

**Federal expenditures on
scientific activities in Canadian
universities : (a statistical analysis)**

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FEDERAL EXPENDITURES ON SCIENTIFIC
ACTIVITIES IN CANADIAN UNIVERSITIES
 (A Statistical Analysis)

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OUTLINE

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1. General Overview

This review is concerned with the various aspects of federal support of research and research training in Canadian universities. Analysis of the subject of financial support is of particular interest to the University Branch of the Ministry, since it constitutes an essential starting point for policy determination.

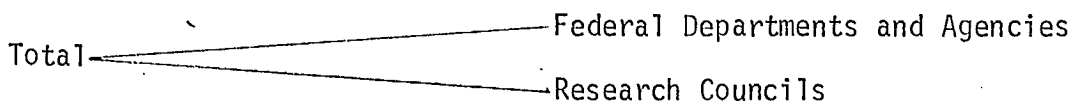
There exists a wealth of statistical data on the various aspects of federal financial involvement in scientific activities. For the benefit of those readers who have not yet had the opportunity to study this financing structure, this analysis begins by setting out a simplified schematic presentation of the major data categories and their relationships:

FIGURE I

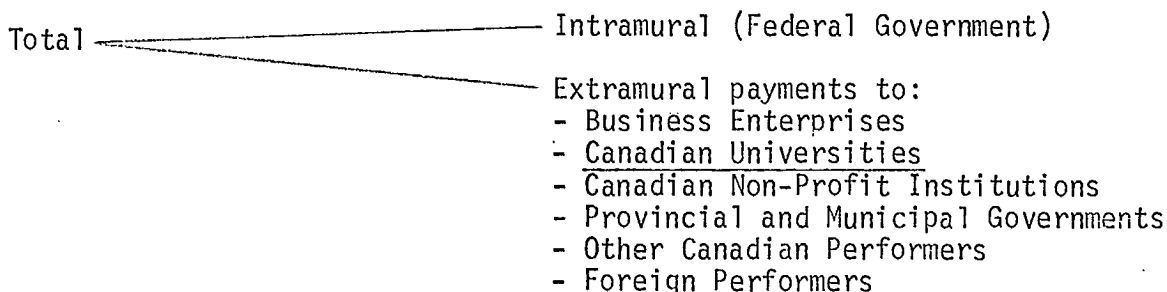
FEDERAL FINANCING OF SCIENTIFIC ACTIVITIES

(Classification of Available Data)

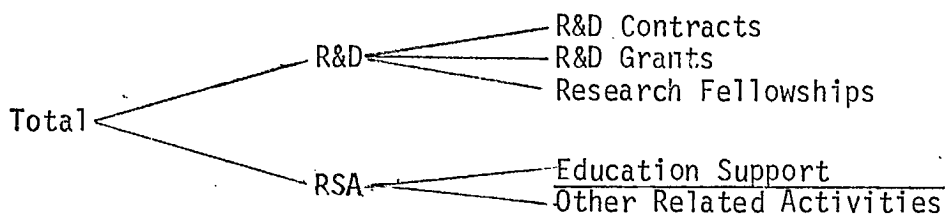
1. By Sponsor



2. By Performer



3. By Function



NOTE: R&D is Research and Development
RSA is Related Scientific Activities
Foreign Performers

The total amounts of funds spent federally are available, from the Statistics Canada Survey¹, on the basis of several concepts: research and development (R&D) vs related scientific activities (RSA) such as scholarships and information; by "sponsor" of funds; and by type of "performer", for example universities, industry, etc. Numerous other cross-classifications provide information on regional aspects; applications (federal policy concerns); and field of research. However, it should be noted that relatively less detail can be obtained for the years prior to 1974-75. The historical survey relating to the Human Sciences did not begin until 1970-71.

*The following tables (Tables 1 to 4) provide a brief overview of the general magnitudes of the expenditures, and of their changes since the beginning of the present decade.

1. See Appendix, item 1 of Data Notes.

TABLE 1.

FEDERAL EXPENDITURES ON SCIENTIFIC ACTIVITIES:

TOTAL, R&D, AND RSA⁽¹⁾

	<u>1970-71</u>	<u>1974-75</u>	<u>1976-77</u>	Change ⁽²⁾ 1970-71 to 1976-77
	(\$ Million)			(Percent)
Total	915.7	1,352.4	1,724.2	11.1
R&D ⁽³⁾	631.3	859.3	1,045.2	8.8
RSA ⁽³⁾	284.4	493.1	679.0	15.6
	(Percentage Distribution)			
Total	100.0	100.0	100.0	
R&D	68.9	63.5	60.6	
RSA	31.1	36.5	39.4	

SOURCE: Statistics Canada, Federal Survey
(see Data Notes in Appendix).

- (1) The expenditures include a small proportion of non-program costs. The proportion is estimated to have been about 7 percent of total expenditures, and appears to have been fairly constant since the beginning of the decade (see Appendix Table A-10).
- (2) Average annual compound growth rate.
- (3) R&D Research and Development
RSA Related Scientific Activities

Table 1 indicates that total expenditures have risen from some \$815.7 million in 1970-71 to an estimated \$1,724.2 million in the current fiscal year (1976-77). This represents a compound annual growth rate of 11.1 percent, in nominal terms. However, the GNE Implicit price index rose at an average annual rate of 8.5 percent over the same period of time, suggesting that the real growth rate was in the neighbourhood of 2.5 percent. A more suitable deflator might be the price index for science expenditures¹, which rose at an annual rate of 9.5 percent. If this index is used, the real growth rate of the above-cited science expenditures was about 1.6 percent annually.

The expenditures include a small proportion of non-program costs (amounting to about 7 percent of total over the period since 1970-71). Such costs cannot be readily separated from program costs at a finer level of disaggregation than total expenditures. Exclusion of non-program costs from those aggregates where it is possible to make the adjustment, however, does not change the growth rates presented here (see Appendix Table A-10).

The financing of Related Scientific Activities rose considerably faster than the financing of Research and Development, with the consequence that since the beginning of the current decade the proportion of R and D dropped from 68.9 percent in 1970-71 to 60.6 percent in 1976-77.

1. See Appendix E for a discussion of the science expenditures price deflator.

Recent trends in the federal expenditures in Human vs Natural (including Health) science activities are illustrated in Table 2. The expenditures in the Human Sciences have become relatively more important, arising from 15.3 percent of the total in 1970-71 to 25.2 percent in 1976-77. Part of this rise, however, can be accounted for by the progressive extension of the Federal Survey to include more departments and agencies whose expenditures are primarily or exclusively in the domain of the Human Sciences.

TABLE 2
FEDERAL FINANCING OF SCIENTIFIC ACTIVITIES,
BY HUMAN AND NATURAL SCIENCES¹⁾

	<u>1970-71</u>	<u>1974-75</u>	<u>1976-77</u>	<u>Change²⁾</u>
	(\$ Million)			(Percent)
Total	915.7	1,352.4	1,724.2	11.1
Human Sciences	140.4	298.8	433.7	20.7
Natural Sciences ³⁾	775.2	1,053.7	1,290.6	8.9
(Percentage Distribution)				
Total	100.0	100.0	100.0	
Human Sciences	15.3	22.1	25.2	
Natural Sciences ³⁾	84.7	77.9	74.8	

SOURCE: See Data Notes in Appendix.

- 1) The expenditures include a small proportion of non-program costs. The proportion is estimated to have been about 7 percent of total expenditures, and appears to have been fairly constant since the beginning of the decade (see Appendix Table A-10).
- 2) Average annual compound growth rate, 1970-71 to 1976-77.
- 3) Natural Sciences include the basic and applied natural sciences, and the health sciences.

Still at the level of total scientific activity, the proportion of such activities carried out by various classes of "performers" have changed considerably during the past several years. Table 3 summarizes these shifts since the beginning of the 1970's.

TABLE 3
FEDERAL FINANCING OF SCIENTIFIC ACTIVITIES
BY PERFORMER⁽¹⁾

	<u>1970-71</u>	<u>1974-75</u>	<u>1976-77</u>	<u>Change</u> ⁽²⁾
		(\$ Million)		(Percent)
Total	915.7	1,352.4	1,724.2	11.1
Intramural	589.5	907.1	1,180.6	12.3
Extramural	326.2	445.4	543.6	8.9
Business Enterprises	151.2	179.5	213.2	5.9
Canadian Universities	142.4	175.7	206.5	6.4
Canadian Non-Profit Institutions	15.6	13.2	16.9	1.3
Provincial and Municipal Governments	1.2	8.5	9.2	40.4
Other Canadian Performers ⁽³⁾	1.9	8.3	11.0	34.0
Foreign Performers ⁽⁴⁾	13.8	60.1	86.9	35.9
(Percentage Distribution)				
Total	100.0	100.0	100.0	
Intramural	64.4	67.1	68.5	
Extramural	35.6	32.9	31.5	
Business Enterprises	16.5	13.3	12.4	
Canadian Universities	15.6	13.0	12.0	
Canadian Non-Profit Institutions	1.7	1.0	1.0	
Provincial and Municipal Governments	0.1	0.6	0.5	
Other Canadian Performers	0.2	0.6	0.6	
Foreign Performers	1.5	4.4	5.0	

SOURCE: See Data Notes in Appendix.

- (1) The expenditures include a small proportion of non-program costs. The proportion is estimated to have been about 7 percent of total expenditures, and appears to have been fairly constant since the beginning of the decade (see Appendix Table A-10).
- (2) Annual compound growth rate, 1970-71 to 1976-77.
- (3) Other Canadian Performers include provincial research councils and foundations, and individuals not working in any other sector.
- (4) Foreign Performers are composed of foreign governments, companies (including foreign subsidiaries of Canadian firms), non-resident foreign nationals and Canadians studying or teaching abroad. The bulk of the funds is disbursed through CIDA and IDRC (see Appendix Table A-11 for a breakdown of such expenditures, for the year 1976-77).

This table (Table 3) shows that, first, there has been a considerable shift towards intramural expenditures on scientific activities since the beginning of the decade. The intramural share rose from 64.4 percent in 1970-71 to 68.5 percent in 1976-77, considering all federally-financed scientific activities. While the funds to Canadian business enterprises and universities continued to grow in absolute size, their shares in total declined: that for Canadian business enterprises fell from 16.5 percent to 12.4 percent, and that for Canadian universities from 15.6 to 12.0 percent. Some of the reduction in shares of the Canadian Universities and Business Enterprises were accompanied by a sharp rise in funds to foreign performers who increased their share from 1.5 to 5.0 percent over this period.

The various federal departments and agencies appear to have retained their relative importance in contributing to the total of expenditures on scientific activities since the early 1970's. Table 4 shows total expenditures by source. According to this table, the Federal Departments are responsible for roughly four-fifths of the total, and this proportion has fluctuated, in both directions, only slightly over the past few years. The share of the Councils went down somewhat, but then rose somewhat, due to a rise in the share of the NRC¹. The share of the MRC has dropped from 3.8 percent in 1970-71 to 2.9 percent² in 1976-77. The Canada Council

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1. Part of this rise reflects the transfer of some \$8 million from the AECB to the NRC, for the TRIUMF project.
 2. This does not include a special \$2 million grant by Health and Welfare Canada in the spring of 1976, which would bring the percentage of MRC funds in total to 3.0 percent for 1976-77, instead of the 2.9 percent shown here.

share seems to have levelled off at just below 2 percent (note that this applies only to funds provided by the Federal Government).

In considering the differences in expenditures to intramural and extramural performers, it should be noted that intramural expenditures include the costs of administering the scientific activities as well as salaries for principal investigators. These costs are also paid for scientific activities performed under contract for the Federal Government. Therefore, any difference in the growth rates of price increases in salary and non-salary components can have an effect on the comparisons of intramural and extramural expenditures.

TABLE 4

FEDERAL EXPENDITURES ON SCIENTIFIC ACTIVITIES,
FINANCED BY FEDERAL DEPARTMENTS AND COUNCILS

	<u>1970-71</u>	<u>1974-75</u>	<u>1976-77</u>	<u>Change</u> ⁽²⁾
		(\$ Million)		(Percent)
Total	915.7	1,352.4	1,724.2	11.1
Federal Departments	729.1	1,117.8	1,405.9	11.6
Research Councils	186.6	234.6	318.3	9.3
Canada Council	20.1	25.1	32.4	8.3
NRC Total ⁽³⁾	132.0	165.7	235.6	10.1
(Intramural)	59.5	77.1	101.9	9.4
(Universities)	61.7	66.2	88.5	6.2
(All Other Extramural)	10.8	22.4	45.2	26.9
MRC	34.5	43.8	50.2	6.5

(Percentage Distribution)

Total	100.0	100.0	100.0
Federal Departments	79.6	82.6	81.5
Research Councils	20.4	17.4	18.5
Canada Council	2.2	1.9	1.9
NRC Total	14.4	12.3	13.7
MRC	3.8	3.2	2.9

SOURCE: See Data Notes in Appendix.

- (1) The expenditures include a small proportion of non-program costs. The proportion is estimated to have been about 7 percent of total expenditures, and appears to have been fairly constant since the beginning of the decade (see Appendix Table A-10).
- (2) Annual compound growth rate.
- (3) The NRC expenditures relate to spending on research intramurally (i.e., in NRC laboratories), and grants to extramural performers such as universities and others.

The sponsoring departments and granting councils support scientific activities by intramural as well as extramural performers, in varying proportions. For example, in the estimates for 1976-77, the federal departments are sponsoring a total of \$1,405.9 million in scientific activities, of which \$1,075 million are performed intramurally, and the remainder extramurally. Of the latter amount, \$46.2 million is paid to universities, and \$284.8 million to other extramural performers, such as Canadian business enterprises, non-profit organizations, etc. The MRC and the Canada Council sponsor virtually no intramural scientific activities. In fact, the bulk of their financing is directed at the university sector. The NRC, however, provides some \$101.9 million of its \$235.6 million total to intramural activities, and \$45.2 million to extramural non-university performers. The NRC is sponsoring some \$88.5 million of scientific activities in the universities. (The allocation of the various sponsors' funds by performer for the year 1976-77 are shown in Table 4a).

TABLE 4a

FEDERAL EXPENDITURES ON SCIENTIFIC ACTIVITIES,

SPONSOR BY PERFORMER, 1976-77

	<u>Total, All Performers</u>	<u>Intramural Performers</u>	<u>Extramural Performers</u>	
			<u>Universities</u>	<u>All Other</u>
			(\$ Million)	
Total, all sponsors	1724.2	1180.6	206.5	337.1
Federal Departments	1405.9	1075.0	46.2	284.8
Research Councils	318.3	105.6	160.3	52.3
Canada Council	32.4	2.3	25.5	4.6
NRC	235.6	101.9	88.5	45.2
MRC	50.2	1.4	46.3	2.5

SOURCE: See Data Notes in Appendix.

2. Universities

While this report concentrates on the analysis of the years since 1970-71, it is essential to provide perspective on the growth and sources of funds paid to universities in aid of research since the beginning of the 1960's. The decade of the 1960's witnessed very considerable expansions of the Canadian university establishment, in enrolment, faculty, financing, construction, diversification, and many other aspects. Ignoring what happened to research funding in the 1960's would seriously hamper understanding the trends since the beginning of the current decade. For example, in 1963-64, federal government expenditures on natural science activities to universities amounted to \$22.7 million. By 1969-70, such expenditures had risen to \$122.1 million, at an annual average growth rate of over 32 percent¹. (This is in nominal terms. The GNE implicit price index rose at an average annual rate of 3.7 percent over the same time, suggesting that the real growth rate of federal university research financing in the Natural Sciences was over 28 percent per year. The price index for science expenditures², a more suitable price indicator for this purpose, rose by 5.9 percent per year, suggesting a real growth rate on this basis of some 26 percent per year.) The sponsorship of this rapidly-growing area of financing was shared in equal terms between the federal departments and agencies, and the granting councils.

Unfortunately, except for expenditures by the Canada Council, expenditures in the social sciences and humanities were not surveyed until 1970-71. In that year, federal expenditures on human sciences to universities, sponsored by all sources, amounted to \$19.2 million.

1. It should be noted that the high growth rate of the 1960's shadowed even that of the 1950's, which is estimated at over 17 percent per annum in nominal (and 13-14 percent in real) terms (for the period 1951-52 to 1961-62 based on Glassco Commission data).

2. See Appendix E.

TABLE 4b

PERCENTAGE DISTRIBUTION OF EXPENDITURES ON RESEARCH
AND DEVELOPMENT TO CANADIAN UNIVERSITIES,
BY FEDERAL, PROVINCIAL AND OTHER SOURCES

	<u>Federal Government</u>				<u>Other</u>	<u>Total</u> ¹⁾
	<u>Total</u>	<u>Federal Departments</u>	<u>Research Councils</u>	<u>Provincial Governments</u>		
	(Percentage Distribution)					
1963-64	59.0			5.0	36.0	100.0
1964-65	57.3			14.9	27.8	100.0
1965-66	60.4			15.0	24.6	100.0
1966-67	64.6			14.6	20.9	100.0
1967-68	69.9			14.0	16.1	100.0
1968-69	70.8			14.3	14.9	100.0
1969-70	77.9			7.5	14.6	100.0
1970-71	77.1	21.8	55.3	8.2	14.7	100.0
1971-72	74.0	22.1	51.9	6.8	19.1	100.0
1972-73	70.7	19.2	51.5	9.7	19.6	100.0
1973-74	68.7	18.4	50.3	12.6	18.7	100.0
1974-75	64.4	17.8	46.6	13.4	22.1	100.0

SOURCE: Data for Research Councils and Federal Departments are based on Statistics Canada, Survey of Federal Government Activities in the Natural and Human Sciences, 1976 Survey.

