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Science Statistics

Estimates of Research and
Development Expenditures
in the Higher Education
Sector, 2008/2009



September 2010 Edition



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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

Spending on research and development in the higher education sector 2008/2009

The higher education sector comprised of institutions such as universities and affiliated research hospitals, experimental stations and clinics, spent \$10.9 billion on research and development (R&D) in 2008/2009, up 7.3% from 2007/2008 (table 1).

When adjusted for inflation, spending reached \$9.0 billion in 2002 constant dollars, up 3.2% from the previous year (table 1).

Higher education institutions continued as the leading source of funding for their R&D performance, providing \$5.1 billion or 46% of total funding in 2008/2009 while the federal government remained the second largest contributor at \$2.8 billion or 26% of total funding (table 1).

Spending on higher education R&D in the natural sciences and engineering (including health sciences) was \$8.7 billion, up 7.3% from 2007/2008 (tables 6, 7). In the social sciences and humanities R&D spending increased 7.4% to \$2.2 billion (table 5).

Roughly two-thirds (67%) of R&D spending in the higher education sector took place in Ontario and Quebec (table 3), the two provinces with the highest concentration of universities and research hospitals.

Analysis

Estimates of Research and Development Expenditures in the Higher Education Sector, 2008/2009

National spending on research and development performed by higher education institutions which includes universities, all affiliated research hospitals, experimental stations and clinics was \$10.9 billion in 2008/2009, a 7.3% increase over 2007/2008 in current dollars. In real or inflation adjusted terms this was \$9.0 billion (based on 2002 constant year dollars), an increase of 3.2% from the previous year (table 1).

Estimates of R&D expenditures in the higher education sector are allocated by three science types: social sciences and humanities; health sciences; and natural sciences and engineering excluding health sciences (or other natural sciences).

In 2008/2009 the allocation of total higher education sector spending on research and development in the social sciences and humanities was \$2.2 billion, a 7.4% increase from 2007/2008. Health sciences spending amounted to \$4.4 billion, up 9.1% from the previous year. Other natural sciences and engineering increased 5.5% to \$4.3 billion in 2008/2009. Taking into consideration inflation, the increase from the previous year for social sciences and humanities was 3.4%, health sciences 5.0% and other natural sciences and engineering 1.5% (tables 2, 5, 6, 7).

Just over two-thirds of total R&D spending in the higher education sector occurred in Ontario (42%) and Quebec (26%) in 2008/2009. The remainder of total R&D expenditures in the higher education sector was performed in the Prairies (16%), British Columbia (10%), and the Atlantic Provinces (6%) (table 3).

Sources of funding

There are six sectors that fund research and development expenditures in the higher education sector: higher education institutions; federal government; provincial government; business enterprise; private non-profit organizations; and, foreign.

Higher Education Sector

Higher education institutions remained the lead source of funding, contributing 46% of total higher education sector R&D expenditures in 2008/2009, or \$5.1 billion, a current dollar increase of 10.6% from the previous year. Adjusting for inflation, higher education institutions provided \$4.2 billion, up 6.4% from 2007/2008 (table 1).

Three-quarters of this funding was directed towards the natural sciences and engineering field comprised of health sciences (39%) and other natural sciences and engineering (36%). The social sciences and humanities field received 26% of the higher education institutions' contributions (table 2).

Similar to the national level, 69% of the funds contributed by this sector were held in Ontario and Quebec, as expected since this is where the majority of higher education institutions reside (table 3).

Federal Government Sector

The federal government remained the second largest contributor to R&D performed in the higher education sector providing \$2.8 billion or 26% of total funding in current dollars. In real dollars this was a 0.6% decline, essentially no change in spending from the previous year (table 1).

Seventeen percent of this funding was allocated to social sciences and humanities activities, while 38% went to health sciences and 45% to other natural sciences and engineering (table 2).

Almost two-thirds (65%) of funds contributed by this sector were held in Ontario and Quebec. Twenty-three percent of federal funding of R&D expenditures in the higher education sector occurred in Alberta (10%) and British Columbia (13%) (table 3).

Provincial Government Sector

The provincial government sector contributed \$1.1 billion in current dollars or 10% of the share in total spending on higher education research and development in 2008/2009, an increase of 6.9% over the previous year. Taking inflation into consideration, the provincial government provided \$913 million, a 2.8% increase from the previous year (table 1).

Half of provincial government funding was allocated to other natural sciences and engineering activities, one-fifth to social sciences and humanities, and health sciences held the remaining 30% (table 2).

The Ontario government contributed 36% of total R&D in the higher education sector followed by 22% provided by the Quebec government. Over one-third of provincial funding for R&D expenditures in the higher education sector was from the governments of Alberta (22%) and British Columbia (12%) (table 3).

Business Enterprise Sector

Funding from the business enterprise sector increased slightly to \$892 million current dollars in 2008/2009 or 8% of the total share of R&D spending in the higher education sector. In real dollars, taking into account inflation, the business enterprise sector's contribution dropped 1.3% to \$737 million (table 1).

Over half (53%) of business enterprise contributions went to other natural sciences and engineering activities, while 43% was allocated to health sciences and 4% to social sciences and humanities (table 2).

Almost three-quarters of business enterprise support occurred in Ontario (46%) and Quebec (28%) (table 3).

Private Non-Profit Sector

In 2008/2009, private non-profit (PNP) organisations increased their contributions to \$949 million in current dollars. In constant dollars this sector increased 2.6% to \$783 million, or 8.7% of the total share of higher education sector R&D expenditures (table 1).

The majority of PNP support went to health sciences which provided 63% of total R&D spending in the higher education sector. Both social sciences and humanities and other natural sciences and engineering contributed almost 19% each (table 2).

