40	123,160
2004 r	920	170	2,110	1,180	37,790	60,440	2,210	1,870	9,490	13,660	50	130,350
2005 r	980	200	2,170	1,350	38,810	63,380	2,370	1,820	9,490	14,870	70	136,040
2006	1,080	230	2,230	1,520	41,460	64,260	2,440	1,810	10,140	13,980	140	140,010
Technicians¹												
2001 r	320	110	790	480	13,860	16,780	1,060	840	2,710	3,310	20	40,570
2002 r	310	80	800	510	14,670	18,060	970	810	2,610	3,590	20	42,690
2003 r	340	100	790	530	15,750	19,910	980	860	2,680	3,550	30	46,060
2004 r	370	90	990	610	17,270	22,250	1,130	960	3,120	4,130	50	51,580
2005 r	400	120	940	560	17,030	22,680	1,280	970	3,070	4,180	40	52,160
2006	560	150	910	700	18,840	24,810	1,310	1,080	3,230	4,570	30	57,220
Other support staff¹												
2001 r	260	80	650	360	7,540	10,090	670	600	1,810	1,860	10	24,220
2002 r	270	60	610	370	7,750	10,520	640	540	1,660	1,970	10	24,700
2003 r	260	80	600	390	8,680	11,810	620	590	1,750	2,040	10	27,140
2004 r	270	70	670	400	8,850	12,580	680	570	1,920	2,230	10	28,560
2005 r	280	80	640	370	8,860	12,820	750	600	1,910	2,330	10	28,990
2006	320	90	630	400	8,800	12,920	690	590	1,830	2,300	10	29,020

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

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 (R & D) — Selected OECD countries and by major sector**

	1997	1998	1999	2000 ^f	2001 ^f	2002 ^f	2003 ^f	2004 ^f	2005 ^f	2006
	thousands									
Total research and development personnel										
Japan ¹	894	926	919	897	892	857	882	896	921	935
Germany	460	462	480	485	481	480	473	471	475	487
United Kingdom	..	..	..	..	312	322	319	314	322	335
France	306	309	314	327	334	340	342	352	354	364
Italy	..	146	143	150	154	164	162	164	175	192
Canada	146	148	153	168	179	183	196	206	214	..
Netherlands	84	85	87	88	89	87	86	92	90	97
Sweden	65	..	67	..	72	..	73	72	78	79
Governments										
Japan ¹	57	59	59	59	63	64	62	62	63	63
Germany	73	73	71	71	72	73	74	76	76	78
United Kingdom	26	29	30	30	23	21	21	21	20	20
France	53	52	53	53	49	48	48	48	50	55
Italy	31	32	31	31	30	31	31	32	33	36
Canada	17	17	17	17	16	17	16	16	18	..
Netherlands	16	16	17	13	13	13	14	14	13	13
Sweden	3	..	3	..	3	..	3	3	4	4
Business enterprise										
Japan ¹	586	613	605	582	562	556	581	587	610	619
Germany	286	288	307	312	307	303	298	299	305	312
United Kingdom	137	148	153	145	154	158	156	150	145	149
France	166	168	172	178	185	191	193	201	195	202
Italy	61	61	60	64	65	70	68	68	71	80
Canada	83	86	91	105	116	118	126	134	138	..
Netherlands	42	44	45	48	48	47	44	50	49	55
Sweden	44	..	44	..	49	..	48	47	56	58
Higher education										
Japan ¹	222	225	228	228	250	221	224	232	234	239
Germany	101	100	101	101	101	105	101	96	95	97
United Kingdom	..	..	..	..	..	..	..	..	..	..
France	80	82	83	90	92	94	95	97	99	101
Italy	..	53	52	55	59	60	59	61	67	68
Canada	45	44	45	45	46	47	52	55	57	..
Netherlands	24	24	24	27	27	27	27	28	28	29
Sweden	18	..	19	..	20	..	21	22	18	17

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 2008/2.

