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SCIENCE AND TECHNOLOGY INDICATORS

FOR

CANADIAN INDUSTRIES

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SCIENCE AND TECHNOLOGY
SCIENCES ET TECHNOLOGIE

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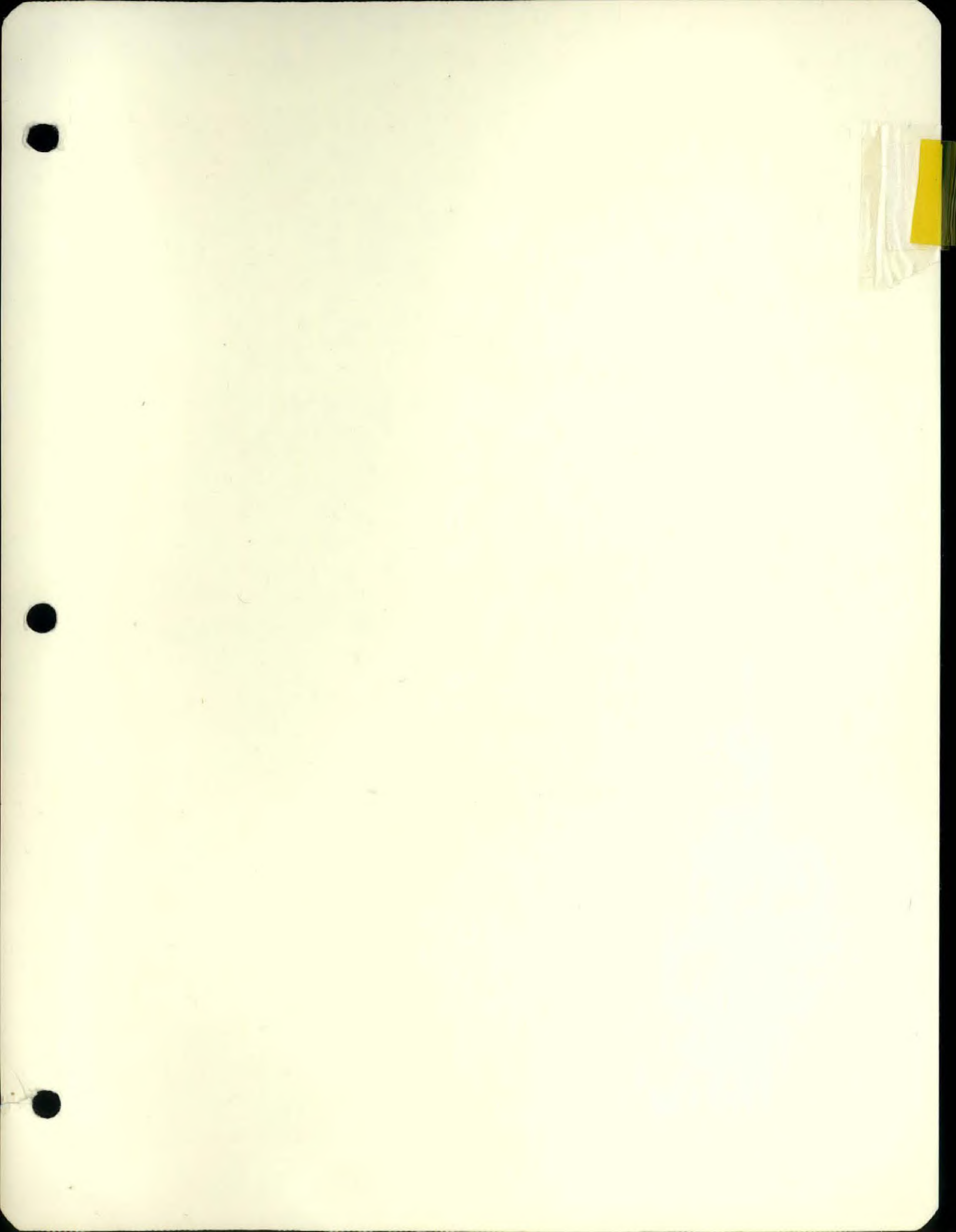
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GLOSSARY



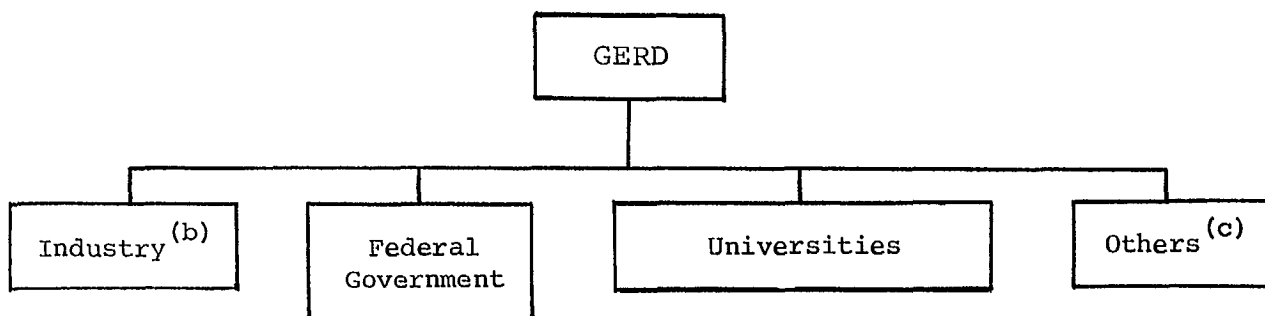
SECTION 1

The purpose of Section 1 is to examine the performance of research and development in Canada. The concept of Gross Expenditure on Research and Development (GERD) and its various components is introduced. The degree of R&D activity in relation to the economy as a whole is measured by the ratio of GERD to Gross National Product (GNP). The share of R&D performed by each sector is also examined with particular emphasis on the role of Canadian industry.

Gross Expenditure on Research and Development

Gross Domestic Expenditure on Research and Development (GERD) is defined by the OECD as total intramural expenditures on R&D performed within the national boundaries of a country. It includes the performance of R&D which is funded from abroad but excludes payments for R&D performed abroad. The following chart shows the various components of GERD as presented by Statistics Canada in the Annual Review of Science Statistics, Catalogue 13-212.

GROSS DOMESTIC EXPENDITURE ON R&D^(a)



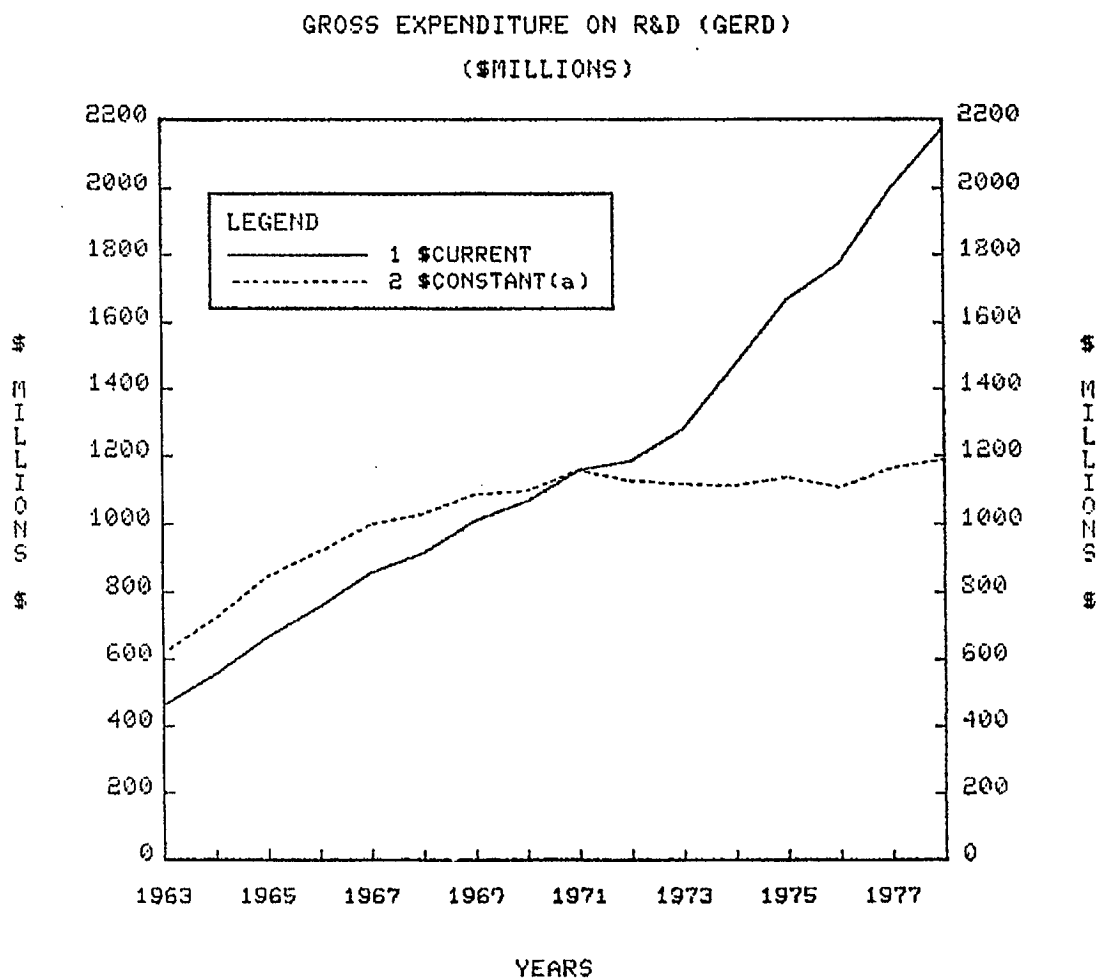
(a) GERD is the sum of the intramural R&D expenditure by four sectors: Industry, Federal Government, Universities, and Others.

(b) Includes Private and Public Enterprises.

(c) Includes Provincial Governments, Provincial Research Organizations, and Private Non-Profit Organizations.

Chart 1.1--Gross Domestic Expenditure on R&D (GERD)

In current dollars, GERD has grown from \$464.9 million in 1963 to \$2177.6 million in 1978. The GNE price index has been employed to convert these values to 1971 dollars. After adjusting for inflation, the growth in GERD was more moderate, especially after 1970 (Appendix Tables A1 to A3).

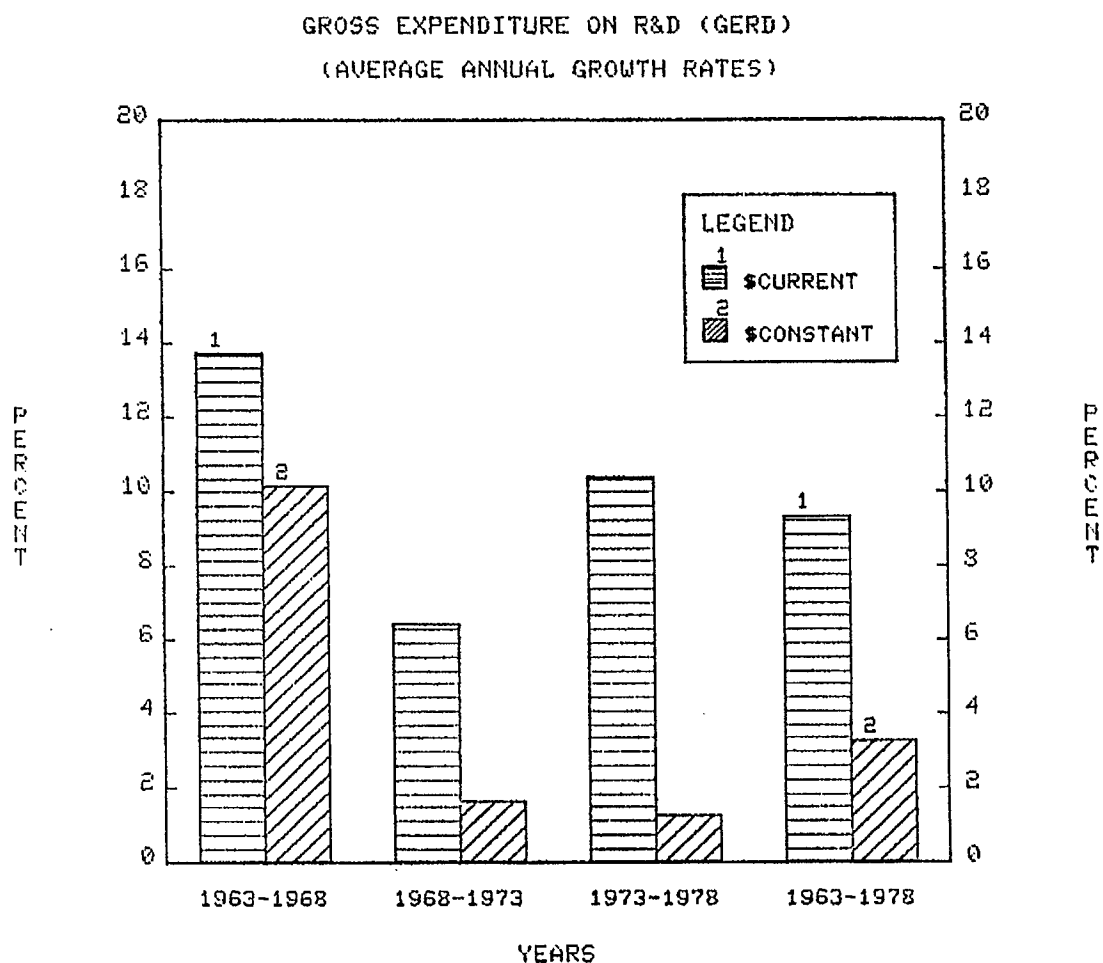


SOURCE : BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

a . 1971=100

Figure 1.1--Current vs. Constant Dollar GERD

In current dollars, the average annual rate of growth in GERD between 1963 and 1978 was 9.4%. In constant dollars, however, it was 3.3%. Since 1971, there has been little real growth and, in several years, there were absolute declines (Appendix Table A5). Figure 1.2 shows the growth of GERD in current and constant dollar terms for selected time periods (Appendix Table A6).



SOURCE : BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

Figure 1.2--Current & Constant Dollar Growth Rates of GERD

The ratio of GERD to GNP provides an indication of the proportion of the country's economic output which is allocated to R&D. This ratio, in Canada's case, has declined to 0.94% in 1978, after reaching a peak of 1.29% in 1967 (Table 1.1). R&D expenditures as a percentage of GNP have declined steadily in the 1970's for all three major sectors (Federal Government, Industry, and University). The Federal Government exhibited the most rapid and prolonged decline from 0.42% in 1967 to 0.26% in 1978. Industry's R&D expenditure to GNP ratio has declined during the 1970's from approximately 0.5% to 0.4%, and universities' ratio from 0.3% to 0.24%. The R&D expenditures of other performers have accounted for less than 0.1% of GNP over the entire period. Since 1967, GNP has outgrown GERD in all but three years (Appendix Tables A4 to A6).

GERD AND GNP
(PERCENTAGE)

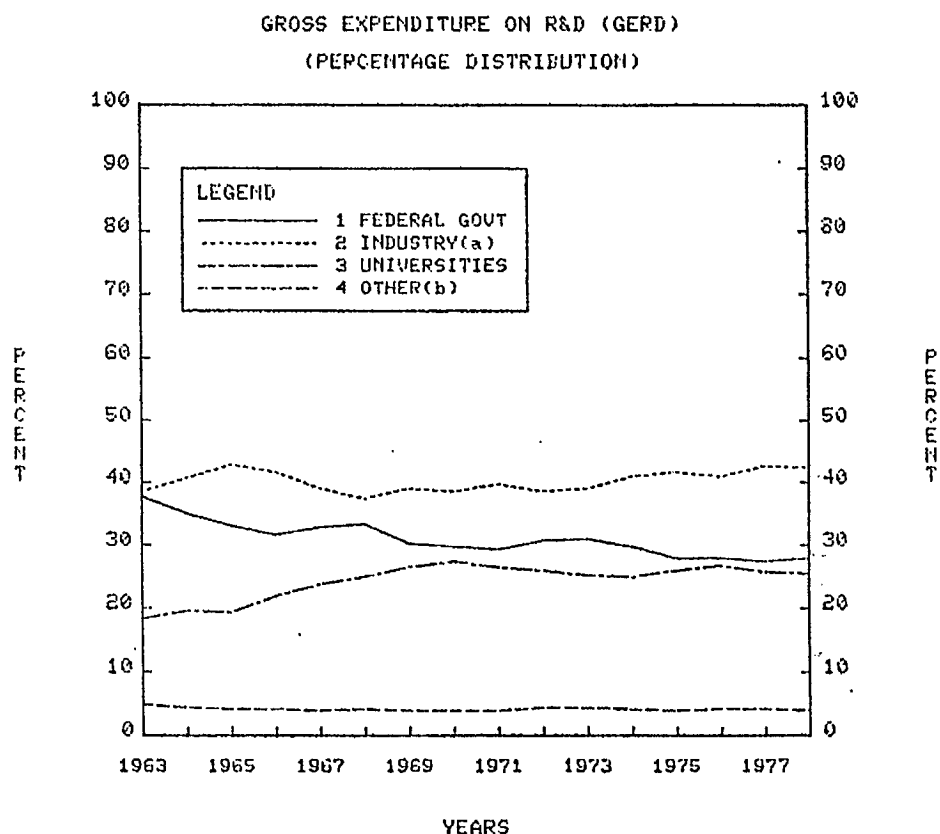
	PERFORMING SECTORS							GNP
	FED	PROV(a)	ALL GOVTS	INDUSTRY(b)	UNIVERSITIES	PNP(c)	TOTAL	
1963	0.38	0.04	0.42	0.39	0.19	0.01	1.01	100.0
1964	0.39	0.04	0.43	0.45	0.22	0.01	1.11	100.0
1965	0.40	0.04	0.44	0.52	0.23	0.01	1.21	100.0
1966	0.39	0.04	0.43	0.51	0.27	0.01	1.23	100.0
1967	0.42	0.04	0.47	0.51	0.31	0.01	1.29	100.0
1968	0.42	0.04	0.46	0.47	0.32	0.01	1.26	100.0
1969	0.38	0.04	0.43	0.49	0.33	0.01	1.26	100.0
1970	0.37	0.04	0.41	0.48	0.34	0.01	1.24	100.0
1971	0.36	0.04	0.40	0.49	0.33	0.01	1.23	100.0
1972	0.35	0.04	0.39	0.44	0.29	0.01	1.13	100.0
1973	0.32	0.04	0.36	0.41	0.26	0.01	1.04	100.0
1974	0.30	0.03	0.33	0.41	0.25	0.01	1.00	100.0
1975	0.28	0.03	0.32	0.42	0.26	0.01	1.01	100.0
1976	0.26	0.03	0.29	0.38	0.25	0.01	0.93	100.0
1977	0.26	0.03	0.29	0.41	0.24	0.01	0.95	100.0
1978	0.26	0.03	0.29	0.40	0.24	0.01	0.94	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

- (a) INCLUDES PROVINCIAL RESEARCH ORGANIZATIONS
- (b) PRIVATE AND PUBLIC ENTERPRISES
- (c) PRIVATE NON-PROFIT ORGANIZATIONS

Table 1.1--R&D Expenditures as a Percentage of GNP by Sector

As shown in Chart 1.1, GERD is the sum of intramural R&D expenditure reported by four sectors. The share of R&D performed by each sector is shown in Figure 1.3 for 1963-1978. The industry sector has always accounted for the largest proportion of GERD and its share has been growing since the late 1960's, from 37.4% in 1968 to 42.6% in 1978. Most of this growth is attributable to the decline in the share provided by the federal government, from 33.3% in 1968 to 27.9% in 1978. In fact, the federal government's share of R&D has declined to roughly the same level as that of the university sector which maintained a share of at least 25% since 1968 (Appendix Table A7). The "other" performers' share of R&D, including provincial governments and research organizations, has remained relatively stable at approximately 4% of GERD.



SOURCE : BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

a . PRIVATE AND PUBLIC ENTERPRISES

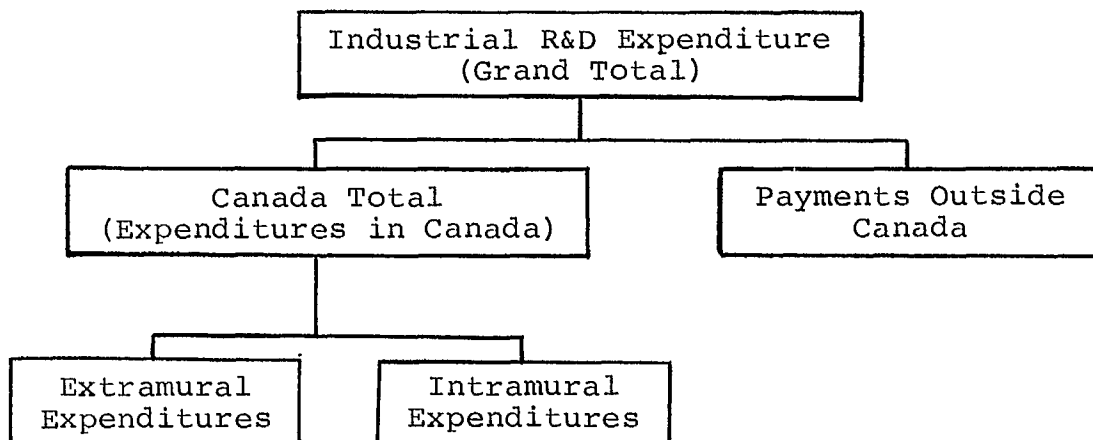
b . INCLUDES PROVINCES, PROVINCIAL RESEARCH ORGANIZATIONS,
AND PRIVATE NON-PROFIT ORGANIZATIONS

Figure 1.3--Distribution of GERD By Sector

Industrial Research and Development Expenditure

The following analysis focusses on R&D expenditure in the industry sector (also referred to as Canadian Firms and Business Enterprises). Chart 1.2 illustrates the inter-relationships among the various components of industrial R&D expenditure. As mentioned previously, only the intramural portion of R&D expenditure is included in the calculation of GERD.

R&D EXPENDITURE BY CANADIAN FIRMS



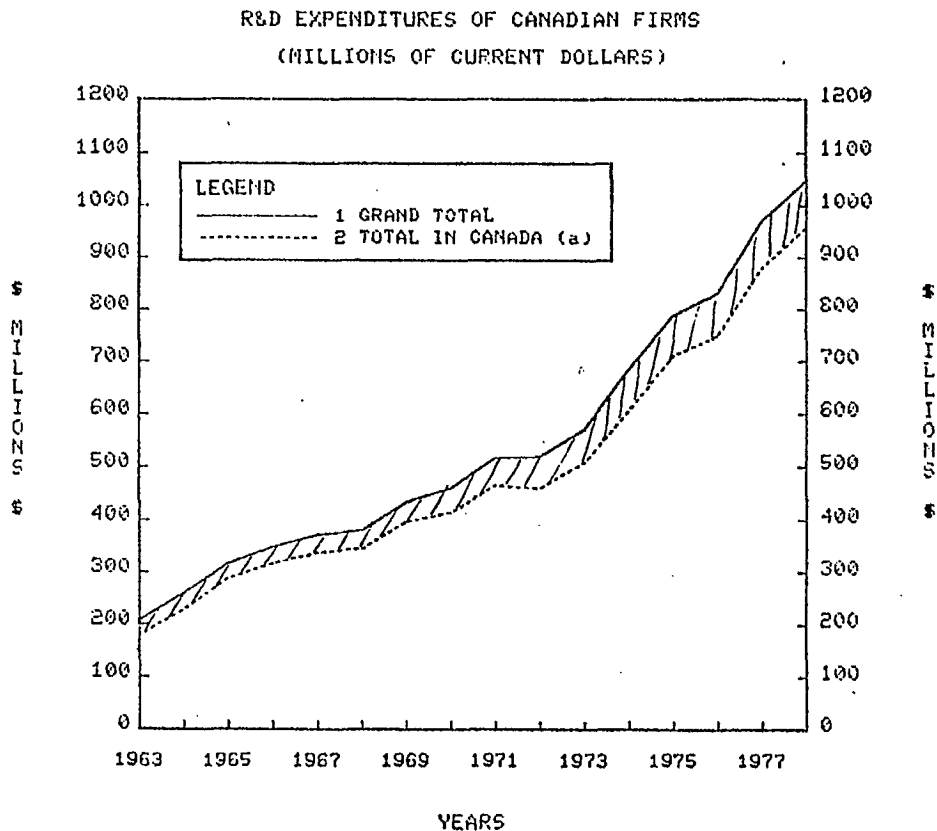
Grand Total = Canada Total + Payments Outside Canada

Canada Total ^(a) = Intramural Expenditure + Extramural Expenditure

(a) The Canada Total will, in fact, be less than the sum of intramural and extramural expenditures since transfers between respondents are deducted from it.

Chart 1.2--Industrial R&D Expenditure

In current dollars, industrial R&D expenditure almost quintupled between 1963 and 1978, from \$210.5 million to \$1048.6 million (See Appendix Table A8). Since 1963, almost 90% of firms' R&D has been directed towards the financing of R&D performed in Canada (Appendix Table A9). The shaded area in Figure 1.4 represents the comparatively small portion of expenditure reported as payments for R&D performed outside Canada.



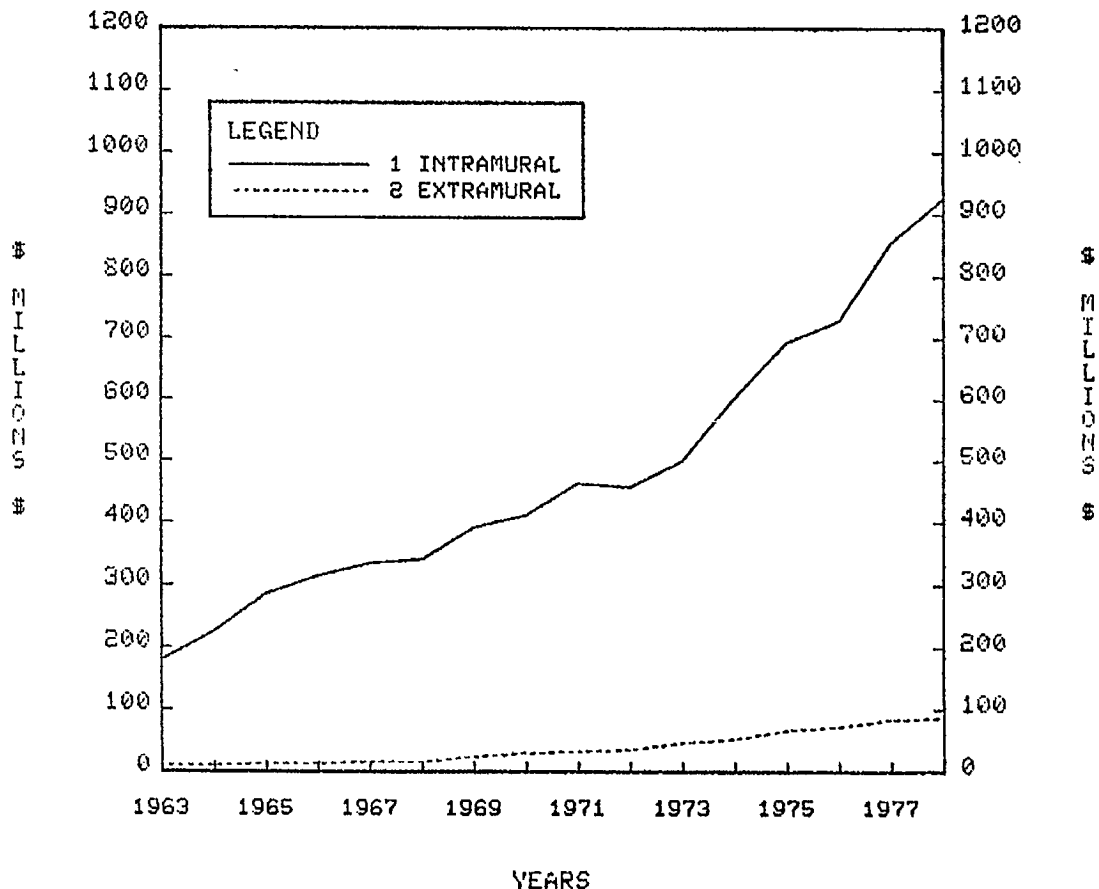
SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212, 1978

a . TO AVOID DOUBLE COUNTING, TRANSFERS BETWEEN RESPONDANTS HAVE BEEN SUBTRACTED FROM THE SUM OF ALL CANADIAN INTRAMURAL AN EXTRAMURAL EXPENDITURES. OTHERWISE, SUCH TRANSFERS WOULD BE ENTERED ONCE AS INTRAMURAL AND ONCE AS EXTRAMURAL.

Figure 1.4--Industrial R&D Expenditure Inside and Outside of Canada

Expenditures on R&D performed in Canada are classified as intramural or extramural. Intramural R&D expenditure includes all funds of an organization used for the performance of in-house R&D. Extramural expenditure accounts for the flow of R&D funds from one organization to another. Transfers of R&D expenditures among firms pose problems of double counting when comparing intramural and extramural expenditures. In any case, Canadian firms have tended to perform their own R&D instead of contracting out to other firms. Thus, intramural expenditures make up the bulk (over 90%) of R&D expenditures (Figure 1.5 and Appendix Table A8).

R&D EXPENDITURES OF CANADIAN FIRMS
(MILLIONS OF CURRENT DOLLARS)



SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212, 1978

Figure 1.5--Industry's Intramural and Extramural Expenditures

As is the case of GERD, much of the increase in industry's intramural R&D expenditure, especially during the 1970's, is a reflection of the high rates of inflation existing in that period. In current dollars, industrial intramural R&D more than quintupled from \$180.4 million in 1963 to \$927.5 million in 1978. In constant dollars, however, it only doubled from \$241.2 million to \$508 million (Appendix Tables A8 and A10). Figure 1.6 shows the divergence in the current and constant dollar values of industry's intramural R&D expenditures. The similarity of this trend with the corresponding one for GERD (Figure 1.1) serves to emphasize the impact of industrial expenditures on GERD.

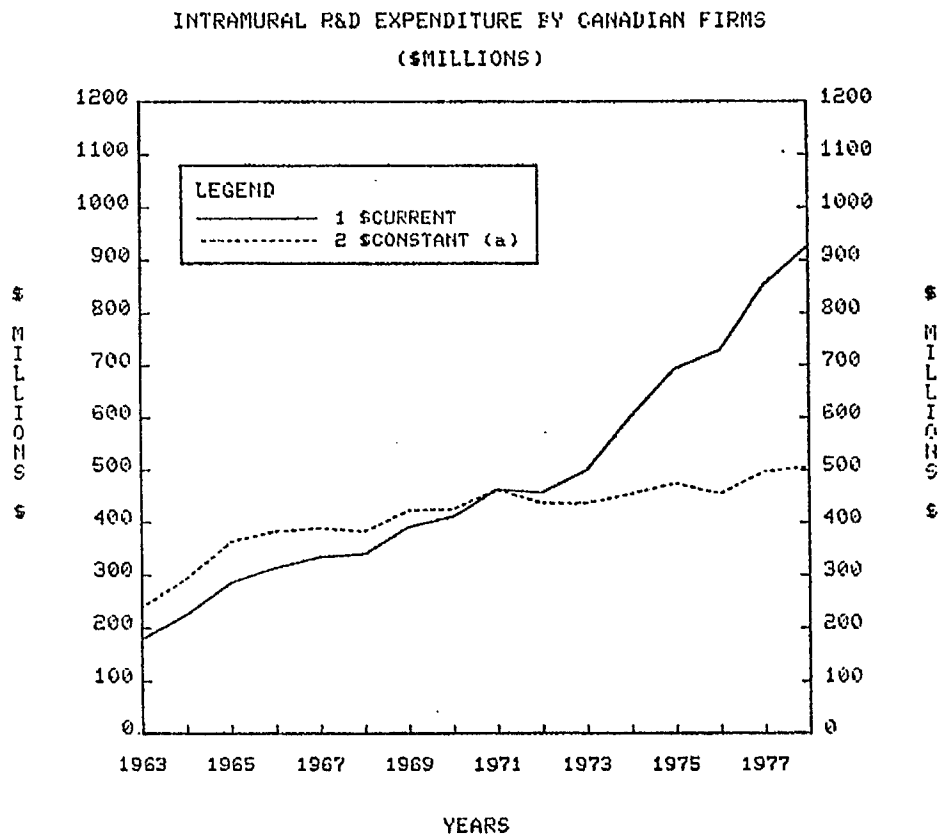
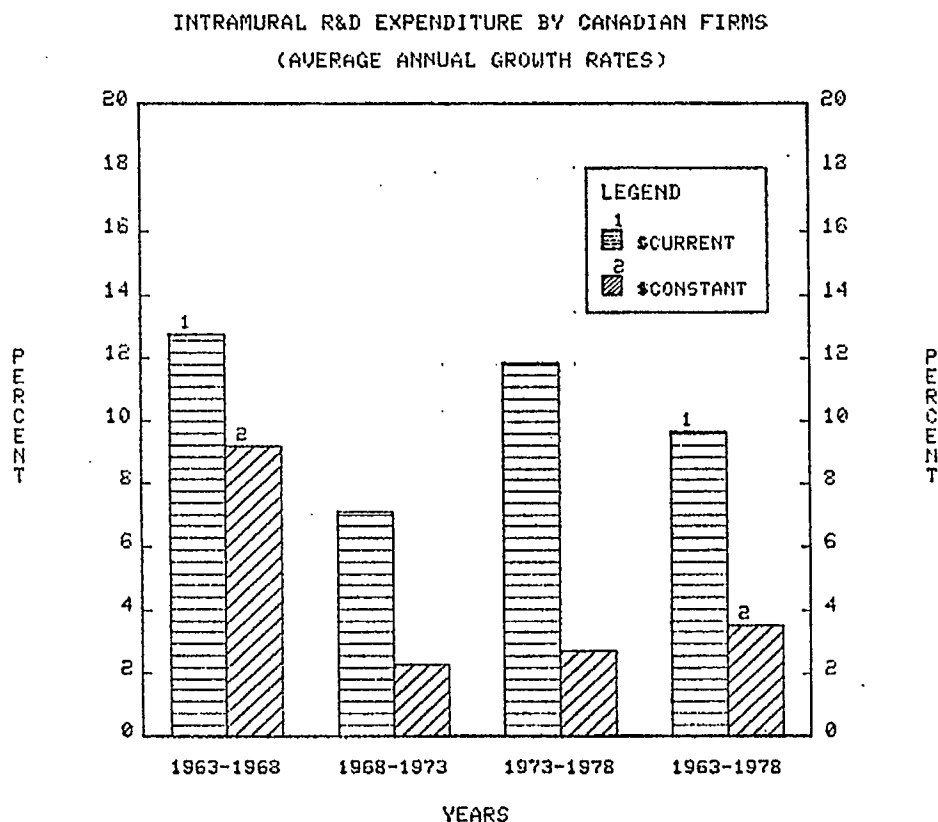


Figure 1.6--Industry's Intramural R&D Expenditure (Current & Constant Dollars)

The growth of intramural R&D expenditure by the industry sector differs significantly when inflationary effects are introduced. These differences are displayed in Figure 1.7 for the period 1963-1978 (Appendix Tables A11 to A13). In constant dollars, intramural R&D expenditures by industry have grown at an average annual rate of 3.6% although the pace has slowed considerably in later years. Real growth between 1963 and 1968 was 9.2% as compared to 2.3% between 1968 and 1973, and 2.7% between 1973 and 1978. These average growth rates, although useful for examining overall trends, do not show how erratically R&D can change from year to year. For example, between 1973 and 1978, the average rate of 2.7% includes annual increases as high as 9.5% and annual declines as great as -4.5% (Appendix Tables A12 and A13).



SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212, 1978

Figure 1.7--Current and Constant Dollar Growth Rates of Intramural R&D Expenditure

APPENDIX A

GERD AND GNP
(MILLIONS OF CURRENT DOLLARS)

	PERFORMING SECTORS						TOTAL	GNP
	FED	PROV(a)	ALL GOVTS	INDUSTRY(b)	UNIVERSITIES	PNP(c)		
1963	175.3	18.9	194.2	180.4	86.0	4.3	464.9	45,978
1964	195.5	20.4	215.9	227.0	108.9	4.6	556.4	50,280
1965	221.8	23.4	245.2	287.4	129.8	5.0	667.4	55,364
1966	241.2	26.5	267.7	317.1	167.2	5.4	757.4	61,828
1967	282.1	28.3	310.4	335.5	206.0	6.0	857.9	66,409
1968	304.6	30.7	335.3	342.1	229.8	6.5	913.7	72,586
1969	305.7	33.7	339.4	393.8	266.3	7.0	1,006.5	79,815
1970	318.1	34.0	352.1	413.0	293.0	7.7	1,065.8	85,685
1971	342.2	37.4	379.6	464.5	309.5	8.3	1,161.9	94,450
1972	364.8	41.9	406.7	459.3	309.4	9.0	1,184.4	105,234
1973	397.1	47.1	444.2	502.2	323.4	9.8	1,279.6	123,560
1974	440.0	49.0	489.0	603.5	369.1	10.7	1,472.3	147,528
1975	466.4	55.8	522.2	696.5	435.7	11.6	1,666.0	165,428
1976	495.0	62.0	557.0	729.9	476.0	12.6	1,775.5	191,492
1977	547.2	68.5	615.7	854.9	514.1	13.6	1,998.3	210,132
1978	606.9	73.3	680.2	927.5	555.2	14.7	2,177.6	232,800

SOURCE: SCIENCE STATISTICS CENTRE, JANUARY 1979

- (a) INCLUDES PROVINCIAL RESEARCH ORGANIZATIONS
- (b) PRIVATE AND PUBLIC ENTERPRISES
- (c) PRIVATE NON-PROFIT ORGANIZATIONS

GERD AND GNP
(MILLIONS OF CONSTANT(d) DOLLARS)

	PERFORMING SECTORS						GNP	
	FED	PROV(a)	ALL GOVTS	INDUSTRY(b)	UNIVERSITIES	PNP(c)	TOTAL	
1963	234.4	25.3	259.6	241.2	115.0	5.7	621.5	61,466
1964	255.2	26.6	281.9	296.3	142.2	6.0	726.4	65,642
1965	280.4	29.6	310.0	363.3	164.1	6.3	843.7	69,989
1966	292.0	32.1	324.1	383.9	202.4	6.5	916.9	74,848
1967	328.4	32.9	361.4	390.6	239.8	7.0	998.7	77,308
1968	343.4	34.6	378.0	385.7	259.1	7.3	1,030.1	81,833
1969	330.1	36.4	366.5	425.3	287.6	7.6	1,086.9	86,191
1970	328.3	35.1	363.4	426.2	302.4	7.9	1,099.9	88,426
1971	342.2	37.4	379.6	464.5	309.5	8.3	1,161.9	94,450
1972	347.4	39.9	387.3	437.4	294.7	8.6	1,128.0	100,223
1973	346.5	41.1	387.6	438.2	282.2	8.6	1,116.6	107,820
1974	333.1	37.1	370.2	456.9	279.4	8.1	1,114.5	111,676
1975	319.0	38.2	357.2	476.4	298.0	7.9	1,139.5	113,148
1976	308.6	38.7	347.3	455.0	296.8	7.9	1,106.9	119,382
1977	319.1	39.9	359.0	498.5	299.8	7.9	1,165.2	122,527
1978	332.4	40.1	372.5	507.9	304.1	8.1	1,192.6	127,497

SOURCE: SCIENCE STATISTICS CENTRE, JANUARY 1979

- (a) INCLUDES PROVINCIAL RESEARCH ORGANIZATIONS
- (b) PRIVATE AND PUBLIC ENTERPRISES
- (c) PRIVATE NON-PROFIT ORGANIZATIONS
- (d) 1971=100

GROSS EXPENDITURE ON RESEARCH AND DEVELOPMENT
(\$MILLIONS)

	\$CURRENT	\$CONSTANT(a)	GNE PRICE INDEX
1963	464.9	621.5	74.8
1964	556.4	726.4	76.6
1965	667.4	843.7	79.1
1966	757.4	916.9	82.6
1967	857.9	998.7	85.9
1968	913.7	1,030.1	88.7
1969	1,006.5	1,086.9	92.6
1970	1,065.8	1,099.9	96.9
1971	1,161.9	1,161.9	100.0
1972	1,184.4	1,128.0	105.0
1973	1,279.6	1,116.6	114.6
1974	1,472.3	1,114.5	132.1
1975	1,666.0	1,139.5	146.2
1976	1,775.5	1,106.9	160.4
1977	1,998.3	1,165.2	171.5
1978	2,177.6	1,192.6	182.6

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS
CENTRE, JANUARY 1979

(a) 1971=100

GERD AND GNP
(AVERAGE ANNUAL GROWTH RATES)

YEAR	PERCENTAGES IN CURRENT DOLLARS							GNP
	PERFORMING SECTORS							
	FED	PROV(a)	ALL GOVTS	INDUSTRY(b)	UNIVERSITIES	PNP(c)	TOTAL	
63-64	11.5	7.9	11.2	25.8	26.6	7.0	19.7	9.4
64-65	13.5	14.7	13.6	26.6	19.2	8.7	19.9	10.1
65-66	8.7	13.2	9.2	10.3	28.8	8.0	13.5	11.7
66-67	17.0	6.8	16.0	5.8	23.2	11.1	13.3	7.4
67-68	8.0	8.5	8.0	2.0	11.6	8.3	6.5	9.3
68-69	0.4	9.8	1.2	15.1	15.9	7.7	10.2	10.0
69-70	4.1	0.9	3.7	4.9	10.0	10.0	5.9	7.4
70-71	7.6	10.0	7.8	12.5	5.6	7.8	9.0	10.2
71-72	6.6	12.0	7.1	-1.1	-0.0	8.4	1.9	11.4
72-73	8.9	12.4	9.2	9.3	4.5	8.9	8.0	17.4
73-74	10.8	4.0	10.1	20.2	14.1	9.2	15.1	19.4
74-75	6.0	13.9	6.8	15.4	18.0	8.4	13.2	12.1
75-76	6.1	11.1	6.7	4.8	9.2	8.6	6.6	15.8
76-77	10.5	10.5	10.5	17.1	8.0	7.9	12.5	9.7
77-78	10.9	7.0	10.5	8.5	8.0	8.1	9.0	10.8
63-78	7.6	8.9	7.7	9.7	11.4	8.3	9.4	11.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

- (a) INCLUDES PROVINCIAL RESEARCH ORGANIZATIONS
- (b) PRIVATE AND PUBLIC ENTERPRISES
- (c) PRIVATE NON-PROFIT ORGANIZATIONS

GEPD AND GNP
(AVERAGE ANNUAL GROWTH RATES)

YEAR	PERCENTAGES IN CONSTANT DOLLARS						TOTAL	GNP
	PERFORMING SECTORS							
	FED	PROV(a)	ALL GOV'TS	INDUSTRY(b)	UNIVERSITIES	PRP(c)		
63-64	8.9	5.1	8.6	22.8	23.7	5.3	16.9	6.8
64-65	9.9	11.3	10.0	22.6	15.4	5.0	16.1	6.6
65-66	4.1	8.4	4.5	5.7	23.3	3.2	8.7	6.9
66-67	12.5	2.5	11.5	1.7	18.5	7.7	8.9	3.3
67-68	4.6	5.2	4.6	-1.3	8.0	4.3	3.1	5.9
68-69	-3.9	5.2	-3.0	10.3	11.0	4.1	5.5	5.3
69-70	-0.5	-3.6	-0.8	0.2	5.1	3.9	1.2	2.6
70-71	4.2	6.6	4.5	9.0	2.3	5.1	5.6	6.8
71-72	1.5	6.7	2.0	-5.8	-4.8	3.6	-2.9	6.1
72-73	-0.3	3.0	0.1	0.2	-4.2	0.0	-1.0	7.6
73-74	-3.9	-9.7	-4.5	4.3	-1.0	-5.8	-0.2	3.6
74-75	-4.2	3.0	-3.5	4.3	6.7	-2.5	2.2	1.3
75-76	-3.3	1.3	-2.8	-4.5	-0.4	0.0	-2.9	5.5
76-77	3.4	3.1	3.4	9.6	1.0	0.0	5.3	2.6
77-78	4.2	0.5	3.8	1.9	1.4	2.5	2.4	4.1
63-78	1.5	2.8	1.6	3.6	5.3	2.3	3.3	4.9

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

- (a) INCLUDES PROVINCIAL RESEARCH ORGANIZATIONS
- (b) PRIVATE AND PUBLIC ENTERPRISES
- (c) PRIVATE NON-PROFIT ORGANIZATIONS

GERD AND GNP
(AVERAGE ANNUAL GROWTH RATES)

YEARS		PERCENTAGES							GNP
		GERD							
		FED PROV(a)	ALL GOVTS	INDUSTRY(b)	UNIVERSITIES	PNP(c)	TOTAL		
1963-1968	\$CURRENT	11.3	10.1	11.2	12.8	20.2	8.4	13.7	9.2
	\$CONSTANT	7.7	6.5	7.6	9.2	16.7	4.9	10.2	5.7
1968-1973	\$CURRENT	5.5	8.3	5.8	7.1	6.3	8.2	6.5	10.2
	\$CONSTANT	0.7	3.4	1.0	2.3	1.5	3.5	1.6	5.4
1973-1978	\$CURRENT	8.1	9.5	8.2	11.9	10.8	8.1	10.4	12.5
	\$CONSTANT	-1.1	0.3	-0.9	2.7	1.7	-1.1	1.2	3.3
1963-1978	\$CURRENT	7.6	8.9	7.7	9.7	11.4	8.3	9.4	11.0
	\$CONSTANT	1.5	2.8	1.6	3.6	5.3	2.3	3.3	4.9

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

- (a) INCLUDES PROVINCIAL RESEARCH ORGANIZATIONS
- (b) PRIVATE AND PUBLIC ENTERPRISES
- (c) PRIVATE NON-PROFIT ORGANIZATIONS

GROSS EXPENDITURE ON R&D
(PERCENTAGE DISTRIBUTION)

PERFORMING SECTORS

	FED	PROV(a)	ALL GOVTS	INDUSTRY(b)	UNIVERSITIES	PNP(c)	TOTAL
1963	37.7	4.1	41.8	38.8	18.5	0.9	100.0
1964	35.1	3.7	38.8	40.8	19.6	0.8	100.0
1965	33.2	3.5	36.7	43.1	19.4	0.7	100.0
1966	31.8	3.5	35.3	41.9	22.1	0.7	100.0
1967	32.9	3.3	36.2	39.1	24.0	0.7	100.0
1968	33.3	3.4	36.7	37.4	25.2	0.7	100.0
1969	30.4	3.3	33.7	39.1	26.5	0.7	100.0
1970	29.8	3.2	33.0	38.8	27.5	0.7	100.0
1971	29.5	3.2	32.7	40.0	26.6	0.7	100.0
1972	30.8	3.5	34.3	38.8	26.1	0.8	100.0
1973	31.0	3.7	34.7	39.2	25.3	0.8	100.0
1974	29.9	3.3	33.2	41.0	25.1	0.7	100.0
1975	28.0	3.3	31.3	41.8	26.2	0.7	100.0
1976	27.9	3.5	31.4	41.1	26.8	0.7	100.0
1977	27.4	3.4	30.8	42.8	25.7	0.7	100.0
1978	27.9	3.4	31.2	42.6	25.5	0.7	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

- (a) INCLUDES PROVINCIAL RESEARCH ORGANIZATIONS
- (b) PRIVATE AND PUBLIC ENTERPRISES
- (c) PRIVATE NON-PROFIT ORGANIZATIONS

R&D EXPENDITURES OF CANADIAN FIRMS
(MILLIONS OF CURRENT DOLLARS)

	INTRAMURAL			EXTRAMURAL	TOTAL IN CANADA (a)	PAYMENTS OUTSIDE CANADA	GRAND TOTAL
	CURRENT	CAPITAL	TOTAL				
1963	153.2	27.2	180.4	9.6	181.8	28.7	210.5
1964	189.4	37.6	227.0	10.6	228.6	33.9	262.5
1965	236.8	50.6	287.4	12.8	289.6	27.7	317.3
1966	266.4	50.7	317.1	13.8	319.8	30.8	350.6
1967	291.5	44.0	335.5	15.3	338.8	34.8	373.6
1968	306.0	36.1	342.1	16.2	345.8	36.6	382.4
1969	344.6	49.2	393.8	23.0	397.7	37.8	435.5
1970	362.9	50.1	413.0	30.5	416.5	44.5	461.0
1971	401.3	63.2	464.5	31.5	467.5	51.6	519.1
1972	412.7	46.6	459.3	34.6	462.5	58.3	520.8
1973	459.4	42.8	502.2	47.7	509.1	64.0	573.1
1974	526.2	77.3	603.5	52.9	607.0	80.9	687.9
1975	627.1	69.4	696.5	67.9	713.0	78.3	791.3
1976	660.6	69.3	729.9	71.8	751.4	81.0	832.4
1977	763.3	91.6	854.9	84.1	882.7	91.2	973.9
1978	834.0	93.5	927.5	87.2	957.8	90.8	1,048.6

SOURCE: STATISTICS CANADA CAT. 13-212, 1978

(a) TO AVOID DOUBLE COUNTING, TRANSFERS BETWEEN RESPONDANTS HAVE BEEN SUBTRACTED FROM THE SUM OF ALL CANADIAN INTRAMURAL AND EXTRAMURAL EXPENDITURES. OTHERWISE, SUCH TRANSFERS WOULD BE ENTERED ONCE AS INTRAMURAL AND ONCE AS EXTRAMURAL.

R&D EXPENDITURES OF CANADIAN FIRMS
(PERCENTAGE DISTRIBUTION)

	INTRAMURAL			EXTRAMURAL	TOTAL IN CANADA (a)	PAYMENTS OUTSIDE CANADA	GRAND TOTAL
	CURRENT	CAPITAL	TOTAL				
1963	72.8	12.9	85.7	4.6	86.4	13.6	100.0
1964	72.2	14.3	86.5	4.0	87.1	12.9	100.0
1965	74.6	15.9	90.6	4.0	91.3	8.7	100.0
1966	76.0	14.5	90.4	3.9	91.2	8.8	100.0
1967	78.0	11.8	89.8	4.1	90.7	9.3	100.0
1968	80.0	9.4	89.5	4.2	90.4	9.6	100.0
1969	79.1	11.3	90.4	5.3	91.3	8.7	100.0
1970	78.7	10.9	89.6	6.6	90.3	9.7	100.0
1971	77.3	12.2	89.5	6.1	90.1	9.9	100.0
1972	79.2	8.9	88.2	6.6	88.8	11.2	100.0
1973	80.2	7.5	87.6	8.3	88.8	11.2	100.0
1974	76.5	11.2	87.7	7.7	88.2	11.8	100.0
1975	79.2	8.8	88.0	8.6	90.1	9.9	100.0
1976	79.4	8.3	87.7	8.6	90.3	9.7	100.0
1977	78.4	9.4	87.8	8.6	90.6	9.4	100.0
1978	79.5	8.9	88.5	8.3	91.3	8.7	100.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212, 1978

(a) TO AVOID DOUBLE COUNTING, TRANSFERS BETWEEN RESPONDANTS HAVE BEEN SUBTRACTED FROM THE SUM OF ALL CANADIAN INTRAMURAL AND EXTRAMURAL EXPENDITURES. OTHERWISE, SUCH TRANSFERS WOULD BE ENTERED ONCE AS INTRAMURAL AND ONCE AS EXTRAMURAL.

R&D EXPENDITURES OF CANADIAN FIRMS
(MILLIONS OF CONSTANT(b) DOLLARS)

	INTRAMURAL			EXTRAMURAL	TOTAL IN CANADA (a)	PAYMENTS OUTSIDE CANADA	GRAND TOTAL
	CURRENT	CAPITAL	TOTAL				
1963	204.8	36.4	241.2	12.8	243.0	38.4	281.4
1964	247.3	49.1	296.4	13.8	298.4	44.3	342.7
1965	299.4	64.0	363.3	16.2	366.1	35.0	401.1
1966	322.5	61.4	383.9	16.7	387.1	37.3	424.4
1967	339.3	51.2	390.6	17.8	394.4	40.5	434.9
1968	345.0	40.7	385.7	18.3	389.9	41.3	431.1
1969	372.1	53.1	425.3	24.8	429.5	40.8	470.3
1970	374.5	51.7	426.2	31.5	429.8	45.9	475.7
1971	401.3	63.2	464.5	31.5	467.5	51.6	519.1
1972	393.0	44.4	437.4	33.0	440.5	55.5	496.0
1973	400.9	37.3	438.2	41.6	444.2	55.8	500.1
1974	398.3	58.5	456.8	40.0	459.5	61.2	520.7
1975	428.9	47.5	476.4	46.4	487.7	53.6	541.2
1976	411.8	43.2	455.0	44.8	468.4	50.5	518.9
1977	445.1	53.4	498.5	49.0	514.7	53.2	567.9
1978	456.8	51.2	508.0	47.8	524.6	49.7	574.3

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212, 1978

(a) TO AVOID DOUBLE COUNTING, TRANSFERS BETWEEN RESPONDANTS HAVE BEEN SUBTRACTED FROM THE SUM OF ALL CANADIAN INTRAMURAL AND EXTRAMURAL EXPENDITURES. OTHERWISE, SUCH TRANSFERS WOULD BE ENTERED ONCE AS INTRAMURAL AND ONCE AS EXTRAMURAL.

(b) 1971=100

R&D EXPENDITURE OF CANADIAN FIRMS
(AVERAGE ANNUAL GROWTH RATES)

YEAR	PERCENTAGES IN CURRENT DOLLARS						
	INTRAMURAL			EXTRAMURAL	TOTAL IN CANADA (a)	PAYMENTS OUTSIDE CANADA	GRAND TOTAL
	CURRENT	CAPITAL	TOTAL				
63-64	23.6	38.2	25.8	10.4	25.7	18.1	24.7
64-65	25.0	34.6	26.6	20.8	26.7	-18.3	20.9
65-66	12.5	0.2	10.3	7.8	10.4	11.2	10.5
66-67	9.4	-13.2	5.8	10.9	5.9	13.0	6.6
67-68	5.0	-18.0	2.0	5.9	2.1	5.2	2.4
68-69	12.6	36.3	15.1	42.0	15.0	3.3	13.9
69-70	5.3	1.8	4.9	32.6	4.7	17.7	5.9
70-71	10.6	26.1	12.5	3.3	12.2	16.0	12.6
71-72	2.8	-26.3	-1.1	9.8	-1.1	13.0	0.3
72-73	11.3	-8.2	9.3	37.9	10.1	9.8	10.0
73-74	14.5	80.6	20.2	10.9	19.2	26.4	20.0
74-75	19.2	-10.2	15.4	28.4	17.5	-3.2	15.0
75-76	5.3	-0.1	4.8	5.7	5.4	3.4	5.2
76-77	15.5	32.2	17.1	17.1	17.5	12.6	17.0
77-78	9.3	2.1	8.5	3.7	8.5	-0.4	7.7
63-78	10.2	6.1	9.7	16.0	9.8	8.9	9.7

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212, 1978

(a) TO AVOID DOUBLE COUNTING, TRANSFERS BETWEEN RESPONDANTS HAVE BEEN SUBTRACTED FROM THE SUM OF ALL CANADIAN INTRAMURAL AND EXTRAMURAL EXPENDITURES. OTHERWISE, SUCH TRANSFERS WOULD BE ENTERED ONCE AS INTRAMURAL AND ONCE AS EXTRAMURAL.