Forty-five percent of PNP contributions took place in Ontario. Quebec held one-quarter of PNP contributions to R&D in the higher education sector and one-tenth occurred in British Columbia (table 3).

Foreign Sector

Foreign sector funding increased 15.4% to \$114 million current dollars in 2008/2009. Considering inflation, foreign contributions increased 11% to \$95 million constant dollars during the same time period. However, the foreign sector's share of funding for R&D in the higher education sector remained at 1% (table 1).

All of foreign sector funding of R&D in the higher education sector went to the natural sciences and engineering field, with 60% allocated to other natural sciences and engineering and 40% to health sciences (table 2).

Most foreign contributions took place in Ontario (47%) followed by one-fifth equally in each of British Columbia and Quebec (table 3).

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 (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

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
Source of funds

	Federal government	Provincial government	Business enterprise	Higher education	Private non-profit organizations	Foreign	Total
millions of current dollars							
1995/1996	854.8	323.2	296.7	1,926.6	265.7	24.2	3,691.2
1996/1997	809.0	297.6	335.6	1,905.5	312.7	36.4	3,696.8
1997/1998	792.7	369.9	381.0	1,971.5	324.5	39.5	3,879.1
1998/1999	862.9	371.6	411.0	2,339.4	335.1	49.5	4,369.5
1999/2000	1,084.6	482.2	460.3	2,648.8	349.2	56.6	5,081.7
2000/2001	1,292.8	587.2	553.4	2,892.1	418.2	49.6	5,793.3
2001/2002	1,586.8	712.0	603.3	2,928.9	509.1	84.1	6,424.2
2002/2003	1,816.7	828.6	643.2	3,461.8	604.5	100.5	7,455.3
2003/2004	2,181.7	1,018.1	679.1	3,589.3	599.4	75.8	8,143.3
2004/2005	2,336.9	1,039.0	754.7	4,146.7	684.9	95.7	9,057.9
2005/2006	2,542.4	973.3	803.3	4,340.9	742.0	116.3	9,518.2
2006/2007	2,487.5	992.7	808.2	4,434.9	775.7	125.7	9,624.8
2007/2008	2,720.2	1,034.0	870.1	4,574.1	889.7	99.1	10,187.3
2008/2009	2,811.5	1,105.1	892.4	5,059.8	948.7	114.4	10,931.9
millions of 2002 constant dollars ¹							
1995/1996	947.7	358.3	328.9	2,135.9	294.6	26.8	4,092.2
1996/1997	883.2	324.9	366.4	2,080.2	341.4	39.7	4,035.8
1997/1998	855.1	399.0	411.0	2,126.8	350.1	42.6	4,184.6
1998/1999	934.9	402.6	445.3	2,534.6	363.1	53.6	4,734.0
1999/2000	1,155.1	513.5	490.2	2,820.9	371.9	60.3	5,411.8
2000/2001	1,321.9	600.4	565.8	2,957.2	427.6	50.7	5,923.6
2001/2002	1,604.4	719.9	610.0	2,961.5	514.8	85.0	6,495.7
2002/2003	1,816.7	828.6	643.2	3,461.8	604.5	100.5	7,455.3
2003/2004	2,112.0	985.6	657.4	3,474.6	580.3	73.4	7,883.2
2004/2005	2,192.2	974.7	708.0	3,890.0	642.5	89.8	8,497.1
2005/2006	2,309.2	884.0	729.6	3,942.7	673.9	105.6	8,645.0
2006/2007	2,203.3	879.3	715.9	3,928.2	687.1	111.3	8,525.1
2007/2008	2,334.9	887.6	746.9	3,926.3	763.7	85.1	8,744.5
2008/2009	2,321.6	912.6	736.9	4,178.2	783.4	94.5	9,027.2

1. CANSIM, table 384-0036.

Table 2
Source of funds and by major field of science, 2008/2009

	Social sciences and humanities ¹		Health sciences ²		Other natural sciences and engineering ³		Total	
	2002 constant ⁴ dollars	Current dollars	2002 constant ⁴ dollars	Current dollars	2002 constant ⁴ dollars	Current dollars	2002 constant ⁴ dollars	Current dollars
millions of dollars								
Total	1,829.5	2,215.5	3,616.4	4,379.4	3,581.3	4,337.0	9,027.2	10,931.9
Federal government	387.4	469.1	884.5	1,071.1	1,049.8	1,271.3	2,321.6	2,811.5
Provincial governments	182.5	221.0	273.7	331.5	456.3	552.6	912.6	1,105.1
Business enterprise	30.1	36.5	317.6	384.6	389.2	471.3	736.9	892.4
Higher education	1,085.5	1,314.6	1,608.9	1,948.4	1,483.7	1,796.8	4,178.2	5,059.8
Private non-profit organizations	143.8	174.2	493.9	598.1	145.7	176.4	783.4	948.7
Foreign	0.0	0.0	37.7	45.7	56.6	68.6	94.5	114.4

1. Social sciences and humanities embrace 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, communications, criminology, demography, economics, geography, history, languages, literature and linguistics, law, library science, philosophy, political sciences, psychology, religious studies, social work, sociology, and urban and regional studies.
2. Health sciences consist of programmes directed towards the protection and improvement of human health.
3. Other natural sciences and engineering consist of disciplines, other than health sciences, concerned with understanding, exploring, developing or utilizing the natural world. Included are engineering, mathematical and physical sciences.
4. CANSIM, table 384-0036.

