The Make-or-Buy Policy
1973-1975

Ministry of State
Science and Technology

Ministère d'État
Sciences et Technologie

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Industry Branch,
Ministry of State for
Science and Technology

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INTRODUCTION

The purpose of this paper is to review the Make-or-Buy policy which was introduced in 1973 with the objective of increasing the proportion of government research and development requirements contracted out to industry rather than performed in-house. Through the implementation of this policy it was expected that the innovation capacity of Canadian industry would be strengthened and its competitive position enhanced.

Although it is certainly premature to assess whether this ultimate economic effect is as yet being achieved, it is however, possible to inquire into the extent to which there has been a shift of research and development to the private sector. It is also possible to examine the extent to which various other objectives, such as regional distribution, are being met in the course of implementing the Make-or-Buy policy. These are the issues to which the current review has been directed and which are dealt with in detail in this report. From this examination it is clear that this policy initiative has had a beneficial effect on several sectors of industry.

For the review of the Make-or-Buy policy, it was appropriate to examine statistics on much broader aspects of science and technology as it relates to private industry. Although perhaps subsidiary to specific concerns about the Make-or-Buy policy, there is one conclusion which cannot be avoided: during the course of the past five years, the proportion of Canada's total resources directed towards research and development has steadily declined. This decline is not restricted to government and, indeed, as pointed out by the OECD in May 1975, is not limited to Canada: research and development expenditures in France, the United Kingdom and the United States have also stagnated or declined. The OECD suggested that the situation in Canada and these other countries (as contrasted for example with Germany and Japan) has reached the point where the national economies may suffer serious long-term damage.

To be concrete, the percentage of gross national expenditure on research and development (GERD) as a percentage of GNP has declined from 1.29 per cent in 1969 to 1.14 per cent in 1972. By way of comparison, the Lamontagne Committee warned that Canada's national research and development ought to be of the order of 2.5 per cent of GNP in order to maintain its international competitiveness.

There is serious concern on the part of a number of observers that the deteriorating Canadian trade balance is partly caused by a lack of know-how. Similar concerns have been expressed by Professor Gilpin with respect to the situation in the United States. In a report to the Joint Economic Committee of the U.S. Congress, Gilpin reminds the U.S. Congress that the major capital stock of an industrially advanced nation is not its physical equipment, but rather the body of scientific knowledge and the capacity of its population to use this knowledge.

To the extent that industry plays a crucial role in the use of this knowledge and in transforming knowledge into trade and employment, the Make-or-Buy policy is potentially a strong mechanism to encourage this transformation process.

THE POLICY

1. Implementation Guidelines

On February 10, 1972, Cabinet established the general policy that more government-funded research and development should be contracted to Canadian industry. Subsequent Cabinet directives gave precise criteria for "Make-or-Buy" decisions and established the overall target that **all** mission-oriented research and development should be contracted to industry except "that which is specifically exempted by the criteria."

In order to implement the policy, Cabinet instructed the Treasury Board Secretariat to provide implementation guidelines to all departments and agencies listed in Schedules A and B of the Financial Administration Act. The Ministry of State for Science and Technology, in consultation with appropriate departments and agencies, was given the responsibility to review the procedures and implications of the Make-or-Buy policy, from time to time, and to report on its findings. The implementation guidelines designated the Department of Supply and Services as the agency responsible for all contracting under the policy. It was instructed to, both determine comprehensively the research capabilities of Canadian industry and to communicate the government's research requirements with industry.

On February 21, 1974, Cabinet expanded the original policy to provide for consideration and financing of Unsolicited Proposals for Research and Development from the private sector. This policy adjunct provided industry with an additional opportunity to participate in government science programs. The Department of Supply and Services was made centrally responsible for the procedure to handle these proposals and was given funds to provide financing for those proposals that were accepted by government departments, from the point of view of mission and priority, but which could not be funded from the current appropriations of the sponsoring department. The Ministry of State for Science and Technology was given the responsibility to evaluate the implications of the new policy.

Thus, in terms of subject matter, the main elements of the policy are: contracts to Canadian industry for mission-oriented R&D, in response to solicited as well as unsolicited proposals, in the natural sciences.

Based on Statistics Canada definitions, the following description of mission-oriented research and development is given by the Treasury Board Guidelines: "Research and experimental development, **minus** free basic research, **plus** feasibility studies." Canadian industry is defined as "all business organizations located in Canada and incorporated or registered under federal or provincial legislation which are engaged in manufacturing, processing, primary and service industries."

2. Evaluation Criteria

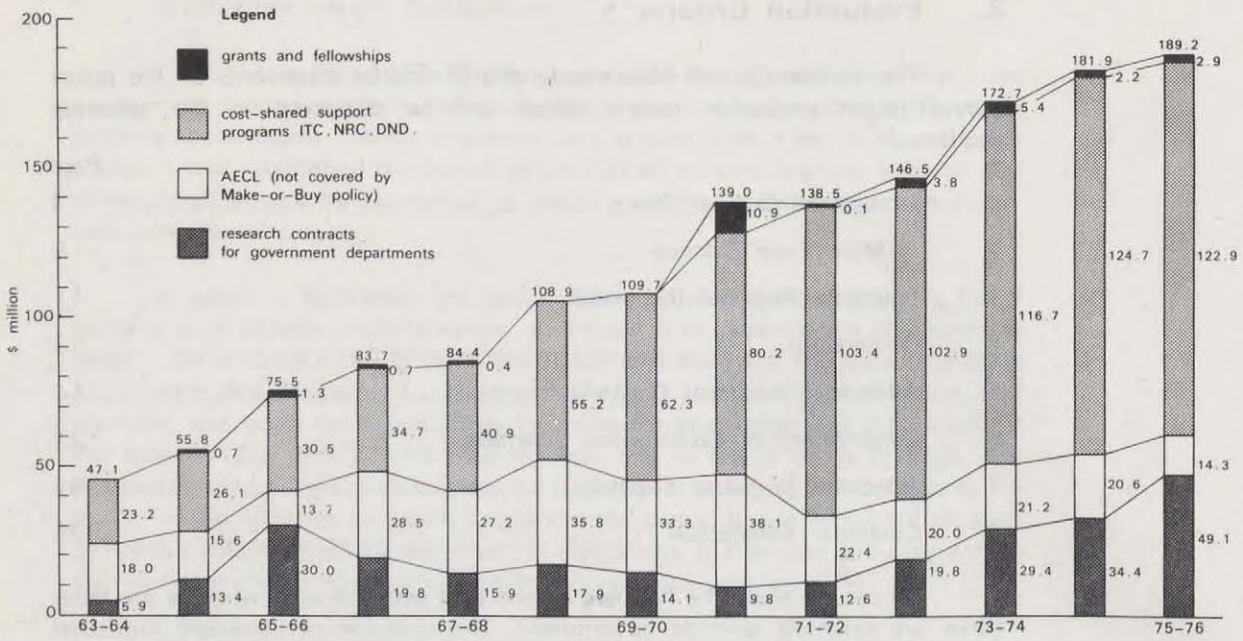
The various Cabinet Memoranda and Ministerial statements on the policy provide eight evaluation criteria which will be discussed in the following sequence:

As can be seen, the first five criteria deal with industry, whereas the latter three are oriented towards government. The criterion of increased industrial capability is at once the most crucial and the most elusive one. In view of the overall objective of the policy, it is a question of whether or not public money has been well spent and whether or not the policy has been effective. This question has been approached statistically as well as on the basis of case histories, individual discussions and comments from firms and industrial associations. This section also includes specific comments from industry on the value of unsolicited proposals.

In almost all instances, the information required to apply the criteria has been derived from the Statistics Canada series on Government Activities in the Natural Sciences, and the Contract Statistics of Supply and Services. To a lesser extent, the evaluation is based on internal MOSST data and data from some other government sources. In all cases, the source and nature of the information have been identified.

