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Research and development (R&D) personnel in Canada, 1993 to 2002

Canada's economic competitiveness depends on scientific and technological development and also on the people responsible for this development, especially those engaged in R&D. In an earlier Science statistics bulletin, we published the gross domestic expenditures on R&D in Canada (GERD). This issue presents a supplementary measure to the GERD, the number of personnel who perform Canada's R&D activities.

This year, the higher education sector personnel were estimated using a revised methodology. Historical revisions to this sector have been made back to 1991. The revisions were based on employment data from the 1991, 1996 and 2001 Census. Further details of the revisions are found in an associated working paper.

In this Service bulletin, estimates of R&D personnel in the business enterprise sector for 2001 and 2002 were revised. Data on R&D performed by the business sector are estimated using two sources of information: a survey questionnaire on Research and Development in Canadian Industry is sent to all major performers of R&D (\$1 million R&D expenditures and over) and, tax information provided by the Canada Revenue Agency from the R&D tax credit claimed under the Scientific Research and Experimental Development (SR&ED) tax credit program. Businesses claiming an R&D tax credit under the SR&ED program are allowed to file their claim up to eighteen months after the end of their fiscal year. At the time this Service bulletin is released, a portion of the R&D tax credit are still outstanding and their value is estimated. This Service bulletin provides preliminary estimates of R&D personnel in the business enterprise sector. Estimates will be revised in the next edition of the Service bulletin on the Industrial R&D in Canada.

Highlights

- ▶ Total R&D personnel in 2002 are estimated at slightly more than 177 thousand full-time equivalent. This is very close to the 2001 revised estimate of 179 thousand full-time equivalents.
- ▶ In 2002 about 3 thousand full-time equivalent R&D personnel in the business enterprise sector were lost. This partly explained the decline of business enterprise R&D expenditures between 2001 and 2002. The communication industry was the most important contributor.
- ▶ An increase in R&D personnel was observed in every other sector including higher education (2.2% increase), federal government (1.6% increase) and provincial governments with a 3.5% increase.
- ▶ Three persons out of five or 63% of full-time equivalent R&D personnel are employed by the business sector, followed by the higher education sector with 27% and the federal government with 8%.
- ▶ In the business enterprise sector, researchers (62%) are the dominant occupational category, followed by technicians (26%), then support staff (12%).

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- ▶ Those conducting research activities in the higher education sector include full and part-time teachers, doctoral students, holders of postdoctoral fellowships, technicians and other support staff. Data in natural sciences as well as social sciences are estimated for this sector. Researchers (74%) dominate R&D in the higher education sector. Support staff and technicians each account for 13 percent of personnel conducting R&D.
- ▶ The federal government reported 13,960 R&D FTEs in 2002 and the provincial governments (including the provincial research organizations) reported 3,290 FTEs doing R&D. The governments sector includes natural and social science activities. Once again the researchers' category is the one with the most personnel. Of the total 17,250 FTEs in the government sector in 2002, 45% are researchers, 28% are technicians and 27% are support staff.
- ▶ Ontario (46%) and Quebec (31%) are the provinces with the highest concentration of R&D personnel. This is due mainly to the greatest concentration of all sectors of employment as well as population in those provinces. British Columbia (9%) has the third largest concentration of R&D personnel and Alberta follows with 7%. Table 7 shows the provincial distribution of personnel engaged in R&D in Canada.
- ▶ Researchers make up 112,630 R&D personnel or 64% of the total. This category has shown an average annual growth rate of 4.6% over the last ten years. The natural sciences and engineering field (NSE) is where 85% of the researchers are found. The remaining 15% are in social sciences and humanities (SSH).
- ▶ Technicians account for 23 percent of the total R&D personnel. These include technicians in the social sciences which are now estimated for the higher education sector.