Table 3
Source of funds and by province, 2008/2009

	Federal government	Provincial governments	Business enterprise	Higher education	Private non-profit organizations	Foreign	Total
millions of current dollars							
Canada	2,811.5	1,105.1	892.4	5,059.8	948.7	114.4	10,931.9
Newfoundland and Labrador	36.2	7.6	17.1	77.4	6.1	1.2	145.6
Prince Edward Island	11.7	1.5	1.7	21.6	1.0	0.0	37.4
Nova Scotia	93.5	8.1	37.1	178.9	24.5	0.5	342.6
New Brunswick	36.8	5.4	4.2	90.9	9.6	3.0	149.9
Quebec	739.7	248.0	253.1	1,289.2	238.6	23.0	2,791.7
Ontario	1,091.5	397.8	412.6	2,199.2	425.4	53.7	4,580.3
Manitoba	72.9	17.9	15.5	148.7	52.9	3.9	311.9
Saskatchewan	87.2	44.5	15.6	145.8	20.3	0.8	314.3
Alberta	267.3	241.0	84.4	447.2	76.4	5.5	1,121.8
British Columbia	374.6	133.2	51.1	461.0	94.0	22.6	1,136.5
millions of 2002 constant dollars ¹							
Canada	2,321.6	912.6	736.9	4,178.2	783.4	94.5	9,027.2
Newfoundland and Labrador	29.9	6.3	14.1	63.9	5.0	1.0	120.2
Prince Edward Island	9.7	1.2	1.4	17.8	0.8	0.0	30.9
Nova Scotia	77.2	6.7	30.6	147.7	20.2	0.4	282.9
New Brunswick	30.4	4.5	3.5	75.1	7.9	2.5	123.8
Quebec	610.8	204.8	209.0	1,064.6	197.0	19.0	2,305.3
Ontario	901.3	328.5	340.7	1,816.0	351.3	44.3	3,782.2
Manitoba	60.2	14.8	12.8	122.8	43.7	3.2	257.6
Saskatchewan	72.0	36.7	12.9	120.4	16.8	0.7	259.5
Alberta	220.7	199.0	69.7	369.3	63.1	4.5	926.3
British Columbia	309.3	110.0	42.2	380.7	77.6	18.7	938.5

1. CANSIM, table 384-0036.

**Table 4
Province**

	Canada	Newfoundland and Labrador	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
millions of current dollars											
1995/1996	3,691.2	58.4	3.7	117.0	56.2	1,111.5	1,432.7	113.5	113.9	327.8	356.5
1996/1997	3,696.8	56.6	4.2	117.6	56.3	1,099.3	1,456.1	111.3	113.6	328.8	353.0
1997/1998	3,879.1	61.2	5.9	125.0	57.4	1,131.6	1,554.2	108.3	118.9	357.7	358.9
1998/1999	4,369.5	72.0	11.4	164.1	80.4	1,273.8	1,699.7	130.8	138.4	408.1	390.8
1999/2000	5,081.7	78.6	11.4	199.6	89.0	1,532.9	1,908.0	157.6	176.1	490.9	437.6
2000/2001	5,793.3	83.4	15.7	199.9	88.2	1,628.6	2,316.2	189.6	228.2	546.0	497.5
2001/2002	6,424.2	89.4	15.7	208.6	88.2	1,778.5	2,575.9	205.9	235.6	664.9	561.5
2002/2003	7,455.3	94.4	18.7	225.5	98.9	2,074.3	2,995.5	224.5	258.8	727.5	737.2
2003/2004	8,143.3	114.1	25.2	259.1	117.5	2,345.0	3,187.4	238.7	244.8	826.8	784.6
2004/2005	9,057.9	115.6	24.2	266.0	114.3	2,467.7	3,835.1	260.6	244.7	898.2	831.5
2005/2006	9,518.2	148.5	27.4	297.4	130.1	2,556.4	3,980.3	294.5	217.7	962.0	904.0
2006/2007	9,624.8	132.2	31.2	316.5	135.0	2,540.7	4,088.1	287.1	216.1	918.9	959.1
2007/2008	10,187.3	139.9	33.7	326.6	143.8	2,610.5	4,314.0	302.0	229.7	1,004.1	1,083.0
2008/2009	10,931.9	145.6	37.4	342.6	149.9	2,791.7	4,580.3	311.9	314.3	1,121.8	1,136.5
millions of 2002 constant dollars ¹											
1995/1996	4,092.2	64.7	4.1	129.7	62.3	1,232.3	1,588.4	125.8	126.3	363.4	395.2
1996/1997	4,035.8	61.8	4.6	128.4	61.5	1,200.1	1,589.6	121.5	124.0	359.0	385.4
1997/1998	4,184.6	66.0	6.4	134.8	61.9	1,220.7	1,676.6	116.8	128.3	385.9	387.2
1998/1999	4,734.0	78.0	12.4	177.8	87.1	1,380.1	1,841.5	141.7	149.9	442.1	423.4
1999/2000	5,411.8	83.7	12.1	212.6	94.8	1,632.5	2,031.9	167.8	187.5	522.8	466.0
2000/2001	5,923.6	85.3	16.1	204.4	90.2	1,665.2	2,368.3	193.9	233.3	558.3	508.7
2001/2002	6,495.7	90.4	15.9	210.9	89.2	1,798.3	2,604.6	208.2	238.2	672.3	567.7
2002/2003	7,455.3	94.4	18.7	225.5	98.9	2,074.3	2,995.5	224.5	258.8	727.5	737.2
2003/2004	7,883.2	110.5	24.4	250.8	113.7	2,270.1	3,085.6	231.1	237.0	800.4	759.5
2004/2005	8,497.1	108.4	22.7	249.5	107.2	2,314.9	3,597.7	244.5	229.5	842.6	780.0
2005/2006	8,645.0	134.9	24.9	270.1	118.2	2,321.9	3,615.2	267.5	197.7	873.8	821.1
2006/2007	8,525.1	117.1	27.6	280.3	119.6	2,250.4	3,621.0	254.3	191.4	813.9	849.5
2007/2008	8,744.5	120.1	28.9	280.3	123.4	2,240.8	3,703.0	259.2	197.2	861.9	929.6
2008/2009	9,027.2	120.2	30.9	282.9	123.8	2,305.3	3,782.2	257.6	259.5	926.3	938.5