DIAGRAM 1

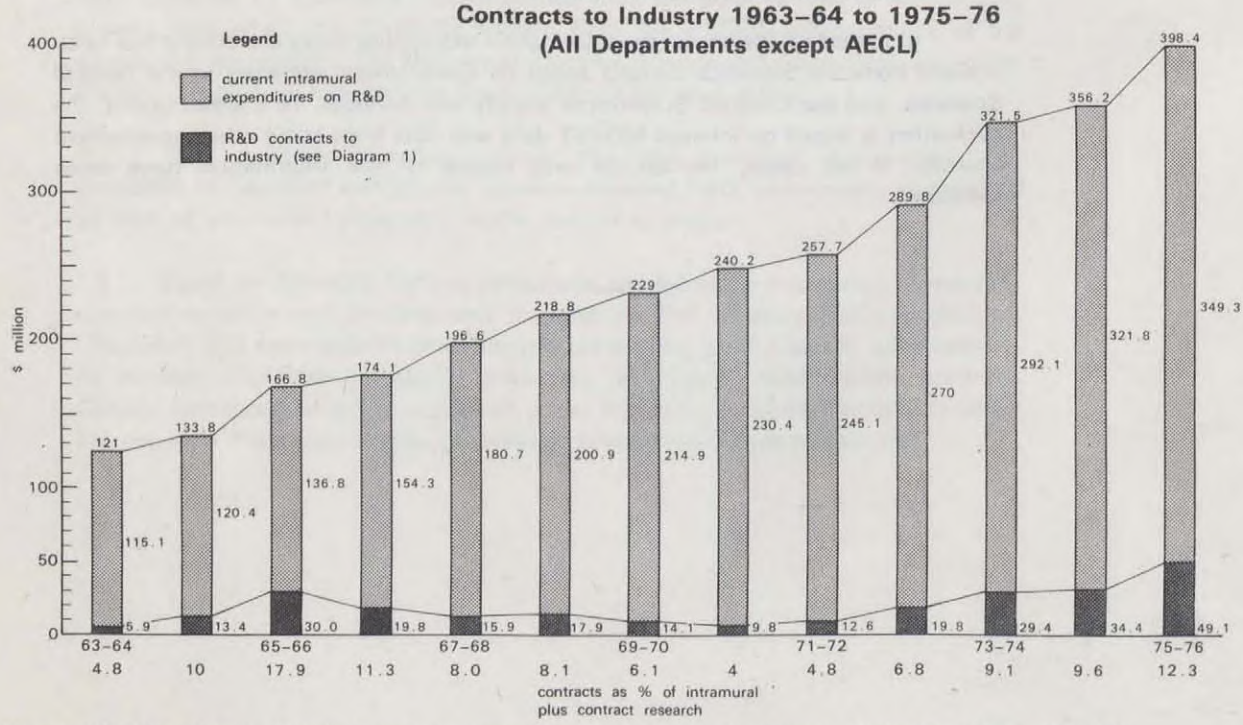
PAYMENTS TO CANADIAN INDUSTRY FOR R&D
1963–64 to 1975–76



Source: Statistics Canada, Science Statistics Section, October 1975.

DIAGRAM 2

CURRENT INTRAMURAL EXPENDITURES FOR R&D VERSUS R&D
Contracts to Industry 1963–64 to 1975–76
(All Departments except AECL)



Source: Statistics Canada, historical series on expenditures in the natural sciences, September 1975, table 20.

AN OVERALL EVALUATION

1. Increased Industrial Share

Diagram 1 shows the long-term trends in "payments to industry" for R&D in the natural sciences. The graph distinguishes between contracts for government departments, contracts administered by AECL, (excluded from the policy), expenditures under the cost-shared industrial support programs, and payments to industry in the form of grants and fellowships. Although the long-term trend does not allow for the precise display of "**mission-oriented R&D**" as defined by the policy (R&D minus free basic research plus feasibility studies), the 12-year trend does show the R&D component which is the largest part of the scientific activities that are covered under the policy. As such, the long-term trend gives a good historical overview of the relative importance of research contracts. Diagram I permits the following observations:

- Over the past 12 years, the chief increase in R&D payments to industry has been under the cost-shared programs which have grown at an average annual rate of 17 per cent from $23 million in 1963-64 to $123 million in 1975-76. The programs that are included in these statistics are **PAIT, DIP, IRDIA, DIR** and **IRAP.***

- Research contracts to industry rose rapidly from $6 million in 1963-64 to $30 million in 1965-66, mainly as a result of the FHE-400 Hydrofoil Project in the Department of National Defence. However, with the progressive execution of that program, research contracts to industry declined to $9.8 million in 1970-71.

- Following the low period of 1970-71, contracts increased again to $19.8 million in 1972-73 and an estimated $49 million in the current fiscal year. The initial increase during this period was caused by the Communications Technology Satellite program of the Department of Communications where research contracts rose rapidly from $4.7 million in 1971-72 to a peak of $14.8 million in 1973-74.

- However, the **continuing** increase in contract research after the fiscal year 1973-1974, when CTS expenditures started to decline, is clearly attributable to increased contract expenditures by all departments of government. In fact, one could speculate that without the Make-or-Buy policy, the CTS peak of 73-74 would have been followed by a similar decline in research contracts as took place during the period 1965-72. Considering the cash flow of the CTS program, contract expenditures without the Make-or-Buy policy would have been of the order of $25 million in 1974-75 and $20 million in 1975-76, instead of $34 and $49 million.

In order to assess these trends against the criterion of "increased industrial share," the industrial contracts were compared with the intramural R&D expenditures during the same period. These figures are shown in Diagram 2. Super-imposed

**Program for The Advancement of Industrial Technology, Defence Industry Productivity Program, Industrial Research and Development Incentives Act, Defence Industry Research Program and the Industrial Research Assistance Program.*

on the declining contract volume during the period 1965-71, is a steady increase of intramural expenditures at an average rate of 9.7 per cent per year. Thus, the overall effect between 1965 and 1972 has been a widening gap between intramural research and industrial contracts. In 1965, the industrial share was 17.9 per cent, which had declined to 4 per cent in 1970-71. However, with the renewed contract activity in 1971-72, the industrial share increased again to 9 per cent in 1973-74 and some 12 per cent in 1975-76. With respect to the first criterion, therefore, *it appears that the Make-or-Buy policy has indeed created an increase in the industrial share of R&D undertaken in industry rather than "in-house."*

This conclusion is confirmed by the short-term Statistics Canada series. Although shorter, this series accounts — in aggregate and by department — precisely for the activities covered under the Make-or-Buy policy: "R&D (exclusive of administrative costs) minus free basic research plus feasibility studies." The short-term series starts in 1970-71 and provides a more refined picture of the relation between intramural and extramural expenditures for mission-oriented R&D. The series differentiates between intramural mission-oriented R&D, contracts to industry, contracts to universities and contracts to other performers. The detailed Tables that were prepared by Statistics Canada are included in Appendix A. Table 1 is a summary of that information.

Because of the exclusion of free basic research and the inclusion of feasibility studies, the total mission-oriented R&D expenditures differ slightly from the simpler R&D figures in Diagram 2. The intramural expenditures are **less** (because of the deletion of significant amounts of free basic research), while the contract amounts are somewhat **more** (because of the addition of feasibility studies). The overall amount of "Mission-oriented R&D" is about 5 per cent more than the simpler category "Research and Development." The trends, however, are identical.

Starting in 1970-71, the industrial share of mission-oriented research increased from 4.4 per cent of total expenditures to 12.9 per cent in 1975-76 (Table I). Leaving aside the absolute amounts for the moment, it is clear that the industrial share of mission-oriented R&D has been rising steadily since 1970-71 at an average rate of some 33 per cent per year. Intramural expenditures during the same period rose at an average rate of 7.2 per cent per year.

Although the Make-or-Buy policy has produced **converging** growth trends between intramural and contract research, the absolute amount of contract research is still modest, as compared to the intramural expenditures. It may be observed that the objective to increase the industrial share has been thwarted by the opposing forces of salary increments for intramural activities and government's desire to curb new expenditures. Nevertheless, all available information shows that *the industrial share of government research has increased from 4.4 per cent to 12.9 per cent over the past five years.* The detailed departmental figures of the short-term trend confirm that this increase was attributable in 71-72 to R&D contracts for the Communications Technology Satellite of DOC but that it has been **maintained** during fiscal years 74-75 and 75-76 by the Make-or-Buy policy.

2. A More Even Balance

With respect to the parallel objective of "a more even balance" (which refers to **all** R&D payments to industry), Diagrams 1 and 2, show that the relation between payments to industry and intramural research has been stable during the past 12 years at an average ratio of 1:2. In 1964-65, all payments to industry constituted

TABLE I

SHORT-TERM SERIES ON INTRAMURAL & CONTRACT EXPENDITURES FOR MISSION-ORIENTED R&D IN THE NATURAL SCIENCES * ($000)

(Schedules A and B — Departments and Agencies)

CURRENT INTRAMURAL		MISSION-ORIENTED R&D CONTRACTS			TOTAL	PERCENTAGES			
	Mission-oriented R&D Expenditures	Industry	Univ. & NP/s	Other		Intramural	Industry**	University	Other
1970-71	223,600	10,594	2,452	3,400	240,046	93.1	4.4	1.0	1.5
1971-72	234,826	14,491	2,644	2,076	254,037	92.4	5.7	1.0	0.8
1972-73	254,544	19,772	4,078	4,109	282,503	90.1	7.0	1.4	1.5
1973-74	267,720	29,483	4,240	3,807	305,250	87.7	9.7	1.4	1.2
1974-75	291,943	34,482	5,581	7,473	339,479	86	10.2	1.6	2.2
1975-76	317,334	49,133	7,811	7,087	381,365	83.2	12.9	2.0	1.9

**According to Make-or-Buy definition mission-oriented R&D comprises "Current Intramural R&D, less free basic research, plus feasibility studies."*

***Canadian Industry*

SOURCE: Statistics Canada Special Tabulation, October 6, 1975 (See Appendix A, Tables I, II, III, IV).