Data for Provinces and Other sources are based on Financial Statistics of Universities and Colleges, prepared by Statistics Canada for the Canadian Association of University Business Officers. Such data exclude some financial awards to individuals enrolled at a university.

1) See Table 4c for estimates in terms of dollars.

TABLE 4c

EXPENDITURES ON RESEARCH AND DEVELOPMENT TO
CANADIAN UNIVERSITIES BY FEDERAL,
PROVINCIAL AND OTHER SOURCES

	<u>Research Councils</u>	<u>Federal Departments</u>	<u>Provinces</u>	<u>Other</u>	<u>Total</u>
	(\$ Million)				
1970-71	88.6	34.9	13.2	23.4	160.1
1971-72	92.9	39.6	12.2	34.2	178.9
1972-73	98.3	36.6	18.6	37.5	191.0
1973-74	104.6	38.2	26.1	38.9	207.8
1974-75	109.1	41.7	31.4	51.7	233.9

AVERAGE ANNUAL GROWTH RATE,

1970-71 to 1974-75

	5.3	4.6	24.2	21.9	9.9
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SOURCE: Data for Research Councils and Federal Departments are based on Statistics Canada, Survey of Federal Government Activities in the Natural and Human Sciences, 1976 Survey.

Data for Provinces and Other sources are based on Financial Statistics of Universities and Colleges, prepared by Statistics Canada for the Canadian Association of University Business Officers.

This report is basically concerned with the federal role in the financing of scientific activities in the universities. However, since the universities receive funds for the same purpose from other sources as well, the current federal role is better understood in the longer-term perspective of the changes in the relative importance of non-federal funds.

As indicated in Table 4b, there have been considerable changes in the proportions contributed to university R&D by the different sources. (It should be noted that information on non-federal sources is readily comparable only for R&D expenditures¹, which are, however, the largest component in total expenditures on scientific activities.) The non-federal share fell during the 1960's, to reach a low point around 1970 when the provincial and other shares together accounted for about 22-23 percent. This compares with a share of over 42 percent in 1964-65 (14.9 percent provincial and 27.8 other sources, including foundations, universities, municipal governments, and other private organizations). Thus, between the early 1960's and the beginning of the 1970's, the federal share had risen from about 57 percent to over 77 percent of total sponsored university R&D expenditures. Since then, in more recent years, the federal proportion has declined, reaching about 64 percent in 1974-75. The provincial share in the same year was 13.4 percent, and that of the other sources 22.1 percent.

1. The source and definitions of the data for non-federal grants are based on CAUBO records.

Since the beginning of the current decade, such R&D financing from all sources has risen about 9.9 percent per year, barely keeping pace with inflation over this period. The maintenance of the R&D funds at a more or less constant level in terms of real spending power was achieved by the provinces and other sponsors stepping up their grants. Table 4c shows that for the period 1970-71 to 1974-75, the annual growth in expenditures in nominal terms, was 5.3 percent for the granting councils, and 4.6 percent for the federal departments and agencies. This compares with an annual growth of 24.2 and 21.9 percent for the provinces and the other sources.

The period since the beginning of the decade has been one of retrenchment in the growth of federal science expenditures to universities: they have increased from \$142.4 million in 1970-71 to an estimated \$206.5 million in 1976-77, at a compound annual growth rate of 6.4 percent, compared with the rate on all federal science expenditures of 11.1 percent. Thus, as noted above, the share of expenditures going directly to the universities has declined considerably (see Table 3 above). If inflation is taken into account, the increase in funds to the universities in current dollars did not match the increase in inflation over that period. However, about half the university operating costs, and thereby presumably also half the cost of administration of research in universities and the costs of the

salaries of the principal investigators, paid from operating grants to universities from the provinces, is reimbursed to the provinces by the Federal Government in the form of post-secondary fiscal transfers. These transfers have grown, since 1970-71, at an average annual rate of over 14 percent.

The composition of the expenditures has changed since the beginning of the decade. The various components of spending on the universities are given in Table 5.

TABLE 5

FEDERAL EXPENDITURES ON SCIENTIFIC ACTIVITIES IN CANADIAN
UNIVERSITIES - HUMAN AND NATURAL SCIENCES⁽¹⁾

	<u>1970-71</u>	<u>1974-75</u>	<u>1976-77</u>	<u>Change</u> ⁽²⁾
		(\$ Million)		(Percent)
Total	142.4	175.5	206.5	6.4
R&D	123.5	150.8	174.2	5.9
Contracts	n.a.	7.6	10.3	n.a.
Grants	n.a.	135.6	155.3	n.a.
Fellowships	n.a.	7.6	8.6	n.a.
RSA	18.9	24.9	32.2	9.3
Education Support	17.7	19.4	25.5	6.3
Other RSA	1.3	5.4	6.7	31.4

SOURCE: Statistics Canada, Federal Survey (for details, see footnote 1, page 2).

(1) These are expenditures sponsored by federal departments and agencies, and the granting councils. The "Total" line of this table is equal to the line "Canadian Universities" in Table 3 above. (Appendix Tables A-1 and A-2 provide a split of this table into Human and Natural Sciences.)

(2) Average annual compound growth rate.

It is evident that expenditures on R&D have grown even less than the total for universities. The compound growth rate for R&D over the period amounts to only 5.9 percent. This is accounted for by the small increases in R&D for Natural Sciences. (Reference was made earlier to the overall drop in the share going to the Natural Sciences, and to the diminution of the relative importance of the MRC, for example).

Ultimately, it will have to be determined if the level and the distribution of the funds provided for scientific activities have been consistent with the underlying requirements. This question must also be posed in relation to expenditures on scientific activity by the universities. The analysis presented here has a more limited scope than attempting to provide answers to such fundamental questions. Initially, the growth and composition of university science expenditures is analysed with respect to more immediate (and partial) indicators such as the relative importance of the university establishment. For this purpose, the expenditures are related to enrolments and faculty. Later, a regional analysis is also presented, as well as a more detailed review of the activities of the various sponsoring agencies.

As noted above, federal expenditures on university science have risen by some 6.4 percent per year since the beginning of the decade. This occurred at a time when there was a retrenchment in the growth rate at the graduate levels of enrolment (although the growth of faculty over this period does

not appear to have been impaired)¹. Table 6 relates expenditures to some university-related factors, such as enrolment and faculty, for the years 1970-71 to 1975-76.

The data indicate that for the four-year period 1970-71 to 1974-75, expenditures to the universities for research and related activities rose an average of about 5.4 percent per year², or substantially less than the rate of inflation. Over this four-year period, undergraduate enrolment rose 3.0 percent per annum, graduate enrolment changed very little, but faculty increased by 5.2 percent per annum. Thus there was some decline in the undergraduate student/professor ratio, and a significant decline in the graduate student/professor ratio. Federal science support per graduate student rose in nominal terms, by an average of about 5.6 percent per year, but fell in terms of purchasing power. Such support for faculty remained constant in nominal terms, but declined significantly in terms of purchasing power. It should be noted that only a certain proportion of the faculty is actually engaged in federally-supported scientific activities. The fact that the index of funds per faculty has remained virtually constant at the 1970-71 level does therefore not necessarily mean that those professors who were successful in their applications for funds were actually held at the 1970-71 level. This aspect will be examined below, in the discussion of the relationship between faculty, applicants and awards by the NRC and the Canada Council.

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1. It should be noted that the data regarding faculty and enrolment trends are not quite as up-to-date as the data regarding the federal expenditures, thanks to the 1976 Survey.
 2. The increase for the six-year period 1970-71 to 1976-77 is estimated to 6.4 percent, due to some acceleration in expenditures during the last two fiscal years.

TABLE 6

UNIVERSITIES: FEDERALLY SUPPORTED SCIENCE EXPENDITURES,
GRADUATE ENROLMENT, AND FACULTY

	<u>1970-71</u>	<u>1971-72</u>	<u>1972-73</u>	<u>1973-74</u>	<u>1974-75</u>	Change (1) 1970-71 to <u>1974-75</u> (Percent)
Expenditures (\$ Million)	142.4	151.4	156.1	166.5	175.7	5.4
Undergraduate Enrolment (FT)	274,963	286,821	285,158	295,553	309,575	3.0
Graduate Enrolment (FT)	30,686	30,923	28,862	29,281	30,441	-0.2
Graduate Enrolment (FTE)	34,946	36,027	34,654	35,885	37,282	1.6
Faculty	23,830	26,286	26,854	27,731	29,214	5.2
Expenditure per Graduate (FT)	100.0	105.5	116.5	122.5	124.4	5.6
Expenditure per Graduate (FTE)	100.0	103.1	110.6	113.9	115.7	3.7
Expenditure per Faculty	100.0	96.4	97.3	100.5	100.6	0.2
Undergraduate per Faculty	11.54	10.91	10.63	10.66	10.60	
Graduate per Faculty (FT)	1.29	1.18	1.07	1.06	1.04	
Graduate per Faculty (FTE)	1.47	1.37	1.29	1.29	1.28	

(1) Average annual compound growth rate.

SOURCE: Expenditure data based on 1976 Survey. Enrolment data: Statistics Canada, Education Division

NOTE: FT: full-time

FTE: Full-time equivalent (i.e. three part-time students are assumed to be the equivalent of one full-time student).

3. Regional Aspects

Of all the influences that shape the regional importance of university life, very few can be cited in statistical form. Nevertheless, in view of the analytic importance of the regional dimension of expenditures to universities by the federal government, an attempt is made to portray at least a partial picture, in the hope that this will provide some insight.

To give some idea regarding the relative impact of the university establishment in the various regions, a few relevant factors are summarized in Table 7.

TABLE 7

REGIONAL DISTRIBUTIONS OF POPULATION; UNIVERSITY ENROLMENT, AND
FEDERAL EXPENDITURES ON SCIENTIFIC
ACTIVITIES TO UNIVERSITIES.

		(1974-75)			
	<u>Canada</u>	<u>Atl</u>	<u>Que</u>	<u>Ont</u>	<u>West</u>
	(Percentage Distribution)				
Expenditures (St. C. Survey)	100.0	6.9	25.7	37.0	30.4
Expenditures (CAUBO)	100.0	6.0	26.2	40.0	27.8
Population - Total (1974)	100.0	9.5	27.3	36.1	27.1
Population - 20-24 (1974)	100.0	9.9	28.7	34.9	26.5
Total Enrolment (FT) ¹⁾	100.0	10.1	20.3	43.1	26.5
Graduate Enrolment (FT)	100.0	6.5	27.0	43.0	23.4
Graduate Enrolment (FTE)	100.0	6.1	28.1	43.3	22.4
Faculty (FT) (1973-74)	100.0	11.3	22.0	40.6	26.1

1) Undergraduate and graduate full-time enrolment

SOURCE: Expenditures - Tables B-7 and B-8
Population - St. C., Intercensal Estimates for 1974
Enrolment and Faculty - St. C., Education Division; Tables B-9,
B-10, and B-11.

The table shows that while most elements in this regional array appear to be in some proportionate balance, there are some interesting exceptions¹. Reading the columns vertically, the Atlantic Provinces' share of expenditures and graduate enrolment seems to be low in relation to such factors as university-age population, undergraduate enrolment and faculty, whereas the opposite holds for Ontario. The relatively high number of faculty and undergraduate enrolment reflect the small university, liberal arts traditions of the Atlantic region (see Table 20 below for the proportions of faculty in the Humanities and Social Sciences). Assuming that the proportions of first degree graduates who continue on to graduate study is the same as for other regions, then it is apparent that the Atlantic region's students go elsewhere in significant numbers for their graduate work.

The relatively low share for total full-time university enrolment in Quebec is influenced by the institutional structure of that province, in that the CEGEP provide more or less the first two years of undergraduate training. Part-time study appears to be relatively somewhat more popular in Quebec than in the other regions, particular the Atlantic region and the West.

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1. Admittedly, this is a subjective assessment, because there is no absolute standard of what would constitute a perfect regional balance.
 2. Of 17 degree-granting institutions in the Atlantic region, only 3 offer doctorates in a full range of disciplines. These three enrol approximately 60 percent of all university students in the region. Another four, enrolling an additional 20 percent, offer masters' programs in a range of disciplines. Further, the higher proportion of faculty in the humanities and social sciences (see Table B-13 in Appendix B) also reflects the liberal arts tradition and would tend to reduce the competition for NRC funds accordingly.

The attempt to analyse the regional distribution of the expenditures is soon frustrated by the realization that the "Federal Survey" does not provide suitably-detailed disaggregations prior to 1973-74¹. For analysis of earlier years, it is necessary to resort to CAUBO data, which, unlike data from the Federal Survey, do not contain financial grants paid to individuals. A comparison for two overlapping years of the two sets of regional expenditure data is given in Table 8.

TABLE 8

REGIONAL DISTRIBUTION OF FEDERAL EXPENDITURES ON
SCIENTIFIC ACTIVITIES TO UNIVERSITIES

	<u>Atl</u>	<u>Que</u>	<u>Ont</u>	<u>West</u>	<u>Canada</u>
	(Percentage Distribution)				
<u>CAUBO Data</u>					
1971-72	5.2	25.5	39.0	30.2	100.0
1972-73	5.5	27.1	38.2	29.2	100.0
1973-74	5.8	26.9	38.4	28.8	100.0
1974-75	6.0	26.2	40.0	27.8	100.0
<u>Federal Survey</u>					
1971-72	n.a.	n.a.	n.a.	n.a.	n.a.
1972-73	n.a.	n.a.	n.a.	n.a.	n.a.
1973-74	7.0	27.2	39.1	26.7	100.0
1974-75	6.9	25.7	37.0	30.4	100.0

SOURCE: Tables B-7 and B-8.

1. While there is a regional breakdown for 1972-73 for the three councils, as shown in Table A-4, there is no regional information on the departments and agencies.

Superficially, the two sets of data appear to have a similar regional pattern, at least at the aggregate level. But this is probably not too useful, since detailed differences may be offsetting each other, thereby hiding some interesting insights. (For example, a comparison for the Canada Council indicates very poor similarity in the regional pattern for the two sources -- see Tables B-7 and B-8 in Appendix B. The omitted expenditures, namely amounts paid directly to individuals, appear to be subject to a different regional pattern, yet they are a much larger proportion of the Canada Council's disbursements to universities than is the case for the other Councils and Agencies.)

4. The Councils and Agencies - Overview

The three Granting Councils, the National Research Council, through its Office of Grants and Scholarships, the Medical Research Council and the Canada Council, are the main agents of the Federal Government for the funding of university research. Other departments and agencies also contribute within the limits of their statutory responsibilities.

Table 4 given earlier in this review provides an overview of the relative contributions of the councils and agencies to total federal expenditures on scientific activities. A closer look at the Councils' and Agencies' involvement with the University sector is provided in the subsequent discussion.

Table 10 indicates that the share of support going to the Human Sciences in the universities has risen from 13.5 percent in 1970-71 to 21.1 percent in 1976-77. The increase is accounted for in almost equal measure by the federal departments and agencies on the one hand, and the Canada Council on the other. The decline in the share going to the Natural Sciences over this time period is also evident in the falling shares by the federal departments and the NRC.

The federal departments' share of total contributions to the Natural Sciences fell from 19.2 to 13.6 percent, and that of the NRC from 45.2 to 42.9 percent. It should be noted that these distributions are affected by the transfer in 1976-77 fiscal year of the \$8.4 million from the AECB to the NRC, for the TRIUMF project. Without this transfer, the decline in the NRC share would have been even greater (to 38.7 percent).

TABLE 10

FEDERAL EXPENDITURES ON SCIENTIFIC ACTIVITIES TO UNIVERSITIES,

BY COUNCILS AND DEPARTMENTS

HUMAN VS NATURAL SCIENCES

	<u>1970-71</u>	<u>1974-75</u>	<u>1976-77</u>	Change ⁽³⁾ <u>1970-71 to</u> <u>1976-77</u>
	(\$ Million)			(Percent)
Total	142.4	175.7	206.5	6.4
Human Sciences	19.2	32.8	43.6	14.6
Natural Sciences	123.2	142.9	162.9	4.8
Federal Departments	37.0	50.2	46.2	3.8
Human Sciences	5.5	13.9	18.1	22.0
Natural Sciences	31.5	36.3	28.1(1)	- 1.9
Councils	105.4	125.5	160.3	7.2
Canada Council	13.7	18.9	25.5	10.9
NRC	61.7	66.2	88.5(1)	6.2
MRC	31.5	40.4	46.3(2)	6.6

(Percentage Distribution)

Total	100.0	100.0	100.0
Human Sciences	13.5	18.7	21.1
Natural Sciences	86.5	81.3	78.9
Federal Departments	26.1	28.6	22.4
Human Sciences	3.9	7.9	8.8
Natural Sciences	22.2	20.7	13.6
Councils	74.0	71.4	77.6
Canada Council	9.6	10.8	12.3
NRC	43.3	37.7	42.9
MRC	21.1	23.0	22.4

SOURCE: Statistics Canada, Federal Survey (for details, see footnote 1, page 2).

(1) An amount of \$8.4 million was transferred from AECB to NRC in 1976-77, for the TRIUMF project. (The growth rate for the Federal Departments including the TRIUMF project would have been 2.5 percent, instead of the 1.9 percent after the transfer. Similarly, without this transfer, the growth rate for the NRC would have been 4.4 percent without the transfer, instead of the 6.2 percent with the transfer.)

(2) Excludes the addition of \$2 million in May, 1976

The Federal Survey (1976) also provides some details on the R&D and Education Support to Universities, by source. This information is available starting with the fiscal year 1974-75. The main features of this information are summarized in Table 11.