1. CANSIM, table 384-0036.

Table 5
Social sciences and humanities

	Canada	Newfoundland and Labrador	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
millions of current dollars											
1995/1996	724.7	15.4	0.9	23.0	13.8	213.5	269.1	24.7	23.8	64.5	76.0
1996/1997	705.2	15.2	1.1	21.3	13.2	204.9	259.6	24.5	23.9	61.1	80.4
1997/1998	731.7	14.7	1.5	21.9	12.8	203.6	285.6	23.8	26.9	62.2	78.7
1998/1999	903.8	16.5	3.5	40.9	25.4	243.9	341.9	33.6	32.6	71.6	93.9
1999/2000	1,062.5	20.5	3.7	48.1	27.8	296.4	401.0	40.4	36.8	86.2	101.6
2000/2001	1,202.4	19.2	4.5	51.9	29.8	323.6	473.5	43.1	47.6	95.5	113.7
2001/2002	1,274.5	23.8	4.3	48.9	29.7	331.4	515.0	44.7	48.5	107.3	120.9
2002/2003	1,414.1	21.7	5.6	51.3	32.2	396.3	535.1	48.7	51.5	120.7	151.0
2003/2004	1,598.8	29.3	6.7	58.0	38.0	453.8	603.2	54.0	48.0	143.2	164.6
2004/2005	1,778.3	27.0	6.8	63.7	40.2	486.2	696.4	59.8	46.1	168.9	183.2
2005/2006	1,891.4	31.7	7.3	71.5	45.8	492.2	761.1	67.1	42.0	176.1	196.8
2006/2007	1,910.7	30.9	8.9	70.6	44.4	481.3	798.8	63.3	42.2	160.5	209.8
2007/2008	2,062.2	36.4	8.8	77.0	44.8	517.1	840.9	65.8	41.9	194.7	234.8
2008/2009	2,215.5	37.0	12.0	81.0	47.2	531.5	913.7	70.4	63.2	214.3	245.2
millions of 2002 constant dollars ¹											
1995/1996	803.4	17.1	1.0	25.5	15.3	236.7	298.3	27.4	26.4	71.5	84.3
1996/1997	769.9	16.6	1.2	23.3	14.4	223.7	283.4	26.7	26.1	66.7	87.8
1997/1998	789.3	15.9	1.6	23.6	13.8	219.6	308.1	25.7	29.0	67.1	84.9
1998/1999	979.2	17.9	3.8	44.3	27.5	264.2	370.4	36.4	35.3	77.6	101.7
1999/2000	1,131.5	21.8	3.9	51.2	29.6	315.7	427.1	43.0	39.2	91.8	108.2
2000/2001	1,229.4	19.6	4.6	53.1	30.5	330.9	484.2	44.1	48.7	97.6	116.3
2001/2002	1,288.7	24.1	4.3	49.4	30.0	335.1	520.7	45.2	49.0	108.5	122.2
2002/2003	1,414.1	21.7	5.6	51.3	32.2	396.3	535.1	48.7	51.5	120.7	151.0
2003/2004	1,547.7	28.4	6.5	56.1	36.8	439.3	583.9	52.3	46.5	138.6	159.3
2004/2005	1,668.2	25.3	6.4	59.8	37.7	456.1	653.3	56.1	43.2	158.4	171.9
2005/2006	1,717.9	28.8	6.6	64.9	41.6	447.0	691.3	60.9	38.1	159.9	178.7
2006/2007	1,692.4	27.4	7.9	62.5	39.3	426.3	707.5	56.1	37.4	142.2	185.8
2007/2008	1,770.1	31.2	7.6	66.1	38.5	443.9	721.8	56.5	36.0	167.1	201.5
2008/2009	1,829.5	30.6	9.9	66.9	39.0	438.9	754.5	58.1	52.2	177.0	202.5