32 per cent of the sum of intramural expenditures and industrial payments. In 1975-76, this percentage was 35. Since 1970-71, this percentage has fluctuated as follows:

	70-71	71-72	72-73	73-74	74-75	75-76
Payments to Industry as a Percentage of Intramural + all Industrial Payments for R&D	37.6	36	35	37	36	35

These percentages show that the modest growth in contract expenditures has had no effect on the overall balance between payments to industry and intramural expenditures. *We must conclude that the initial target of the policy to obtain "a more even balance" is still a long way off.*

3. Contract Statistics: A Digression

Before looking at the geographical distribution of R&D contracts, it is necessary to establish whether or not the DSS contract statistics do indeed

TABLE II

MISSION-ORIENTED R&D CONTRACTS IN THE NATURAL SCIENCES TO INDUSTRY By Department: 1970-71 to 1975-76

($ 000)

DEPARTMENT	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76
AECB	46	26	33	42	16	40
CPDL	39	-	-	-	28	28
Communications	3,121	4,680	10,738	14,826	13,123	12,974
EMR	284	139	448	526	1,344	1,651
Environment	846	2,160	934	4,074	5,009	8,345
IAND	189	106	231	187	415	664
IT&C	45	-	-	-	-	-
National Defence	5,702	6,757	6,566	5,083	5,630	7,976
National Film Board	-	-	-	-	5	15
NHW	45	77	45	48	87	40
NRC	-	-	-	786	1,851	4,361
DSS	-	-	-	-	2,186	7,285
Transport	277	541	777	3,911	4,788	5,754
TOTAL	10,594	14,491	19,772	29,483	34,482	49,133

Source: Statistics Canada, Special Tabulation, October 20, 1975

correspond with the Statistics Canada data, keeping in mind of course that the Statistics Canada figures refer to **expenditures**, whereas the DSS statistics refer to **commitments**. In order of magnitude, if not in detail, the two figures should be comparable.

Table II shows the breakdown of industrial contract expenditures as reported by each department to Statistics Canada over the past five years. The Table shows the cash flow of the CTS program and the increased contract expenditures since 1973-74 by the Departments of Energy, Mines and Resources, Environment, National Defence and Transport. The figures shown for the Department of Supply and Services are the DSS Bridge Financing Fund for Unsolicited Proposals. In terms of contract statistics, the DSS figure is dispersed among those government departments that have accepted unsolicited proposals with the use of bridge financing.

Table III shows the DSS industrial contracts for mission-oriented R&D since 1973-74. A year-by-year comparison of Tables II and III shows first of all that contract expenditures for the Department of Communications exceeded new contract commitments for all three years by $6-8 million. This lag between commitment and

TABLE III

MISSION-ORIENTED R&D CONTRACTS AWARDED BY DSS

TO INDUSTRY	1973-74 Quantity	1973-74 $	1974-75 Quantity	1974-75 $	1975-76 (April 1-Sept. 30) Quantity	1975-76 (April 1-Sept. 30) $
Communications	47	7,457,874	53	5,749,925	31	1,990,247
Environment	204	3,904,401	245	7,149,980	174	7,312,385
National Defence	45	2,835,405	67	3,022,685	45	2,671,312
Energy, Mines and Resources	64	2,023,434	104	4,624,060	50	4,625,017
Atomic Energy Control Board	2	35,200	3	9,500	1	24,588
Ministry of State for Science & Technology	7	228,545	4	65,355	–	–
Indian & Northern Affairs	3	374,930	7	649,354	1	9,500
Transport	10	226,547	17	567,152	23	1,711,100
Cdn. Commercial Corporation	6	1,359,107	3	2,163,419	1	713,416
National Research Council	6	1,247,992	6	797,024	8	2,997,943
Public Archives	1	10,000	–	–	–	–
Agriculture	2	131,330	4	92,666	10	152,320
Regional Economic Expansion	–	–	3	109,975	1	24,600
International Joint Commission	–	–	1	6,800	–	–
Justice	–	–	1	13,200	–	–
Urban Affairs	–	–	–	–	5	257,077
Industry, Trade & Commerce	1	24,213	4	205,083	1	42,060
National Health & Welfare	–	–	–	–	3	31,957
Veterans Affairs	–	–	1	14,900	1	2,999
Canadian Penitentiary Service	–	–	–	–	1	239,357
Revenue Canada	–	–	–	–	1	27,407
Manpower and Immigration	–	–	–	–	4	481,045
Statistics Canada	–	–	1	98,476	1	150,000
Post Office	–	–	1	188,527	–	–
Classified	–	–	7	2,411,857	12	1,946,907
INDUSTRY TOTAL	398	19,858,978	532	27,939,938	374	25,411,237
TO UNIVERSITIES & NON-PROFIT INSTITUTIONS:	326	3,208,504	374	6,029,701	312	7,103,936
TO OTHER PERFORMERS:	187	1,772,473	230	1,914,531	174	1,581,918
GRAND TOTAL	911	25,839,995	1,136	35,884,170	860	34,097,091

Source: Science Centre, Department of Supply and Services, October, 1975

expenditure is a normal reflection of program execution. A similar discrepancy between expenditures and commitments for the Department of National Defence is explained by a number of classified contracts, and by the DND practice to buy ready-made equipment for tests and trials. Although these expenditures are included in the DND budget for Research and Development, the resulting contracts - which are essentially for the procurement of existing goods - do not show up in the R&D statistics of DSS.

Table III also indicates that a number of government departments, which have not yet reported to Statistics Canada, have started to contract-out mission-oriented R&D probably through the mechanism of unsolicited proposals.

4. Equitable Regional Dispersion

Having established that the contract statistics are indeed representative for the policy, the analysis will now turn to the geographical distribution of these **contracts** as summarized in Tables IV and V. These figures show that:

TABLE IV

REGIONAL DISTRIBUTION OF MISSION-ORIENTED R&D CONTRACTS AWARDED TO INDUSTRY

	1973 - 74			1974 - 75			1975 - 76 (Apr. 1 to Sept. 30)			TOTAL TO DATE	
	Quantity	$	%	Quantity	$	%	Quantity	$	%	$	%
Newfoundland	2	11,238	-	5	64,012	0.2	-	-	-	75,250	-
Prince Edward Island	-	-	-	-	-	-	2	6,705	-	6,705	-
Nova Scotia	6	111,130	0.6	10	162,470	0.6	10	2,364,224	9.3	2,637,824	3.6
New Brunswick	9	66,743	0.4	6	38,225	0.1	6	118,822	0.5	223,790	0.3
Quebec	63	7,222,422	36	73	7,532,477	27	61	6,571,513	26	21,326,412	29.0
Ontario	200	9,703,947	49	289	13,118,090	47	183	12,195,075	48	35,017,112	48.0
Manitoba	5	48,059	0.2	7	303,325	1	6	243,713	1	595,097	0.8
Saskatchewan	13	192,053	1	15	920,442	3.3	14	955,243	4	2,067,738	2.8
Alberta	43	1,053,643	5.3	40	1,582,925	5.7	18	872,901	3.4	3,509,469	4.8
British Columbia	43	962,114	5	61	3,098,587	11	61	1,841,391	7.2	5,902,092	8.0
Yukon, NWT	1	2,500	-	1	26,833	0.1	4	96,095	-	125,428	0.2
Other	13	485,129	2.4	25	1,092,552	4	9	145,555	0.6	1,723,236	2.4
INDUSTRY TOTAL	398	19,858,978	100	352	27,939,938	100	374	25,411,237	100	73,210,153	100

Source: Science Centre, Department of Supply and Services, October, 1975

- For any given year, Ontario and Quebec have received approximately three-quarters of the R&D contract dollars distributed.
- The 1974-75 percentage distribution shows a significant increase in British Columbia and Saskatchewan with a decrease in Quebec.
- The distribution for the first half of 1975-76 shows a significant increase in the Atlantic provinces, but a decrease in the West.

By removing the foreign component, the overall Canadian distribution of contract dollars becomes as follows: Atlantic Provinces, 4.1 per cent; Quebec 29.8 per cent; Ontario, 49 per cent; the Prairie Provinces, 8.8 per cent; and British Columbia 8.3 per cent. The question to be answered is whether or not these distributions do indeed reflect an equitable "regional dispersion."