TABLE 11

FEDERAL EXPENDITURES ON SCIENTIFIC ACTIVITIES TO UNIVERSITIES
BY COUNCILS AND DEPARTMENTS
R&D, AND EDUCATION SUPPORT

	<u>1974-75</u>	<u>1976-77</u>
	(\$ Million)	
• Total	175.7	206.5
R&D	150.8	174.2
RSA	24.9	32.3
Education Support ⁽¹⁾	19.4	25.5
Federal Departments	50.2	46.2
R&D	41.7	34.2
RSA	8.5	12.0
Education Support	5.3	7.5
Councils	125.5	160.3
R&D	109.1	140.0
RSA	16.4	20.3
Education Support	14.1	18.0

(1) Education support is the major component of Related Scientific Activities (RSA). It is defined as grants to individuals or institutions intended to support the advanced education of students beyond the Bachelor's degree level.

According to this information, the Councils allocate about 11 percent of their funds that go to universities for the purpose of education support, and most of the remainder to R&D. As will be seen below this split varies by council. The departments allocate about the same proportion to R&D and Education Support as do the Councils taken together.

A further breakdown of the information in Table 11, relating to the Councils, is provided in Table 12.

TABLE 12

FEDERAL EXPENDITURES ON SCIENTIFIC
ACTIVITIES IN CANADIAN UNIVERSITIES
R&D AND EDUCATION SUPPORT BY COUNCIL

	<u>1974-75</u>	<u>1976-77</u>
	(\$ Million)	
Canada Council - Total	18.9	25.5
R&D	10.5	15.4
Education Support	6.4	8.1
Other RSA	2.0	2.0
NRC - Total	66.2	88.2
R&D	59.5	79.6
Education Support	6.7	8.6
MRC - Total	40.4	46.3
R&D	39.0	45.1
Education Support	1.1	1.0
Other RSA	0.3	0.2

SOURCE: Statistics Canada, Federal Survey (for details, see footnote 1, page 2).

According to this table, the largest contributor to university scientific activity is the NRC (with 42.7 percent in 1976-77). The MRC, the federal departments, and the Canada Council rank in that order. Education support varies considerably in importance within each Agencies' expenditures. For example, this item constitutes about one-third of the Canada Council expenditures to the universities, but only about 10 percent of the budget of the NRC. The structure of medical research is such that education support, as defined and shown in Table 12, requires a relatively smaller share of the MRC budget¹.

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1. The data described here are based on definitions used in the Federal Survey by Statistics Canada. Education support in that Survey includes grants to individuals or institutions intended to support the advanced education of students beyond the Bachelor's degree level. However, the MRC also provides first professional degree graduates in medicine, dentistry, and veterinary science with support for training in research methods. Also, the MRC provides assistance to qualified Ph.D.s with degrees in either fields of study, for research training in clinical research. In a wider sense, this is also a form of education support. In 1974-75, the MRC spent some \$2.1 million, or 5.2 percent of its total expenditures to the universities, on such special training. This was in addition to the \$1.1 million on strictly-defined education support, as defined in the Statistics Canada survey.

5. The National Research Council

In the current fiscal year (1976-77), the NRC, through its office of Grants and Scholarships, is paying some \$88.5 million to the universities in aid of scientific activities. Such NRC support grew by 6.2 percent per year since 1970-71, when it amounted to \$61.7. This section of the review examines a number of dimensions of these NRC expenditures to the universities, such as regional aspects, education support, and distribution by field of study.

i) Regional Aspects

The regional distribution of expenditures appears to be governed by the pattern of applications which, in turn, may or may not closely resemble the underlying patterns of such closely-related factors as faculty and graduate enrolments, or such indirectly-related factors as population. The NRC, in an analysis¹ of its regional spending notes that in its attempt to provide a regional balance in its program, it has to bear two factors in mind: "1) NRC can award grants only if they are applied for; and 2) it would be injurious in the long run to support poor research, and so standards of excellence must be independent of regional, linguistic or cultural considerations." In that study, the authors found that the applicants to the various programs operated by the NRC define the "potential research community" available for carrying on research with NRC support. There are significant differences between the regional distribution of population and

1. NRC, "Analysis of Some Aspects of the Program of Scholarships and Grants-in-Aid of Research", (mimeo.), Ottawa, August 31, 1973.

S. Peitchinis (Financing Post-Secondary Education in Canada, Calgary, 1971) also has a regional analysis of the councils, but it is very brief, with no more than general conclusions about the regional aspects.

the regional distribution of the research community, as shown by the authors in the following table (Table 13):

TABLE 13

NUMBER OF APPLICANTS FOR NRC OPERATING GRANTS,
PER 10,000 POPULATION

	<u>1970-71</u>	<u>1971-72</u>	<u>1972-73</u>
Atl	2.07	2.39	2.39
Que	1.62	1.68	1.70
Ont	2.86	2.99	2.99
West	2.89	3.02	3.02
Canada	2.44	2.57	2.58

SOURCE: NRC, op.cit, p.22

The number of applicants in relation to the population is substantially higher in the Western provinces and in Ontario than in Quebec and the Atlantic provinces. These differences are largely symptomatic of a range of historical and other factors that have shaped the regional pattern of the Canadian University establishment. In assessing the regional distribution NRC funds, therefore, these underlying differences must be kept in mind.

The latest year for which information on the regional distribution of applicants for NRC funds is available (at the time of writing this report¹) is 1972-73, which also happens to be the first year for which there is a regional distribution of NRC expenditures from the Federal Survey. For this reason, 1972-73 is the only recent year for which regional funds, faculty, as well as applicants can be compared.

TABLE 14
DISTRIBUTION OF NRC FUNDS, AND VARIOUS
REGIONAL INDICATORS, 1972-73

	<u>Population</u> (1971 Census)	<u>Nat. Sciences</u> <u>Faculty</u> FT	<u>Natural Sciences</u> <u>Graduate</u> <u>Enrolment</u> FT FTE		<u>Applicants</u>	<u>Funds</u> ⁽¹⁾
		(Percentage Distribution)				
Atl	9.6	10.9	6.8	6.5	8.9	6.7
Que	28.0	23.8	19.4	20.9	18.4	20.3
Ont	35.8	37.1	41.3	41.6	41.5	44.0
West	26.6	28.2	32.6	31.0	31.2	29.0
Canada	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Faculty, Enrolment, and Funds: Appendix Tables B-8, B-9, B-10, and B-11

Applicants -- NRC, op. cit., p.21.

(1) Funds include NRC expenditures to universities on R&D and RSA, amounting to \$63.8 million. The regional distributions for R&D funds alone, excluding scholarships, etc., is approximately the same as the distribution used in this table.

1. NRC are in the process of tabulating more up-to-date data on applicants by region.

Table 14 shows that Ontario and the Western Provinces have the highest number of faculty as well as the highest proportion of applicants and grants per population. While the Atlantic provinces also have a relatively high faculty-to-population ratio, their share of applicants is less than one would expect on the basis of faculty, and grants are disproportionately low, in relation to population, faculty and applications. Quebec receives a higher share of funds than expected on the basis of applicants, however, both faculty and applicants are lower, compared in per capita terms, in relation to the other regions.

Additional insight into these regional differences is gained by comparing the number of applicants for NRC funds with the natural sciences faculty (see Table 15).

TABLE 15

APPLICANTS FOR NRC GRANTS, AND NATURAL
SCIENCE FACULTY, 1972-73

	<u>Natural Sciences Faculty</u>	<u>Applicants NRC Grants</u>	<u>Ratio of Applicants to Faculty</u>
	(Number)	(Number)	(Percent)
Atlantic	864	492	56.9
Quebec	1887	1022	54.2
Ontario	2944	2305	78.3
West	2235	1730	77.4
Canada	7930	5549	70.0

SOURCE: Faculty - Appendix Table A-7
Applicants - NRC, op.cit., p.21

Considerably smaller proportions of faculty members appear to be applying for NRC funds in the Atlantic region and Quebec than in Ontario and the West. This appears to be another of the principal reasons explaining the regional differences in the disbursements of NRC grants.

ii) Research Training

A special tabulation by the NRC, attached in Appendix C, presents an analysis of NRC expenditures (total NRC vote) over the period 1970-71 to 1975-76. This material indicates that while the overall proportion of direct training expenditures has remained fairly stable, the share for post-graduate students has been declining, and the share for post-doctoral recipients has been rising sharply. For example, since 1970-71, the share of funds going to post-doctorates has risen from 1.8 percent to 4.1 percent in 1975-76, and that for post-graduates has declined from 12.7 to 10.8 percent (see table 16, lines 1 and 2). The rise in the share of funds to post-doctorates is the result of a combination of rising numbers (from 205 to 245 annual awards over this period) and rising stipends per award (from \$5512 to \$9796, a rise of 78 percent). By comparison, the number of post-graduate awards has declined from 2337 to 1760 per year, while the size of the stipend per post-graduate award has risen only 38 percent (from \$3522 to \$4847). (See Table C-4 in Appendix C.)

The current practice in Canadian universities is to employ graduate students in research projects. It has been argued that, if not the total, then at least a sizeable proportion of the amount paid to such students in

the form of salaries constitutes research training. Analysis of the NRC data indicates that a substantial proportion of peer-adjudicated grants ends up in the hands of graduate students and post-doctoral assistants. As shown in Table 16, salaries to postgraduate and post-doctoral assistants paid out of peer-adjudicated grants amounted to about 20 percent of the total vote over the period 1970-71 to 1975-76. This proportion has remained unchanged over this period. However, as shown in Table 16, the share of salaries to postgraduate students has declined, from 14 percent to 8.5 percent of the total NRC vote, and the share of postdoctoral recipients has risen from 6.6 percent to 8.5 percent.

If the assumption is made that salaries to assistants also constitute some form of research training, then the total proportion of NRC funds devoted to research training, including direct and indirect support, has amounted to 34-35 percent over the past six years. The postgraduate share has declined over this period, while the share going to postdoctoral recipients has increased quite considerably. This is a reflection of efforts to restrain the growth in graduate enrollment, and of the increased need for support to Ph.D. graduates who have difficulty finding suitable employment.

TABLE 16

NRC DIRECT AND INDIRECT RESEARCH TRAINING

(As Percentage of Total NRC Vote)

	<u>1970-71</u>	<u>1971-72</u>	<u>1972-73</u>	<u>1973-74</u>	<u>1974-75</u>	<u>1975-76</u>
	(Percentage Distribution)					
<u>Direct Training Grants</u> ⁽¹⁾						
1. Postgraduate	12.7	12.0	10.7	10.1	10.1	10.8
2. Postdoctoral	1.8	2.3	2.8	3.4	3.9	4.1
3. TOTAL	14.5	14.3	13.5	13.5	14.0	14.9
<u>Salaries to Assistants</u> ⁽²⁾						
4. Postgraduate	14.0	13.2	12.1	11.7	11.3	11.5
5. Postdoctoral	6.6	7.4	8.1	8.4	8.4	8.5
6. TOTAL	20.6	20.6	20.2	20.1	19.7	20.0
<u>Total Direct & Indirect Research Training</u>						
7. Postgraduate (1+4)	26.7	25.2	22.8	21.8	21.4	22.3
8. Postdoctoral (2+5)	8.4	9.7	10.9	11.8	12.4	12.6
9. TOTAL (7+8)	35.1	34.9	33.7	33.6	33.8	34.9
10. All Other	64.9	65.1	66.3	66.4	66.2	65.1
11. TOTAL NRC VOTE (9-10)	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Appendix Tables C-1 - C-3, Appendix C

(1) See Table C-1, "HQM Training and Development"

(2) See Table C-2, "Salaries to Assistants Paid out of Peer Adjudicated Grants"

iii) Distribution of NRC Expenditures by Field of Study

The NRC provides grants in aid of university research to scholars in the various fields of natural science. The analysis undertaken here attempts to determine how the distribution of NRC funds amongst the various fields relates to the distribution of faculty and applicants. For this purpose, the field of study classifications from the various existing sources on enrolment, faculty, and expenditure data had to be reconciled. (The methodology for the reconciliation is given in Appendix F.) It should be noted that this analysis yields approximations only rather than exact results, because there is always a certain amount of ambiguity in classifying activities and expenditures by field of study on a precisely comparable basis.

Table 17 shows field of study distributions of enrolments and faculty in the natural sciences, applicants for, and awards of, NRC research grants. The data were averaged for four years (1971-72 to 1974-75) in order to reduce the effect on the comparisons due to any unusual changes in any of the years taken by themselves.

The table shows a remarkable consistency in the distributions of faculty, applicants, and awards. For example, the correlation coefficients¹ between the distributions of faculty and applicants, and between faculty and successful applicants are, .98 and .97. The only exception is geology,

1. The correlation is based on a regression analysis of the form $y = a - bx$, where y and x are the dependent and independent variables.

for which there have been more applicants and awards than would have been expected on the basis of faculty (i.e., 9 percent of total applicants and awards, but only 6 percent of total faculty were from this field of study). The correlation between the distributions of faculty and funds awarded is less strong, although still quite high (with a coefficient of .85). The reason for this somewhat lower coefficient is that the award per applicant in mathematics is substantially lower than in other fields, with the result that while 16 percent of total faculty and applicants are from the field of mathematics, only 8.4 percent of the funds went to that field.

The correlation between the field of study distributions of graduate enrolments on the one hand, and NRC funds on the other, is less direct and less strong. It is basically a function of student-teacher ratios, and the success rate of professors obtaining NRC funds, in the various fields of study. For example, the student-teacher ratio for engineering is relatively much higher than in the basic natural science fields, especially mathematics and physics. The basic sciences field, therefore, obtain more funds than the applied sciences, in relation to the distribution of graduate enrolments.

TABLE 17

NRC EXPENDITURES TO UNIVERSITIES, GRADUATE ENROLMENT,

AND FACULTY, BY FIELD OF STUDY

(Average of Four Years Ending 1974-75)

	Graduate Enrolment		Faculty	Applications	Awards	
	<u>FT</u>	<u>FTE</u>	<u>FT</u>	<u>(Scholars)</u>	<u>(Scholars)</u>	<u>(Funds)</u>
	(Percentage Distribution)					
Engineering	32.2	33.7	26.2	23.2	24.0	24.7
Biology	23.7	23.2	23.3	22.5	21.8	23.3
Chemistry	12.1	11.7	13.6	12.4	11.6	15.9
Geology	5.7	5.5	6.0	9.1	9.0	8.7
Mathematics	12.8	12.9	16.4	15.4	16.1	8.4
Physics	9.6	9.2	14.5	12.8	13.0	14.3
(All Other)	3.8	3.8	-	4.7	4.5	4.7
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Enrolment (MA and Ph.D. in the Natural Sciences), and Faculty (full-time Natural Sciences) based on tabulations obtained from Education Division, Statistics Canada.

Applications and Awards are based on NRC, Annual Reports (for years 1971-72 to 1974-75). Funds are "Research Grants", as defined by the NRC.

NOTE: The methodology used for reconciling the various Field of Study classifications is provided in Appendix F of this review. The "All other" is merely a residual balancing item, and the various percentages are not comparable.

6. The Canada Council

The expenditures by the Canada Council to universities in aid of scientific activities have risen from /13.7 million in 1970-71 to \$25.5 million in 1976-77, at an annual growth rate of 10.9 percent. This growth rate is in nominal terms and is slightly higher than the rate of inflation over this period. The most rapidly-growing component of this council's expenditures have been R&D grants. As shown in Table 18, this component rose at an annual rate of 22.8 percent between 1972-73 to 1976-77. The shares of the Canada Council's university expenditures for Research Fellowships and for Education Support have been declining over the past several years¹.

1. Education Support, according to the Statistics Canada definition, includes grants to individuals or institutions intended to support the advanced education of students beyond the bachelor's degree level. For Canada Council expenditures, this would relate mainly to Doctoral Fellowships. It should be noted that the Canada Council provides about \$3 million per year in education support to Foreign Performers. This amount is not included in Table 18, which relates only to payments to Canadian universities.

TABLE 18

CANADA COUNCIL, EXPENDITURES TO CANADIAN
UNIVERSITIES FOR SCIENTIFIC ACTIVITIES

	<u>Total</u>	<u>R&D Grants</u>	<u>Research Fellowships</u>	<u>Education Support</u>	<u>All Other</u>
	(\$ Million)				
1970-71	13.7	n.a.	n.a.	n.a.	n.a.
1971-72	13.8	n.a.	n.a.	n.a.	n.a.
1972-73	15.0	4.8	2.8	n.a.	n.a.
1973-74	16.7	5.4	3.4	n.a.	n.a.
1974-75	18.9	6.5	3.7	6.4	2.3
1975-76	22.5	8.7	4.3	7.2	2.3
1976-77	25.5	10.9	4.5	8.1	2.3
	(Percentage Distribution)				
1970-71	100.0	n.a.	n.a.	n.a.	n.a.
1971-72	100.0	n.a.	n.a.	n.a.	n.a.
1972-73	100.0	32.0	18.7	n.a.	n.a.
1973-74	100.0	32.2	20.4	n.a.	n.a.
1974-75	100.0	34.4	19.6	33.9	12.2
1975-76	100.0	38.7	19.1	32.0	10.2
1976-77	100.0	42.7	17.6	31.8	9.0
	(Growth Rates) ⁽¹⁾				
1970-71 to 1976-77	10.9	n.a.	n.a.	n.a.	n.a.
1972-73 to 1976-77	14.2	22.8	12.6	n.a.	n.a.
1974-75 to 1976-77	16.2	25.8	10.3	12.5	0
1975-76 to 1976-77	13.3	25.3	4.7	12.5	0

(1) Average annual compound growth rate

This section examines several aspects of the Canada Council's expenditure program in greater detail.

i) Trends in Fellowships, Faculty and Enrolment

Unlike graduate enrolment in the Natural Sciences, which has been declining over the past several years, graduate enrolment in the humanities and social sciences has continued to rise¹. Applications to the Canada Council for doctoral fellowships have continued to fall, and the number of actual awards have dropped even more rapidly. Table 19 indicates that in 1971-72, there were some 2395 doctoral awards, but in 1975-76 these had been reduced to 1387.