1. CANSIM, table 384-0036.

Table 6
Health sciences

	Canada	Newfoundland and Labrador	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
millions of current dollars											
1995/1996	1,428.4	15.3	0.3	45.7	4.7	452.5	606.1	43.8	30.4	126.8	102.8
1996/1997	1,430.4	15.0	0.3	46.3	4.6	449.0	614.1	42.7	27.3	130.0	101.1
1997/1998	1,516.1	17.3	0.6	52.8	4.8	457.4	661.6	40.8	31.1	147.3	102.4
1998/1999	1,627.8	21.6	0.6	62.2	6.8	507.8	671.1	45.6	36.1	166.5	109.5
1999/2000	1,822.5	20.1	0.6	71.8	7.1	597.5	706.1	53.8	43.5	199.5	122.5
2000/2001	2,103.9	23.9	1.4	72.6	7.5	633.9	875.6	62.0	57.9	225.0	144.1
2001/2002	2,382.6	25.4	1.3	83.4	7.7	700.2	977.1	74.1	67.6	274.5	171.3
2002/2003	2,955.6	29.7	2.1	88.1	9.2	813.5	1,296.6	81.2	76.4	306.1	252.7
2003/2004	3,086.8	35.9	3.6	107.3	10.5	877.1	1,314.8	83.1	65.3	330.0	259.2
2004/2005	3,584.6	39.0	3.7	102.9	9.6	921.2	1,692.0	91.6	64.8	351.1	308.8
2005/2006	3,767.1	54.7	4.8	112.0	10.9	969.0	1,740.4	105.9	63.2	387.1	319.2
2006/2007	3,780.9	45.1	4.8	126.4	13.1	986.2	1,736.6	103.4	60.6	376.4	328.3
2007/2008	4,013.6	42.6	3.6	123.7	14.7	1,004.9	1,887.9	106.4	62.4	381.7	385.7
2008/2009	4,379.4	48.4	4.7	133.1	16.7	1,147.0	2,018.9	116.0	84.5	428.1	382.1
millions of 2002 constant dollars ¹											
1995/1996	1,583.6	17.0	0.3	50.7	5.2	501.7	672.0	48.6	33.7	140.6	114.0
1996/1997	1,561.6	16.4	0.3	50.5	5.0	490.2	670.4	46.6	29.8	141.9	110.4
1997/1998	1,635.5	18.7	0.6	57.0	5.2	493.4	713.7	44.0	33.5	158.9	110.5
1998/1999	1,763.6	23.4	0.7	67.4	7.4	550.2	727.1	49.4	39.1	180.4	118.6
1999/2000	1,940.9	21.4	0.6	76.5	7.6	636.3	752.0	57.3	46.3	212.5	130.5
2000/2001	2,151.2	24.4	1.4	74.2	7.7	648.2	895.3	63.4	59.2	230.1	147.3
2001/2002	2,409.1	25.7	1.3	84.3	7.8	708.0	988.0	74.9	68.4	277.6	173.2
2002/2003	2,955.6	29.7	2.1	88.1	9.2	813.5	1,296.6	81.2	76.4	306.1	252.7
2003/2004	2,988.2	34.8	3.5	103.9	10.2	849.1	1,272.8	80.4	63.2	319.5	250.9
2004/2005	3,362.7	36.6	3.5	96.5	9.0	864.2	1,587.2	85.9	60.8	329.4	289.7
2005/2006	3,421.5	49.7	4.4	101.7	9.9	880.1	1,580.7	96.2	57.4	351.6	289.9
2006/2007	3,348.9	39.9	4.3	112.0	11.6	873.5	1,538.2	91.6	53.7	333.4	290.8
2007/2008	3,445.2	36.6	3.1	106.2	12.6	862.6	1,620.5	91.3	53.6	327.6	331.1
2008/2009	3,616.4	40.0	3.9	109.9	13.8	947.2	1,667.1	95.8	69.8	353.5	315.5

1. CANSIM, table 384-0036.

Table 7
Other natural sciences and engineering

	Canada	Newfoundland and Labrador	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
millions of current dollars											
1995/1996	1,538.1	27.7	2.5	48.3	37.6	445.5	557.6	45.0	59.7	136.5	177.7
1996/1997	1,561.2	26.4	2.8	50.0	38.4	445.4	582.5	44.1	62.4	137.7	171.5
1997/1998	1,631.4	29.2	3.7	50.3	39.7	470.7	607.0	43.7	61.0	148.2	177.8
1998/1999	1,837.9	33.9	7.3	61.0	48.2	522.0	686.7	51.6	69.8	170.0	187.4
1999/2000	2,196.8	38.0	7.2	79.6	54.2	639.0	800.9	63.4	95.8	205.1	213.6
2000/2001	2,487.0	40.2	9.8	75.5	50.9	671.2	967.1	84.5	122.7	225.5	239.6
2001/2002	2,767.1	40.2	10.1	76.2	50.8	746.7	1,083.8	87.0	119.5	283.2	269.6
2002/2003	3,085.6	43.0	11.0	86.1	57.5	864.5	1,163.8	94.6	130.9	300.7	333.5
2003/2004	3,457.7	48.9	14.9	93.9	69.0	1,014.2	1,269.4	101.5	131.5	353.6	360.8
2004/2005	3,695.1	49.6	13.7	99.4	64.5	1,060.3	1,446.8	109.2	133.8	378.1	339.6
2005/2006	3,859.7	62.1	15.3	113.9	73.5	1,095.2	1,478.8	121.5	112.5	398.8	388.1
2006/2007	3,933.3	56.2	17.5	119.5	77.5	1,073.2	1,552.7	120.4	113.2	382.0	421.0
2007/2008	4,111.5	60.9	21.2	125.9	84.3	1,088.4	1,585.3	129.8	125.4	427.8	462.5
2008/2009	4,337.0	60.2	20.7	128.5	86.0	1,113.1	1,647.6	125.5	166.7	479.4	509.2
millions of 2002 constant dollars ¹											
1995/1996	1,705.2	30.7	2.8	53.5	41.7	493.9	618.2	49.9	66.2	151.3	197.0
1996/1997	1,704.4	28.8	3.1	54.6	41.9	486.2	635.9	48.1	68.1	150.3	187.2
1997/1998	1,759.9	31.5	4.0	54.3	42.8	507.8	654.8	47.1	65.8	159.9	191.8
1998/1999	1,991.2	36.7	7.9	66.1	52.2	565.5	744.0	55.9	75.6	184.2	203.0
1999/2000	2,339.5	40.5	7.7	84.8	57.7	680.5	852.9	67.5	102.0	218.4	227.5
2000/2001	2,542.9	41.1	10.0	77.2	52.0	686.3	988.9	86.4	125.5	230.6	245.0
2001/2002	2,797.9	40.6	10.2	77.0	51.4	755.0	1,095.9	88.0	120.8	286.3	272.6
2002/2003	3,085.6	43.0	11.0	86.1	57.5	864.5	1,163.8	94.6	130.9	300.7	333.5
2003/2004	3,347.2	47.3	14.4	90.9	66.8	981.8	1,228.8	98.3	127.3	342.3	349.3
2004/2005	3,466.3	46.5	12.9	93.2	60.5	994.7	1,357.2	102.4	125.5	354.7	318.6
2005/2006	3,505.6	56.4	13.9	103.5	66.8	994.7	1,343.1	110.4	102.2	362.2	352.5
2006/2007	3,483.9	49.8	15.6	105.8	68.6	950.6	1,375.3	106.6	100.3	338.4	372.9
2007/2008	3,529.2	52.3	18.2	108.1	72.4	934.2	1,360.8	111.4	107.6	367.2	397.0
2008/2009	3,581.3	49.7	17.1	106.1	71.0	919.2	1,360.5	103.6	137.7	395.9	420.5

1. CANSIM, table 384-0036.

Data quality, concepts and methodology

Estimation of research and development expenditures in the higher education sector, 2008/2009

Definitions

Natural sciences and engineering

The natural sciences and engineering (NSE) field embraces the disciplines of study concerned with understanding, exploring, developing or utilizing the natural world. Included are the engineering, mathematical, life and physical sciences.