In April 1973, Statistics Canada summarized in an unpublished note, the regional distribution of industrial R&D **expenditures** in Canada. This distribution is shown in Table V, together with the dollar distribution of R&D contracts. If the Statistics Canada distribution of industrial expenditures is taken as the expected distribution for R&D contracts, it can be shown statistically that the observed distribution of contract expenditures is not compatible with the hypothesis that the distribution is determined entirely by (the distribution of) industrial research activities in Canada. Only the Quebec distribution is according to expectation. Ontario is consistently lower than expected, while both the Atlantic and Western provinces are higher.

TABLE V

REGIONAL DISTRIBUTION OF INDUSTRIAL R&D EXPENDITURES AND R&D CONTRACTS

Region	Industrial R&D Expenditures* $ % Canada Total	R&D Contracts $ % Canada Total**			
		73–74	74–75	75–76	Total To Date
Atlantic Provinces	0.6	1	1	9.8	4.1
Quebec	29.8	37.5	28	26.0	29.8
Ontario	60.1	50.0	49.0	48.3	49.0
Prairie Provinces	5.5	6.5	9.5	8.5	8.8
British Columbia	4.0	5.0	11.5	7.3	8.3

**Statistics Canada, 1971 Survey on Industrial R&D*

***Department of Supply and Services*

Based on these figures, it is fair to conclude that R&D contracts have not been overly concentrated in the two main industrial areas of Canada, but that they have been distributed to industries in various regions of Canada.

5. Ownership

Information on the ownership of companies receiving government R&D contracts has been taken from a random sample of all R&D contracts awarded by DSS since April 1, 1973. This sample contains 208 contracts, of which 81 are industrial contracts representing 75 R&D establishments in Canada and three in the United States. The size of the Canadian establishments in the sample ranges from five employees to more than 5,000 (See Table VII). In order to determine the ownership of these firms, the name and address of each Canadian establishment was checked by the Business Finance Division of Statistics Canada against the ownership records of the Corporation and Labour Union Returns Act. The results are presented in Table VI.

The ownership information allows the following conclusions:

- 57 per cent of the companies in the sample are too small in terms of sales or assets to report ownership details under the Corporation and Labour Union Returns Act, but our general knowledge of these companies indicates that they are predominantly Canadian-owned. These companies account for 38 per cent of the dollar value in the sample.

TABLE VI

OWNERSHIP OF COMPANIES IN CANADA RECEIVING R&D CONTRACTS

CALURA Ownership Category	Number of Establishments	Total $ Value of Contracts
1. United States	2	1,180,522
2. United Kingdom	1	5,020
3. Other European Countries	–	–
4. All Other Foreign Countries	–	–
5. Foreign Control but no single Country Controlling 50% or more	–	–
6. Canadian	28	1,370,511
7. Identifiable Canadian Ownership plus "Uncertain" together over 50%	1	10,000
No Information Available in CALURA records*	43*	1,590,938
TOTAL	75	4,156,991

**Companies with assets less than $250,000 or sales less than $500,000 are not required to report under the Corporation and Labour Union Returns Act.*

- Of the 32 companies in the sample that did report ownership details, 28 are Canadian-owned. These companies received 33 per cent of the aggregate contract value of the sample. Thus, in total, 71 per cent of the aggregate contract value was awarded to Canadian-owned companies.

- The two American-owned companies in the sample received five large contracts, amounting to 28 per cent of the contract value.

Thus, with respect to ownership, there is substantial evidence that contracts under the Make-or-Buy policy, both in numbers and in dollars, have favoured Canadian-owned enterprises.

The apparent bias towards small companies and the possible concentration of large contracts will be examined in more detail in the next section.

6. Increased Industrial Capability

The criterion of industrial capability has been approached in two ways, using both statistical evidence and industry statements, first the statistics: Between April

TABLE VII

DISTRIBUTION OF COMPANY R&D EXPENDITURES AND R&D CONTRACTS BY COMPANY SIZE

	Company R&D Expenditures Statistics Canada (1973)			R&D Contracts 1/4/73 to 30/9/75			
Total Employment	No.	$ Value ($000)	% of $	No.	$ Value	Av. Value	% of $
<250	251	25,923	6	61*	1,893,172	31,035	45.5
250 - 749	161	21,034	5	7	155,837	22,262	4
750 - 1449	171	53,999	13	5	848,022	169,604	20
1500 - 2999	75	40,635	9.5	3	821,360	273,786	20
3000 - 4999	67	57,920	13.5	1	88,100	88,100	2
>5000	67	226,953	53	1	350,500	350,500	8.5
TOTAL	792	426,463	100	78	4,156,991	53,294	100

Sources: Statistics Canada, Science Statistics Section, October, 1975

**Note: 60 per cent of these firms have less than 50 employees.*

1, 1973, and September 30, 1975, DSS had awarded a total of 1,124 mission-oriented R&D contracts to industry for a total value of $73 million. These contracts were of two kinds: contracts for *research services* and contracts for *technology development.* The services consisted of a large variety of studies, reviews, surveys and assessments, while the development contracts were principally in the fields of communication, defence, transport and measurement techniques. The average value of contracts to industry has increased from $49,000 in 1973-74 to $70,000 in the current fiscal year, and the dollar distribution among industry sectors has been as follows:

Primary Sector:	$ 0.6 million (1 per cent)
Secondary Sector:	$42.8 million (58 per cent)
Service Sector:	$29.7 million (41 per cent)

These initial figures show that the average contract has been rather modest and that the primary sector has not participated in the contracting policy to any extent.

Table VII shows the distribution, by company size, of industry-financed R&D and the distribution of contract dollars. The contract values were obtained from the same sample of contracts that was used for the criterion on ownership. The industrial figures were obtained from the 1973 Statistics Canada survey. Although the Statistics Canada figures may be somewhat low for small establishments, they have

TABLE VIII

DISTRIBUTION BY COMPANY SIZE OF COMPANY R&D EXPENDITURES AND ALL R&D CONTRACTS OF $250,000 AND OVER

	Company R&D Expenditures Statistics Canada (1973)			R&D Contracts 1/4/73 to 30/9/75		
Total Employment	No.	Value ($000)	% of $	No.	$ Value	% of $
<250	251	25,923	6	12	5,462,679	19
250-749	161	21,034	5	6	10,658,029	38
750-1499	171	53,999	13	3	933,685	3
1500-2999	75	40,635	9.5	11	9,239,678	33
3000-4999	67	57,920	13.5	1	1,158,000	4
>5000	67	226,952	53	2	771,500	3
TOTAL	792	426,463	100	35	28,223,571	100

been taken as the expected distribution of contract money to test the hypothesis that the dollar distribution of contract money has been in accordance with the size distribution of industrial R&D in Canada.

However, the distribution of contract dollars in the sample differs significantly from the expected distribution. Table VII also shows that:

- The large research establishments, which account for 53 per cent of the industrial R&D effort in Canada, account for less than 10 per cent of the aggregate contract value. Most of the R&D establishments in this size category are in the chemical-based industries, wood-based industries and the metal industries.

- Small research establishments which account for 6 per cent of the commercial R&D effort in Canada, account for 45 per cent of the contract value in the sample and for 78 per cent of the establishments. Although the average contract value to these firms has been only $30,000, the aggregate amount represents some $12.5 million per year during the past 2.5 years, which is a rather significant sum compared to company-financed R&D in this size category of $26 million per year in 1973.

- The medium-sized research establishments in the sample, 250 to 3,000 employment range, which account for 27.5 per cent of the industrial R&D, account for 45 per cent of the contract research. The average contract to these establishments in the sample has been of the order of $155,000 with increasing contract value to the larger companies.

- An examination of the actual contracts in the sample shows that the great majority of contracts, in all size categories, has been awarded to firms in one of the following three industrial sectors: electronics, "transportation" (a statistical classification which includes a variety of high-technology enterprises), and the service sector. Thus, it appears that the contract mechanism has favoured small and medium-sized companies in three specific industry sectors, with significantly larger contracts to the medium-sized companies.

The latter phenomenon requires further investigation and we will now examine whether or not the distribution of large contracts has indeed been restricted to companies with more than 750 employees. Table V in Appendix A lists all contracts in excess of $250,000 awarded between April 1, 1973 and September 30, 1975. Table VIII is a summary of that information by company size.

Table VIII shows a more even distribution of large contracts than was expected from the sample shown in Table VII. In fact, the figures show that about one-fifth of the large contracts has gone to small companies. These are: EBA Engineering Consultants; Space Research Corporation; SED Systems; MacDonald-Dettwiler and Associates; Canadian Thin Films; Sciex Limited; F.F. Slaney and Company; Huntec (70) Limited; and Trigg, Woollett and Associates. The total dollar volume to these companies has been $5.5 million over the past 2 1/2 years.

However, the lion share of the large contracts has indeed gone to medium-sized companies. In fact, 74 per cent of the total value of the large R&D contracts have gone to companies in the 250 to 3,000 employment range, which account for only 27 per cent of the company-financed R&D effort in Canada.