R&D EXPENDITURE OF CANADIAN FIRMS
(AVERAGE ANNUAL GROWTH RATES)

YEAR	PERCENTAGES IN CONSTANT DOLLARS						
	INTRAMURAL			EXTRAMURAL	TOTAL IN CANADA (a)	PAYMENTS OUTSIDE CANADA	GRAND TOTAL
	CURRENT	CAPITAL	TOTAL				
63-64	20.7	35.0	22.9	7.8	22.8	15.4	21.8
64-65	21.1	30.3	22.6	16.9	22.7	-20.9	17.0
65-66	7.7	-4.0	5.7	3.2	5.7	6.5	5.8
66-67	5.2	-16.5	1.7	6.6	1.9	8.7	2.5
67-68	1.7	-20.5	-1.2	2.5	-1.2	1.9	-0.9
68-69	7.9	30.5	10.3	36.0	10.2	-1.1	9.1
69-70	0.6	-2.7	0.2	26.7	0.1	12.5	1.2
70-71	7.2	22.2	9.0	0.1	8.8	12.4	9.1
71-72	-2.1	-29.8	-5.8	4.6	-5.8	7.6	-4.5
72-73	2.0	-15.8	0.2	26.3	0.9	0.6	0.8
73-74	-0.6	56.7	4.2	-3.8	3.4	9.7	4.1
74-75	7.7	-18.9	4.3	16.0	6.1	-12.5	3.9
75-76	-4.0	-9.0	-4.5	-3.6	-3.9	-5.7	-4.1
76-77	8.1	23.6	9.5	9.6	9.9	5.3	9.4
77-78	2.6	-4.1	1.9	-2.6	1.9	-6.5	1.1
63-78	4.1	-0.0	3.6	9.9	3.7	2.8	3.6

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212, 1978

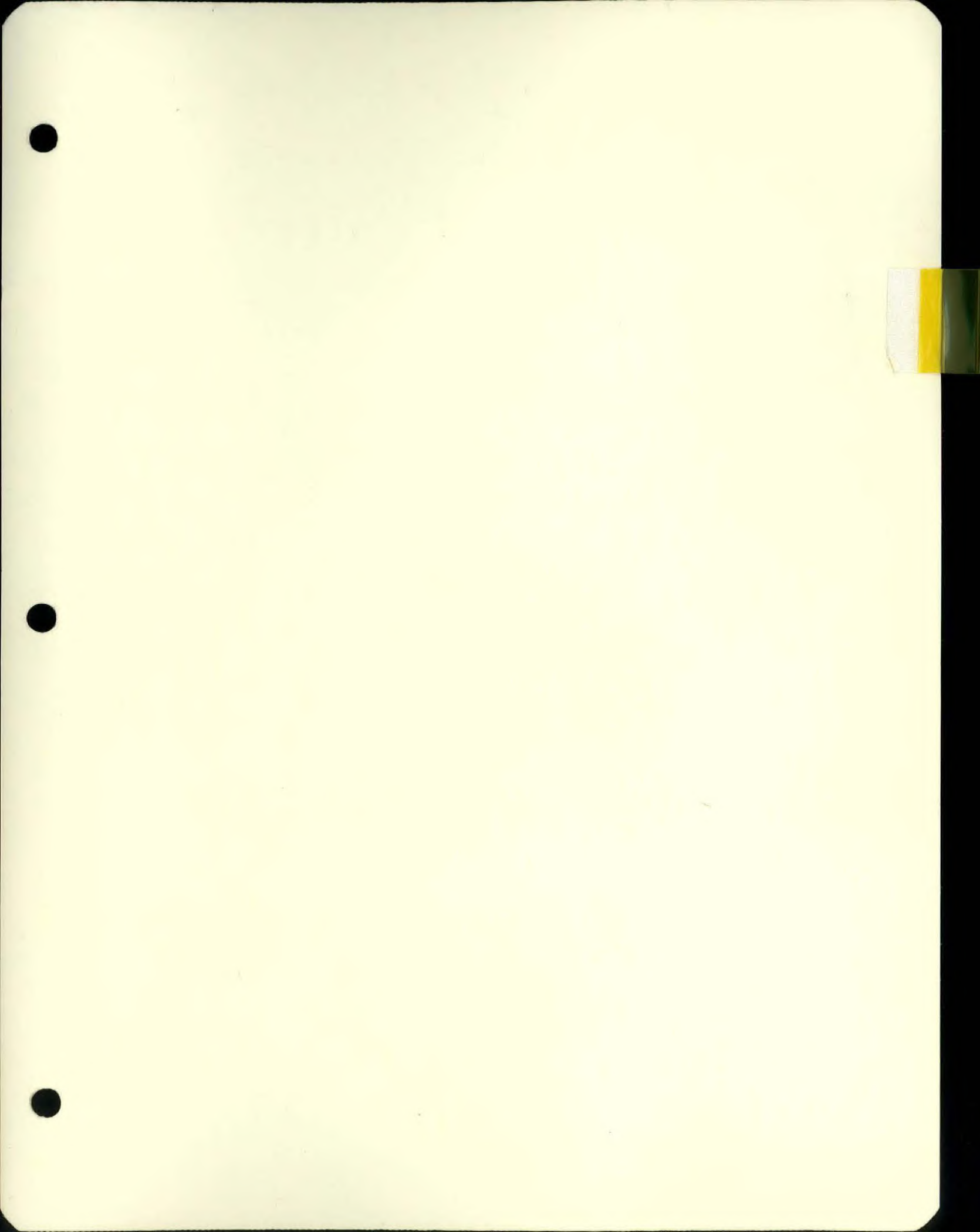
(a) TO AVOID DOUBLE COUNTING, TRANSFERS BETWEEN RESPONDANTS HAVE BEEN SUBTRACTED FROM THE SUM OF ALL CANADIAN INTRAMURAL AND EXTRAMURAL EXPENDITURES. OTHERWISE, SUCH TRANSFERS WOULD BE ENTERED ONCE AS INTRAMURAL AND ONCE AS EXTRAMURAL.

R&D EXPENDITURE OF CANADIAN FIRMS
(AVERAGE ANNUAL GROWTH RATES)

PERCENTAGES

		1963-1968	1968-1973	1973-1978	1963-1978
CURRENT EXPENDITURE	\$CURRENT	13.9	7.6	11.9	10.2
	\$CONSTANT	10.4	2.8	2.7	4.1
CAPITAL EXPENDITURE	\$CURRENT	5.4	2.6	12.6	6.1
	\$CONSTANT	1.9	-2.2	3.5	-0.0
TOTAL INTRAMURAL EXPENDITURE	\$CURRENT	12.8	7.1	11.9	9.7
	\$CONSTANT	9.2	2.3	2.7	3.6
EXTRAMURAL EXPENDITURE	\$CURRENT	10.8	19.0	12.8	16.0
	\$CONSTANT	7.3	14.2	3.6	9.9
CANADA TOTAL	\$CURRENT	12.8	7.1	12.4	9.8
	\$CONSTANT	9.3	2.3	3.2	3.7
PAYMENTS OUTSIDE CANADA	\$CURRENT	4.0	12.1	6.1	8.9
	\$CONSTANT	0.5	7.3	-3.0	2.8
GRAND TOTAL	\$CURRENT	11.8	7.7	11.8	9.7
	\$CONSTANT	8.3	2.8	2.6	3.6

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212, 1978



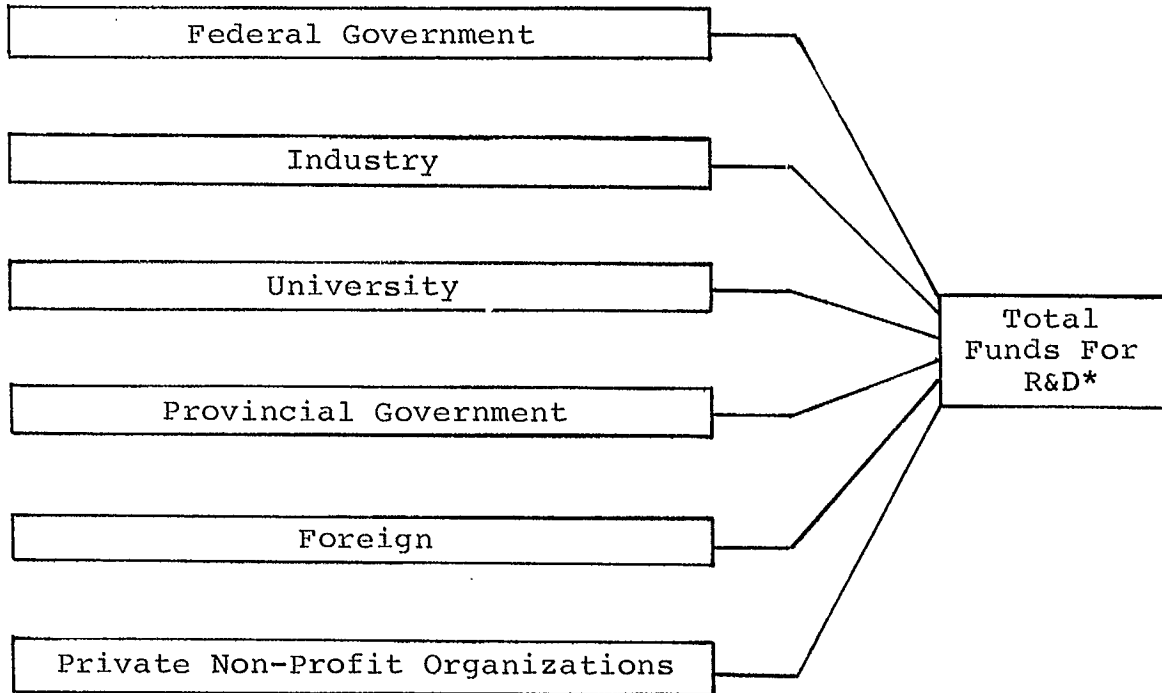
SECTION 2

The purpose of Section 2 is to examine the funding of Canadian research and development. The proportion of funds provided by each source and the changes in their respective shares are outlined. A more detailed examination of the funding of industrial R&D is also conducted.

SOURCES OF FUNDS FOR R&D PERFORMED IN CANADA

Total intramural R&D expenditures (GERD) in Canada are financed by six different sources. These appear in order of importance in Chart 2.1 (Appendix Tables B1 and B2). Since the value of total funds for R&D performed in Canada is equal to GERD, the trends in total funding are the same as for GERD (refer to Figures 1.1 and 1.2 of Section 1).

FUNDERS OF R&D PERFORMED IN CANADA



*Value of Total Funds for R&D = Value of GERD

Chart 2.1--Fundors of R&D Performed in Canada

Table 2.1 shows the relationship between funders and performers of R&D in 1978. The government sector financed 48.4% of all R&D performed in Canada (Appendix Table B3). On the performance side, government was responsible for 31.2% (Appendix Table B4). In the other two sectors (industry and university), performance exceeded funding shares. Outside funding was especially important in the university sector where it was almost equal to the in-house financing of R&D (Appendix Table B5).

TOTAL R&D EXPENDITURE IN CANADA IN 1978
(MILLIONS OF CURRENT DOLLARS)

FUNDING SECTORS	PERFORMING SECTORS						TOTAL
	FEDERAL	PROVINCIAL(a)	ALL GOVTS	INDUSTRY(b)	UNIVERSITIES	PRIVATE NON-PROFIT	
FEDERAL	606.9	2.2	609.1	115.0	181.0	0.6	905.7
PROVINCIAL(a)	0.0	63.7	63.7	30.0	45.0	9.3	148.0
ALL GOVTS	606.9	65.9	672.8	145.0	226.0	9.9	1,053.7
INDUSTRY(b)	0.0	6.8	6.8	732.5	1.6	0.4	741.3
UNIVERSITIES	0.0	0.0	0.0	0.0	292.6	0.0	292.6
PRIVATE NON-PROFIT	0.0	0.0	0.0	0.0	27.1	4.4	31.5
FOREIGN	0.0	0.6	0.6	50.0	7.9	0.0	58.5
TOTAL	606.9	73.3	680.2	927.5	555.2	14.7	2,177.6

SOURCE: SCIENCE STATISTICS CENTRE, JANUARY 1979

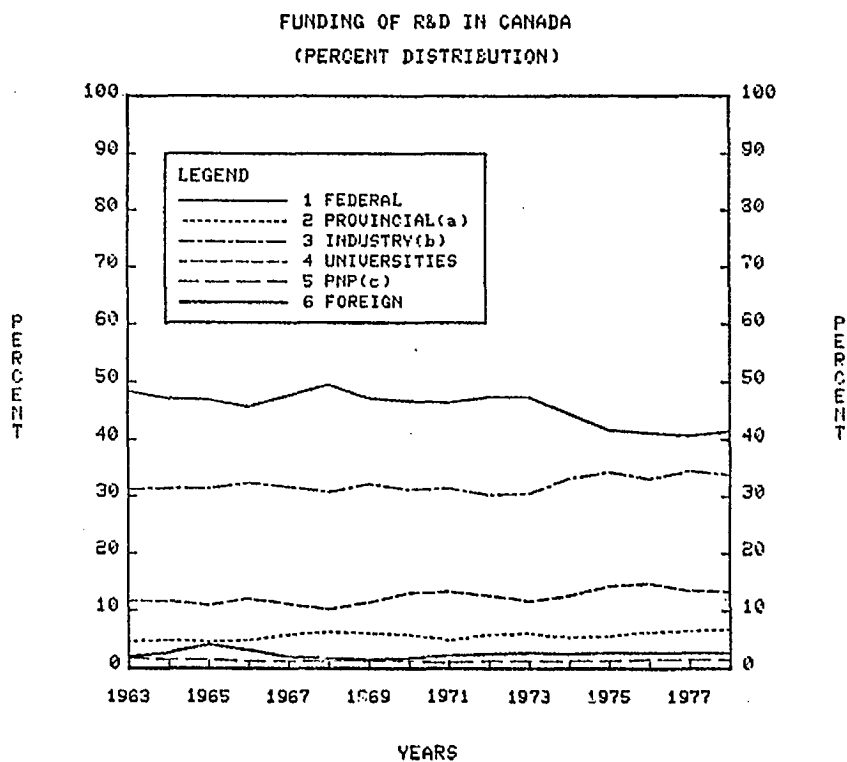
(a) INCLUDING PROVINCIAL RESEARCH ORGANIZATIONS

(b) PRIVATE AND PUBLIC ENTERPRISES

Table 2.1--Funding versus Performance

The federal government has always been the leading funder of R&D but its relative share has declined in recent years (Figure 2.1). It's contribution, which fluctuated between 47% and 49% from 1963 to 1973, fell to 44.7% in 1974 and 41.7% in 1975. It now appears to have stabilized in the 41% range (Appendix Table B6). The industry sector's contribution to R&D funding, meanwhile, has been relatively stable with a gradual increase from about 31% in the mid-1960's to about 34% in the late 1970's. The university sector's share of funding has fluctuated from 10% to 15% of total GERD, with the trend in its share tending to increase over time.

Provincial governments, foreign sources, and private non-profit organizations have accounted for about 10% of R&D funds. Because of their small size, the impact on total funding has been relatively slight.



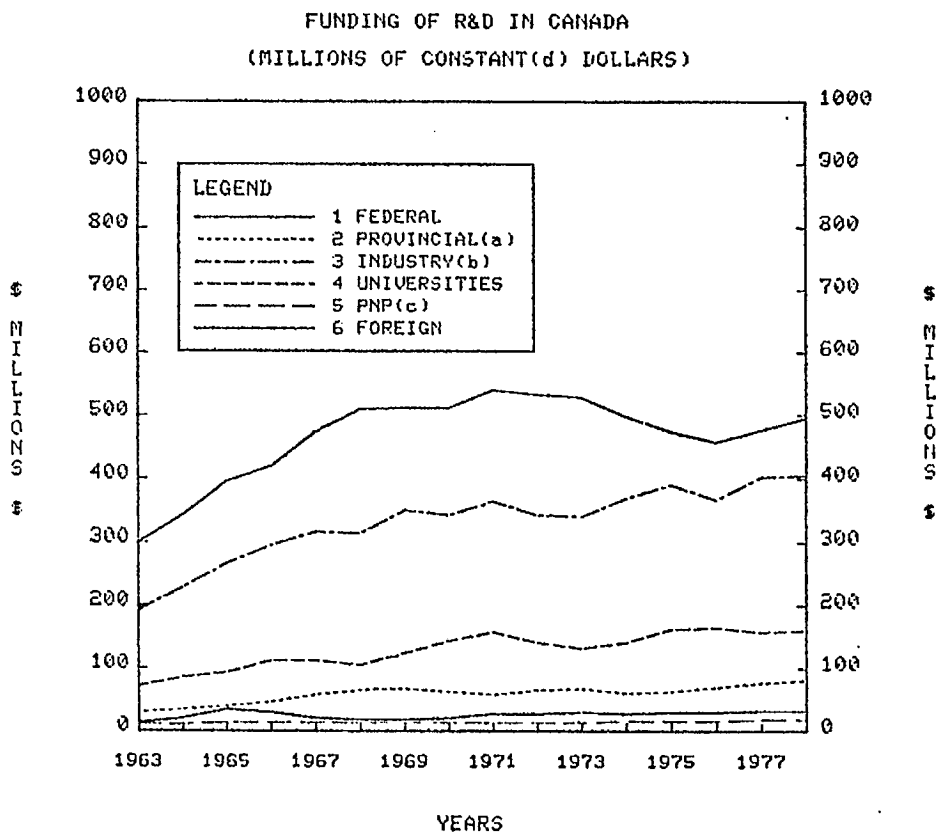
SOURCE : BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

- a . INCLUDING PROVINCIAL RESEARCH ORGANIZATIONS
- b . PRIVATE AND PUBLIC ENTERPRISES
- c . PRIVATE NON-PROFIT ORGANIZATIONS

Figure 2.1--Distribution of R&D Funding

The federal government's contribution to R&D funding more than quadrupled between 1963 and 1978 (\$225.6 to \$905.7 million). In 1978, the funds provided by the industry and university sectors were more than 5 times their value in 1963 (Appendix Tables B1 and B2).

These current dollar increases in expenditure are reduced substantially when inflation is taken into account. Figure 2.2 shows the value of funding by each sector in 1971 constant dollars. It is interesting to note that in real terms, federal funding of R&D was less in 1978 than in the period; 1968 to 1974.



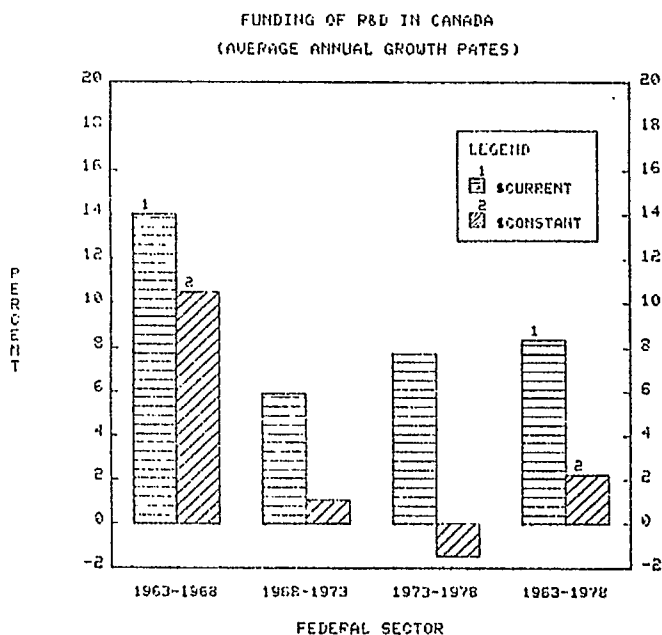
SOURCE : BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

- a . INCLUDING PROVINCIAL RESEARCH ORGANIZATIONS
- b . PRIVATE AND PUBLIC ENTERPRISES
- c . PRIVATE NON-PROFIT ORGANIZATIONS
- d . 1971=100

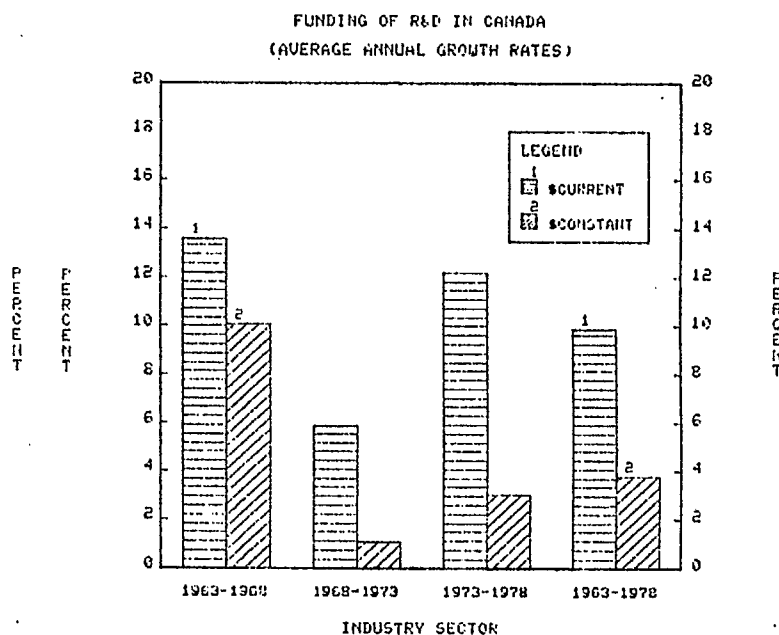
Figure 2.2--Funding of R&D in Constant Dollars

The two major funders of R&D (federal government and industry) had their greatest growth in the mid-1960's (Figure 2.3). Since then, the federal government has shown a downward trend in its contribution. In real terms, the average annual rate of growth in R&D funding by the federal government was 10.5% between 1963 and 1968, but only 1.0% between 1968 and 1973 (Appendix Tables B7 to B9). Between 1973 and 1978, it decreased absolutely at an average annual rate of -1.4%, as a result of the very steep declines between 1973 and 1976. The fifteen-year (1963-1978) average rate of growth in federal funding was 2.2%.

In the case of industry, the rapid growth exhibited in the mid-1960's (10.1%) also turned downward between 1968 and 1973 (1.1%). However, there was a slight recovery in the 1973-1978 period (3.0%) and the overall fifteen-year average annual rate of growth was 3.8%.



SOURCE : BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979



SOURCE : BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

Figure 2.3--Current & Constant Dollar Growth of Federal and Industrial Funding of R&D

Table 2.2 illustrates the funder/performer relationship of the industry sector with respect to R&D. Industry plays an almost insignificant role in the funding of R&D performed by other sectors. Between 1963 and 1978, the proportion of industry's R&D funds flowing to other sectors has never exceeded 1.2% (see Appendix Tables B10 to B12). As a performer of R&D, industry has been responsible for about 80% of its own R&D funds.

TOTAL R&D EXPENDITURES IN CANADA IN 1978
(PERCENT DISTRIBUTION)

	INDUSTRY SECTOR	
	FUNDS TO	FUNDS RECEIVED
	FROM	
FEDERAL	0.0	12.4
PROVINCIAL (a)	0.9	3.2
ALL GOVTS	0.9	15.6
INDUSTRY (b)	98.8	79.0
UNIVERSITIES	0.2	0.0
PRIVATE NON-PROFIT	0.1	0.0
FOREIGN	0.0	5.4
TOTAL	100.0	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS
CENTRE, JANUARY 1979

(a) INCLUDING PROVINCIAL RESEARCH
ORGANIZATIONS

(b) PRIVATE AND PUBLIC ENTERPRISES

Table 2.2--Industry as a Performer and Funder of R&D

INDUSTRY AS RECIPIENT OF R&D FUNDS

There are four major sources of funds for industrial intramural R&D expenditure. These sources are presented in Chart 2.2 in order of importance.

FUNDERS OF INDUSTRIAL INTRAMURAL R&D

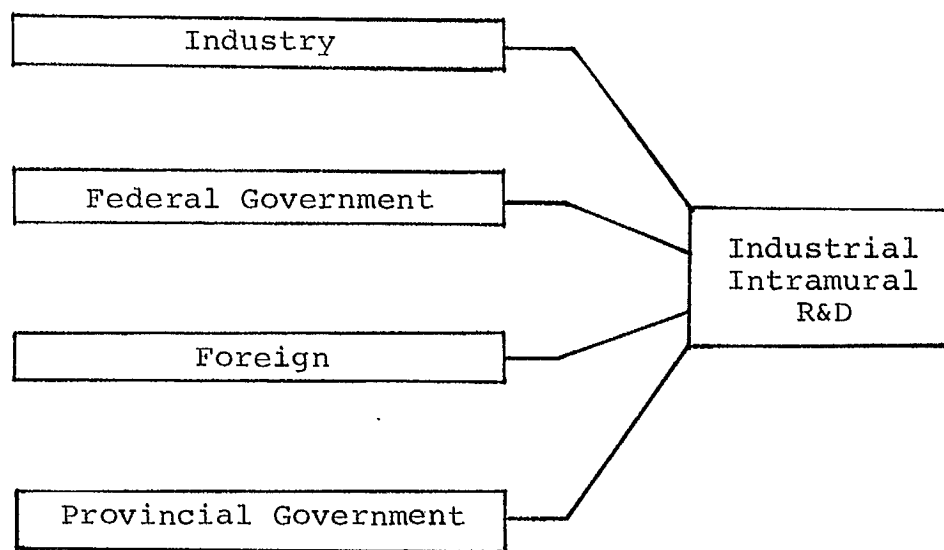


Chart 2.2--Fundurs of Industrial Intramural R&D

The contribution of each source to industrial intramural R&D has varied over the years (current and constant dollar values in Appendix Tables B13 and B14). The industry sector has generally provided between 77% and 82% of the funds for its own R&D (Appendix Table B15). Federal funds made up approximately 17% of industrial R&D funds in the mid-1960's but this has declined to 12% in recent years. Foreign sources have remained in the 5%-7% range over the entire period. Provincial governments, although their share is still relatively small, have increased substantially in recent years, from 0.2% in 1974 to 3.2% in 1978. The shaded area in Figure 2.4 shows the value of R&D performed by industry which is funded from outside sources.

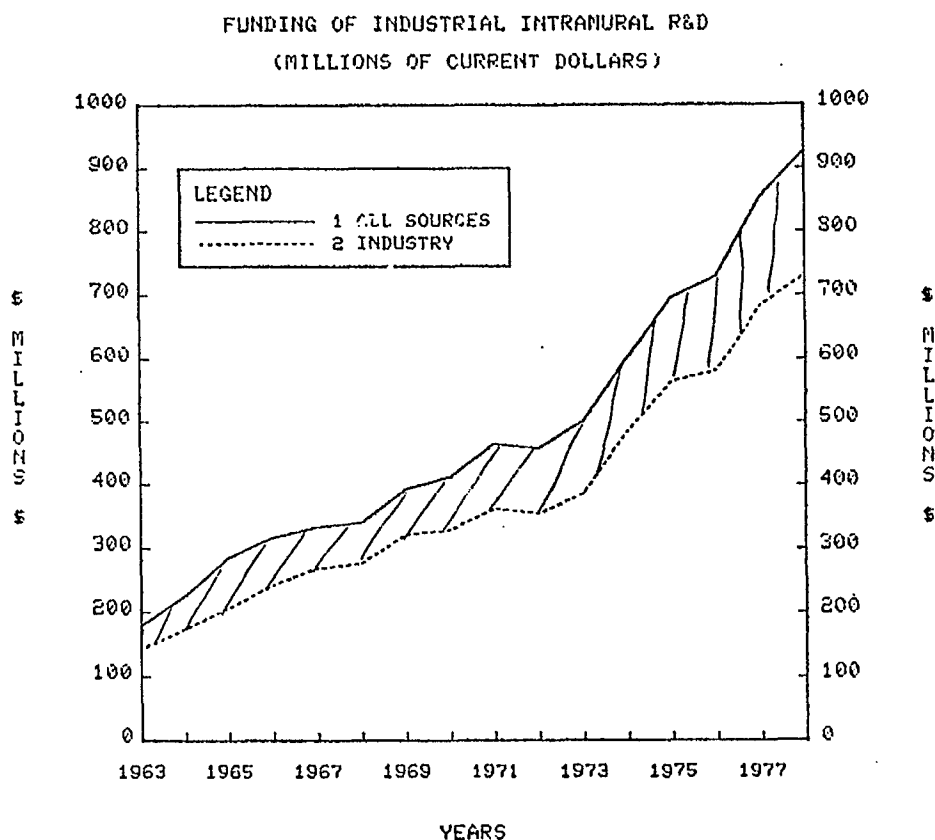
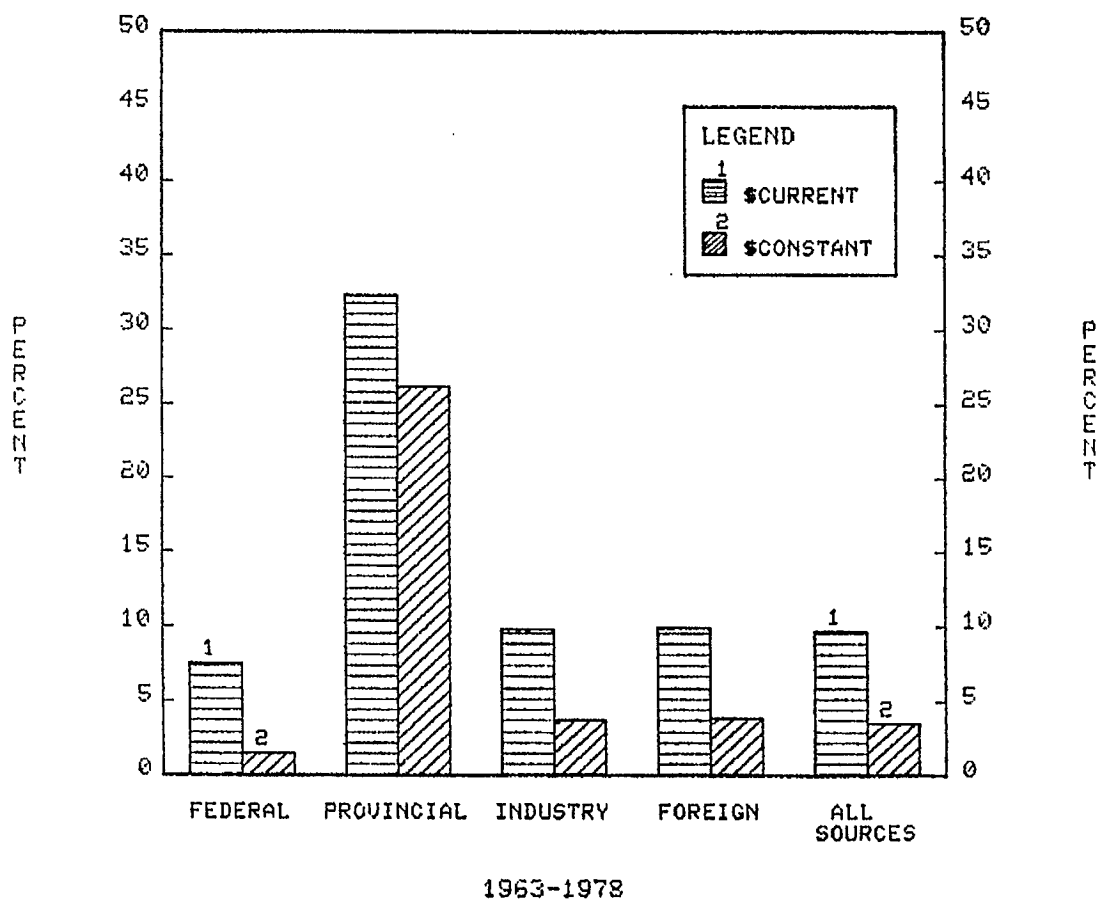


Figure 2.4--Distribution of Sources of Funds for Industrial R&D

In constant dollars, industry's funding of its own R&D has grown at an average annual rate of 3.8% between 1963 and 1978 (Appendix Table B16). Although this accounted for almost 80% of the funds provided for industrial intramural R&D, it is also interesting to note the growth of funds received from the other sources (annual growth rates available in Appendix Tables B17 and B18). Figure 2.5 shows the fifteen-year average rate of growth for all sources of funds for industrial intramural R&D. Although the rate of growth for provincial governments was large, its impact on total funding has been minimal because of the small size of its funding base relative to the other sources.

FUNDING OF INDUSTRIAL INTRAMURAL R&D
(AVERAGE ANNUAL GROWTH RATES)



SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212, 1978

Figure 2.5--Growth of Funds for Industrial R&D by Source

The growth in provincial funding of industrial R&D has had a significant impact on the composition of government funding of industrial R&D. Since 1974, the provincial component has accounted for an increasingly larger share of the total funds provided by government (Appendix Table B19). The gap between the two curves in Figure 2.6 indicates how rapidly the size of the provincial component has changed in recent years. Before 1974, the provincial contribution to total government funding of industrial R&D was almost negligible.

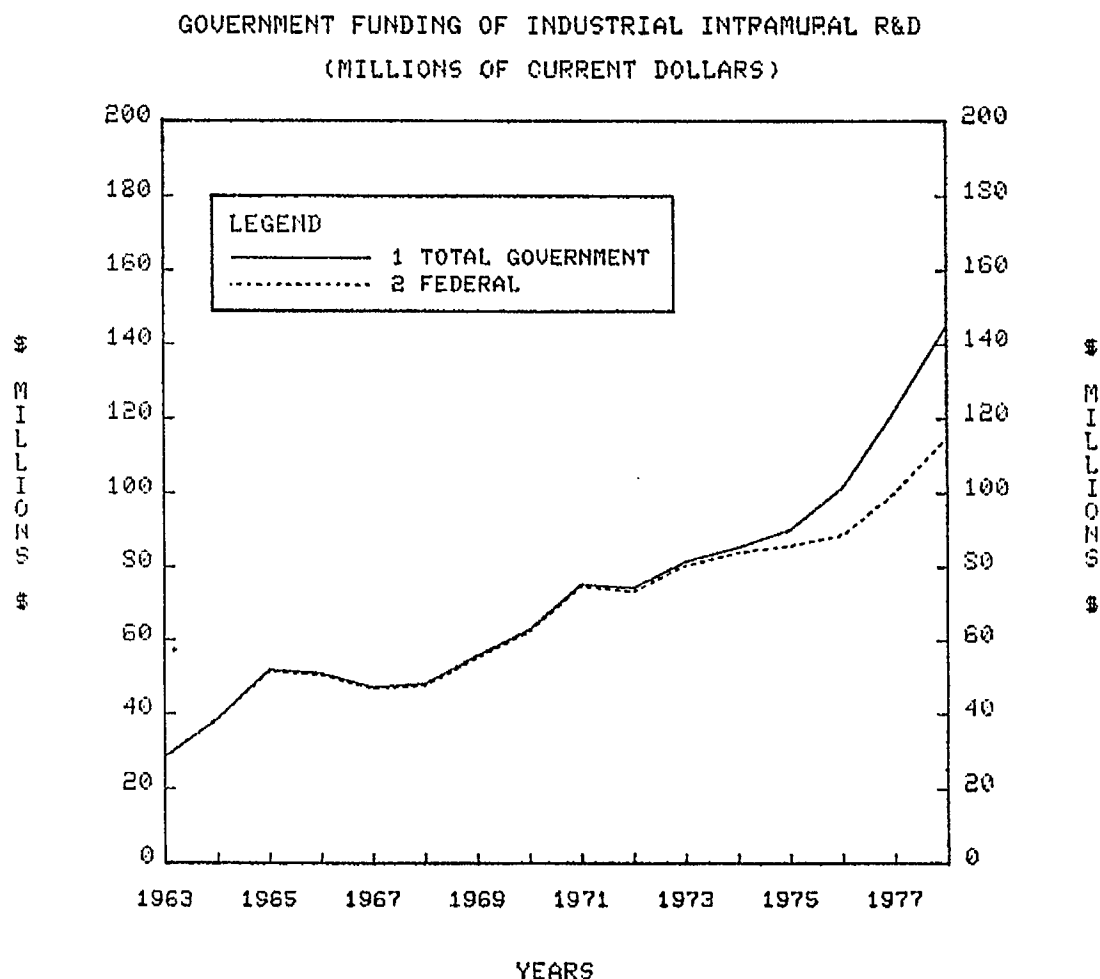


Figure 2.6--Government Funding of Industrial R&D.

The increase in provincial funding in the last four years has been conspicuous. Prior to 1974, federal and provincial shares of total government funding of industrial R&D were approximately 99% and 1%, respectively (Appendix Table B20). By 1978, the federal government was providing 79.3% of the total. Figure 2.7 shows the change in the proportions of funds provided by the two levels of government. The federal government now contributes approximately \$4 for each provincial dollar, which is in sharp contrast to the relationship before 1974.

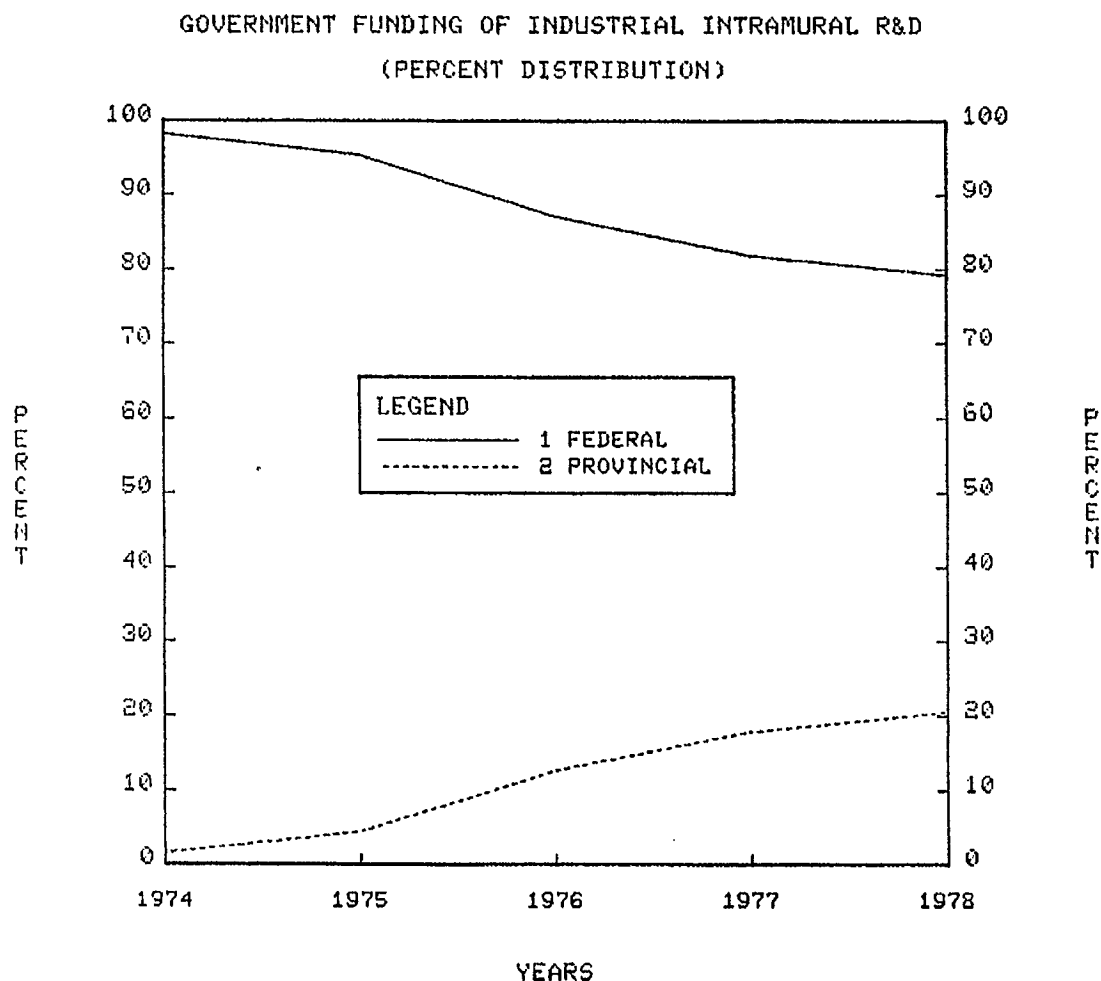
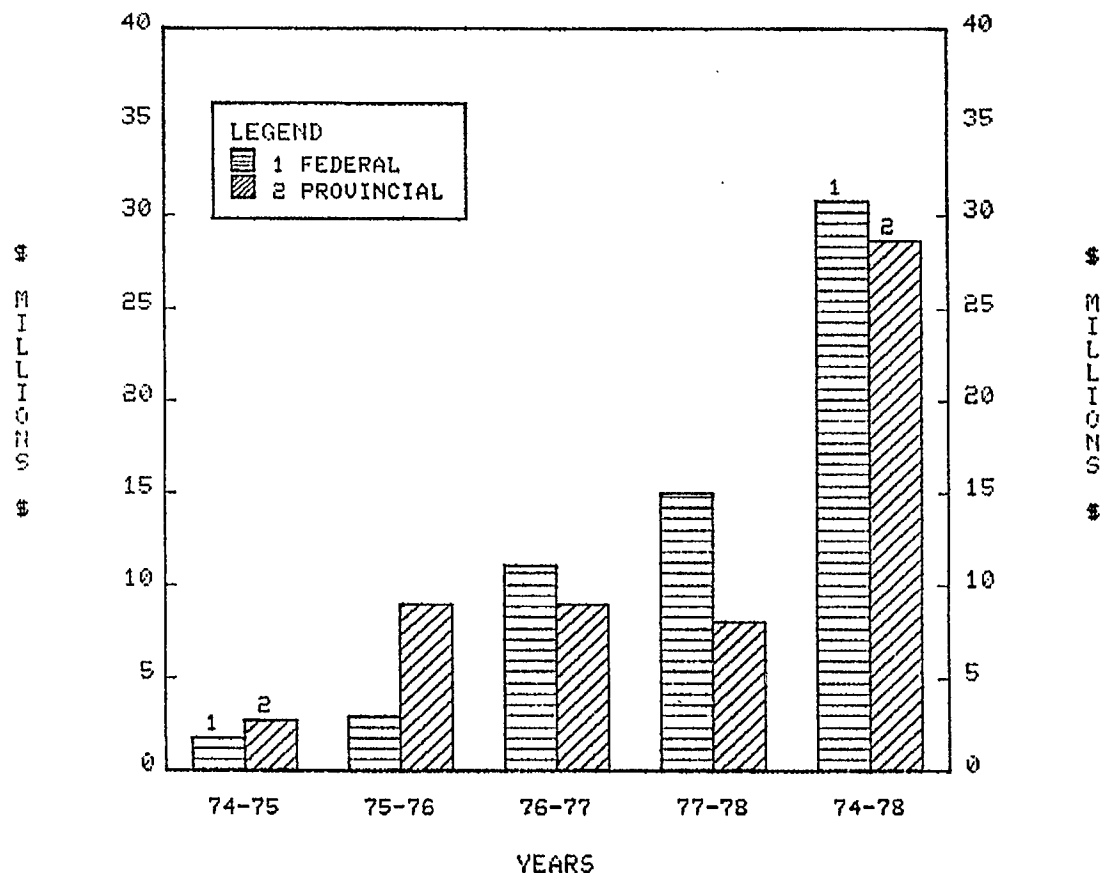


Figure 2.7--Distribution of Government Funds for Industrial R&D.

The year-to-year change in provincial government funding of industrial R&D was greater than that of the federal government in 1974 and 1976 (Figure 2.8). Although increases in federal government funding were greater in 1977 and 1978, the actual dollar increase from 1974 to 1978 was almost equal for the two levels of government (Appendix Table B21).

It is important to recognize that the substantial growth in provincial funding was not a country-wide phenomenon. Although many provinces increased their funding of industrial R&D between 1974 and 1978, most of the growth was attributable to Alberta and, more specifically, to its financing of energy-related R&D projects.

GOVERNMENT FUNDING OF INDUSTRIAL INTRAMURAL R&D
(ABSOLUTE CHANGES)



SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212, 1978

Figure 2.8--Annual Increase in Federal & Provincial Funds to Industry.

APPENDIX B

FUNDING OF R&D IN CANADA
(MILLIONS OF CURRENT DOLLARS)

FUNDING SECTORS

	FEDERAL	PROVINCIAL(a)	ALL GOVTS	INDUSTRY(b)	UNIVERSITIES	PNP(c)	FOREIGN	TOTAL
1963	225.6	21.5	247.1	145.4	54.3	8.6	9.5	464.9
1964	262.7	26.8	289.5	175.9	66.2	9.1	15.7	556.4
1965	313.6	31.2	344.8	211.1	74.3	9.6	27.6	667.4
1966	346.4	37.8	384.2	245.8	93.3	10.2	23.9	757.4
1967	408.6	50.3	458.9	273.2	96.6	10.9	18.3	857.9
1968	452.9	58.2	511.1	280.8	93.8	11.4	16.6	913.7
1969	475.7	62.0	537.7	325.0	115.2	12.1	16.5	1,006.5
1970	497.8	61.6	559.4	333.2	140.5	12.9	19.8	1,065.8
1971	540.7	57.2	597.9	365.6	157.3	13.8	27.3	1,161.9
1972	562.2	68.4	630.6	360.3	149.5	14.6	29.4	1,184.4
1973	607.6	78.1	685.7	391.7	152.2	15.4	34.6	1,279.6
1974	658.7	80.4	739.1	489.1	187.7	20.1	36.3	1,472.3
1975	694.3	91.9	786.2	571.3	240.1	23.3	45.1	1,666.0
1976	734.5	113.0	847.5	589.0	264.4	26.2	48.4	1,775.5
1977	818.3	131.7	950.0	693.4	272.4	28.9	53.6	1,998.3
1978	905.7	148.0	1,053.7	741.3	292.6	31.5	58.5	2,177.6

SOURCE: SCIENCE STATISTICS CENTRE, JANUARY 1979

- (a) INCLUDING PROVINCIAL RESEARCH ORGANIZATIONS
 (b) PRIVATE AND PUBLIC ENTERPRISES
 (c) PRIVATE NON-PROFIT ORGANIZATIONS

FUNDING OF R&D IN CANADA
(MILLIONS OF CONSTANT(d) DOLLARS)

FUNDING SECTORS

	FEDERAL	PROVINCIAL(a)	ALL GOVTS	INDUSTRY(b)	UNIVERSITIES	PNP(c)	FOREIGN	TOTAL
1963	301.6	28.7	330.3	194.4	72.6	11.5	12.7	621.5
1964	343.0	35.0	377.9	229.6	86.4	11.9	20.5	726.4
1965	396.5	39.4	435.9	266.9	93.9	12.1	34.9	843.7
1966	419.4	45.8	465.1	297.6	113.0	12.3	28.9	916.9
1967	475.7	58.6	534.2	318.0	112.5	12.7	21.3	998.7
1968	510.6	65.6	576.2	316.6	105.7	12.9	18.7	1,030.1
1969	513.7	67.0	580.7	351.0	124.4	13.1	17.8	1,086.9
1970	513.7	63.6	577.3	343.9	145.0	13.3	20.4	1,099.9
1971	540.7	57.2	597.9	365.6	157.3	13.8	27.3	1,161.9
1972	535.4	65.1	600.6	343.1	142.4	13.9	28.0	1,128.0
1973	530.2	68.2	598.3	341.8	132.8	13.4	30.2	1,116.6
1974	498.6	60.9	559.5	370.2	142.1	15.2	27.5	1,114.5
1975	474.9	62.9	537.8	390.8	164.2	15.9	30.8	1,139.5
1976	457.9	70.4	528.4	367.2	164.8	16.3	30.2	1,106.9
1977	477.1	76.8	553.9	404.3	158.8	16.9	31.3	1,165.2
1978	496.0	81.1	577.1	406.0	160.2	17.3	32.0	1,192.6

SOURCE: SCIENCE STATISTICS CENTRE, JANUARY 1979

- (a) INCLUDING PROVINCIAL RESEARCH ORGANIZATIONS
- (b) PRIVATE AND PUBLIC ENTERPRISES
- (c) PRIVATE NON-PROFIT ORGANIZATIONS
- (d) 1971=100

TOTAL R&D EXPENDITURE IN CANADA IN 1978
(% DISTRIBUTION BY SOURCE OF FUNDS)

FUNDING SECTORS	PERFORMING SECTORS						TOTAL
	FEDERAL	PROVINCIAL(a)	ALL GOVTS	INDUSTRY(b)	UNIVERSITIES	PRIVATE NON-PROFIT	
FEDERAL	100.0	3.0	89.5	12.4	32.6	4.1	41.6
PROVINCIAL(a)	0.0	86.9	9.4	3.2	8.1	63.3	6.8
ALL GOVTS	100.0	89.9	98.9	15.6	40.7	67.3	48.4
INDUSTRY(b)	0.0	9.3	1.0	79.0	0.3	2.7	34.0
UNIVERSITIES	0.0	0.0	0.0	0.0	52.7	0.0	13.4
PRIVATE NON-PROFIT	0.0	0.0	0.0	0.0	4.9	29.9	1.4
FOREIGN	0.0	0.8	0.1	5.4	1.4	0.0	2.7
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

(a) INCLUDING PROVINCIAL RESEARCH ORGANIZATIONS

(b) PRIVATE AND PUBLIC ENTERPRISES

TOTAL R&D EXPENDITURE IN CANADA IN 1978
(% DISTRIBUTION OF EACH SECTOR'S FUNDS)

FUNDING SECTORS	PERFORMING SECTORS						TOTAL
	FEDERAL	PROVINCIAL(a)	ALL GOV'TS	INDUSTRY(b)	UNIVERSITIES	PRIVATE NON-PROFIT	
FEDERAL	67.0	0.2	67.3	12.7	20.0	0.1	100.0
PROVINCIAL(a)	0.0	43.0	43.0	20.3	30.4	6.3	100.0
ALL GOV'TS	57.6	6.3	63.9	13.8	21.4	0.9	100.0
INDUSTRY(b)	0.0	0.9	0.9	98.8	0.2	0.1	100.0
UNIVERSITIES	0.0	0.0	0.0	0.0	100.0	0.0	100.0
PRIVATE NON-PROFIT	0.0	0.0	0.0	0.0	86.0	14.0	100.0
FOREIGN	0.0	1.0	1.0	85.5	13.5	0.0	100.0
TOTAL	27.9	3.4	31.2	42.6	25.5	0.7	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

(a) INCLUDING PROVINCIAL RESEARCH ORGANIZATIONS

(b) PRIVATE AND PUBLIC ENTERPRISES

FUNDING & PERFORMANCE OF R&D IN CANADA IN 1978
(MILLIONS OF CURRENT DOLLARS)

	FUNDED BY	PERFORMED BY	PERF/FUND (%)
FEDERAL	905.7	606.9	0.7
PROVINCIAL(a)	148.0	73.3	0.5
ALL GOVTS	1,053.7	680.2	0.6
INDUSTRY(b)	741.3	927.5	1.3
UNIVERSITIES	292.6	555.2	1.9
PRIVATE NON-PROFIT	31.5	14.7	0.5
FOREIGN	58.5	0.0	0.0
TOTAL	2,177.6	2,177.6	1.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS
CENTRE, JANUARY 1979

- (a) INCLUDING PROVINCIAL RESEARCH ORGANIZATIONS
- (b) PRIVATE AND PUBLIC ENTERPRISES

FUNDING OF R&D IN CANADA
(PERCENT DISTRIBUTION)

FUNDING SECTORS

	FEDERAL	PROVINCIAL (a)	ALL GOVTS	INDUSTRY (b)	UNIVERSITIES	PNP (c)	FOREIGN	TOTAL
1963	48.5	4.6	53.2	31.3	11.7	1.8	2.0	100.0
1964	47.2	4.8	52.0	31.6	11.9	1.6	2.8	100.0
1965	47.0	4.7	51.7	31.6	11.1	1.4	4.1	100.0
1966	45.7	5.0	50.7	32.5	12.3	1.3	3.2	100.0
1967	47.6	5.9	53.5	31.8	11.3	1.3	2.1	100.0
1968	49.6	6.4	55.9	30.7	10.3	1.2	1.8	100.0
1969	47.3	6.2	53.4	32.3	11.4	1.2	1.6	100.0
1970	46.7	5.8	52.5	31.3	13.2	1.2	1.9	100.0
1971	46.5	4.9	51.5	31.5	13.5	1.2	2.3	100.0
1972	47.5	5.8	53.2	30.4	12.6	1.2	2.5	100.0
1973	47.5	6.1	53.6	30.6	11.9	1.2	2.7	100.0
1974	44.7	5.5	50.2	33.2	12.7	1.4	2.5	100.0
1975	41.7	5.5	47.2	34.3	14.4	1.4	2.7	100.0
1976	41.4	6.4	47.7	33.2	14.9	1.5	2.7	100.0
1977	40.9	6.6	47.5	34.7	13.6	1.4	2.7	100.0
1978	41.6	6.8	48.4	34.0	13.4	1.4	2.7	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

(a) INCLUDING PROVINCIAL RESEARCH ORGANIZATIONS

(b) PRIVATE AND PUBLIC ENTERPRISES

(c) PRIVATE NON-PROFIT ORGANIZATIONS

FUNDING OF R&D IN CANADA
(AVERAGE ANNUAL GROWTH RATES)

YEAR	PERCENTAGES IN CURRENT DOLLARS							
	FEDERAL	PROVINCIAL (a)	ALL GOVTS	INDUSTRY (b)	UNIVERSITIES	PNP (c)	FOREIGN	TOTAL
63-64	16.4	24.7	17.2	21.0	21.9	5.8	65.3	19.7
64-65	19.4	16.4	19.1	20.0	12.2	5.5	75.8	19.9
65-66	10.5	21.2	11.4	16.4	25.6	6.3	-13.4	13.5
66-67	18.0	33.1	19.4	11.1	3.5	6.9	-23.4	13.3
67-68	10.8	15.7	11.4	2.8	-2.9	4.6	-9.3	6.5
68-69	5.0	6.5	5.2	15.7	22.8	6.1	-0.6	10.2
69-70	4.6	-0.6	4.0	2.5	22.0	6.6	20.0	5.9
70-71	8.6	-7.1	6.9	9.7	12.0	7.0	37.9	9.0
71-72	4.0	19.6	5.5	-1.4	-5.0	5.8	7.7	1.9
72-73	8.1	14.2	8.7	8.7	1.8	5.5	17.7	8.0
73-74	8.4	2.9	7.8	24.9	23.3	30.5	4.9	15.1
74-75	5.4	14.3	6.4	16.8	27.9	15.9	24.2	13.2
75-76	5.8	23.0	7.8	3.1	10.1	12.4	7.3	6.6
76-77	11.4	16.5	12.1	17.7	3.0	10.3	10.7	12.5
77-78	10.7	12.4	10.9	6.9	7.4	9.0	9.1	9.0
63-78	8.3	11.3	8.7	9.9	10.9	8.7	9.7	9.4

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

- (a) INCLUDING PROVINCIAL RESEARCH ORGANIZATIONS
- (b) PRIVATE AND PUBLIC ENTERPRISES
- (c) PRIVATE NON-PROFIT ORGANIZATIONS

FUNDING OF R&D IN CANADA
(AVERAGE ANNUAL GROWTH RATES)

YEAR	PERCENTAGES IN CONSTANT DOLLARS							
	FEDERAL	PROVINCIAL (a)	ALL GOVTS	INDUSTRY (b)	UNIVERSITIES	PNP (c)	FOREIGN	TOTAL
63-64	13.7	22.0	14.4	18.1	19.0	3.5	61.4	16.9
64-65	15.6	12.6	15.3	16.2	8.7	1.7	70.2	16.1
65-66	5.8	16.2	6.7	11.5	20.3	1.7	-17.2	8.7
66-67	13.4	27.9	14.9	6.9	-0.4	3.3	-26.3	8.9
67-68	7.3	11.9	7.9	-0.4	-6.0	1.6	-12.2	3.1
68-69	0.6	2.1	0.8	10.9	17.7	1.6	-4.8	5.5
69-70	0.0	-5.1	-0.6	-2.0	16.6	1.5	14.6	1.2
70-71	5.3	-10.1	3.6	6.3	8.5	3.8	33.8	5.6
71-72	-1.0	13.8	0.5	-6.2	-9.5	0.7	2.6	-2.9
72-73	-1.0	4.8	-0.4	-0.4	-6.7	-3.6	7.9	-1.0
73-74	-6.0	-10.7	-6.5	8.3	7.0	13.4	-8.9	-0.2
74-75	-4.8	3.3	-3.9	5.6	15.6	4.6	12.0	2.2
75-76	-3.6	11.9	-1.7	-6.0	0.4	2.5	-1.9	-2.9
76-77	4.2	9.1	4.8	0.1	-3.6	3.7	3.6	5.3
77-78	4.0	5.6	4.2	0.4	0.9	2.4	2.2	2.4
63-78	2.2	5.2	2.6	3.8	4.8	2.6	3.6	3.3

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

(a) INCLUDING PROVINCIAL RESEARCH ORGANIZATIONS

(b) PRIVATE AND PUBLIC ENTERPRISES

(c) PRIVATE NON-PROFIT ORGANIZATIONS

FUNDING OF R&D IN CANADA
(AVERAGE ANNUAL GROWTH RATES)

PERCENTAGES

		1963-1968	1968-1973	1973-1978	1963-1978
FEDERAL	\$CURRENT	14.0	5.9	7.7	8.3
	\$CONSTANT	10.5	1.0	-1.4	2.2
PROVINCIAL	\$CURRENT	20.2	4.8	14.0	11.3
	\$CONSTANT	16.7	0.0	4.8	5.2
ALL GOVTS	\$CURRENT	14.6	5.8	8.5	8.7
	\$CONSTANT	11.1	0.9	-0.7	2.6
INDUSTRY	\$CURRENT	13.6	5.9	12.2	9.9
	\$CONSTANT	10.1	1.1	3.0	3.8
UNIVERSITIES	\$CURRENT	11.7	9.5	12.8	10.9
	\$CONSTANT	8.2	4.7	3.6	4.8
PNP	\$CURRENT	5.7	6.1	13.7	8.7
	\$CONSTANT	2.2	1.2	4.6	2.6
FOREIGN	\$CURRENT	8.9	16.4	11.0	9.7
	\$CONSTANT	5.3	11.6	1.9	3.6
TOTAL	\$CURRENT	13.7	6.5	10.4	9.4
	\$CONSTANT	10.2	1.6	1.2	3.3