Social sciences and humanities

The social sciences and humanities (SSH) field embraces all disciplines involved in studying human actions and conditions and the social, economic and institutional mechanisms affecting humans. Included are such disciplines as anthropology, 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.

Scientific research and experimental development (R&D)

Creative work undertaken on a systematic basis in order to increase the stock of scientific and technical knowledge and to use this knowledge in new applications.

The central characteristic of R&D is an appreciable element of novelty and of uncertainty. New knowledge, products or processes are sought. The work is normally performed by, or under the supervision of, persons with postgraduate degrees in the natural sciences or engineering.

An R&D project generally has three characteristics:

- a substantial element of uncertainty, novelty and innovation;
- a well-defined project design;
- a report on the procedures and results of the projects.

Canadian business enterprises

This sector is composed of business and government enterprises, including public utilities and government owned firms and frequently referred to as the industry sector. Incorporated consultants providing scientific and engineering services are also included. Industrial research institutes located at Canadian universities are considered to be in the university sector.

Higher education

The higher education sector is composed of all universities, colleges of technology and other institute of post-secondary education, whatever their source of finance or legal status. It also includes all research institutes, experimental stations and clinics operating under the direct control of, or administered by, or associated with, the higher education establishments.

Canadian private non-profit institutions

Charitable foundations, voluntary health organizations, scientific and professional societies, and other organizations not established to earn profits comprise this sector. Private non-profit institutions primarily serving or controlled by another sector should be included in that sector (e.g., the Pulp and Paper Research Institute is in Canadian business enterprises).

Canadian provincial and municipal governments

Departments and agencies of these governments form this sector. Government enterprises, such as provincial utilities are included in the Canadian business enterprises sector, and hospitals in the Canadian non-profit institutions or university sector.

Other Canadian performers

This sector includes all individuals or organizations not belonging to any of the above sectors. In particular, it includes provincial research councils and foundations.

Foreign performers

All foreign governments, foreign companies (including foreign subsidiaries of Canadian firms), international organizations, non resident foreign nationals and Canadians studying or teaching abroad, are included in this sector.

Methodology of estimating higher education research and development expenditures (HERD)

1. Introduction

Research is an integral part of higher education institutions' mission. Faculty do research as part of their teaching function. They also perform research sponsored by other sectors of the economy. Total research and development performed by the higher education sector is the sum of expenditures made from funds received from other organizations (sponsored research) and the monies spent from the institutions' own budgets (non-sponsored research).

Higher education is not a sector in the System of National Accounts, but in the system of research and development, gross domestic expenditures on research and development (GERD), it is separated because of its critical role in the creation and dissemination of new knowledge. The Organisation for Economic Cooperation and Development (OECD) describes it as "all universities, colleges of technology and other institutes of post-secondary education, whatever their source of finance and or legal status. It also includes all research institutes, experimental stations, and clinics operating under the direct control of, or administered by, or associated with, the higher education establishments."¹

Estimation of HERD can be approached in two ways: sources of funds (income) approach and research performed (expenditure) approach. However, they yield different results as all the funds received by institutions in any one year may not be spent in that same year.

Statistics Canada employs a combination of the two approaches due to data constraints. The expenditure approach is used to estimate total HERD while details -- sources of funds and science fields -- are based on the income approach. Any discrepancies in estimates derived from the two different approaches are fully resolved to ensure all the data presented in this release are consistent.

1. OECD, The Measurement of Scientific and Technical Activities – Frascati Manual. Paris 2002.

As mentioned above, higher education sector R&D has two main components: sponsored and non-sponsored. Each of these is further sub-divided into direct and indirect costs:

- (a) Direct sponsored research is the university research funded by external organizations in government, business, private not-for-profit, and the foreign sectors. Direct cost refers to expenditures that can be easily and accurately attributed to a single project such as researchers' salaries;
- (b) Direct non-sponsored research is a co-product of teaching. It is an integral part of the teaching function; and
- (c) Indirect cost of sponsored and non-sponsored research. This is the cost of research that cannot be easily and accurately traced to a single project or activity because it is jointly incurred by numerous research projects and activities going on in an institution at the same time and therefore must be apportioned to each project according to its usage of the institution's facilities and services. Examples include fire insurance on a building, utility bills and the use of central services.

2. Methodology

The current estimation methodology was proposed by the 1999 Working Group and has been applied since 1998/99. The principal source of data is the annual survey, *Financial Information of Universities and Colleges*, conducted by the Canadian Association of University Business Officers (CAUBO). Tables from this survey are provided by the Tourism and Centre for Education Statistics Division of Statistics Canada.

R&D Expenditure (expenditure approach)

Total HERD is the sum of direct sponsored research, direct non-sponsored research and indirect cost of sponsored and non sponsored research. In the estimation model, an additional module is added to account for affiliated hospitals not included in these components.