**Table 3-2
Personnel engaged in research and development (R & D) — 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									
1997	75,860	17,320	93,180	31,190	1,760	32,950	17,120	2,440	19,560	145,690
1998 ^f	78,210	17,000	95,210	31,450	1,720	33,170	17,070	2,410	19,480	147,860
1999 ^f	82,620	16,020	98,640	32,160	1,750	33,910	18,350	2,450	20,800	153,350
2000 ^f	91,660	16,310	107,970	36,150	1,830	37,980	19,670	2,510	22,180	168,130
2001 ^f	97,950	16,620	114,570	38,930	1,650	40,580	21,440	2,770	24,210	179,360
2002 ^f	98,980	16,960	115,940	40,990	1,690	42,680	21,840	2,870	24,710	183,330
2003 ^f	104,820	18,340	123,160	44,280	1,780	46,060	24,160	2,980	27,140	196,360
2004 ^f	110,890	19,460	130,350	49,720	1,860	51,580	25,460	3,100	28,560	210,490
2005 ^f	115,700	20,350	136,050	50,270	1,880	52,150	25,800	3,190	28,990	217,190
2006	119,300	20,710	140,010	55,250	1,970	57,220	25,680	3,340	29,020	226,250

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 (R & D) — 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								
1997	82,640	..	82,640	24,190	20,730	44,920	13,420	530	13,950
1998	85,930	..	85,930	23,940	20,380	44,320	13,220	510	13,730
1999 r	91,310	..	91,310	25,130	19,460	44,590	13,490	590	14,080
2000 r	104,720	..	104,720	25,330	19,820	45,150	14,120	580	14,700
2001 r	115,700	..	115,700	26,190	20,110	46,300	13,040	700	13,740
2002 r	118,370	..	118,370	26,820	20,520	47,340	13,220	740	13,960
2003 r	127,060	..	127,060	29,810	22,070	51,880	12,870	710	13,580
2004 r	138,110	..	138,110	31,330	23,400	54,730	13,000	720	13,720
2005 r	140,610	..	140,610	32,670	24,280	56,950	14,470	780	15,250
2006	148,810	..	148,810	32,600	24,670	57,270	14,160	980	15,140

	Provincial governments ¹			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								
1997	2,710	260	2,970	1,210	..	1,210	124,170	21,520	145,690
1998 r	2,610	240	2,850	1,030	..	1,030	126,730	21,130	147,860
1999 r	2,350	170	2,520	850	..	850	133,130	20,220	153,350
2000 r	2,460	250	2,710	850	..	850	147,480	20,650	168,130
2001 r	2,500	230	2,730	890	..	890	158,320	21,040	179,360
2002 r	2,560	260	2,820	840	..	840	161,810	21,520	183,330
2003 r	2,240	320	2,560	1,280	..	1,280	173,260	23,100	196,360
2004 r	2,250	300	2,550	1,380	..	1,380	186,070	24,420	210,490
2005 r	2,260	360	2,620	1,760	..	1,760	191,770	25,420	217,190
2006	2,450	370	2,820	2,210	..	2,210	200,230	26,020	226,250

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 3-4
Personnel engaged in research and development (R & D) — 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									
1997	5,610	240	5,850	3,830	70	3,900	3,980	220	4,200	13,950
1998	5,620	230	5,850	3,760	60	3,820	3,840	220	4,060	13,730
1999	5,750	270	6,020	3,790	70	3,860	3,950	250	4,200	14,080
2000	5,840	280	6,120	3,750	70	3,820	4,530	230	4,760	14,700
2001	5,250	360	5,610	3,700	80	3,780	4,090	260	4,350	13,740
2002	5,800	390	6,190	3,700	70	3,770	3,720	280	4,000	13,960
2003	5,740	370	6,110	3,690	70	3,760	3,440	270	3,710	13,580
2004	5,620	360	5,980	3,640	90	3,730	3,740	270	4,010	13,720
2005	6,710	380	7,090	3,870	90	3,960	3,890	310	4,200	15,250
2006	6,320	430	6,750	4,060	130	4,190	3,780	420	4,200	15,140