1. Graduate enrolment in the natural science (excl. health) declined at a rate of -4.3 percent per year for the years 1971-72 to 1974-75, while Human Sciences graduate enrolment rose by 3.3 percent over this period.

TABLE 19

CANADA COUNCIL LEAVE AND DOCTORAL FELLOWSHIPS,
AND FACULTY AND ENROLMENT IN THE HUMANITIES
AND SOCIAL SCIENCES

	<u>Leave Fellowships</u>		<u>Doctoral Fellowships</u>		<u>Faculty</u>	<u>Graduate Enrolment</u>		
	<u>Applicants</u>	<u>Awards</u>	<u>Applicants</u>	<u>Awards</u>	<u>FT</u>	<u>FT</u>	<u>FTE</u>	
	(Number)							
1971-72	375	239	4350	2395	15,163	18,802	22,927	
1972-73	467	300	3662	1955	15,473	18,444	23,137	
1973-74	614	339	3562	1722	15,858	19,059	24,399	
1974-75	736	368	3354	1534	16,731	20,105	25,633	
1975-76	843	346	3187	1387	n.a.	n.a.	n.a.	
	(Growth Rates)							
1971-72 to 1974-75	25.2	15.5	-8.3	-13.8	3.3	2.3	3.8	
1971-72 to 1975-76	22.4	9.7	-9.3	-12.8	n.a.	n.a.	n.a.	

SOURCE: Data on Leave and Doctoral Fellowships are based on the annual reports of the Canada Council for the years 1971-72 to 1975-76. Data on Faculty and Graduate Enrolment in the Human Sciences are from Tables A-5, A-6 and A-7 in Appendix A of this review.

Leave fellowships, on the other hand, increased considerably over this period, from 239 in 1971-72 to 346 in 1975-76. Applications for such support grew even faster than awards (see Table 19).

ii) Regional Aspects

The regional pattern of the Canada Council's expenditures to the universities is best analysed in terms of the various major programs. This section examines the regional distribution of applications and awards in relation to the regional distribution of faculty and graduate enrolment (in the humanities and social sciences). The analysis relates to the average of the four years ending 1974-75. An average of several years was chosen to reduce the effect on comparability due to possible irregularities in the data of an individual year.

In the doctoral fellowships program, Canada Council awards, are distributed across the various regions in close accordance with the distribution of applications and graduate enrolments. The bulk of the enrolments is at universities in Ontario. (The percentages for all regions are given in Table 20.)

TABLE 20

CANADA COUNCIL - REGIONAL DISTRIBUTION OF RESEARCH GRANTS AND FELLOWSHIPS, COMPARED TO
ENROLMENT, FACULTY, AND APPLICATIONS IN THE HUMANITIES & SOCIAL SCIENCES
 (Average Percentage for Years Ending 1974-75)

	Humanities and Social Sciences			Research Grants			Leave Fellowships			Doctoral Fellowships		
	Graduate Enrolment		Faculty	Applications	Awards	Funds	Applications	Awards	Funds	Applications	Awards	Funds
	FI	FTE	FT	(Percentage Distribution)								
Atlantic	5.9	5.5	11.8	n.a.	8.9	6.6	8.2	5.5	5.9	5.0	4.7	4.6
Quebec	25.9	27.7	20.2	n.a.	20.8	32.2	16.7	16.0	17.5	25.7	27.3	27.3
Ontario	44.8	44.9	41.1	n.a.	47.6	40.9	44.5	48.6	47.5	46.5	44.2	44.4
West	23.4	21.9	26.9	n.a.	23.5	20.3	30.6	29.9	29.1	22.9	23.9	23.7
Canada	100.0	100.0	100.0	n.a.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Data on Graduate Enrolment and Faculty are based on Tables A-5, A-6, and A-7 in Appendix A of this review.
 Data on Grants and Fellowships are from Canada Council annual reports for the years 1971-72 and 1974-75.

TABLE 20

Regarding the Leave Fellowship program, the regional pattern of the Canada Council awards do not accord closely with the regional distribution of faculty. There are two reasons for this. First, applications for such fellowships are relatively more concentrated in Ontario and the West, which together have 68 percent of the human sciences faculty but provide 75 percent of the applications. Second, the "success ratio"¹ for Ontario and the West is higher than for Quebec and the Atlantic Region (see Table 20 for further details).

The other major program, namely research grants, is the program that has risen most rapidly over the past several years. The regional distribution is quite different from that of the fellowship programs. For example, the share going to Quebec is relatively greater, and that going to Ontario and the West lower, than in the other programs. A regional distribution of applications for this program is not yet available, but the relationship between number and amount of the awards indicates that the funds per successful application are substantially higher in Quebec than in the other three regions.

1. i.e., the ratio of actual number of awards to applicants.

iii) Distribution by Field of Study

This section attempts to relate Canada Council expenditures by the various fields of study to the distribution of graduate enrolment and faculty in the same fields. The relevant funds for this comparison are research grants and leave fellowships. The data have been averaged for the four years ending 1974-75, in order to reduce the effect on comparability arising out of possible data irregularities in any given single year.

The first step in this analysis was to reconcile the field of study classifications employed in the various data sources on faculty, enrolments, and funds. The detailed methodology of the reconciliation is given in Appendix F of this review. It should be noted that the results from this type of analysis are approximations only, because there is always a certain amount of ambiguity in classifying activities for such a wide range of fields.

The distribution of funds by field of study corresponds most closely to the distribution of applicants, as would be expected. In comparing funds and faculty distributions, there are three different groups of disciplines: first, there is a group for which awards are substantially greater than would be expected on the basis of the faculty distribution (included here are Anthropology and Archaeology, and History); second, there is a group for which the awards are substantially less than would be expected on the basis of the faculty distribution (included here are

Business and Commerce; Education; and Religious Studies); third, for the largest group, the distribution of Canada Council funds accords more or less well with the distribution of faculty (i.e., for Economics; Geography; Law; Political Science and Public Administration; Psychology; Sociology; Languages, Literature, and Linguistics; and Philosophy).

The largest proportion of the funds goes to the fields of Languages, Literature and Linguistics(24 percent of the period 1971-72 to 1974-75), with 13.5 percent going to History. This program appears to have an orientation that is favouring the humanities rather than the social sciences, at least based on the relative distribution of faculty and funds in the two areas. (See Table 21.)

TABLE 21

DISTRIBUTION OF CANADA COUNCIL GRANTS AND LEAVE FELLOWSHIPSBY FIELD OF STUDY(Average for Four Years Ending 1974-75)

	Humanities and Social Sciences			Research Grants and Leave Fellowships		
	Graduate Enrolment		Faculty	Applications	Awards	
	FT	FTE	FT	(Scholars)	Scholars	Funds
	(Percentage Distribution)					
Anthropology and Archaeology	1.8	1.7	2.0	6.0	7.2	8.6
Business and Commerce	12.9	12.8	6.4	1.7	1.4	1.4
Economics	5.4	5.0	5.6	6.4	6.2	6.6
Geography	3.4	3.3	4.4	4.6	4.6	4.3
Law	0.8	1.0	2.9	2.3	2.4	2.5
Political Science and Public Administration	4.4	4.1	4.3	6.3	5.6	6.7
Psychology	8.7	8.1	7.5	8.9	8.6	10.6
Social Work	4.4	3.7	1.8	0.2	--	--
Sociology	4.1	4.1	5.2	5.8	5.0	6.8
Languages, Literature and Linguistics	14.4	14.0	23.8	25.8	27.3	24.0
History	5.5	5.4	6.4	15.5	17.6	13.5
Philosophy	3.5	3.3	4.3	4.0	4.0	3.7
Religious Studies	5.5	5.1	3.3	1.5	1.1	0.9
Education	14.4	19.1	20.2	3.9	2.4	3.3
(All Other)	10.7	9.4	2.0	7.2	6.5	6.9
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Data for Enrolment (MA and Ph.D.) and Faculty in the Humanities and Social Sciences are based on tabulations from the Education Division of Statistics Canada.

Applications and Awards are based on Canada Council, Annual Report (for fiscal years 1971-72 to 1974-75). Funds awarded are the sum of Research Grants and Leave Fellowships.

7. The Medical Research Council

The expenditures to universities for scientific activities by this council have increased from \$30.0 million in 1970-71 to \$46.3 million in 1976-77. In nominal terms, the average annual growth rate was 7.5 percent, or some 2 percent per year less than the increase in inflation.

According to the definitions used by Statistics Canada in the Federal Survey, almost the entire amount spent each year by the MRC is considered R&D spending. However, it includes certain programs, administered through the universities, that are designed to train certain qualified personnel in clinical research methods. These are usually persons who already have either a first professional degree (in a related field such as medicine) and need to be trained in clinical research methods, or persons with a related postgraduate degree, but require clinical research experience. These programs are estimated to account for about 7.9 percent of the MRC expenditures in 1974-75¹. This is research training in a certain sense, but because such persons already have degrees, and are carrying out applied research, their funding is not defined as education support in the Statistics Canada data.

The idea of an "equitable" or balanced regional distribution for this field of research is particularly difficult to conceive. The medical research and training institutions have developed for reasons other than regional equality. Nevertheless, for whatever they are worth, regional comparisons for the expenditures of this Council are also included here. Table 22 shows a particularly heavy concentration of MRC expenditures and enrolment in

1. i.e., \$1.1 million of education support as defined in the Federal Survey, plus \$2.1 million for more broadly-defined research training, out of total 1974-75 expenditures of \$40.4 million.

the health field in Quebec. This is undoubtedly related to the existence of French and English-speaking universities and hospitals.

It could be argued that one of the appropriate standards for comparing medical research expenditure by region should be medical school enrolments. As one might expect, the per capita enrolment for MD degrees is higher in Quebec than in other regions. The regional distribution of combined medical school (MD) and graduate health enrolments are shown in Table 22 (last column). Even with this standard, large regional imbalances are evident, particularly concerning the share of the funds to the Atlantic Region.

However, it appears that the proportion of funds spent in the Atlantic Region has been growing significantly. Based on information obtained directly from the MRC, the share of MRC funds for that region is now approaching five percent (see Appendix Table D-1, Appendix D)¹.

1. Due to differences in source, the dollar values for the MRC shown in Table D-1 are not strictly comparable with those from the Statistics Canada 1976 Survey that is used generally in this review. The conclusions about the general regional tendencies shown in the MRC-based data are, however, not affected by this difference.

TABLE 22

MEDICAL RESEARCH COUNCIL'S REGIONAL DISTRIBUTION OF FUNDS
AND VARIOUS REGIONAL INDICATORS, 1973-74

	<u>MRC Funds</u>	<u>Population</u>	<u>Faculty</u>		<u>Graduate Enrolment.</u>				<u>Enrolment For MD's</u>	<u>MD&Grad. Health Enrolment</u>
			<u>Total</u>	<u>Health</u>	<u>Total</u>		<u>Health</u>			
					<u>FT</u>	<u>FTE</u>	<u>FT</u>	<u>FTE</u>		
			(Percentage Distribution)							
Atl.	2.7	9.5	11.3	8.8	5.9	5.7	1.6	1.7	9.8	8.6
Que	37.2	27.3	22.1	23.9	24.2	26.3	33.0	35.1	35.4	35.0
Ont	35.6	36.1	39.2	38.4	44.3	44.1	39.9	38.9	31.4	32.6
West	24.4	27.1	27.5	28.9	25.6	23.9	25.4	24.3	23.5	23.8
Canada	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Statistics Canada, Federal Survey; Intercensal Estimate; Tables B-9, B-10, B-11; in Appendix B; and Table A-9 in Appendix A.

TABLE 22

8. Federal Departments and Agencies

Expenditures to universities for scientific activities have risen from \$37 million in 1970-71 to 46.2 million in 1976-77, at an average annual growth rate of 3.8 percent. However, the 1976-77 total was reduced through the effect of the budget transfer from the AECB, a federal agency included here, to the NRC, of the TRIUMF project, amounting to \$8.4 million. (The growth rate over this period is 6.7 percent per year including the \$8.4 million.)

An increasing proportion of the funds is spent in the support of the human as opposed to the natural sciences (see Table 10 above). Three-quarters are spent on R&D, while some 16 percent are spent on education support (in 1976-77, this group is estimated to have provided some \$7.5 million for education support, out of the total of \$46.2 million paid to universities).

In terms of regional criteria, the Departments' funds are distributed across the regions along the pattern of the population. The correspondence is less close for faculty, and even less close for graduate enrolment (see Table 23). This is a reflection of relatively larger payments through contracts (some of which may not be considered as suitable for graduate training), and relatively larger payments for related scientific activities (not related to graduate study -- e.g., data gathering).

1. Analysis for this group is the subject of a separate report.

TABLE 23

FEDERAL DEPARTMENTS' AND AGENCIES' REGIONAL DISTRIBUTION
OF FUNDS, AND VARIOUS REGIONAL INDICATORS, 1973-74

	<u>Departments' and Agencies' Funds</u>	<u>Population</u>		<u>Faculty</u>		<u>Total Grad. Enrol't</u>	
		(Percentage Distribution)		FT	FTE		
Atl	11.7	9.5	11.3	5.9	6.3		
Que	28.0	27.3	22.1	24.2	22.6		
Ont	32.3	36.1	39.2	44.3	42.3		
West	28.0	27.1	27.5	25.6	28.8		
Canada	100.0	100.0	100.0	100.0	100.0		

SOURCE: See Table 22

9. Summary of Findings

The foregoing statistical review found that:

- federal expenditures on scientific activities have been rising at an annual compound rate of about 11 percent since the beginning of the 1970's. After accounting for inflation, the real growth rate was in the neighbourhood of 1.6 percent per annum.
- The support of Related Scientific Activities rose significantly faster than the financing of R&D, with the consequence that since the beginning of the current decade the proportion of expenditures devoted to R&D dropped from 68.9 percent in 1970-71 to 60.6 percent in 1976-77
- The share of support to the Human Sciences in total federal expenditures on scientific activities has grown from 15.3 percent in 1970-71 to 25.2 percent in 1976-77. Support to the Natural Sciences has increased relatively less than the support of the Human Sciences.
- There has been a shift towards intramural expenditures on scientific activities since the beginning of the decade. The intramural share rose from 64.4 percent in 1970-71 to 68.5 percent in 1976-77.
- The extramural performers for whom support grew relatively less were Canadian business enterprises (whose share in total dropped from 16.5 to 12.4 percent) and Canadian Universities (15.6 to 12.0 percent).

The losses within the overall extramural share were accompanied by a sharp rise in payments to Foreign performers (mostly through CIDA and IDRC programs) whose share increased from 1.5 to 5.0 percent.

- The share of total federal expenditures attributed to the various federal departments and agencies, as opposed to the granting councils, has remained fairly stable. The Federal Departments are responsible for roughly four-fifths of the total, with some minor fluctuations in both directions since the beginning of the 1970's. The Councils account for the remainder, with minor fluctuations for the shares of the Canada Council and NRC. The share of the MRC declined from 3.8 to 2.9 percent of the total (with the May 1976 budget addition of \$2 million, the MRC share is 3.0).
- Direct Federal expenditures on scientific activities in the university sector rose by 6.4 percent over the 6-year period ending in 1976-77, from \$142.2 million to \$206.5 million. In terms of constant prices, the total has declined over this period. However, it should be remembered that the provinces have been reimbursed for approximately half of the operating costs of all post-secondary institutions -- an expenditure which has grown during this period at a rate exceeding the rate of inflation -- and that the indirect costs of research are included in the operating costs. Also, the relatively lower growth rates of the 1970's follow the period of the 1960's when federal

expenditures to the university sector grew at an annual rate of over 30 percent in nominal terms and over 25 percent in real terms.

- During the 1970's federal R&D expenditures to universities have grown substantially less than provincial and other sources' expenditures for this purpose. This is a reversal from the growth patterns of the 1960's. In effect, in global terms, the non-federal sources have compensated the universities for the reduction in the growth of federal contributions to R&D to the extent that R&D expenditures to the universities from all sources combined have just about kept pace with the rate of inflation.
- Of the funds going to the Universities sector, the portion designated for R&D has grown less rapidly than spending on Related Scientific Activities. In particular, expenditures on R&D in the Natural Sciences have been growing relatively less rapidly than other expenditures.
- Some elements of the university system continued to grow over this period: there was some growth in undergraduate enrolments, and considerable growth in faculty. However, graduate enrolment has remained virtually unchanged since the beginning of the decade.
- Federal expenditures as a whole for scientific activities in the universities have risen in nominal terms in relation to graduate enrolment, but declined somewhat when expressed in real terms. In relation to faculty, such expenditures have remained constant in nominal terms, but declined considerably in real terms.