Data on R&D personnel (except for the higher education sector) are derived from surveys conducted by the Science and Innovation Surveys Section, Science, Innovation and Electronic Information Division. Estimates based on various data sources are made for the higher education sector. Data are expressed in full-time equivalents (FTE). The data are grouped into three occupational categories:

- researchers (scientists and engineers);
- technicians;
- support staff;

and classified into five sectors of the employing institutions:

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

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

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TABLE 1. Personnel engaged in R&D, by sector of performance, 1993 to 2002

Sector of performance	1993 ^f	1994 ^f	1995 ^f	1996 ^f	1997 ^f	1998 ^f	1999 ^f	2000 ^f	2001 ^f	2002
FTE (rounded to the nearest 10)										
Federal government	17,240	16,730	15,550	14,840	13,950	13,730	14,080	14,700	13,740	13,960
% change	-0.2	-3.0	-7.1	-4.6	-6.0	-1.6	2.5	4.4	-6.5	1.6
Provincial governments	3,710	3,450	3,230	2,880	2,970	2,850	2,780	3,130	3,180	3,290
% change	-8.2	-7.0	-6.4	-10.8	3.1	-4.0	-2.5	12.6	1.6	3.5
Business enterprise ¹	61,530	78,880	82,010	79,340	82,690	85,990	90,890	104,030	115,050 ^P	111,800 ^P
% change	7.1	28.2	4.0	-3.3	4.2	4.0	5.7	14.5	10.6	-2.8
Higher education	43,670	43,460	43,020	45,430	44,920	44,320	44,590	45,150	46,300	47,340
% change	1.8	-0.5	-1.0	5.6	-1.1	-1.3	0.6	1.3	2.5	2.2
Private non-profit organizations	1,090	1,110	1,160	1,230	1,210	1,040	860	850	710	730
% change	11.2	1.8	4.5	6.0	-1.6	-14.0	-17.3	-1.2	-16.5	2.8
Total	127,240	143,630	144,970	143,720	145,740	147,930	153,200	167,860	178,980	177,120
% change	3.8	12.9	0.9	-0.9	1.4	1.5	3.6	9.6	6.6	-1.0

1. Natural sciences and engineering only.

TABLE 2. Personnel engaged in R&D, all sectors, by occupational category, 1993 to 2002

Year	Researchers			Technicians			Support staff			Total
	NSE	SSH	Total	NSE	SSH	Total	NSE	SSH	Total	
FTE (rounded to the nearest 10)										
1993 ^f	61,450	14,040	75,490	28,980	1,980	30,960	18,030	2,760	20,790	127,240
1994 ^f	71,580	14,320	85,900	34,060	1,930	35,990	19,040	2,700	21,740	143,630
1995 ^f	72,920	14,460	87,380	34,150	1,850	36,000	19,000	2,590	21,590	144,970
1996 ^f	73,220	17,270	90,490	31,440	1,760	33,200	17,550	2,480	20,030	143,720
1997 ^f	75,890	17,320	93,210	31,200	1,760	32,960	17,120	2,450	19,570	145,740
1998 ^f	78,250	17,000	95,250	31,470	1,720	33,190	17,080	2,410	19,490	147,930
1999 ^f	82,790	16,020	98,810	32,270	1,750	34,020	17,920	2,450	20,370	153,200
2000 ^f	92,180	16,310	108,490	36,240	1,830	38,070	18,790	2,510	21,300	167,860
2001 ^f	98,340	16,620	114,960	38,730	1,640	40,370	20,880	2,770	23,650	178,980
2002	95,670	16,960	112,630	38,690	1,690	40,380	21,240	2,870	24,110	177,120

TABLE 3. Personnel engaged in R&D in the federal government, by occupational category, 1993 to 2002

Occupational category	1993 ^f	1994 ^f	1995 ^f	1996 ^f	1997 ^f	1998 ^f	1999 ^f	2000 ^f	2001 ^f	2002
FTE (rounded to the nearest 10)										
Natural sciences and engineering	16,600	16,110	14,970	14,260	13,420	13,220	13,490	14,120	13,040	13,220
Researchers	6,380	6,310	5,990	6,030	5,610	5,620	5,750	5,840	5,250	5,800
Technicians	4,450	4,620	4,230	4,040	3,830	3,760	3,790	3,750	3,700	3,700
Support staff	5,770	5,180	4,750	4,190	3,980	3,840	3,950	4,530	4,090	3,720
Social sciences and humanities	640	620	580	580	530	510	590	580	700	740
Researchers	260	260	240	280	240	230	270	280	360	390
Technicians	80	70	70	60	70	60	70	70	80	70
Support staff	300	290	270	240	220	220	250	230	260	280
Total	17,240	16,730	15,550	14,840	13,950	13,730	14,080	14,700	13,740	13,960

TABLE 4. Personnel engaged in R&D in the provincial government sector, by occupational category, 1993 to 2002