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 3-5
Personnel engaged in research and development (R & D) — Provincial government sector¹, 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	
1997	1,290	200	1,490	940	20	960	480	40	520	2,970
1998	1,280	180	1,460	890	20	910	440	40	480	2,850
1999 r	1,140	130	1,270	820	20	840	390	20	410	2,520
2000 r	1,210	170	1,380	870	50	920	380	30	410	2,710
2001 r	1,160	170	1,330	830	30	860	510	30	540	2,730
2002 r	1,170	190	1,360	880	40	920	510	30	540	2,820
2003 r	1,030	230	1,260	730	50	780	480	40	520	2,560
2004 r	1,010	220	1,230	800	40	840	440	40	480	2,550
2005	1,060	270	1,330	790	40	830	410	50	460	2,620
2006	1,140	290	1,430	900	50	950	410	30	440	2,820

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 3-6
Personnel engaged in research and development (R & D) — Business enterprise sector, by occupational category**

	Researchers		Technicians		Support staff		Total
		Total		Total		Total	
1997 r		51,960		21,570		9,110	82,640
1998 r		54,680		22,010		9,240	85,930
1999 r		58,000		22,810		10,500	91,310
2000 r		66,870		26,740		11,110	104,720
2001 r		73,120		29,660		12,920	115,700
2002 r		73,200		31,590		13,580	118,370
2003 r		76,460		34,570		16,030	127,060
2004 r		81,300		39,820		16,990	138,110
2005 r		83,690		39,800		17,120	140,610
2006		87,580		44,280		16,950	148,810

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 3-7
Personnel engaged in research and development (R & D) — 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	
1997	16,550	16,880	33,430	4,340	1,670	6,010	3,300	2,180	5,480	44,920
1998	16,250	16,590	32,840	4,370	1,640	6,010	3,320	2,150	5,470	44,320
1999	17,400	15,620	33,020	4,400	1,660	6,060	3,330	2,180	5,510	44,590
2000	17,440	15,860	33,300	4,490	1,710	6,200	3,400	2,250	5,650	45,150
2001	18,110	16,090	34,200	4,440	1,540	5,980	3,640	2,480	6,120	46,300
2002	18,530	16,380	34,910	4,560	1,580	6,140	3,730	2,560	6,290	47,340
2003	21,160	17,740	38,900	4,750	1,660	6,410	3,900	2,670	6,570	51,880
2004 r	22,500	18,880	41,380	4,850	1,730	6,580	3,980	2,790	6,770	54,730
2005	23,720	19,700	43,420	4,920	1,750	6,670	4,030	2,830	6,860	56,950
2006	23,540	19,990	43,530	4,980	1,790	6,770	4,080	2,890	6,970	57,270

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 3-8
Personnel engaged in research and development (R & D) — Private non-profit sector¹, by occupational category

	Researchers	Technicians	Support staff	Total
	number			
1997	450	510	250	1,210
1998 ^r	380	420	230	1,030
1999 ^r	330	340	180	850
2000	300	300	250	850
2001 ^r	310	300	280	890
2002 ^r	280	260	300	840
2003 ^r	430	540	310	1,280
2004 ^r	460	610	310	1,380
2005 ^r	520	890	350	1,760
2006	720	1,030	460	2,210

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 4-1
Researchers engaged in research and development (R & D) — Selected OECD countries