- Regarding the regional distribution of federal expenditure to the universities for scientific activities, the Atlantic Region's share is low in relation to such factors as university-age population, undergraduate enrolment, and faculty, whereas the opposite holds for Ontario. (This is a reflection of the small university, liberal arts tradition of the Atlantic Region, whose students probably go to other regions in significant numbers to do their graduate work.)
- The increase in the Human Sciences support to the universities was accounted for in almost equal measure by the Federal Departments and the Canada Council. The decline in the share going to the Natural Sciences is mostly due to relatively less growth in support from the Federal Departments.
- The largest contributor to university scientific activity is the NRC, accounting for about 43 percent of the total (including the funds for TRIUMF transferred from AECB to NRC in 1976-77). The MRC, and the federal departments and agencies each account for about \$46 million in 1976-77. The Canada Council's expenditures for this purpose are \$25.5 million.
- The number of natural sciences faculty in relation to the population is substantially higher in the Western region and in Ontario than in Quebec and the Atlantic region. This is largely symptomatic of a range of historical and institutional realities that have shaped

the regional pattern of the Canadian university establishment.

- Ontario and the West also provide proportionately higher numbers of applicants for NRC funds, and receive a proportionately higher share of the grants.
- From 1970-71 to 1975-76, NRC postdoctoral support (both direct and indirect) rose considerably in relative importance, while the share going to post-graduate support (direct as well as indirect) dropped. This is a reflection of the decreased enrolments in graduate programs in the natural sciences and engineering, and of the increased need for support to Ph.D. graduates who have difficulty finding suitable employment.
- The distribution of NRC expenditures by field of study correlates very highly with the distribution of faculty by field of study, and reasonably highly with the distribution of graduate enrolment by field of study.
- Applications to the Canada Council for doctoral fellowships have continued to fall over the 1971-72 to 1975-76 period, despite annual increases in the number of graduate students in the human sciences.
- Applications to the Canada Council for leave fellowships have been rising considerably over the four years ending 1975-76. Awards for such applications have also grown, but not quite as rapidly as applications.

- Canada Council doctoral fellowships are distributed regionally in close accordance with the distribution of applications and graduate enrolments. The lion's share of the human sciences graduate enrolments are in Ontario (about 45 percent in recent years).
- Leave fellowships awarded by the Canada Council are concentrated in Ontario and the West, because of relatively more applications received from these two regions, and because the applications from these two regions have a higher success ratio.
- Canada Council research grants, which increased nominally at an annual rate of over 20 percent from 1972-73 to 1976-77, differ in their regional distribution from the fellowships programs. The share of grants going to Quebec universities is relatively much higher than expected on the basis of Quebec's share in faculty or graduate enrolment.
- Over the 1971-72 to 1974-75 period, Canada Council Research grants and leave fellowships have been distributed in accordance with applicants by field of study, but there are disciplines where 1) awards are substantially greater than would be expected on the basis of the faculty distribution (Anthropology, Archaeology, and History); 2) awards are substantially less than would be expected on the basis of the faculty distribution (Business and Commerce; Education; Religious Studies); and 3) awards are more or less in line of the distribution of faculty (Economics; Geography; Law; Political Science; Psychology; Sociology; Languages; and Philosophy).

- The largest proportion of Canada Council funds goes to Languages, Literature, and Linguistics (24 percent of the 1971-72 1974-75 total), with 13.5 percent going to History. When compared to the distribution of faculty, the program appears to have a humanities rather than social sciences orientation.

- MRC expenditures to universities on scientific activities have grown by less than the rate of inflation in recent years (7.5 percent annually in nominal terms for the 1970-71 to 1976-77 period). Disbursement of MRC funds are concentrated in Quebec universities. This is undoubtedly related to the existence of French and English-speaking universities and hospitals.

- Expenditures by federal departments and agencies on university scientific activities rose at an average annual rate of 3.8 percent in the six years ending 1976-77. The funds are distributed across the regions in line with the distribution of the population.

APPENDICES

- Data Notes
- Note on Regional Calculations
- Note on Growth Rate Calculations

- Appendix A - Basic Data
- Appendix B - Analytical Data
- Appendix C - Analytical Data Based on
NRC Records
- Appendix D - Summary of MRC Expenditures by
Region, Based on MRC Records
- Appendix E - A Price Deflator for Science
Expenditures - a Technical Note
- Appendix F - Field of Study - Reconciliation of
Classifications for Expenditures,
Enrolment, and Faculty

Data Notes

1. Expenditure data in this review, with the exception of some earlier regional CAUBO data, come from the Statistics Canada Survey. The following printouts are available:

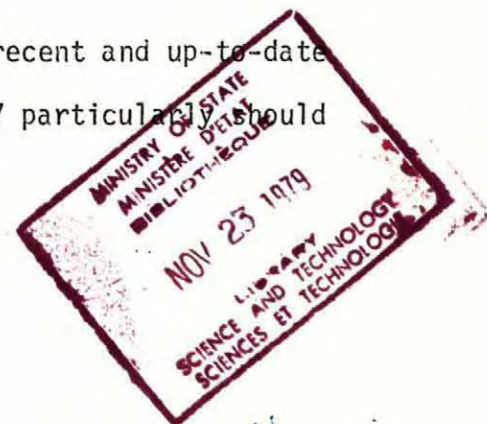
Federal Government Activities in the Human Sciences

- Fiscal Years 1970-71 to 1976-77 (Historical Series)
- Fiscal Years 1974-75, 1975-76, 1976-77 (1976 Survey Results)
- Principal Applications; Fiscal Years 1974-75, 1975-76, 1976-77
- Applications of Expenditures on Intramural R&D in the Human Sciences (1974-75, 1975-76, 1976-77)
- Regional Distribution (1974-75, 1975-76)
- Intramural R&D Expenditures (Fiscal Years 1974-75, 1975-76, 1976-77)

Federal Government Activities in the Natural Sciences

- Fiscal Years 1963-64 to 1976-77 (Historical Series)
- Fiscal Years (1974-75, 1975-76, 1976-77 (1976 Survey Results)
- Principal Application Tables (1974-75, 1975-76, 1976-77)
- Intramural R&D in the Natural Sciences (1974-75, 1975-76, 1976-77)
- Regional Distribution (1974-75, 1975-76)

It should be noted that, while those are the most recent and up-to-date figures available, they are not final. Data for 1976-77 particularly should be considered preliminary, being budget estimates.



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2. The CAUBO data on federal expenditures for science in universities (Table A-3) are incomplete in that they do not cover all financial awards to individuals enrolled at a university. The proportion of such funds is particularly large within the Canada Council budget, so that the CAUBO data relating to this council should be interpreted with particular care. Analytical tables affected by this factor are Tables B-1, B-3, B-5, B-6, and B-7.

3. In the enrolment data, there is evidence of some "curiosities". In Table A-5, based on Statistics Canada sources, the graduate enrolment in health-related fields in the Atlantic Region is shown as 36, 27, 19 and 42 for the four years ending in 1974-75. These numbers are, by necessity, an integral part of the analytical background calculations in Appendix B, but are so small that, therefore, when interpreting the calculations in these table cells, a great deal of judgment must be applied by the reader. Health-related post-graduate enrolments for the Atlantic Region affect the relevant cells in Tables B-1 to B-4, B-9 and B-10.

A similar problem is found for the year 1971-72 where the health-related graduate enrolment for Quebec is shown as 943 as compared with 486 in Ontario, and 330 in Quebec the following year. This is obviously a very suspicious number, and should be ignored, despite the fact that it emanates from Statistics Canada publications. It affects the particular cell in each of the Appendix B tables using enrolment.

4. In theory, the CAUBO data in each of the cells of Table A-3 should be lower than the Federal Survey data in Table A-4. In one case, however, this is not so: for Ontario in 1974-75, the "Other federal" expenditures are \$14,919,000 in the CAUBO records¹, and only \$12,175,000 in the Statistics Canada 1976 Survey (for a difference of \$2,744,000). These are numbers shown in the official records, and there is little that can be done other than to treat them as questionable. As far as the analytical background material is concerned, the Ontario (1974-75) OTHFED cell is affected in the following tables: Table B-1 to B-8. It should be noted that the 1976 Survey data by Statistics Canada are subject to revision, in the course of their semi-annual updating of this body of information. In the meantime, however, this is the most up-to-date information.

1. It should also be noted that CAUBO data reflect expenditures made during the year by the university scientists, which are not necessarily made during the same year as is the case for the funding agency. This arises because funds received for research are placed in trust by the university and only appear as "income" and "expenditure" (simultaneously) when they are used.

Note On Regional Calculations

Each table in Appendices A and B contains a set of annual regional matrices. For a given year t,

$$M_{nk} = \begin{bmatrix} M_{11} & \dots & M_{1j} \\ \vdots & & \vdots \\ M_{ij} & \dots & M_{ij} \end{bmatrix}$$

where n represents the regions: Atl., Que., Ont., West, and Canada; and k represents either sponsor or field of study:

<u>Sponsor</u>	<u>Field</u>
Canada Council	Humanities & Social Sciences
NRC	Natural Sciences
MRC	Health Sciences
OTHFED	All Sciences
Total	All Sciences

Appendix B tables B-1 to B-6 are the result of simple cell-by-cell matrix divisions, using the table matrices indicated in the source of each table. Thus, in the dollars-per-graduate student table, the funds and enrollment are related by sponsor and field of study.

Note on Calculation of Growth Rates

The growth rates shown in this review are average annual compound growth rates. The main reason for choosing this particular type of growth rate is that it is mathematically comparable for periods of different duration. (The use of total percentage changes can be misleading for this reason.)

In particular, the algebraic formulation used for the growth rate is:

$$i = \frac{t-1}{\sqrt[t]{x_t/x_1}} - 1 = \frac{(t-1)}{\sqrt[t]{\prod_{n=1}^{t-1} x_{n-1}/x_n}} - 1$$

where i = average annual compound growth rate

x = a particular time series

n = a given year

$t-1$ = the number of periods for which the growth rate is calculated

APPENDIX A

BASIC DATA

Note: The basic expenditure data used in this study have been taken from the Statistics Canada 1976 Survey. With the exception of Tables A-1, A-2 and A-4, these expenditure data are not contained in this Appendix, in view of the ready availability of the Survey. Table A-4 is given here because it is the result of a special regional tabulation from the 1976 Survey. Tables A-1 and A-2 are a further breakdown of data in Table 5. The sources of all other basic data in this Appendix are indicated on each table.

TABLE A-1

<u>FEDERAL EXPENDITURES ON SCIENTIFIC ACTIVITIES IN</u>				Change ⁽¹⁾ 1970-71 to 1976-77
<u>CANADIAN UNIVERSITIES - HUMAN SCIENCES</u>				
	<u>1970-71</u>	<u>1974-75</u>	<u>1976-77</u>	
	(\$ Million)			
Total	19.2	32.8	43.6	14.6
R&D	9.8	18.0	25.0	16.9
Contracts	n.a.	1.9	2.5	n.a.
Grants	n.a.	11.8	17.1	n.a.
Fellowships	n.a.	4.3	5.3	n.a.
RSA	9.4	14.8	18.6	12.0
Education Support	8.3	10.7	13.9	9.0
Other RSA	1.1	4.1	4.7	27.4

(1) Average annual compound growth rate

SOURCE: Statistics Canada, Federal Survey (for details, see footnote 1, page 2).

TABLE A-2

<u>FEDERAL EXPENDITURES ON SCIENTIFIC ACTIVITIES IN</u>				Change ⁽¹⁾ 1970-71 to 1976-77
<u>CANADIAN UNIVERSITIES - NATURAL SCIENCES</u>				
	<u>1970-71</u>	<u>1974-75</u>	<u>1976-77</u>	
	(\$ Million)			
Total	123.2	142.9	162.9	4.8
R&D	113.7	132.8	149.2	4.6
Contracts	4.5	5.8	7.7	9.4
Grants	106.6	123.8	138.2	4.4
Fellowships	2.6	3.2	3.3	4.1
RSA	9.5	10.1	13.6	5.2
Education Support	9.3	8.7	11.6	3.4
Other RSA	0.2	1.4	2.1	48.0

(1) Average annual compound growth rate

Source: Statistics Canada, Federal Survey (for details, see footnote 1, page 2).

TABLE A-3

FEDERAL RESEARCH GRANTS TO UNIVERSITIES (CAUBO)

(\$ 000)

AGENCY	ATL	QUE	ONT	WEST	CAN
1971/1972					
CC	230.	728.	1336.	728.	3022.
NRC	2961.	8134.	22943.	18433.	52471.
MRC	1318.	9241.	9964.	7522.	28045.
OTHFED	1287.	10157.	9055.	6849.	27348.
TOTAL	5796.	28260.	43298.	33532.	110886.
1972/1973					
CC	330.	745.	1504.	640.	3219.
NRC	3727.	11034.	22799.	17678.	55238.
MRC	1245.	11524.	10108.	7910.	30787.
OTHFED	1127.	8468.	10336.	8014.	27945.
TOTAL	6429.	31771.	44747.	34242.	117189.
1973/1974					
CC	342.	1839.	1794.	1025.	5000.
NRC	4324.	11235.	21999.	18150.	55708.
MRC	1355.	11588.	11178.	8214.	32335.
OTHFED	1422.	9759.	14202.	9484.	34867.
TOTAL	7443.	34421.	49173.	36873.	127910.
1974/1975					
CC	423.	2609.	2230.	1122.	6384.
NRC	4519.	13390.	27442.	18542.	63893.
MRC	1672.	13110.	12024.	9186.	35992.
OTHFED	1935.	7989.	14919.	10437.	35280.
TOTAL	8549.	37098.	56615.	39287.	141549.

SOURCE: CAUBO

FEDERAL RESEARCH PAYMENTS TO UNIVERSITIES (FEDSURU)
(\$000)

AGENCY	ATL	QUE	ONT	WEST	CAN *	NOT ALLOCATED	CAN
1971/1972							
CC	0.	0.	0.	0.	0.	0.	13,819
NRC	0.	0.	0.	0.	0.	0.	64,449
MRC	0.	0.	0.	0.	0.	0.	31,416
OTHFED	0.	0.	0.	0.	0.	0.	41,723
TOTAL	0.	0.	0.	0.	0.	0.	151,407
1972/1973							
CC	622.	3693.	6828.	3011.	14154.	849	15,003
NRC	4193.	12745.	27639.	18224.	62801.	965	63,766
MRC	1223.	10824.	11399.	6367.	31813.	3,449	35,262
OTHFED	0.	0.	0.	0.	0.	0.	42,109
TOTAL	0.	0.	0.	0.	0.	0.	156,140
1973/1974							
CC	887.	4318.	7945.	3232.	16382.	2,448	18,830
NRC	4454.	13146.	27236.	18296.	63134.	1,483	66,617
MRC	1036.	14228.	13615.	9333.	38212.	0.	38,212
OTHFED	4829.	11579.	13387.	11599.	41394.	11,128	52,522
TOTAL	11206.	43271.	62183.	42462.	159122.	15,059	174,181
1974/1975							
CC	802.	4686.	8035.	3613.	17136.	1,715	18,852
NRC	4705.	13762.	28484.	19217.	66168.	43	66,211
MRC	1681.	14323.	14137.	10276.	40417.	0	40,417
OTHFED	4581.	10845.	12175.	18562.	46163.	4,080	50,243
TOTAL	11769.	43616.	62831.	51668.	169884.	5,838	175,723

* Excludes data that cannot be allocated on a regional basis.
0. means data not available.

SOURCE: Statistics Canada, Federal Survey (for details, see footnote 1, page 2).

UNIVERSITY GRADUATE ENROLLMENT (FULL TIME)

SUBJECT	ATL	QUE	ONT	WEST	CAN
1971/1972					
HUM SC	984.	4546.	8526.	4746.	18802.
NAT SC	590.	1747.	4592.	3379.	10308.
HLTH S	36.	943.	486.	348.	1813.
TOTAL	1610.	7236.	13604.	8473.	30923.
1972/1973					
HUM SC	1085.	4781.	8041.	4537.	18444.
NAT SC	632.	1809.	3849.	3036.	9326.
HLTH S	27.	330.	442.	296.	1095.
TOTAL	1741.	6920.	12332.	7869.	28862.
1973/1974					
HUM SC	1116.	4792.	8701.	4450.	19059.
NAT SC	589.	1920.	3803.	2756.	9068.
HLTH S	19.	381.	461.	293.	1154.
TOTAL	1724.	7093.	12965.	7499.	29281.
1974/1975					
HUM SC	1354.	5638.	8995.	4118.	20105.
NAT SC	595.	2139.	3627.	2674.	9035.
HLTH S	42.	456.	479.	324.	1301.
TOTAL	1991.	8233.	13101.	7116.	30441.

SOURCE: Statistics Canada, Education Division

UNIVERSITY GRADUATE ENROLLMENT (FULL TIME EQUIVALENT)

SUBJECT	ATL	QUE	ONT	WEST	CAN
1971/1972					
HUM SC	1102.	5927.	10494.	5403.	22927.
NAT SC	614.	2083.	4951.	3535.	11182.
HLTH S	36.	1003.	516.	363.	1918.
TOTAL	1752.	9613.	15960.	9302.	36027.
1972/1973					
HUM SC	1227.	6498.	10200.	5211.	23137.
NAT SC	673.	2158.	4282.	3192.	10305.
HLTH S	29.	395.	482.	309.	1215.
TOTAL	1926.	9051.	14964.	8713.	34654.
1973/1974					
HUM SC	1365.	6687.	11028.	5319.	24399.
NAT SC	642.	2301.	4308.	2940.	10191.
HLTH S	22.	455.	504.	314.	1295.
TOTAL	2029.	9443.	15840.	8573.	35885.
1974/1975					
HUM SC	1574.	7463.	11449.	5147.	25633.
NAT SC	645.	2516.	4188.	2882.	10231.
HLTH S	47.	512.	518.	340.	1418.
TOTAL	2266.	10490.	16156.	8370.	37282.