1. Direct sponsored research

Direct sponsored research expenditure is derived from data in CAUBO Table 2.² As the source does not separate direct and indirect costs, 95% of the sponsored research expenditure reported to CAUBO is assumed to represent direct sponsored research; the remaining 5% is assigned to indirect cost representing recoveries made from the sponsors.

2. Direct non-sponsored research

Faculty divide their time among the three primary functions; teaching, research and community services. The time spent on research when it is undertaken as part of the teaching function is defined as non-sponsored research. Central to the estimate of the value of direct non-sponsored research are the portion of faculty time spent on this type of research and faculty salaries.

In order to estimate the amount of faculty time spent on research, Statistics Canada commissioned a faculty time use survey in 2001. Academic staff at Canadian universities was the target population.³ After analysis of the results and some modifications, faculty research time coefficients were derived, detailed by eight academic disciplines and three university sizes. They are summarized in Table A. Note that coefficients were estimated for total, not non-sponsored research, but an adjustment was made to faculty salaries -- which can be more easily divided between sponsored and non-sponsored research -- to avoid double counting.

2. Modules in the CAUBO survey questionnaire are called tables. In order to avoid confusion the prefix CAUBO is used whenever the reference is to the CAUBO questionnaire.

3. This telephone survey, conducted between April and June 2001, interviewed 2,173 academic staff at 36 universities and affiliated hospitals. For details, see Réjean Landry and Nabil Amara., Estimation of Time Spent on Research in the Higher Education Sector, study prepared for the Working Group on the Higher Education and Health R&D Expenditures, August 2001.

Table A
Fraction of faculty time spent on sponsored and non-sponsored research, 2000

	Small	Medium	Large
	percent		
Natural sciences and engineering			
Agriculture and biological sciences	0.30	0.40	0.45
Engineering and applied sciences	0.35	0.35	0.40
Mathematics and physical sciences	0.30	0.35	0.45
Health sciences	0.30	0.40	0.45
Social Sciences and humanities			
Education	0.20	0.25	0.25
Fine arts	0.20	0.20	0.20
Humanities	0.25	0.25	0.30
Social sciences	0.25	0.30	0.35

These coefficients are applied against the number of full-time faculty in each of the eight teaching disciplines and the salaries of academic ranks reported by CAUBO for each institution. It is further assumed that all faculty members are at the same salary levels in the absence of more detailed salary information from existing sources. The resulting figure is reduced by the amount of salaries funded by the sponsors.

Size classification of universities is based on three criteria (Table B): the amount of expenditure on sponsored research (reported by CAUBO); the proportion of sponsored R&D expenditure to general operating expenditure; and finally, the number of doctoral programs offered by the institution. An institution has to satisfy two of the three conditions to decide its group. However, if it is judged to be small on two criteria and large on the third it is assigned to the medium group.

It should be noted that the final objective is not to create an individual ranking for universities but rather to group them into three size groups to make possible R&D expenditure estimates at the aggregate level.

Table B
Criteria used to classify universities by size

	Small	Medium		Large
		From	To	
Sponsored research expenditure (\$million)	<10	10	30	>30
Sponsored research expenditure as percent of general operating expenditure (%)	<10	10	20	>20
Number of doctoral programs	<10	10	30	>30

3. Indirect cost of sponsored and non-sponsored research

In the estimation model, indirect costs are the sum of four components:

- federal government indirect cost payments - it is taken from CAUBO Table 6;
- indirect costs recovered from non-federal sponsors - it is embedded in CAUBO's data, and assumed to be 5 per cent of the sponsored research expenditure;
- indirect cost not reimbursed by sponsors – it is derived as a fraction of direct sponsored research; it is discussed in detail below; and finally
- indirect cost of non-sponsored research – it is estimated the same way as the indirect cost of sponsored research not reimbursed by sponsors.

As indicated, data for the first two components are available, but the third and fourth items are estimated by calculating the indirect to direct university operating cost ratio. This ratio is computed in several steps described below. The methodology is a short-cut version of the very detailed method employed in the 1982 CAUBO study.⁴

A. Total operating cost is defined as the sum of expenditures from three funds -- general operating; special purpose and trust; and sponsored research; the other funds that higher education institutions maintain – capital, ancillary and endowment -- are assumed to contain no operating cost.

B. Second, indirect cost portion of each of the three funds is calculated. It is accomplished by calculating the indirect to direct operating cost ratio for the general operating fund for which most detail is available and applying it to special purpose and trust fund for which no detail is available.

(a) All expenditure from all items⁵ in the general operating fund (except on student services and academic salaries) is assumed to represent indirect operating cost; only academic faculty salaries are apportioned, 11% to indirect cost and 89% to direct cost,⁶ based on the findings of a 1982 study that 11% of faculty time was taken up by the various administrative duties that support teaching and research;

(b) As an independent ratio cannot be calculated for student services and for special purpose and trust fund because of the lack of detailed data, they are assumed to contain direct and indirect costs in the same proportion as the general operating fund;

(c) Five percent of the sponsored research fund is assumed to represent indirect operating cost;

(d) Thus total indirect cost is the sum of the three items, Ba to Bc;

C. Third, direct operating cost is derived residually by subtracting indirect operating cost (Bd) from the total operating cost (A).

D. Finally, dividing indirect operating cost (Bd) by direct operating cost (C) we obtain the indirect university operating cost ratio. These estimates are made, one each for small, medium and large institutions, using the classification criteria listed in Table B above.

These ratios are applied to direct sponsored research expenditures and direct non-sponsored research expenditures to arrive at an estimate of indirect cost of research not reimbursed by sponsors and indirect cost of non-sponsored research.

4. Teaching hospitals not included elsewhere

Data sources are constantly reviewed to ensure full coverage of teaching hospitals. Statistics from the Survey of Hospitals collected by The Canadian Institute for Health Information are used to calculate the direct and indirect cost of research performed by teaching hospitals not included elsewhere.