	1997	1998	1999 ^r	2000 ^r	2001 ^r	2002 ^r	2003 ^r	2004 ^r	2005 ^r	2006
	thousands									
Researchers										
United States	1,160	..	1,261	1,289	1,320	1,342	1,431	1,394	1,388	..
Japan ¹	625	653	659	648	676	647	675	677	705	710
Germany	236	238	255	258	264	266	269	270	272	279
United Kingdom	146	158	..	..	167	174	178	174	179	184
France	155	156	160	172	177	186	193	202	204	211
Italy	66	65	65	66	67	71	70	72	82	88
Canada	93	95	99	108	115	116	123	128	134	..
Netherlands	38	39	40	42	46	38	37	42	41	47
Sweden	37	..	40	..	46	..	48	49	55	56
	millions									
Total labour force										
United States	132	134	136	139	139	139	140	142	144	147
Japan ¹	68	67	67	67	66	64	64	64	64	64
Germany	37	38	38	39	39	39	39	39	39	39
United Kingdom	28	29	29	29	30	30	30	31	31	31
France	23	23	24	24	25	25	25	25	25	25
Italy	22	22	22	23	23	24	24	24	24	25
Canada	14	14	15	15	15	16	16	16	16	17
Netherlands	8	8	8	8	8	8	8	8	8	8
Sweden	4	4	4	4	4	4	4	4	4	4
	ratio									
Total researchers per 1,000 total employment										
United States	8.8	..	9.3	9.3	9.5	9.7	10.2	9.8	9.6	..
Japan ¹	9.2	9.7	9.9	9.7	10.4	10.1	10.6	10.6	11.0	11.1
Germany	6.3	6.3	6.6	6.6	6.7	6.8	6.9	6.9	7.0	7.1
United Kingdom	5.1	5.5	..	..	5.6	5.8	5.9	5.7	5.8	5.9
France	6.8	6.7	6.8	7.1	7.2	7.5	7.7	8.1	8.1	8.3
Italy	3.0	2.9	2.9	2.9	2.9	3.0	2.9	3.0	3.4	3.6
Canada	6.6	6.6	6.7	7.1	7.5	7.4	7.7	7.9	8.2	..
Netherlands	5.0	5.0	5.1	5.2	5.5	4.6	4.5	5.1	4.9	5.6
Sweden	9.2	..	9.6	..	10.6	..	11.0	11.2	12.7	12.6

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 2008/2, Table 08.

Table 4-2
Researchers engaged in research and development (R & D) — Major field of science and sector of performance

	Federal government	Provincial ¹ governments	Business enterprise	Higher education	Private non-profit	Total
	number					
All sciences						
1997	5,850	1,490	51,960	33,430	450	93,180
1998	5,850	1,460	54,680	32,840	380	95,210
1999 r	6,020	1,270	58,000	33,020	330	98,640
2000 r	6,120	1,380	66,870	33,300	300	107,970
2001 r	5,610	1,330	73,120	34,200	310	114,570
2002 r	6,190	1,360	73,200	34,910	280	115,940
2003 r	6,110	1,260	76,460	38,900	430	123,160
2004 r	5,980	1,230	81,300	41,380	460	130,350
2005 r	7,090	1,330	83,690	43,420	520	136,050
2006	6,750	1,430	87,580	43,530	720	140,010
Natural sciences and engineering						
1997	5,610	1,290	51,960	16,550	450	75,860
1998	5,620	1,280	54,680	16,250	380	78,210
1999 r	5,750	1,140	58,000	17,400	330	82,620
2000 r	5,840	1,210	66,870	17,440	300	91,660
2001 r	5,250	1,160	73,120	18,110	310	97,950
2002 r	5,800	1,170	73,200	18,530	280	98,980
2003 r	5,740	1,030	76,460	21,160	430	104,820
2004 r	5,620	1,010	81,300	22,500	460	110,890
2005 r	6,710	1,060	83,690	23,720	520	115,700
2006	6,320	1,140	87,580	23,540	720	119,300

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 4-3
Researchers engaged in research and development (R & D) — 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									
1997	4,990	3,701	749	481	10,423	12,610	391	86	16,553	16,878
1998	5,024	3,640	754	473	10,043	12,409	428	73	16,249	16,595
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

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

Table 4-4
Researchers engaged in research and development (R & D) — Sector of performance