SOURCE: Statistics Canada, Education Division
See Table A-5

UNIVERSITY FACULTY

SUBJECT	ATL	QUE	ONT	WEST	CAN
1971/1972					
HUM SC	1745.	3071.	6096.	4251.	15163.
NAT SC	837.	1782.	2875.	2231.	7725.
HLTH S	281.	886.	1293.	938.	3398.
TOTAL	2863.	5739.	10264.	7420.	26286.
1972/1973					
HUM SC	1831.	3065.	6373.	4204.	15473.
NAT SC	864.	1887.	2944.	2235.	7930.
HLTH S	316.	827.	1376.	932.	3451.
TOTAL	3011.	5779.	10693.	7371.	26854.
1973/1974					
HUM SC	1913.	3213.	6479.	4253.	15858.
NAT SC	891.	2021.	2945.	2285.	8142.
HLTH S	330.	891.	1433.	1077.	3731.
TOTAL	3134.	6125.	10857.	7615.	27731.
1974/1975					
HUM SC	1976.	3426.	7059.	4270.	16731.
NAT SC	948.	2058.	3265.	2254.	8525.
HLTH S	378.	942.	1543.	1095.	3958.
TOTAL	3302.	6426.	11867.	7619.	29214.

SOURCE: See Table A-5

MASTERS AND PHD GRADUATES

SUBJECT	ATL	QUE	QNT	WEST	CAN
1971/1972					
HUM SC	369.	1451.	4418.	1749.	7987.
NAT SC	233.	564.	1745.	1010.	3552.
HLTH S	11.	144.	176.	112.	443.
TOTAL	613.	2159.	6339.	2871.	11982.
1972/1973					
HUM SC	469.	1765.	4600.	1712.	6546.
NAT SC	208.	684.	1581.	1042.	3515.
HLTH S	19.	198.	179.	102.	498.
TOTAL	696.	2647.	6360.	2856.	12559.
1973/1974					
HUM SC	0.	0.	0.	0.	0.
NAT SC	0.	0.	0.	0.	0.
HLTH S	0.	0.	0.	0.	0.
TOTAL	0.	0.	0.	0.	0.
1974/1975					
HUM SC	0.	0.	0.	0.	0.
NAT SC	0.	0.	0.	0.	0.
HLTH S	0.	0.	0.	0.	0.
TOTAL	0.	0.	0.	0.	0.

SOURCE: Statistics Canada, Education Division
See Table A-5

TABLE A-9

FULL-TIME ENROLMENT, MEDICINE, BACHELOR AND
FIRST PROFESSIONAL DEGREE, BY REGION

	<u>Atl</u>	<u>Que</u>	<u>Ont</u>	<u>West</u>	<u>Can</u>
1970-71	370	2045	1720	1194	5329
1971-72	371	1737	1883	1308	5299
1972-73	838	2280	2107	1577	6802
1973-74	689	2497	2218	1660	7064
1974-75	487	2688	2254	1809	7238

SOURCE: Statistics Canada, Education Division
1970-71 and 1971-72; published in Cat. No.
81-204. Later years: from computer printouts.

TABLE A-10

FEDERAL EXPENDITURES ON SCIENTIFIC ACTIVITIES:

ESTIMATES OF NON PROGRAM COSTS

	<u>1970-71</u>	<u>1974-75</u>	<u>1976-77</u>	<u>Growth Rate 1970-71 to 1976-77</u>
Total	915.7	1352.4	1724.2	11.1
Program Costs	852.7	1255.6	1602.1	11.1
Non-program Costs	63.0	96.8	122.1	11.7
Human Sciences Total	140.4	298.8	433.7	20.7
Program Costs	127.4	278.0	403.8	21.2
Non-program costs	13.0	20.8	29.9	14.9
Natural Sciences Total	775.2	1053.7	1290.6	8.9
Program Costs	725.2	977.2	1198.2	8.7
Non-program costs	50.0	76.1	92.4	10.8

NOTE: Non-program costs for the earlier years are estimates.

TABLE A-11

PAYMENTS TO FOREIGN PERFORMERS

(1976-77)

	Amount (In \$'000)	Percent of Total
1. By Department or Agency:		
CIDA	40,355	46.5
IDRC	24,755	28.5
NRC	6,318	7.3
Communications	5,500	6.3
Canada Council	3,640	4.2
National Defence	2,440	2.8
MRC	2,411	2.8
Others	1,461	1.7
T o t a l	86,880	100.0
2. By Type of Expenditure:		
a) R&D - R&D Grants - CIDA	16,601	19.1
IDRC	14,828	17.1
NRC (Engineering)	4,957	5.7
R&D Contracts - Communications	5,500	6.3
National Defence	2,440	2.8
Research Fellowships - MRC	2,355	2.7
IDRC	1,257	1.5
All Other R&D Support (less than \$1 Million)	1,848	2.1
T o t a l	49,786	57.3
b) RSA - Education Support - IDRC	4,012	4.6
Canada Council	3,640	4.2
Feasibility Studies - CIDA	23,754	27.3
IDRC	1,226	1.4
Scientific Information - IDRC	1,424	1.6
Data Collection - IDRC	1,574	1.8
All Other RSA Support (less than \$1 Million)	1,464	1.7
T o t a l	37,094	42.7
Total for All Support	86,880	100.0

APPENDIX B
ANALYTICAL DATA

RESEARCH GRANTS (CAUBO) PER GRAD STUDENT (FT)

AGENCY	ATL	QUE	ENT	WEST	CAN
1971/1972					
CC	234.	160.	157.	153.	161.
NRC	5019.	4656.	4996.	5455.	5090.
MRC	36611.	9800.	20502.	21615.	15469.
OTHFED	799.	1404.	666.	808.	884.
TOTAL	3600.	3905.	3183.	3958.	3586.
1972/1973					
CC	304.	156.	187.	141.	175.
NRC	5897.	6100.	5923.	5823.	5923.
MRC	46111.	34921.	22869.	26723.	28116.
OTHFED	647.	1224.	838.	1018.	968.
TOTAL	3693.	4591.	3629.	4352.	4060.
1973/1974					
CC	306.	384.	206.	230.	262.
NRC	7341.	5852.	5785.	6586.	6143.
MRC	71316.	30415.	24247.	28034.	28020.
OTHFED	825.	1376.	1095.	1265.	1191.
TOTAL	4317.	4853.	3793.	4917.	4368.
1974/1975					
CC	312.	463.	248.	272.	318.
NRC	7595.	6260.	7566.	6934.	7072.
MRC	39810.	28750.	25102.	28352.	27665.
OTHFED	972.	970.	1139.	1467.	1159.
TOTAL	4294.	4506.	4321.	5521.	4650.

SOURCE: TABLE A-3 and TABLE A-5

RESEARCH GRANTS (FEDSURV) PER GRAD STUDENT (FT)

AGENCY	ATL	QUE	ONT	WEST	CAN*
1971/1972					
CC	0.	0.	0.	0.	0.
NRC	0.	0.	0.	0.	0.
MRC	0.	0.	0.	0.	0.
OTHFED	0.	0.	0.	0.	0.
TOTAL	0.	0.	0.	0.	0.
1972/1973					
CC	573.	772.	849.	664.	767.
NRC	6634.	7045.	7181.	6003.	6734.
MRC	45296.	32800.	25790.	28267.	29053.
OTHFED	0.	0.	0.	0.	0.
TOTAL	0.	0.	0.	0.	0.
1973/1974					
CC	795.	901.	913.	726.	860.
NRC	7562.	6847.	7162.	6639.	6962.
MRC	54526.	37344.	29534.	31853.	33113.
OTHFED	2801.	1632.	1033.	1547.	1414.
TOTAL	6500.	6101.	4796.	5662.	5434.
1974/1975					
CC	592.	831.	893.	877.	852.
NRC	7908.	6434.	7853.	7187.	7324.
MRC	40024.	31410.	29514.	31716.	31066.
OTHFED	2301.	1317.	929.	2608.	1516.
TOTAL	5911.	5298.	4796.	7261.	5581.

* Weighted average of four regions, excluding funds that cannot be allocated on a regional basis.

SOURCE: Table A-4 and Table A-5

RESEARCH GRANTS (CAUBO) PER GRAD STUDENT (FTE)

AGENCY	ATL	QUE	ONT	WEST	CAN
1971/1972					
CC	209.	123.	127.	135.	132.
NRC	4825.	3906.	4634.	5214.	4692.
MRC	36275.	9213.	19323.	20703.	14619.
OTHFED	734.	1127.	567.	736.	759.
TOTAL	3308.	3135.	2713.	3605.	3078.
1972/1973					
CC	269.	115.	147.	123.	139.
NRC	5535.	5114.	5324.	5538.	5360.
MRC	43430.	29199.	20971.	25571.	25346.
OTHFED	585.	936.	691.	920.	806.
TOTAL	3338.	3510.	2990.	3930.	3382.
1973/1974					
CC	251.	275.	163.	193.	205.
NRC	6732.	4883.	5107.	6174.	5467.
MRC	62538.	25468.	22164.	26131.	24963.
OTHFED	701.	1034.	897.	1106.	972.
TOTAL	3668.	3645.	3104.	4301.	3564.
1974/1975					
CC	269.	350.	195.	218.	249.
NRC	7003.	5323.	6552.	6434.	6245.
MRC	35574.	25605.	23197.	26991.	25388.
OTHFED	854.	762.	923.	1247.	946.
TOTAL	3772.	3536.	3504.	4694.	3797.

SOURCE: TABLE A-3 and TABLE A-6

RESEARCH GRANTS (FEDSURV) PER GRAD STUDENT (FTE)

AGENCY	ATL	QUE	ONT	WEST	CAN*
1971/1972					
CC	0.	0.	0.	0.	0.
NRC	0.	0.	0.	0.	0.
MRC	0.	0.	0.	0.	0.
OTHFED	0.	0.	0.	0.	0.
TOTAL	0.	0.	0.	0.	0.
1972/1973					
CC	507.	568.	669.	578.	612.
NRC	6227.	5907.	6454.	5709.	6094.
MRC	42663.	27426.	23649.	27048.	26191.
OTHFED	0.	0.	0.	0.	0.
TOTAL	0.	0.	0.	0.	0.
1973/1974					
CC	650.	646.	720.	608.	671.
NRC	6934.	5714.	6322.	6225.	6195.
MRC	47815.	31270.	26996.	29691.	29500.
OTHFED	2380.	1226.	845.	1353.	1154.
TOTAL	5523.	4582.	3926.	4953.	4434.
1974/1975					
CC	510.	628.	702.	702.	669.
NRC	7291.	5471.	6801.	6668.	6467.
MRC	35766.	27975.	27274.	30194.	28510.
OTHFED	2021.	1034.	754.	2218.	1238.
TOTAL	5193.	4158.	3889.	6173.	4557.

* See Table B-2

SOURCE: Table A-4 and Table A-6

TABLE B-5 (I)

RESEARCH GRANTS (CAUBO) PER PROFESSOR

AGENCY	ATL	QUE	ONT	WEST	CAN
1971/1972					
CC	132.	237.	219.	171.	199.
NRC	3538.	4565.	7980.	8262.	6792.
MRC	4690.	10430.	7706.	8019.	8253.
OTHFED	450.	1770.	882.	923.	1040.
TOTAL	2024.	4924.	4218.	4519.	4218.
1972/1973					
CC	180.	243.	236.	152.	208.
NRC	4314.	5847.	7744.	7910.	6966.
MRC	3940.	13935.	7346.	8487.	8921.
OTHFED	374.	1465.	967.	1087.	1041.
TOTAL	2135.	5498.	4185.	4646.	4364.
1973/1974					
CC	179.	572.	277.	241.	315.
NRC	4853.	5559.	7470.	7943.	6842.
MRC	4106.	13006.	7800.	7627.	8667.
OTHFED	454.	1593.	1308.	1245.	1257.
TOTAL	2375.	5620.	4529.	4842.	4613.
1974/1975					
CC	214.	762.	316.	263.	382.
NRC	4767.	6506.	8405.	8226.	7495.
MRC	4423.	13917.	7793.	8389.	9093.
OTHFED	586.	1243.	1257.	1370.	1208.
TOTAL	2589.	5773.	4771.	5156.	4845.

SOURCE: Tables A-3 and A-7

TABLE B-5 (II)

RESEARCH GRANTS (FEDSURV) PER PROFESSOR

AGENCY	ATL	QUE	ONT	WEST	CAN
1971/1972					
CC	0.	0.	0.	0.	0.
NRC	0.	0.	0.	0.	0.
MRC	0.	0.	0.	0.	0.
OTHFED	0.	0.	0.	0.	0.
TOTAL	0.	0.	0.	0.	0.
1972/1973					
CC	340.	1205.	1071.	716.	915.
NRC	4853.	6754.	9388.	8154.	7919.
MRC	3870.	13088.	8284.	8977.	9218.
OTHFED	0.	0.	0.	0.	0.
TOTAL	0.	0.	0.	0.	0.
1973/1974					
CC	464.	1344.	1226.	760.	1033.
NRC	4999.	6505.	9248.	8008.	7754.
MRC	3139.	15969.	9501.	8666.	10242.
OTHFED	1541.	1890.	1233.	1523.	1493.
TOTAL	3576.	7065.	5727.	5576.	5738.
1974/1975					
CC	406.	1368.	1138.	846.	1024.
NRC	4963.	6687.	8724.	6526.	7762.
MRC	4447.	15205.	9162.	9384.	10211.
OTHFED	1387.	1688.	1026.	2436.	1580.
TOTAL	3564.	6787.	5295.	6781.	5815.

SOURCE: Table A-4 and Table A-8

RESEARCH GRANTS(CAUBO)PER MASTERS AND PHD GRAD

AGENCY	ATL	QUE	ONT	WEST	CAN
1971/1972					
CC	623.	502.	302.	416.	378.
NRC	12708.	14422.	13148.	16250.	14772.
MRC	119818.	64174.	56614.	67161.	63307.
OTHFED	2100.	4704.	1426.	2386.	2282.
TOTAL	9455.	13089.	6830.	11680.	9254.
1972/1973					
CC	704.	422.	327.	374.	377.
NRC	17918.	16132.	14421.	16965.	15715.
MRC	65526.	58202.	56469.	77549.	61821.
OTHFED	1619.	3199.	1625.	2806.	2225.
TOTAL	9237.	12003.	7036.	11989.	9331.
1973/1974					
CC	0.	0.	0.	0.	0.
NRC	0.	0.	0.	0.	0.
MRC	0.	0.	0.	0.	0.
OTHFED	0.	0.	0.	0.	0.
TOTAL	0.	0.	0.	0.	0.
1974/1975					
CC	0.	0.	0.	0.	0.
NRC	0.	0.	0.	0.	0.
MRC	0.	0.	0.	0.	0.
OTHFED	0.	0.	0.	0.	0.
TOTAL	0.	0.	0.	0.	0.

PERCENT DISTRIBUTION OF GRANTS (CAUBO)

AGENCY	ATL	QUE	ONT	WEST	CAN
1971/1972					
CC	7.6	24.1	44.2	24.1	100.0
MRC	5.6	15.5	43.7	35.1	100.0
MRC	4.7	33.0	35.5	26.8	100.0
OTHFED	4.7	37.1	33.1	25.0	100.0
TOTAL	5.2	25.5	39.0	30.2	100.0
1972/1973					
CC	10.3	23.1	46.7	19.9	100.0
MRC	6.7	20.0	41.3	32.0	100.0
MRC	4.0	37.4	32.8	25.7	100.0
OTHFED	4.0	30.3	37.0	28.7	100.0
TOTAL	5.5	27.1	38.2	29.2	100.0
1973/1974					
CC	6.8	36.8	35.9	20.5	100.0
MRC	7.8	20.2	39.5	32.6	100.0
MRC	4.2	35.8	34.6	25.4	100.0
OTHFED	4.1	28.0	40.7	27.2	100.0
TOTAL	5.8	26.9	38.4	28.8	100.0
1974/1975					
CC	6.6	40.9	34.9	17.6	100.0
MRC	7.1	21.0	42.9	29.0	100.0
MRC	4.6	36.4	33.4	25.5	100.0
OTHFED	5.5	22.6	42.3	29.6	100.0
TOTAL	6.0	26.2	40.0	27.8	100.0

SOURCE: TABLE A-3

TABLE B-8

PERCENT DISTRIBUTION OF GRANTS (FEDSURU)

AGENCY	ATL	QUE	ONT	WEST	CAN
1971/1972					
CC	0.0	0.0	0.0	0.0	0.0
NRC	0.0	0.0	0.0	0.0	0.0
MRC	0.0	0.0	0.0	0.0	0.0
OTHFED	0.0	0.0	0.0	0.0	0.0
TOTAL	0.0	0.0	0.0	0.0	0.0
1972/1973					
CC	4.4	26.1	48.2	21.3	100.0
NRC	6.7	20.3	44.0	29.0	100.0
MRC	3.8	34.0	35.8	26.3	100.0
OTHFED	0.0	0.0	0.0	0.0	0.0
TOTAL	0.0	0.0	0.0	0.0	0.0
1973/1974					
CC	5.4	26.4	48.5	19.7	100.0
NRC	7.1	20.8	43.1	29.0	100.0
MRC	2.7	37.2	35.6	24.4	100.0
OTHFED	11.7	28.0	32.3	28.0	100.0
TOTAL	7.0	27.2	39.1	26.7	100.0
1974/1975					
CC	4.7	27.3	46.9	21.1	100.0
NRC	7.1	20.8	43.0	29.0	100.0
MRC	4.2	35.4	35.0	25.4	100.0
OTHFED	9.9	23.5	26.4	40.2	100.0
TOTAL	6.9	25.7	37.0	30.4	100.0