Table VIII confirms the earlier conclusion that large R&D establishments have not participated in contract research to any extent. Table V in the Appendix confirms also that research contracts have been awarded mainly to companies in three specific industry sectors: **electronics, "transportation" and the service sector.**

In terms of government research, the large contracts listed in Table V of Appendix A represent six government programs and two categories of projects:

1.	The CTS Program of **DOC**	$ 9,673,934
2.	The Remote Sensing Program in **EMR**	$ 4,169,303
3.	The Remote Manipulator Program of **NRC**	$ 2,615,784
4.	The Canada–Hawaii Telescope, **NRC**	$ 2,213,416
5.	The Ocean Data Program of **EC**	$ 2,126,850
6.	The Demonstration Program of Pollution Abatement Technology of **EC**	$ 1,158,000
7.	A variety of geological, geophysical, geochemical, hydrographic and biological studies of several departments: **INA, EMR, DND** and **DOE**	$ 2,188,605
8.	The remainder consists of a variety of technology developments, mainly for **DOC** and **DND**	$ 4,077,605
	TOTAL	$28,223,571

TABLE IX

COMPANIES RECEIVING MORE THAN $1 MILLION R&D CONTRACTS

1.	SPAR Aerospace Products Limited, Toronto, Ontario.	$6,015,784
2.	RCA Limited, Ste Anne de Bellevue, P.Q.	$4,762,806 (U.S.)
3.	Innotech Aviation Limited, Dorval, P.Q.	$2,515,395
4.	Hermes Electronics, Dartmouth, N.S.	$2,126,850
5.	MacDonald, Detwiller & Associates, Vancouver, B.C.	$1,646,907
6.	Canadian Marconi Company, Montreal, P.Q.	$1,611,603 (U.K.)
7.	SED Systems, Saskatoon, Sask.	$1,511,128
8.	Surveyer, Nenniger & Chenevert, Montreal, P.Q.	$1,500,000
9.	Great Lakes Paper Company, Thunder Bay, Ontario.	$1,158,000

This listing shows first of all, the CTS program of the Department of Communications which reflects a departmental contracting-out policy before it had become more general in government policy. With respect to the other programs, it appears that the National Research Council and the Department of Energy, Mines and Resources have applied the policy with the greatest intensity at the program level, culminating in NRC's program to develop, in Canada, the remote manipulator system for NASA's Space Shuttle. The nature of these programs explains why the most prominent activities under the Make-or-Buy policy have been confined to three industrial sectors: electronics, transportation and the large group of companies providing scientific services.

As for individual firms, Table IX shows nine companies that have received more than $1 million in R&D contracts over the past 2 1/2 years.

With the exception of RCA and Marconi, all are Canadian-owned, ranging in size from 50 to 2,500 employees and representing all regions of Canada. Together, these companies account for $23 million in R&D contracts or 32 per cent of all contracts awarded between April 1, 1973 and September 30, 1975.

Although this evaluation has not included a systematic survey of increased industrial capability in terms of profitability and sales trends of all companies that have received research contracts, **all available information suggests that the Make-or-Buy policy has had its strongest impact to date on:**

- *small and medium-sized companies*
- *growing companies*
- *Canadian-owned companies*
- *high technology companies*
- *companies in the electronics sector, the "transportation" sector and the service sector.*

In order to assess the potential industrial benefits of R&D contracts, DSS examined 650 post-contract evaluation reports. Government scientists who were responsible for the contents of these contracts judged that further technological benefits were *probable* in 35 per cent of the cases, *possible* in 30 per cent, and *unlikely* in 35 per cent.

We will now examine how industry, as represented by associations and individual companies themselves, has measured the effect of the Make-or-Buy policy. The following comments are based on meetings with representatives of associations and individual companies.

The Air Industries Association expressed the following views:

- Those companies that have contracted under the Make-or-Buy policy have been very pleased with it. The fact that research is being fully funded with a provision for profit is considered to be a major improvement over all other government dealings with industry, and much more in line with the favourable conditions enjoyed by competing companies in other countries.

- The administration of the policy has been "well run" and, specifically, with respect to unsolicited proposals companies have known within weeks whether or not a proposal has been accepted.

- On balance, however, the Air Industries Association sees the Make-or-Buy policy only as a solution to a "corner of the problem." The Air Industry considers itself in a critical position and takes the view that no policy can achieve all-round positive results as long as there is no plan, no strategy, and no agreement on selected areas of expertise.

The Electronics Industries Association of Canada feels that a great deal of "standard manufacturing" will be moved to other countries and that Canada must develop strong specializations in high technology areas to keep "one step ahead" of that development. As to the Make-or-Buy policy, the Association uses only one yardstick to measure its impact: total dollar volume contracted, with the immediate target to reach "dollar parity" between intramural and contractual research. The Association observes that the immediate target has not even yet been approached. Even though certain member firms have benefitted from the policy, the Association feels that the contracted volume of R&D is still so small that the more fundamental question whether or not industrial capability has been increased is still irrelevant.

The Association also stated that the contracting-out policy cannot achieve the government objective to raise Canada's overall level of scientific activities without involving many more industrial sectors. These could only be reached through major

programs in areas such as food and energy. If such programs were well formulated, the Association is of the opinion that companies would re-orient their activities in order to respond to these programs through the contract mechanism.

Canadian Manufacturers' Association and The Canadian Chamber of Commerce

The R&D Committees of the Canadian Manufacturers' Association (CMA) and The Canadian Chamber of Commerce (CCC) have had a number of discussions about the Make-or-Buy policy which they properly understand to be 'to establish additional industrial capability and to exploit the need for R&D by Government through contracts placed with industry, thus encouraging development of new products, processes, services, increased specialization, competitiveness and advantage in the market place.' Both organizations feel, however, that the contracting-out policy has not reached the manufacturing industry as a whole mainly because, with few exceptions, government science missions do not coincide with research objectives of industry. The chemical industry, for instance, has not participated in contract research at all. Individual companies are not prepared to staff-up for government contracts where there is no clear ongoing need for the new technology and no commercial opportunity behind the project.

Specifically, with respect to individual industrial sectors, the Associations have made four comments:

1. As far as the **Electronics Sector** is concerned, the contract approach is ''exceedingly useful'' because many of the customers are government or government-related institutions, both in Canada and abroad.

2. In those instances where a particular industry sector has had the same problem as government, meaningful co-operative research programs have been formulated. The CPAR program for instance, is highly regarded by the **Pulp and Paper** companies.

3. The Associations feel that the **Service Sector** is receiving too high a proportion of the contracts, without really **contributing to the original objective of the policy.** In fact, it is the view of both CMA and CCC that ''less than 10 per cent'' of the contracted research has been in accordance with the original objective.

4. In order to attain balance in government contracts, more sectors of industry would have to be involved in the contract mechanism. Government needs to modify or enlarge its science missions and ought to formulate major research programs, which in some instances might include R&D by government, industry and universities.

The **Canadian Association of Aerial Surveyors** stresses the point that, notwithstanding the Make-or-Buy policy, the Canadian Aerial Surveyors **have had limited access** to the government mapping business, mainly because the large category of scientific data collection is not covered by the policy. The Aerial Survey industry considers itself an imperilled industry, and feels that government is its chief competitor.

The **Association of Consulting Engineers of Canada** have made the following observations:

- The Make-or-Buy policy has given consulting engineers access to problems in a great variety of disciplines, thus allowing individual firms to deepen and widen their experience in a number of socially relevant fields.

- As a result of government contracts, consulting engineers have been able to offer better and more cost-effective scientific and engineering services to other customers.

- The Association of Consulting Engineers of Canada advocates the inclusion of "related scientific activities" under the Make-or-Buy policy.

Individual firms that have participated in contract research with the federal government are rather unanimous in their views on the Make-or-Buy policy. All agree that the contract mechanism is a strong mechanism to enhance industrial innovation. All agree that contracts have four principal advantages:

- Commercial products resulting from fully-funded contracts are more *price competitive* in that R&D costs need not be recovered through product cost,

- Fully-funded contracts provide *working capital* to the company for all of its activities associated with the project,

- The profit on fully-funded R&D contracts adds to the *financial strength* of the company, better enables it to pursue follow-on work which may require plant expansion or other investment,

- With respect to export business, foreign governments place a great deal of *credence* in the fact that the technology has already been *purchased* by the Canadian government. This is particularly true in developing countries where the procurement of high technology items is always negotiated via a government laboratory. Most of these laboratories have close ties with their counterparts in the Canadian government laboratories.

With respect to *unsolicited proposals,* all agree that the unsolicited proposal adjunct has been a major mechanism to encourage innovation in industry, **while responding to social needs** as reflected by government programs. The major concern that has been raised by the private sector deals with the uncertainty and possible lack of funding of successful projects once DSS bridge financing runs out.