5. Total HERD

Total HERD is then the sum of (1) direct sponsored research expenditures, (2) direct non-sponsored research expenditures, (3) indirect cost of sponsored and non-sponsored research, and (4) direct and indirect cost of research at teaching hospitals not covered elsewhere.

Sources of funds, income approach

Sources of funds data obtained from CAUBO Table 1 require two main refinements before they can be used; reconciliation of sector definitions and resolving discrepancies between income and expenditure data.

4. Canadian Association of University Business Officers (CAUBO), 1982 Report of the Study on the Cost of University Research. August 1982.

5. These are libraries, central computing and communication, administration and general, physical plant and external relations. See CAUBO Table 4.

6. See Statistics Canada. Explanation of indirect cost assumption: 11% of salaries.

First, the CAUBO sector definitions do not conform to those used in the higher education sector R&D. There is a good mapping for federal government, provincial governments and the foreign sectors but, as shown in Table C, business and not-for-profit sectors had to be constructed from various components. Furthermore, certain items, including tuition and other fees, sales of goods and services and other investment, are not related to research and were excluded.

Second, income and expenditure sides of sponsored research fund need to be reconciled. This is first done at the aggregate level for each higher education institution because detail is only available for the income side. When income is higher than expenditure it is adjusted down to the level of expenditure and the difference is prorated to the sources; however, no adjustment is made when expenditure exceeds income.

Table C
Sector definitions

	Definition
HERD categories	Components from the CAUBO survey
Federal government	Federal government agencies: Social Sciences and Humanities Research Council (1); Natural Sciences and Engineering Research Council (3); Canadian Institutes of Health Research (4); Canada Foundation for Innovation (5); and Canada Research Chairs (6) Federal departments and other: Health Canada (2); other federal (7).
Provincial governments	Provincial (8), other provincial sources (10) and municipal (9) governments.
Higher education sector	It is estimated from a combination of CAUBO data and faculty data provided by the Centre for Education Statistics.
Business enterprises	Donations including bequests from individuals (15), and business enterprises (16); grants and contracts from individuals (18); business enterprises (19); and a portion of miscellaneous (24).
Private non-profit	Donations including bequests from not-for-profit organizations (17); grants; contracts from not-for-profit organizations (20); and a portion of miscellaneous (24).
Foreign	Foreign (11).

Note(s): Numbers in parentheses refer to row numbers in CAUBO Table 1.

Expenditure by field of science, income approach

Estimates of research expenditure by science type are based on adjusted income, described in the preceding section. As summarized in Table D, allocation is funding institution-specific and takes into account organization's mandate and statistical information, wherever available.

Table D
Estimation of science type higher education research and development (HERD) by source of funds: allocation ratios

	Natural science and engineering	Social sciences and humanities	Health
Federal			
NSERC funding	all	none	none
SSHRC funding	none	all	none
CIHR funding	none	none	all
CFI and CRC funding	share equal to (NSERC funds / funds from three granting councils)	share equal to (SSHRC funds / funds from three granting council)	share equal to (CIHR funds / funds from three granting councils)
Other federal*	60%	30%	10%
Health Canada	none	none	all
Provincial funding**	50%	20%	30%
Business	calculated from data supplied by NSERC	calculated from data supplied by SSHRC	calculated from data supplied by CIHR
Not-for-profit	calculated from data supplied by NSERC	calculated from data supplied by SSHRC	calculated from data supplied by CIHR
Foreign***	60%	none	40%

* Distribution is based on data from the survey of federal science expenditures and personnel;

** Shares are calculated from data supplied by provincial governments;

*** Allocation is based on the U.S. data from the National Science foundation.

Note(s): NSERC – Natural Sciences and Engineering Research Council;
SSRC – Social Sciences and Humanities; Research Council;
CIHR – Canadian Institutes of Health Research;
CFI – Canada Foundation for Innovation;
CRC – Canada Research Chairs Program

3. Historical continuity of data series

This working paper contains fifteen years of HERD estimates based on the revised estimation procedure first used for 1998/1999 estimates. During the 1999/2000 estimation procedure, revised faculty time coefficients on research were used. These new coefficients were then applied to the 1998/1999 estimates as we feel those new coefficients better reflect university research activity levels. During the 2000/2001 estimation procedure a better analysis of “teaching hospitals” expenditures was completed. Some overlap between the private non-profit sector and the higher education sector was discovered and resolved. One will see historical revisions in both sectors back as far as 1991/1992.

During the 2001/2002 estimation procedure the one-time grant awarded to the universities for indirect costs related to sponsored research was reviewed. The estimation system had to be modified to ensure those costs were firstly sourced to the federal government and secondly were not double counted. In 2003/2004 the indirect costs grant awarded from the federal government became an annual payment to universities. The estimation system ensures these payments are not counted twice.

The inclusion in CAUBO statistics sponsored research activities performed in teaching hospitals is constantly reviewed as some teaching hospitals are included and some are not. For those that are not included, estimates are made using information from the Annual Hospital Survey, collected by The Canadian Institute for Health Information (CIHI).

4. Future work

Statistics Canada held a technical workshop to review the assumptions and methodology of estimating HERD, in October 2009, as part of its regular review of data quality. The Workshop made several recommendation concerning, among others, data sources, assumptions, methods, sector coverage, and the impact of new developments, particularly the Networks of Centres of Excellence and the Knowledge Infrastructure Program.⁷ They also included the formation of a Working Group to make proposals for implementing the recommendations. The Working Group was formed in December 2009 and has been holding discussions to prepare its report.

7. Fred Gault, Higher Education Sector Research and Development (HERD), Estimation Model and Methodology, Statistics Canada Workshop, February 2010, Catalogue no. 88F0006X, no. 1.