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY
1979

INDUSTRY AS FUNDER OF R&D
(MILLIONS OF CURRENT DOLLARS)

SECTORS RECEIVING FUNDS

	FEDERAL	PROVINCIAL	ALL GOVTS	INDUSTRY	UNIVERSITIES	PNP	TOTAL
1963	0.0	0.7	0.7	144.2	0.4	0.1	145.4
1964	0.0	0.8	0.8	174.6	0.4	0.1	175.9
1965	0.0	1.1	1.1	209.5	0.4	0.1	211.1
1966	0.0	1.5	1.5	243.8	0.4	0.1	245.8
1967	0.0	1.5	1.5	271.2	0.4	0.1	273.2
1968	0.0	1.7	1.7	278.4	0.5	0.2	280.8
1969	0.0	1.9	1.9	322.4	0.5	0.2	325.0
1970	0.0	1.6	1.6	330.8	0.6	0.2	333.2
1971	0.0	1.9	1.9	362.5	1.0	0.2	365.6
1972	0.0	1.9	1.9	357.1	1.1	0.2	360.3
1973	0.0	2.9	2.9	387.6	1.0	0.2	391.7
1974	0.0	3.3	3.3	484.1	1.4	0.3	489.1
1975	0.0	4.2	4.2	565.4	1.4	0.3	571.3
1976	0.0	5.2	5.2	582.0	1.5	0.3	589.0
1977	0.0	5.9	5.9	685.6	1.6	0.3	693.4
1978	0.0	6.8	6.8	732.5	1.6	0.4	741.3

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

INDUSTRY AS FUNDER OF R&D
(MILLIONS OF CONSTANT(a) DOLLARS)

SECTORS RECEIVING FUNDS

	FEDERAL	PROVINCIAL	ALL GOVTS	INDUSTRY	UNIVERSITIES	PNP	TOTAL
1963	0.0	0.9	0.9	192.8	0.5	0.1	194.4
1964	0.0	1.0	1.0	227.9	0.5	0.1	229.6
1965	0.0	1.4	1.4	264.8	0.5	0.1	266.9
1966	0.0	1.8	1.8	295.1	0.5	0.1	297.6
1967	0.0	1.7	1.7	315.7	0.5	0.1	318.0
1968	0.0	1.9	1.9	313.9	0.6	0.2	316.6
1969	0.0	2.1	2.1	348.2	0.5	0.2	351.0
1970	0.0	1.7	1.7	341.4	0.6	0.2	343.9
1971	0.0	1.9	1.9	362.5	1.0	0.2	365.6
1972	0.0	1.8	1.8	340.1	1.0	0.2	343.1
1973	0.0	2.5	2.5	338.2	0.9	0.2	341.8
1974	0.0	2.5	2.5	366.5	1.1	0.2	370.2
1975	0.0	2.9	2.9	386.7	1.0	0.2	390.8
1976	0.0	3.2	3.2	362.8	0.9	0.2	367.2
1977	0.0	3.4	3.4	399.8	0.9	0.2	404.3
1978	0.0	3.7	3.7	401.2	0.9	0.2	406.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

(a) 1971=100

INDUSTRY AS FUNDER OF R&D
(PERCENT DISTRIBUTION)

SECTORS RECEIVING FUNDS

	FEDERAL	PROVINCIAL	ALL GOVTS	INDUSTRY	UNIVERSITIES	PNP	TOTAL
1963	0.0	0.5	0.5	99.2	0.3	0.1	100.0
1964	0.0	0.5	0.5	99.3	0.2	0.1	100.0
1965	0.0	0.5	0.5	99.2	0.2	0.0	100.0
1966	0.0	0.6	0.6	99.2	0.2	0.0	100.0
1967	0.0	0.5	0.5	99.3	0.1	0.0	100.0
1968	0.0	0.6	0.6	99.1	0.2	0.1	100.0
1969	0.0	0.6	0.6	99.2	0.2	0.1	100.0
1970	0.0	0.5	0.5	99.3	0.2	0.1	100.0
1971	0.0	0.5	0.5	99.2	0.3	0.1	100.0
1972	0.0	0.5	0.5	99.1	0.3	0.1	100.0
1973	0.0	0.7	0.7	99.0	0.3	0.1	100.0
1974	0.0	0.7	0.7	99.0	0.3	0.1	100.0
1975	0.0	0.7	0.7	99.0	0.2	0.1	100.0
1976	0.0	0.9	0.9	98.8	0.3	0.1	100.0
1977	0.0	0.9	0.9	98.9	0.2	0.0	100.0
1978	0.0	0.9	0.9	98.8	0.2	0.1	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, JANUARY 1979

FUNDING OF INDUSTRIAL INTRAMURAL R&D
(MILLIONS OF CURRENT DOLLARS)

FUNDING SECTORS

	FEDERAL	PROVINCIAL	INDUSTRY	FOREIGN	ALL SOURCES
1963	28.9	0.1	144.2	7.2	180.4
1964	38.6	0.2	174.6	13.6	227.0
1965	51.7	0.3	209.5	25.9	287.4
1966	50.7	0.4	243.8	22.2	317.1
1967	47.0	0.5	271.2	16.8	335.5
1968	47.9	0.6	278.4	15.2	342.1
1969	55.3	0.7	322.4	15.4	393.8
1970	62.4	0.8	330.8	19.1	413.0
1971	74.8	0.9	362.5	26.3	464.5
1972	73.5	1.0	357.1	27.7	459.3
1973	80.6	1.1	387.6	32.9	502.2
1974	84.2	1.3	484.1	33.9	603.5
1975	86.0	4.0	565.4	41.1	696.5
1976	88.9	13.0	582.0	46.0	729.9
1977	100.0	22.0	685.6	47.3	854.9
1978	115.0	30.0	732.5	50.0	927.5

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT.
13-212, 1978

FUNDING OF INDUSTRIAL INTRAMURAL R&D
(MILLIONS OF CONSTANT(a) DOLLARS)

FUNDING SECTORS

	FEDERAL	PROVINCIAL	INDUSTRY	FOREIGN	ALL SOURCES
1963	38.6	0.1	192.8	9.6	241.2
1964	50.4	0.3	227.9	17.8	296.4
1965	65.4	0.4	264.8	32.7	363.3
1966	61.4	0.5	295.1	26.9	383.9
1967	54.7	0.6	315.7	19.6	390.6
1968	54.0	0.7	313.9	17.1	385.7
1969	59.7	0.8	348.2	16.6	425.3
1970	64.4	0.8	341.4	19.7	426.2
1971	74.8	0.9	362.5	26.3	464.5
1972	70.0	1.0	340.1	26.4	437.4
1973	70.3	1.0	338.2	28.7	438.2
1974	63.7	1.0	366.5	25.7	456.8
1975	58.8	2.7	386.7	28.1	476.4
1976	55.4	8.1	362.8	28.7	455.0
1977	58.3	12.8	399.8	27.6	498.5
1978	63.0	16.4	401.2	27.4	508.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT.
13-212, 1978

(a) 1971=100

FUNDING OF INDUSTRIAL INTRAMURAL R&D
(PERCENT DISTRIBUTION)

FUNDING SECTORS

	FEDERAL	PROVINCIAL	INDUSTRY	FOREIGN	ALL SOURCES
1963	16.0	0.1	79.9	4.0	100.0
1964	17.0	0.1	76.9	6.0	100.0
1965	18.0	0.1	72.9	9.0	100.0
1966	16.0	0.1	76.9	7.0	100.0
1967	14.0	0.1	80.8	5.0	100.0
1968	14.0	0.2	81.4	4.4	100.0
1969	14.0	0.2	81.9	3.9	100.0
1970	15.1	0.2	80.1	4.6	100.0
1971	16.1	0.2	78.0	5.7	100.0
1972	16.0	0.2	77.7	6.0	100.0
1973	16.0	0.2	77.2	6.6	100.0
1974	14.0	0.2	80.2	5.6	100.0
1975	12.3	0.6	81.2	5.9	100.0
1976	12.2	1.8	79.7	6.3	100.0
1977	11.7	2.6	80.2	5.5	100.0
1978	12.4	3.2	79.0	5.4	100.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT.
13-212, 1978

FUNDING OF INDUSTRIAL INTRAMURAL R&D
(AVERAGE ANNUAL GROWTH RATES)

PERCENTAGES

		1963-1968	1968-1973	1973-1978	1963-1978
FEDERAL	\$CURRENT	8.9	10.4	6.6	7.6
	\$CONSTANT	5.3	5.6	-2.5	1.5
PROVINCIAL	\$CURRENT	34.3	12.1	74.8	32.3
	\$CONSTANT	30.7	7.2	65.7	26.2
INDUSTRY	\$CURRENT	13.6	5.9	12.2	9.9
	\$CONSTANT	10.1	1.0	3.0	3.8
FOREIGN	\$CURRENT	12.0	17.0	9.2	10.0
	\$CONSTANT	8.5	12.2	-0.0	3.9
ALL SOURCES	\$CURRENT	12.8	7.1	11.9	9.7
	\$CONSTANT	9.2	2.3	2.7	3.6

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212, 1978

FUNDING OF INDUSTRIAL INTRAMURAL R&D
(AVERAGE ANNUAL GROWTH RATES)

YEAR	PERCENTAGES IN CURRENT DOLLARS				
	FEDERAL	PROVINCIAL	INDUSTRY	FOREIGN	ALL SOURCES
63-64	33.6	100.0	21.1	88.9	25.8
64-65	33.9	50.0	20.0	90.4	26.6
65-66	-1.9	33.3	16.4	-14.3	10.3
66-67	-7.3	25.0	11.2	-24.3	5.8
67-68	1.9	20.0	2.7	-9.5	2.0
68-69	15.4	16.7	15.8	1.3	15.1
69-70	12.8	14.3	2.6	24.0	4.9
70-71	19.9	12.5	9.6	37.7	12.5
71-72	-1.7	11.1	-1.5	5.3	-1.1
72-73	9.7	10.0	8.5	18.8	9.3
73-74	4.5	18.2	24.9	3.0	20.2
74-75	2.1	207.7	16.8	21.2	15.4
75-76	3.4	225.0	2.9	11.9	4.8
76-77	12.5	69.2	17.8	2.8	17.1
77-78	15.0	36.4	6.8	5.7	8.5
63-78	7.6	32.3	9.9	10.0	9.7

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT.
13-212, 1978

FUNDING OF INDUSTRIAL INTRAMURAL R&D
(AVERAGE ANNUAL GROWTH RATES)

YEAR	PERCENTAGES IN CONSTANT DOLLARS				
	FEDERAL	PROVINCIAL	INDUSTRY	FOREIGN	ALL SOURCES
63-64	30.4	95.3	18.2	84.5	22.9
64-65	29.7	45.2	16.2	84.4	22.6
65-66	-6.1	27.7	11.4	-17.9	5.7
66-67	-10.9	20.2	7.0	-27.2	1.7
67-68	-1.3	16.2	-0.6	-12.4	-1.2
68-69	10.6	11.7	10.9	-3.0	10.3
69-70	7.8	9.2	-1.9	18.5	0.2
70-71	16.2	9.0	6.2	33.4	9.0
71-72	-6.4	5.8	-6.2	0.3	-5.8
72-73	0.5	0.8	-0.5	8.8	0.2
73-74	-9.4	2.5	8.3	-10.6	4.2
74-75	-7.7	178.0	5.5	9.5	4.3
75-76	-5.8	196.2	-6.2	2.0	-4.5
76-77	5.2	58.3	10.2	-3.8	9.5
77-78	8.0	28.1	0.3	-0.7	1.9
63-78	1.5	26.2	3.8	3.9	3.6

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT.
13-212, 1978

GOVERNMENT FUNDING OF INDUSTRIAL INTRAFURAL R&D
(MILLIONS OF CURRENT DOLLARS)

	FEDERAL	PROVINCIAL	TOTAL GOVERNMENT
1963	28.9	0.1	29.0
1964	38.6	0.2	38.8
1965	51.7	0.3	52.0
1966	50.7	0.4	51.1
1967	47.0	0.5	47.5
1968	47.9	0.6	48.5
1969	55.3	0.7	56.0
1970	62.4	0.8	63.2
1971	74.8	0.9	75.7
1972	73.5	1.0	74.5
1973	80.6	1.1	81.7
1974	84.2	1.3	85.5
1975	86.0	4.0	90.0
1976	88.9	13.0	101.9
1977	100.0	22.0	122.0
1978	115.0	30.0	145.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT.
13-212, 1978

GOVERNMENT FUNDING OF INDUSTRIAL INTRAMURAL R&D
(PERCENT DISTRIBUTION)

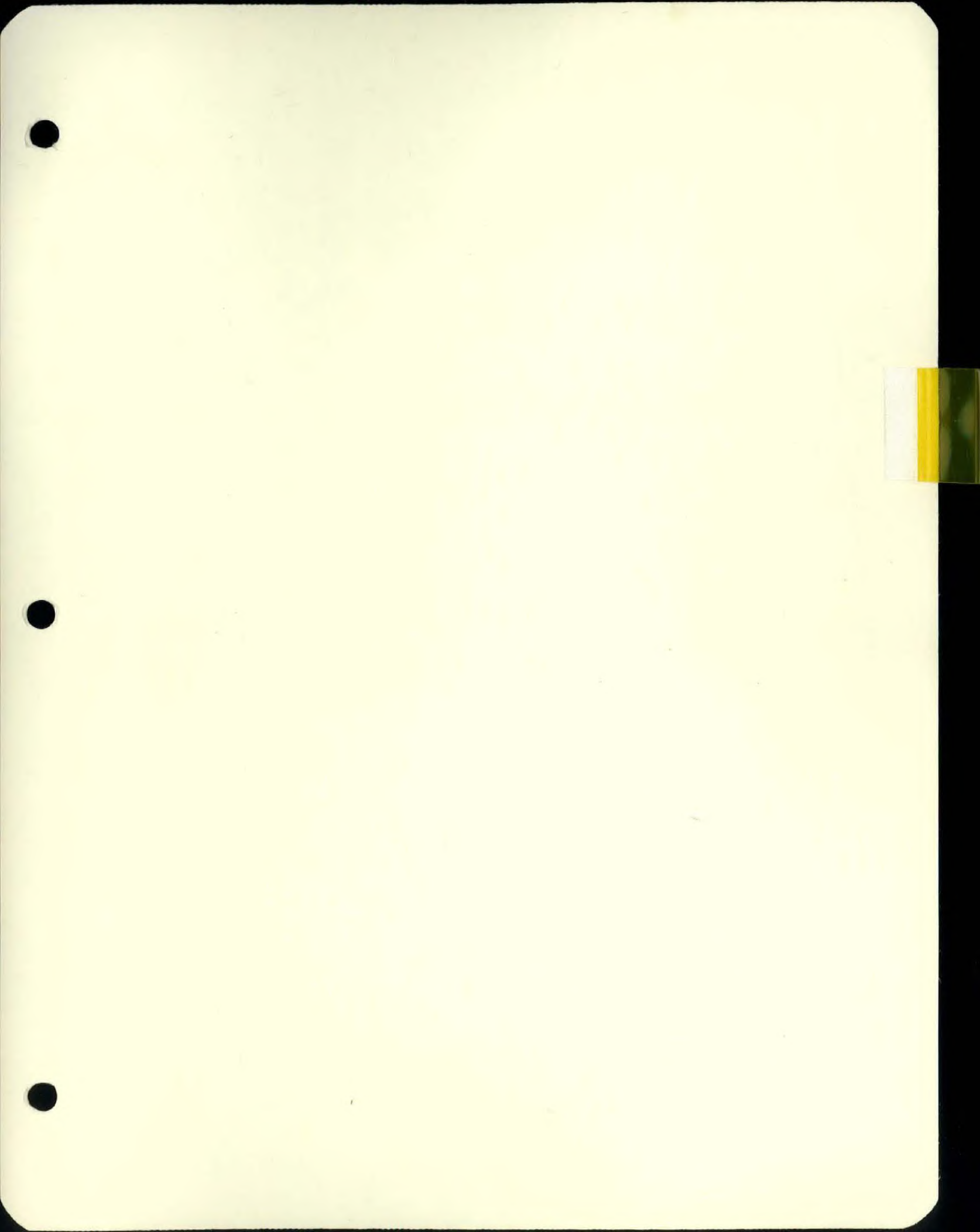
	FEDERAL	PROVINCIAL	TOTAL GOVERNMENT
1963	99.7	0.3	100.0
1964	99.5	0.5	100.0
1965	99.4	0.6	100.0
1966	99.2	0.8	100.0
1967	98.9	1.1	100.0
1968	98.8	1.2	100.0
1969	98.8	1.3	100.0
1970	98.7	1.3	100.0
1971	98.8	1.2	100.0
1972	98.7	1.3	100.0
1973	98.7	1.3	100.0
1974	98.5	1.5	100.0
1975	95.6	4.4	100.0
1976	87.2	12.8	100.0
1977	82.0	18.0	100.0
1978	79.3	20.7	100.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT.
13-212, 1978

GOVERNMENT FUNDING OF INDUSTRIAL INTRAMURAL R&D
(ABSOLUTE CHANGES)

YEAR	FEDERAL	PROVINCIAL	TOTAL GOVERNMENT
63-64	9.7	0.1	9.8
64-65	13.1	0.1	13.2
65-66	-1.0	0.1	-0.9
66-67	-3.7	0.1	-3.6
67-68	0.9	0.1	1.0
68-69	7.4	0.1	7.5
69-70	7.1	0.1	7.2
70-71	12.4	0.1	12.5
71-72	-1.3	0.1	-1.2
72-73	7.1	0.1	7.2
73-74	3.6	0.2	3.8
74-75	1.8	2.7	4.5
75-76	2.9	9.0	11.9
76-77	11.1	9.0	20.1
77-78	15.0	8.0	23.0
74-78	30.8	28.7	59.5

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT.
13-212, 1978



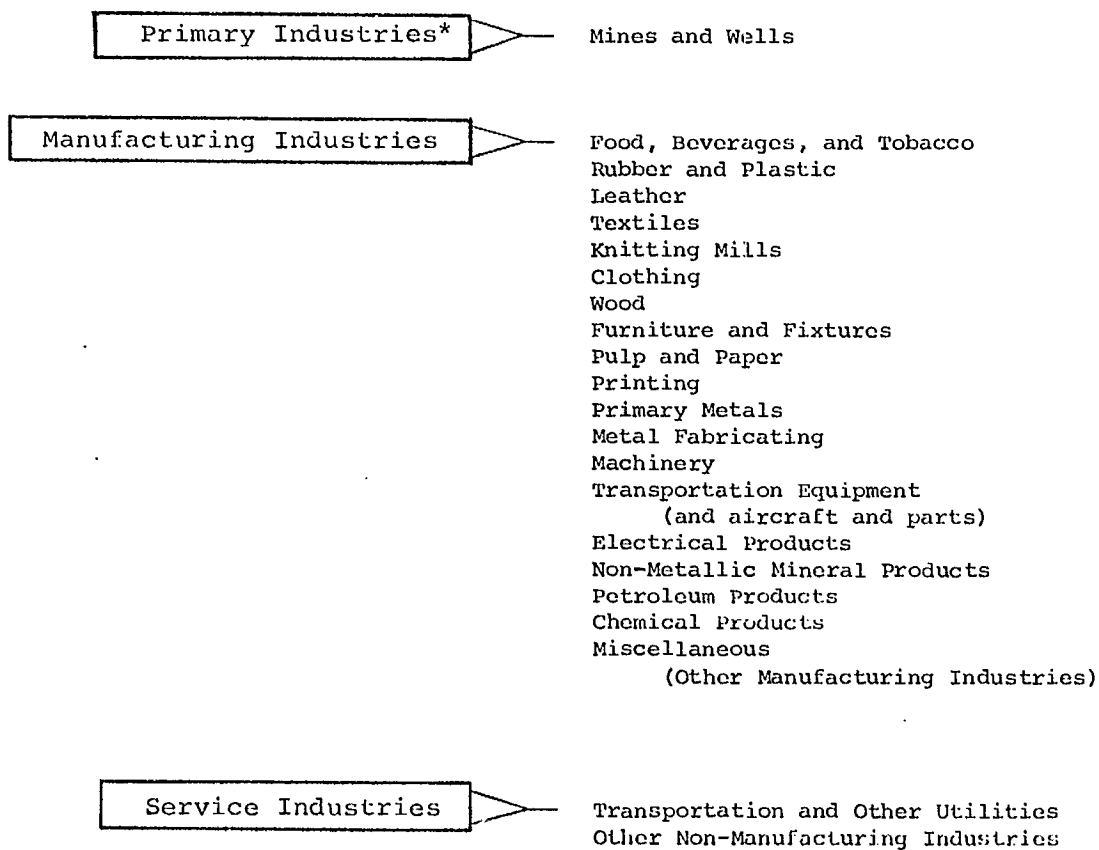
SECTION 3

The purpose of Section 3 is to examine intramural R&D expenditures of the three industry groups (manufacturing, primary, and service). Attention is focussed on the trends in the performance of R&D by the three industry groups. The major sources of R&D funds are also outlined.

INTRAMURAL R&D EXPENDITURE BY INDUSTRY GROUPS

Industrial intramural R&D expenditure is classified by three industry groups: manufacturing, primary, and service industries. Chart 3.1 lists the various industries included in each of the three industry groups.

INDUSTRY GROUPS



*Agriculture is excluded by Statistics Canada due to insignificant R&D expenditures.

Chart 3.1--Industry Groups

Over eighty percent of industrial intramural R&D expenditures are performed by the manufacturing industries. Figure 3.1 shows that, although manufacturing has consistently dominated intramural R&D expenditure, its share has declined from 86.8% in 1971 to 83% in 1978. During the same period, the share of service industries increased from 9.5% to 11.5% while the share of primary industries fluctuated around 6% (Appendix Table C1).

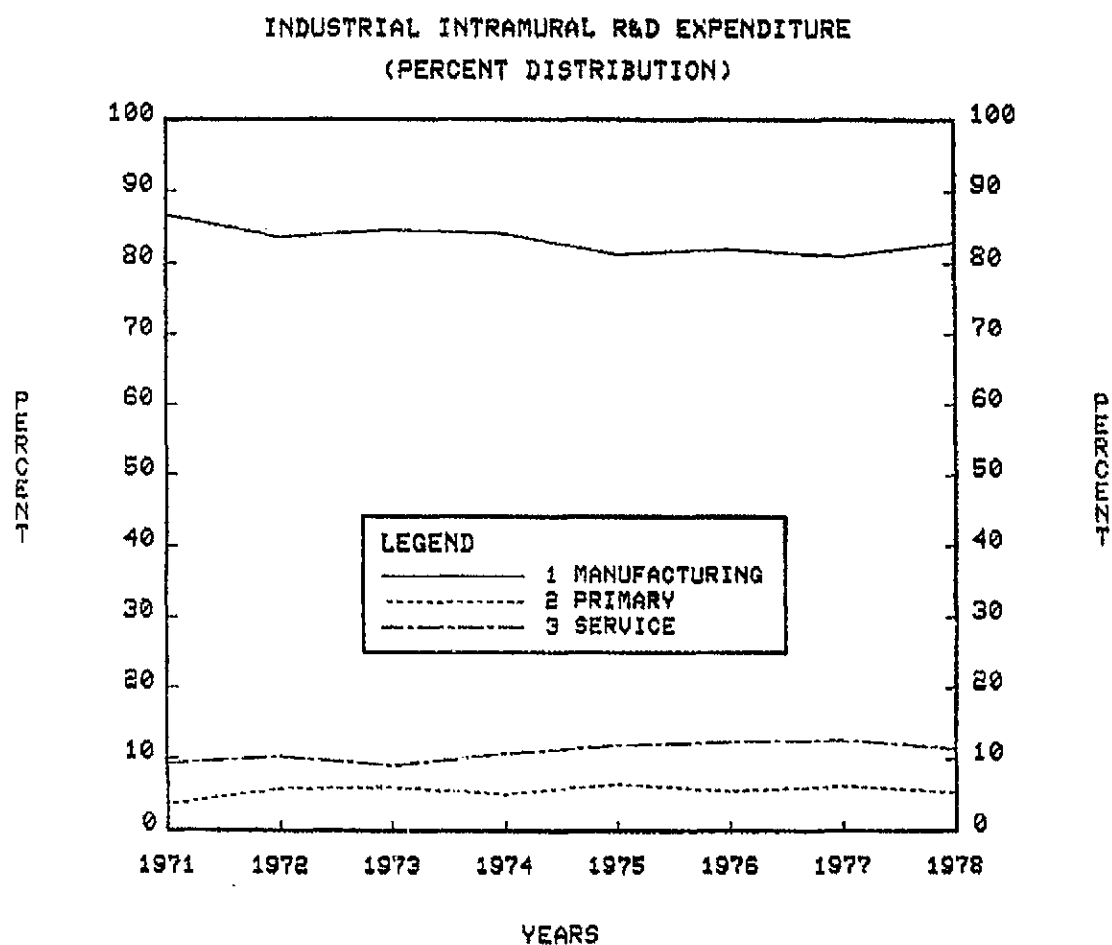
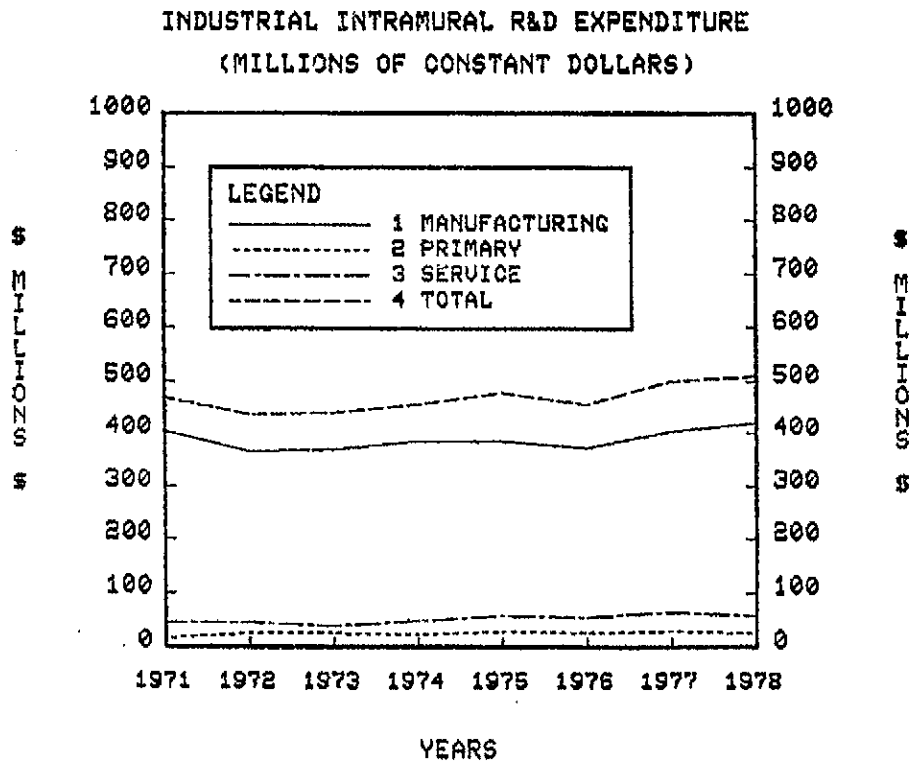


Figure 3.1--Distribution of Intramural R&D Expenditure By Industry Group

Industrial intramural R&D expenditure has almost doubled in current dollars from \$457.5 million in 1971 to \$927.5 million in 1978. All industry groups recorded substantial increases in current dollars between 1971 and 1978. Intramural R&D expenditures by the primary industries almost tripled while services more than doubled (Appendix Table C2). The manufacturing industries' 1978 intramural R&D expenditure was almost double that of 1971.

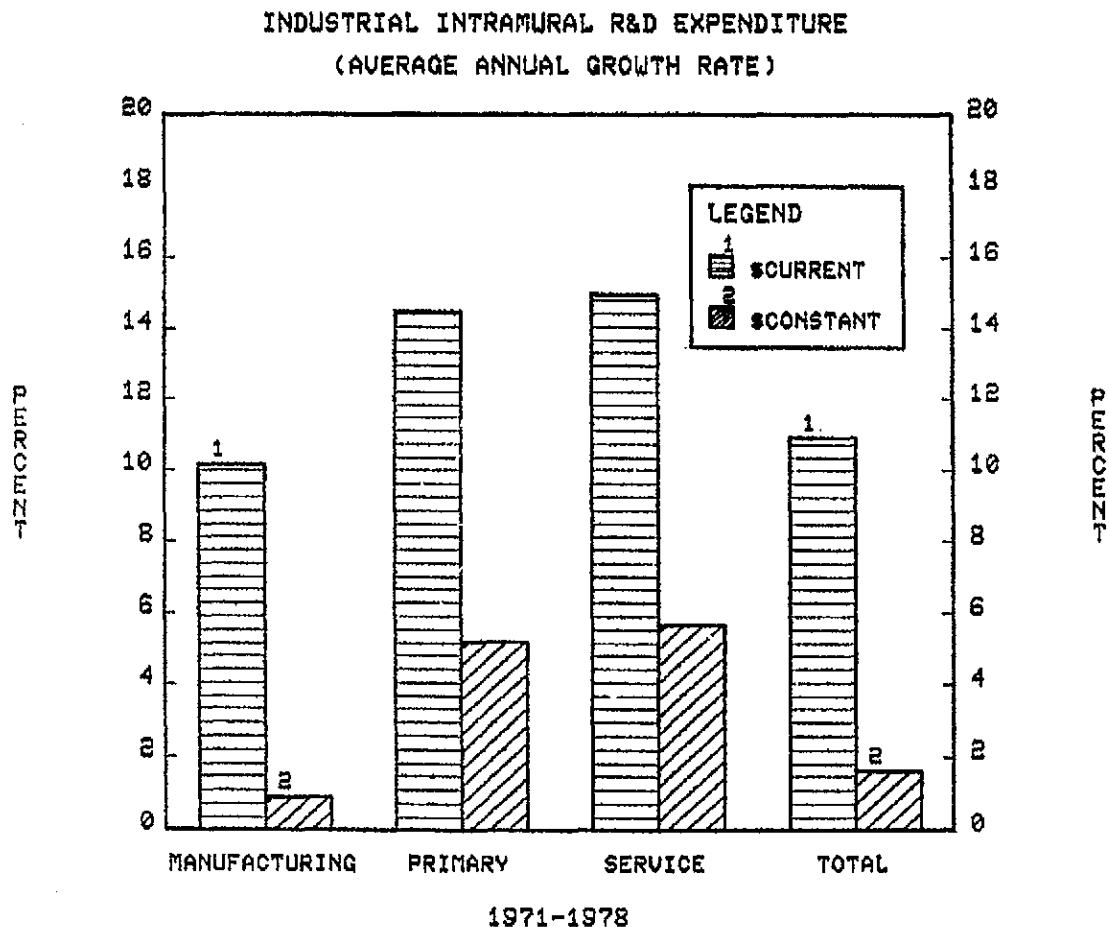
After adjusting for inflation, industrial intramural R&D expenditure increased by only 9%. Figure 3.2 shows the trend in constant dollars for all of industry and for the three industry groups. Total intramural R&D expenditure rose above the 1971 level only after 1975. In the manufacturing group, intramural expenditure was below the 1971 level in all years except 1978.



SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

Figure 3.2--Intramural R&D Expenditure in Constant Dollars

From 1971 to 1978, the average annual rate of growth for industrial intramural R&D expenditure was 10.9% in current dollars and 1.7% in constant dollars. Figure 3.3 presents average annual rates of growth for intramural R&D expenditure by industry group. Constant dollar expenditure by manufacturing increased at an annual average rate of 0.9%. This was substantially less than the primary industries (5.2%) and the service industries (5.7%), although the growth in these two industry groups started from a much smaller base (Appendix Table C3).



SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

Figure 3.3--Average Annual Growth of Intramural R&D Expenditures

The ratio of industrial intramural R&D expenditure to GNP has declined from about 0.5% in 1971 to 0.4% in 1978 (Table 3.1). Intramural R&D expenditures by both primary and service industries were fairly stable, accounting for less than 0.1% of GNP. The manufacturing industries' total intramural R&D expenditure dropped from 0.43% of GNP in 1971 to 0.33% in 1978 (Appendix Table C4).

INDUSTRIAL INTRAMURAL R&D EXPENDITURE AND GNP
(PERCENT OF GNP)

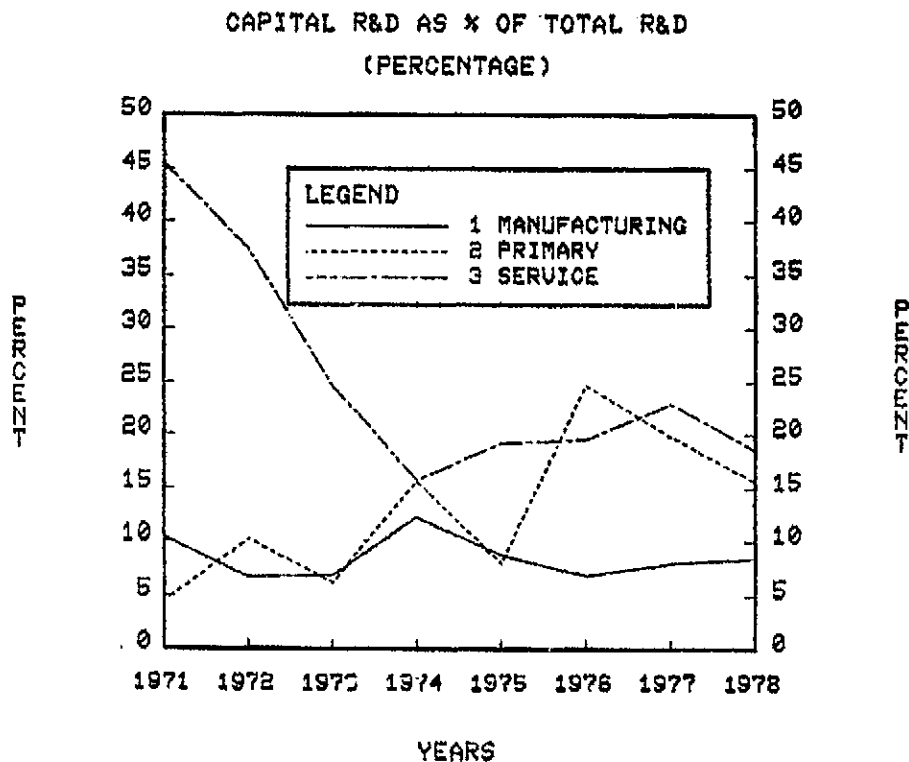
	MANUFACTURING	PRIMARY	SERVICE	TOTAL	GNP
1971	0.43	0.02	0.05	0.49	100.0
1972	0.37	0.03	0.05	0.44	100.0
1973	0.34	0.02	0.04	0.41	100.0
1974	0.34	0.02	0.04	0.41	100.0
1975	0.34	0.03	0.05	0.42	100.0
1976	0.31	0.02	0.05	0.38	100.0
1977	0.33	0.03	0.05	0.41	100.0
1978	0.33	0.02	0.05	0.40	100.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

Table 3.1--Intramural R&D Expenditure as % of GNP

Industrial intramural R&D expenditure can be further divided into current and capital expenditures. Although capital expenditure account for less than 15% of industrial intramural R&D expenditure, its importance varies across industry groups (Appendix Table C5). Figure 3.4 shows how the share of capital expenditure to total expenditure has changed from 1971 to 1978 for the three industry groups.

The share of capital to total expenditure in the service industries declined sharply from 1971 to 1974. This decline was attributable to public utilities (principally hydro-electric companies) and to firms in transportation and communication services.



SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

Figure 3.4--Capital R&D as Percentage of Total R&D

SOURCES OF R&D FUNDS FOR INDUSTRY GROUPS

The distribution by source of R&D funds for each industry group is shown in Chart 3.2 (Appendix Tables C6 and C7). In 1977, the reporting companies account for over 60% of R&D funds in each industry group. The federal government funded a larger proportion of R&D in the manufacturing industries than in the service and primary industries. In the primary industries, the other Canadian sources played a very significant role in the financing of R&D while the foreign sources were barely visible.

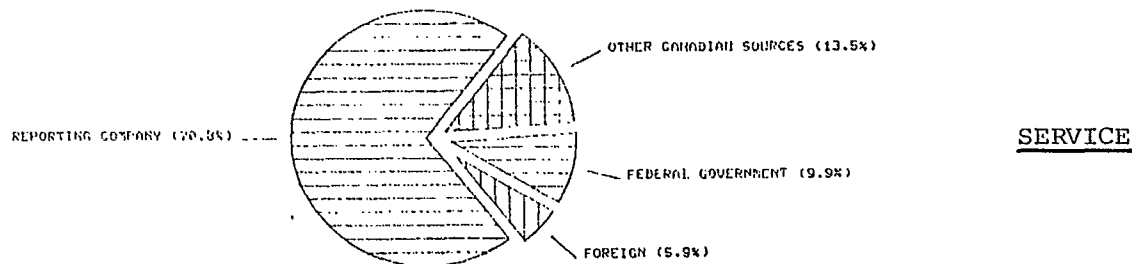
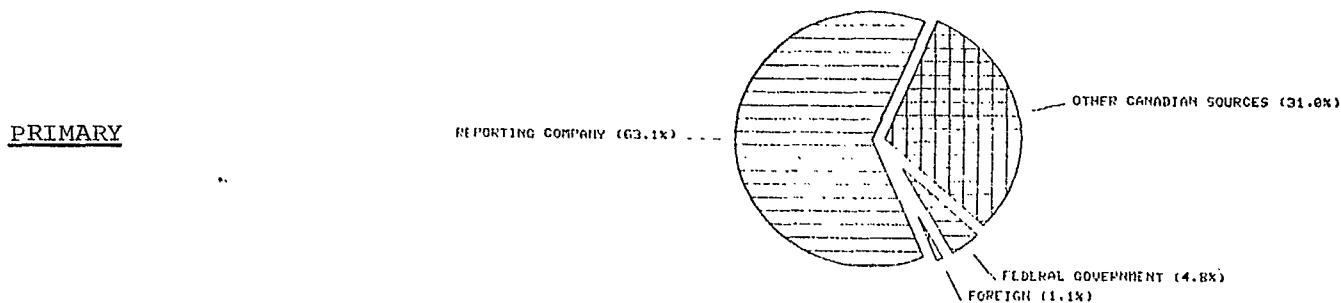
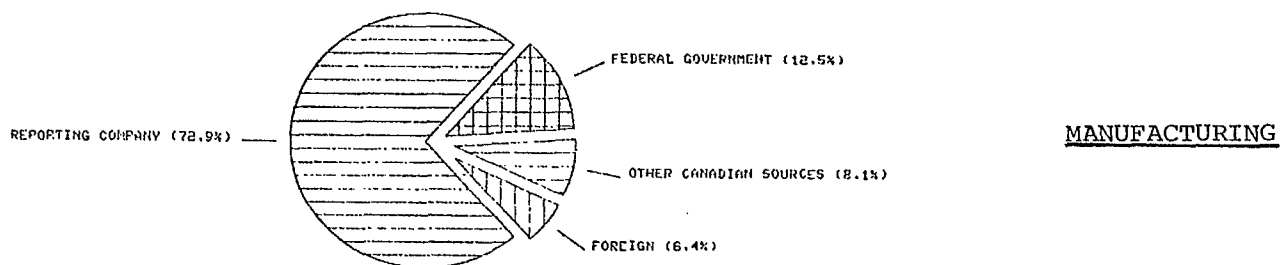


Chart 3.2--Distribution of R&D Funds By Source

The distribution by industry group of each source's R&D funds is shown in Chart 3.3 (Appendix Table C8). Manufacturing industries have captured the bulk of funds provided by each source. In fact, the distribution by industry group of R&D funds is fairly similar for all sources. A notable exception is "Other Canadian Sources" which is more heavily concentrated in primary and service industries.

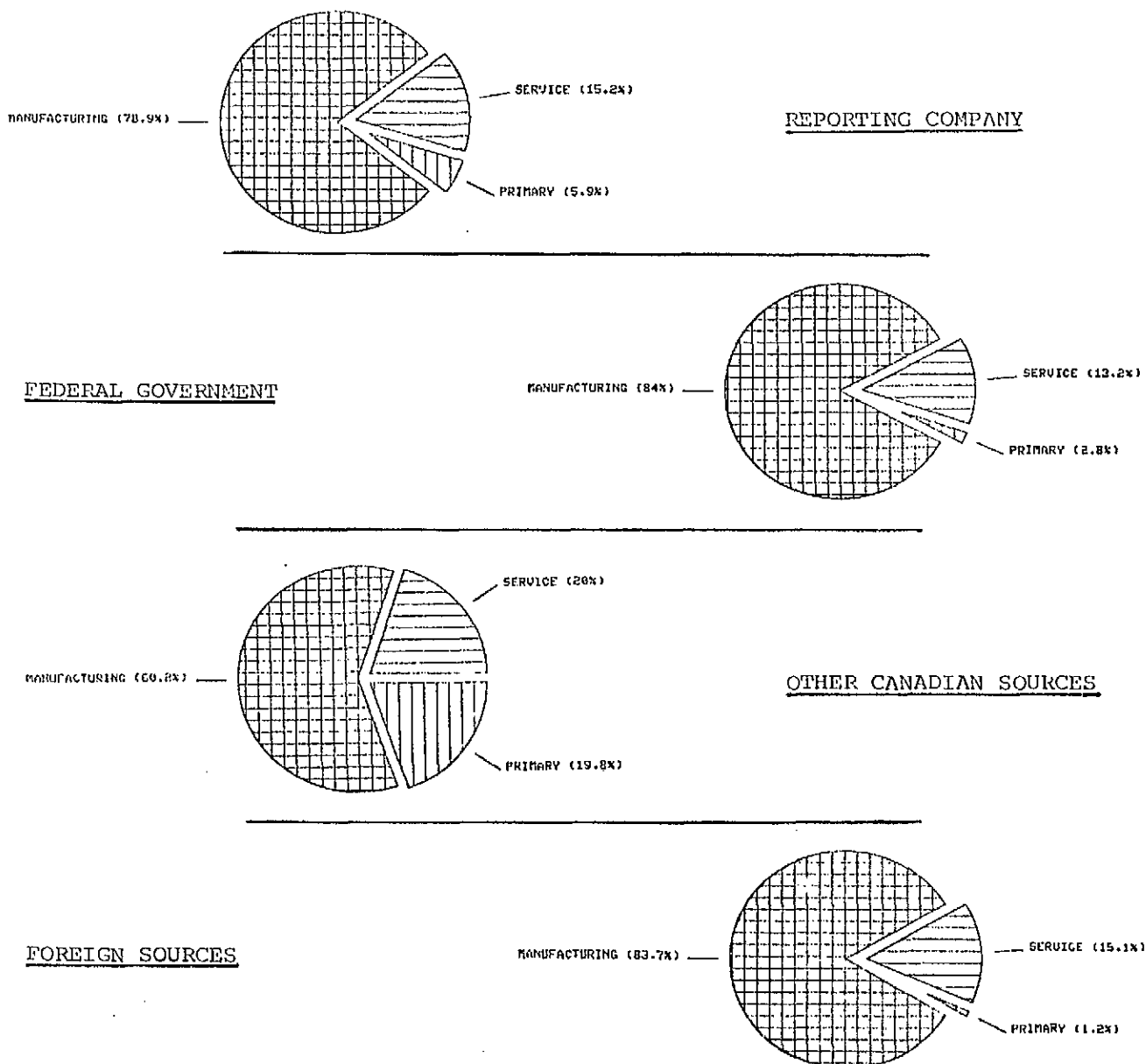


Chart 3.3--Distribution of R&D Funds By Industry Group

APPENDIX C

INDUSTRIAL INTRAMURAL R&D EXPENDITURE
(MILLIONS OF DOLLARS)

INDUSTRIES

		1971	1972	1973	1974	1975	1976	1977	1978
MANUFACTURING	\$CURRENT	405.7	384.6	425.3	507.5	566.2	598.1	692.1	770.2
	\$CONSTANT	405.7	366.3	371.1	384.2	387.3	372.9	403.6	421.8
PRIMARY	\$CURRENT	17.3	27.3	30.3	30.8	46.3	40.9	53.7	50.3
	\$CONSTANT	17.3	26.0	26.4	23.3	31.7	25.5	31.3	27.5
SERVICE	\$CURRENT	44.5	47.4	46.6	65.2	84.0	90.9	109.1	107.0
	\$CONSTANT	44.5	45.1	40.7	49.4	57.5	56.7	63.6	58.6
TOTAL	\$CURRENT	467.5	459.3	502.2	603.5	696.5	729.9	854.9	927.5
	\$CONSTANT	467.5	437.4	438.2	456.8	476.4	455.0	498.5	508.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

INDUSTRIAL INTRAMURAL R&D EXPENDITURE
(AVERAGE ANNUAL GROWTH RATES)

INDUSTRIES		PERCENTAGES							
		71-72	72-73	73-74	74-75	75-76	76-77	77-78	71-78
MANUFACTURING	\$CURRENT	-5.2	10.6	19.8	11.1	5.6	15.7	11.3	10.2
	\$CONSTANT	-9.7	1.3	3.9	0.4	-3.7	8.2	4.5	0.9
PRIMARY	\$CURRENT	57.8	11.0	1.7	50.3	-11.7	31.3	-6.3	14.5
	\$CONSTANT	50.3	1.7	-11.8	35.8	-19.5	22.8	-12.0	5.2
SERVICE	\$CURRENT	6.5	-1.7	39.9	28.8	8.2	20.0	-1.9	15.0
	\$CONSTANT	1.4	-9.9	21.4	16.4	-1.4	12.3	-7.9	5.7
TOTAL	\$CURRENT	-1.8	9.3	20.2	15.4	4.8	17.1	8.5	10.9
	\$CONSTANT	-6.4	0.2	4.2	4.3	-4.5	9.5	1.9	1.7

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

INDUSTRIAL INTRAMURAL R&D EXPENDITURE AND GNP
(MILLIONS OF CURRENT DOLLARS)

	MANUFACTURING	PRIMARY	SERVICE	TOTAL	GNP
1971	405.7	17.3	44.5	467.5	94,450
1972	384.6	27.3	47.4	459.3	105,234
1973	425.3	30.3	46.6	502.2	123,560
1974	507.5	30.8	65.2	603.5	147,528
1975	566.2	46.3	84.0	696.5	165,428
1976	598.1	40.9	90.9	729.9	191,492
1977	692.1	53.7	109.1	854.9	210,132
1978	770.2	50.3	107.0	927.5	231,800

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977
& 1978)

CAPITAL R&D AS % OF TOTAL R&D
(PERCENTAGES)

	MANUFACTURING	PRIMARY	SERVICE	TOTAL
1971	10.4	4.6	45.4	13.5
1972	6.8	10.3	37.6	10.1
1973	7.0	6.3	24.7	8.6
1974	12.3	15.6	15.8	12.8
1975	8.7	8.0	19.3	10.0
1976	6.9	24.7	19.6	9.5
1977	8.1	19.9	23.0	10.7
1978	8.5	15.7	18.7	10.1

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT.
13-212 (1977 & 1978)

SOURCES OF FUNDS FOR INTRAMURAL R&D EXPENDITURE IN 1977
(MILLIONS OF CURRENT DOLLARS)

SOURCES	INDUSTRY GROUPS			TOTAL
	MANUFACTURING	PRIMARY	SERVICE	
REPORTING COMPANY	474.9	35.4	91.7	602.0
FEDERAL GOVERNMENT	81.6	2.7	12.8	97.1
OTHER CANADIAN SOURCES	52.8	17.4	17.5	87.7
TOTAL CANADIAN SOURCES	609.4	55.5	121.9	786.8
FOREIGN SOURCES	42.0	0.6	7.6	50.2
TOTAL (a)	651.4	56.1	129.5	837.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-003, VOL. 3, NO. 7

(a) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS WILL NOT CORRESPOND EXACTLY TO THE SUM OF THE ITEMS ADDED.

SOURCES OF FUNDS FOR INTRAMURAL R&D EXPENDITURE IN 1977
(PERCENT DISTRIBUTION BY SOURCE OF FUNDS)

SOURCES	INDUSTRY GROUPS			
	MANUFACTURING	PRIMARY	SERVICE	TOTAL
REPORTING COMPANY	72.9	63.1	70.8	71.9
FEDERAL GOVERNMENT	12.5	4.8	9.9	11.6
OTHER CANADIAN SOURCES	8.1	31.0	13.5	10.5
TOTAL CANADIAN SOURCES	93.6	98.9	94.1	94.0
FOREIGN SOURCES	6.4	1.1	5.9	6.0
TOTAL (a)	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-003, VOL. 3, NO. 7

(a) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS WILL NOT CORRESPOND EXACTLY TO THE SUM OF THE ITEMS ADDED.

SOURCES OF FUNDS FOR INTRAMURAL R&D EXPENDITURE IN 1977
(PERCENT DISTRIBUTION BY INDUSTRY GROUP)

SOURCES	INDUSTRY GROUPS			TOTAL
	MANUFACTURING	PRIMARY	SERVICE	
REPORTING COMPANY	78.9	5.9	15.2	100.0
FEDERAL GOVERNMENT	84.0	2.8	13.2	100.0
OTHER CANADIAN SOURCES	60.2	19.8	20.0	100.0
TOTAL CANADIAN SOURCES	77.5	7.1	15.5	100.0
FOREIGN SOURCES	83.7	1.2	15.1	100.0
TOTAL (a)	77.8	6.7	15.5	100.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-003, VOL. 3, NO. 7

(a) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS WILL NOT CORRESPOND EXACTLY TO THE SUM OF THE ITEMS ADDED.

SECTION 4

The purpose of Section 4 is to examine intramural R&D expenditures in the manufacturing industries. The leading R&D industries are identified and trends in their performance of R&D are studied. The sources of R&D funds for these manufacturing industries are also outlined.

INTRAMURAL R&D EXPENDITURE BY MANUFACTURING INDUSTRIES

Six industries account for the bulk of intramural R&D expenditure in manufacturing. These six industries are shown in Chart 4.1 along with "Other Manufacturing" which includes all remaining industries in manufacturing. Detailed results for individual manufacturing industries, including percentage shares of total manufacturing R&D, current and constant dollar trends, and growth rates are contained in Appendix Tables D1 to D5.

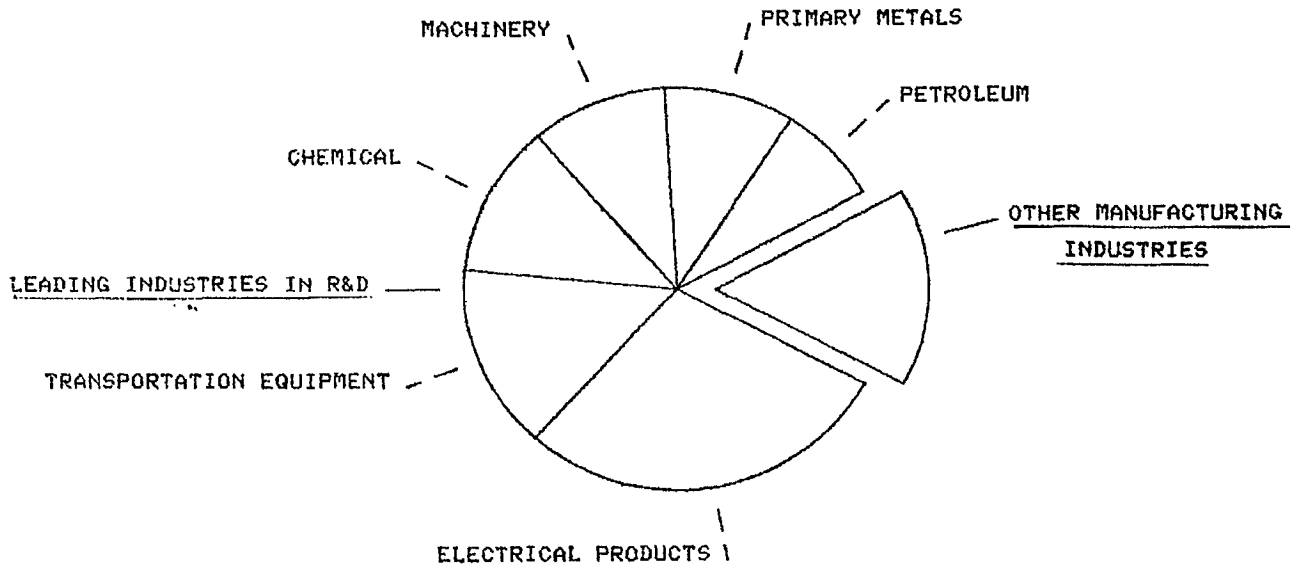


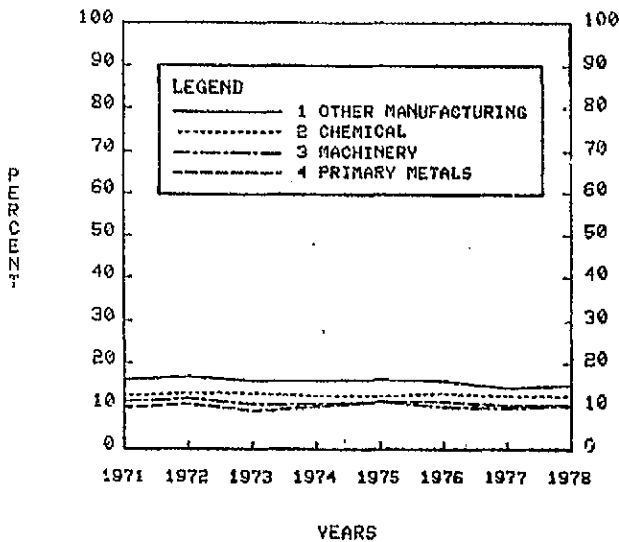
Chart 4.1--Industry Groups Within Manufacturing Industries

Figure 4.1 examines the distribution of intramural R&D expenditures among the seven industry groups identified within manufacturing industries (Appendix Tables D6 and D7). The electrical products industry is the leader in terms of R&D expenditure but its share decreased from 34.6% in 1971 to 24.8% in 1978. The petroleum industry's share of R&D has increased from 4.3% in 1971 to 8.5% in 1978.

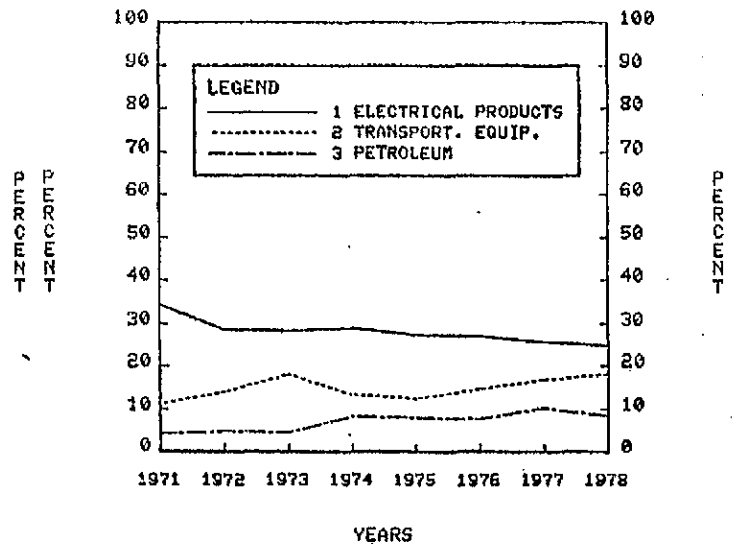
The trend in the share of transportation equipment industry is dominated by the aircraft and parts industry. Its share of R&D has also increased from 11.2% in 1971 to 18.3% in 1978 although it is subject to more variations than the other industries.

Changes in the shares of the other four industries have been relatively insignificant (Figure 4.1).

INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(PERCENT DISTRIBUTION)



INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(PERCENT DISTRIBUTION)



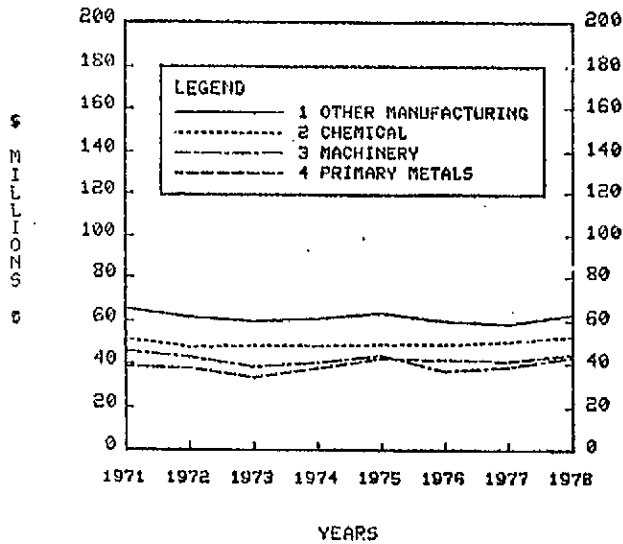
SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

Figure 4.1--Distribution of Intramural R&D Expenditure

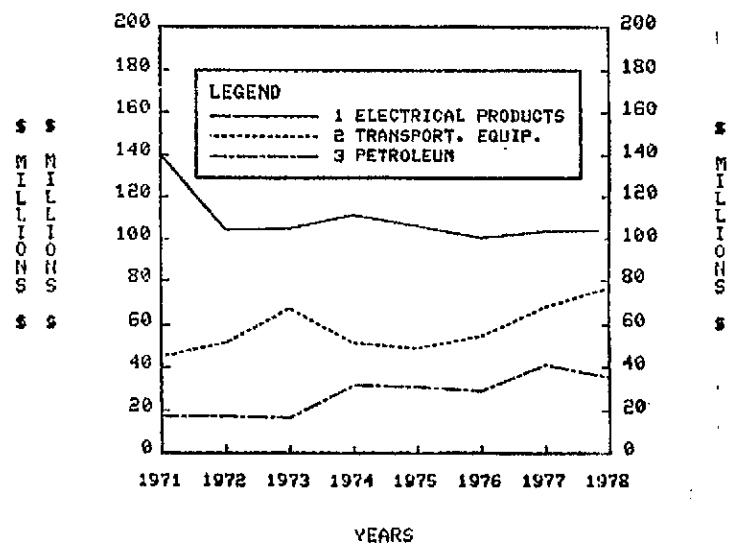
Figure 4.2 shows constant dollar trends in intramural R&D expenditures for the seven industry groups in manufacturing (Appendix Table B8). The most noticeable increase was in the petroleum industry where constant dollar expenditure more than doubled between 1971 and 1978. Other industries which recorded increases in constant dollar expenditures were primary metals, transportation equipment, and chemicals.

The sharpest decline occurred in electrical products, where R&D expenditure decreased by 25%. It should be noted that this decline was concentrated between 1971 and 1972, after which the expenditure in constant dollars was relatively stable.

INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(MILLIONS OF CONSTANT (a) DOLLARS)



INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(MILLIONS OF CONSTANT (a) DOLLARS)

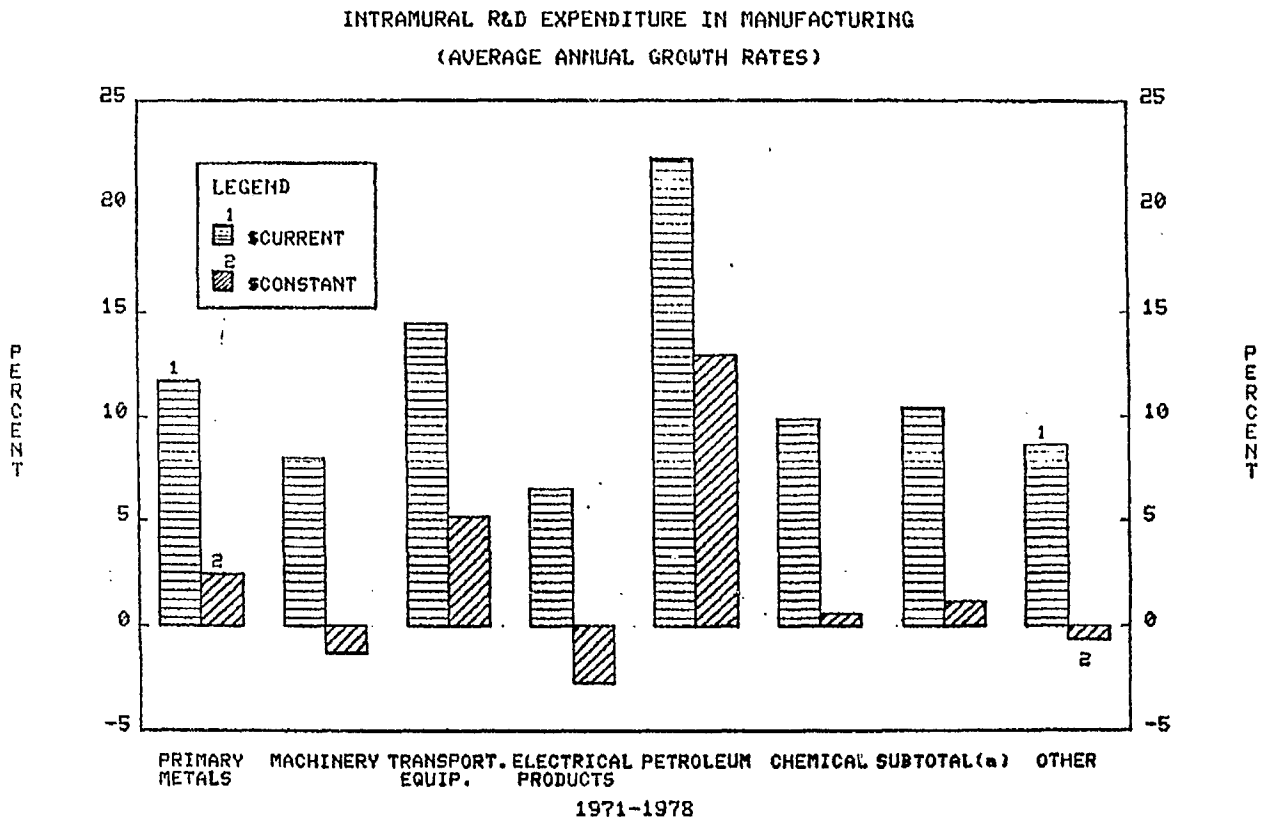


SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

a . 1971=100

Figure 4.2--Intramural R&D Expenditure in Constant Dollars

Figure 4.3 presents the average annual growth rates of intramural R&D expenditure between 1971 and 1978 for the seven industry groups in manufacturing. These averages, although useful for examining overall trends, do not show how erratically R&D can change from year to year (Appendix Table D9). Even for those industries where constant dollar growth was positive, decreases did occur in some years. For example, the petroleum industry increased its expenditure by 88% in 73-74 and then had negative growth of -1.4% in 74-75 and -7.1% in 75-76.

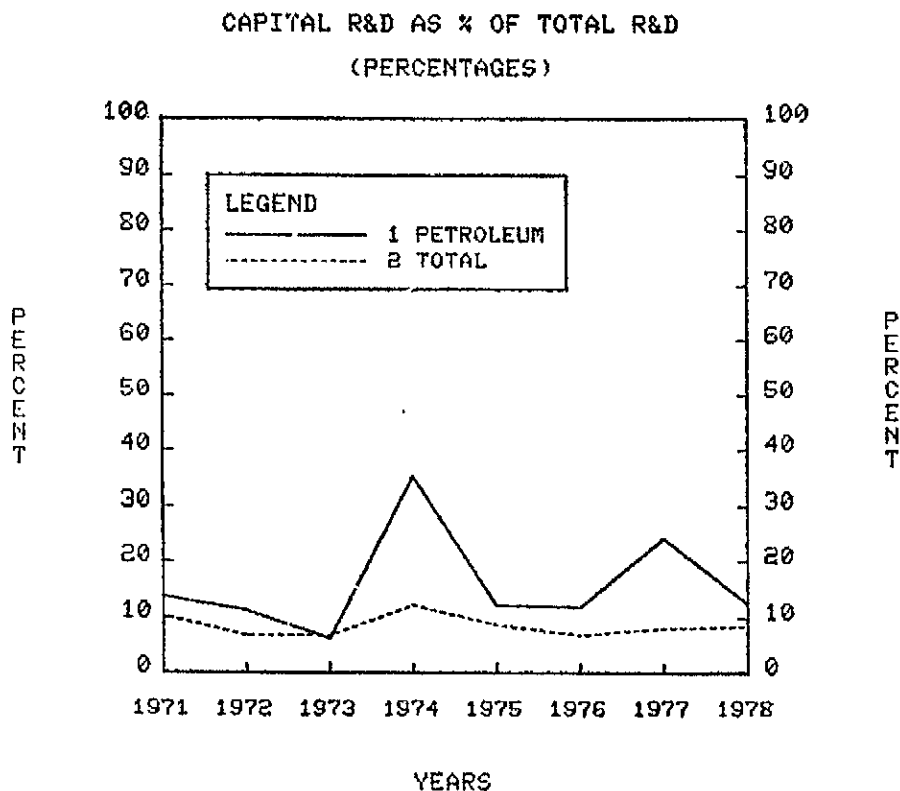


SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

a . AVERAGE FOR THE SIX LEADING R&D INDUSTRIES

Figure 4.3--Average Annual Growth in Intramural R&D Expenditure

The distribution of intranural R&D expenditure between current and capital expenditures has been relatively stable between 1971 and 1978 for all industry groups within manufacturing except for the petroleum industry (Appendix Tables D10 and D11). The 1974 increase in the share of capital to total R&D in the petroleum industry was primarily due to the construction of pilot plants and prototypes related to Arctic gas explorations and the tar sands project. The tar sands project was also responsible for the increase in 1977. Figure 4.4 compares the changes in the share of capital to total R&D expenditure for total manufacturing industries and for the petroleum industry.



SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

Figure 4.4--Capital R&D as Percentage of Total R&D

SOURCES OF R&D FUNDS FOR MANUFACTURING INDUSTRIES

Chart 4.2 shows the distribution by source of R&D funds for each of the seven industry groups in manufacturing during 1977. Canadian sources provided over 93% of the funds in all industries except machinery (Appendix Tables D12 and D13). The bulk of Canadian funds came from the reporting companies. The federal government was most visible in the transportation equipment industry providing over 25% of R&D funds and least evident in the petroleum industry, providing about 2%. Detailed figures for all manufacturing industries are available in Appendix Tables D14 and D15.

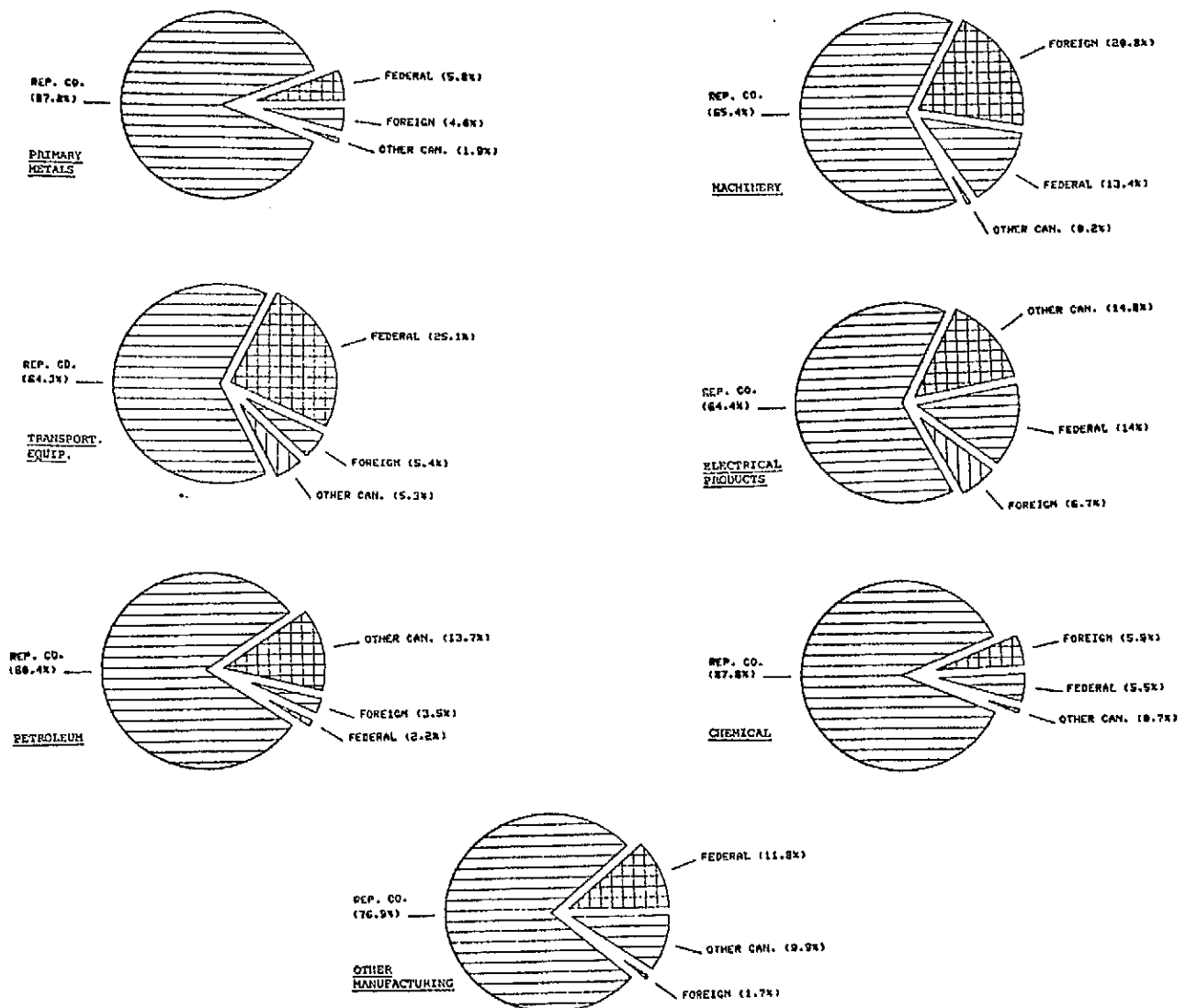


Chart 4.2--Distribution of R&D Funds By Source

Chart 4.3 shows how each source's R&D funds were distributed among the seven industry groups in manufacturing during 1977. Foreign funding was directed primarily toward the machinery and electrical products industries, which together received almost 60% of total foreign funds (Appendix Table D16).

With respect to Canadian sources, almost two-thirds of federal funds for R&D were allocated to transportation equipment and electrical products industries. The electrical products industry also received 50% of the R&D funds from "Other Canadian Sources". Detailed figures for all manufacturing industries are shown in Appendix Table D17.

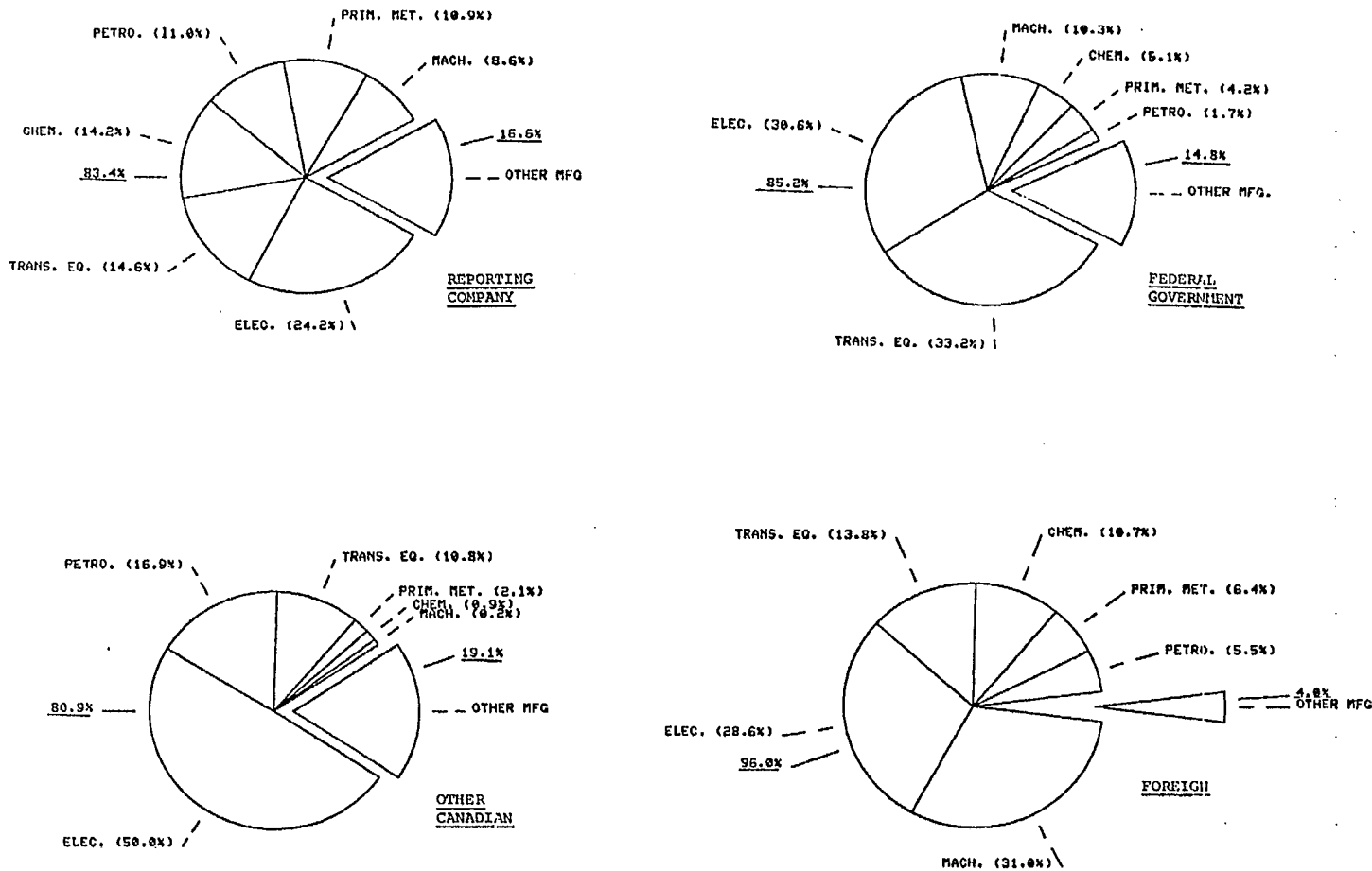


Chart 4.3--Distribution of R&D Funds By Industry

APPENDIX D

INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(MILLIONS OF CURRENT DOLLARS)

INDUSTRIES(a)

	1971	1972	1973	1974	1975	1976	1977	1978
FOOD, BEVERAGE, AND TOBACCO	16.1	17.2	17.1	20.8	24.6	24.0	27.3	28.6
RUBBER & PLASTIC	4.9	5.1	5.0	5.1	5.3	6.1	7.0	7.9
LEATHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXTILE	4.0	4.2	4.3	3.4	5.3	6.4	5.3	5.5
KNITTING MILLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CLOTHING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WOOD BASED (b)	19.9	19.6	20.2	26.2	29.5	34.0	37.4	40.5
PRINTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PRIMARY METAL	38.8	40.6	38.9	50.4	63.0	67.4	71.1	81.3
METAL FABRICATING	9.0	7.4	8.6	7.9	9.9	9.5	11.2	13.4
MACHINERY	46.3	45.5	44.7	54.3	64.2	59.1	67.2	79.4
TRANSPORT. EQUIP.	45.5	54.5	77.3	68.4	71.7	87.6	116.9	140.6
ELECTRICAL PRODUCTS	140.3	109.9	120.4	147.3	155.8	161.8	178.1	190.9
NON-METALLIC MINERALS	3.0	4.2	4.8	5.7	4.9	4.2	4.7	4.9
PETROLEUM	17.5	18.6	19.6	42.5	46.4	47.3	71.6	65.1
CHEMICAL	51.5	50.2	55.8	63.9	71.8	78.5	86.8	97.0
MISCELLANEOUS	8.9	7.4	8.7	11.7	13.9	12.0	13.6	14.9
TOTAL	405.7	384.6	425.3	507.5	566.2	598.1	692.1	770.2

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

(a) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE EXPRESSED.

(b) "WOOD" AND "PULP & PAPER". "FURNITURE & FIXTURES" INCLUDED IN "MISCELLANEOUS".

INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(MILLIONS OF CONSTANT(c) DOLLARS)

INDUSTRIES(a)

	1971	1972	1973	1974	1975	1976	1977	1978
FOOD, BEVERAGE, AND TOBACCO	16.1	16.4	14.9	15.7	16.8	15.0	15.9	15.7
RUBBER & PLASTIC	4.9	4.9	4.4	3.9	3.6	3.8	4.1	4.3
LEATHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXTILE	4.0	4.0	3.8	2.6	3.6	4.0	3.1	3.0
KNITTING MILLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CLOTHING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WOOD BASED (b)	19.9	18.7	17.6	19.8	20.2	21.2	21.8	22.2
PRINTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PRIMARY METAL	38.8	38.7	33.9	38.2	43.1	42.0	41.5	44.5
METAL FABRICATING	9.0	7.0	7.5	6.0	6.8	5.9	6.5	7.3
MACHINERY	46.3	43.3	39.0	41.1	43.9	36.8	39.2	43.5
TRANSPORT. EQUIP.	45.5	51.9	67.5	51.8	49.0	54.6	68.2	77.0
ELECTRICAL PRODUCTS	140.3	104.7	105.1	111.5	106.6	100.9	103.8	104.5
NON-METALLIC MINERALS	3.0	4.0	4.2	4.3	3.4	2.6	2.7	2.7
PETROLEUM	17.5	17.7	17.1	32.2	31.7	29.5	41.7	35.7
CHEMICAL	51.5	47.8	48.7	48.4	49.1	48.9	50.6	53.1
MISCELLANEOUS	8.9	7.0	7.6	8.9	9.5	7.5	7.9	8.2
TOTAL	405.7	366.3	371.1	384.2	387.3	372.9	403.6	421.8

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

(a) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE EXPRESSED.

(b) "WOOD" AND "PULP & PAPER". "FURNITURE & FIXTURES" INCLUDED IN "MISCELLANEOUS".

(c) 1971=100

INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(PERCENT DISTRIBUTION)

INDUSTRIES(a)

	1971	1972	1973	1974	1975	1976	1977	1978
FOOD, BEVERAGE, AND TOBACCO	4.0	4.5	4.0	4.1	4.3	4.0	3.9	3.7
RUBBER & PLASTIC	1.2	1.3	1.2	1.0	0.9	1.0	1.0	1.0
LEATHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXTILE	1.0	1.1	1.0	0.7	0.9	1.1	0.8	0.7
KNITTING MILLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CLOTHING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WOOD BASED (b)	4.9	5.1	4.7	5.2	5.2	5.7	5.4	5.3
PRINTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PRIMARY METAL	9.6	10.6	9.1	9.9	11.1	11.3	10.3	10.6
METAL FABRICATING	2.2	1.9	2.0	1.6	1.7	1.6	1.6	1.7
MACHINERY	11.4	11.8	10.5	10.7	11.3	9.9	9.7	10.3
TRANSPORT. EQUIP.	11.2	14.2	18.2	13.5	12.7	14.6	16.9	18.3
ELECTRICAL PRODUCTS	34.6	28.6	28.3	29.0	27.5	27.1	25.7	24.8
NON-METALLIC MINERALS	0.7	1.1	1.1	1.1	0.9	0.7	0.7	0.6
PETROLEUM	4.3	4.8	4.6	8.4	8.2	7.9	10.3	8.5
CHEMICAL	12.7	13.1	13.1	12.6	12.7	13.1	12.5	12.6
MISCELLANEOUS	2.2	1.9	2.0	2.3	2.5	2.0	2.0	1.9
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

- (a) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE EXPRESSED.
- (b) "WOOD" AND "PULP & PAPER". "FURNITURE & FIXTURES" INCLUDED IN "MISCELLANEOUS".

INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(AVERAGE ANNUAL GROWTH RATES)

INDUSTRIES (a)	PERCENTAGES IN CURRENT DOLLARS							
	71-72	72-73	73-74	74-75	75-76	76-77	77-78	71-78
FOOD, BEVERAGE, AND TOBACCO	6.8	-0.6	21.6	18.3	-2.4	13.8	4.8	8.9
RUBBER & PLASTIC	4.1	-2.0	2.0	3.9	15.1	14.8	12.9	6.6
LEATHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXTILE	5.0	2.4	-20.9	55.9	20.8	-17.2	3.8	6.0
KNITTING MILLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CLOTHING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WOOD BASED (b)	-1.5	3.1	29.7	12.6	15.3	10.0	8.3	11.8
PRINTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PRIMARY METAL	4.6	-4.2	29.6	25.0	7.0	5.5	14.3	11.7
METAL FABRICATING	-17.8	16.2	-8.1	25.3	-4.0	17.9	19.6	6.4
MACHINERY	-1.7	-1.8	21.5	18.2	-7.9	13.7	18.2	8.0
TRANSPORT. EQUIP.	19.8	41.8	-11.5	4.8	22.2	33.4	20.3	14.4
ELECTRICAL PRODUCTS	-21.7	9.6	22.3	5.8	3.9	10.1	7.2	6.6
NON-METALLIC MINERALS	40.0	14.3	18.8	-14.0	-14.3	11.9	4.3	4.1
PETROLEUM	6.3	5.4	116.8	9.2	1.9	51.4	-9.1	22.2
CHEMICAL	-2.5	11.2	14.5	12.4	9.3	10.6	11.8	9.9
MISCELLANEOUS	-16.9	17.6	34.5	18.8	-13.7	13.3	9.6	9.3
TOTAL	-5.2	10.6	19.3	11.6	5.7	15.7	11.3	10.2

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

(a) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE EXPRESSED.

(b) "WOOD" AND "PULP & PAPER". "FURNITURE & FIXTURES" INCLUDED IN "MISCELLANEOUS".

INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(AVERAGE ANNUAL GROWTH RATES)

INDUSTRIES(a)	PERCENTAGES IN CONSTANT DOLLARS							
	71-72	72-73	73-74	74-75	75-76	76-77	77-78	71-78
FOOD, BEVERAGE, AND TOBACCO	1.7	-8.9	5.5	6.9	-11.1	6.4	-1.6	-0.3
RUBBER & PLASTIC	-0.9	-10.2	-11.5	-6.1	4.9	7.3	6.0	-2.6
LEATHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXTILE	0.0	-6.2	-31.4	40.8	10.1	-22.5	-2.5	-3.3
KNITTING MILLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CLOTHING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WOOD BASED(b)	-6.2	-5.6	12.5	1.7	5.1	2.9	1.7	2.5
PRINTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PRIMARY METAL	-0.3	-12.2	12.4	12.9	-2.5	-1.3	7.4	2.5
METAL FABRICATING	-21.7	6.5	-20.3	13.2	-12.5	10.3	12.4	-2.9
MACHINERY	-6.4	-10.0	5.4	6.8	-16.1	6.3	11.0	-1.2
TRANSPORT. EQUIP.	14.1	30.0	-23.2	-5.3	11.4	24.8	13.0	5.2
ELECTRICAL PRODUCTS	-25.4	0.4	6.1	-4.4	-5.3	3.0	0.7	-2.7
NON-METALLIC MINERALS	33.3	4.7	3.0	-22.3	-21.9	4.7	-2.1	-5.2
PETROLEUM	1.2	-3.4	88.1	-1.4	-7.1	41.6	-14.6	13.0
CHEMICAL	-7.2	1.8	-0.7	1.5	-0.3	3.4	5.0	0.6
MISCELLANEOUS	-20.8	7.7	16.7	7.3	-21.3	6.0	2.9	0.0
TOTAL	-9.7	1.3	3.5	0.8	-3.7	8.2	4.5	0.9

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

(a) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE EXPRESSED.

(b) "WOOD" AND "PULP & PAPER". "FURNITURE & FIXTURES" INCLUDED IN "MISCELLANEOUS".

INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(PERCENT DISTRIBUTION)

INDUSTRIES

	1971	1972	1973	1974	1975	1976	1977	1978
PRIMARY METALS	9.6	10.6	9.1	9.9	11.1	11.3	10.3	10.6
MACHINERY	11.4	11.8	10.5	10.7	11.3	9.9	9.7	10.3
TRANSPORT. EQUIP.	11.2	14.2	18.2	13.5	12.7	14.6	16.9	18.3
ELECTRICAL PRODUCTS	34.6	28.6	28.3	29.0	27.5	27.0	25.7	24.8
PETROLEUM	4.3	4.8	4.6	8.4	8.2	7.9	10.3	8.5
CHEMICAL	12.7	13.1	13.1	12.6	12.7	13.1	12.5	12.6
SUBTOTAL	83.8	83.0	83.9	84.1	83.5	83.9	85.5	85.0
OTHER MANUFACTURING	16.2	17.0	16.1	15.9	16.5	16.1	14.5	15.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(MILLIONS OF CURRENT DOLLARS)

INDUSTRIES

	1971	1972	1973	1974	1975	1976	1977	1978
PRIMARY METALS	38.8	40.6	38.9	50.4	63.0	67.4	71.1	81.3
MACHINERY	46.3	45.5	44.7	54.3	64.2	59.1	67.2	79.4
TRANSPORT. EQUIP.	45.5	54.5	77.3	68.4	71.7	87.6	116.9	140.6
ELECTRICAL PRODUCTS	140.3	109.9	120.4	147.3	155.8	161.8	178.1	190.9
PETROLEUM	17.5	18.6	19.6	42.5	46.4	47.3	71.6	65.1
CHEMICAL	51.5	50.2	55.8	63.9	71.8	78.5	86.8	97.0
SUBTOTAL	339.9	319.3	356.7	426.8	472.9	501.7	591.7	654.3
OTHER MANUFACTURING	65.8	65.3	68.6	80.7	93.3	96.5	100.4	115.9
TOTAL	405.7	384.6	425.3	507.5	566.2	598.2	692.1	770.2

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(MILLIONS OF CONSTANT(a) DOLLARS)

INDUSTRIES

	1971	1972	1973	1974	1975	1976	1977	1978
PRIMARY METALS	38.8	38.7	33.9	38.2	43.1	42.0	41.5	44.5
MACHINERY	46.3	43.3	39.0	41.1	43.9	36.8	39.2	43.5
TRANSPORT. EQUIP.	45.5	51.9	67.5	51.8	49.0	54.6	68.2	77.0
ELECTRICAL PRODUCTS	140.3	104.7	105.1	111.5	106.6	100.9	103.8	104.5
PETROLEUM	17.5	17.7	17.1	32.2	31.7	29.5	41.7	35.7
CHEMICAL	51.5	47.8	48.7	48.4	49.1	48.9	50.6	53.1
SUBTOTAL	339.9	304.1	311.3	323.1	323.5	312.8	345.0	358.3
OTHER MANUFACTURING	65.8	62.2	59.9	61.1	63.8	60.2	58.5	63.5
TOTAL	405.7	366.3	371.1	384.2	387.3	372.9	403.6	421.8

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

(a) 1971=100

INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(AVERAGE ANNUAL GROWTH RATES)

PERCENTAGES

		PRIMARY METALS	MACHINERY EQUIP.	TRANSPORT. EQUIP.	ELECTRICAL PRODUCTS	PETROLEUM	CHEMICAL	SUBTOTAL (a)	OTHER	TOTAL
71-72	\$CURRENT	4.6	-1.7	19.8	-21.7	6.3	-2.5	-6.1	-0.8	-5.2
	\$CONSTANT	-0.3	-6.4	14.1	-25.4	1.2	-7.2	-10.5	-5.5	-9.7
72-73	\$CURRENT	-4.2	-1.8	41.8	9.6	5.4	11.2	11.7	5.1	10.6
	\$CONSTANT	-12.2	-10.0	30.0	0.4	-3.4	1.8	2.4	-3.7	1.3
73-74	\$CURRENT	29.6	21.5	-11.5	22.3	116.8	14.5	19.7	17.6	19.3
	\$CONSTANT	12.4	5.4	-23.2	6.1	88.1	-0.7	3.8	2.0	3.5
74-75	\$CURRENT	25.0	18.2	4.8	5.8	9.2	12.4	10.8	15.6	11.6
	\$CONSTANT	12.9	6.8	-5.3	-4.4	-1.4	1.5	0.1	4.5	0.8
75-76	\$CURRENT	7.0	-7.9	22.2	3.9	1.9	9.3	6.1	3.4	5.7
	\$CONSTANT	-2.5	-16.1	11.4	-5.3	-7.1	-0.3	-3.3	-5.7	-3.7
76-77	\$CURRENT	5.5	13.7	33.4	10.1	51.4	10.6	17.9	4.0	15.7
	\$CONSTANT	-1.3	6.3	24.8	3.0	41.6	3.4	10.3	-2.7	8.2
77-78	\$CURRENT	14.3	18.2	20.3	7.2	-9.1	11.8	10.6	15.4	11.3
	\$CONSTANT	7.4	11.0	13.0	0.7	-14.6	5.0	3.9	8.4	4.5
71-78	\$CURRENT	11.7	8.0	14.4	6.6	22.2	9.9	10.5	8.7	10.2
	\$CONSTANT	2.5	-1.2	5.2	-2.7	13.0	0.6	1.2	-0.6	0.9

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

(a) AVERAGE FOR THE SIX LEADING R&D INDUSTRIES

CAPITAL R&D AS % OF TOTAL R&D
(PERCENTAGES)

INDUSTRIES

	1971	1972	1973	1974	1975	1976	1977	1978
PRIMARY METALS	10.6	6.9	3.9	11.3	14.9	4.5	9.3	11.7
MACHINERY	18.1	7.9	5.8	13.4	13.6	5.1	4.8	9.1
TRANSPORT. EQUIP.	4.0	5.0	3.0	2.5	1.7	2.5	2.5	4.3
ELECTRICAL PRODUCTS	12.5	5.0	9.8	12.8	6.5	8.1	8.4	7.6
PETROLEUM	13.7	11.3	6.1	35.5	12.1	11.8	24.3	12.4
CHEMICAL	6.4	6.2	8.6	10.0	9.9	7.5	8.3	10.1
SUBTOTAL (a)	10.9	7.0	6.2	14.3	9.8	6.6	9.6	9.2
OTHER MANUFACTURING (a)	7.5	8.7	8.5	9.6	7.3	9.7	8.7	9.3
TOTAL	10.4	6.8	6.9	12.3	8.7	6.9	8.1	8.5

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

(a) AVERAGE FIGURES

CAPITAL R&D AS % OF TOTAL R&D IN MANUFACTURING
(PERCENTAGES)

INDUSTRIES (a)

	1971	1972	1973	1974	1975	1976	1977	1978
FOOD, BEVERAGE, AND TOBACCO	6.2	13.4	6.4	8.2	12.2	7.1	9.2	6.6
RUBBER & PLASTIC	6.1	3.9	4.0	7.8	5.7	3.3	7.1	7.6
LEATHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXTILE	7.5	7.1	9.3	5.9	5.7	29.7	11.3	7.3
KNITTING MILLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CLOTHING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WOOD BASED (b)	5.0	6.6	5.4	8.0	7.1	9.4	10.7	8.4
PRINTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PRIMARY METAL	10.6	6.9	3.9	11.3	14.9	4.5	9.3	11.7
METAL FABRICATING	8.9	10.8	15.1	8.9	5.1	4.2	8.0	18.7
MACHINERY	18.1	7.9	5.8	13.4	13.6	5.1	4.8	9.1
TRANSPORT. EQUIP.	4.0	5.0	3.0	2.5	1.7	2.5	2.5	4.3
ELECTRICAL PRODUCTS	12.5	5.0	9.8	12.8	6.5	8.1	8.4	7.6
NON-METALLIC MINERALS	6.7	16.7	14.6	19.3	8.2	9.5	10.6	10.2
PETROLEUM	13.7	11.3	6.1	35.5	12.1	11.8	24.3	12.4
CHEMICAL	6.4	6.2	8.6	10.0	9.9	7.5	8.3	10.1
MISCELLANEOUS	12.4	2.7	4.6	9.4	7.2	5.0	3.7	6.0
TOTAL	10.4	6.8	6.9	12.3	8.7	6.9	8.1	8.5

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

(a) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE EXPRESSED.

(b) "WOOD" AND "PULP & PAPER". "FURNITURE & FIXTURES" INCLUDED IN "MISCELLANEOUS".

FUNDING OF MANUFACTURING'S INTRAMURAL R&D IN 1977
(PERCENT DISTRIBUTION BY SOURCE)

INDUSTRIES	SOURCES				
	REPORTING COMPANY	FEDERAL GOVERNMENT	OTHER CANADIAN	TOTAL CANADIAN	FOREIGN TOTAL
PRIMARY METALS(a)	87.8	5.8	1.9	95.4	4.6 100.0
MACHINERY	65.4	13.4	0.2	79.2	20.8 100.0
TRANSPORT. EQUIP.	64.3	25.1	5.3	94.6	5.4 100.0
ELECTRICAL PRODUCTS	64.4	14.0	14.8	93.3	6.7 100.0
PETROLEUM	80.4	2.2	13.7	96.5	3.5 100.0
CHEMICAL	87.8	5.5	0.7	94.1	5.9 100.0
SUBTOTAL	72.2	12.7	7.8	92.7	7.3 100.0
OTHER MANUFACTURING	76.9	11.8	9.9	98.3	1.7 100.0
TOTAL	72.9	12.5	8.1	93.6	6.4 100.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-003, VOL. 3, NO. 7

(a) FIGURES IN COLUMNS 3, 4, AND 5 HAVE BEEN ADJUSTED DUE TO CONFIDENTIALITY.

FUNDING OF MANUFACTURING'S INTRAMURAL R&D IN 1977
(MILLIONS OF CURRENT DOLLARS)

INDUSTRIES	SOURCES					
	REPORTING COMPANY	FEDERAL GOVERNMENT	OTHER CANADIAN	TOTAL CANADIAN	FOREIGN	TOTAL
PRIMARY METALS(a)	51.7	3.4	1.1	56.2	2.7	58.9
MACHINERY	40.9	8.4	0.1	49.5	13.0	62.5
TRANSPORT. EQUIP.	69.4	27.1	5.7	102.2	5.8	108.0
ELECTRICAL PRODUCTS	114.7	25.0	26.4	166.1	12.0	178.1
PETROLEUM	52.2	1.4	8.9	62.6	2.3	64.9
CHEMICAL	67.2	4.2	0.5	72.0	4.5	76.5
SUBTOTAL	396.1	69.5	42.7	508.6	40.3	548.9
OTHER MANUFACTURING	78.8	12.1	10.1	100.8	1.7	102.5
TOTAL	474.9	81.6	52.8	609.4	42.0	651.4

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-003, VOL. 3, NO. 7

(a) FIGURES IN COLUMNS 3, 4, AND 5 HAVE BEEN ADJUSTED DUE TO CONFIDENTIALITY.

FUNDING OF MANUFACTURING'S INTRAMURAL R&D IN 1977
(PERCENT DISTRIBUTION BY SOURCE)

INDUSTRIES(a)	SOURCES				TOTAL(c)
	REPORTING COMPANY	FEDERAL GOVERNMENT	OTHER CANADIAN(c)	FOREIGN(c)	
FOOD, BEVERAGE, AND TOBACCO	83.3	13.4	0.0	0.0	100.0
RUBBER & PLASTIC	92.3	7.7	0.0	0.0	100.0
LEATHER	0.0	0.0	0.0	0.0	0.0
TEXTILE	96.3	1.9	0.0	0.0	100.0
KNITTING MILLS	0.0	0.0	0.0	0.0	0.0
CLOTHING	0.0	0.0	0.0	0.0	0.0
WOOD BASED(b)	64.5	9.3	22.8	3.1	100.0
PRINTING	0.0	0.0	0.0	0.0	0.0
PRIMARY METAL	87.8	5.8	1.9	4.6	100.0
METAL FABRICATING	86.3	7.3	0.0	0.0	100.0
MACHINERY	65.4	13.4	0.2	20.8	100.0
TRANSPORT. EQUIP.	64.3	25.1	5.3	5.4	100.0
ELECTRICAL PRODUCTS	64.4	14.0	14.8	6.7	100.0
NON-METALLIC MINERALS	90.6	7.5	0.0	0.0	100.0
PETROLEUM	80.4	2.2	13.7	3.5	100.0
CHEMICAL	87.8	5.5	0.7	5.9	100.0
MISCELLANEOUS	66.0	32.0	1.0	0.0	100.0
TOTAL(c)	72.9	12.5	3.1	6.4	100.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-003, VOL. 3, NO. 7

- (a) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE EXPRESSED.
- (b) "WOOD" AND "PULP & PAPER". "FURNITURE & FIXTURES" INCLUDED IN "MISCELLANEOUS".
- (c) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS WILL NOT CORRESPOND EXACTLY TO THE SUM OF THE ITEMS ADDED.

FUNDING OF MANUFACTURING'S INTRAMURAL R&D IN 1977
(MILLIONS OF CURRENT DOLLARS)

INDUSTRIES(a)	SOURCES				TOTAL(c)
	REPORTING COMPANY	FEDERAL GOVERNMENT	OTHER CANADIAN(c)	FOREIGN(c)	
FOOD, BEVERAGE, AND TOBACCO	22.4	3.6	0.0	0.0	26.9
RUBBER & PLASTIC	6.0	0.5	0.0	0.0	6.5
LEATHER	0.0	0.0	0.0	0.0	0.0
TEXTILE	5.2	0.1	0.0	0.0	5.4
KNITTING MILLS	0.0	0.0	0.0	0.0	0.0
CLOTHING	0.0	0.0	0.0	0.0	0.0
WOOD BASED(b)	22.9	3.3	8.1	1.1	35.5
PRINTING	0.0	0.0	0.0	0.0	0.0
PRIMARY METAL	51.7	3.4	1.1	2.7	58.9
METAL FABRICATING	10.7	0.9	0.0	0.0	12.4
MACHINERY	40.9	8.4	0.1	13.0	62.5
TRANSPORT. EQUIP.	69.4	27.1	5.7	5.8	108.0
ELECTRICAL PRODUCTS	114.7	25.0	26.4	12.0	178.1
NON-METALLIC MINERALS	4.8	0.4	0.0	0.0	5.3
PETROLEUM	52.2	1.4	8.9	2.3	64.9
CHEMICAL	67.2	4.2	0.5	4.5	76.5
MISCELLANEOUS	6.8	3.3	0.1	0.0	10.3
TOTAL(c)	474.9	81.6	52.8	42.0	651.4

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-003, VOL. 3, NO. 7

- (a) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE EXPRESSED.
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- (c) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS WILL NOT CORRESPOND EXACTLY TO THE SUM OF THE ITEMS ADDED.

FUNDING OF MANUFACTURING'S INTRAMURAL R&D IN 1977
(PERCENT DISTRIBUTION BY INDUSTRY)

INDUSTRIES	SOURCES					
	REPORTING COMPANY	FEDERAL GOVERNMENT	OTHER CANADIAN	TOTAL CANADIAN	FOREIGN	TOTAL
PRIMARY METALS(a)	10.9	4.2	2.1	9.2	6.4	9.0
MACHINERY	8.6	10.3	0.2	8.1	31.0	9.6
TRANSPORT. EQUIP.	14.6	33.2	10.8	16.8	13.8	16.6
ELECTRICAL PRODUCTS	24.2	30.6	50.0	27.3	28.6	27.3
PETROLEUM	11.0	1.7	16.9	10.3	5.5	10.0
CHEMICAL	14.2	5.1	0.9	11.8	10.7	11.7
SUBTOTAL	83.4	85.2	80.9	83.5	96.0	84.3
OTHER MANUFACTURING	16.6	14.8	19.1	16.5	4.0	15.7
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-003, VOL. 3, NO. 7

(a) FIGURES IN COLUMNS 3, 4, AND 5 HAVE BEEN ADJUSTED DUE TO CONFIDENTIALITY.

FUNDING OF MANUFACTURING'S INTRAMURAL R&D IN 1977
(PERCENT DISTRIBUTION BY INDUSTRY)

INDUSTRIES(a)	SOURCES				TOTAL(c)
	REPORTING COMPANY	FEDERAL GOVERNMENT	OTHER CANADIAN(c)	FOREIGN(c)	
FOOD, BEVERAGE, AND TOBACCO	4.7	4.4	0.0	0.0	4.1
RUBBER & PLASTIC	1.3	0.6	0.0	0.0	1.0
LEATHER	0.0	0.0	0.0	0.0	0.0
TEXTILE	1.1	0.1	0.0	0.0	0.8
KNITTING MILLS	0.0	0.0	0.0	0.0	0.0
CLOTHING	0.0	0.0	0.0	0.0	0.0
WOOD BASED(b)	4.8	4.0	15.3	2.6	5.4
PRINTING	0.0	0.0	0.0	0.0	0.0
PRIMARY METAL	10.9	4.2	2.1	6.4	9.0
METAL FABRICATING	2.3	1.1	0.0	0.0	1.9
MACHINERY	8.6	10.3	0.2	31.0	9.6
TRANSPORT. EQUIP.	14.6	33.2	10.8	13.8	16.6
ELECTRICAL PRODUCTS	24.2	30.6	50.0	28.6	27.3
NON-METALLIC MINERALS	1.0	0.5	0.0	0.0	0.8
PETROLEUM	11.0	1.7	16.9	5.5	10.0
CHEMICAL	14.2	5.1	0.9	10.7	11.7
MISCELLANEOUS	1.4	4.0	0.2	0.0	1.6
TOTAL(c)	100.0	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-003, VOL. 3, NO. 7

(a) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE EXPRESSED.

(b) "WOOD" AND "PULP & PAPER". "FURNITURE & FIXTURES" INCLUDED IN "MISCELLANEOUS".

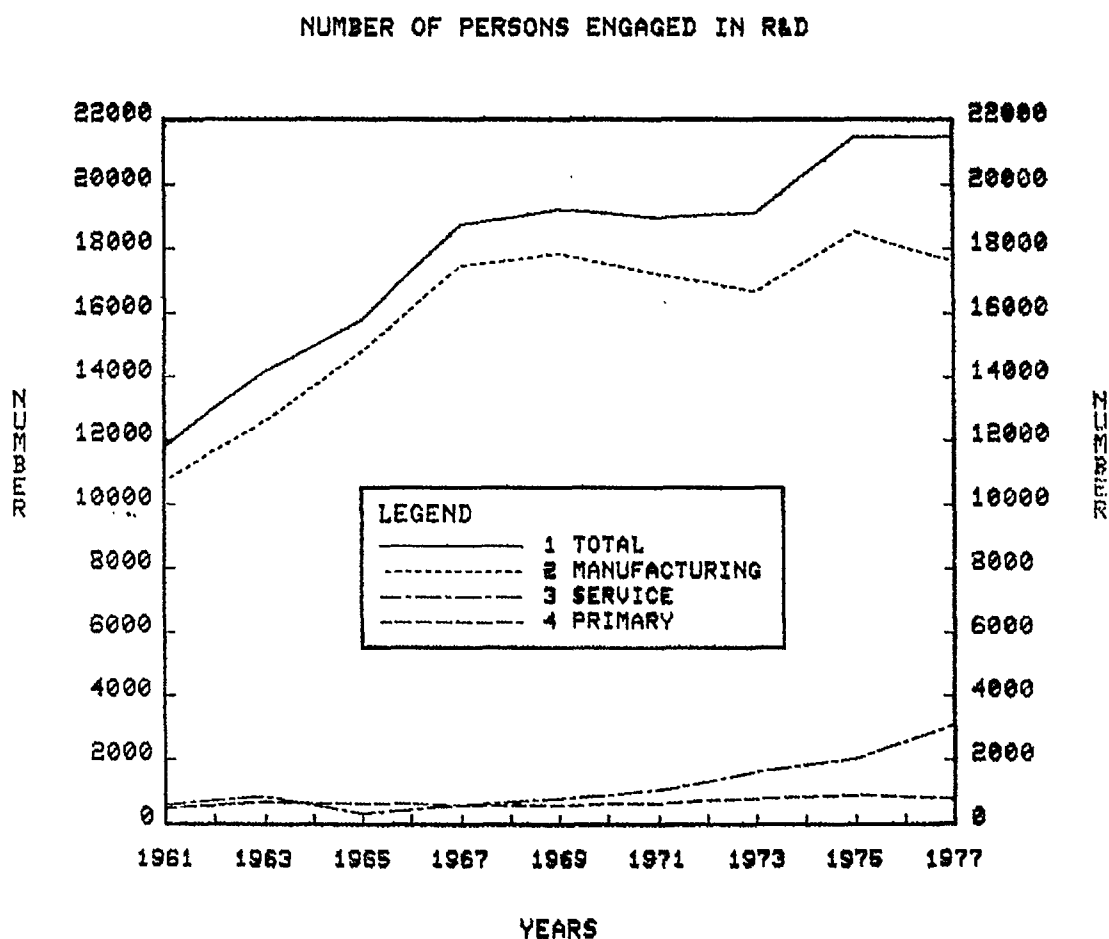
(c) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS WILL NOT CORRESPOND EXACTLY TO THE SUM OF THE ITEMS ADDED.

SECTION 5

The purpose of Section 5 is to study the trends in the employment of R&D personnel in Canadian industry. Changes in the number of persons engaged in R&D activities by the three industry groups (Section 3) and by the leading R&D industries (Section 4) are examined in detail. R&D personnel as a proportion of total employment in the economy is also outlined.

R&D PERSONNEL BY INDUSTRY GROUPS

The total number of persons engaged in industrial R&D almost doubled between 1961 and 1977, from 11832 to 21519. Figure 5.1 shows two periods (1967-1973 and 1975-1977) in which no significant changes occurred in total employment of R&D personnel. The most noticeable increase in employment was in the service industries where R&D personnel in 1977 was over 5 times that in 1961 (Appendix Table E1).



SOURCE : BASED ON DATA FROM SCIENCE STATISTICS CENTRE

Figure 5.1--R&D Personnel By Industry Groups

In terms of the three industry groups, manufacturing has employed over 80% of total R&D personnel but its share has been declining over the years (Appendix Table E2). Manufacturing's share of R&D personnel has dropped from a peak of 93.6% in 1965 to 81.9% in 1977. The service industries, meanwhile, have climbed from a low of 2.3% in 1965 to a high of 14.4% in 1977. The primary industries' share of R&D personnel has been approximately 4% (Figure 5.2).

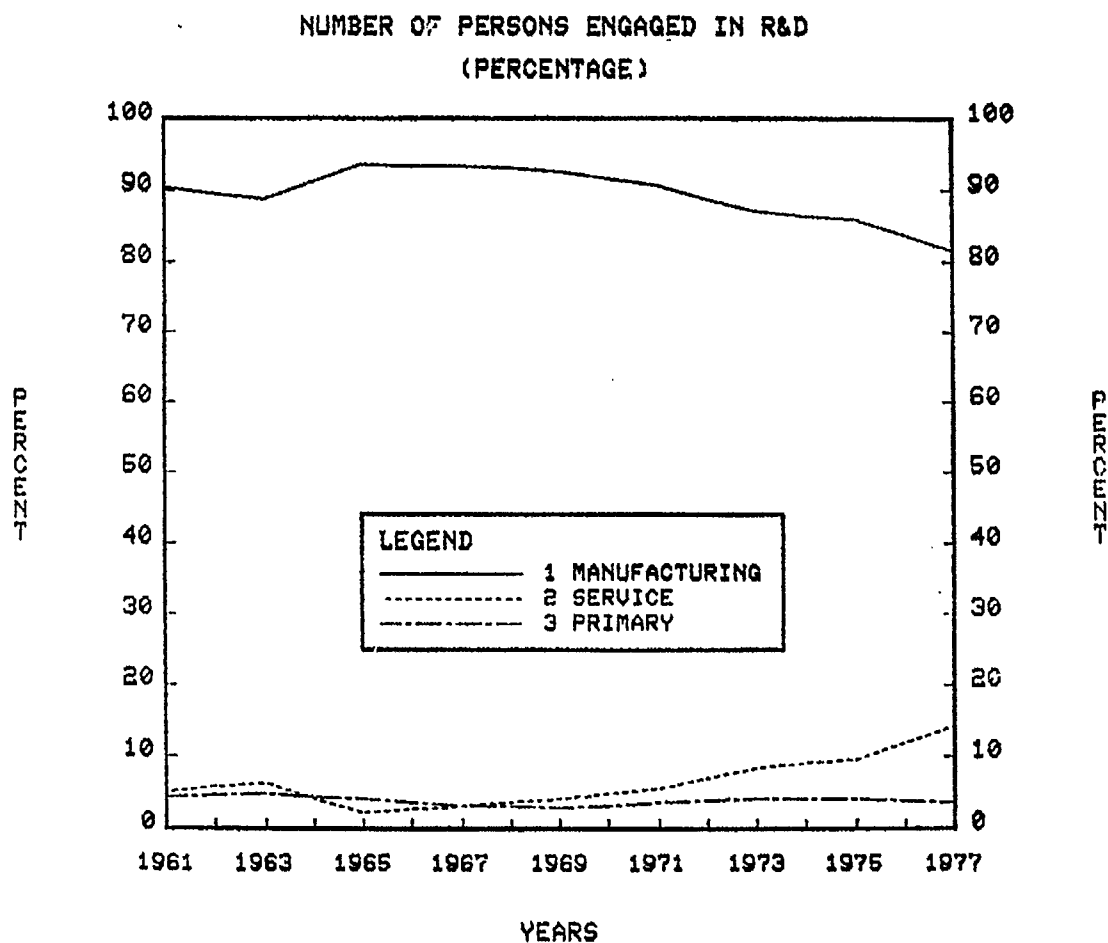
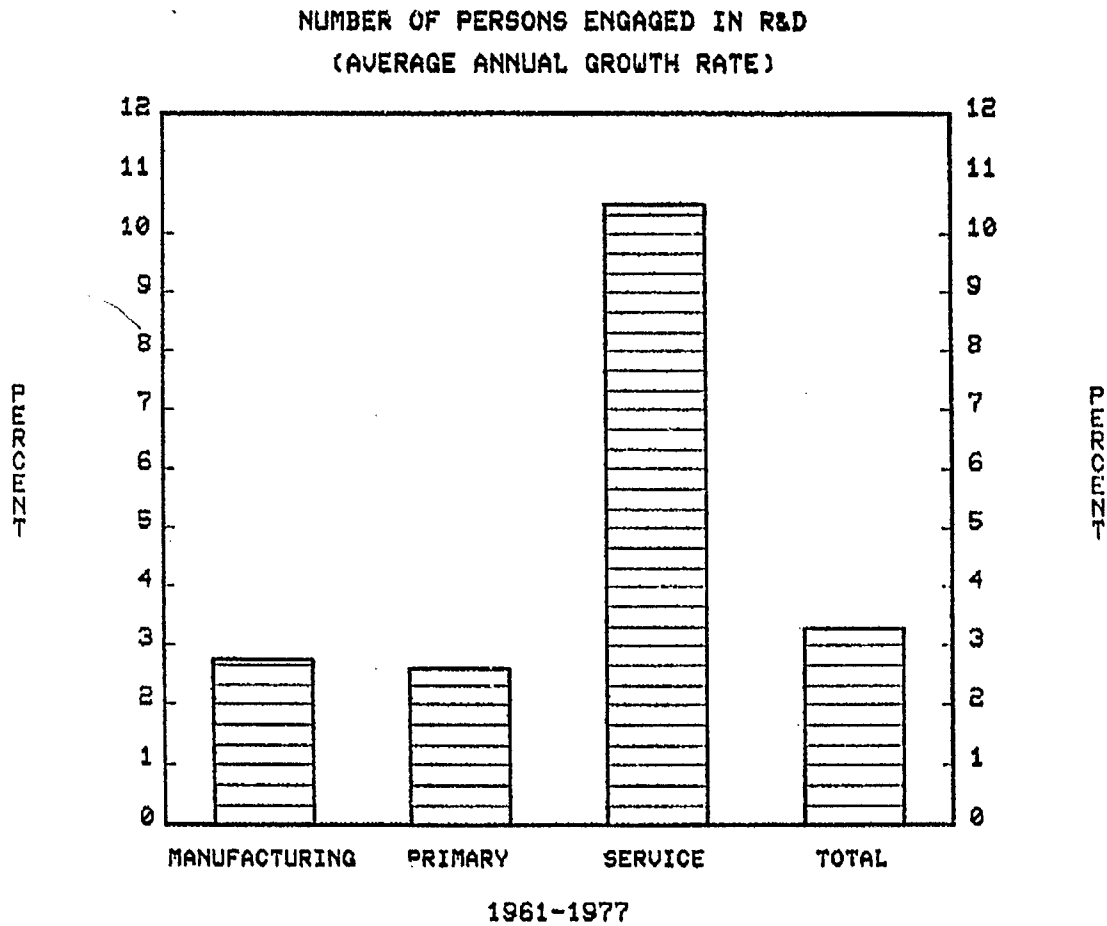


Figure 5.2--Distribution of R&D Personnel By Industry Group

Between 1961 and 1977, the average annual growth rate of R&D personnel in all industries was 3.3% (Figure 5.3). Manufacturing and primary industries had similar growth rates of about 2.6%. However, in the 1970's, R&D personnel has declined in manufacturing during six of those years.

The significant increase in R&D employees in the service industries is reflected in the average annual growth rate of over 10%. Except for the period, 1963-1965, the annual growth rate of R&D employees in the services has been positive and in double digits (Appendix Table E3).



SOURCE : BASED ON DATA FROM SCIENCE STATISTICS CENTRE

Figure 5.3--Growth of R&D Personnel By Industry Groups

The number of persons engaged in R&D as a percentage of the total employed in the economy has not varied a great deal between 1961 and 1977 (Table 5.1 and Appendix Table E4). The number of R&D employees has fluctuated from 0.20% to 0.25% of total employment in the economy. Since the late 1960's, however, this stability at the aggregate level has been characterized by a noticeable decline in manufacturing and an accompanying increase in services.