On balance then and taking into account statistics as well as industrial points of view, we come to the following conclusions on the question of industrial capability:

1. *For reasons of competitiveness, financial stability, and international credibility, individual companies consider research contracts as a strong mechanism to encourage and foster industrial innovation. Contracts resulting from unsolicited proposals are particularly useful in this regard.*

2. *The Make-or-Buy policy has had a positive impact on small and medium-sized, Canadian-owned companies in three industrial sectors: electronics, "transportation" and the service sector.*

3. *In the judgment of government scientists,* ***technological benefits*** *to industry have been probable in 35 per cent of the contracts, possible in 30 per cent and unlikely in 35 per cent.*

4. *Because contracts are directly related to the specific science missions of government, large parts of industry have not been reached by the policy, nor will they be reached if government science missions remain unaltered.*

5. *Although Canadian manufacturers consider the contract mechanism to be a potential mechanism to increase Canada's* ***overall*** *industrial capability, other major research programs are needed in order to engage more of industry in a meaningful manner.*

6. *Because of the exclusion of Related Scientific Activities from the policy, large parts of the government high-technology market have not become accessible to Canadian industry.*

The evaluation will now turn to the three government-oriented criteria: employment trends, in-house capability and customer satisfaction.

7. Employment of Government Scientists

The information presented in this section is based on the Statistics Canada series on man-years (work-years) for personnel engaged in natural science activities, which is derived from the Government Main Estimates.

Table X compares the overall trend in government employment with employment trends in two sub-sets: programs **not** employing personnel engaged in the natural sciences (operational programs), and programs that **do** employ personnel in the natural sciences (science-based programs). The difference between the two series is spectacular. On the whole, there has been a 17.4 per cent increase in federal employment from 1972-73 to 1975-76, or an overall increase of nearly 52,000 work-years. The operational programs account for 85 per cent of this increase with a growth rate of 24.5 per cent. The science-based programs have grown at 6.6 per cent and account for not more than 15 per cent of the total increase in work-years.

A more detailed examination of the personnel categories in the science-based programs was carried out by the Program Review and Assessment Division of MOSST. The analysis shows that the number of work-years actively engaged in natural science activities has **decreased** by 0.8 per cent, which suggests that much of the 6.6 per cent growth was allocated to non-scientific activities within the science-based programs.

TABLE X

COMPARISON OF GROWTH TRENDS IN GOVERNMENT EMPLOYMENT

Component of Federal Work-Force	Fiscal Year 1972-73 (Work-Years)	Fiscal Year 1975-76 (Work-Years)	Change From 1972-73 to 1975-76 (Work-Years)	Change From 1972-73 to 1975-76 (%)
ALL PROGRAMS	295,736	347,357	51,621	17.5
- Programs NOT Employing Personnel Engaged in Natural Science Activities	179,938	223,963	44,025	24.5
- Programs Employing Personnel Engaged in Natural Science Activities	115,798	123,394	7,596	6.6
- Personnel Actively Engaged in Natural Science Activities	25,568	25,373	- 195	-0.8
- Personnel Engaged in R&D	16,324	16,596	272	1.7
- Programs with Contract R&D More Than 10% of Total Expenditures	48,912	49,382	470	1.0
- Personnel Engaged in Natural Science Activities	8,644	8,602	- 42	-0.5
- Personnel Engaged in R&D	5,921	5,909	- 12	-0.2

Sources: Government Main Estimates; MOSST Science Expenditure Reporting System; Statistics Canada Natural Sciences Survey 1972-1975

Table X shows the same employment trends for those science programs that contract more than 10 per cent of their total expenditures. The slight decrease in personnel activity engaged in natural sciences (-0.5 per cent), is of the same magnitude as for all science-based programs (-0.8 per cent).

The chief conclusion of this section must be that the entire allocation of human resources to science-based programs, with or without contracting, has been virtually at a standstill during the past three years. Possible sub-effects of the contracting-out policy as such are statistically not visible.

8. In-house Capability

With respect to the Make-or-Buy policy, the term "new R&D", has generally been equated with "new money" or "B-Budget" funds. Table XI shows the total increase in current expenditures for all scientific activities - R&D as well as RSA -

TABLE XI

INCREASE IN CURRENT EXPENDITURES ON SCIENTIFIC ACTIVITIES FY 1972–73 to FY 1975–76 BY DEPARTMENT OR AGENCY ($ 000)

Department or Agency		72–73	73–74	74–75	75–76
Agriculture	Actual Increase	7,590	5,962	5,994	8,591
	Corrected for salaries	3,929	3,467	2,618	1,397
C.M.H.C.	Actual Increase	505	– 353	568	1,635
	Corrected for salaries	505	0	568	1,635
Communications	Actual Increase	8,161	7,858	1,158	–1,421
	Corrected for salaries	8,161	6,193	1,158	0
E.M.R.	Actual Increase	4,970	4,539	4,265	6,185
	Corrected for salaries	4,970	2,534	1,088	0
Environment	Actual Increase	26,692	2,480	25,958	23,222
	Corrected for salaries	17,780	0	15,207	8,539
Indian and Northern Affairs	Actual Increase	522	118	112	368
		522	118	112	168
Health and Welfare Canada	Actual Increase	5,130	640	3,410	484
	Corrected for salaries	4,559	0	2,717	0
National Defence[1]	Actual Increase	–1,875	9,317	8,196	1,190
	Corrected for salaries	0	8,244	5,397	0
N.R.C.[2]	Actual Increase	9,385	4,222	14,450	25,960
	Corrected for salaries	7,403	2,524	11,390	22,596
D.S.S.	Actual Increase	–	–	2,921	9,787
	Corrected for salaries	–	–	2,921	9,787
Transport	Actual Increase	310	3,582	2,033	2,915
	Corrected for salaries	251	3,444	235	0
TOTAL	Actual Increase	61,390	38,365	69,065	78,916
	Corrected for Salaries	48,080	26,524	43,411	44,122

SOURCE: Statistics Canada, Survey of Federal Government Activities in the Natural Sciences

[1]MOSST Revision

[2]For NRC, the increases for 1974-75 and 1975-76 are composed of $12.4 and $12.6 million for Engineering and Natural Science Research and $0.9 and $12.6 for Scholarships and Grants in Aid of Research. The large increase in 1975-76 reflects the increase in the latter program.

in eleven departments and agencies. The Table shows two figures for each department: the actual increase as compiled by Statistics Canada from the Survey of Federal Government Science Activities in the Natural Sciences and a reduced figure to remove the effects of increased salaries and wages. This reduction was calculated by the Research and Analysis Group and the PRA Division of MOSST, based on the percentage increase in salaries and wages as reported in the Government Estimates ("Blue Book").

Table XI has been interpreted as follows:

- The net increase in federal science expenditures, has been of the order of $45 million per year during the past 4 years, or about 4 per cent of the respective annual science budgets.

- A department-by-department comparison of the total adjusted increment with contract expenditures for mission-oriented R&D (Table II) indicates, however, that virtually **all** new money has been contracted.

- With the possible exception of one department, a comparison of Tables II and XI seems to suggest also that departments maintain the contracting funds from year to year for that purpose, and that contract increments of one year have not become part of the intramural A-base during the next.

The overall picture of resource allocation suggests that no significant science initiatives have developed during the past few years either in-house or under contract. *In fact, the entire increase in federal science activities is attributable to the modest increase in contract research.* Only two initiatives stand out: the joint NASA-NRC-Industry Program to develop the Remote Manipulators for the Post-Apollo Shuttle Program, and the Energy R&D Program that has recently been proposed by the Minister of Energy, Mines and Resources. From these examples, one concludes that many science managers in government have been seeking ways to integrate Canada's industrial capability into departmental programs in a meaningful way, but that the very momentum of the in-house effort, the absence of pressing national problems, and the general constraint on government expenditures, have prevented major new science programs to develop over the past four years. Meanwhile, the budget figures indicate that the in-house capability, as measured by intramural expenditures has not been affected, either one way or another, by the contracting-out policy. The judgment of some government scientists on this matter is that the budgetary constraints of the past few years have reduced **all** government capability to react to problems that require scientific examination, be it in-house or under contract. Conversely, this condition could also be interpreted to mean that old science programs are not being discontinued in favour of new initiatives.

9. Customer Satisfaction

Although each completed government contract has a post-contract evaluation report, the information of these reports is qualitative and subjective. Moreover, the absence of similar reports for intramural projects rebuffs any systematic comparison between contract research and intramural research. As for subjective "satisfaction," however, DSS examined 650 post-contract reports.