	1997	1998 ^r	1999 ^r	2000 ^r	2001 ^r	2002 ^r	2003 ^r	2004 ^r	2005 ^r	2006
	number									
Total	93,180	95,210	98,640	107,970	114,570	115,940	123,160	130,350	136,050	140,010
Federal government	5,850	5,850	6,020	6,120	5,610	6,190	6,110	5,980	7,090	6,750
Provincial governments	1,060	1,070	870	970	1,140	1,170	1,070	1,040	1,150	1,250
Provincial research organizations	430	390	400	410	190 ¹	190 ¹	190 ¹	190 ¹	180 ¹	180 ¹
Business enterprise	51,960	54,680	58,000	66,870	73,120	73,200	76,460	81,300	83,690	87,580
Higher education	33,430	32,840	33,020	33,300	34,200	34,910	38,900	41,380	43,420	43,530
Private non-profit organizations	450	380	330	300	310	280	430	460	520	720

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 (R & D) — Natural sciences and engineering, by sector of performance

	Federal government	Provincial governments ¹	Business enterprise	Higher education	Private non-profit	Total
	number					
1997	3,830	940	21,570	4,340	510	31,190
1998 ^r	3,760	890	22,010	4,370	420	31,450
1999 ^r	3,790	820	22,810	4,400	340	32,160
2000 ^r	3,750	870	26,740	4,490	300	36,150
2001 ^r	3,700	830	29,660	4,440	300	38,930
2002 ^r	3,700	880	31,590	4,560	260	40,990
2003 ^r	3,690	730	34,570	4,750	540	44,280
2004 ^r	3,640	800	39,820	4,850	610	49,720
2005 ^r	3,870	790	39,800	4,920	890	50,270
2006	4,060	900	44,280	4,980	1,030	55,250

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 (R & D) — Social sciences and humanities, by sector of performance

	Federal government	Provincial governments	Business enterprise ¹	Higher education	Private non-profit ¹	Total
	number					
1997	70	20	...	1,670	...	1,760
1998	60	20	...	1,640	...	1,720
1999	70	20	...	1,660	...	1,750
2000	70	50	...	1,710	...	1,830
2001 ^r	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

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 ¹ governments	Business enterprise	Higher education	Private non-profit organization	Total
	number					
All sciences						
1997	4,200	520	9,110	5,480	250	19,560
1998	4,060	480	9,240	5,470	230	19,480
1999 r	4,200	410	10,500	5,510	180	20,800
2000 r	4,760	410	11,110	5,650	250	22,180
2001 r	4,350	540	12,920	6,120	280	24,210
2002 r	4,000	540	13,580	6,290	300	24,710
2003 r	3,710	520	16,030	6,570	310	27,140
2004 r	4,010	480	16,990	6,770	310	28,560
2005 r	4,200	460	17,120	6,860	350	28,990
2006	4,200	440	16,950	6,970	460	29,020
Natural sciences and engineering						
1997	3,980	480	9,110	3,300	250	17,120
1998	3,840	440	9,240	3,320	230	17,070
1999 r	3,950	390	10,500	3,330	180	18,350
2000 r	4,530	380	11,110	3,400	250	19,670
2001 r	4,090	510	12,920	3,640	280	21,440
2002 r	3,720	510	13,580	3,730	300	21,840
2003 r	3,440	480	16,030	3,900	310	24,160
2004 r	3,740	440	16,990	3,980	310	25,460
2005 r	3,890	410	17,120	4,030	350	25,800
2006	3,780	410	16,950	4,080	460	25,680

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 7-1
Federal personnel engaged in research and development (R & D) — Major department or agency

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	number									
Total	13,950	13,730	14,080	14,700	13,740	13,960	13,580	13,720	15,250	15,140
Agriculture and Agri-Food Canada	2,430	2,430	2,410	2,800	2,660	1,810	1,740	1,650	2,080	2,040
Atomic Energy of Canada Limited	1,460	1,190	1,170	890	950	1,160	1,000	1,250	1,450	1,360
Canadian Space Agency	310	290	340	370	420	460	480	500	520	540
Environment Canada	770	740	830	840	840	890	910	910	970	1,000
Fisheries and Oceans Canada	800	770	850	900	890	890	520	510	500	490
Health Canada	540	520	510	520	670	700	620	400	420	340
Industry Canada	350	400	400	450	420	480	360	350	360	360
National Defence	1,170	1,300	1,290	1,350	1,300	1,480	1,480	1,560	1,540	1,540
National Research Council	2,730	2,760	2,810	2,930	2,510	2,720	2,970	3,000	3,650	3,680
Natural Resources Canada	2,370	2,280	2,310	2,430	1,690	1,850	1,920	1,660	1,690	1,440
Natural Sciences and Engineering Research Council	180	180	210	220	230	250	260	270	260	270
Other departments or agencies	850	850	950	1,000	1,160	1,270	1,320	1,660	1,810	2,080