R&D PERSONNEL AND TOTAL EMPLOYMENT
(PERCENTAGE)

	MANUFACTURING	PRIMARY	SERVICE	TOTAL	TOTAL EMPL.
1961	0.177	0.009	0.010	0.195	100.0
1963	0.197	0.011	0.014	0.222	100.0
1965	0.215	0.010	0.005	0.230	100.0
1967	0.235	0.008	0.008	0.251	100.0
1969	0.227	0.008	0.010	0.245	100.0
1971	0.212	0.008	0.013	0.234	100.0
1973	0.190	0.009	0.019	0.218	100.0
1975	0.199	0.010	0.022	0.232	100.0
1977	0.183	0.008	0.032	0.223	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

Table 5.1--R&D Personnel As Percentage of Total Employment

The personnel involved in R&D activities can be classified by occupational category. The major division is between professional and support staff. Chart 5.1 shows further breakdowns in the classification of R&D personnel.

PERSONS ENGAGED IN R&D

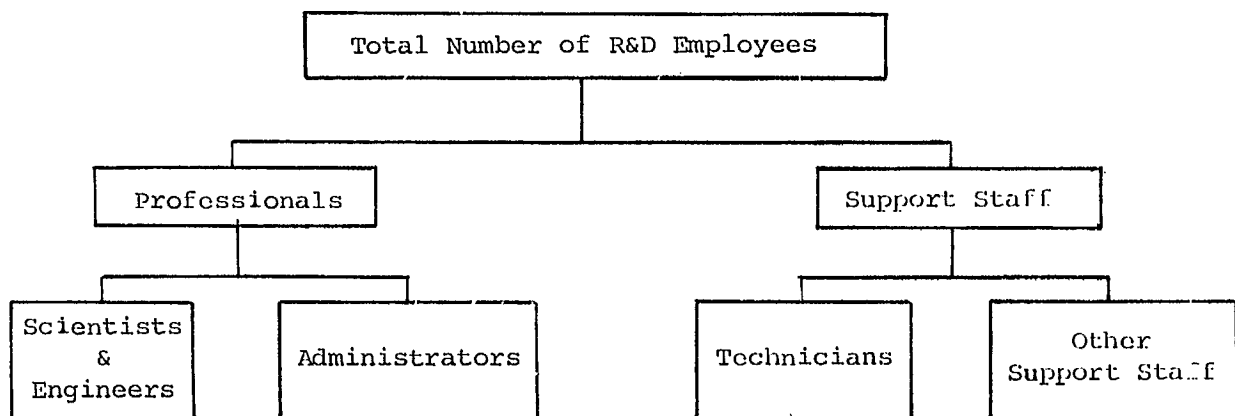


Chart 5.1--R&D Personnel by Occupational Category

Figure 5.4 shows professionals as a percentage of total R&D personnel for the three industry groups. The professional category has increased in relation to support staff in both manufacturing and service industries (Appendix Tables E5 and E6). In the primary industries, professionals have declined from 47.8% of total R&D employees in 1961 to 37.8% in 1977.

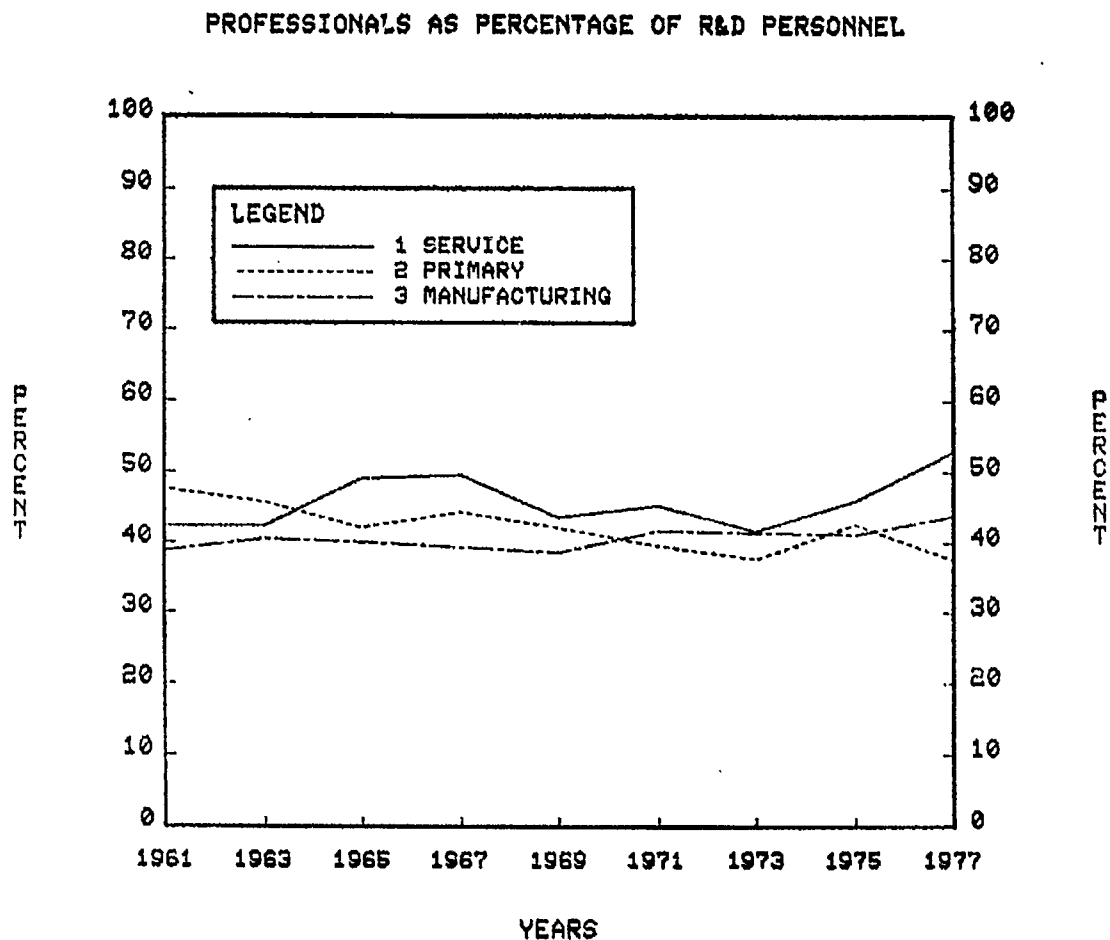
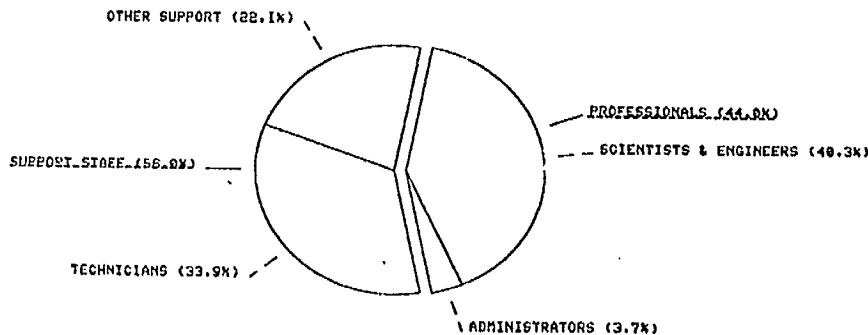
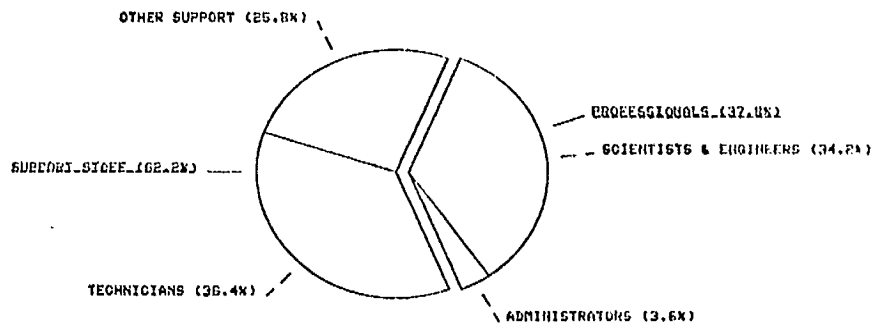


Figure 5.4--Professionals as % of Total R&D Personnel in the Industry Groups

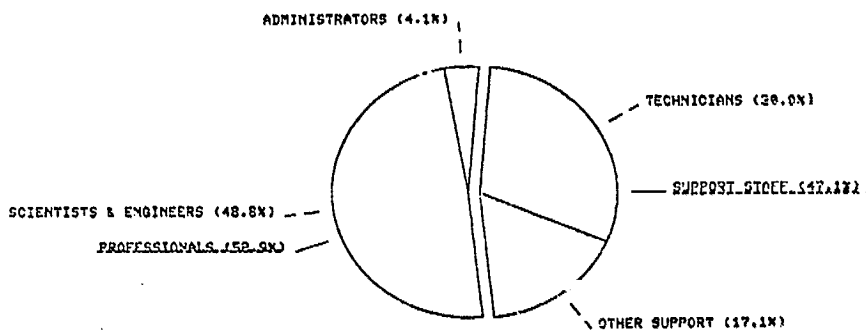
In 1977, scientists and engineers accounted for 41.3% of all R&D personnel in Canadian industry (Appendix Tables E7 and E8). Support staff was divided into technicians (33.4%) and other support staff (21.5%). The remaining 3.7% of R&D personnel was accounted for by administrators. The 1977 distribution of personnel by occupational category for the three industry groups is shown in Chart 5.2.



M-A-N-U-F-A-C-T-U-R-I-N-G



P-R-I-M-A-R-Y



S-E-R-V-I-C-E

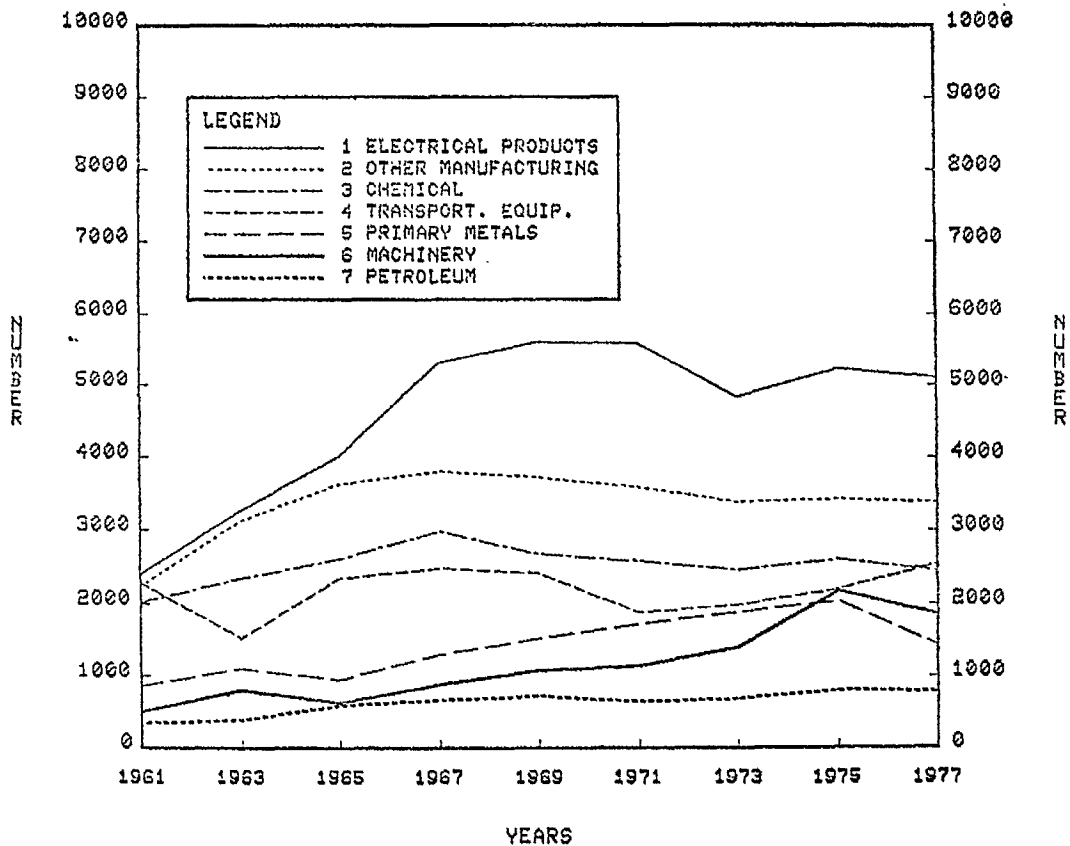
Chart 5.2--R&D Personnel by Occupational Category

R&D PERSONNEL BY MANUFACTURING INDUSTRIES

Figure 5.5 shows employment trends for seven industry groups within manufacturing. Although R&D personnel in manufacturing has almost doubled between 1961 and 1977, this trend was not prevalent for all manufacturing industries. The number of R&D employees has almost quadrupled in the machinery industry and more than doubled in the electrical products and petroleum industries (Appendix Table E9).

Detailed data for individual manufacturing industries such as time series trends, the industries' share of R&D personnel, year-to-year growth rates, and distribution by type are available in Appendix Tables E10 to E15.

R&D PERSONNEL IN MANUFACTURING

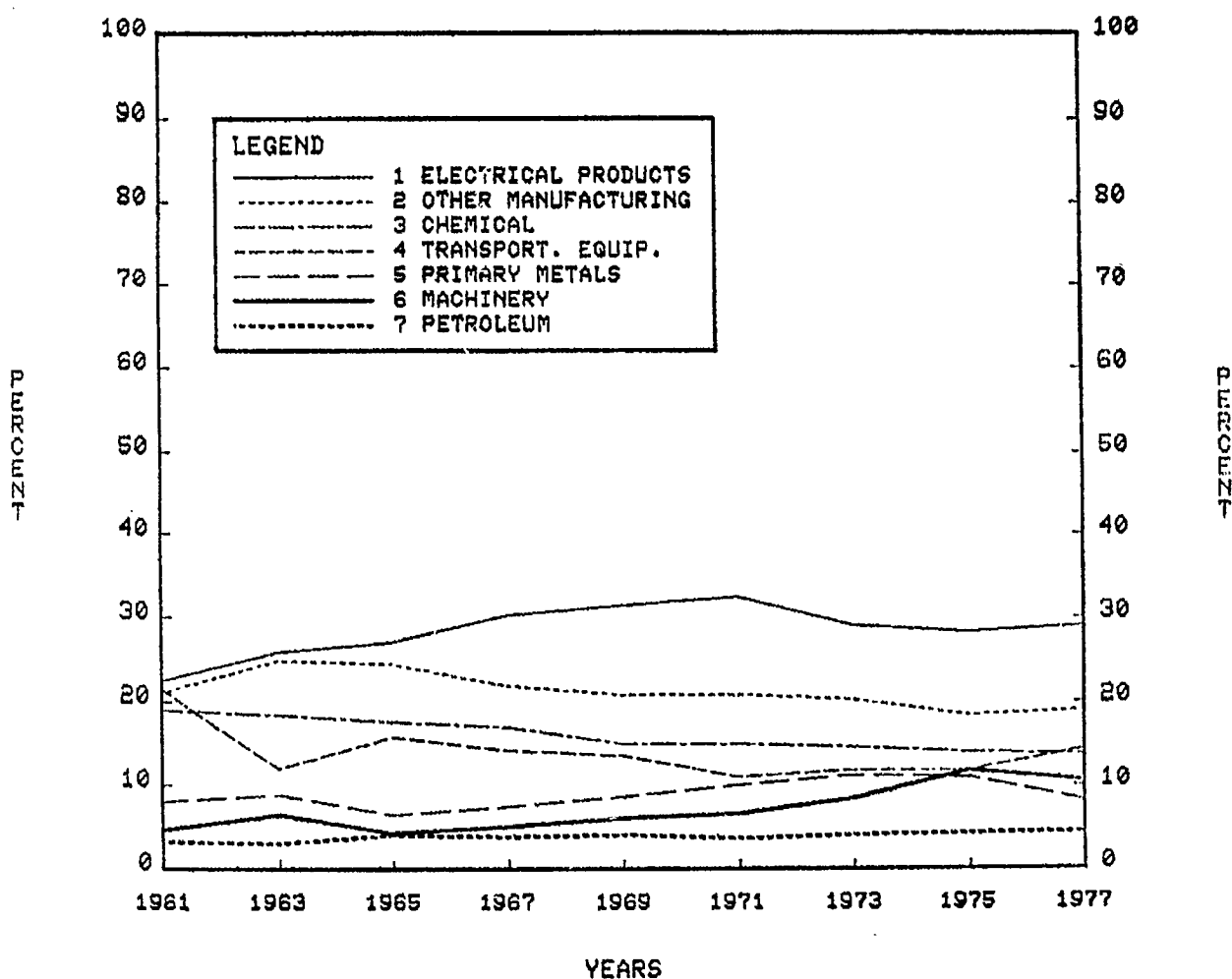


SOURCE : BASED ON DATA FROM SCIENCE STATISTICS CENTRE

Figure 5.5--R&D Personnel in Manufacturing

The six manufacturing industries with the largest R&D expenditures have employed about 80% of total R&D personnel. The remaining 20% of R&D personnel were distributed across all other manufacturing industries (Appendix Table 16). The electrical products industry's share of total R&D personnel increased from 22.4% in 1961 to about 30% in 1977 (Figure 5.6). The only other industry to show a significant increase in the share of R&D personnel was the machinery industry which employed 4.7% in 1961 and 10.6% by 1977.

R&D PERSONNEL IN MANUFACTURING



SOURCE : BASED ON DATA FROM SCIENCE STATISTICS CENTRE

Figure 5.6--Distribution of R&D Personnel in Manufacturing

Figure 5.7 shows the average annual growth of R&D personnel for the seven industry groups identified in manufacturing. Employment of R&D personnel increased most rapidly in the machinery industry, growing at an average rate of 8.4% per year. The slowest growth rates occurred in the transportation equipment and chemical industries, which recorded increases of less than 1% per year (Appendix Table E17).

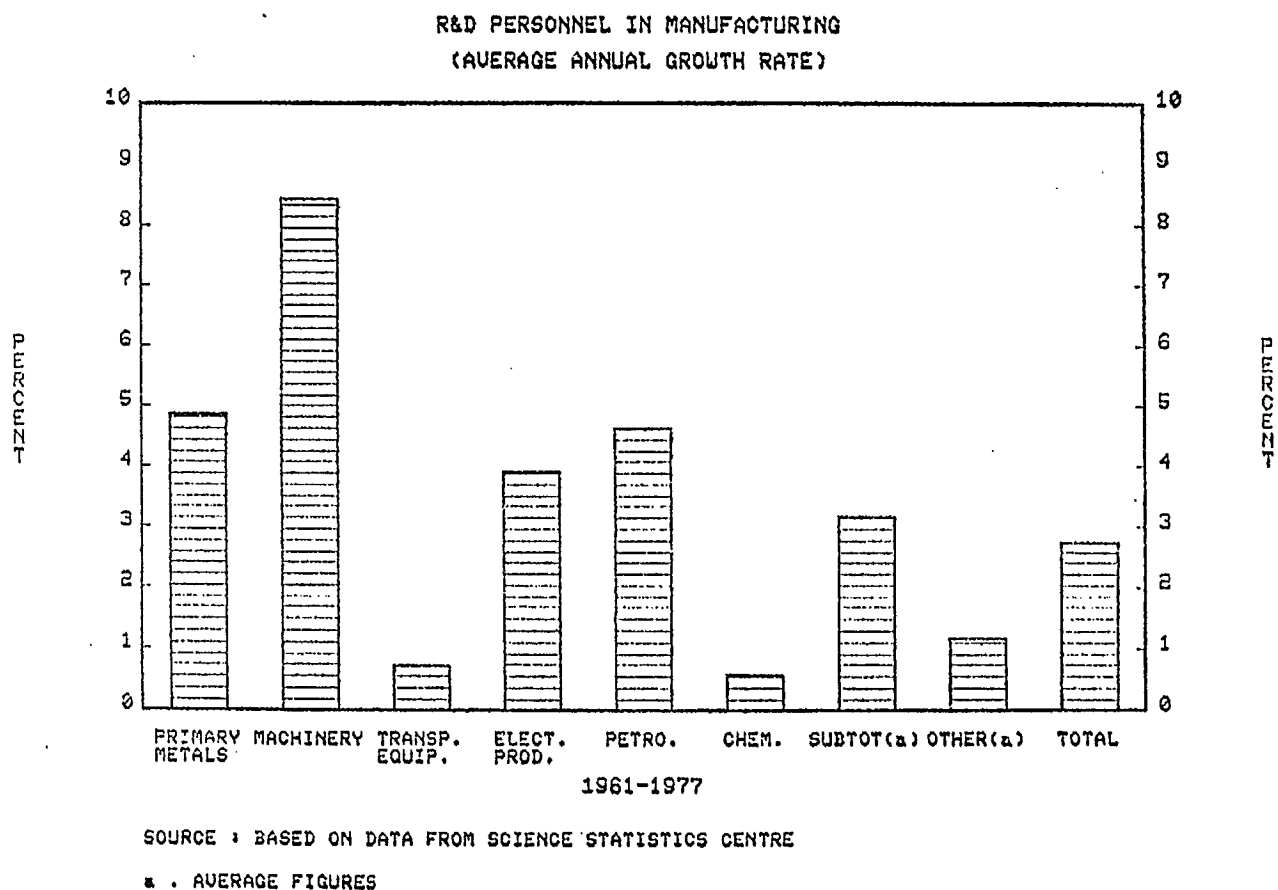


Figure 5.7--Growth of R&D Personnel in Manufacturing

The proportion of professionals engaged in R&D activities in manufacturing has shown a tendency to increase over the years, from 38.9% in 1961 to 44.0% in 1977 (Appendix Table E18). Figure 5.8 shows that four of the seven industry groups (electrical products, petroleum, chemical, and other manufacturing) employed between 40% and 50% of their R&D staff in the professional category. In the other three industry groups (primary metals, transportation equipment, and machinery), professionals accounted for 30% to 40% of R&D personnel. However, the proportion of professionals in the machinery industry has shown a significant increase from 20.3% in 1961 to 34.5% in 1977.

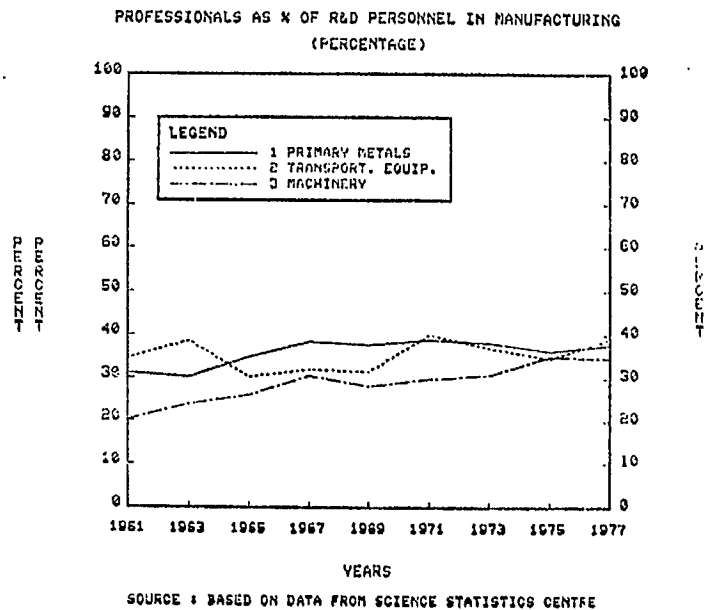
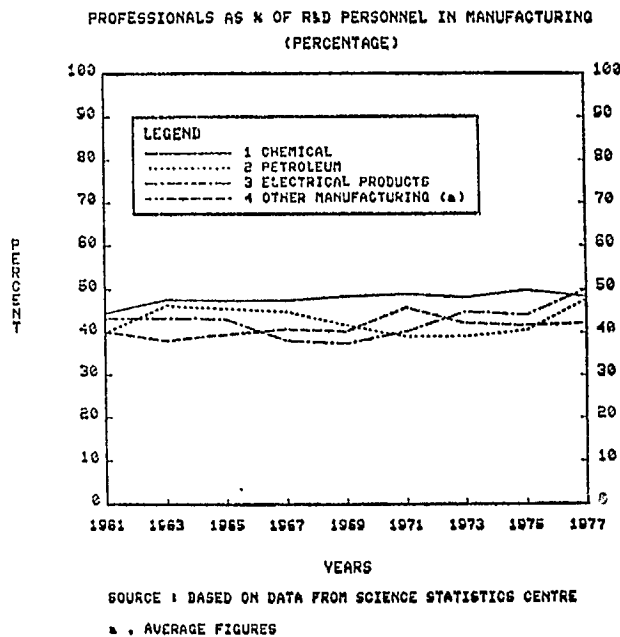


Figure 5.8--Professionals as Percent of R&D Personnel

Chart 5.3 shows the 1977 distribution of R&D personnel by occupational category for the seven manufacturing industry groups. Overall, scientists and engineers accounted for about 40% of total R&D personnel (Appendix Tables E19 and E20). In the electrical products, petroleum, and chemical industries, scientists and engineers accounted for 44% to 48% of all R&D personnel while in the remaining four manufacturing industries, they accounted for 31% to 37%.

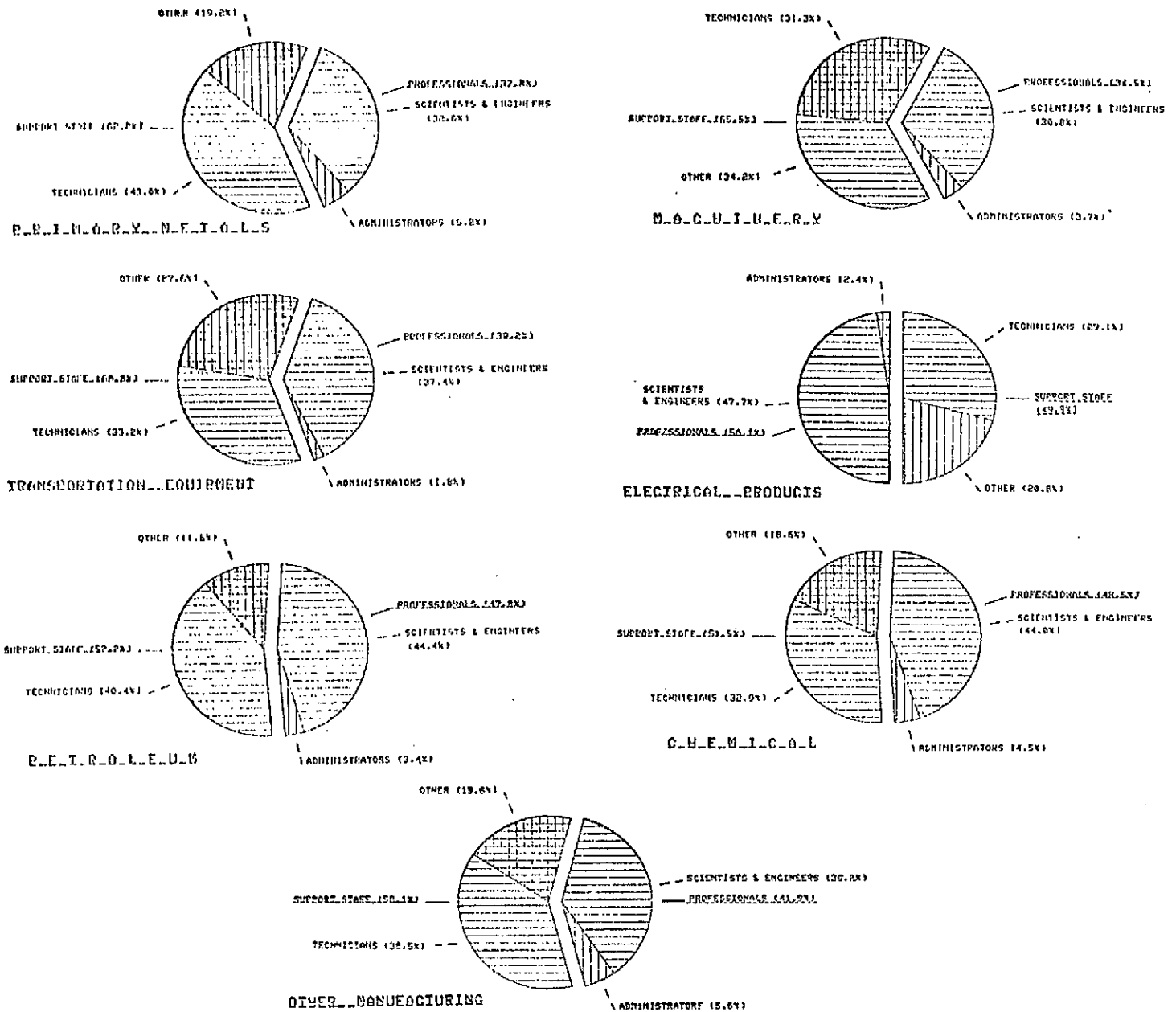


Chart 5.3--R&D Personnel by Occupational Category

NUMBER OF PERSONS ENGAGED IN R&D

	MANUFACTURING	PRIMARY	SERVICE	TOTAL
1961	10,710	521	601	11,832
1963	12,589	685	885	14,159
1965	14,772	655	358	15,785
1967	17,474	605	622	18,701
1969	17,815	588	786	19,189
1971	17,199	677	1,075	18,951
1973	16,666	807	1,630	19,103
1975	18,512	921	2,067	21,500
1977	17,622	806	3,091	21,519

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS
CENTRE

NUMBER OF PERSONS ENGAGED IN R&D
(PERCENTAGE)

	MANUFACTURING	PRIMARY	SERVICE	TOTAL
1961	90.5	4.4	5.1	100.0
1963	88.9	4.8	6.3	100.0
1965	93.6	4.1	2.3	100.0
1967	93.4	3.2	3.3	100.0
1969	92.8	3.1	4.1	100.0
1971	90.8	3.6	5.7	100.0
1973	87.2	4.2	8.5	100.0
1975	86.1	4.3	9.6	100.0
1977	81.9	3.7	14.4	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS
CENTRE

NUMBER OF PERSONS ENGAGED IN R&D
(AVERAGE ANNUAL GROWTH RATE)

	PERCENTAGES			
	MANUFACTURING	PRIMARY	SERVICE	TOTAL
61-62	8.8	15.7	23.6	9.8
62-63	8.1	13.6	19.1	9.0
63-64	8.7	-2.2	-29.8	5.7
64-65	8.0	-2.2	-42.4	5.4
65-66	9.1	-3.8	36.9	9.2
66-67	8.4	-4.0	26.9	8.5
67-68	1.0	-1.4	13.2	1.3
68-69	1.0	-1.4	11.6	1.3
69-70	-1.7	7.6	18.4	-0.6
70-71	-1.8	7.0	15.5	-0.6
71-72	-1.5	9.6	25.8	0.4
72-73	-1.6	8.8	20.5	0.4
73-74	5.5	7.1	13.4	6.3
74-75	5.2	6.6	11.8	5.9
75-76	-2.4	-6.2	24.8	0.0
76-77	-2.5	-6.7	19.9	0.0
61-77	2.7	2.6	10.5	3.3

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

R&D PERSONNEL AND TOTAL EMPLOYMENT

	MANUFACTURING	PRIMARY	SERVICE	TOTAL	TOTAL ENPL
1961	10,710	521	601	11,832	6,055,000
1963	12,589	685	885	14,159	6,375,000
1965	14,772	655	358	15,785	6,862,000
1967	17,474	605	622	18,701	7,451,000
1969	17,815	588	786	19,189	7,832,000
1971	17,199	677	1,075	18,951	8,104,000
1973	16,666	807	1,630	19,103	8,761,000
1975	18,512	921	2,067	21,500	9,284,000
1977	17,622	806	3,091	21,519	9,648,000

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

PROFESSIONALS & SUPPORT STAFF ENGAGED IN R&D

		1961	1963	1965	1967	1969	1971	1973	1975	1977
MANUFACTURING	PROFESSIONAL	4,169	5,105	5,914	6,890	6,889	7,174	6,940	7,638	7,746
	SUPPORT	6,541	7,484	8,858	10,584	10,926	10,025	9,726	10,874	9,876
	SUBTOTAL	10,710	12,589	14,772	17,474	17,815	17,199	16,666	18,512	17,622
PRIMARY	PROFESSIONAL	249	314	277	268	249	268	305	393	305
	SUPPORT	272	371	378	337	339	409	502	528	501
	SUBTOTAL	521	685	655	605	588	677	807	921	806
SERVICE	PROFESSIONAL	255	376	176	309	343	487	683	952	1,634
	SUPPORT	346	509	182	313	443	588	947	1,115	1,457
	SUBTOTAL	601	885	358	622	786	1,075	1,630	2,067	3,091
TOTAL	PROFESSIONAL	4,673	5,795	6,367	7,467	7,481	7,929	7,928	8,983	9,685
	SUPPORT	7,159	8,364	9,418	11,234	11,708	11,022	11,175	12,517	11,834
	SUBTOTAL	11,832	14,159	15,785	18,701	19,189	18,951	19,103	21,500	21,519

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

PROFESSIONALS & SUPPORT STAFF ENGAGED IN R&D
(PERCENTAGE)

		1961	1963	1965	1967	1969	1971	1973	1975	1977
MANUFACTURING	PROFESSIONAL	38.9	40.6	40.0	39.4	38.7	41.7	41.6	41.3	44.0
	SUPPORT	61.1	59.4	60.0	60.6	61.3	58.3	58.4	58.7	56.0
	SUBTOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
PRIMARY	PROFESSIONAL	47.8	45.8	42.3	44.3	42.3	39.6	37.8	42.7	37.8
	SUPPORT	52.2	54.2	57.7	55.7	57.7	60.4	62.2	57.3	62.2
	SUBTOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
SERVICE	PROFESSIONAL	42.4	42.5	49.2	49.7	43.6	45.3	41.9	46.1	52.9
	SUPPORT	57.6	57.5	50.8	50.3	56.4	54.7	58.1	53.9	47.1
	SUBTOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
TOTAL	PROFESSIONAL	39.5	40.9	40.3	39.9	39.0	41.8	41.5	41.8	45.0
	SUPPORT	60.5	59.1	59.7	60.1	61.0	58.2	58.5	58.2	55.0
	SUBTOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

R&D PERSONNEL BY OCCUPATIONAL CATEGORY IN 1977

		MANUFACTURING	PRIMARY	SERVICE	TOTAL
PROFESSIONALS	SCIENTISTS & ENGINEERS	7,102	276	1,508	8,886
	ADMINISTRATORS	644	29	126	799
	SUBTOTAL	7,746	305	1,634	9,685
SUPPORT STAFF	TECHNICIANS	5,978	293	927	7,198
	OTHER	3,898	208	530	4,636
	SUBTOTAL	9,876	501	1,457	11,834
TOTAL		17,622	806	3,091	21,519

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

R&D PERSONNEL BY OCCUPATIONAL CATEGORY IN 1977
(PERCENTAGE)

		MANUFACTURING	PRIMARY	SERVICE	TOTAL
PROFESSIONALS	SCIENTISTS & ENGINEERS	40.3	34.2	48.8	41.3
	ADMINISTRATORS	3.7	3.6	4.1	3.7
	SUBTOTAL	44.0	37.8	52.9	45.0
SUPPORT STAFF	TECHNICIANS	33.9	36.4	30.0	33.4
	OTHER	22.1	25.8	17.1	21.5
	SUBTOTAL	56.0	62.2	47.1	55.0
TOTAL		100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

NUMBER OF PERSONS ENGAGED IN R&D IN MANUFACTURING

	1961	1963	1965	1967	1969	1971	1973	1975	1977
PRIMARY METALS	868	1,115	946	1,305	1,536	1,736	1,886	2,046	1,448
MACHINERY	502	816	623	894	1,089	1,155	1,417	2,189	1,871
TRANSPORT. EQUIP.	2,297	1,531	2,341	2,491	2,436	1,892	1,991	2,201	2,553
ELECTRICAL PRODUCTS	2,400	3,261	4,015	5,303	5,608	5,595	4,838	5,239	5,118
PETROLEUM	345	394	599	674	728	653	686	804	789
CHEMICAL	2,039	2,340	2,617	2,996	2,685	2,586	2,464	2,612	2,462
SUBTOTAL	8,451	9,457	11,141	13,663	14,082	13,617	13,282	15,091	14,241
OTHER MANUFACTURING	2,259	3,132	3,631	3,811	3,733	3,582	3,384	3,421	3,381
TOTAL	10,710	12,589	14,772	17,474	17,815	17,199	16,666	18,512	17,622

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

NUMBER OF PERSONS ENGAGED IN R&D IN MANUFACTURING

	YEARS								
	1961	1963	1965	1967	1969	1971	1973	1975	1977
FOOD & BEVERAGE AND TOBACCO	332	470	477	524	522	571	629	859	913
RUBBER AND PLASTIC	156	216	230	270	283	252	205	216	266
LEATHER	0	0	0	0	0	0	0	0	0
TEXTILE	141	248	369	344	329	232	234	205	166
KNITTING MILLS	0	0	0	0	0	0	0	0	0
CLOTHING	0	0	0	0	0	0	0	0	0
WOOD BASED (a)	803	834	1,270	1,388	1,284	1,136	1,063	1,141	1,129
PRINTING	0	0	0	0	0	0	0	0	0
PRIMARY METAL	868	1,115	946	1,305	1,536	1,736	1,886	2,046	1,448
METAL FABRICATING	208	350	276	303	292	255	257	360	385
MACHINERY	502	816	623	894	1,089	1,155	1,417	2,189	1,871
TRANSPORTATION EQUIPMENT	2,297	1,531	2,341	2,491	2,436	1,892	1,991	2,201	2,553
ELECTRICAL PRODUCTS	2,400	3,261	4,015	5,303	5,608	5,595	4,838	5,239	5,118
NON-METALLIC MINERALS	160	206	166	178	179	185	188	185	172
PETROLEUM	345	394	599	674	728	653	686	804	789
CHEMICAL	2,039	2,340	2,617	2,996	2,685	2,586	2,464	2,612	2,462
MISCELLANEOUS	459	808	843	804	844	951	808	455	350
TOTAL	10,710	12,589	14,772	17,474	17,815	17,199	16,666	18,512	17,622

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

(a) INCLUDES "FURNITURE & FIXTURES" AND "PULP & PAPER".

NUMBER OF PERSONS ENGAGED IN R&D IN MANUFACTURING
(PERCENTAGE)

	YEARS								
	1961	1963	1965	1967	1969	1971	1973	1975	1977
FOOD & BEVERAGE AND TOBACCO	3.1	3.7	3.2	3.0	2.9	3.3	3.8	4.6	5.2
RUBBER AND PLASTIC	1.5	1.7	1.6	1.5	1.6	1.5	1.2	1.2	1.5
LEATHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXTILE	1.3	2.0	2.5	2.0	1.8	1.3	1.4	1.1	0.9
KNITTING MILLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CLOTHING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WOOD BASED (a)	7.5	6.6	8.6	7.9	7.2	6.6	6.4	6.2	6.4
PRINTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PRIMARY METAL	8.1	8.9	6.4	7.5	8.6	10.1	11.3	11.1	8.2
METAL FABRICATING	1.9	2.8	1.9	1.7	1.6	1.5	1.5	1.9	2.2
MACHINERY	4.7	6.5	4.2	5.1	6.1	6.7	8.5	11.8	10.6
TRANSPORTATION EQUIPMENT	21.4	12.2	15.8	14.3	13.7	11.0	11.9	11.9	14.5
ELECTRICAL PRODUCTS	22.4	25.9	27.2	30.3	31.5	32.5	29.0	28.3	29.0
NON-METALLIC MINERALS	1.5	1.6	1.1	1.0	1.0	1.1	1.1	1.0	1.0
PETROLEUM	3.2	3.1	4.1	3.9	4.1	3.8	4.1	4.3	4.5
CHEMICAL	19.0	18.6	17.7	17.1	15.1	15.0	14.8	14.1	14.0
MISCELLANEOUS	4.3	6.4	5.7	4.6	4.7	5.5	4.8	2.5	2.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

(a) INCLUDES "FURNITURE & FIXTURES" AND "PULP & PAPER".

NUMBER OF PERSONS ENGAGED IN R&D IN MANUFACTURING
(AVERAGE ANNUAL GROWTH RATE)

	FOOD BEV. & PLAS. TOBAC.	RUBB. & PLAS.	LEATHER	TEXTILE	KNIT. MILLS	CLOTH.	WOOD BASED(a)	PRINT.	PRIM. METALS	MET. FAB.	MACH.	TRANS. EQU.	ELECT. PROD.	NON- MET. MIN.	PETRO.	CHEM.	MISC.	TOTAL
61-62	20.8	19.2	0.0	37.9	0.0	0.0	1.9	0.0	14.2	34.1	31.3	-16.7	17.9	14.4	7.1	7.4	38.0	8.8
62-63	17.2	16.1	0.0	27.5	0.0	0.0	1.9	0.0	12.5	25.4	23.8	-20.0	15.2	12.6	6.6	6.9	27.5	8.1
63-64	0.7	3.2	0.0	24.4	0.0	0.0	26.1	0.0	-7.6	-10.6	-11.8	26.5	11.6	-9.7	26.0	5.9	2.2	8.7
64-65	0.7	3.1	0.0	19.6	0.0	0.0	20.7	0.0	-8.2	-11.8	-13.4	20.9	10.4	-10.8	20.6	5.6	2.1	8.0
65-66	4.9	8.7	0.0	-3.4	0.0	0.0	4.6	0.0	19.0	4.9	21.7	3.2	16.0	3.6	6.3	7.2	-2.3	9.1
66-67	4.7	8.0	0.0	-3.5	0.0	0.0	4.4	0.0	15.9	4.7	17.9	3.1	13.8	3.5	5.9	6.8	-2.4	8.4
67-68	-0.2	2.4	0.0	-2.2	0.0	0.0	-3.7	0.0	8.9	-1.8	10.9	-1.1	2.9	0.3	4.0	-5.2	2.5	1.0
68-69	-0.2	2.4	0.0	-2.2	0.0	0.0	-3.9	0.0	8.1	-1.8	9.8	-1.1	2.8	0.3	3.9	-5.5	2.4	1.0
69-70	4.7	-5.5	0.0	-14.7	0.0	0.0	-5.8	0.0	6.5	-6.3	3.0	-11.2	-0.1	1.7	-5.2	-1.8	6.3	-1.7
70-71	4.5	-5.8	0.0	-17.3	0.0	0.0	-6.1	0.0	6.1	-6.8	2.9	-12.6	-0.1	1.6	-5.4	-1.9	6.0	-1.8
71-72	5.1	-9.3	0.0	0.4	0.0	0.0	-3.2	0.0	4.3	0.4	11.3	2.6	-6.8	0.8	2.5	-2.4	-7.5	-1.5
72-73	4.8	-10.3	0.0	0.4	0.0	0.0	-3.3	0.0	4.1	0.4	10.2	2.5	-7.3	0.8	2.5	-2.4	-8.1	-1.6
73-74	18.3	7.7	0.0	-6.2	0.0	0.0	3.7	0.0	4.2	20.0	27.2	5.3	4.1	-0.8	8.6	3.0	-21.8	5.5
74-75	15.5	2.6	0.0	-6.6	0.0	0.0	3.5	0.0	4.1	16.7	21.4	5.0	4.0	-0.8	7.9	2.9	-27.9	5.2
75-76	3.1	11.6	0.0	-9.5	0.0	0.0	-0.5	0.0	-14.6	3.5	-7.3	8.0	-1.2	-3.5	-0.9	-2.9	-11.5	-2.4
76-77	3.0	10.4	0.0	-10.5	0.0	0.0	-0.5	0.0	-17.1	3.4	-7.8	7.4	-1.2	-3.6	-0.9	-3.0	-13.0	-2.5
61-77	5.2	1.2	0.0	-1.5	0.0	0.0	1.3	0.0	4.9	1.5	8.4	0.7	3.9	0.1	4.6	0.6	-2.4	2.7

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

(a) INCLUDES "FURNITURE AND FIXTURES" AND "PULP AND PAPER".

PROFESSIONALS AS % OF R&D PERSONNEL IN MANUFACTURING
(PERCENTAGE)

	YEARS									
	1961	1963	1965	1967	1969	1971	1973	1975	1977	
FOOD & BEVERAGE AND TOBACCO	47.3	42.3	48.4	47.1	42.0	47.6	41.2	40.0	43.8	
RUBBER AND PLASTIC	44.2	44.0	44.3	43.3	43.1	50.8	51.7	46.8	48.1	
LEATHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TEXTILE	34.0	18.1	25.7	29.9	34.7	44.0	35.9	40.5	43.4	
KNITTING MILLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CLOTHING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WOOD BASED (a)	35.6	37.6	37.2	36.7	36.7	38.4	39.9	41.5	39.8	
PRINTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PRIMARY METAL	31.2	30.3	35.0	38.5	37.8	38.9	38.1	36.3	37.8	
METAL FABRICATING	37.5	42.3	42.8	35.6	37.0	44.3	43.2	45.3	42.1	
MACHINERY	20.3	24.0	26.2	30.5	28.1	30.0	30.8	35.0	34.5	
TRANSPORTATION EQUIPMENT	34.6	38.8	30.3	32.1	31.6	40.1	37.1	34.6	39.2	
ELECTRICAL PRODUCTS	43.3	43.5	43.3	38.1	37.5	40.3	44.8	44.2	50.1	
NON-METALLIC MINERALS	35.6	34.0	34.3	41.6	40.8	44.9	38.3	38.4	38.4	
PETROLEUM	40.0	46.2	45.6	45.0	41.8	39.1	39.1	40.5	47.8	
CHEMICAL	44.6	47.6	47.6	47.4	48.6	48.9	48.3	49.8	48.5	
MISCELLANEOUS	47.9	48.5	45.0	51.1	48.9	51.1	45.0	40.9	39.7	
TOTAL	38.9	40.6	40.0	39.4	38.7	41.7	41.6	41.3	44.0	

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

(a) INCLUDES "FURNITURE & FIXTURES" AND "PULP & PAPER".

R&D PERSONNEL BY OCCUPATIONAL CATEGORY IN 1977

	PROFESSIONALS			SUPPORT STAFF			TOTAL
	SCIEN. & ENG.	ADMIN.	SUBTOTAL	TECH.	OTHER SUPPORT	SUBTOTAL	
FOOD & BEVERAGE AND TOBACCO	361	39	400	351	162	513	913
RUBBER AND PLASTIC	115	13	128	106	32	138	266
LEATHER	0	0	0	0	0	0	0
TEXTILE	60	12	72	39	55	94	166
KNITTING MILLS	0	0	0	0	0	0	0
CLOTHING	0	0	0	0	0	0	0
WOOD BASED (a)	401	48	449	455	225	680	1,129
PRINTING	0	0	0	0	0	0	0
PRIMARY METAL	472	75	547	623	278	901	1,448
METAL FABRICATING	143	19	162	147	76	223	385
MACHINERY	576	70	646	586	639	1,225	1,871
TRANSPORTATION EQUIPMENT	955	45	1,000	848	705	1,553	2,553
ELECTRICAL PRODUCTS	2,440	125	2,565	1,491	1,062	2,553	5,118
NON-METALLIC MINERALS	59	7	66	66	40	106	172
PETROLEUM	350	27	377	319	93	412	789
CHEMICAL	1,084	111	1,195	810	457	1,267	2,462
MISCELLANEOUS	122	17	139	137	74	211	350
TOTAL MANUFACTURING	7,102	644	7,746	5,978	3,898	9,876	17,622

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

(a) INCLUDES "FURNITURE & FIXTURES" AND "PULP & PAPER".

R&D PERSONNEL BY OCCUPATIONAL CATEGORY IN 1977
(PERCENTAGE)

	PROFESSIONALS			SUPPORT STAFF			TOTAL
	SCIEN. & ENG.	ADMIN.	SUBTOTAL	TECH.	OTHER SUPPORT	SUBTOTAL	
FOOD & BEVERAGE AND TOBACCO	39.5	4.3	43.8	38.4	17.7	56.2	100.0
RUBBER AND PLASTIC	43.2	4.9	48.1	39.8	12.0	51.9	100.0
LEATHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXTILE	36.1	7.2	43.4	23.5	33.1	56.6	100.0
KNITTING MILLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CLOTHING	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WOOD BASED (a)	35.5	4.3	39.8	40.3	19.9	60.2	100.0
PRINTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PRIMARY METAL	32.6	5.2	37.8	43.0	19.2	62.2	100.0
METAL FABRICATING	37.1	4.9	42.1	38.2	19.7	57.9	100.0
MACHINERY	30.8	3.7	34.5	31.3	34.2	65.5	100.0
TRANSPORTATION EQUIPMENT	37.4	1.8	39.2	33.2	27.6	60.8	100.0
ELECTRICAL PRODUCTS	47.7	2.4	50.1	29.1	20.8	49.9	100.0
NON-METALLIC MINERALS	34.3	4.1	38.4	38.4	23.3	61.6	100.0
PETROLEUM	44.4	3.4	47.8	40.4	11.8	52.2	100.0
CHEMICAL	44.0	4.5	48.5	32.9	18.6	51.5	100.0
MISCELLANEOUS	34.9	4.9	39.7	39.1	21.1	60.3	100.0
TOTAL MANUFACTURING	40.3	3.7	44.0	33.9	22.1	56.0	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

(a) INCLUDES "FURNITURE & FIXTURES" AND "PULP & PAPER".

NUMBER OF PERSONS ENGAGED IN R&D IN MANUFACTURING
(PERCENTAGE)

	1961	1963	1965	1967	1969	1971	1973	1975	1977
PRIMARY METALS	8.1	8.9	6.4	7.5	8.6	10.1	11.3	11.1	8.2
MACHINERY	4.7	6.5	4.2	5.1	6.1	6.7	8.5	11.8	10.6
TRANSPORT. EQUIP.	21.4	12.2	15.8	14.3	13.7	11.0	11.9	11.9	14.5
ELECTRICAL PRODUCTS	22.4	25.9	27.2	30.3	31.5	32.5	29.0	28.3	29.0
PETROLEUM	3.2	3.1	4.1	3.9	4.1	3.8	4.1	4.3	4.5
CHEMICAL	19.0	18.6	17.7	17.1	15.1	15.0	14.8	14.1	14.0
SUBTOTAL	78.9	75.1	75.4	78.2	79.0	79.2	79.7	81.5	80.8
OTHER MANUFACTURING	21.1	24.9	24.6	21.8	21.0	20.8	20.3	18.5	19.2
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

NUMBER OF PERSONS ENGAGED IN R&D IN MANUFACTURING
(AVERAGE ANNUAL GROWTH RATE)

	PRIMARY METALS	MACHINERY EQUIP.	TRANSP. PROD.	ELECT. PROD.	PETRO.	CHEM.	SUBTOT(a)	OTHER(a)	TOTAL
61-62	14.2	31.3	-16.7	17.9	7.1	7.4	6.0	19.3	8.8
62-63	12.5	23.8	-20.0	15.2	6.6	6.9	5.6	16.2	8.1
63-64	-7.6	-11.8	26.5	11.6	26.0	5.9	8.9	8.0	8.7
64-65	-8.2	-13.4	20.9	10.4	20.6	5.6	8.2	7.4	8.0
65-66	19.0	21.7	3.2	16.0	6.3	7.2	11.3	2.5	9.1
66-67	15.9	17.9	3.1	13.8	5.9	6.8	10.2	2.4	8.4
67-68	8.9	10.9	-1.1	2.9	4.0	-5.2	1.5	-1.0	1.0
68-69	8.1	9.8	-1.1	2.8	3.9	-5.5	1.5	-1.0	1.0
69-70	6.5	3.0	-11.2	-0.1	-5.2	-1.8	-1.7	-2.0	-1.7
70-71	6.1	2.9	-12.6	-0.1	-5.4	-1.9	-1.7	-2.1	-1.8
71-72	4.3	11.3	2.6	-6.8	2.5	-2.4	-1.2	-2.8	-1.5
72-73	4.1	10.2	2.5	-7.3	2.5	-2.4	-1.2	-2.8	-1.6
73-74	4.2	27.2	5.3	4.1	8.6	3.0	6.8	0.5	5.5
74-75	4.1	21.4	5.0	4.0	7.9	2.9	6.4	0.5	5.2
75-76	-14.6	-7.3	8.0	-1.2	-0.9	-2.9	-2.8	-0.6	-2.4
76-77	-17.1	-7.8	7.4	-1.2	-0.9	-3.0	-2.9	-0.6	-2.5
61-77	4.9	8.4	0.7	3.9	4.6	0.6	3.2	1.2	2.7

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

(a) AVERAGE FIGURES

PROFESSIONALS AS % OF R&D PERSONNEL IN MANUFACTURING
(PERCENTAGE)

	1961	1963	1965	1967	1969	1971	1973	1975	1977
PRIMARY METALS	31.2	30.3	35.0	38.5	37.8	38.9	38.1	36.3	37.8
MACHINERY	20.3	24.0	26.2	30.5	28.1	30.0	30.8	35.0	34.5
TRANSPORT. EQUIP.	34.6	38.8	30.3	32.1	31.6	40.1	37.1	34.6	39.2
ELECTRICAL PRODUCTS	43.5	43.5	43.3	38.1	37.5	40.3	44.8	44.2	50.1
PETROLEUM	40.0	46.2	45.6	45.0	41.8	39.1	39.1	40.5	47.8
CHEMICAL	44.6	47.6	47.6	47.4	48.6	48.9	48.3	49.8	48.5
SUBTOTAL (a)	35.7	38.4	38.0	38.6	37.6	39.5	39.7	40.1	43.0
OTHER MANUFACTURING (a)	40.3	38.1	39.7	40.8	40.4	45.9	42.2	41.9	42.2
TOTAL MANUFACTURING	38.9	40.6	40.0	39.4	38.7	41.7	41.6	41.3	44.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

(a) AVERAGE FIGURES

R&D PERSONNEL BY OCCUPATIONAL CATEGORY IN 1977

	PROFESSIONALS			SUPPORT STAFF			TOTAL
	SCIEN. & ENG.	ADMIN.	SUBTOTAL	TECH.	OTHER SUPPORT	SUBTOTAL	
PRIMARY METALS	472	75	547	623	278	901	1,448
MACHINERY	576	70	646	586	639	1,225	1,871
TRANSPORT. EQUIP.	955	45	1,000	848	705	1,553	2,553
ELECTRICAL PRODUCTS	2,440	125	2,565	1,491	1,062	2,553	5,118
PETROLEUM	350	27	377	319	93	412	789
CHEMICAL	1,084	111	1,195	810	457	1,267	2,462
SUBTOTAL	5,877	453	6,330	4,677	3,234	7,911	14,241
OTHER MANUFACTURING	1,225	191	1,416	1,301	664	1,965	3,381
TOTAL MANUFACTURING	7,102	644	7,746	5,978	3,898	9,876	17,622

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

R&D PERSONNEL BY OCCUPATIONAL CATEGORY IN 1977
(PERCENTAGE)

	PROFESSIONALS			SUPPORT STAFF			TOTAL
	SCIEN. & ENG.	ADMIN.	SUBTOTAL	TECH.	OTHER SUPPORT	SUBTOTAL	
PRIMARY METALS	32.6	5.2	37.8	43.0	19.2	62.2	100.0
MACHINERY	30.8	3.7	34.5	31.3	34.2	65.5	100.0
TRANSPORT. EQUIP.	37.4	1.8	39.2	33.2	27.6	60.8	100.0
ELECTRICAL PRODUCTS	47.7	2.4	50.1	29.1	20.8	49.9	100.0
PETROLEUM	44.4	3.4	47.8	40.4	11.8	52.2	100.0
CHEMICAL	44.0	4.5	48.5	32.9	18.6	51.5	100.0
SUBTOTAL	41.3	3.2	44.4	32.8	22.7	55.6	100.0
OTHER MANUFACTURING	36.2	5.6	41.9	38.5	19.6	58.1	100.0
TOTAL MANUFACTURING	40.3	3.7	44.0	33.9	22.1	56.0	100.0

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE

SECTION 6

The purpose of Section 6 is to introduce three indicators of research intensity (P&D expenditure as a percent of value added; R&D expenditure as a percent of total shipments; and R&D personnel as a percent of total employment). Manufacturing industries are classified by research intensity and the characteristics of each group are examined.

INDICATORS OF RESEARCH INTENSITY IN MANUFACTURING

Indicators of research intensity relate the amount of R&D conducted in an industry to other indicators of economic activity in the industry. The three most frequently used indicators of research intensity are: a) R&D expenditure as a percentage of value added; b) R&D expenditure as a percentage of total shipments (or gross production); and c) R&D Personnel as a percentage of total employment.