From a scientific point of view, 78 per cent of these contracts were performed according to expectation, 18 per cent exceeded expectation, and 4 per cent fell short of expectation. Contractually speaking, 88 per cent were finished according to expectation, 9 per cent exceeded expectation and 3 per cent fell short. *These judgments indicate that the great majority of R&D contracts for the federal government are carried out to the satisfaction of the customer scientist and the DSS contract manager.*

Personal comments from program directors and senior government scientists provide further insight into the Make-or-Buy policy. Although the comments differ in detail, they have recurring themes:

- In the present state of Canada's economic development a Make-or-Buy policy is a sound idea.

- Although the cooperation with industry has been good, the basic scientific capability of industry is "deplorably weak", even to the point that it affects the engineering capability. The level of experience that government scientists expected to find in their industrial counterparts is simply not there.

- By and large, Canadian industry has not invested in the kind of scientists and engineers who have a broad overview of major areas of science and technology.

- As a result, government scientists in a variety of major programs must work with industry in ways that are below state of the art.

- At the same time, this reality has pressed home with government scientists the true state of affairs in industrial research in Canada with the result that there is a growing awareness and a growing concern among government scientists that, "Canada is slipping."

- Even though a specific research contract in industry may have lifted the general level of competence, the question remains whether or not the uplift is permanent.

- A joint government-industry approach to science and technology is necessary and possible.

10. Summary of Conclusions (Principal Evaluation Criteria)

The conclusions that have been reached in this part of the evaluation of the Make-or-Buy policy are twofold.

On the positive side we observe that:

- *the industrial share of government R&D has increased from 4.4 per cent to 12.9 per cent over the past five years.*

- *R&D contracts have not been overly concentrated in the two main industrial areas of Canada, but have been distributed to industries in various regions of Canada.*

- *Contracts under the Make-or-Buy policy, both in number and in value, have favoured Canadian-owned enterprises.*

- *For reasons of competitiveness, financial stability and international credence, individual companies consider fully-funded R&D contracts a strong mechanism to encourage and foster industrial innovation. Contracts resulting from unsolicited proposals are particularly useful in this regard.*

- *Research contracts have had a positive impact on small and medium-sized companies in three industrial sectors: electronics, "transportation" and those companies that provide scientific services.*

- *In the judgment of government scientists, technological benefits to industry have been probable in 35 per cent of all R&D contracts completed, possible in 30 per cent and unlikely in 35 per cent.*

- *Notwithstanding certain weaknesses in industrial R&D, government scientists are satisfied that industry can contribute in a significant manner to the science mission of government.*

On the negative side we conclude that:

- *With or without the industrial support payments for R&D, the initial target of the policy to obtain a "more even balance" remains a distant goal.*

- *Because of the nature of present science missions of government, large parts of industry have not been reached by the Make-or-Buy policy nor will they be reached if government science missions remain unchanged.*

- *Canadian manufacturers consider research contracts to be a good mechanism to increase Canada's industrial innovative capability, and they are hopeful that major new research programs in such areas as food and energy will engage more of industry in a meaningful manner.*

- *Because of the exclusion of related scientific activities from the policy, large parts of the government high-technology market have not become accessible to Canadian industry.*

- *In addition, it may be noted that: the total resources allocated to science-based programs, with or without contracting, has been virtually at a standstill during the past three years. The modest increase that has taken place in contract research during that period represents almost the* ***entire*** *increase in federal science activities.*

- *From a national point of view, senior government scientists express concern about the lack of certain skills in industry.*

SUBSIDIARY POLICY ASPECTS

Although the various directives on the Make-or-Buy policy raise only the evaluation criteria that have been outlined in the previous chapter, there are a number of related policy issues that deserve discussion. These are the role of universities; non-profit institutions; research contracts to "Other Performers;" federal-provincial relations; excluded activities. Following is a discussion of these issues.

1. University Contracts

Although the Make-or-Buy policy does not apply to universities, the Department of Supply and Services has awarded a fairly steady percentage of its research contracts to universities. There are two reasons for this. First of all some departments have converted their university grants program into a contracting program, in order to enable universities to recover their overhead costs adequately. For example, the Department of Communications has taken this step and has asked DSS to manage the contracting process.

The second reason has been the presence of specific kinds of expertise in universities which was needed by certain government programs and which was *not* available in industry. In those instances, DSS used university contracts as a legitimate complement to industrial contracts. This practice has been in accordance with Section 17 of the Treasury Board Guidelines.

The volume of university contracts, including contracts to non-profit institutions, reported by DSS, is identical to the contract expenditures reported by Statistics Canada, indicating that DSS has become responsible for **all** contract relations with the university community.

	($ 000)		
	1973–74	**1974–75**	**1975–76**
Statistics Canada contract expend. to universities and non–profit institutes	4,240	5,581	7,811
DSS Contract Statistics: Universities and Non–profit Institutes	3,208	6,029	7,103 (to date)*

**Nov. '75*

However, concern has been expressed that the contracting-out policy has provided university faculty with significant extra income and that many university professors have created "paper companies" to attract government contracts. To verify these allegations, MOSST asked DSS to examine **all** contract files (1996) for the period April 1, 1974 - September 30, 1975, in order to determine:

TABLE XII

DSS RESEARCH CONTRACTS INVOLVING UNIVERSITY STAFF

April 1, 1974 – September 30, 1975

	No. of Contracts	Value	Method of Contract	
			Front Door	Direct
1. Contracts with universities	563	$9,664,015	563	–
2. Contracts with individuals associated with universities	28	213,208	17	11
3. Contracts with companies employing individuals associated with universities	20	949,308	15	5
4. Contracts with companies with sub–contracts to universities	15	250,252*	15	–
5. Contracts with companies with sub–contracts to individuals associated with universities	4	22,360*	1	3
TOTAL DURING PERIOD:	630	$11,099,143	611	19

**Total Value of Sub-Contracts*

1. The number and value of contracts with universities during that 18-month period and the method of contracting for university personnel,

2. The number and value of contracts with individuals who are associated with universities and the method of contracting,

3. The number and value of contracts and the method of contracting with industrial enterprises that employ individuals associated with universities,

4. The number and value of contracts and the method of contracting with industrial enterprises which placed sub-contracts with universities,

5. The number and value of contracts and the method of contracting with industrial enterprises which placed sub-contracts with individuals who are associated with universities.

In all of these categories, the "method of contracting" indicates whether the contract was awarded to the university administration (as opposed to an individual professor) or whether the university administration had given prior approval to a certain sub-contracting arrangement. These contracts are referred to as "Front Door" contracts. In those cases where the university administration was not made aware of the contract, the contracting method is called "Direct." In addition to the contracting mechanism, DSS has examined what financial remuneration is made to the principal investigator in the first category of contracts. The results are shown in Table XII and can be summarized as follows:

- Of the 630 research contracts that involved university personnel, 97 per cent (611 contracts) were awarded "through the front door."

- A total of 20 contracts were awarded to companies which employed individuals associated with universities. The 18 companies which received these contracts were all properly incorporated.

- Fifteen of these contracts were awarded with the specific approval of the university administration. In terms of money, these represent 80 per cent of the contracts in this category.

- All sub-contracts from companies to universities were awarded to the university administration.

- In three instances, companies retained individual university personnel on a sub-contract basis without prior approval by the university. In terms of money, these represent in total $18,860 or 1.7 per cent of all university-related contracts.

The overall conclusion, therefore, is that DSS has dealt almost exclusively with the university administration rather than with individual professors. Even where contracts have been awarded to university-related companies, DSS has obtained prior approval from the university administration to contract with key university personnel in 80 per cent of the cases. In total, DSS has awarded contracts to 18 university-related companies. In the case of those industrial contracts where the company required a university sub-contract, DSS has ensured that approval was obtained by the company from the university administration in 16 out of 19 cases. In the remaining cases, DSS was not aware of the university involvement at the time of contracting.

With respect to remuneration of university professors, the DSS study shows that:

- 61 per cent of the university contracts have **no** remuneration for the principal investigator,

- 39 per cent of the university contracts allow for some kind of payment to the principal investigator, either as an honorarium or as some form of time charge. The remuneration of the principal investigator ranges from 8.9 per cent of the contract value to 43 per cent of the contract value, with a median of about 16 per cent. In all cases, however, the actual payment is a matter between the university administration and the professor, and not between the professor and government.

In summary, it appears that DSS and government departments have made responsible and legitimate use of university expertise. University contracts have been modest in size (average value $17,600) and there is no evidence that the Make-or-Buy policy has given rise to a large number of university-related "paper" companies. In terms of dealing with the university community, DSS has dealt almost exclusively with the university administration. The remuneration of principal investigators has been modest and has been entirely an internal university matter.

TABLE XIII

DISTRIBUTION OF R&D CONTRACTS AMONG RESEARCH COUNCILS AND OTHER NON-PROFIT ORGANIZATIONS

April 1, 1973 – September 30, 1975.