Occupational category	1993 ^f	1994 ^f	1995 ^f	1996 ^f	1997 ^f	1998 ^f	1999 ^f	2000 ^f	2001 ^f	2002
FTE (rounded to the nearest 10)										
<u>Government departments</u>¹										
Natural sciences and engineering	2,500	2,440	2,170	1,750	1,740	1,690	1,660	1,930	2,480	2,550
Researchers	1,090	1,150	1,000	900	860	890	880	1,030	1,210	1,250
Technicians	980	850	790	580	590	520	550	660	840	860
Support staff	430	440	380	270	290	280	230	240	430	440
Social sciences and humanities	380	360	310	290	260	240	170	250	220	260
Researchers	280	260	230	210	200	180	130	170	170	190
Technicians	40	40	30	30	20	20	20	50	20	40
Support staff	60	60	50	50	40	40	20	30	30	30
Sub Total	2,880	2,800	2,480	2,040	2,000	1,930	1,830	2,180	2,700	2,810
<u>Provincial research organizations</u>²										
Researchers	390	300	310	310	430	390	410	410	200	190
Technicians	270	220	250	280	350	370	360	360	160	180
Support staff	170	130	190	250	190	160	180	180	120	110
Sub Total	830	650	750	840	970	920	950	950	480	480
Total	3,710	3,450	3,230	2,880	2,970	2,850	2,780	3,130	3,180	3,290

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 only.

TABLE 5. Personnel engaged in R&D in the business enterprise sector, by occupational category, 1993 to 2002

Occupational category	1993 ^f	1994 ^f	1995 ^f	1996 ^f	1997 ^f	1998 ^f	1999 ^f	2000 ^f	2001	2002
FTE (rounded to the nearest 10)										
Researchers	36,310	46,860	48,980	48,500	51,990	54,720	58,020	67,160	73,310	69,640
Technicians	17,610	22,740	23,280	21,580	21,580	22,020	22,830	26,680	29,400	29,190
Support staff	7,610	9,280	9,750	9,260	9,120	9,250	10,040	10,190	12,340	12,970
Total	61,530	78,880	82,010	79,340	82,690	85,990	90,890	104,030	115,050^P	111,800^P

TABLE 6. Personnel engaged in R&D in the higher education sector, by occupational category, 1993 to 2002

Occupational category	1993 ^f	1994 ^f	1995 ^f	1996 ^f	1997 ^f	1998 ^f	1999 ^f	2000 ^f	2001	2002
FTE (rounded to the nearest 10)										
Natural sciences and engineering	25,910	25,490	25,020	24,790	24,190	23,940	25,130	25,330	26,190	26,820
Researchers	16,730	16,420	16,160	17,010	16,550	16,250	17,400	17,440	18,110	18,530
Technicians	5,270	5,210	5,090	4,420	4,340	4,370	4,400	4,490	4,440	4,560
Support staff	3,910	3,860	3,770	3,360	3,300	3,320	3,330	3,400	3,640	3,730
Social sciences and humanities	17,760	17,970	18,000	20,640	20,730	20,380	19,460	19,820	20,110	20,520
Researchers	13,500	13,800	13,990	16,780	16,880	16,590	15,620	15,860	16,090	16,380
Technicians	1,860	1,820	1,750	1,670	1,670	1,640	1,660	1,710	1,540	1,580
Support staff	2,400	2,350	2,260	2,190	2,180	2,150	2,180	2,250	2,480	2,560
Total	43,670	43,460	43,020	45,430	44,920	44,320	44,590	45,150	46,300	47,340

TABLE 7. Provincial distribution of personnel engaged in R&D, by sector, by occupational category, 2002