A comparison of the three indicators for total manufacturing is presented in Table 6.1. All three indicators of research intensity show a decline in the early 1970's followed by a moderate recovery in later years.

INDICATORS OF RESEARCH INTENSITY IN MANUFACTURING (PERCENTAGE)

	R&D/VA (a)	R&D/TS (b)	R&D PERS/TE(c)
1971	1.75	0.71	1.06
1972	1.48	0.60	-
1973	1.38	0.55	0.95
1974	1.35	0.53	-
1975	1.46	0.55	1.06
1976	1.41	0.53	-
1977	1.48	0.55	1.03

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978) AND MAPID

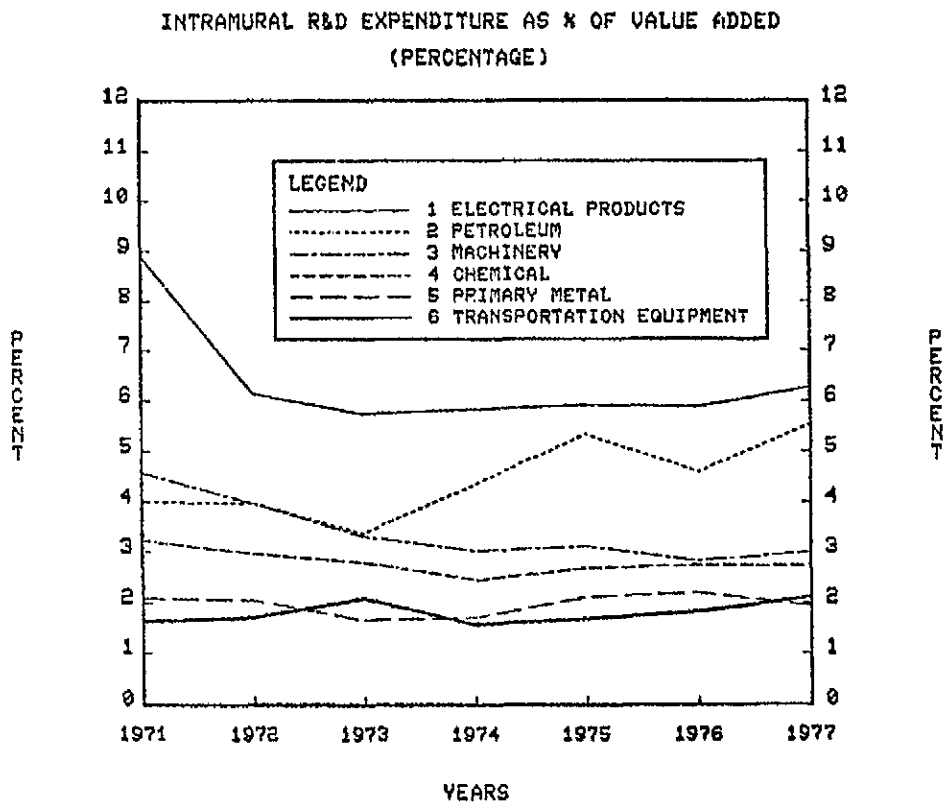
- (a) INTRAMURAL R&D EXPENDITURE AS % OF VALUE ADDED
- (b) INTRAMURAL R&D EXPENDITURE AS % OF TOTAL SHIPMENTS
- (c) R&D PERSONNEL AS % OF TOTAL EMPLOYMENT

Table 6.1--Indicators of Research Intensity

a) Value Added

R&D expenditure in manufacturing declined from 1.75% of value added in 1971 to 1.48% in 1977 (Appendix Tables F1-F3). Among the six most research intensive industries, only petroleum and transportation equipment recorded overall increases in research intensity between 1971 and 1977 (Figure 6.1). The petroleum industry also displayed the most volatile behaviour over that period, fluctuating between 4% and 6% of value added.

Although the electrical products industry was the most research intensive industry, there was a significant decline in its research intensity from 1971 to 1972. Since 1972, however, electrical products have maintained R&D expenditures equal to approximately 6% of value added.



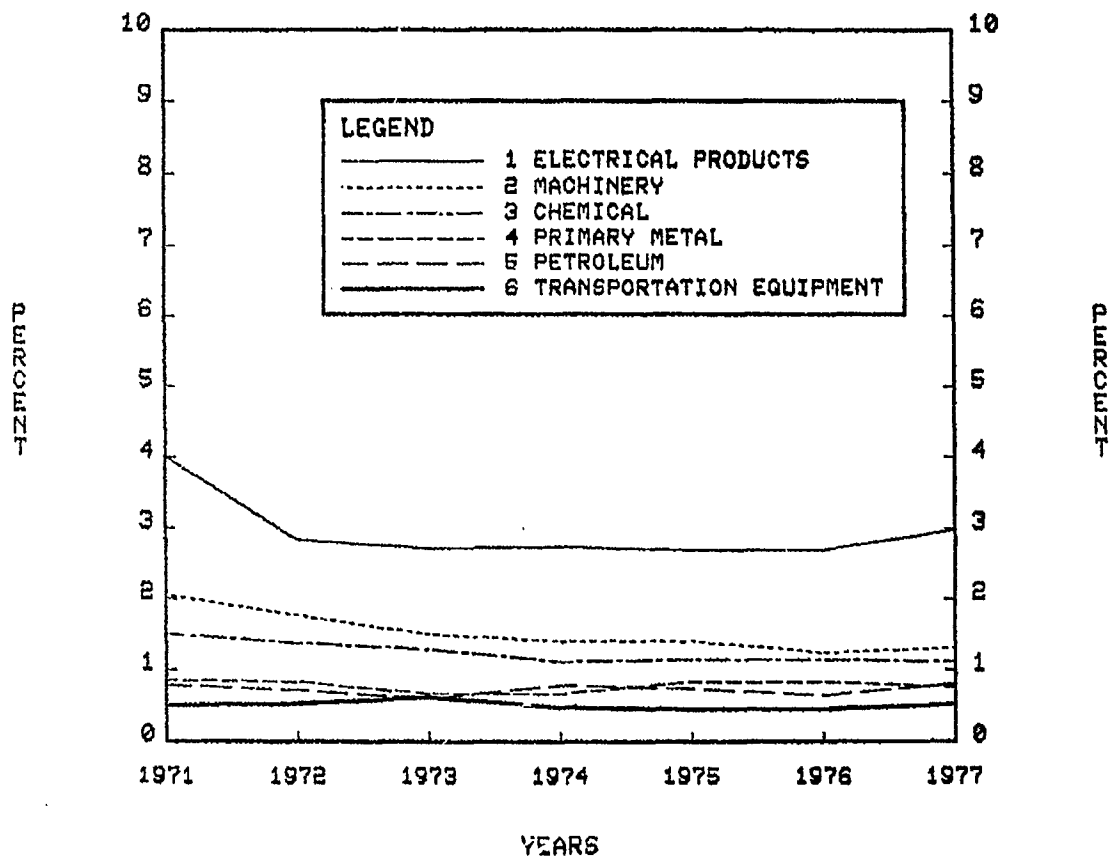
SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212
(1977 & 1978) AND MAPID

Figure 6.1--R&D Expenditure as a per cent of Value Added

b) Total Shipments

R&D expenditure in manufacturing declined from 0.71% of total shipments in 1971 to 0.55% in 1977 (Appendix Tables F4-F5). Except for the petroleum industry, which drops from second to fifth place, the ranking of industries by research intensity is the same using the shipments or value added indicator. However, the trends in research intensity by industry are more stable when based on the shipments indicator (Figure 6.2).

INTRAMURAL R&D EXPENDITURE AS % OF TOTAL SHIPMENTS
(PERCENTAGE)

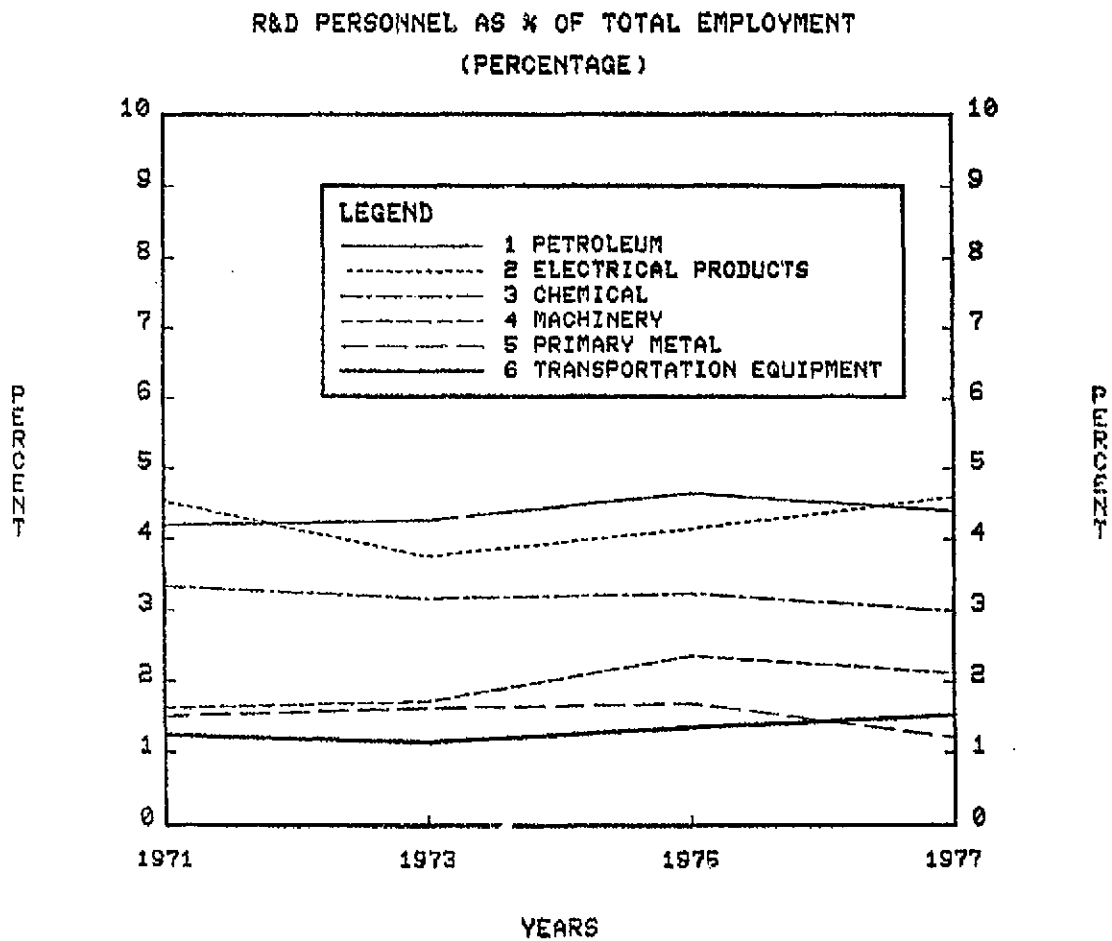


SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978) AND MAPID

Figure 6.2--R&D Expenditure as a per cent of Total Shipments

c) R&D Personnel

R&D Personnel in manufacturing has been approximately 1% of total employment from 1971 to 1977 (Appendix Tables F6-F8). As in the case with the value added and shipments indicators, the same six industries are identified as the most research intensive. With the personnel indicator, petroleum becomes the most research intensive industry, followed by electrical products and chemicals (Figure 6.3). The ratio of R&D personnel to total employment for the other three industry groups varies between 1.0% and 2.0%.



SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978) AND MAPID

Figure 6.3--R&D Personnel as a per cent of Total Employment

Although all three indicators give similar results, intramural R&D expenditure as a percentage of value added is generally the accepted index of research intensity. Table 6.2 shows the ranking of two-digit SIC manufacturing industries with respect to the value added index for 1977.

INTRAMURAL R&D EXPENDITURE AS % OF VALUE ADDED IN 1977
(PERCENTAGE)

	R&D/VA
ELECTRICAL PRODUCTS	6.28
PETROLEUM	5.56
MACHINERY	3.00
CHEMICAL	2.77
TRANSPORTATION EQUIP	2.14
PRIMARY METALS	1.95
MISCELLANEOUS	1.01
RUBBER & PLASTIC	0.53
WOOD BASED	0.49
TEXTILE	0.41
FOOD BEV & TOBACCO	0.39
METAL FABRIC	0.30
NON-MET MINERALS	0.28
TOTAL MFG (a)	1.48

SOURCE: BASED ON DATA FROM
STATISTICS CANADA CAT.
13-212 (1978) AND MAPID

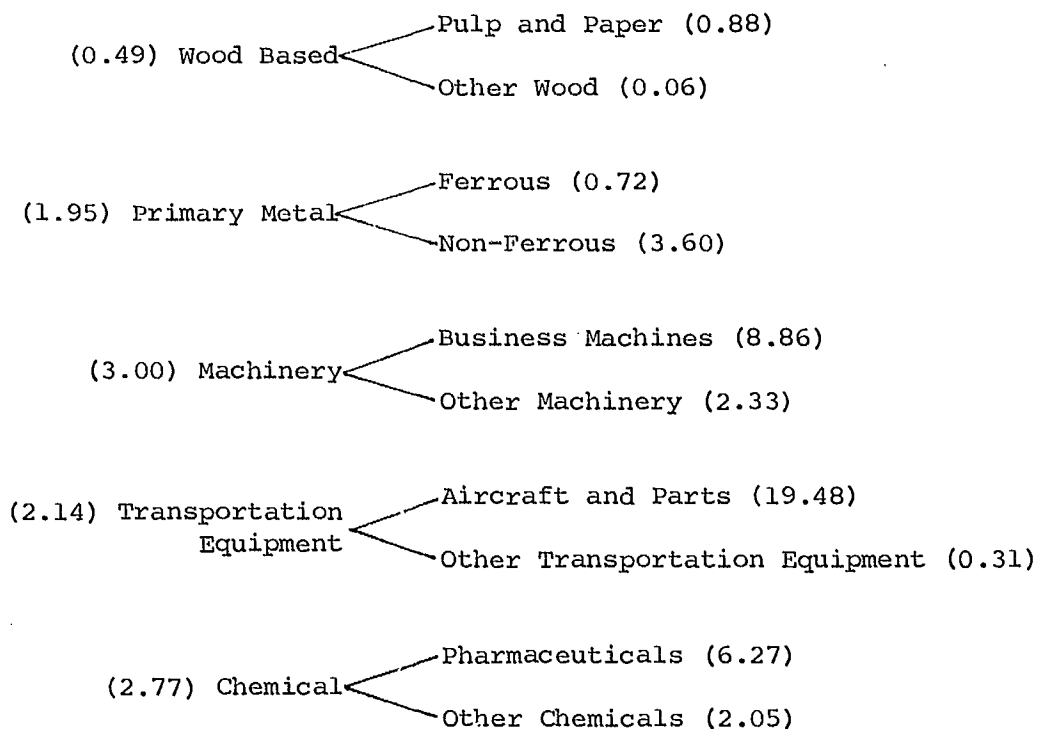
(a) INDUSTRIES WITH NO R&D
INCLUDE LEATHER, KNITTING
MILLS, CLOTHING, AND
PRINTING

Table 6.2--Relative Research Intensity of Manufacturing Industries

RESEARCH INTENSIVE MANUFACTURING INDUSTRIES

Selected industries are further disaggregated into three-digit SIC industries to give a better view of relative research intensities. Chart 6.1 lists these selected industries and their respective sub-categories. The trends displayed by the three indicators for these three-digit SIC industries are available in Appendix Tables F9-F11 and the actual values of R&D expenditure, value added, etc., are available in Appendix Tables F12-F16.

CLASSIFICATION OF SELECTED INDUSTRIES
INTO THREE-DIGIT SIC INDUSTRIES*



*Figures in brackets are intramural R&D as a per cent of value added for 1977.

Chart 6.1--Sub-categories of Selected Industries

An entirely different picture appears when three-digit SIC industries are introduced into the ranking of manufacturing industries by research intensity. The four levels of research intensity chosen are as follows:

1) Highly research intensive industries have R&D/VA ratios of over 3.0% and R&D PERS/TE ratios greater than 2.0%;

2) Medium research intensive industries have R&D/VA ratios between 1.0% and 3.0% and R&D PERS/TE ratios greater than 1.0%;

3) Low research intensive industries have R&D/VA ratios of less than 1.0% and R&D PERS/TE ratios less than 1.0%;

4) No research.

Based on this classification scheme, research intensity in highly research intensive industries, whether measured by the value added or the personnel indicator, is at least twice the average for total manufacturing. In medium research intensive industries, research intensity is greater than the average for total manufacturing.

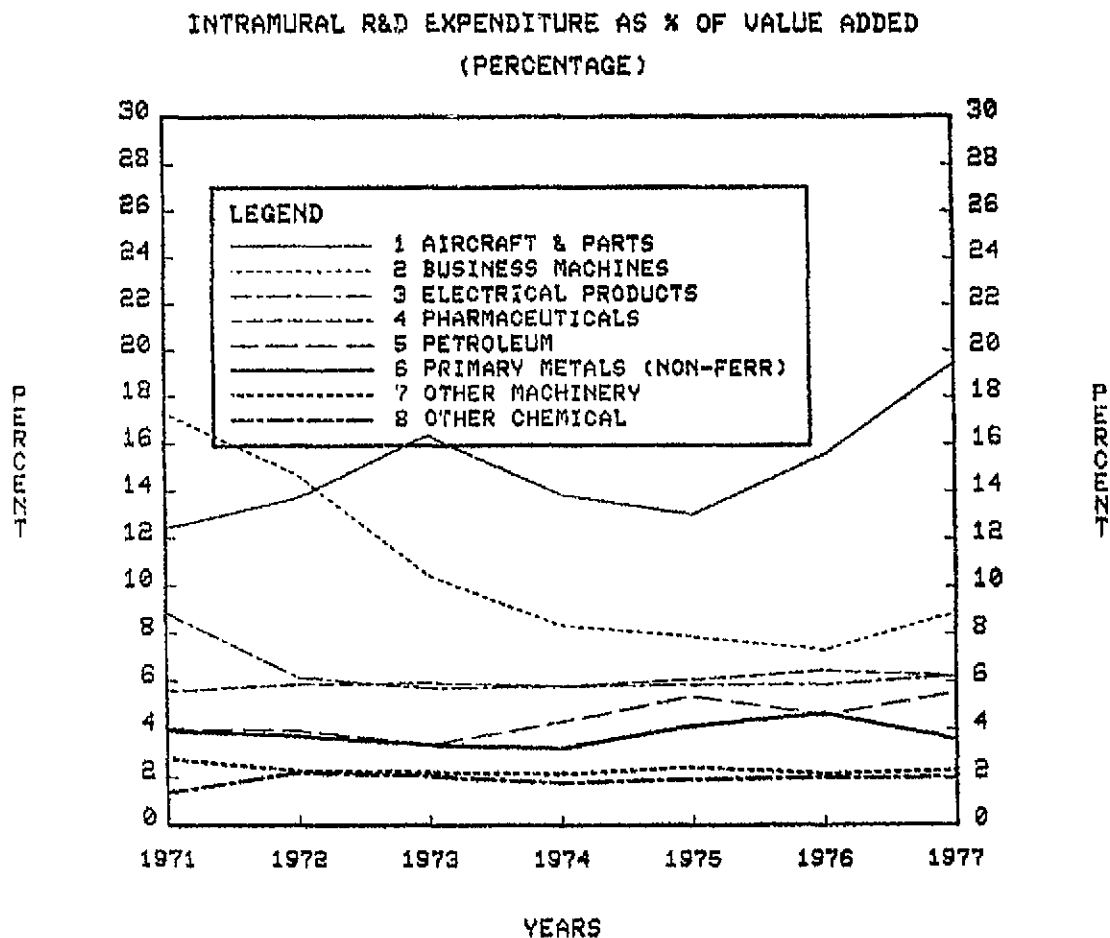
INDICATORS OF RESEARCH INTENSITY FOR 1977
(PERCENTAGE)

		R&D/VA	R&D PERS/TE
HIGHLY RESEARCH INTENSIVE	AIRCRAFT & PARTS	19.48	8.98
	BUSINESS MACHINES	8.86	6.21
	ELECTRICAL PRODUCTS	6.28	4.62
	PHARMACEUTICALS	6.27	5.66
	PETROLEUM	5.56	4.42
	PRIM MET (NON-FERR)	3.60	2.15
MEDIUM RESEARCH INTENSIVE	OTHER MACHINERY	2.33	1.69
	OTHER CHEMICAL	2.05	2.45
LOW RESEARCH INTENSIVE	MISCELLANEOUS	1.01	0.56
	PULP & PAPER	0.88	0.85
	PRIM MET (FERR)	0.72	0.53
	RUBBER & PLASTIC	0.53	0.48
	TEXTILE	0.41	0.25
	FOOD BEV & TOBACCO	0.39	0.39
	OTHER TRANSP EQUIP	0.31	0.38
	METAL FABRIC	0.30	0.26
	NON-MET MINERALS	0.28	0.33
	OTHER WOOD	0.06	0.05
	TOTAL MFG	1.48	1.03

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1978) AND
MAPID

Table 6.3--Relative Research Intensity of Manufacturing Industries

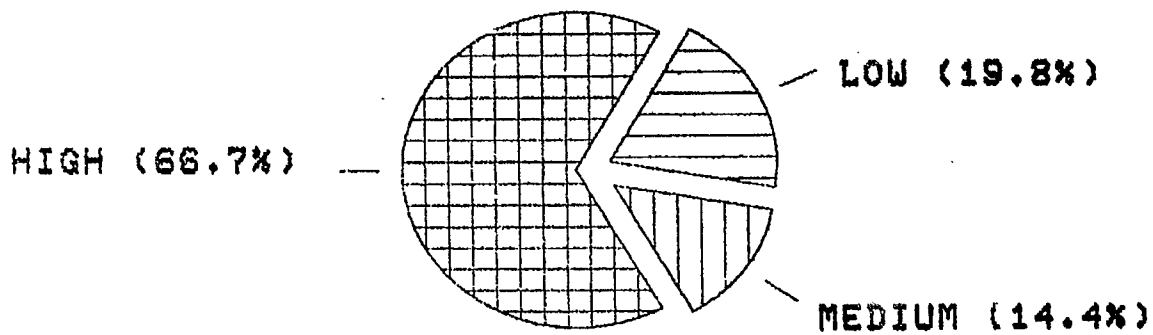
Figure 6.4 shows the trend in research intensity for the eight industries identified in Table 6.3 as research intensive. The trends in the two most research intensive industries, aircraft & parts and business machines, stand in sharp contrast to one another. Research intensity in aircraft & parts has been characterized by a fluctuating but upward trend while in business machines, there has been a precipitous decline (Appendix Table F17).



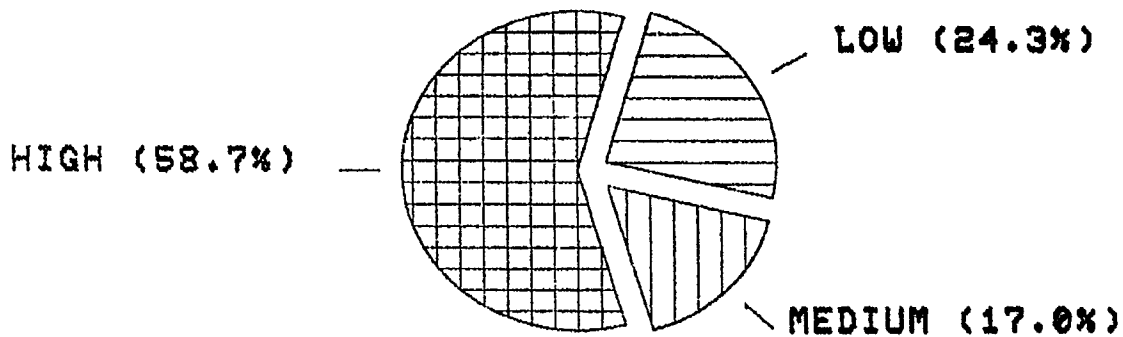
SOURCE : BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978) AND MAPID

Figure 6.4--Trend of Research Intensities

Chart 6.2 examines the distribution of R&D expenditure and personnel in 1977 for each group of industries, after classification by research intensity. The highly research intensive industries accounted for almost 70% of all manufacturing R&D expenditure and employed almost 60% of the R&D personnel (Appendix Tables F18 and F19).



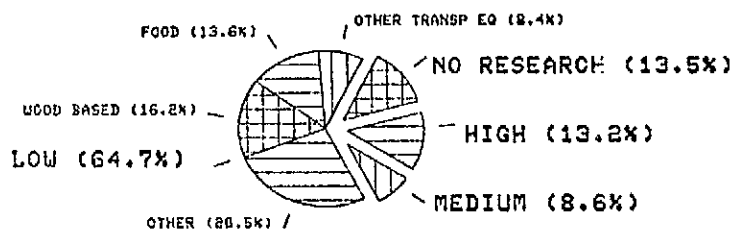
R&D EXPENDITURES



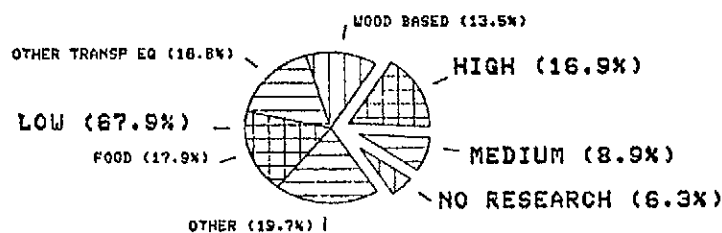
R&D PERSONNEL

Chart 6.2--Distribution of R&D Expenditure and Personnel

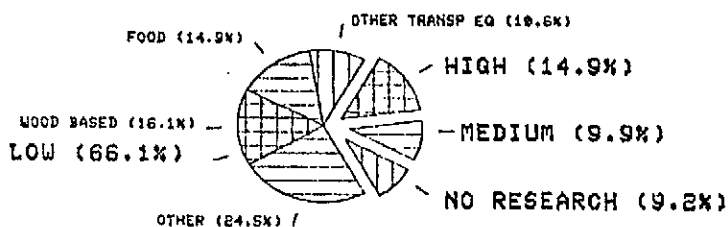
High and medium research intensive industries accounted for about one-quarter of value added, total shipments, and total employment in manufacturing in 1977 (Chart 6.3). The large share attributed to low research intensive industries is primarily a reflection of three industry groups (food, beverage & tobacco; wood based products; and other transportation equipment), which together accounted for about 40% to 50% of all manufacturing activity, depending on the choice of indicator (Appendix Tables F18 and F19).



TOTAL EMPLOYMENT



TOTAL SHIPMENTS



VALUE ADDED

Chart 6.3--Distribution of Value Added, Total Shipments, and Total Employment

Table 6.4 relates R&D expenditure of research intensive industries to their profit after tax. Because of the cyclical volatility of profits, the figures in Table 6.4 compare average R&D expenditure to average profit after tax over the period 1972-1976 (Appendix Tables F20 and F21).

Three fairly distinct groups emerge from this classification:

1) R&D expenditures are significantly greater than profits (aircraft & parts);

2) R&D expenditures are less than total profits but are still a significant proportion of this total (electrical products, non-ferrous primary metals, other machinery, and pharmaceuticals);

3) R&D expenditures are a small and relatively insignificant proportion of total profit after tax (business machines, other chemical, and petroleum).

INTRAMURAL R&D EXPENDITURE AS % OF PROFIT AFTER TAX
(PERCENTAGE)

	R&D/PROF(a)	R&D/VA(a)
AIRCRAFT & PARTS	413.02	14.58
ELECTRICAL PRODUCTS	69.72	5.91
PRIMARY METALS (NON-FERR)	60.60	3.91
OTHER MACHINERY	59.78	2.29
PHARMACEUTICALS	55.04	6.06
BUSINESS MACHINES	16.73	9.28
OTHER CHEMICAL	14.42	2.01
PETROLEUM	4.70	4.46
AVERAGE(b)	25.74	4.53

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT.
13-212 (1978) AND MAPID

(a) AVERAGES OF R&D EXPENDITURE, PROFIT AFTER TAX,
AND VALUE ADDED FOR THE PERIOD 1972-1976 ARE
USED

(b) AVERAGE OF THE ABOVE 8 INDUSTRIES

Table 6.4--R&D Expenditures as a per cent of Profit After Tax

APPENDIX F

INTRAMURAL R&D EXPENDITURE AS % OF VALUE ADDED IN MANUFACTURING
(PERCENTAGE (b))

	YEARS						
	1971	1972	1973	1974	1975	1976	1977
FOOD & BEVERAGE AND TOBACCO	0.45	0.44	0.38	0.41	0.43	0.38	0.39
RUBBER AND PLASTIC	0.75	0.67	0.56	0.50	0.51	0.52	0.53
LEATHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TEXTILE	0.53	0.48	0.43	0.29	0.48	0.53	0.41
KNITTING MILLS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CLOTHING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WOOD BASED (a)	0.62	0.50	0.40	0.41	0.50	0.50	0.49
PRINTING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRIMARY METAL	2.11	2.07	1.68	1.73	2.14	2.23	1.95
METAL FABRICATING	0.48	0.36	0.35	0.25	0.30	0.27	0.30
MACHINERY	4.58	3.97	3.34	3.04	3.14	2.83	3.00
TRANSPORTATION EQUIPMENT	1.65	1.73	2.11	1.60	1.70	1.84	2.14
ELECTRICAL PRODUCTS	8.89	6.15	5.77	5.85	5.92	5.89	6.28
NON-METALLIC MINERALS	0.34	0.42	0.42	0.42	0.33	0.26	0.28
PETROLEUM	4.02	4.00	3.38	4.34	5.36	4.62	5.56
CHEMICAL	3.25	3.00	2.82	2.48	2.70	2.76	2.77
MISCELLANEOUS	1.17	0.92	0.95	1.06	1.20	0.93	1.01
TOTAL	1.75	1.48	1.38	1.35	1.46	1.41	1.48

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978) AND MAPID

(a) INCLUDES "FURNITURE & FIXTURES" AND "PULP & PAPER".

(b) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE EXPRESSED.

INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(MILLIONS OF CURRENT DOLLARS (b))

	YEARS						
	1971	1972	1973	1974	1975	1976	1977
FOOD & BEVERAGE AND TOBACCO	16.1	17.2	17.1	20.8	24.6	24.0	27.3
RUBBER AND PLASTIC	4.9	5.1	5.0	5.1	5.3	6.1	7.0
LEATHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXTILE	4.0	4.2	4.3	3.4	5.3	6.4	5.3
KNITTING MILLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CLOTHING	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WOOD BASED (a)	19.9	19.6	20.2	26.2	29.5	34.0	37.4
PRINTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PRIMARY METAL	38.8	40.6	38.9	50.4	63.0	67.4	71.1
METAL FABRICATING	9.0	7.4	8.6	7.9	9.9	9.5	11.2
MACHINERY	46.3	45.5	44.7	54.3	64.2	59.1	67.2
TRANSPORTATION EQUIPMENT	45.5	54.5	77.3	68.4	71.7	87.6	116.9
ELECTRICAL PRODUCTS	140.3	109.9	120.4	147.3	155.8	161.8	178.1
NON-METALLIC MINERALS	3.0	4.2	4.8	5.7	4.9	4.2	4.7
PETROLEUM	17.5	18.6	19.6	42.5	46.4	47.3	71.6
CHEMICAL	51.5	50.2	55.8	63.9	71.8	78.5	86.8
MISCELLANEOUS	8.3	7.4	8.7	11.7	13.9	12.0	13.6
TOTAL	405.7	384.6	425.3	507.5	566.2	598.2	692.1

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

(a) INCLUDES "FURNITURE & FIXTURES" AND "PULP & PAPER".

(b) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE EXPRESSED.

VALUE ADDED IN MANUFACTURING
(MILLIONS OF CURRENT DOLLARS)

	YEARS						
	1971	1972	1973	1974	1975	1976	1977
FOOD & BEVERAGE AND TOBACCO	3,596.7	3,900.0	4,488.8	5,072.6	5,710.4	6,259.7	6,982.1
RUBBER AND PLASTIC	649.4	762.8	885.4	1,029.8	1,031.0	1,169.8	1,323.7
LEATHER	219.2	224.4	248.2	291.6	316.5	363.4	352.6
TEXTILE	751.1	873.3	1,001.9	1,173.8	1,099.8	1,206.4	1,302.8
KNITTING MILLS	202.9	218.3	245.5	277.3	294.5	302.1	297.5
CLOTHING	716.2	801.3	903.1	1,024.5	1,143.2	1,312.4	1,360.9
WOOD BASED (a)	3,235.6	3,889.7	5,048.8	6,392.8	5,884.0	6,851.4	7,558.2
PRINTING	1,125.3	1,263.7	1,484.6	1,700.3	1,899.4	2,113.3	2,282.9
PRIMARY METAL	1,841.8	1,960.6	2,308.9	2,911.8	2,948.2	3,027.3	3,654.0
METAL FABRICATING	1,889.3	2,049.4	2,437.7	3,190.9	3,278.3	3,565.3	3,699.0
MACHINERY	1,010.5	1,144.9	1,337.3	1,785.5	2,046.8	2,089.0	2,240.0
TRANSPORTATION EQUIPMENT	2,756.6	3,151.0	3,664.0	4,276.0	4,208.5	4,762.3	5,467.0
ELECTRICAL PRODUCTS	1,578.2	1,787.9	2,086.4	2,520.0	2,631.8	2,746.6	2,835.6
NON-METALLIC MINERALS	889.3	1,010.1	1,149.8	1,346.6	1,502.4	1,627.3	1,652.9
PETROLEUM	435.3	465.5	580.7	978.3	866.0	1,024.2	1,287.9
CHEMICAL	1,582.5	1,676.0	1,975.6	2,579.0	2,663.0	2,842.0	3,135.3
MISCELLANEOUS	708.2	802.8	919.7	1,103.6	1,160.1	1,290.6	1,344.0
TOTAL	23,187.9	25,981.7	30,766.5	37,654.5	38,683.7	42,553.3	46,776.2

SOURCE: BASED ON DATA FROM MAPID

(a) INCLUDES "FURNITURE & FIXTURES" AND "PULP & PAPER".

INTRAMURAL R&D EXPENDITURE AS % OF TOTAL SHIPMENTS
(PERCENTAGE (b))

	YEARS						
	1971	1972	1973	1974	1975	1976	1977
FOOD & BEVERAGE AND TOBACCO	0.15	0.14	0.12	0.12	0.13	0.12	0.12
RUBBER AND PLASTIC	0.37	0.34	0.27	0.22	0.23	0.23	0.24
LEATHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TEXTILE	0.22	0.20	0.18	0.13	0.20	0.22	0.17
KNITTING MILLS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CLOTHING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WOOD BASED (a)	0.26	0.22	0.18	0.19	0.23	0.22	0.22
PRINTING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRIMARY METAL	0.87	0.86	0.68	0.67	0.84	0.86	0.78
METAL FABRICATING	0.23	0.18	0.17	0.12	0.15	0.13	0.14
MACHINERY	2.05	1.77	1.51	1.41	1.42	1.25	1.33
TRANSPORTATION EQUIPMENT	0.50	0.53	0.64	0.49	0.46	0.47	0.53
ELECTRICAL PRODUCTS	4.00	2.85	2.72	2.74	2.69	2.70	2.99
NON-METALLIC MINERALS	0.18	0.23	0.22	0.22	0.17	0.13	0.14
PETROLEUM	0.80	0.73	0.62	0.79	0.76	0.67	0.81
CHEMICAL	1.51	1.38	1.30	1.14	1.16	1.16	1.13
MISCELLANEOUS	0.61	0.49	0.50	0.54	0.60	0.47	0.50
TOTAL	0.71	0.60	0.55	0.53	0.55	0.53	0.55

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978) AND MAP ID

(a) INCLUDES "FURNITURE & FIXTURES" AND "PULP & PAPER".

(b) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE EXPRESSED.

VALUE OF TOTAL SHIPMENTS IN MANUFACTURING
(MILLIONS OF CURRENT DOLLARS)

	YEARS						
	1971	1972	1973	1974	1975	1976	1977
FOOD & BEVERAGE AND TOBACCO	10,893.2	12,094.1	14,498.5	17,318.6	19,564.7	20,692.9	22,561.6
RUBBER AND PLASTIC	1,308.8	1,498.5	1,833.9	2,299.0	2,333.5	2,632.8	2,913.3
LEATHER	454.2	487.0	553.6	621.8	663.7	767.8	766.3
TEXTILE	1,824.8	2,070.7	2,345.5	2,657.6	2,611.5	2,889.5	3,154.9
KNITTING MILLS	461.7	475.8	541.8	614.0	638.2	644.7	652.2
CLOTHING	1,533.4	1,706.9	1,930.8	2,197.8	2,452.4	2,764.6	2,853.9
WOOD BASED (a)	7,534.2	8,953.4	11,068.3	13,765.0	13,069.0	15,497.1	17,053.5
PRINTING	1,734.3	1,943.1	2,257.7	2,650.7	3,006.5	3,358.0	3,639.2
PRIMARY METAL	4,475.1	4,743.3	5,727.9	7,545.9	7,510.9	7,873.0	9,130.7
METAL FABRICATING	3,882.6	4,196.5	4,998.5	6,458.7	6,814.5	7,469.2	7,936.5
MACHINERY	2,253.2	2,567.1	2,968.1	3,841.1	4,534.8	4,728.5	5,057.2
TRANSPORTATION EQUIPMENT	9,021.8	10,242.3	12,172.7	14,041.5	15,674.0	18,522.8	22,022.1
ELECTRICAL PRODUCTS	3,503.9	3,858.9	4,429.3	5,374.2	5,790.0	5,994.5	5,950.3
NON-METALLIC MINERALS	1,650.5	1,851.3	2,133.9	2,539.0	2,857.2	3,143.7	3,325.6
PETROLEUM	2,192.5	2,532.2	3,181.1	5,352.4	6,133.2	7,099.9	8,837.8
CHEMICAL	3,400.5	3,627.3	4,298.2	5,595.6	6,170.8	6,788.7	7,704.0
MISCELLANEOUS	1,354.7	1,512.0	1,750.1	2,157.5	2,323.8	2,549.4	2,705.5
TOTAL	57,479.4	64,360.3	76,689.8	95,030.2	102,148.6	113,417.0	126,264.5

SOURCE: BASED ON DATA FROM MAPID

(a) INCLUDES "FURNITURE & FIXTURES" AND "PULP & PAPER".

R&D PERSONNEL AS % OF TOTAL EMPLOYMENT IN MANUFACTURING
(PERCENTAGE (b))

	YEARS			
	1971	1973	1975	1977
FOOD & BEVERAGE AND TOBACCO	0.25	0.27	0.37	0.39
RUBBER AND PLASTIC	0.56	0.38	0.41	0.48
LEATHER	0.00	0.00	0.00	0.00
TEXTILE	0.33	0.30	0.29	0.25
KNITTING MILLS	0.00	0.00	0.00	0.00
CLOTHING	0.00	0.00	0.00	0.00
WOOD BASED (a)	0.45	0.37	0.42	0.41
PRINTING	0.00	0.00	0.00	0.00
PRIMARY METAL	1.52	1.62	1.70	1.21
METAL FABRICATING	0.19	0.18	0.24	0.26
MACHINERY	1.63	1.74	2.37	2.13
TRANSPORTATION EQUIPMENT	1.26	1.15	1.38	1.54
ELECTRICAL PRODUCTS	4.54	3.78	4.16	4.62
NON-METALLIC MINERALS	0.36	0.34	0.33	0.33
PETROLEUM	4.21	4.26	4.66	4.42
CHEMICAL	3.34	3.19	3.25	3.01
MISCELLANEOUS	1.65	1.29	0.70	0.56
TOTAL	1.06	0.95	1.06	1.03

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212
(1977 & 1978) AND MAPID

(a) INCLUDES "FURNITURE & FIXTURES" AND "PULP & PAPER".

(b) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT
AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE
EXPRESSED.

R&D PERSONNEL IN MANUFACTURING
(NUMBER(b))

	YEARS			
	1971	1973	1975	1977
FOOD & BEVERAGE AND TOBACCO	571	629	859	913
RUBBER AND PLASTIC	252	205	216	266
LEATHER	0	0	0	0
TEXTILE	232	234	205	166
KNITTING MILLS	0	0	0	0
CLOTHING	0	0	0	0
WOOD BASED (a)	1,136	1,063	1,141	1,129
PRINTING	0	0	0	0
PRIMARY METAL	1,736	1,886	2,046	1,448
METAL FABRICATING	255	257	360	385
MACHINERY	1,155	1,417	2,189	1,871
TRANSPORTATION EQUIPMENT	1,892	1,991	2,201	2,553
ELECTRICAL PRODUCTS	5,595	4,838	5,239	5,118
NON-METALLIC MINERALS	185	188	185	172
PETROLEUM	653	686	804	789
CHEMICAL	2,586	2,464	2,612	2,462
MISCELLANEOUS	951	808	455	350
TOTAL	17,199	16,666	18,512	17,622

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212
(1977 & 1978)

(a) INCLUDES "FURNITURE & FIXTURES" AND "PULP & PAPER".

(b) ZERO ENTRIES IMPLY THAT FIGURES ARE EITHER NOT
AVAILABLE OR THE AMOUNT IS TOO SMALL TO BE
EXPRESSED.

TOTAL EMPLOYMENT IN MANUFACTURING
(NUMBER)

	YEARS			
	1971	1973	1975	1977
FOOD & BEVERAGE AND TOBACCO	227,995	230,915	229,715	231,791
RUBBER AND PLASTIC	44,672	54,377	52,963	55,699
LEATHER	27,930	27,251	26,834	23,456
TEXTILE	69,350	76,863	71,050	65,508
KNITTING MILLS	23,919	25,879	24,682	20,628
CLOTHING	98,457	104,300	100,528	94,939
WOOD BASED (a)	254,576	283,789	274,747	276,774
PRINTING	84,110	90,593	92,912	91,760
PRIMARY METAL	114,314	116,462	120,335	119,219
METAL FABRICATING	137,015	144,921	150,899	146,735
MACHINERY	71,062	81,640	92,290	87,657
TRANSPORTATION EQUIPMENT	150,155	173,358	159,642	165,287
ELECTRICAL PRODUCTS	123,181	127,928	125,868	110,813
NON-METALLIC MINERALS	51,291	55,949	55,932	52,518
PETROLEUM	15,517	16,087	17,264	17,849
CHEMICAL	77,377	77,328	80,251	81,805
MISCELLANEOUS	57,483	62,426	65,247	61,977
TOTAL	1,628,404	1,751,066	1,741,159	1,704,415

SOURCE: BASED ON DATA FROM MAPID

(a) INCLUDES "FURNITURE & FIXTURES" AND "PULP & PAPER".

INTRAMURAL R&D AS % OF VALUE ADDED IN MANUFACTURING
(PERCENTAGE)

		1971	1972	1973	1974	1975	1976	1977
WOOD BASED	PULP & PAPER	1.05	0.94	0.78	0.62	0.78	0.83	0.88
	OTHER WOOD	0.06	0.06	0.03	0.07	0.10	0.07	0.06
	TOTAL	0.62	0.50	0.40	0.41	0.50	0.50	0.49
PRIMARY METALS	FERROUS	0.81	0.94	0.66	0.73	0.78	0.72	0.72
	NON-FERROUS	3.95	3.76	3.42	3.29	4.18	4.70	3.60
	TOTAL	2.11	2.07	1.68	1.73	2.14	2.23	1.95
MACHINERY	BUSINESS MACHINES	17.33	14.77	10.43	8.40	7.91	7.30	8.86
	OTHER MACHINERY	2.83	2.32	2.22	2.21	2.49	2.21	2.33
	TOTAL	4.58	3.97	3.34	3.04	3.14	2.83	3.00
TRANSP. EQUIP.	AIRCRAFT & PARTS	12.49	13.78	16.41	13.93	13.06	15.57	19.48
	OTHER TRANSP. EQUIP.	0.35	0.45	0.46	0.35	0.38	0.34	0.31
	TOTAL	1.65	1.73	2.11	1.60	1.70	1.84	2.14
CHEMICAL	PHARMACEUTICALS	5.58	5.88	5.93	5.80	6.12	6.48	6.27
	OTHER CHEMICALS	1.42	2.26	2.10	1.83	1.99	2.02	2.05
	TOTAL	2.24	3.00	2.82	2.48	2.70	2.76	2.77

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978) AND
MAPID

INTRAMURAL R&D AS % OF TOTAL SHIPMENTS IN MANUFACTURING
(PERCENTAGE)

		1971	1972	1973	1974	1975	1976	1977
WOOD BASED	PULP & PAPER	0.45	0.39	0.34	0.30	0.35	0.37	0.38
	OTHER WOOD	0.03	0.03	0.02	0.03	0.04	0.03	0.03
	TOTAL	0.26	0.22	0.18	0.19	0.23	0.22	0.22
PRIMARY METALS	FERROUS	0.38	0.43	0.32	0.32	0.32	0.30	0.31
	NON-FERROUS	1.38	1.36	1.08	1.06	1.51	1.60	1.33
	TOTAL	0.87	0.86	0.68	0.67	0.84	0.86	0.78
MACHINERY	BUSINESS MACHINES	7.08	6.26	4.73	4.19	3.63	3.15	3.48
	OTHER MACHINERY	1.28	1.04	1.00	1.02	1.12	0.98	1.05
	TOTAL	2.05	1.77	1.51	1.41	1.42	1.25	1.33
TRANSP. EQUIP.	AIRCRAFT & PARTS	7.08	8.02	10.56	8.08	7.38	9.26	12.49
	OTHER TRANSP. EQUIP.	0.10	0.13	0.13	0.10	0.10	0.08	0.07
	TOTAL	0.50	0.53	0.64	0.49	0.46	0.47	0.53
CHEMICAL	PHARMACEUTICALS	3.48	3.65	3.55	3.49	3.56	3.56	3.55
	OTHER CHEMICALS	0.62	0.98	0.91	0.81	0.81	0.81	0.79
	TOTAL	1.04	1.38	1.30	1.14	1.16	1.16	1.13

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978) AND
MAPID

R&D PERSONNEL AS % OF TOTAL EMPLOYMENT IN MANUFACTURING
(PERCENTAGE)

		1971	1973	1975	1977
WOOD BASED	PULP & PAPER	0.85	0.78	0.82	0.85
	OTHER WOOD	0.09	0.06	0.07	0.05
	TOTAL	0.45	0.37	0.42	0.41
PRIMARY METALS	FERROUS	0.35	0.36	0.48	0.53
	NON-FERROUS	3.04	3.46	3.47	2.15
	TOTAL	1.52	1.62	1.70	1.21
MACHINERY (a)	BUSINESS MACHINES	0.00	0.00	7.25	6.21
	OTHER MACHINERY	0.00	0.00	1.80	1.69
	TOTAL	1.63	1.74	2.37	2.13
TRANSP. EQUIP.	AIRCRAFT & PARTS	5.81	4.88	7.08	8.98
	OTHER TRANSP. EQUIP.	0.40	0.49	0.45	0.38
	TOTAL	1.26	1.15	1.38	1.54
CHEMICAL	PHARMACEUTICALS	5.42	5.74	6.57	5.66
	OTHER CHEMICALS	2.89	2.59	2.51	2.45
	TOTAL	3.34	3.19	3.25	3.01

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212
(1977 & 1978) AND MAPID

(a) ZERO ENTRIES IMPLY DATA ARE NOT AVAILABLE

INTRAMURAL R&D EXPENDITURE IN MANUFACTURING
(MILLIONS OF CURRENT DOLLARS)

		1971	1972	1973	1974	1975	1976	1977
WOOD BASED	PULP & PAPER	19.0	18.5	19.3	24.6	27.1	32.0	35.3
	OTHER WOOD	0.9	1.1	0.9	1.6	2.4	2.0	2.1
	TOTAL	19.9	19.6	20.2	26.2	29.5	34.0	37.4
PRIMARY METALS	FERROUS	8.8	11.0	9.5	13.0	13.8	13.5	15.0
	NON-FERROUS	30.0	29.6	29.4	37.4	49.2	53.9	56.1
	TOTAL	38.8	40.6	38.9	50.4	63.0	67.4	71.1
MACHINERY	BUSINESS MACHINES	21.2	22.5	19.1	20.2	19.4	18.5	20.5
	OTHER MACHINERY	25.1	23.0	25.6	34.1	44.8	40.6	46.7
	TOTAL	46.3	45.5	44.7	54.3	64.2	59.1	67.2
TRANSP. EQUIP.	AIRCRAFT & PARTS	36.8	41.7	62.2	54.8	57.2	72.8	101.5
	OTHER TRANSP. EQUIP.	8.7	12.8	15.1	13.6	14.5	14.8	15.4
	TOTAL	45.5	54.5	77.3	68.4	71.7	87.6	116.9
CHEMICAL	PHARMACEUTICALS	17.5	20.0	22.2	24.5	28.0	30.8	33.5
	OTHER CHEMICALS	18.0	30.2	33.6	39.4	43.8	47.7	53.3
	TOTAL	35.5	50.2	55.8	63.9	71.8	78.5	86.8

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978)

VALUE ADDED IN MANUFACTURING
(MILLIONS OF CURRENT DOLLARS)

		1971	1972	1973	1974	1975	1976	1977
WOOD BASED	PULP & PAPER	1,803.7	1,961.6	2,476.4	3,945.0	3,469.8	3,844.1	4,031.8
	OTHER WOOD	1,432.0	1,928.1	2,572.4	2,447.7	2,414.2	3,007.3	3,526.4
	TOTAL	3,235.6	3,889.7	5,048.8	6,392.8	5,884.0	6,851.4	7,558.2
PRIMARY METALS	FERROUS	1,083.1	1,173.4	1,448.9	1,773.5	1,772.4	1,880.5	2,095.6
	NON-FERROUS	758.7	787.2	860.0	1,138.3	1,175.8	1,146.8	1,558.4
	TOTAL	1,841.8	1,960.6	2,308.9	2,911.8	2,948.2	3,027.3	3,654.0
MACHINERY	BUSINESS MACHINES	122.3	152.3	183.1	240.5	245.1	253.3	231.4
	OTHER MACHINERY	888.1	992.5	1,154.2	1,545.0	1,801.6	1,835.7	2,008.5
	TOTAL	1,010.5	1,144.9	1,337.3	1,785.5	2,046.8	2,089.0	2,240.0
TRANSP. EQUIP.	AIRCRAFT & PARTS	294.8	302.6	379.0	393.5	438.0	467.5	521.0
	OTHER TRANSP. EQUIP.	2,461.8	2,848.4	3,285.0	3,882.5	3,770.5	4,294.8	4,946.0
	TOTAL	2,756.6	3,151.0	3,664.0	4,276.0	4,208.5	4,762.3	5,467.0
CHEMICAL	PHARMACEUTICALS	313.8	340.1	374.4	422.3	457.2	475.6	534.5
	OTHER CHEMICALS	1,268.7	1,335.9	1,601.2	2,156.7	2,205.9	2,366.4	2,600.7
	TOTAL	1,582.5	1,676.0	1,975.6	2,579.0	2,663.0	2,842.0	3,135.3

SOURCE: BASED ON DATA FROM MAPID

VALUE OF TOTAL SHIPMENTS IN MANUFACTURING
(MILLIONS OF CURRENT DOLLARS)

		1971	1972	1973	1974	1975	1976	1977
WOOD BASED	PULP & PAPER	4,251.0	4,715.1	5,633.8	8,143.8	7,637.1	8,749.1	9,362.5
	OTHER WOOD	3,283.2	4,238.2	5,434.5	5,621.2	5,431.8	6,748.0	7,691.0
	TOTAL	7,534.2	8,953.4	11,068.3	13,765.0	13,069.0	15,497.1	17,053.5
PRIMARY METALS	FERROUS	2,308.5	2,560.6	3,015.3	4,002.1	4,256.4	4,509.9	4,915.3
	NON-FERROUS	2,166.6	2,182.7	2,712.6	3,543.8	3,254.6	3,363.1	4,215.5
	TOTAL	4,475.1	4,743.3	5,727.9	7,545.9	7,510.9	7,873.0	9,130.7
MACHINERY	BUSINESS MACHINES	299.2	359.6	403.5	482.5	534.7	588.1	588.8
	OTHER MACHINERY	1,953.9	2,207.5	2,564.7	3,358.6	4,000.1	4,140.4	4,468.4
	TOTAL	2,253.2	2,567.1	2,968.1	3,841.1	4,534.8	4,728.5	5,057.2
TRANSP. EQUIP.	AIRCRAFT & PARTS	519.6	519.8	588.8	678.4	775.1	786.2	812.7
	OTHER TRANSP EQUIP	8,502.2	9,722.5	11,583.8	13,363.0	14,898.8	17,736.6	21,209.5
	TOTAL	9,021.8	10,242.3	12,172.7	14,041.5	15,674.0	18,522.8	22,022.1
CHEMICAL	PHARMACEUTICALS	503.4	547.8	624.6	701.9	787.2	865.7	943.5
	OTHER CHEMICALS	2,897.2	3,079.5	3,673.6	4,893.6	5,383.6	5,923.0	6,760.5
	TOTAL	3,400.5	3,627.3	4,298.2	5,595.6	6,170.8	6,788.7	7,704.0

SOURCE: BASED ON DATA FROM MAPID

R&D PERSONNEL IN MANUFACTURING
(NUMBER)

		1971	1973	1975	1977
WOOD BASED	PULP & PAPER	1,013	960	1,045	1,056
	OTHER WOOD	123	103	96	73
	TOTAL	1,136	1,063	1,141	1,129
PRIMARY METALS	FERROUS	230	252	342	366
	NON-FERROUS	1,506	1,634	1,704	1,082
	TOTAL	1,736	1,886	2,046	1,448
MACHINERY (a)	BUSINESS MACHINES	0	0	697	536
	OTHER MACHINERY	0	0	1,492	1,335
	TOTAL	1,155	1,417	2,189	1,871
TRANSP. EQUIP.	AIRCRAFT & PARTS	1,381	1,267	1,578	2,011
	OTHER TRANSP. EQUIP.	511	724	623	542
	TOTAL	1,892	1,991	2,201	2,553
CHEMICAL	PHARMACEUTICALS	750	841	972	806
	OTHER CHEMICALS	1,836	1,623	1,640	1,656
	TOTAL	2,586	2,464	2,612	2,462

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212
(1977 & 1978)

(a) ZERO ENTRIES IMPLY DATA ARE NOT AVAILABLE

TOTAL EMPLOYMENT IN MANUFACTURING
(NUMBER)

		1971	1973	1975	1977
WOOD BASED	PULP & PAPER	119,709	123,138	127,342	124,463
	OTHER WOOD	134,867	160,651	147,405	152,311
	TOTAL	254,576	283,789	274,747	276,774
PRIMARY METALS	FERROUS	64,804	69,261	71,268	68,802
	NON-FERROUS	49,510	47,201	49,067	50,417
	TOTAL	114,314	116,462	120,335	119,219
MACHINERY	BUSINESS MACHINES	8,696	10,866	9,613	8,635
	OTHER MACHINERY	62,366	70,774	82,677	79,022
	TOTAL	71,062	81,640	92,290	87,657
TRANSP. EQUIP.	AIRCRAFT & PARTS	23,756	25,963	22,289	22,382
	OTHER TRANSP. EQUIP.	126,399	147,395	137,353	142,905
	TOTAL	150,155	173,358	159,642	165,287
CHEMICAL	PHARMACEUTICALS	13,831	14,649	14,793	14,231
	OTHER CHEMICALS	63,546	62,679	65,458	67,574
	TOTAL	77,377	77,328	80,251	81,805

SOURCE: BASED ON DATA FROM MAPID

INTRAMURAL R&D AS % OF VALUE ADDED
(PERCENTAGE)

RESEARCH
INTENSIVE
INDUSTRIES

	1971	1972	1973	1974	1975	1976	1977
AIRCRAFT & PARTS	12.49	13.78	16.41	13.93	13.06	15.57	19.48
BUSINESS MACHINES	17.33	14.77	10.43	8.40	7.91	7.30	8.86
ELECTRICAL PRODUCTS	8.89	6.15	5.77	5.85	5.92	5.89	6.28
PHARMACEUTICALS	5.58	5.88	5.93	5.80	6.12	6.46	6.27
PETROLEUM	4.02	4.00	3.38	4.34	5.36	4.62	5.56
PRIM MET (NON-FERR)	3.95	3.76	3.42	3.29	4.18	4.70	3.60
OTHER MACHINERY	2.83	2.32	2.22	2.21	2.49	2.21	2.33
OTHER CHEMICAL	1.42	2.26	2.10	1.83	1.99	2.02	2.05
AVERAGE(a)	5.41	4.79	4.60	4.26	4.53	4.59	4.85

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1977 & 1978) AND MAP ID

(a) AVERAGE FOR ABOVE 8 INDUSTRIES

CHARACTERISTICS OF INDUSTRIES BY RESEARCH INTENSITY FOR 1977 (a)
(PERCENT DISTRIBUTION)

		R&D EXP	VALUE ADDED	SHIPMENTS	PROFIT	R&D PERS	EMPLOYMENT
HIGHLY RESEARCH INTENSIVE	AIRCRAFT & PARTS	14.7	1.1	0.6	0.4	11.4	1.3
	BUS MACHINES	3.0	0.5	0.5	3.4	3.0	0.5
	ELECTRICAL PRODUCTS	25.7	6.1	4.7	3.9	29.0	6.5
	PHARMACEUTICALS	4.8	1.1	0.7	1.0	4.6	0.8
	PETROLEUM	10.3	2.8	7.0	20.3	4.5	1.0
	PRIM MET (NON-FERR)	8.1	3.3	3.3	0.6	6.1	3.0
	SUBT	66.7	14.9	16.9	29.7	58.7	13.2
MEDIUM RESEARCH INTENSIVE	OTHER MACHINES	6.7	4.3	3.5	1.5	7.6	4.6
	OTHER CHEMICAL	7.7	5.6	5.4	6.7	9.4	4.0
	SUBT	14.4	9.9	8.9	8.3	17.0	8.6
LOW RESEARCH INTENSIVE	MISCELLANEOUS	2.0	2.9	2.1	2.6	2.0	3.6
	PULP & PAPER	5.1	8.6	7.4	7.6	6.0	7.3
	PRIM MET (FERR)	2.2	4.5	3.9	3.3	2.1	4.0
	RUB & PLASTIC	1.0	2.8	2.3	0.4	1.5	3.3
	TEXTILE	0.8	2.8	2.5	0.8	0.9	3.8
	FOOD BEV & TOBACCO	3.9	14.9	17.9	15.8	5.2	13.6
	OTHER TRANSP EQU	2.2	10.6	16.8	11.1	3.1	8.4
	MET FABRICATING	1.6	7.9	6.3	7.4	2.2	8.6
	NON-MET MINERALS	0.7	3.5	2.6	3.5	1.0	3.1
	OTHER WOOD	0.3	7.5	6.1	2.8	0.4	8.9
	SUBT	19.8	66.1	67.9	55.3	24.3	64.7
NO RESEARCH	LEATHER	0.0	0.8	0.6	0.3	0.0	1.4
	KNIT MILLS	0.0	0.6	0.5	0.1	0.0	1.2
	CLOTHING	0.0	2.9	2.3	1.6	0.0	5.6
	PRINTING	0.0	4.9	2.9	4.7	0.0	5.4
	SUBT	0.0	9.2	6.3	6.8	0.0	13.5
	MANUFACTURING	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1978) AND MAPID

(a) PROFIT AFTER TAX DATA ARE FOR 1976

CHARACTERISTICS OF INDUSTRIES BY RESEARCH INTENSITY FOR 1977 (a)

		R&D EXP(b)	VA(b)	SHIP(b)	PROF(b)	R&D PERS(c)	EMPL(c)
HIGHLY RESEARCH INTENSIVE	AIRCRAFT & PARTS	101.5	521.0	812.7	18.8	2,011	22,382
	BUS MACHINES	20.5	231.4	588.8	153.6	536	8,635
	ELECTRICAL PRODUCTS	178.1	2,835.6	5,950.3	177.9	5,118	110,813
	PHARMACEUTICALS	33.5	534.5	943.5	47.0	806	14,231
	PETROLEUM	71.6	1,287.9	8,837.8	919.0	789	17,849
	PRIM MET (NON-FERR)	56.1	1,558.4	4,215.5	29.4	1,082	50,417
	SUBT	461.3	6,968.9	21,348.5	1,345.7	10,342	224,327
MEDIUM RESEARCH INTENSIVE	OTHER MACHINES	46.7	2,008.5	4,468.4	68.4	1,335	79,022
	OTHER CHEMICAL	53.3	2,600.7	6,760.5	305.8	1,656	67,574
	SUBT	100.0	4,609.3	11,228.9	374.2	2,991	146,596
LOW RESEARCH INTENSIVE	MISCELLANEOUS	13.6	1,344.0	2,705.5	119.1	350	61,977
	PULP & PAPER	35.3	4,031.8	9,362.5	346.3	1,056	124,463
	PRIM MET (FERR)	15.0	2,095.6	4,915.3	148.6	366	68,802
	RUB & PLASTIC	7.0	1,323.7	2,913.3	20.0	266	55,699
	TEXTILE	5.3	1,302.8	3,154.9	36.4	166	65,508
	FOOD BEV & TOBACCO	27.3	6,982.1	22,561.6	713.8	913	231,791
	OTHER TRANSP EQU	15.4	4,946.0	21,209.5	503.8	542	142,905
	MET FABRICATING	11.2	3,699.0	7,936.5	334.3	385	146,735
	NON-MET MINERALS	4.7	1,652.9	3,325.6	158.9	172	52,518
	OTHER WOOD	2.1	3,526.4	7,691.0	124.8	73	152,311
	SUBT	136.9	30,904.1	85,775.6	2,506.0	4,289	1,102,709
NO RESEARCH	LEATHER	0.0	352.6	766.3	15.4	0	23,456
	KNIT MILLS	0.0	297.5	652.2	4.4	0	20,628
	CLOTHING	0.0	1,360.9	2,853.9	73.5	0	94,939
	PRINTING	0.0	2,282.9	3,639.2	212.7	0	91,760
	SUBT	0.0	4,293.9	7,911.5	306.0	0	230,783
	MANUFACTURING	692.1	46,776.2	126,264.5	4,531.8	17,622	1,704,415

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1978) AND MAPID

(a) PROFIT AFTER TAX DATA ARE FOR 1976

(b) MILLIONS OF CURRENT DOLLARS

(c) NUMBER

INTRAMURAL R&D AS % OF PROFIT AFTER TAX
(PERCENTAGE)

RESEARCH
INTENSIVE
INDUSTRIES

	1972	1973	1974	1975	1976
AIRCRAFT & PARTS	254.27	409.21	480.70	706.17	387.23
BUSINESS MACHINES	23.78	22.39	18.52	12.65	12.04
ELECTRICAL PRODUCTS	88.42	66.67	64.30	54.63	90.95
PHARMACEUTICALS	50.89	53.75	47.30	57.61	65.53
PETROLEUM	4.11	3.00	4.80	5.81	5.15
PRIM MET (NON-FERR)	87.57	43.43	28.01	75.93	183.33
OTHER MACHINERY	57.64	60.09	59.51	61.37	59.36
OTHER CHEMICAL	18.82	18.21	10.97	12.88	15.60
AVERAGE (a)	30.73	26.13	21.79	25.09	27.52

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-212 (1978) AND
MAPID

(a) AVERAGE FOR ABOVE 8 INDUSTRIES

PROFIT AFTER TAX IN MANUFACTURING
(MILLIONS OF CURRENT DOLLARS)

RESEARCH
INTENSIVE
INDUSTRIES

	1972	1973	1974	1975	1976
AIRCRAFT & PARTS	16.4	15.2	11.4	8.1	18.8
BUSINESS MACHINES	94.6	85.3	109.1	153.4	153.6
ELECTRICAL PRODUCTS	124.3	180.6	229.1	285.2	177.9
PHARMACEUTICALS	39.3	41.3	51.8	48.6	47.0
PETROLEUM	452.7	653.6	885.0	799.0	919.0
PRIM MET (NON-FERR)	33.8	67.7	133.5	64.8	29.4
OTHER MACHINERY	39.9	42.6	57.3	73.0	68.4
OTHER CHEMICAL	160.5	184.5	359.2	340.1	305.8
TOTAL	961.5	1,270.8	1,836.4	1,772.2	1,719.9

SOURCE: BASED ON DATA FROM MAPID

SECTION 7

The purpose of Section 7 is to examine the relationship between structural characteristics (firm size and ownership) and the performance of R&D at the industry group level (primary, manufacturing, and services) and within manufacturing. Research intensities of R&D performing firms are also presented.