SOURCE: Table A-4

TABLE B-9

PERCENT DISTRIBUTION OF GRADUATE ENROLLMENT (FT)

SUBJECT	ATL	QUE	ONT	NEST	CAN
1971/1972					
HUM SC	5.2	24.2	45.3	25.2	100.0
NAT SC	5.7	16.9	44.5	32.8	100.0
HLTH S	2.0	52.0	26.8	19.2	100.0
TOTAL	5.2	23.4	44.0	27.4	100.0
1972/1973					
HUM SC	5.9	25.9	43.6	24.6	100.0
NAT SC	6.8	19.4	41.3	32.6	100.0
HLTH S	2.5	30.1	40.4	27.0	100.0
TOTAL	6.0	24.0	42.7	27.3	100.0
1973/1974					
HUM SC	5.9	25.1	45.7	23.3	100.0
NAT SC	6.3	21.2	41.9	30.4	100.0
HLTH S	1.6	33.0	39.9	25.4	100.0
TOTAL	5.9	24.2	44.3	25.6	100.0
1974/1975					
HUM SC	6.7	28.0	44.7	20.5	100.0
NAT SC	6.6	23.7	40.1	29.6	100.0
HLTH S	3.2	35.0	36.8	24.9	100.0
TOTAL	6.5	27.0	43.0	23.4	100.0

SOURCE: Table A-5

TABLE B-10

PERCENT DISTRIBUTION OF GRADUATE ENROLLMENT (FTE)

SUBJECT	ATL	QUE	ONT	WEST	CAN
1971/1972					
HUM SC	4.8	25.9	45.8	23.6	100.0
NAT SC	5.5	18.6	44.3	31.6	100.0
HLTH S	1.9	52.3	26.9	18.9	100.0
TOTAL	4.9	25.0	44.3	25.8	100.0
1972/1973					
HUM SC	5.3	28.1	44.1	22.5	100.0
NAT SC	6.5	20.9	41.6	31.0	100.0
HLTH S	2.4	32.5	39.7	25.5	100.0
TOTAL	5.6	26.1	43.2	25.1	100.0
1973/1974					
HUM SC	5.6	27.4	45.2	21.8	100.0
NAT SC	6.3	22.6	42.3	28.8	100.0
HLTH S	1.7	35.1	38.9	24.3	100.0
TOTAL	5.7	26.3	44.1	23.9	100.0
1974/1975					
HUM SC	6.1	29.1	44.7	20.1	100.0
NAT SC	6.3	24.6	40.9	28.2	100.0
HLTH S	3.3	36.1	36.6	24.0	100.0
TOTAL	6.1	28.1	43.3	22.4	100.0

SOURCE: Table A-6

PERCENT DISTRIBUTION OF PROFESSORS

SUBJECT	ATL	QUE	ONT	WEST	CAN
1971/1972					
HUM SC	11.5	20.3	40.2	28.0	100.0
NAT SC	10.8	23.1	37.2	28.9	100.0
HLTH S	8.3	26.1	38.1	27.6	100.0
TOTAL	10.9	21.8	39.0	28.2	100.0
1972/1973					
HUM SC	11.8	19.8	41.2	27.2	100.0
NAT SC	10.9	23.8	37.1	28.2	100.0
HLTH S	9.2	24.0	39.9	27.0	100.0
TOTAL	11.2	21.5	39.8	27.4	100.0
1973/1974					
HUM SC	12.1	20.3	40.9	26.8	100.0
NAT SC	10.9	24.8	36.2	28.1	100.0
HLTH S	8.8	23.9	38.4	28.9	100.0
TOTAL	11.3	22.1	39.2	27.5	100.0
1974/1975					
HUM SC	11.8	20.5	42.2	25.5	100.0
NAT SC	11.1	24.1	38.3	26.4	100.0
HLTH S	9.6	23.8	39.0	27.7	100.0
TOTAL	11.3	22.0	40.6	26.1	100.0

SOURCE: Table A-11

TABLE B-12

PERCENT DISTRIBUTION OF MASTERS AND PHD GRADS

SUBJECT	ATL	QUE	ONT	WEST	CAN
1971/1972					
HUM SC	4.6	18.2	55.3	21.9	100.0
NAT SC	6.6	15.9	49.1	28.4	100.0
HLTH S	2.5	32.5	39.7	25.3	100.0
TOTAL	5.1	18.0	52.9	24.0	100.0
1972/1973					
HUM SC	5.5	20.7	53.8	20.0	100.0
NAT SC	5.9	19.5	45.0	29.6	100.0
HLTH S	3.8	39.8	35.9	20.5	100.0
TOTAL	5.5	21.1	50.6	22.7	100.0
1973/1974					
HUM SC	0.0	0.0	0.0	0.0	0.0
NAT SC	0.0	0.0	0.0	0.0	0.0
HLTH S	0.0	0.0	0.0	0.0	0.0
TOTAL	0.0	0.0	0.0	0.0	0.0
1974/1975					
HUM SC	0.0	0.0	0.0	0.0	0.0
NAT SC	0.0	0.0	0.0	0.0	0.0
HLTH S	0.0	0.0	0.0	0.0	0.0
TOTAL	0.0	0.0	0.0	0.0	0.0

SOURCE: Table A-8

TABLE B-13

FACULTY AND GRADUATE ENROLMENT PER
10,000 POPULATION, BY REGION, 1973-74

	<u>Atl.</u>	<u>Que</u>	<u>Ont</u>	<u>West</u>	<u>Can</u>
	(Per 10,000 Population)				
<u>Faculty</u>					
Hum. & Soc. Sci.	9.0	5.2	8.0	7.0	7.1
Nat. Sci.	4.2	3.3	3.6	3.8	3.6
Health Sci.	1.6	1.5	1.8	1.8	1.7
TOTAL	14.7	11.9	13.4	12.5	12.4
<u>Grad. Enrolment (FT)</u>					
Hum. & Soc. Sci.	5.2	7.8	10.8	7.3	8.5
Nat. Sci.	2.8	3.1	4.7	4.5	4.0
Health Sci.	0.1	0.6	0.6	0.5	0.5
TOTAL	8.1	11.6	16.0	12.3	13.0
<u>Grad. Enrolment (FTE)</u>					
Hum. & Soc. Sci.	6.4	10.9	13.7	8.7	10.9
Nat. Sci.	3.0	3.8	5.3	4.8	4.5
Health Sci.	0.1	0.7	0.6	0.5	0.6
TOTAL	9.5	15.4	19.6	14.1	16.0

SOURCE: Tables A-5, A-6 and A-7; and Population intercensal estimates

TABLE B-14

REGIONAL RATIOS OF GRADUATE STUDENTS TO
FACULTY, BY FIELD OF STUDY, 1973-74

	<u>Atl</u>	<u>Que</u>	<u>Ont</u>	<u>West</u>	<u>Can</u>
	(Students Per Prof.)				
<u>Full-Time Enrollment</u>					
Hum. & Soc. Sci.	.58	1.49	1.34	1.05	1.20
Nat. Sci.	.66	.95	1.29	1.21	1.11
Health Sci.	*	.43	.32	.27	.31
TOTAL	.55	1.15	1.19	.98	1.06
<u>Full-Time Equivalent Enrl't</u>					
Hum. & Soc. Sci.	.71	2.08	1.70	1.25	1.54
Nat. Sci.	.72	1.14	1.46	1.29	1.25
Health Sci.	*	.51	.35	.29	.35
TOTAL	.65	1.54	1.46	1.12	1.29

*Too volatile because of small numbers involved

SOURCE: Based on data in Tables A-5, A-6, and A-7

TABLE B-15

DISTRIBUTION OF FULL-TIME ENROLMENT, MEDICINE, BACHELOR
AND FIRST PROFESSIONAL DEGREE, BY REGION

	<u>Atl</u>	<u>Que</u>	<u>Ont</u>	<u>West</u>	<u>Can</u>
	(Percentage Distribution)				
1970-71	6.9	38.4	32.3	22.4	100.0
1971-72	7.0	32.8	35.5	24.7	100.0
1972-73	12.3	33.5	31.0	23.2	100.0
1973-74	9.8	35.4	31.4	23.5	100.0
1974-75	6.7	37.1	31.1	25.0	100.0

SOURCE: Table A-9

APPENDIX C

Analytical Tables Based on NRC Records

TABLE C-1

THE CHANGE IN THE RELATIVE IMPORTANCE OF POSTGRADUATE
AND POSTDOCTORAL ASSISTANCE BY NRC

		1970-71	1971-72	1972-73	1973-74	1974-75	1975-76 P
Total Expenditures from NRC Vote	\$M	64.79	67.54	66.54	68.59	69.29	78.99
HQM Training and Development							
Postgraduates	\$M	8.23	8.10	7.10	6.90	7.02	8.53
Postdoctoral (1)	\$M	1.19	1.59	1.91	2.39	2.73	3.27
TOTAL	\$M	9.42	9.69	9.01	9.29	9.75	11.80
Funds to Postgraduates as Percent of Vote	(Percent)	12.7	12.0	10.7	10.1	10.1	10.8
Funds to Postdoctoral as Percent of Vote	(Percent)	1.8	2.3	2.8	3.4	3.9	4.1
Combined as Percent of Vote	(Percent)	14.5	14.3	13.5	13.5	14.0	14.9

(1) Including senior level awards.

P Preliminary

SOURCE: Based on NRC special tabulations

Note: The data in these tables, while approximately corresponding to data provided in the Statistics Canada Survey, have not been reconciled. The analytical points remain valid.

TABLE C-2

THE CHANGE IN THE RELATIVE IMPORTANCE OF
"PEER ADJUDICATED GRANTS" BY NRC

		1970-71	1971-72	1972-73	1973-74	1974-75	1975-76 P
Total Expenditures from NRC Vote	\$M	64.79	67.54	66.54	68.59	69.29	78.99
Total Peer Adjudicated Grants	\$M	48.42	49.16	48.78	50.98	50.88	59.09
of which to							
Postgraduate Assistants	\$M	9.07	8.89	8.03	8.05	7.85	9.07
Postdoctoral Assistants	\$M	4.26	4.98	5.42	5.73	5.84	6.72
Peer Adjudicated Grants as Percent of Vote of which	(Percent)	74.7	72.8	73.3	74.3	73.4	74.8
Postgraduate Assistants	(Percent)	14.0	13.2	12.1	11.7	11.3	11.5
Postdoctoral Assistants	(Percent)	6.6	7.4	8.1	8.4	8.4	8.5

P Preliminary

SOURCE: See Table C-1

TABLE C-3

SUMMARY OF CHANGES IN THE RELATIVE IMPORTANCE OF
PEER ADJUDICATED AND HQM GRANTS

		1970-71	1971-72	1972-73	1973-74	1974-75	1975-76 P
		(As Percentage of NRC Parliamentary Vote)					
HQM Training and Development	(Percent)	14.5	14.3	13.5	13.5	14.1	14.9
Peer Adjudicated Grants	(Percent)	74.7	72.8	73.3	74.3	73.4	74.8
All Other Grants	(Percent)	10.8	7.5	13.2	12.2	12.5	10.3
Total NRC Vote	(Percent)	100.0	100.0	100.0	100.0	100.0	100.0
Direct and Indirect Postgraduate (1)	(Percent)	26.7	25.2	22.8	21.8	21.4	22.3
Direct and Indirect Postdoctoral	(Percent)	8.4	9.7	10.9	11.8	12.4	12.6
Combined Postgraduate and Postdoctoral	(Percent)	35.1	34.9	33.7	33.6	33.8	34.9

(1) Includes HQM training and development awards, and that portion of peer adjudicated grants that is paid to postgraduate and postdoctoral assistants in the form of salaries.

P Preliminary

SOURCE: See Table C-1

TABLE C-4

HQM GRANTS, AND SALARY PORTION OF PEER ADJUDICATED GRANTS,
PER POSTGRADUATE AND PER POSTDOCTORATE

		1970-71	1971-72	1972-73	1973-74	1974-75	1975-76P
HQM Grants to Postgraduates	\$M	8.23	8.10	7.10	6.90	7.02	8.53
No. of Postgraduates		2337	2122	2015	1724	1698	1760
Average Award per Postgraduate	\$	3522	3817	3523	4002	4134	4847
HQM Grants to Postdoctorates	\$M	1.13	1.27	1.57	1.94	2.15	2.40
No. of Postdoctorates		205	217	248	256	279	245
Average Award per Postdoctorate	\$	5512	5853	6361	7578	7706	9796
Salaries (1) to Postgraduates	\$M	9.07	8.89	8.03	8.05	7.85	9.07
No. of Postgraduates		3110	2960	2685	2550	2491	2122
Average Salary per Postgraduate	\$	2916	3003	2991	3157	3151	4274
Salaries (1) to Postdoctorates	\$M	4.25	4.98	5.42	5.73	5.84	6.72
No. of Postdoctorates		692	786	751	737	729	748
Average Salary per Postdoctorate	\$	6156	6336	7217	7775	8011	8984

(1) Paid out of peer adjudicated and developmental grants.

P Preliminary estimates

SOURCE: See Table C-1

APPENDIX D

SUMMARY OF MRC EXPENDITURES BY REGION,

BASED ON MRC RECORDS

TABLE D-1

MRC, REGIONAL DISTRIBUTION OF EXPENDITURES ON SCIENTIFIC
ACTIVITIES IN CANADIAN UNIVERSITIES

	<u>Atlantic</u>		<u>Quebec</u>		<u>Ontario</u>		<u>West</u>		<u>Canada</u>
	(\$000)	%	(\$000)	%	(\$000)	%	(\$000)	%	(\$000)
1968-69	840	3.2	10,132	38.9	8,971	34.5	6,074	23.3	26,016
1969-70	1,129	3.8	11,413	38.7	9,813	33.3	7,109	24.9	29,463
1970-71	1,160	3.6	11,532	35.9	10,728	33.3	8,745	27.1	32,165
1971-72	1,357	4.0	12,297	36.7	11,703	34.9	8,181	24.4	33,538
1972-73	1,227	3.5	12,932	36.8	12,551	35.7	8,470	24.1	35,179
1973-74	1,422	3.7	13,961	36.7	13,470	35.4	9,235	24.2	38,087
1974-75	1,673	4.2	14,208	35.3	14,117	35.1	10,248	25.5	40,246
1975-76	2,122	4.7	15,914	35.5	16,092	35.9	10,732	23.9	44,860

Note: Excludes "non-institutional", and "outside Canada"

SOURCE: Medical Research Council Tabulations, based on MRC records and definition

APPENDIX E

A PRICE DEFLATOR FOR SCIENCE EXPENDITURES

(A Technical Note)

The traditional index for deflating science expenditures has been the National Accounts GNE implicit price index. Occasionally, the Consumer Price Index (CPI) has also been used. The advantages of using these indexes are that they are readily available, that they are generally well understood, and that they are fairly simple to apply. The main disadvantage, however, is that their internal composition is quite different from that of science expenditures, and that, therefore, the degree of true price erosion in science expenditures is not properly taken into account.

Some alternative science price indexes have been proposed in recent years. For example, the OECD suggested a base-weighted index. For weights, they provided a base-year distribution of science expenditures, averaged for several countries, including such components as materials, personnel, equipment, etc. Their suggestion was to use existing national price and cost indexes for the various basic components, and to combine these component indexes into a total science expenditure price index on the basis of the average international base weights. This method has some intuitive appeal, but is not really the best answer either. One major problem is that the expenditure distribution for a particular country could be quite different from the international average.

Both the MRC and the NRC have recently been experimenting with variants of the OECD index. However, instead of using an international average weighting pattern, they attempted to obtain information on the relative importance of various components of the expenditures which they finance. Such information can be used for a weighting pattern to combine

the cost changes of various individual components into a single price index. But since there is often ambiguity or uncertainty in the actual choice of cost indicators, such indexes tend to convey an air of subjectivity in favour of the index designer.

There is need, therefore, for an index that is not only fair to sponsors and recipients of the funds, but also simple, easy to understand, and readily available. The Science Council in a recent technical note¹ suggested that the implicit price index for current government expenditures might be an index that most closely represents the movements of the price component in federally-financed science expenditures. This suggestion is basically of merit, but fails to take account of the role of capital spending.

The following is a methodology that is similar to that of the Science Council, but is based on current as well as capital expenditure price indexes².

Total government expenditures, and federally-financed science expenditures (a constituent element of total government spending), have a current and a capital component, each with its own price behaviour. The relative proportions of current and capital spending in the two sets of expenditure data are, however, quite different, as is shown in Table E-1. (For science expenditures, complete coverage is available only as of 1970-71, when the survey of

1. K. P. Beltzner, Science Council, Report on Conversion Factors and Science Expenditures, September 29, 1976.

L. Sullivan, Science Council, Statistical Tables on Conversion Factors and Science Expenditures, September 21, 1976.

2. This index is a further elaboration of science expenditure price index work begun at MOSST and Statistics Canada.

the Human Sciences was started.) The share of capital to total federal science expenditures over the seven years ending in 1976-77, was roughly 6 per cent. The comparable percentage for total government spending was substantially higher.

The science expenditures price index calculated here is based on the expenditure weights derived from the proportions of the current and capital federal science expenditures; and on the implicit price indexes for current government expenditures on goods and services and government gross fixed capital formation.

Chart E-1 compares this particular index with two other indexes, namely the GNE implicit price deflator, and the Government implicit price deflator. (The latter is the ratio of the current and constant dollar values of the sum of current and capital expenditures by government.)

The National Accounts implicit price indexes for government expenditures relate to all levels of government. Unfortunately, the expenditures in the National Accounts are not deflated by level of government, so that there are no specific current and capital expenditures price indexes for federal government expenditures.