Sector of performance	N.L.	P.E.I.	N.S.	N.B.	Que..	Ont.	Man.	Sask.	Alta.	B.C.	Total ²
FTE (rounded to the nearest 10)											
Federal government	210	60	570	220	2,060	2,360	560	420	640	670	7,790
Researchers	80	20	220	60	920	1,130	230	160	250	330	3,410
Technicians	70	20	180	80	470	760	190	140	220	210	2,350
Other	60	20	170	80	670	470	140	120	170	130	2,030
Federal government (National Capital Region)	...	...	...	...	370	5,800	...	...	...	...	6,170
Researchers	...	...	...	...	230	2,550	...	...	...	...	2,780
Technicians	...	...	...	...	40	1,380	...	...	...	...	1,420
Other	...	...	...	...	100	1,870	...	...	...	...	1,970
Provincial governments	..	..	..	100	920	1,040	40	210	740	210	3,290
Researchers	..	..	..	50	450	620	30	100	240	130	1,630
Technicians	..	..	..	30	300	310	0	90	280	60	1,080
Other	..	..	..	20	170	110	10	20	220	20	580
Business enterprise	250	90	990	600	38,990	54,170	1,340	920	5,140	9,310	111,800
Researchers	160	60	600	310	22,000	36,400	710	450	3,290	5,660	69,640
Technicians	60	20	270	200	11,760	12,300	440	330	1,280	2,530	29,190
Other ¹	30	10	120	90	5,230	5,470	190	140	570	1,120	12,970
Higher education	840	120	1,560	860	13,180	17,840	1,510	1,400	4,900	5,130	47,340
Researchers	510	60	940	530	10,140	13,450	950	880	3,620	3,830	34,910
Technicians	160	30	310	160	1,510	2,150	280	260	640	640	6,140
Other	170	30	310	170	1,530	2,240	280	260	640	660	6,290
Private non-profit organizations	...	...	50	20	40	110	120	...	350	40	730
Researchers	...	...	40	10	30	20	30	...	100	30	260
Technicians	...	...	0	0	0	50	60	...	80	10	200
Other	...	...	10	10	10	40	30	...	170	0	270
Total	1,300	270	3,170	1,800	55,560	81,320	3,570	2,950	11,770	15,360	177,120
Researchers	750	140	1,800	960	33,770	54,170	1,950	1,590	7,500	9,980	112,630
Technicians	290	70	760	470	14,080	16,950	970	820	2,500	3,450	40,380
Other	260	60	610	370	7,710	10,200	650	540	1,770	1,930	24,110

1. No provincial distribution between technicians and other; estimated proportionally according to national total.

2. Includes the Yukon, Northwest Territories and Nunavut.

TABLE 8. Researchers engaged in R&D, by sector of performance, 1993 to 2002

Sector of performance	1993 ^f	1994 ^f	1995 ^f	1996 ^f	1997 ^f	1998 ^f	1999 ^f	2000 ^f	2001 ^f	2002
FTE (rounded to the nearest 10)										
Federal government	6,640	6,570	6,230	6,310	5,850	5,850	6,020	6,120	5,610	6,190
Provincial governments	1,370	1,410	1,230	1,110	1,060	1,070	1,010	1,200	1,380	1,440
Provincial research organizations	390	300	310	310	430	390	410	410	200 ¹	190 ¹
Business enterprise	36,310	46,860	48,980	48,500	51,990	54,720	58,020	67,160	73,310	69,640
Higher education	30,230	30,220	30,150	33,790	33,430	32,840	33,020	33,300	34,200	34,910
Private non-profit organizations	550	540	480	470	450	380	330	300	260	260
Total	75,490	85,900	87,380	90,490	93,210	95,250	98,810	108,490	114,960	112,630

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

TABLE 9. Personnel engaged in R&D, in selected OECD countries, by major sector, 1993 to 2002

Sector of performance	1993 ^f	1994 ^f	1995 ^f	1996 ^f	1997 ^f	1998 ^f	1999 ^f	2000 ^f	2001 ^f	2002
	('000 FTE)									
Total R&D personnel:										
Japan ¹	947	946	948	892	894	926	919	897	892	857
Germany	..	..	459	454	460	462	480	485	481	480
United Kingdom	270	..	..	..	..	..	..	..	..	..
France	314	315	318	321	306	309	314	327	334	344
Italy	142	144	142	142	..	146	143	150	154	..
Canada*	127	144	145	144	146	148	153	168	179	177
Netherlands	74	79	79	81	84	85	87	89	90	..
Sweden	57	..	63	..	65	..	67	..	72	..
Governments:										
Japan ¹	56	56	56	56	57	59	59	59	63	64
Germany	71	73	75	75	73	73	71	71	72	73
United Kingdom	34	32	29	27	26	29	30	30	23	21
France	68	68	69	69	53	52	53	53	49	52
Italy	33	33	33	32	31	32	31	31	30	..
Canada*	21	20	19	18	17	17	17	18	17	17
Netherlands	15	16	16	16	16	16	17	13	14	13
Sweden	3	..	4	..	3	..	3	..	3	..
Business Enterprise:										
Japan ¹	583	578	574	589	586	613	605	582	562	556
Germany	294	..	283	277	286	288	307	312	307	303
United Kingdom	164	157	146	142	137	148	153	145	152	167
France	164	162	162	163	166	168	172	178	185	191
Italy	62	63	60	61	61	61	60	64	65	..
Canada*	62	79	82	79	83	86	91	104	115	112
Netherlands	31	36	37	39	42	44	45	48	48	47
Sweden	35	..	42	..	44	..	44	..	49	..
Higher Education:										
Japan ¹	279	284	291	218	222	225	228	228	250	221
Germany	..	..	101	102	101	100	101	101	101	105
United Kingdom	66	..	..	..	..	..	..	..	..	..
France	75	78	81	82	80	82	83	90	92	94
Italy	47	48	48	49	..	53	52	55	59	..
Canada*	44	43	43	45	45	44	45	45	46	47
Netherlands	27	26	25	24	24	24	24	27	27	..
Sweden	17	..	17	..	18	..	19	..	20	..