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 7-2

Federal personnel engaged in research and development (R & D) — Natural sciences and engineering and social sciences and humanities, by occupational category and department or agency

	2006			
	Researchers	Technicians	Support staff	Total
	number			
Natural sciences and engineering	6,320	4,060	3,780	14,160
Agriculture and Agri-Food Canada	660	950	430	2,040
Atomic Energy of Canada Limited	600	350	410	1,360
Canadian Space Agency	270	10	260	540
Environment Canada	610	250	140	1,000
Fisheries and Oceans Canada	230	220	40	490
Health Canada	190	110	30	330
Industry Canada	260	50	50	360
National Defence	720	380	390	1,490
National Research Council	1,460	1,050	1,180	3,690
Natural Resources Canada	880	420	130	1,430
Other Departments or Agencies	440	270	720	1,430
Social sciences and humanities	430	130	420	980
Bank of Canada	30	30	20	80
Canadian Museum of Civilization	10	20	40	70
International Development Research Centre	90	0	40	130
National Defence	40	10	10	60
National Gallery of Canada	20	10	10	40
Social Sciences and Humanities Research Council	10	0	120	130
Statistics Canada	170	60	170	400
Other departments or agencies	60	0	10	70

Table 8

Proportion of time devoted to research and development, by field of science, by classification of institutions and by personnel

	Natural sciences and engineering	Social sciences and humanities
	percent	
Large universities		
Full-time teachers	0.35	0.25
Doctoral students	0.85	0.85
Postdoctoral research fellows	0.80	0.65
Medium universities		
Full-time teachers	0.30	0.20
Doctoral students	0.85	0.85
Postdoctoral research fellows	0.80	0.65
Small universities		
Full-time teachers	0.25	0.15
Doctoral students	0.85	0.85
Postdoctoral research fellows	0.80	0.65

Table 9
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							
1997	1	0.15	0.87	0.66	1	0.13	0.45	0.59
1998	1	0.15	0.87	0.66	1	0.13	0.45	0.59
1999	1	0.15	0.87	0.66	1	0.13	0.45	0.59
2000	1	0.15	0.87	0.66	1	0.13	0.45	0.59
2001	1	0.14	0.83	0.68	1	0.12	0.39	0.63
2002	1	0.14	0.83	0.68	1	0.12	0.39	0.63
2003	1	0.14	0.83	0.68	1	0.12	0.39	0.63
2004	1	0.14	0.83	0.68	1	0.12	0.39	0.63
2005	1	0.14	0.83	0.68	1	0.12	0.39	0.63
2006	1	0.14	0.83	0.68	1	0.12	0.39	0.63

Note(s): For example, in 2003, in the Natural sciences and engineering, for every 1.0 full-time teacher doing research and development, there was 0.14 part-time teacher, 0.83 technician and 0.68 other support staff.

Data quality, concepts and methodology

Estimates of research and development personnel in Canada

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".¹

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".²

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, Science, Innovation and Electronic Information Division (SIEID) 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".³ 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 Michael Lynch at 613-951-2201; Michael.Lynch@statcan.gc.ca or Cindy Carter at 613-951-1856; Cindy.Carter@statcan.gc.ca to obtain more information or visit our website at 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, SIEID 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 2006-2007. The surveys currently cover four provinces: Ontario, Manitoba, Alberta and British Columbia. Estimates are made for Saskatchewan and for the Eastern provinces. 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 SIEID, 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. 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.

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

1. sponsored research expenditures;
2. sponsored research as a percentage of general operating expenditures and
3. 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, SIEID 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.