The Science Expenditures Price Index is provided in Table E-2.

It was constructed by the following methodology:

$$P_f = (Q_{t-1}^2 + Q_{t-1}^3 + Q_{t-1}^4 + Q_t^1) / 4,$$

where P is the Science Expenditures Price Index:

f is a particular fiscal year ending at March 31 of
calendar year t;

Q is a base-weighted quarterly price index derived
in the following manner:

$$Q_t^i = .94 q_t^{i,i} + .06 q_t^{ii,i},$$

where q_t^i is the quarterly implicit price index for current government
expenditures on goods and services

q_t^{ii} is the quarterly implicit price index for government gross
fixed capital formation;

i = quarters 1 to 4 of a given calendar year.

TABLE E-1

DISTRIBUTION OF CURRENT AND CAPITAL EXPENDITURES,
TOTAL GOVERNMENT (NATIONAL ACCOUNTS BASIS), AND
FEDERAL EXPENDITURES ON SCIENTIFIC ACTIVITIES

TOTAL GOVERNMENT EXPENDITURES

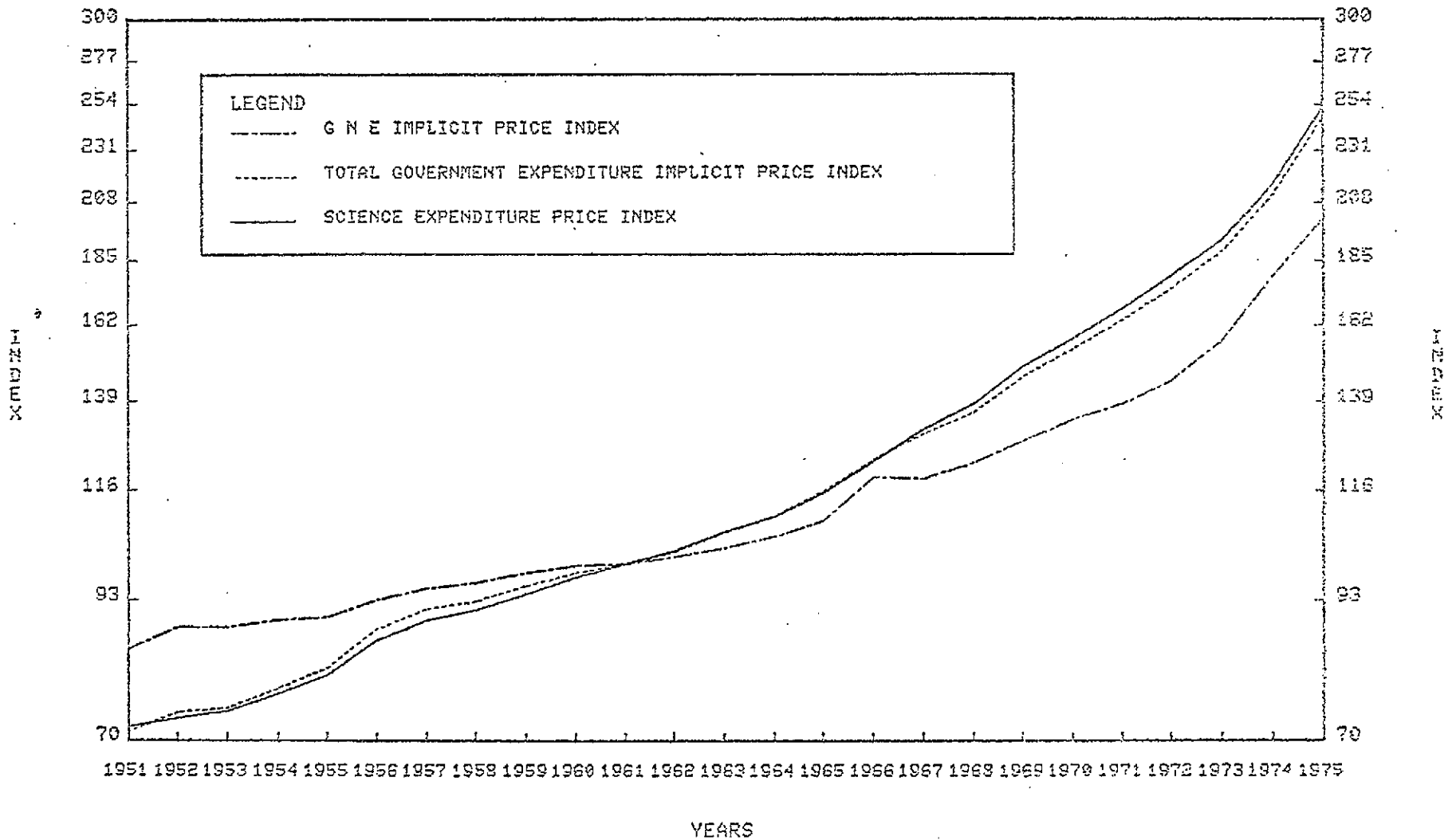
	<u>Current</u>	<u>Capital</u>	<u>Total</u>
		(Per Cent)	
1970	84.0	16.0	100.0
1971	83.0	17.0	100.0
1972	83.6	16.4	100.0
1973	84.1	15.9	100.0
1974	83.7	16.3	100.0
1975	83.5	16.5	100.0

FEDERAL SCIENCE EXPENDITURES

	<u>Current</u>	<u>Capital</u>	<u>Total</u>
		(Per Cent)	
1970-71	93.9	6.1	100.0
1971-72	93.6	6.4	100.0
1972-73	94.1	5.9	100.0
1973-74	94.4	5.6	100.0
1974-75	94.3	5.7	100.0
1975-76	93.5	6.5	100.0
1976-77	94.6	5.4	100.0

CHART 1

SCIENCE EXPENDITURE DEFLATORS (1961 = 100)
1951 - 1975



SOURCE : BASED ON DATA FROM STATISTICS CANADA; NATIONAL INCOME AND EXPENDITURE ACCOUNTS (CAT.# 13-531 OCCASIONAL); AND C.S.R. (CAT.# 11-003).

TABLE E-2

SCIENCE EXPENDITURES PRICE INDEX

FISCAL YEAR	INDEX (1971=100)	PERCENTAGE CHANGE
1947-48	30.59	
1948-49	34.56	13.0
1949-50	36.14	4.6
1950-51	38.11	5.4
1951-52	42.69	12.0
1952-53	43.85	2.7
1953-54	44.85	2.3
1954-55	46.48	3.6
1955-56	48.40	4.1
1956-57	51.92	7.3
1957-58	53.85	3.7
1958-59	54.92	2.0
1959-60	56.81	3.4
1960-61	58.72	3.4
1961-62	60.11	2.4
1962-63	61.64	2.6
1963-64	64.34	4.4
1964-65	66.59	3.5
1965-66	70.25	5.5
1966-67	74.58	6.2
1967-68	79.40	6.5
1968-69	83.88	5.6
1969-70	90.54	7.9
1970-71	95.51	5.5
1971-72	101.87	6.7
1972-73	109.70	7.7
1973-74	119.49	8.9
1974-75	137.36	15.0
1975-76	154.20	12.3
1976-77	164.70 (1)	6.8

(1) Projected at 6.8 per cent, CANDIDE mode!

APPENDIX F

FIELD OF STUDY - RECONCILIATION OF CLASSIFICATIONS
FOR EXPENDITURES, ENROLLMENT, AND FACULTY

FIELD OF STUDY - RECONCILIATION OF CLASSIFICATIONS
FOR EXPENDITURES, ENROLLMENT, AND FACULTY

In order to compare expenditures of the various granting councils by "Field of Study" to various university-related indicators such as graduate enrollment and faculty, it is necessary to reconcile the classification used in the various data sources. There are two basic sources for expenditures, namely the annual reports of the granting councils, and the Statistics Canada Survey of Federal Expenditures on Scientific Activities. The classifications relating to field of study are not the same in the two sources. Also, while the classifications for graduate enrollments, and for faculty, are relatively close (both being the responsibility of the Education Division of Statistics Canada), they differ in varying degrees from those used for the expenditures, especially for the classifications used by the councils.

Basically, the approach taken here was to list all the names for "Field of Study" from each data source, and to attempt to match those with the same name. This is, of course, only a rough approximation, that nevertheless is believed to serve the purpose of the analysis in this report. A more thorough reconciliation, if possible at all, would require content analysis as well as standardization between the reports of the councils and the classifications used by Statistics Canada.

The result of this comparison is two tables of fields of study where data from the diverse sources are thought to be reasonably comparable. Table F-1 relates to the Natural Sciences (excluding health. Health expenditure data are not classified in a way that permits comparison with enrollments and faculty by field of study). Table F-2 relates to the Human Sciences. Both tables contain, for a given field of study, the codes of other sources (lists A to D) containing comparable data. The "All Other" categories are merely balancing items, and their contents cannot be compared like those of a given field of study listed by name. (The "All Other" category for Table F-1, List B, for example, contains between 11 and 12 percent of the NRC expenditures for the past four years.)

Several reconciliation problems remain unresolved. For example, each of the three granting councils supports certain aspects of psychology. The faculty and enrolment for this field of study on the other hand, cannot be readily split up along the same lines as the expenditures by the councils. Another problem requiring further attention is the effect of the classification change for faculty and graduate enrolment in certain fields of the basic natural sciences between 1969-70 and 1970-71. The change resulted in an increase for the field of medicine, and a commensurate decrease in a number of life sciences fields, such as biology, zoology, etc. Thus the share of expenditures going to the life sciences is possibly not exactly comparable with the proportion of faculty and enrolment shown in that field.

TABLE F-1

NATURAL SCIENCES (EX. HEALTH)

FIELDS OF STUDY WITH COMPARABLE DATA

	<u>Code Number of</u>			
	<u>List A</u>	<u>List B</u>	<u>List C</u>	<u>List D</u>
Engineering	14 to 27	10 to 14	1 to 3	7 to 14
Biology	1,11	1 to 4	4 to 11	1 - 6
Chemistry	5	6	17	20
Environmental	9,10,11,12,13	15	19	21
Mathematics	6	17,18	18,20	19
Physics	4,7	7,8,9	21	22
All Other	2,3,8	5,16	22	

HEALTH SCIENCES

Total Health Sciences	n.a. (1)	n.a. (1)	12,13,14, 15,16	15,16,17, 18
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(1) Total MRC expenditures, including item 2 of List A.

SOURCE: Lists A to D below.

TABLE F-1
(cont'd)

LIST A: Expenditures (Statistics Canada)

Code No.

LIFE SCIENCES

- | | |
|---|----------|
| 1 | Biology |
| 2 | Clinical |
| 3 | Other |

PHYSICS AND MATH SCIENCES

- | | |
|---|-------------|
| 4 | Astronomy |
| 5 | Chemistry |
| 6 | Mathematics |
| 7 | Physics |
| 8 | Other |

ENVIRONMENTAL SCIENCES

- | | |
|----|-------------------------|
| 9 | Atmospheric |
| 10 | Geology |
| 11 | Biological Oceanography |
| 12 | Physical Oceanography |
| 13 | Other |

ENGINEERING SCIENCES

- | | |
|----|---------------------------|
| 14 | Aeronautics and Astronomy |
| 15 | Agriculture and Forestry |
| 16 | Architecture |
| 17 | Bio-engineering |
| 18 | Chemical |
| 19 | Civil and Surveying |
| 20 | Electrical |
| 21 | Engineering Physics |
| 22 | Industrial |
| 23 | Materials |
| 24 | Mechanical |
| 25 | Mining |
| 26 | Ocean |
| 27 | Other |

SOURCE: Statistics Canada, Federal Government Activities in the Natural Sciences, Questionnaire Guide, and Questionnaire.

TABLE F-1

(cont'd)

LIST C: MA and Ph.D. Enrollments Statistics Canada

Code No.

ENGINEERING AND APPLIED SCIENCES

- 1 Architecture
- 2 Engineering
- 3 Forestry

AGRICULTURE AND BIOLOGICAL SCIENCES

- 4 Agriculture
- 5 Biochemistry
- 6 Biology
- 7 Botany
- 8 Household Sciences
- 9 Veterinary Medicine
- 10 Zoology
- 11 Other

HEALTH SCIENCES

- 12 Dentistry
- 13 Medicine
- 14 Nursing
- 15 Pharmacy
- 16 Other

MATHEMATICS AND PHYSICAL SCIENCES

- 17 Chemistry
- 18 Computer Science
- 19 Geology
- 20 Mathematics
- 21 Physics (including meteorology)
- 22 Other

SOURCE: Statistics Canada, classification used by Education Division.

TABLE F-1
(cont'd)

LIST D: Full-time University Teachers (Statistics Canada)

Code No.

1	Agriculture
2	Biology
3	Botany
4	Household Science and Related
5	Veterinary Medicine and Sciences
6	Zoology
7	Architecture
8	Chemical Engineering
9	Civil Engineering
10	Electrical Engineering
11	Mechanical Engineering
12	Mining Engineering
13	Forestry Engineering
14	Other Applied Sciences
15	Dentistry
16	Medicine
17	Nursing
18	Pharmacy
19	Mathematics
20	Chemistry
21	Geology and Related
22	Physics

SOURCE: See list C above.

TABLE F-2

HUMANITIES AND SOCIAL SCIENCES
FIELDS OF STUDY WITH COMPARABLE DATA

Code Number of:

	<u>List A</u>	<u>List B</u>	<u>List C</u>	<u>List D</u>
Anthropology & Archaeology	1	4,5	10	16
Business & Commerce	2	1,26	11	18
Economics	6	9	12	19
Geography	7,18	12,25	13	17,20
Law	10	16	14	21
Political Sc. & Public Adm.	13	3,20	16	22
Psychology	14	21	17	23
Social Work	16	23	18	24
Sociology	4,5,17	7,8,24	19	25
Languages, Lit. & Linguistics	9	15,17	1,2,3,4, 15	5,9,10,11, 12,13
History	8	13	5	6
Philosophy	12	19	7	14
Religious Studies	15	22	8	15
Education	20	2,10	21	1,2
(All Other)	3,11,19	6,11,14, 18,27	6,9,20	3,4,7,8,

SOURCE: Lists A to D below.

TABLE F-2

HUMANITIES AND SOCIAL SCIENCES
FIELDS OF STUDY WITH COMPARABLE DATA

	<u>Code Number of:</u>			
	<u>List A</u>	<u>List B</u>	<u>List C</u>	<u>List D</u>
Anthropology & Archaeology	1	4,5	10	16
Business & Commerce	2	1,26	11	18
Economics	6	9	12	19
Geography	7,18	12,25	13	17,20
Law	10	16	14	21
Political Sc. & Public Admin.	13	3,20	16	22
Psychology	14	21	17	23
Social Work	16	23	18	24
Sociology	4,5,17	7,8,24	19	25
Languages, Lit. & Linguistics	9	15,17	1,2,3,4, 15	5,9,10,11, 12,13
History	8	13	5	6
Philosophy	12	19	7	14
Religious Studies	15	22	8	15
Education	20	2,10	21	1,2
(All Other)	3,11,19	6,11,14, 18,27	6,9,20	3,4,7,8,

SOURCE: Lists A to D below.

TABLE F-2
(cont'd)

LIST A:	<u>Expenditures</u>	<u>(Statistics Canada)</u>
1	Anthropology	
2	Business Administration and Commerce	
3	Communications	
4	Criminology	
5	Demography	
6	Economics	
7	Geography	
8	History	
9	Languages, Literature, Linguistics	
10	Law	
11	Library Science	
12	Philosophy	
13	Political Science (including Public Administration)	
14	Psychology	
15	Religious Studies	
16	Social Work	
17	Sociology	
18	Urban and Regional Studies	
19	Other	
20	Education	

SOURCE: Statistics Canada, Federal Government Activities in the Human Sciences, Questionnaire Guide, and Questionnaire.

TABLE F-2

(cont'd)

LIST B: Expenditures (Canada Council)

Code No.

1	Business Administration
2	Education Administration
3	Public Administration
4	Anthropology
5	Archaeology
6	Communication Studies
7	Criminology
8	Demography
9	Economics
10	Education
11	Fine Arts, Architecture
12	Geography
13	History
14	Information Sciences
15	Languages and Literature (including Classics)
16	Law
17	Linguistics
18	Mathematics
19	Philosophy
20	Political Science
21	Psychology
22	Religious Studies
23	Social Work
24	Sociology
25	Urban and Regional Studies
26	Industrial Relations
27	Other

SOURCE: Canada Council, Annual Report (various recent years).

TABLE F-2

LIST C: MA and Ph.D. Enrollment (Statistics Canada)

Code No.

1	Classics and Latin
2	English
3	French
4	Other Modern Languages
5	History
6	Library Science
7	Philosophy
8	Theology and Religion
9	Other Humanities
10	Anthropology
11	Commerce and Business
12	Economics
13	Geography
14	Law
15	Linguistics
16	Political Science and Public Administration
17	Psychology
18	Social Work
19	Sociology
20	Other Social Sciences
21	Education

SOURCE: Classifications used by Education Division of Statistics Canada.

TABLE F-2

LIST D: Full-time University Teachers (Statistics Canada)

Code No.

1	Physical Education
2	Education
3	Music
4	Fine and Applied Arts
5	Classics
6	History
7	Library and Records Sciences
8	Mass Media Studies
9	English
10	French
11	German
12	Spanish
13	Other Modern Languages
14	Philosophy
15	Religious Studies
16	Anthropology
17	Area Studies
18	Commerce, Business Administration
19	Economics
20	Geography
21	Law
22	Political Science
23	Psychology
24	Social Work
25	Sociology

SOURCE: See List C above.