R&D PERFORMING FIRMS AND RESEARCH INTENSITY BY FIRM SIZE

Structural characteristics can have a significant impact on a firm's R&D performance. In this section, attention is focussed on two particular variables, firm size and ownership (Chart 7.1).

STRUCTURAL CHARACTERISTICS

FIRM SIZE

- Small* — with sales less than \$10 million
(includes non-commercial firms unless otherwise specified)
- Large* — with sales greater than or equal to \$10 million

OWNERSHIP

- Canadian-controlled* — where 50% or more of voting rights are held inside Canada
- control is also assigned to Canada where 50% of voting rights is distributed outside Canada among non-associated shareholders but where the voting rights held in Canada constitute the largest single holding reported by any country
- Foreign-controlled* — where 50% or more of voting rights are held outside Canada or held by one or more Canadian corporations that are themselves foreign-controlled

Chart 7.1--Structural Characteristics of R&D Performing Firms

In 1977, over 80% of industrial R&D expenditure was performed by large firms. This pattern appears in both primary and manufacturing industries. In services, however, small firms accounted for 44% of industrial R&D expenditure (Table 7.1 and Appendix Table G1).

PERFORMANCE OF R&D IN 1977 (a)
(DISTRIBUTION BY FIRM SIZE)

(PERCENTAGES)

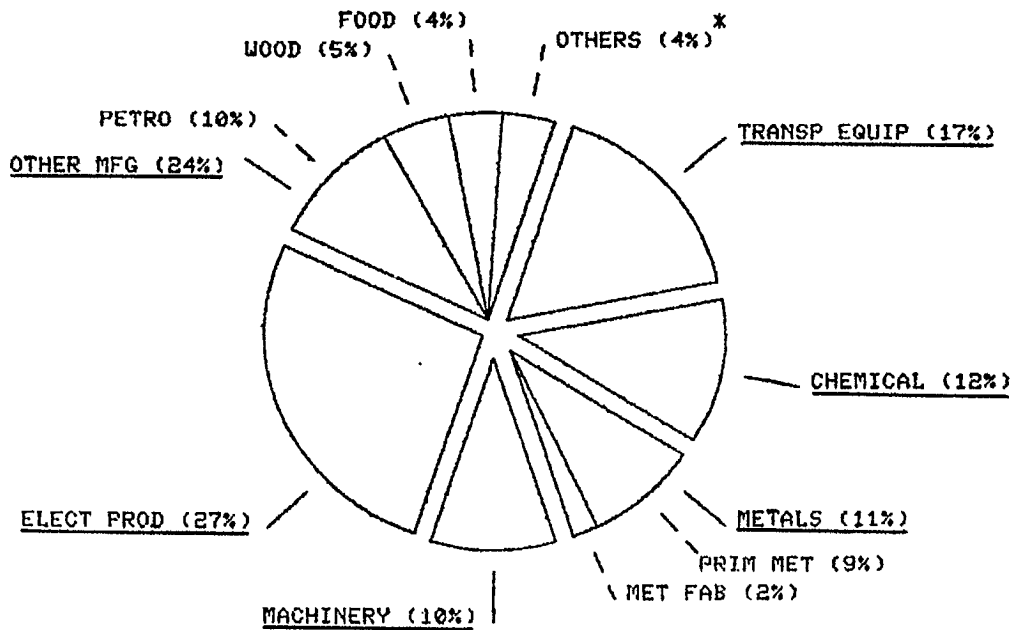
	SMALL	LARGE	TOTAL
PRIMARY	13	88	100
MANUFACTURING	12	88	100
SERVICES	44	55	100
TOTAL	17	83	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS
MAY NOT CORRESPOND EXACTLY TO THE SUM OF THE ITEMS
ADDED.

Table 7.1--Distribution of R&D, By Firm Size and Industry Group

Since 78% of industrial R&D expenditure is performed in manufacturing (Appendix Table G1), a more detailed examination of manufacturing industries is warranted. Due to data constraints, certain industries are re-aggregated into groups for presentation purposes. Chart 7.2 shows the composition of each manufacturing industry group and its relative size.



MANUFACTURING INDUSTRIES

*Includes rubber & plastic, textiles, non-metallic minerals, and miscellaneous manufacturing industries.

Chart 7.2--Manufacturing Industry Groups

Except for machinery, which accounts for 10% of R&D in manufacturing, over 85% of each group's R&D expenditure is attributed to large firms (Table 7.2 and Appendix Table G2). The contribution of small firms is particularly small in the metals (6%) and the transportation equipment (2%) industries.

PERFORMANCE OF R&D IN 1977 (a)
(DISTRIBUTION BY FIRM SIZE)

(PERCENTAGES)

	SMALL	LARGE	TOTAL
METALS	6	94	100
MACHINERY	27	71	100
ELECT PROD	13	88	100
CHEMICAL	10	88	100
TRANSP EQUIP	2	98	100
OTHER	15	85	100
TOTAL	12	88	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS
MAY NOT CORRESPOND EXACTLY TO THE SUM OF THE
ITEMS ADDED.

Table 7.2--Distribution of R&D, By Firm Size and By
Manufacturing Industries

In Section 6, R&D expenditure was compared to the sales of all firms in an industry, including those firms which perform no R&D. In this section, the R&D to sales ratio is again presented but covering only firms which are actively engaged in R&D.

In 1977, the research intensity of small firms was much higher than for large firms regardless of the industry group. The remarkably high research intensity of the small firms category in primary and service industries is a reflection of the large number of non-commercial firms. In 1975, non-commercial firms accounted for 54% of the small firms category in primary industries and 42% in services (Appendix Table G3). Table 7.3 also shows that the research intensity of R&D performing firms in primary industries is significantly higher than those in manufacturing or services.

RESEARCH INTENSITY OF R&D PERFORMING FIRMS IN 1977 (a)
(BY FIRM SIZE AND BY INDUSTRY GROUP)

(PERCENTAGES)

	SMALL	LARGE	TOTAL
PRIMARY	28.00	1.07	1.21
MANUFACTURING	6.76	0.92	0.92
SERVICES	34.34	0.55	0.98
TOTAL	10.57	0.80	0.94

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) AS MEASURED BY RATIO OF R&D EXPENDITURE TO SALES.

Table 7.3--Research Intensity of R&D Performing Firms, By Firm Size and By Industry Group

Within manufacturing industries, the research intensity of small firms is again much higher than that of large firms. Except for other manufacturing, the research intensity of small firms is 3 to 6 times as high as that of large firms (Table 7.4).

In other manufacturing industries, the wide divergence in research intensity is due, in part, to the composition of the two size groups. The scientific instruments industry accounts for one-quarter of R&D performing firms in the small firms category (Appendix Table G4). In the large firms category, a low research intensive industry group (food, beverages, & tobacco) accounts for 40% of the R&D firms.

RESEARCH INTENSITY OF R&D PERFORMING FIRMS IN 1977 (a)
(BY FIRM SIZE AND BY MANUFACTURING INDUSTRIES)

(PERCENTAGES)

	SMALL	LARGE	TOTAL
METALS	2.74	0.55	0.58
MACHINERY	7.26	1.16	1.53
ELECT PROD	9.62	3.20	3.48
CHEMICAL	4.12	1.22	1.33
TRANSP EQUIP	7.14	1.35	1.37
OTHER	7.69	0.37	0.43
TOTAL	6.76	0.82	0.92

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) AS MEASURED BY RATIO OF R&D EXPENDITURE TO SALES.

Table 7.4--Research Intensity of R&D Performing Firms, By Firm Size and By Manufacturing Industries

R&D PERFORMING FIRMS AND RESEARCH INTENSITY BY OWNERSHIP

In 1977, 57% of industrial R&D expenditure was performed by Canadian-controlled firms and 43% by foreign-controlled firms. These proportions were almost identical to that in manufacturing (Table 7.5 and Appendix Table G5). The foreign-controlled firms were responsible for 73% of industrial R&D expenditure in the primary industries but only 7% in services.

PERFORMANCE OF R&D IN 1977 (a)
(DISTRIBUTION BY OWNERSHIP)

(PERCENTAGES)

	CANADIAN	FOREIGN	TOTAL
PRIMARY	27	73	100
MANUFACTURING	53	48	100
SERVICES	92	7	100
TOTAL	57	43	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS
MAY NOT CORRESPOND EXACTLY TO THE SUM OF THE ITEMS
ADDED.

Table 7.5--Distribution of R&D, By Ownership and By Industry Group

The relatively even division between Canadian- and foreign-controlled R&D expenditures conceals significant differences within the various manufacturing industry groups. Three groups (machinery, chemical, and other manufacturing) have over two-thirds of their R&D performed by foreign-controlled firms (Table 7.6 and Appendix Table G6). Meanwhile, one-third of the R&D performed by the electrical products and transportation equipment industries is foreign-controlled. In the metals industries, foreign-controlled firms account for just 10% of the R&D.

PERFORMANCE OF R&D IN 1977 (a)
(DISTRIBUTION BY OWNERSHIP)

(PERCENTAGES)

	CANADIAN	FOREIGN	TOTAL
METALS	90	10	100
MACHINERY	25	75	100
ELECT PROD	69	31	100
CHEMICAL	26	73	100
TRANSP EQUIP	61	39	100
OTHER	34	66	100
TOTAL	53	48	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS
MAY NOT CORRESPOND EXACTLY TO THE SUM OF THE
ITEMS ADDED.

Table 7.6--Distribution of R&D, By Ownership and By
Manufacturing Industries

At the total industry level, Canadian-controlled firms have a higher research intensity than foreign-controlled firms (Table 7.7). In both primary and manufacturing industries, Canadian-controlled firms are more research intensive than those which are foreign-controlled. However, in the service industries, the research intensity of foreign-controlled firms is much higher.

RESEARCH INTENSITY OF R&D PERFORMING FIRMS IN 1977 (a)
(BY OWNERSHIP AND BY INDUSTRY GROUP)

(PERCENTAGES)

	CANADIAN	FOREIGN	TOTAL
PRIMARY	1.27	1.19	1.21
MANUFACTURING	1.17	0.74	0.92
SERVICES	0.95	1.70	0.98
TOTAL	1.11	0.79	0.94

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) AS MEASURED BY RATIO OF R&D EXPENDITURE TO SALES.

Table 7.7--Research Intensity of R&D Performing Firms, By
Ownership and By Industry Group

With the exception of other manufacturing industries, Canadian-controlled firms in all manufacturing industry groups are more research intensive than their foreign-controlled counterparts (Table 7.8). In particular, Canadian-controlled firms in transportation equipment are almost twenty times as research intensive as foreign-controlled firms. This difference is principally a reflection of the much larger sales of foreign-controlled firms, which were almost \$7.3 billion in 1977 as compared to \$600 million for Canadian-controlled firms.

RESEARCH INTENSITY OF R&D PERFORMING FIRMS IN 1977 (a)
(BY OWNERSHIP AND BY MANUFACTURING INDUSTRIES)

(PERCENTAGES)

	CANADIAN	FOREIGN	TOTAL
METALS	0.60	0.43	0.58
MACHINERY	1.67	1.49	1.53
ELECT PROD	4.99	2.08	3.48
CHEMICAL	1.86	1.19	1.33
TRANSP EQUIP	11.34	0.58	1.37
OTHER	0.39	0.46	0.43
TOTAL	1.17	0.74	0.92

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) AS MEASURED BY RATIO OF R&D EXPENDITURE TO SALES.

Table 7.8--Research Intensity of R&D Performing Firms, By
Ownership and By Manufacturing Industries

RESEARCH INTENSITY BY FIRM SIZE AND OWNERSHIP

In primary industries, foreign-controlled firms are more research intensive in the large firms category but overall, Canadian-controlled firms have a higher research intensity.

In manufacturing industries, Canadian-controlled firms are more research intensive at the total industry level and in the large firms category.

In service industries, foreign-controlled firms are more research intensive in the large firms category. Unlike the other two industry groups, foreign-controlled firms are also more research intensive at the total industry level.

RESEARCH INTENSITY OF R&D PERFORMING FIRMS IN 1977 (a)
(BY STRUCTURAL CHARACTERISTICS AND BY INDUSTRY GROUP)

(PERCENTAGES)

		PRIMARY MANUFACTURING	SERVICES	TOTAL
SMALL	CDN	24.00	6.60	38.93
	FOR	b	6.80	17.65
	SUBT	28.00	6.76	34.34
LARGE	CDN	0.87	1.02	0.55
	FOR	1.13	0.69	0.60
	SUBT	1.07	0.82	0.55
TOTAL	CDN	1.27	1.17	0.95
	FOR	1.19	0.74	1.70
	SUBT	1.21	0.92	0.98

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) AS MEASURED BY RATIO OF R&D EXPENDITURE TO SALES.

(b) DUE TO ROUNDING AND CONFIDENTIALITY, NO ESTIMATES
ARE AVAILABLE FOR THIS ITEM.

Table 7.9--Research Intensity of R&D Performing Firms, By
Structural Characteristics and By Industry Group

In manufacturing, small firms have the higher R&D to sales ratios and within this size group, Canadian-controlled firms are generally more research intensive. However, there are exceptions. For example, foreign-controlled small firms in both machinery and transportation equipment industries are much more research intensive than their Canadian-controlled counterparts.

In the large firms category, Canadian-controlled firms are more research intensive in all but one manufacturing group. In other manufacturing, foreign-controlled firms out-perform Canadian-controlled firms.

RESEARCH INTENSITY OF R&D PERFORMING FIRMS IN 1977 (a)
(BY STRUCTURAL CHARACTERISTICS AND BY MANUFACTURING INDUSTRIES)

(PERCENTAGES)

		METALS	MACH	ELECT PROD	CHEM	TRANSP EQUIP	OTHER	TOTAL
SMALL	CDN	2.97	3.37	12.20	4.07	5.00b	9.39	6.60
	FOR	2.22	19.64	6.90	4.23	11.11b	3.00	6.80
	SUBT	2.74	7.26	9.62	4.12	7.14	7.69	6.76
LARGE	CDN	0.55	1.29	4.61	1.68	11.41	0.24	1.02
	FOR	0.38	1.13	1.86	1.14	0.58	0.45	0.69
	SUBT	0.52	1.16	3.20	1.22	1.35	0.37	0.82
TOTAL	CDN	0.57	1.67	4.99	1.86	11.34	0.39	1.17
	FOR	0.43	1.49	2.08	1.19	0.58	0.46	0.74
	SUBT	0.55	1.53	3.48	1.33	1.37	0.43	0.92

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, FEBRUARY 1980

(a) AS MEASURED BY RATIO OF R&D EXPENDITURE TO SALES.

(b) ESTIMATED

Table 7.10--Research Intensity of R&D Performing Firms, By Structural Characteristics and By Manufacturing Industries

APPENDIX G

PERFORMANCE OF R&D IN 1977 (a)
(DISTRIBUTION BY INDUSTRY GROUP)

(PERCENTAGES)

	SMALL	LARGE	TOTAL
PRIMARY	5	7	7
MANUFACTURING	55	83	78
SERVICES	40	10	16
TOTAL	100	100	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS
MAY NOT CORRESPOND EXACTLY TO THE SUM OF THE ITEMS
ADDED.

PERFORMANCE OF R&D IN 1977 (a)
(DISTRIBUTION BY MANUFACTURING INDUSTRIES)

(PERCENTAGES)

	SMALL	LARGE	TOTAL
METALS	5	12	11
MACHINERY	22	8	10
ELECT PROD	29	27	27
CHEMICAL	10	12	12
TRANSP EQUIP	3	18	17
OTHER	31	23	24
TOTAL	100	100	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS
MAY NOT CORRESPOND EXACTLY TO THE SUM OF THE
ITEMS ADDED.

SMALL FIRMS PERFORMING R&D IN 1975
(PERCENTAGES)

	SMALL		TOTAL
	NON-COMM	SALES <\$10 MILLION	
PRIMARY	54	46	100
MANUFACTURING	9	91	100
SERVICES	42	58	100
TOTAL	17	83	100

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT.
13-212 (1977)

R&D PERFORMING FIRMS IN OTHER MANUFACTURING IN 1975 (a)
(DISTRIBUTION BY INDUSTRIES)

(PERCENTAGES)

	SMALL		LARGE		TOTAL
	NON-COMM SALES <\$10 MILLION		SALES ≥\$10 MILLION		
FOOD BEV & TOBACCO	8	16	15	41	30
RUBBER & PLASTIC	8	3	4	7	6
TEXTILES	0	8	7	5	6
WOOD BASED	33	12	15	23	19
NON-METALLIC MINERALS	0	6	5	8	7
PETROLEUM	0	3	3	4	4
SCIENTIFIC INSTRUMENTS	33	21	23	3	12
MISCELLANEOUS	17	30	28	9	17
TOTAL	100	100	100	100	100

SOURCE: BASED ON DATA FROM STATISTICS CANADA CAT. 13-213 (1977)

(a) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS MAY NOT CORRESPOND EXACTLY TO THE SUM OF THE ITEMS ADDED.

PERFORMANCE OF R&D IN 1977 (a)
(DISTRIBUTION BY INDUSTRY GROUP)

(PERCENTAGES)

	CANADIAN	FOREIGN	TOTAL
PRIMARY	3	11	7
MANUFACTURING	72	86	78
SERVICES	25	3	16
TOTAL	100	100	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS
MAY NOT CORRESPOND EXACTLY TO THE SUM OF THE ITEMS
ADDED.

PERFORMANCE OF R&D IN 1977 (a)
(DISTRIBUTION BY MANUFACTURING INDUSTRIES)

(PERCENTAGES)

	CANADIAN	FOREIGN	TOTAL
METALS	19	2	11
MACHINERY	5	15	10
ELECT PROD	36	18	27
CHEMICAL	6	18	12
TRANSP EQUIP	19	14	17
OTHER	15	33	24
TOTAL	100	100	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, SOME TOTALS
MAY NOT CORRESPOND EXACTLY TO THE SUM OF THE
ITEMS ADDED.

SECTION 8

The purpose of Section 8 is to examine the extent of federal R&D funding with respect to the structural characteristics discussed in Section 7 (firm size and ownership). The impact of federal R&D funds is investigated at the industry group level (primary, manufacturing, and services) and within manufacturing.

FEDERAL FUNDING OF R&D BY FIRM SIZE

In 1977, one-quarter of federal R&D funds was allocated to small firms (Table 8.1). In primary industries, large firms were the principal recipients of federal funds. In manufacturing, 19% of federal support was directed towards small firms, which represented over 60% of federal money received by small firms (Appendix Table H1). In service industries, small firms received 69% of federal funds which accounted for almost 40% of federal support to small firms.

FEDERAL FUNDING OF INTRAMURAL R&D IN 1977
(DISTRIBUTION BY FIRM SIZE)

(PERCENTAGES)

	SMALL	LARGE	TOTAL
PRIMARY (a)	-	95+	100
MANUFACTURING	19	81	100
SERVICES	69	31	100
TOTAL	25	75	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, MORE PRECISE
ESTIMATES ARE NOT AVAILABLE.

Table 8.1--Distribution of Federal Funds, By Industry Group

Large firms in manufacturing received more federal R&D funds across all industry groups (Table 8.2). Two groups, the electrical products and transportation equipment industries, received almost two-thirds of all federal funds (Appendix Table H2). About 90% of funds allocated to these two industries went to large firms.

FEDERAL FUNDING OF INTRAMURAL R&D IN 1977
(DISTRIBUTION BY FIRM SIZE)

(PERCENTAGES)

	SMALL	LARGE	TOTAL
METALS (a)	-	95+	100
MACHINERY	25	75	100
ELECT PROD	24	76	100
CHEMICAL	25	75	100
TRANSP EQUIP (a)	-	95+	100
OTHER (a)	38	54	100
TOTAL	19	81	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, MORE PRECISE
ESTIMATES ARE NOT AVAILABLE.

Table 8.2--Distribution of Federal Funds, By Manufacturing
Industries

Federal funding of industrial R&D plays a more prominent role in manufacturing and services than in primary industries. It is especially important for small firms in manufacturing and services, accounting for between 15% and 20% of their R&D expenditures (Table 8.3). Across all industry groups, federal funding accounts for 16.9% of small firms' R&D expenditures and 10.5% of large firms' R&D expenditures.

FEDERAL FUNDING AS % OF INTRAMURAL R&D IN 1977
(BY FIRM SIZE AND BY INDUSTRY GROUP)

(PERCENTAGES)

	SMALL	LARGE	TOTAL
PRIMARY	a	6.1	5.4
MANUFACTURING	19.2	11.5	12.4
SERVICES	15.8	5.6	10.0
TOTAL	16.9	10.5	11.6

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, NO ESTIMATES
ARE AVAILABLE FOR THIS ITEM.

Table 8.3--Federal Funding as % of Intramural R&D, By Firm
Size and By Industry Group

In manufacturing, federal funds make up 5% to 25% of each industry group's total R&D expenditures (Table 8.4). Where estimates are available, federal funds represent more than 20% of R&D expenditures for three groups of firms: large firms in transportation equipment; and small firms in electrical products and other manufacturing. For total manufacturing, federal funds account for 19.2% of small firms' R&D and 11.5% of large firms' R&D.

FEDERAL FUNDING AS % OF INTRAMURAL R&D IN 1977
(BY FIRM SIZE AND BY MANUFACTURING INDUSTRIES)

(PERCENTAGES)

	SMALL	LARGE	TOTAL
METALS	a	6.0	5.6
MACHINERY	11.8	13.3	12.7
ELECT PROD	26.1	12.2	14.0
CHEMICAL	12.5	4.4	5.2
TRANSP EQUIP	a	25.5	25.0
OTHER	20.8	5.3	8.4
TOTAL	19.2	11.5	12.4

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, NO ESTIMATES
ARE AVAILABLE FOR THIS ITEM.

Table 8.4--Federal Funding as % of Intramural R&D, By Firm
Size and By Manufacturing Industries

FEDERAL FUNDING OF R&D BY OWNERSHIP

In 1977, 60% of federal funds was allocated to Canadian-controlled firms (Table 8.5) and almost 80% of this went to manufacturing (Appendix Table H3). Foreign-controlled firms received more than their Canadian-controlled counterparts only in the primary industries.

FEDERAL FUNDING OF INTRAMURAL R&D IN 1977
(DISTRIBUTION BY OWNERSHIP)

(PERCENTAGES)

	CANADIAN	FOREIGN	TOTAL
PRIMARY	33	67	100
MANUFACTURING	54	46	100
SERVICES (a)	90+	-	100
TOTAL	59	41	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, MORE PRECISE
ESTIMATES ARE NOT AVAILABLE.

Table 8.5--Distribution of Federal Funds, By Industry Group

Within manufacturing, federal funds are divided evenly between Canadian- and foreign-controlled firms in three industry groups: electrical products, chemical, and transportation equipment (Table 8.6 and Appendix Table H4). Canadian-controlled firms claimed almost 70% of federal funds in other manufacturing while in the metals groups, federal funding of foreign-controlled firms' R&D is relatively small. Machinery is the only industry group where a significantly high proportion of federal funds goes to foreign-controlled firms.

FEDERAL FUNDING OF INTRAMURAL R&D IN 1977
(DISTRIBUTION BY OWNERSHIP)

(PERCENTAGES)

	CANADIAN	FOREIGN	TOTAL
METALS (a)	95+	-	100
MACHINERY (a)	38	75	100
ELECT PROD	48	52	100
CHEMICAL	50	50	100
TRANSP EQUIP	52	48	100
OTHER	69	31	100
TOTAL	54	47	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, MORE PRECISE
ESTIMATES ARE NOT AVAILABLE.

Table 8.6--Distribution of Federal Funds, By Manufacturing
Industries

Federal funding of R&D does not vary significantly between Canadian- and foreign-controlled firms in each industry group (Table 8.7). In total, federal funding accounts for 11.9% of Canadian-controlled firms' R&D and 11.1% of foreign-controlled firms' R&D.

FEDERAL FUNDING AS % OF INTRAMURAL R&D IN 1977
(BY OWNERSHIP AND BY INDUSTRY GROUP)

(PERCENTAGES)

	CANADIAN	FOREIGN	TOTAL
PRIMARY	6.7	4.9	5.4
MANUFACTURING	12.9	12.3	12.4
SERVICES	10.0	a	10.0
TOTAL	11.9	11.1	11.6

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, NO ESTIMATES
ARE AVAILABLE FOR THIS ITEM.

Table 8.7--Federal Funding as % of Intramural R&D, By
Ownership and By Industry Group

At the total manufacturing level, federal R&D funds play a slightly more important role in Canadian-controlled firms than those which are foreign-controlled (12.9% as compared to 12.3%). However, these statistical averages can be very misleading because the importance of federal R&D funds to Canadian- and foreign-controlled firms varies considerably within each industry group (Table 8.8). For example, in the electrical products industry, federal funds account for almost one-quarter of foreign-controlled firms' R&D as compared to 10% for Canadian-controlled firms. In the transportation equipment industry, federal funding is significant for both groups of firms. In all other industry groups, federal support of R&D is higher for Canadian-controlled firms.

FEDERAL FUNDING AS % OF INTRAMURAL R&D IN 1977
(BY OWNERSHIP AND BY MANUFACTURING INDUSTRIES)

(PERCENTAGES)

	CANADIAN	FOREIGN	TOTAL
METALS	6.3	a	5.6
MACHINERY	a	a	12.7
ELECT PROD	9.8	23.6	14.0
CHEMICAL	10.0	3.6	5.2
TRANSP EQUIP	21.2	31.0	25.0
OTHER	17.0	3.9	8.4
TOTAL	12.9	12.3	12.4

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, NO ESTIMATES
ARE AVAILABLE FOR THIS ITEM.

Table 8.8--Federal Funding as % of Intramural R&D, By
Ownership and By Manufacturing Industries

FEDERAL FUNDING OF R&D BY FIRM SIZE AND OWNERSHIP

At the total economy level, federal support is most important for small Canadian-controlled firms with 18.7% of their R&D funds coming from federal sources (Table 8.9). In manufacturing industries, federal support of small Canadian-controlled firms is even greater with federal funds accounting for almost one-quarter of their R&D expenditures.

In primary industries, estimates are only available for large firms and federal funding is more important for the Canadian-controlled group. In services, estimates are limited to Canadian-controlled firms, with the level of federal R&D support being higher for small firms.

FEDERAL FUNDING AS % OF INTRAMURAL R&D IN 1977
(BY FIRM SIZE AND BY OWNERSHIP)

(PERCENTAGES)

		PRIMARY MANUFACTURING	SERVICES	TOTAL	
SMALL	CDN	a	24.0	15.7	18.7
	FOR	a	14.8	a	11.4
	SUBT	a	19.2	15.8	16.9
LARGE	CDN	10.0	11.0	5.8	10.0
	FOR	5.1	12.0	a	11.1
	SUBT	6.1	11.5	5.6	10.5
TOTAL	CDN	6.7	12.9	10.0	11.9
	FOR	4.9	12.3	a	11.1
	SUBT	5.4	12.4	10.0	11.6

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, NO ESTIMATES
ARE AVAILABLE FOR THIS ITEM.

Table 8.9--Federal Funding as % of Intramural R&D, By
Structural Characteristics and By Industry Group

Data constraints severely limit comparisons of federal R&D funding by firm size and ownership within each manufacturing industry group (Table 8.10). For example, in the small firms category, electrical products is the only industry group where sufficiently reliable estimates are available covering both Canadian- and foreign-controlled firms.

In the large firms category, the importance of federal R&D funding would appear to follow no strict pattern when firms are classified on the basis of ownership. In the transportation equipment industry, both Canadian- and foreign-controlled firms benefit from high levels of federal R&D funding. Elsewhere, federal R&D funding is most important for foreign-controlled firms in electrical products and for Canadian-controlled firms in machinery.

FEDERAL FUNDING AS % OF INTRAMURAL R&D IN 1977
(BY FIRM SIZE AND BY OWNERSHIP)

(PERCENTAGES)

		METALS	MACH	ELECT PROD	CHEM	TRANSP EQUIP	OTHER	TOTAL
SMALL	CDN	a	a	26.7	20.0	a	25.0	24.0
	FOR	a	a	25.0	a	a	a	14.8
	SUBT	a	11.8	26.1	12.5	a	20.8	19.2
LARGE	CDN	6.6	20.0	7.4	6.3	21.9	12.5	11.0
	FOR	a	11.4	23.4	3.8	31.0	4.0	12.0
	SUBT	6.0	13.3	12.2	4.4	25.5	5.3	11.5
TOTAL	CDN	6.3	a	9.8	10.0	21.2	17.0	12.9
	FOR	a	a	23.6	3.6	31.0	3.9	12.3
	SUBT	5.6	12.7	14.0	5.2	25.0	8.4	12.4

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE, FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, NO ESTIMATES ARE AVAILABLE FOR THIS ITEM.

Table 8.10--Federal Funding as % of Intramural R&D, By Structural Characteristics and By Manufacturing Industries

APPENDIX H

FEDERAL FUNDING OF INTRAMURAL R&D IN 1977
(DISTRIBUTION BY INDUSTRY GROUP)

(PERCENTAGES)

	SMALL (a)	LARGE	TOTAL
PRIMARY	-	4	3
MANUFACTURING	60+	90	84
SERVICES	38	5	13
TOTAL	100	100	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, MORE PRECISE
ESTIMATES ARE NOT AVAILABLE.

FEDERAL FUNDING OF INTRAMURAL R&D IN 1977
(DISTRIBUTION BY MANUFACTURING INDUSTRIES)

(PERCENTAGES)

	SMALL (a)	LARGE	TOTAL
METALS	-	6	5
MACHINERY	-	9	10
ELECT PROD	40+	29	31
CHEMICAL	-	5	5
TRANSP EQUIP	-	41	33
OTHER	33+	11	16
TOTAL	100	100	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, MORE PRECISE
ESTIMATES ARE NOT AVAILABLE.

FEDERAL FUNDING OF INTRAMURAL R&D IN 1977
(DISTRIBUTION BY INDUSTRY GROUP)

(PERCENTAGES)

	CANADIAN	FOREIGN (a)	TOTAL
PRIMARY	2	-	3
MANUFACTURING	77	95	84
SERVICES	21	-	13
TOTAL	100	100	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, MORE PRECISE
ESTIMATES ARE NOT AVAILABLE.

FEDERAL FUNDING OF INTRAMURAL R&D IN 1977
(DISTRIBUTION BY MANUFACTURING INDUSTRIES)

(PERCENTAGES)

	CANADIAN	FOREIGN (a)	TOTAL
METALS	9	-	5
MACHINERY	7	16	10
ELECT PROD	27	34	31
CHEMICAL	5	-	5
TRANSP EQUIP	32	34	33
OTHER	20	11	16
TOTAL	100	100	100

SOURCE: BASED ON DATA FROM SCIENCE STATISTICS CENTRE,
FEBRUARY 1980

(a) DUE TO ROUNDING AND CONFIDENTIALITY, MORE PRECISE
ESTIMATES ARE NOT AVAILABLE.

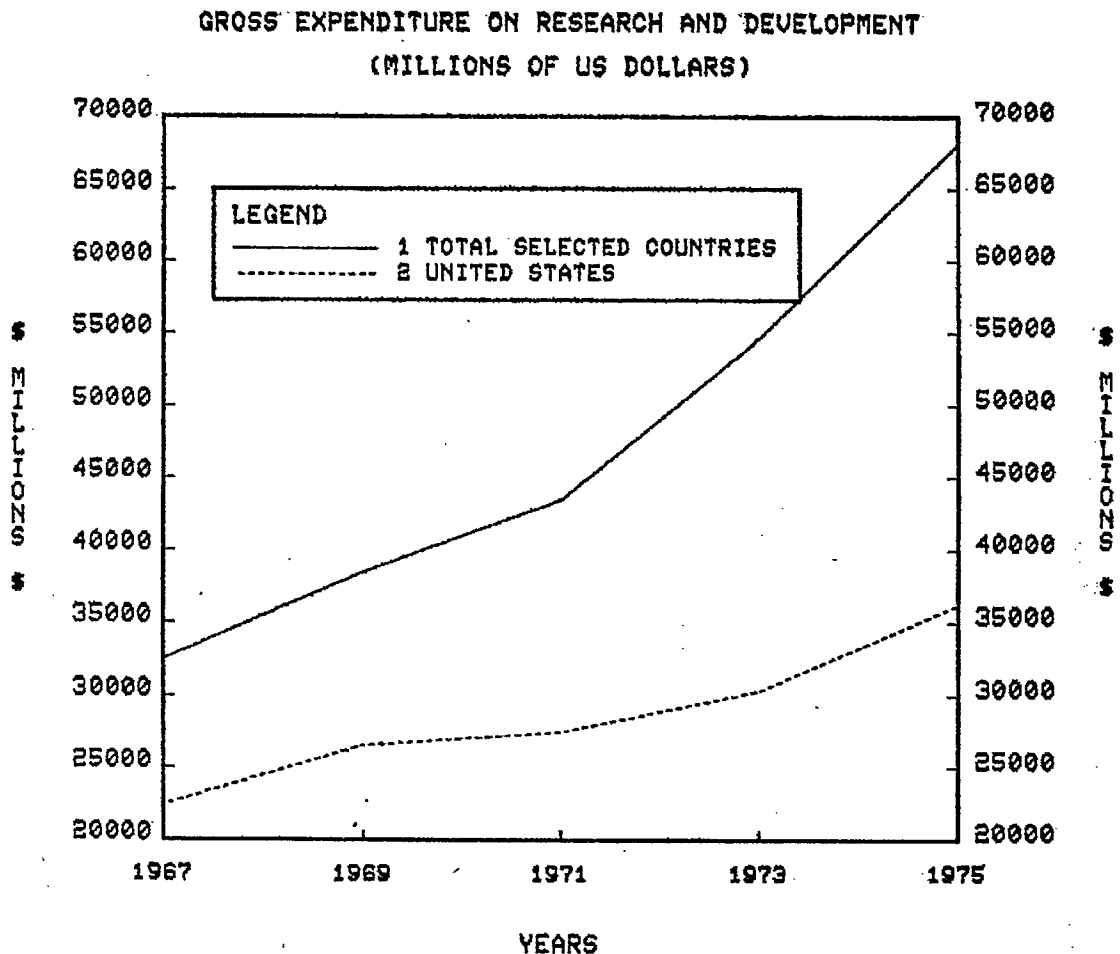
SECTION 9

SECTION 9

The purpose of Section 9 is to compare Canada's R&D activities with that of selected OECD member countries. The performance and funding of R&D by sector are presented. In addition, each country's employment of research scientists and engineers is examined.

GROSS EXPENDITURE ON R&D IN OECD COUNTRIES

In this section, attention focusses on a selected group of countries which together account for over 90% of R&D reported by OECD member countries (Appendix Table II). Between 1967 and 1975, R&D performed by these countries more than doubled in current dollar terms. The United States consistently had the highest R&D expenditure among the nine selected countries. However, the share of R&D performed by the other countries has grown since 1967, as shown by the widening gap between total selected countries and the United States in Figure 9.1. This trend is primarily due to increased R&D activities in both Germany and Japan.



SOURCE : BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1975", OECD

Figure 9.1--R&D Expenditures of Selected OECD Member Countries

GERD as a percentage of GDP (Gross Domestic Product) indicates the proportion of an economy's resources which is devoted to R&D activities. Although the ratio is declining, the United States has devoted the highest percentage of its GDP to research and development. Only four countries (Denmark, Germany, Japan, and Sweden) show upward trends in the GERD to GDP ratio. Canada and the remaining countries have been diverting an increasingly smaller percentage of GDP to R&D activities. Between 1967 and 1975, Canadian R&D declined from 1.33% to 1.04% of GDP (Table 9.1).

GERD AS % OF GDP
(PERCENTAGES)

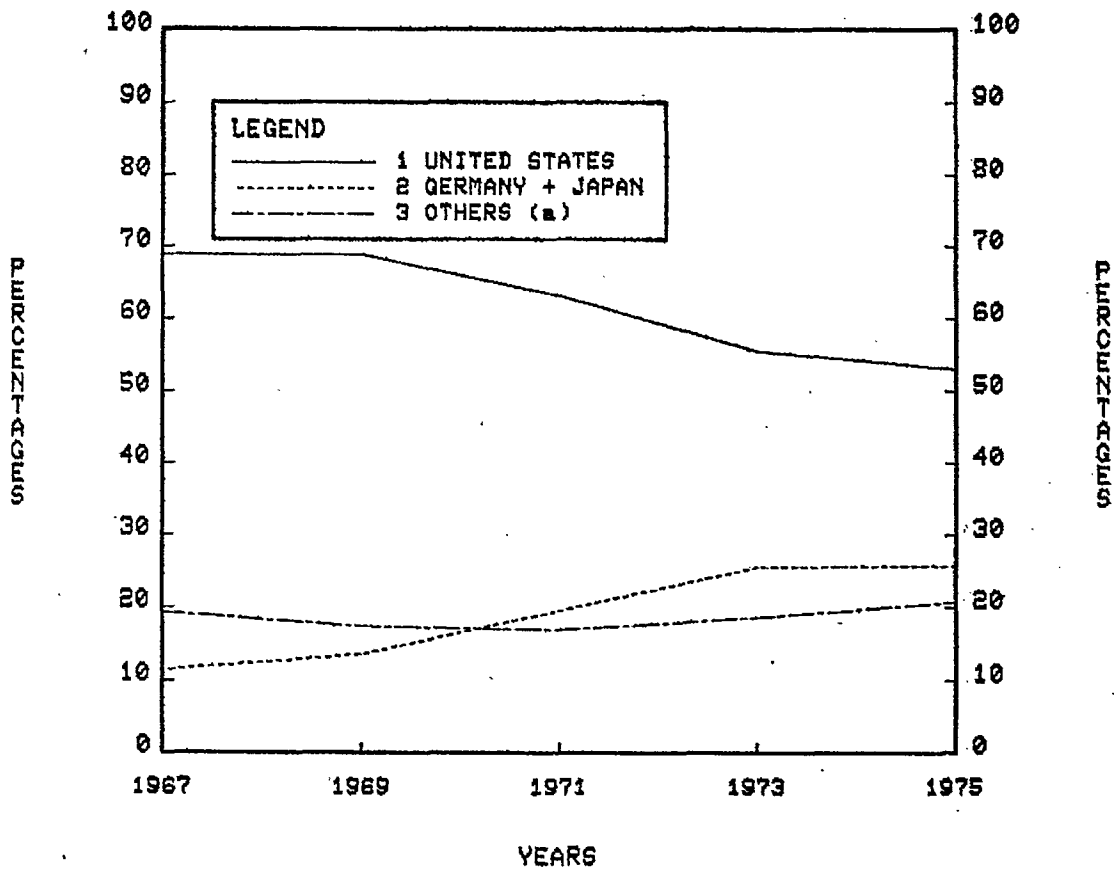
	1967	1969	1971	1973	1975
CANADA	1.33	1.32	1.22	1.08	1.04
DENMARK	0.75	1.01	0.82	0.95	1.08
FRANCE	2.19	1.98	1.83	1.74	1.77
GERMANY	1.69	1.75	2.07	1.98	2.11
JAPAN	1.37	1.51	1.66	1.75	1.76
NORWAY	0.97	1.00	0.90	0.97	0.95
SWEDEN	1.30	1.24	1.49	1.64	1.79
UNITED KINGDOM	2.35	2.20	1.90	1.81	2.08
UNITED STATES	2.82	2.85	2.59	2.44	2.38
TOTAL SELECTED COUNTRIES	2.38	2.36	2.20	2.06	2.06

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1975", OECD

Table 9.1--GERD as % of GDP

Among the nine selected countries, the United States performs over 50% of total R&D, although its share declined from 69% in 1967 to 53% in 1975. Over the same period, the combined R&D expenditures of Germany and Japan have increased from 12% to 26%. The share of the remaining countries, including Canada with 2.5%, has remained unchanged, accounting for about 20% of R&D (Figure 9.2 and Appendix Table I2).

GROSS EXPENDITURE ON RESEARCH AND DEVELOPMENT
(PERCENTAGES)



SOURCE : BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1975", OECD

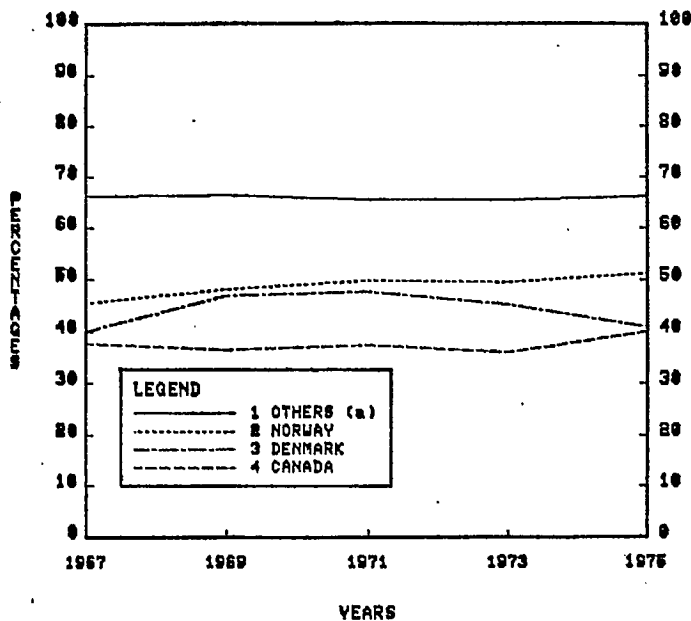
a . INCLUDES CANADA, DENMARK, FRANCE, NORWAY, SWEDEN, AND UNITED KINGDOM

Figure 9.2--Performance of R&D By Country

The R&D performed by the industry and government sectors has generally accounted for 70% or more of total R&D expenditures in all countries (Appendix Table I3). In terms of industry-performed R&D, Norway, Denmark, and Canada stand in sharp contrast to the six other selected countries (Figure 9.3). The industry sector has performed between 40% and 50% of total R&D in Norway and Denmark and less than 40% in Canada. In France, the share of industrial R&D has grown from 54% to 61% while in the five remaining countries, it has been well above 60%.

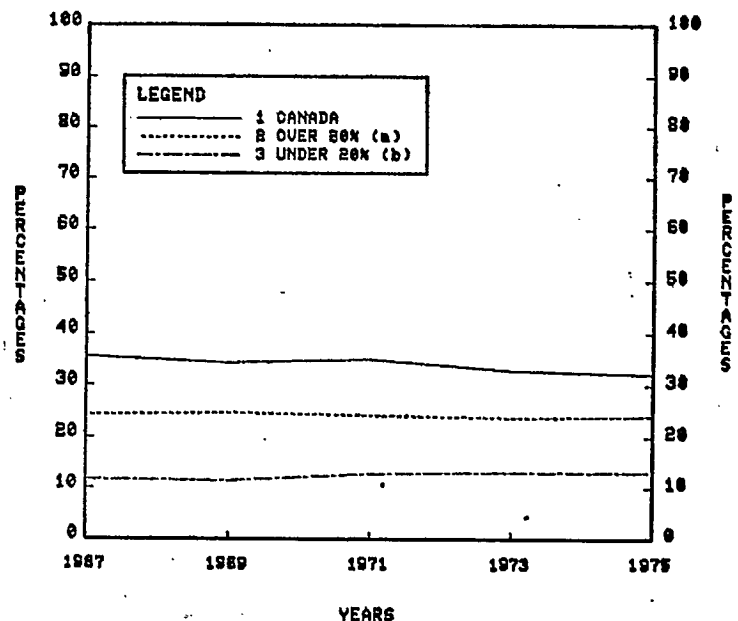
The share of government-performed R&D has consistently been highest in Canada, accounting for about one-third of total R&D and has tended to exceed 20% in four other countries (Denmark, France, Norway, and the United Kingdom). In Germany, Japan, Sweden, and the United States, meanwhile, the share of government-performed R&D has remained below 20%.

**R&D PERFORMED BY INDUSTRY SECTOR
(PERCENTAGE OF GERD)**



a . AVERAGE FOR FRANCE, GERMANY, JAPAN, SWEDEN, UNITED KINGDOM, AND UNITED STATES

**R&D PERFORMED BY GOVERNMENT SECTOR
(PERCENTAGE OF GERD)**



a . AVERAGE FOR DENMARK, FRANCE, NORWAY, AND UNITED KINGDOM
b . AVERAGE FOR GERMANY, JAPAN, SWEDEN, AND UNITED STATES

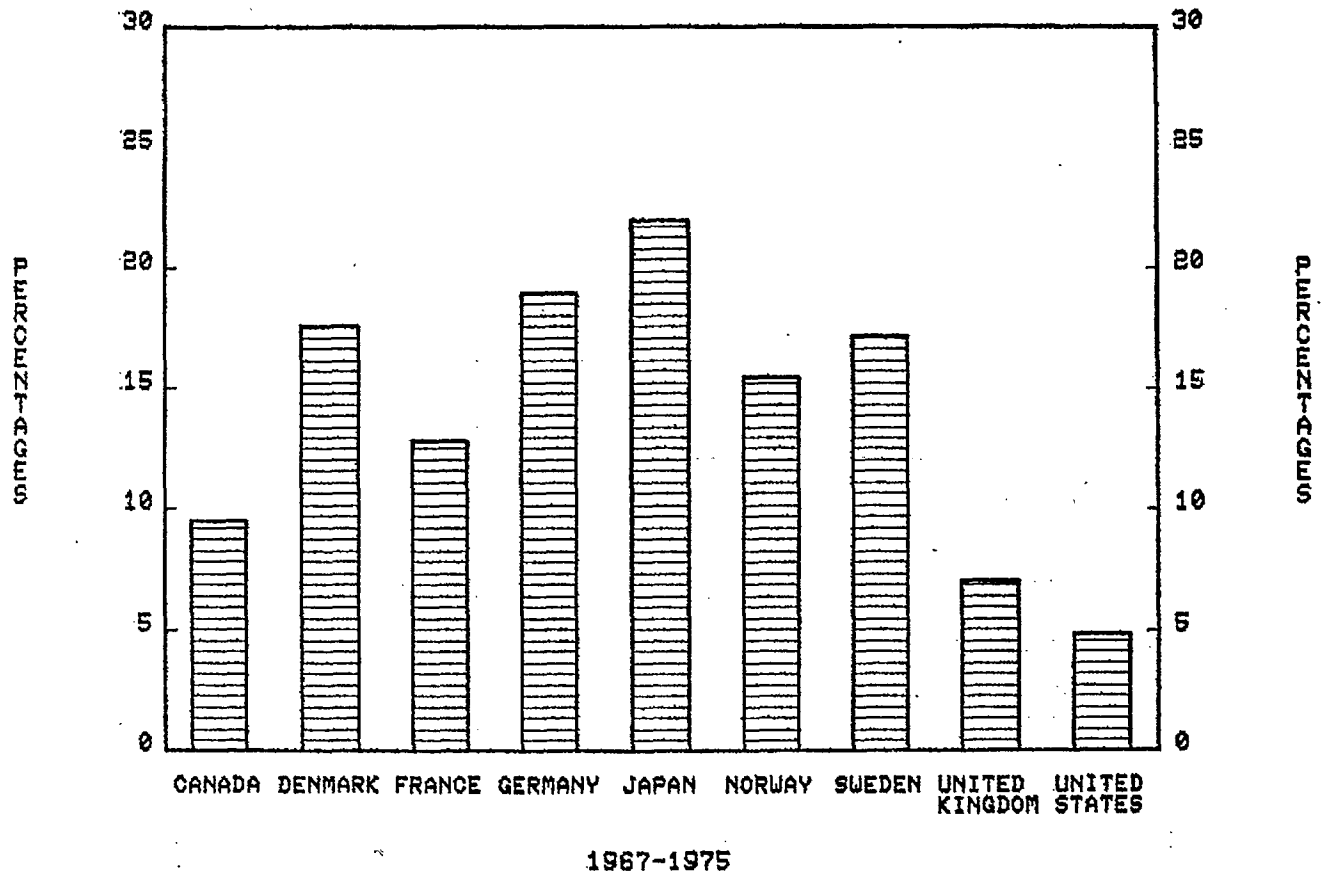
SOURCE : BASED ON DATA FROM 'INTERNATIONAL STATISTICAL YEARS 1967-1975', OECD

Figure 9.3--Performance of R&D By Industry and Government Sectors

INDUSTRIAL R&D IN OECD COUNTRIES

Between 1967 and 1975, the industry sectors in Japan and Germany were the leading performers of R&D, with average annual growth rates of 21.9% and 18.9%, respectively. Three countries recorded average annual growth rates of less than 10%: Canada (9.6%), United Kingdom (7.1%), and United States (4.9%). The average growth rates of the remaining four countries varied between 15% and 17% (Figure 9.4 and Appendix Table I4).