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

* Table 2.

Source: OECD, Main Science and Technology Indicators, 2004/2.

TABLE 10. Researchers engaged in R&D in selected OECD countries, 1993 to 2002

Country	1993 ^r	1994 ^r	1995 ^r	1996 ^r	1997 ^r	1998 ^r	1999 ^r	2000 ^r	2001 ^r	2002
('000 FTE)										
Researchers:										
United States	965	..	988	..	1,160	..	1,261	..	..	..
Japan ¹	641	659	673	617	625	653	659	648	676	647
Germany	..	..	231	230	236	238	255	258	264	266
United Kingdom	135	142	147	145	146	158	..	..	..	..
France	146	149	151	155	155	156	160	172	177	186
Italy	74	76	76	76	66	65	65	66	67	..
Canada*	75	86	87	90	93	95	99	108	115	113
Netherlands	32	34	34	34	38	39	40	42	45	..
Sweden	29	..	34	..	37	..	40	..	46	..
Total labour force:										
('000,000)										
United States	131	133	134	138	141	144	146	149	149	148
Japan ¹	66	66	67	67	68	67	67	67	66	65
Germany	40	40	39	37	37	38	38	39	39	39
United Kingdom	28	28	29	28	28	29	29	29	30	30
France	25	25	25	23	23	23	24	24	25	25
Italy	23	23	23	22	22	22	23	23	24	24
Canada	14	15	15	15	15	15	16	16	16	17
Netherlands	7	7	7	7	8	8	8	8	8	8
Sweden	4	4	4	4	4	4	4	4	4	4
Researchers per 1,000 persons in the labour force:										
ratio										
United States	7.4	..	7.4	..	8.2	..	8.6	..	..	..
Japan ¹	9.7	9.9	10.1	9.2	9.2	9.7	9.9	9.7	10.2	9.9
Germany	..	..	5.9	6.2	6.3	6.3	6.7	6.7	6.8	6.9
United Kingdom	4.7	5.0	5.1	5.2	5.2	5.5	..	..	..	..
France	5.8	5.9	6.0	6.8	6.8	6.7	6.8	7.1	7.2	7.5
Italy	3.2	3.3	3.3	3.5	3.0	2.9	2.9	2.9	2.8	..
Canada	5.2	5.9	6.0	6.1	6.2	6.2	6.3	6.8	7.1	6.8
Netherlands	4.5	4.8	4.6	4.7	5.0	5.0	5.1	5.2	5.5	..
Sweden	6.7	..	7.7	..	9.2	..	9.6	..	10.6	..

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

* Table 3.

Source: OECD, Main Science and Technology Indicators, 2004/2.

Note of appreciation

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- .. 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

This publication was prepared by **Janet Thompson**, Science and Innovation Surveys Section, Science, Innovation and Electronic Information Division.

For more detail on R&D personnel, see the Working Paper No. ST-05-08E, "Estimates of Research and Development Personnel in Canada, 1979 to 2002", available from the Science and Innovation Surveys Section, Science, Innovation and Electronic Information Division.

Current publications of the Science and Innovation Surveys Section include:

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

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

Federal scientific activities, 2003-04, catalogue no. 88-204-XIE, annual. It presents statistics on the federal government's activities in science and technology (S&T). It covers expenditures and person-years by type of science, performing sectors, provinces, federal departments and agencies.

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