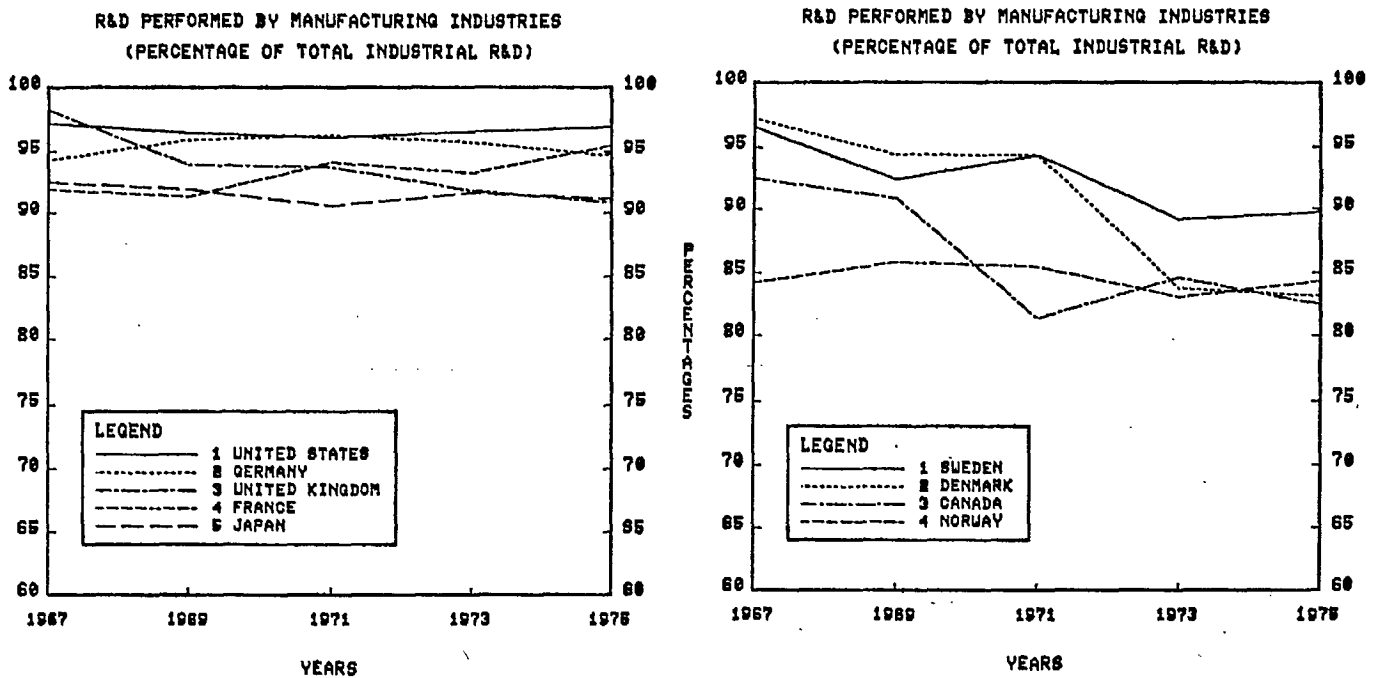
**GERD PERFORMED BY INDUSTRY SECTOR
(AVERAGE ANNUAL GROWTH RATES)**



SOURCE : BASED ON DATA FROM 'INTERNATIONAL STATISTICAL YEARS 1967-1975', OECD

Figure 9.4--Growth of Industrial R&D

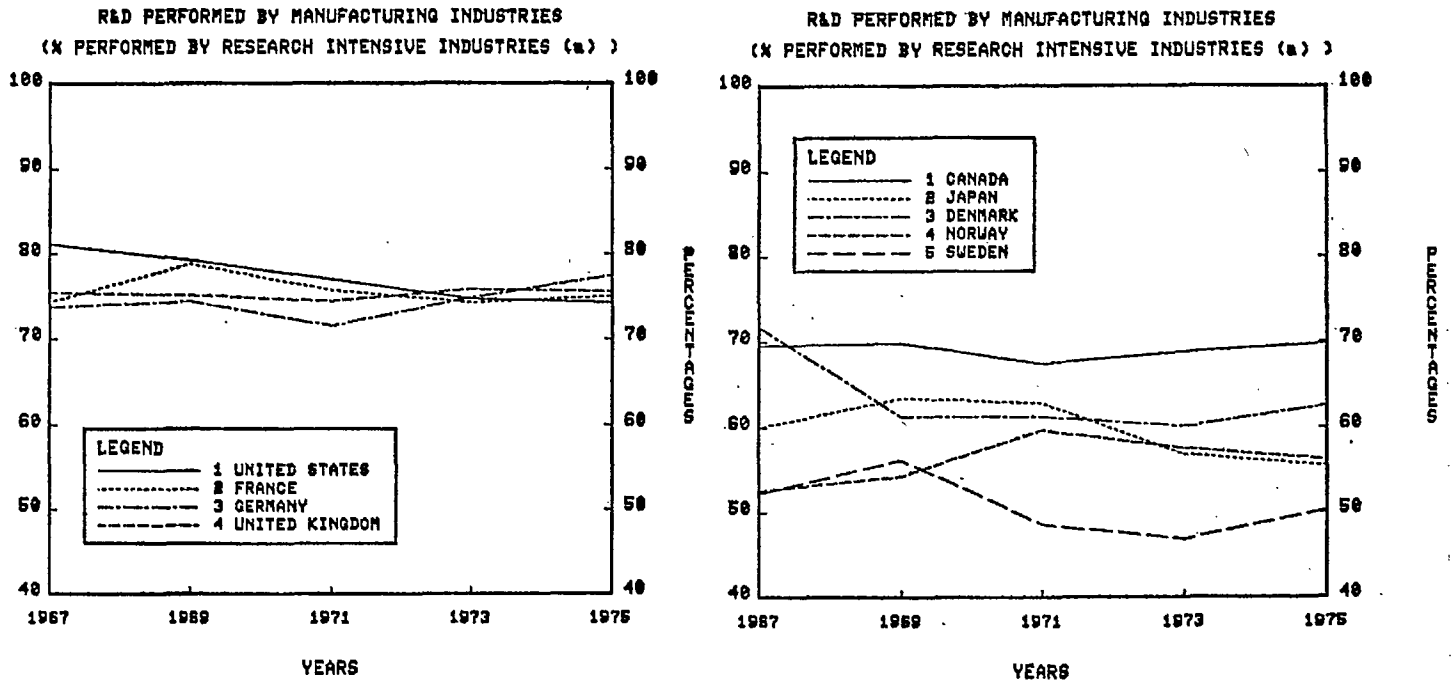
In 1967, over 90% of industrial R&D was performed by manufacturing industries in all countries (Appendix Table I5). Since then, only France has shown significant increases in the share of R&D performed in manufacturing industries (Figure 9.5). Canadian manufacturing, in particular, has experienced significant declines in the proportion of R&D performed. Although the differences are small, manufacturing's share of R&D is generally less in the four smaller countries and correspondingly greater in the five larger ones.



SOURCE : BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1978", OECD

Figure 9.5--Performance of R&D by Manufacturing Industries

In Section 6, manufacturing industries were classified according to research intensity. The research intensive industries include aircraft & parts, machinery, electrical products, pharmaceuticals, petroleum, and other chemicals. In this section, R&D activity of corresponding industries in the OECD countries are examined (Appendix Table I6). In four countries (the United States, France, Germany, and the United Kingdom), well over 70% of manufacturing R&D is performed by the research intensive industries. These same industries perform about 70% of manufacturing R&D in Canada but their share is significantly less in Japan, Denmark, Norway, and Sweden (Figure 9.6).



SOURCE : BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1975", OECD

a . RESEARCH INTENSIVE INDUSTRIES INCLUDE AIRCRAFT & PARTS, MACHINERY, ELECTRICAL PRODUCTS, PHARMACEUTICALS, PETROLEUM, AND OTHER CHEMICALS

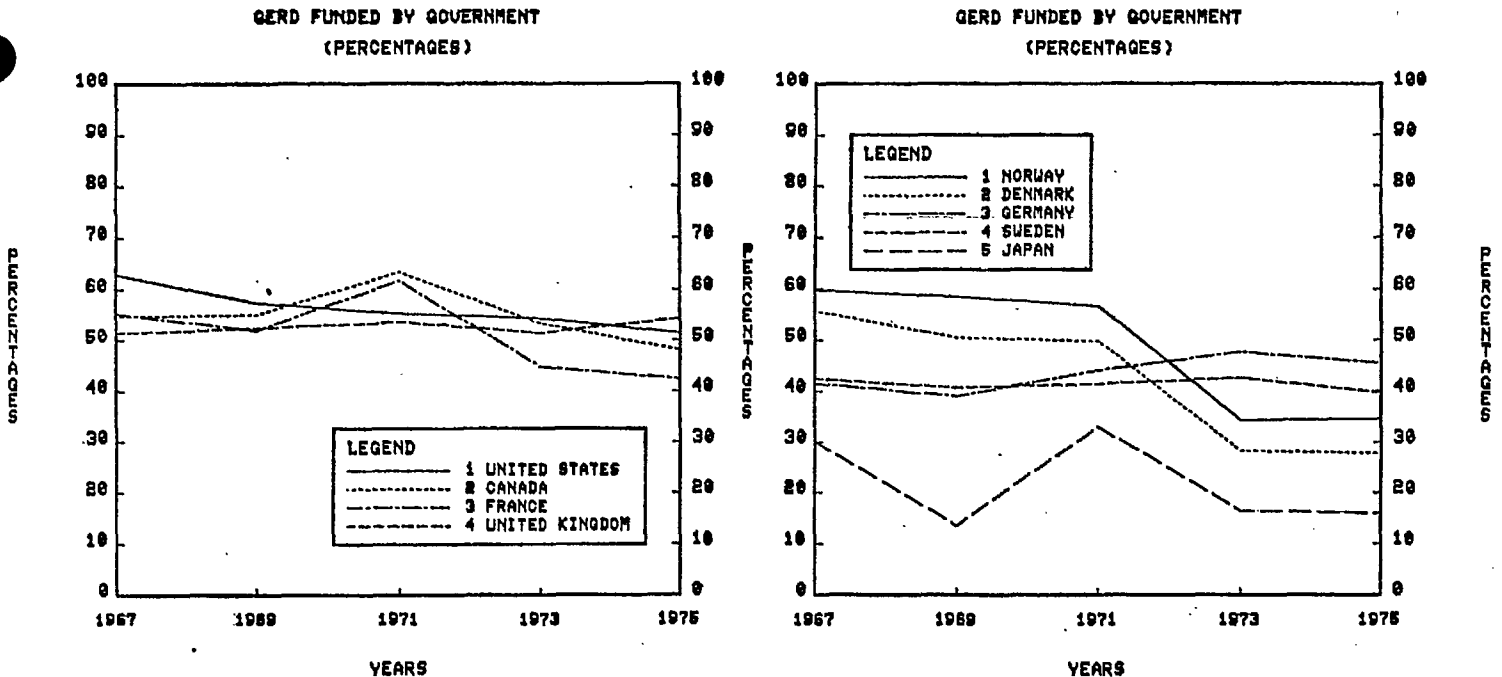
Figure 9.6--Performance of R&D by Research Intensive Industries

FUNDING OF GERD AND INDUSTRIAL R&D IN OECD COUNTRIES

The bulk of funds for each country's GERD originate from national sources. Foreign funding is most noticeable in France and the United Kingdom but still account for only 3% to 5% of all R&D funds (Appendix Table I7). In Canada, foreign funds account for less than 3% of R&D funds.

In terms of national sources of R&D funds, the government has accounted for over 50% of GERD in the United States, Canada, France, and the United Kingdom. Except for the United Kingdom, the share of government funding has declined since 1967 (Figure 9.7 and Appendix Table I8). Government funding in Germany and Sweden fluctuated between 40% and 50% while in Norway, Denmark, and Japan it showed a marked decline.

The trends of funds provided by the industry sector and by other national sources are available in Appendix Tables I9 and I10.



SOURCE : BASED ON DATA FROM 'INTERNATIONAL STATISTICAL YEARS 1967-1975', OECD

Figure 9.7--GERD Funded by Government Sector

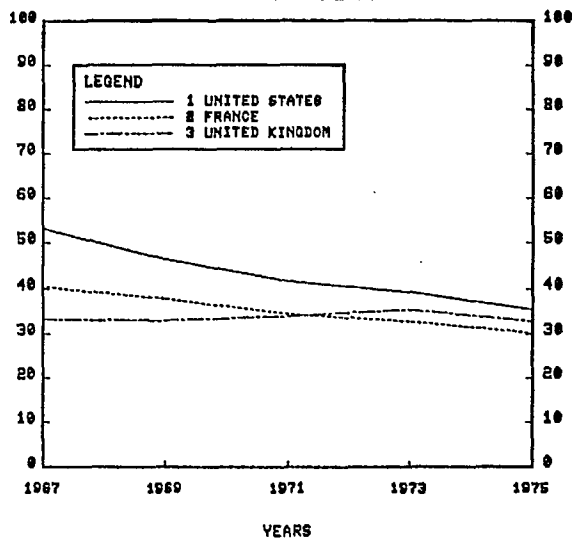
Foreign funding of industrial R&D is also minor in all selected countries. Only Canada, France, and the United Kingdom report over 5% of funds originating from foreign sources (Appendix Table I11).

With respect to national funds, the selected countries can be divided into three distinct groups. In the United States, France, and United Kingdom, the government finances over 30% of industrial R&D (Appendix Table I12). However, both the United States and France showed significant declines in government support of industrial R&D between 1967 and 1975 (Figure 9.8). Government funding varies between 10% and 20% of industrial R&D in Norway, Germany, Sweden, and Canada, while in Japan and Denmark government funds are barely noticeable.

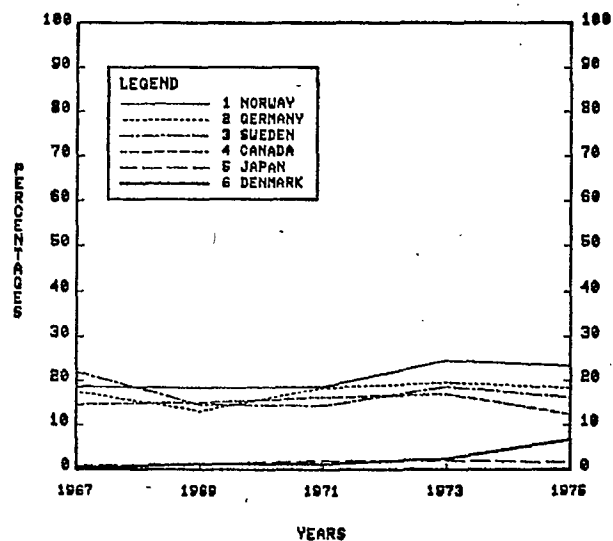
It should be noted that OECD information on government R&D funding reflects only direct grants and subsidies. Other methods of government support including such measures as preferential tax rates, R&D tax credits and deductions, special depreciation allowances, low interest loans and loan guarantees, co-operative research ventures, and free access to government research facilities and equipment are not taken into account.

The trends of R&D funding by the industry sector and by other national sources are available in Appendix Tables I13 and I14.

INDUSTRIAL R&D FUNDED BY GOVERNMENT (PERCENTAGES)



INDUSTRIAL R&D FUNDED BY GOVERNMENT (PERCENTAGES)



SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1975", OECD

Figure 9.8--Industrial R&D Funded by Government Sector

Table 9.2 shows government funds as a percentage of R&D expenditures for selected industries. The extent of government support varies a great deal across all selected countries. However, Japan does stand out in that a very small share of its R&D is financed by the government, regardless of the industry. In comparing different industries, government funds account for a significantly higher proportion of R&D in the aerospace industry across all countries.

GOVERNMENT FUNDS AS SHARE OF R&D IN 1975

	AEROSPACE		ELECTRICAL ELECTRONIC		MACHINERY		CHEMICAL		BASIC METALS	
	%	RANK	%	RANK	%	RANK	%	RANK	%	RANK
CANADA	45.0	5	12.6	6	14.0	3	5.1	3	3.7	6
DENMARK	0.0	0	4.0	8	2.9	8	1.3	7	0.0	0
FRANCE	66.3	3	29.7	3	6.7	7	3.3	4	4.8	5
GERMANY	58.4	4	14.0	5	20.1	2	1.0	8	9.8	2
JAPAN	a	a	2.2	9	1.4	9	0.3	9	0.8	8
NORWAY	0.0	0	15.3	7	35.1	1	7.5	2	10.8	1
SWEDEN	a	a	6.4	4	10.1	4	1.6	6	6.4	3
U.K.	82.2	1	44.3	1	8.2	6	3.1	5	2.2	7
U.S.	77.6	2	38.1	2	8.8	5	8.7	1	6.1	4

SOURCE: BASED ON DATA FROM OECD NEWSLETTER, NO.4, SPRING 1979

(a) NO ESTIMATES AVAILABLE

Table 9.2--Government Funding of Industrial R&D

The distribution of government R&D funds in manufacturing follows a similar pattern across all selected countries. Government funds are concentrated in two industries: electrical/electronics and transportation equipment (primarily in aerospace). In France, the United Kingdom, and the United States, over 90% of government funds went to the electrical/electronics and transportation equipment industries. These same industries received over 60% of government R&D expenditures in Germany, Japan, Sweden and Canada.

1975 DISTRIBUTION OF GOVERNMENT R&D FUNDS IN MANUFACTURING
(PERCENTAGES)

	CANADA	DENMARK	FRANCE	GERMANY	JAPAN	NORWAY (1974)	SWEDEN	UNITED KINGDOM	UNITED STATES
ELECTRICAL	29.2	29.3	38.6	30.9	32.4	24.9	10.2	34.4	33.7
CHEMICAL	7.3	15.8	2.6	2.3	3.3	8.8	1.0	1.8	2.8
TRANSP. EQUIP.	33.9	6.6	55.4	41.7	49.4	6.5	62.9	60.9	57.8
AEROSPACE	31.9	0.0	54.9	41.0	a	0.0	a	58.7	53.4
OTHER	2.1	6.6	0.5	0.7	a	6.5	a	2.2	4.4
BASIC METALS	4.0	0.0	0.8	2.3	4.4	10.5	4.4	0.2	0.3
MACHINERY	16.2	40.5	1.4	20.7	7.8	32.2	14.7	1.9	2.3
OTHER MFG	9.0	7.7	1.1	2.4	2.6	16.9	6.9	0.5	2.7
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM OECD NEWSLETTER, NO. 4, SPRING 1979

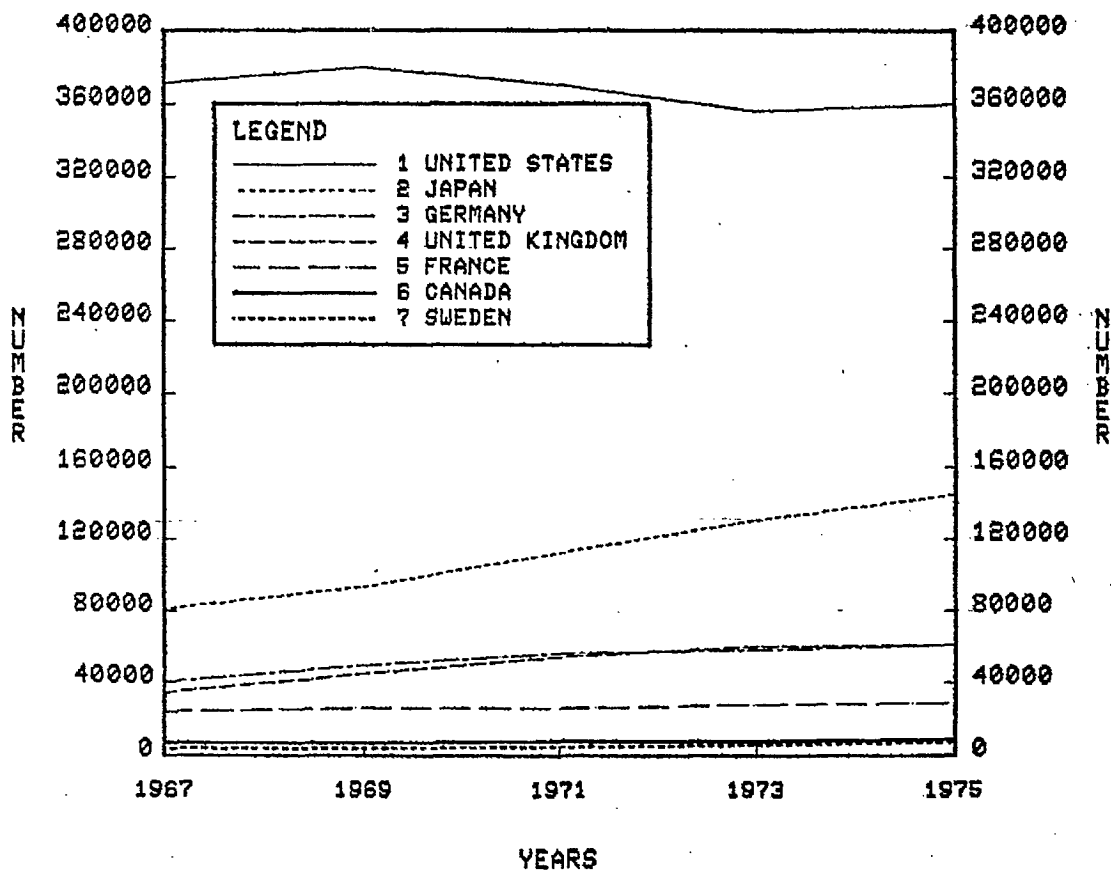
(a) NO ESTIMATES AVAILABLE

Table 9.3--Government R&D Funds in Manufacturing

RESEARCH SCIENTISTS AND ENGINEERS IN OECD COUNTRIES

The number of research scientists and engineers employed in industry is by far the highest in the United States (Figure 9.9). Japan is a distant second but has shown an increasing trend between 1967 and 1975. Canada and Sweden employ the fewest number of research scientists and engineers, about 8,000 to 9,000 in 1975 (Appendix Table I15).

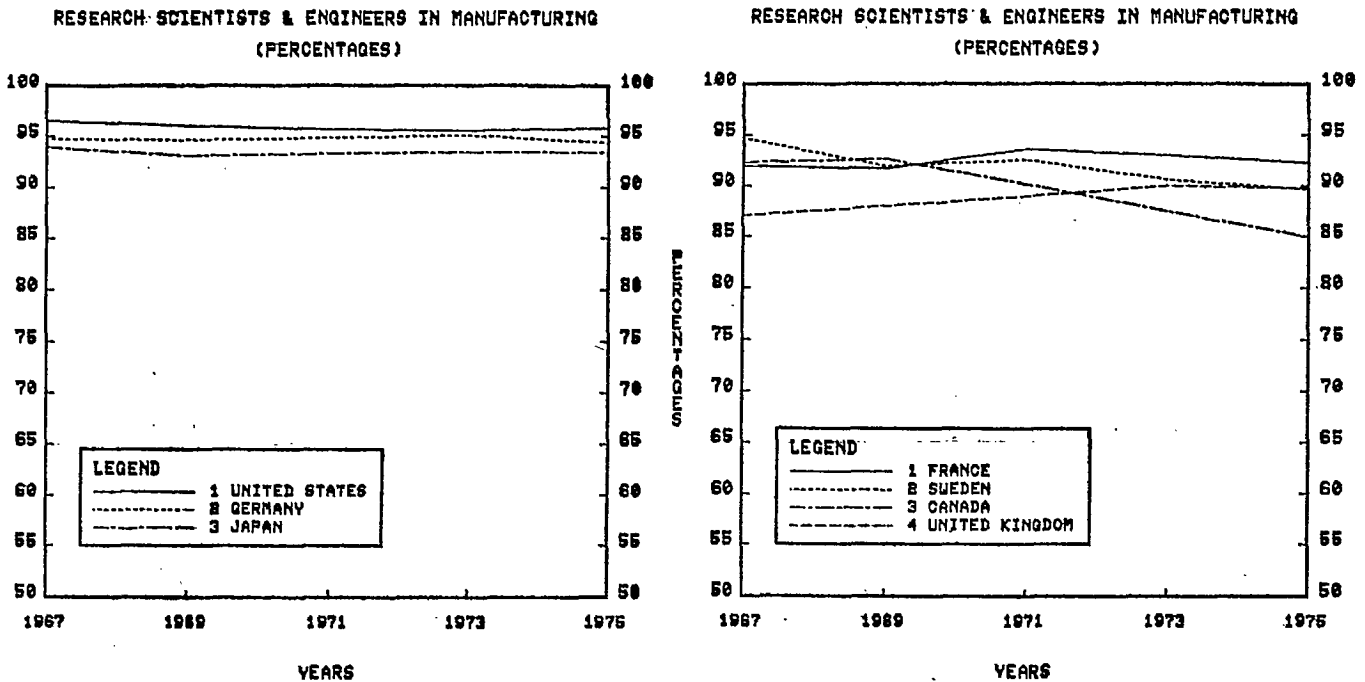
RESEARCH SCIENTISTS & ENGINEERS IN INDUSTRY



SOURCE : BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS
1967-1975", OECD

Figure 9.9--Research Scientists and Engineers Employed in Industry Sector

Between 1967 and 1975, the proportion of research scientists and engineers in manufacturing was well over 90% in the United States, Germany, Japan, and France (Appendix Table I16). In both Sweden and Canada, manufacturing's share of research scientists and engineers has fallen while the United Kingdom has recorded an increase (Figure 9.10).



SOURCE : BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1975", OECD

Figure 9.10--Research Scientists and Engineers Employed in Manufacturing Industries

The ratio of research scientists and engineers to the total employed in manufacturing has shown significant increases in four countries: Germany, Japan, Sweden, and the United Kingdom. Research scientists and engineers make up between 0.3% and 0.4% of total manufacturing employment in Canada and France while the ratio in the United States is about 1.8% (Table 9.4).

SCIENTISTS & ENGINEERS AS % OF TOTAL EMPLOYED IN MANUFACTURING
(PERCENTAGES)

	1967	1969	1971	1973	1975
CANADA	0.39	0.38	0.39	0.35	0.40
DENMARK	a	a	a	a	a
FRANCE	0.42	0.43	0.43	0.44	0.46
GERMANY	0.40	0.47	0.53	0.59	0.65
JAPAN	0.61	0.65	0.76	0.85	1.01
NORWAY	0.24	a	a	a	a
SWEDEN	0.34	0.33	0.44	0.55	0.64
UNITED KINGDOM	0.36	0.00	0.00	0.69	0.73
UNITED STATES	1.85	1.81	1.91	1.70	1.88

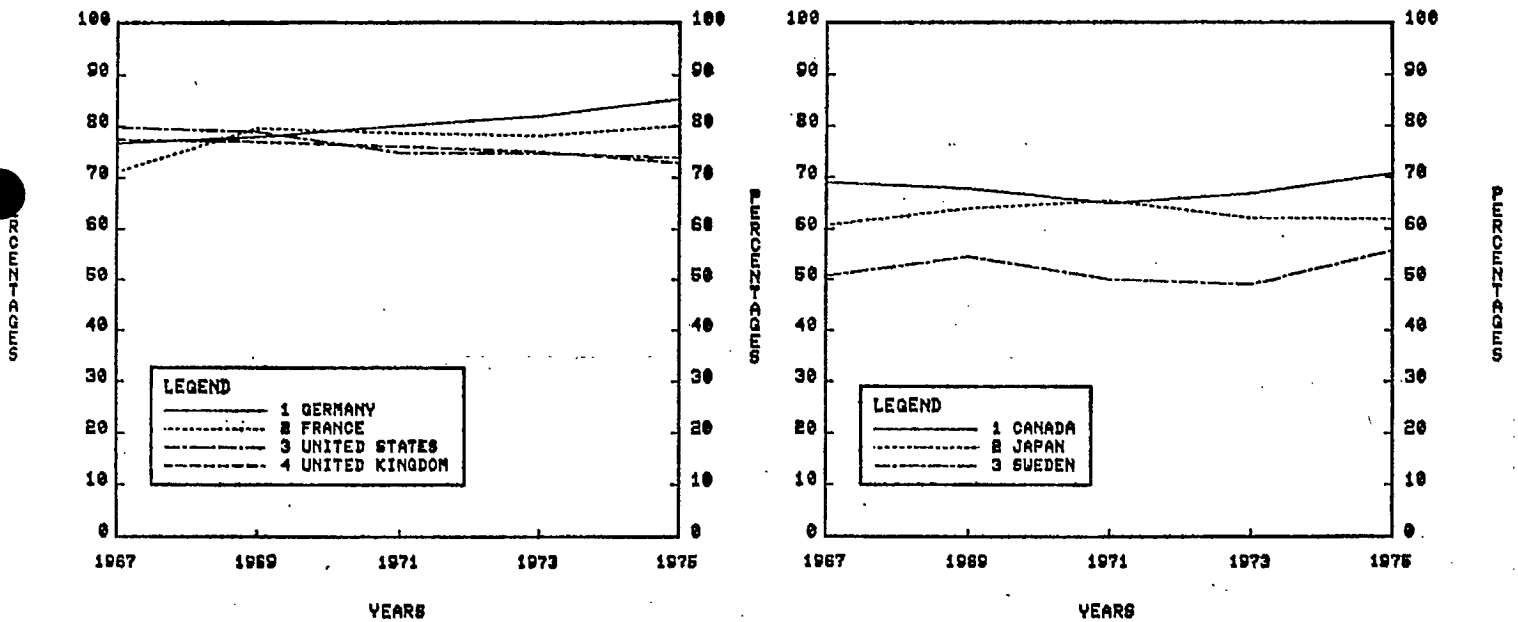
SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1975" AND "LABOUR FORCE STATISTICS 1964-1975", OECD

(a) NO ESTIMATES AVAILABLE

Table 9.4--Research Scientists and Engineers as % of Total Employment in Manufacturing

Over 70% of research scientists and engineers are employed in research intensive manufacturing industries in Germany, France, the United States, and the United Kingdom (Figure 9.11 and Appendix Table II7). In addition, the trend is an increasing one in Germany and France. Research intensive manufacturing industries employed 70% or less of research scientists and engineers in Canada, Japan, and Sweden.

RESEARCH SCIENTISTS & ENGINEERS IN RESEARCH INTENSIVE INDUSTRIES
(PERCENTAGES)



SOURCE : BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1975", OECD

Figure 9.11--Research Scientists and Engineers Employed in Research Intensive Industries

APPENDIX I

GROSS EXPENDITURE ON R&D
(MILLIONS OF US DOLLARS)

	1967	1969	1971	1973	1975
CANADA	828.3	979.2	1,145.4	1,352.4	1,757.6
DENMARK	90.4	145.3	143.2	272.7	398.2
FRANCE	2,506.8	2,678.2	2,920.4	4,353.1	5,985.7
GERMANY	2,084.3	2,652.0	4,499.1	6,806.7	8,846.5
JAPAN	1,684.1	2,592.3	4,041.0	7,223.2	8,766.7
NORWAY	80.7	97.0	111.6	164.0	255.0
SWEDEN	336.1	368.1	538.2	820.3	1,216.0
UNITED KINGDOM	2,480.1	2,439.8	2,596.5	3,264.4	4,647.5
UNITED STATES	22,453.0	26,595.0	27,527.6	30,410.6	36,302.6
TOTAL SELECTED COUNTRIES	32,543.9	38,546.8	43,523.0	54,667.4	68,175.8

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS
1967-1975", OECD

GROSS EXPENDITURE ON R&D
(% PERFORMED BY COUNTRY)

	1967	1969	1971	1973	1975
CANADA	2.5	2.5	2.6	2.5	2.6
DENMARK	0.3	0.4	0.3	0.5	0.6
FRANCE	7.7	6.9	6.7	8.0	8.8
GERMANY	6.4	6.9	10.3	12.5	13.0
JAPAN	5.2	6.7	9.3	13.2	12.9
NORWAY	0.2	0.3	0.3	0.3	0.4
SWEDEN	1.0	1.0	1.2	1.5	1.8
UNITED KINGDOM	7.6	6.3	6.0	6.0	6.8
UNITED STATES	69.0	69.0	63.2	55.6	53.2
TOTAL SELECTED COUNTRIES	100.0	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS
1967-1975", OECD

R&D BY PERFORMING SECTOR (a)
(PERCENTAGES)

		CANADA	DENMARK	FRANCE	GERMANY	JAPAN	NORWAY	SWEDEN	UNITED KINGDOM	UNITED STATES	TOTAL
1967	IND	38	40	54	68	63	45	70	66	69	66
	GOVT	36	21	32	5	13	21	14	23	15	17
	OTHER	27	38	14	27	24	34	16	11	16	17
1969	IND	37	47	56	68	67	48	66	65	69	67
	GOVT	34	26	29	5	12	20	15	25	14	16
	OTHER	29	27	15	27	21	32	19	11	16	17
1971	IND	38	48	56	67	66	50	65	64	67	65
	GOVT	35	25	28	10	14	20	12	24	16	17
	OTHER	27	28	16	22	20	30	23	11	18	18
1973	IND	36	45	59	65	66	50	67	63	66	64
	GOVT	33	25	25	15	13	19	8	26	16	17
	OTHER	31	29	16	20	21	31	25	11	19	19
1975	IND	40	41	61	66	64	51	69	63	67	65
	GOVT	32	26	23	16	13	20	8	27	16	17
	OTHER	28	33	16	18	22	29	23	11	18	18

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1975", OECD

(a) DUE TO ROUNDING, THE THREE SECTORS MAY NOT ADD TO 100%.

GERD PERFORMED BY INDUSTRY SECTOR
(AVERAGE ANNUAL GROWTH RATES)

	67-68	68-69	69-70	70-71	71-72	72-73	73-74	74-75	67-75
CANADA	7.4	6.9	10.1	9.1	6.5	6.1	22.3	18.2	9.6
DENMARK	43.9	30.5	-0.0	-0.0	40.5	28.8	16.3	14.0	17.6
FRANCE	4.7	4.5	5.0	4.7	29.1	22.6	20.4	16.9	12.8
GERMANY	13.6	12.0	33.9	25.3	22.6	18.4	16.8	14.4	18.9
JAPAN	32.9	24.8	27.0	21.2	38.3	27.7	9.3	8.5	21.9
NORWAY	13.7	12.0	9.5	8.7	23.1	18.8	30.3	23.3	15.5
SWEDEN	1.7	1.7	21.7	17.8	29.0	22.5	25.8	20.5	17.2
UNITED KINGDOM	-2.0	-2.1	3.1	3.0	11.6	10.4	20.6	17.1	7.1
UNITED STATES	9.4	8.6	-0.4	-0.4	7.1	6.6	7.8	7.2	4.9
TOTAL SELECTED COUNTRIES	9.6	8.8	4.7	4.5	13.7	12.0	11.3	10.1	8.7

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1975", OECD

R&D PERFORMED BY INDUSTRY GROUP
(PERCENTAGES)

		CANADA	DENMARK	FRANCE	GERMANY	JAPAN	NORWAY	SWEDEN	UNITED KINGDOM	UNITED STATES
1967	MFG	92.6	97.3	91.9	94.3	92.5	84.3	96.6	98.3	97.3
	PRIM	4.1	0.0	0.0	1.5	1.3	4.7	2.0	0.2	0.0
	SERV	3.3	8.4	8.1	4.2	6.2	11.0	1.4	1.4	2.7
	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1969	MFG	90.9	94.4	91.4	96.0	92.0	85.8	92.4	93.9	96.5
	PRIM	2.8	0.4	0.3	1.3	1.1	1.5	2.6	0.7	0.0
	SERV	6.3	5.3	8.3	2.7	6.9	12.7	5.0	5.4	3.5
	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1971	MFG	81.4	94.4	94.1	96.3a	90.6	85.5	94.3	93.7	96.2
	PRIM	4.2	0.4	1.4	1.1a	0.8	1.6	2.0	0.6	0.0
	SERV	14.4	5.3	4.5	2.6a	8.6	12.9	3.7	5.7	3.8
	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1973	MFG	84.6	83.7	93.3	95.7a	91.7	83.1	89.2	91.9	96.6
	PRIM	5.3	0.3	1.3	1.4a	0.7	2.0	2.0	0.9	0.0
	SERV	10.1	16.0	5.4	2.9a	7.6	14.9	8.8	7.2	3.4
	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1975	MFG	82.5	83.2	95.5	94.7a	91.2	84.3	89.8	90.9	97.0
	PRIM	6.0	0.9	1.6	2.1a	0.9	1.4	2.4	1.3	0.0
	SERV	11.5	15.9	5.8	3.3a	7.9	14.3	7.8	7.8	3.0
	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1975", OECD

(a) ESTIMATES

DISTRIBUTION OF R&D BY RESEARCH INTENSITY (a)
(PERCENTAGES)

		CANADA	DENMARK	FRANCE	GERMANY	JAPAN	NORWAY	SWEDEN	UNITED KINGDOM	UNITED STATES
1967	HIGH	69.7	71.8	74.4	73.8	60.1	52.7	52.3	75.5	81.2
	LOW	30.3	21.3	25.6	25.8	39.9	46.8	47.7	23.8	18.8
	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1969	HIGH	70.0	61.3	79.0	74.5	63.5	54.3	56.2	75.3	79.4
	LOW	30.0	38.7	21.0	25.5	36.5	45.7	43.8	24.7	20.6
	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1971	HIGH	67.6	61.3	75.8	71.6b	62.9	59.8	48.7	74.4	77.0
	LOW	32.4	38.7	24.2	22.5b	37.1	40.2	50.5	25.6	23.0
	TOTAL	100.0	100.0	100.0	100.0b	100.0	100.0	100.0	100.0	100.0
1973	HIGH	68.9	60.3	74.4	74.9b	56.9	57.6	46.9	76.0	74.8
	LOW	31.1	36.4	25.6	20.9b	43.1	42.4	53.1	24.0	25.2
	TOTAL	100.0	100.0	100.0	100.0b	100.0	100.0	100.0	100.0	100.0
1975	HIGH	69.9	62.7	75.0	77.5b	55.7	56.3	50.4	75.7	74.4
	LOW	30.0	35.5	25.0	19.0b	44.3	43.7	49.6	24.3	25.6
	TOTAL	100.0	100.0	100.0	100.0b	100.0	100.0	100.0	100.0	100.0

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1975", OECD

(a) HIGH RESEARCH INTENSIVE INDUSTRIES INCLUDE AIRCRAFT & PARTS, MACHINERY, ELECTRICAL PRODUCTS, PHARMACEUTICALS, PETROLEUM, AND OTHER CHEMICALS.

(b) ESTIMATES

GERD FUNDED BY FOREIGN SOURCES
(PERCENTAGES)

	1967	1969	1971	1973	1975
CANADA	2.8	2.3	2.5	2.8	2.9
DENMARK	0.6	0.5	0.5	0.7	0.0
FRANCE	3.3	4.1	3.6	3.5	5.3
GERMANY	0.5	0.3	0.9	1.2	2.3
JAPAN	0.1	0.1	0.1	0.1	0.1
NORWAY	3.3	1.4	1.5	1.5	2.4
SWEDEN	1.0	1.4	1.0	1.3	1.7
UNITED KINGDOM	3.9	3.6	3.6	5.4	4.9
UNITED STATES	0.0	0.0	0.0	0.0	0.0

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS
1967-1975", OECD

GERD FUNDED BY GOVERNMENT
(PERCENTAGES)

	1967	1969	1971	1973	1975
CANADA	54.9	55.2	63.5	53.5	48.3
DENMARK	55.8	50.5	49.8	28.5	28.0
FRANCE	55.3	52.0	61.7	44.8	42.4
GERMANY	41.5	39.2	44.1	47.7	45.7
JAPAN	30.2	13.7	33.1	16.5	16.2
NORWAY	59.9	58.7	56.8	34.5	34.5
SWEDEN	42.5	40.8	41.6	42.8	39.8
UNITED KINGDOM	51.6	52.5	53.6	51.5	54.3
UNITED STATES	62.9	57.6	55.2	54.3	51.5

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS
1967-1975", OECD

GERD FUNDED BY INDUSTRY
(PERCENTAGES)

	1967	1969	1971	1973	1975
CANADA	31.9	30.7	30.9	28.3	33.7
DENMARK	40.2	46.7	47.4	45.0	45.0
FRANCE	32.6	34.1	37.1	40.5	42.1
GERMANY	57.8	60.2	55.4	52.0	54.1
JAPAN	62.9	67.6	66.4	66.4	65.0
NORWAY	38.8	40.1	42.0	38.4	40.5
SWEDEN	55.6	57.6	56.4	55.0	58.0
UNITED KINGDOM	44.8	45.1	44.3	46.1	42.9
UNITED STATES	32.8	37.6	39.3	42.4	43.5

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS
1967-1975", OECD

GERD FUNDED BY OTHER NATIONAL SOURCES
(PERCENTAGES)

	1967	1969	1971	1973	1975
CANADA	13.2	14.1	5.6	18.2	17.9
DENMARK	4.0	2.8	2.8	26.5	26.0
FRANCE	12.1	13.9	1.1	14.7	15.5
GERMANY	0.7	0.5	0.5	0.3	0.2
JAPAN	6.9	18.6	0.5	17.1	18.9
NORWAY	1.3	1.2	1.2	27.1	25.0
SWEDEN	1.9	1.7	2.0	2.2	2.2
UNITED KINGDOM	3.7	2.4	2.1	2.4	2.8
UNITED STATES	4.4	4.7	5.5	3.3	5.0

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS
1967-1975", OECD

INDUSTRIAL R&D FUNDED BY FOREIGN SOURCES
(PERCENTAGES)

	1967	1969	1971	1973	1975
CANADA	5.0	5.0	5.8	7.4	7.0
DENMARK	0.0	0.5	0.5	1.1	1.8
FRANCE	4.3	6.1	5.2	4.7	7.8
GERMANY	0.5	0.3	1.3	1.8	3.2
JAPAN	0.0	0.0	0.1	0.1	0.1
NORWAY	2.3	1.2	1.4	1.4	2.3
SWEDEN	0.2	0.9	0.7	1.4	2.1
UNITED KINGDOM	3.7	4.4	4.7	6.3	6.3
UNITED STATES	0.0	0.0	0.0	0.0	0.0

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS
1967-1975", OECD

INDUSTRIAL R&D FUNDED BY GOVERNMENT
(PERCENTAGES)

	1967	1969	1971	1973	1975
CANADA	14.7	15.2	16.2	17.0	12.4
DENMARK	0.4	1.3	1.3	2.4	6.8
FRANCE	40.5	38.1	34.6	33.0	30.4
GERMANY	17.5	13.2	18.4	19.6	18.5
JAPAN	0.9	1.2	2.0	2.0	1.7
NORWAY	18.6	18.4	18.6	24.6	23.5
SWEDEN	22.1	14.5	14.4	18.8	16.2
UNITED KINGDOM	33.4	33.2	34.3	35.5	33.0
UNITED STATES	53.3	46.7	41.9	39.3	35.6

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS
1967-1975", OECD

INDUSTRIAL R&D FUNDED BY INDUSTRY
(PERCENTAGES)

	1967	1969	1971	1973	1975
CANADA	85.3	84.8	83.8	80.6	87.6
DENMARK	99.5	98.7	98.7	97.6	93.2
FRANCE	59.5	61.9	65.1	66.6	69.2
GERMANY	82.3	86.7	81.4	80.3	81.4
JAPAN	99.0	98.8	98.0	98.0	98.1
NORWAY	81.4	81.6	81.4	75.3	76.5
SWEDEN	77.8	85.2	85.6	81.2	83.7
UNITED KINGDOM	64.5	66.3	65.3	64.5	67.0
UNITED STATES	46.7	53.4	58.1	60.7	64.4

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS
1967-1975", OECD

INDUSTRIAL R&D FUNDED BY OTHER NATIONAL SOURCES
(PERCENTAGES)

	1967	1969	1971	1973	1975
CANADA	0.00	0.00	0.00	2.36	0.00
DENMARK	0.06	0.00	0.00	0.00	0.00
FRANCE	0.02	0.02	0.33	0.40	0.35
GERMANY	0.27	0.07	0.18	0.14	0.09
JAPAN	0.13	0.00	0.00	0.00	0.15
NORWAY	0.00	0.00	0.00	0.11	0.00
SWEDEN	0.11	0.25	0.03	0.04	0.04
UNITED KINGDOM	2.10	0.45	0.49	0.00	0.00
UNITED STATES	0.00	0.00	0.00	0.00	0.00

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS
1967-1975", OECD

NUMBER OF RESEARCH SCIENTISTS & ENGINEERS IN INDUSTRY

	1967	1969	1971	1973	1975
CANADA	7,467	7,469	7,711	7,928	8,985
DENMARK	1,668	a	a	a	a
FRANCE	24,724	26,142	26,288	27,961	29,433
GERMANY	40,770	49,857	56,589	59,039	61,582
JAPAN	81,664	94,060	112,763	130,690	145,216
NORWAY	1,197	a	a	a	a
SWEDEN	4,095	4,054	4,961	6,458	8,093
UNITED KINGDOM	34,733	a	a	60,801	61,700
UNITED STATES	371,900	380,600	370,600	356,600	360,800

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS
1967-1975", OECD

(a) NO ESTIMATES AVAILABLE

RESEARCH SCIENTISTS & ENGINEERS IN INDUSTRY
(% BY INDUSTRY GROUP)

		CANADA	DENMARK	FRANCE	GERMANY	JAPAN	NORWAY	SWEDEN	UNITED KINGDOM	UNITED STATES
1967	PRIM	4	0	0	2	1	5	3	1	0
	MFG	92	91	92	95	94	77	95	87	97
	SERV	4	8	8	4	5	18	2	12	3
	TOTAL	100	100	100	100	100	100	100	100	100
1969	PRIM	3	a	1	1	1	a	4	a	0
	MFG	93	a	92	95	93	a	92	a	96
	SERV	5	a	8	4	6	a	4	a	4
	TOTAL	100	a	100	100	100	a	100	a	100
1971	PRIM	3	a	1	1	1	a	3	a	0
	MFG	90	a	94	95	93	a	93	a	96
	SERV	6	a	5	4	6	a	4	a	4
	TOTAL	100	a	100	100	100	a	100	a	100
1973	PRIM	4	a	1	1	1	a	2	1	0
	MFG	88	a	93	95	94	a	91	90	96
	SERV	9	a	6	4	6	a	7	9	4
	TOTAL	100	a	100	100	100	a	100	100	100
1975	PRIM	4	a	1	1	1	a	3	2	0
	MFG	85	a	92	94	94	a	90	90	96
	SERV	11	a	6	4	6	a	7	9	4
	TOTAL	100	a	100	100	100	a	100	100	100

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS 1967-1975", OECD

(a) NO ESTIMATES AVAILABLE

SCIENTISTS & ENGINEERS IN RESEARCH INTENSIVE INDUSTRIES
(PERCENTAGES)

	1967	1969	1971	1973	1975
CANADA	69.1	68.0	65.0	67.0	70.8
DENMARK	73.3	a	a	a	a
FRANCE	71.3	79.7	78.6	78.1	80.2
GERMANY	76.9	78.0	80.1	82.0	85.4
JAPAN	60.9	64.1	65.5	62.3	62.1
NORWAY	50.7	a	a	a	a
SWEDEN	50.8	54.6	50.0	49.1	55.8
UNITED KINGDOM	77.4	a	a	75.0	72.9
UNITED STATES	79.8	79.0	74.9	74.9	73.9

SOURCE: BASED ON DATA FROM "INTERNATIONAL STATISTICAL YEARS
1967-1975", OECD

(a) NO ESTIMATES AVAILABLE

GLOSSARY

The following terms and definitions are based primarily on those provided in The Measurement of Scientific and Technical Activities (Frascati Manual), OECD, 1976.

AGRICULTURE includes:

- a) agronomy, rural science;
- b) forestry, horticulture;
- c) dairying, animal husbandry;
- d) veterinary science;
- e) other.

APPLIED RESEARCH is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective. Applied research develops ideas into operational form. The knowledge or information derived from it is often patented but may also be kept secret.

BASIC RESEARCH is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. It is usually undertaken by scientists who may set their own goals and to a large extent organize their own work. However, in some instances basic research may be primarily oriented or directed towards some broad fields of general interest. Such research is sometimes called "oriented basic research".

BUSINESS ENTERPRISE SECTOR includes:

- a) All firms, organizations whose primary activity is the production of goods or services for sale to the general public at a price intended approximately to cover at least the cost of production.
- b) Private and public enterprises.

CAPITAL EXPENDITURE covers annual gross capital expenditure actually incurred by performers, irrespective of the method of finance, the period over which this may be written off, or whether the expenditure is for replacement or an addition to assets. It includes:

- a) the acquisition of land;
- b) expenditures on buildings, fixed assets and plant, including major improvements, modifications, repairs and renovations as well as legal fees resulting from the purchase of real estate;
- c) the acquisition of major instruments and equipment.

The sale or transfer of fixed assets are shown separately, and depreciations for building, plant and equipment are excluded.

CHANGE IN TECHNIQUE is an alteration of the character of the equipment, products, and organization which are actually being used. A technique is a utilized-method of production.

CURRENT EXPENDITURE includes:

- a) Wages, salaries and all related elements of labour costs (or "fringe benefits") such as bonus payments, holiday pay, contributions to pension funds, payroll taxes and welfare expenditure.
- b) Materials and equipment, other than major items of equipment, including books, journals, reference material, subscriptions to libraries, scientific societies and so forth.
- c) Water and fuel, including gas and electricity.
- d) Maintenance and repair of buildings and equipment. Rent, rates and cleaning.

e) Administrative expenses and share of overhead costs in the case of research departments or institutes sharing premises or facilities with other parts of a large organization.

f) Purchase of services (e.g. cost of computer time).

It excludes actual or imputed provisions for depreciation.

ECONOMIC GROWTH is usually measured by the growth of a nation's gross product. Technological Change is an important factor responsible for the rate of economic growth.

ENGINEERING includes:

- a) metallurgy, mining;
- b) mechanical engineering;
- c) construction, civil engineering;
- d) electrical engineering;
- e) aeronautical engineering
- f) chemical engineering, fuel and petroleum technology;
- g) textile engineering;
- h) geology;
- i) general technology and applied science;
- j) other..

EXPERIMENTAL DEVELOPMENT is systematic work, drawing on existing knowledge gained from research and/or practical experience, that is directed to producing new materials, products and devices, to installing new processes, systems and services, and to improving substantially those already produced or installed.

EXTRAMURAL R&D EXPENDITURE denotes a flow of R&D funds from one organization or sector to another. Extramural flows can be identified in two ways:

1. As "extramural expenditures" which are the sums an organization (or sector) reports having paid to another organization (or sector) for the performance of R&D.

2. As R&D supported by "extramural source of funds" which are the sums an organization (or sector) reports having received from another organization (or sector) for the performance of R&D.

Such payments can take the form of contracts, grants or donations and they can be made in cash or in kind (e.g. equipment made available to the performer).

FOREIGN SECTOR includes: Institutions on all territory outside the political frontiers of a country except that:

i) vehicles, ships, aircraft and space satellites operated by domestic organizations and testing grounds leased or acquired by a government and/or private organizations in other countries' territory are not to be considered abroad.

ii) the facilities of international organizations situated within the political frontiers of the reporting country are to be considered abroad.

GOVERNMENT SECTOR includes:

Organizations which furnish but do not normally sell to the community those services which cannot otherwise conveniently or economically be provided and which act as the administrative agency for the economic and social policy of the community.

GROSS DOMESTIC EXPENDITURE ON RESEARCH EXPERIMENTAL
DEVELOPMENT (GERD)

GERD is total intramural expenditure for R&D performed on national territory during a given period. It includes R&D performed on the national territory funded from abroad, but excludes payments to abroad for the performance of R&D (and R&D performance of international organizations within the country).

HUMANITIES AND FINE ARTS includes:

- a) humanities;
- b) fine arts;
- c) education
- d) other.

INDUSTRY GROUPS classification breakdown:

1. Primary Industries

Agriculture

Mines and Wells

2. Manufacturing Industries

Food, Beverages, and Tobacco

Rubber and Plastic

Leather

Textiles

Knitting Mills

Clothing

Wood

Furniture and Fixtures

Pulp and Paper
Printing
Primary Metals
Metal Fabricating
Machinery
Transportation Equipment (and aircraft & parts)
Electrical Products
Non-Metallic Mineral Products
Petroleum Products
Chemical Products
Miscellaneous (Other Manufacturing Industries)

3. Service Industries

Transportation and Other Utilities
Other Non-Manufacturing Industries

INNOVATION is an invention which is applied for the first time. It is a key stage in the process leading to the full evaluation and utilization of an invention.

INPUT MEASURES OF R&D are:

- a) measures of manpower employed on R&D;
- b) measures of expenditure on R&D.

INTRAMURAL R&D EXPENDITURE includes all funds used for the performance of R&D within a particular organization or sector of the economy, whatever the source of finance. It includes both current and capital expenditure.

INVENTION is a prescription for a new product or process that was not obvious to one skilled in the relevant art at the time the idea was generated. The new product or process must have prospective utility as well as novelty.

MEDICAL SCIENCES include:

- a) medicine;
- b) dentistry;
- c) pharmacy;
- d) other.

NATURAL SCIENCES include:

- a) mathematics;
- b) physics, mechanics, electronics, astronomy;
- c) chemistry, physical chemistry;
- d) biology, botany, zoology;
- e) bio-chemistry, bio-physics;
- f) geology & earth sciences, meteorology, geophysics;
- g) Other.

OTHER SUPPORT STAFF are skilled and unskilled craftsmen, secretarial and clerical staff working on or directly associated with R&D activity.

PILOT PLANT The construction and operation of a pilot plant is a part of R&D as long as the principal purposes are to obtain experience and to compile engineering and other data to be used in:

- evaluating hypotheses;
- writing new product formulae;
- establishing new finished product specifications;
- designing special equipment and structures required by a new process;
- preparing operating instructions or manuals on the process.

But if a pilot plant switches to operating as a normal commercial production unit, the activity can no longer be considered R&D even though it may still be described as "pilot plant".

PRIVATE NON-PROFIT SECTOR includes: Most private organizations which are not established primarily with the aim of earning a profit. They are maintained by fees, dues and donations from members and sponsors, by grants from government and enterprises, and may also obtain revenue from the direct sale of some of their products and services, as, for instance, publications and public lecture programmes.

PRODUCT FIELD classification implies the R&D activity of each enterprise or establishment is broken down according to the product field to which it is relevant.

PRODUCTIVITY is the ratio of output to input. The usual input considered is that of labour. Factors affecting the rate of growth of labour productivity include the rate of technological change, the marginal rate of substitution between capital and labour, the achievement of economies of scale, and the rate of diffusion of relevant technological information.

PROTOTYPES A prototype is an original model on which something new is patterned and of which all things of the same type are representations or copies. It is a basic model possessing the essential characteristics of the intended product. The design, construction and testing of prototypes normally fall within the scope of R&D.

PURE SCIENCE is directed toward understanding, whereas technology is directed toward use.

RESEARCH AND DEVELOPMENT EXPENDITURE can be spent either:

- inside (intramural expenditure), or
- outside (extramural expenditure) - a firm, ministry or public agency, private non-profit institution or university.

RESEARCH INTENSITY refers to the amount of research and development conducted in an industry. Generally, one or more of the following indices have been used for the classification of industries as High, Medium, or Low Research Intensive:

1. R&D expenditures as a percentage of shipments or value-added;
2. the number of R&D personnel engaged as a proportion of the total employment in an industry;
3. average skill level of workers.

RESEARCH AND EXPERIMENTAL DEVELOPMENT comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications. Three categories of R&D may be distinguished: Basic Research; Applied Research; and Experimental Development.

The differences between research and development relate primarily to the orientation of the work, the degree of uncertainty in a given problem, and the

length of time work can be expected to proceed without visible pay-off. Research tends to be oriented more toward the search for new knowledge (rather than toward the capacity to produce a particular product), to involve greater uncertainty of outcome, and to require more time for maturity than development.

RESEARCHERS (R&D SCIENTISTS AND ENGINEERS) are persons actually engaged in the conception and/or creation of new knowledge, products, processes, methods and systems.

SCIENTIFIC FIELDS classification implies the following breakdowns

- a) natural sciences;
- b) engineering;
- c) medical sciences;
- d) agriculture;
- e) social sciences;
- f) humanities and fine arts.

SECTOR classifications offer a framework for the analysis of flows of funds to (and from) the R&D funding and performing agencies. The 5 sectors are: Business Enterprise (Industry); Government; Universities; Private Non-Profit; and, Foreign.

SOCIAL SCIENCES include:

- a) political science, diplomacy;
- b) economics, commerce, banking;
- c) sociology, ethnology;
- d) other.

TECHNICIANS perform auxiliary technical tasks connected with R&D normally under the direction and supervision of a researcher (R&D scientist or engineer).

TECHNOLOGICAL CHANGE is the advance of technology, such advance often taking the form of new methods of producing existing products, new designs which enable the production of products with important new characteristics, and new techniques of organization, marketing, and management. A new piece of knowledge is a technological change only when it is first discovered.

TECHNOLOGY is society's pool of knowledge regarding the industrial arts. It consists of knowledge used by industry regarding the principles of physical and social phenomena, knowledge regarding the application of these principles to production, and knowledge regarding the day-to-day operations of production.

TECHNOLOGY INTENSITY refers to the level of technology embodied in an industry's product lines and production techniques. Although there is no precise measure, the following are generally accepted as proxies for the classification of industries as High, Medium, or Low Technology Intensive:

1. proportion of sales associated with the introduction of new products;
2. the number of invention patents received;
3. the number of significant innovations pioneered.

UNIVERSITY SECTOR includes:

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