Organization	No. of Contracts	Total Value	Average Value
1. Ontario Research Foundation	37	$ 824,175	$22,275
2. B.C. Research	22	$ 328,259	$14,920
3. New Brunswick Research and Productivity Council	4	$ 119,363	$29,940
4. Saskatchewan Research Council	2	$ 49,300	$24,650
5. Nova Scotia Research Foundation	3	$ 44,418	$14,B06
6. All Other Organizations	24	$ 437,056	$18,210
TOTAL	92	$1,802,571	$19,593

On balance, it seems that university contracts have been used with good judgment and not to the detriment of the contracting-out policy, nor in unfair competition with industry.

2. Non-profit Institutions

Since April 1, 1973, research contracts with non-profit institutions have amounted to $1,802,571. In general, the non-profit institutes were used where there existed a very specific expertise which was not available either in industry or in university. This has also been the reason why some of these organizations have been successful with unsolicited proposals. Yet the overall volume of business with the non-profit organizations has been small. The average contract has been $19,500 and the main distribution is shown in Table XIII.

The relation with the provincial research councils has been the subject of some discussion. In those provinces where the research councils must derive most of their income from contract research, they tend to compete with the very industry they are meant to support. Given the present state of Canada's economic development, the role of the research councils is becoming increasingly unclear. The relation that has developed between the non-profit institutes and the Government of Canada has been on the basis of Section 17 of the Make-or-Buy Guidelines. This position was explained clearly in a letter from the Honourable Jeanne Sauvé and in a more recent letter by the Honourable C.M. Drury.

In May 1973 Mme. Sauvé wrote to the Industrial Research Institute at McGill University that the main thrust of the policy is "to help ensure that R&D activities are translated more effectively into additional Canadian industrial capability. While universities and non-profit institutions are not specifically excluded, there is indeed an intentional bias, where appropriate, towards the use of Canadian industry to

perform the R&D required by the various government departments." "I am particularly interested," wrote Madame Sauvé, "in the aspect of the Make-or-Buy policy which encourages teaming arrangements between industry and, on a sub-contract basis, Industrial Research Institutes such as yours."

In April 1975 the Honourable C.M. Drury reiterated this position in a letter to the Ontario Research Foundation: "...in conformity with the basic (policy) objective, an industrial performer having the required capabilities, would be given preference, but an industry-oriented R&D organization... would be selected ... if an acceptable industrial performer cannot be identified."

Apart from providing a specific answer to a specific question, it is difficult to judge the overall economic benefit when research contracts are carried out by provincial research establishments. There are neither immediate industrial spin-offs nor obvious educational benefits. *It appears that the non-profit institutes have tended to regard federal research contracts simply as an immediate source of income.* That - by itself - is not in keeping with the objectives of the contracting-out policy, and, accordingly, such institutes have not been major beneficiaries of government contracts.

3. Research Contracts to "Other Performers"

Table I shows that departments have reported substantial amounts of money to Statistics Canada as research contracts to "other performers." The figures reported by Statistics Canada differ significantly from contract statistics in the category reported by the Department of Supply and Services:

	($ 000)			
	1973–74	1974–75	1975–76	
Statistics Canada Contracts to "Other Performers"	3,807	7,473	7,087	See Table I
DSS Contracts to "Other Performers"	1,772	1,914	1,581	See Table III

However, more detailed examination of the Statistics Canada figures show that most payments to "other performers" have been in the nature of grants rather than contracts. The principal departments that reported expenditures in this category are: Industry, Trade and Commerce, and the Department of Regional Economic Expansion. The payments in this category have been for capital structures and operating grants to such organizations as the Maritime Resources Management Services, which is a supra-governmental agency in the Atlantic provinces. Other payments have been to municipalities and some to individuals.

The payments by Industry, Trade and Commerce are related to operating grants to industrial research institutes and are not contracts for research to be done on behalf of that department.

On balance, it appears that most of the payments for R&D to "other performers" as reported by Statistics Canada are grants rather than contracts, and are related to government objectives other than industrial technology.

4. Federal–Provincial Relations

The purpose behind the contracting-out policy is to improve Canada's industrial technological capability. Concurrent with this federal policy, there are a number of provincial policies also dealing with industrial development and the use of science and technology.

Ontario is the only province in Canada that has an equivalent to the contracting-out policy. Provincial ministries in Ontario have been directed to contract-out their requirements for research and development to the private sector. The province has no central contracting-out agency and each ministry will implement the policy under general administrative guidelines issued by the Provincial Management Board. The policy was adopted in 1974, but no overall statistics are yet available.

In the Province of Quebec, a conscious effort has been made to harness science and technology to the benefit of the province. Emanating from the university community on the one hand, and from provincially-owned utilities on the other, Quebec has created several semi-public non-profit research institutes. The explicit purpose of these institutes is to aid industrial growth and economic development within the Province. Although the Government of Quebec is interested in having federal research performed in the Province, it is clear that the industrial bias of the Make-or-Buy policy mitigates against strong participation by universities and non-profit institutes. The main reason that the Province of Quebec has received one-third of the federal contract money to date, has to do with the strong participation of RCA and related electronics companies in the CTS program, and with the presence of two of Canada's foremost consulting engineering companies in Montreal.

The situation in the Western Provinces is less well defined. The Province of Alberta has major scientific expertise in the technologically intensive service sector, particularly in the fields of engineering, earth sciences, geophysics and environmental sciences. The Province is developing a $100 million research program on energy and the provincial government is favourably inclined to engage Alberta companies in contract research for this program. In those instances where the federal government and the provincial government have agreed to a joint research program, federal officials have recognized and acknowledged the special provincial interest in the development of local capabilities. For instance, the federal-Alberta research program on environmental aspects of tar-sand exploitation, which uses contract research to a large extent, employs a review mechanism for federal contracts which includes not only officials from DSS and Environment Canada, but also the provincial program director to give emphasis to the development of provincial expertise in environmental sciences.

A similar example from Atlantic Canada is the joint federal-provincial feasibility study for the Bay of Fundy tidal power project. Although the program is largely carried out under federal contract, the Department of Supply and Services must respond to the direction given by the joint federal-provincial steering committee.

The same situation will arise in the forthcoming coal studies in British Columbia and the Lloydminster Oil Recovery Program in Saskatchewan. All these examples illustrate that: *federal-provincial relations will be of increasing importance under the Make-or-Buy policy, particularly in the case of joint research programs where the research pertains to areas under provincial jurisdiction.*

TABLE XIV

CURRENT GOVERNMENT EXPENDITURES FOR RELATED SCIENTIFIC ACTIVITIES AND HUMAN SCIENCES IN ALL DEPARTMENTS EXCEPT AECL ($ 000)

	71–72	72–73	73–74	74–75	75–76
Related Scientific Activities*					
Intramural:	166.5	200.8	176.5	204.0	226.2
Contracts to Industry:	8.1	6.5	5.1	6.5	8.1
Contract % Total	4.6	3.1	2.8	3.0	3.5
Human Sciences**					
Intramural R&D plus RSA:	122.7	129.2	148.3	183.9	219.4
Contracts to Business Enterprises	5.2	6.6	5.5	8.0	9.3
Contract % Total	4.0	4.8	3.7	4.3	4.2

Source: Statistics Canada, Long-term Series Federal Government Activities with Natural Sciences, September 1975

**Source: Statistics Canada, Catalogue 13-205, November, 1972. MOSST: Federal Scientific Resources, December, 1974, p. 69*

5. Excluded Activities

Table XIV shows a summary of the two large categories of science that have been excluded from the contracting-out policy, i.e. Related Scientific Activities (RSA) and the Human Sciences.

Related Scientific Activities consists of scientific data collection, (e.g. hydrographic surveys), scientific information, testing and standardization, feasibility studies and education support. Table XIV shows current intramural expenditures of the order of $225 million in this category and $8 million contract expenditures, exclusive of feasibility studies. Most of the intramural expenditures are concentrated in five departments: Environment ($120.6 million in 1975-76); Energy, Mines and Resources ($38.5 million); National Research Council ($19.3 million); National Defence ($17.7 million); and Consumer and Corporate Affairs ($9.5 million). In terms of industrial interest, the greatest opportunity exists in the programs of scientific data collection in Environment Canada and Energy, Mines and Resources.

Although the DSS contract statistics show many contracts that might possibly be interpreted as Related Scientific Activities, the program departments tend to identify them all as mission-oriented R&D. The large contracts for airborne geophysical surveys on behalf of Energy, Mines and Resources, however, which clearly belong in the category of RSA, are not shown in the DSS statistics.

The Canadian Association of Aerial Surveyors and the Association of Consulting Engineers of Canada have made the point that Related Scientific Activities contain so many industrial opportunities in a variety of high-technology areas that they ought to be included in the contracting-out policy. The Science Council took this position also in its Annual Report of 1973 on the grounds that related scientific activities "possess a year-to-year continuity that R&D lacks," which will, in many instances, establish a base from which good R&D will emerge.

The Association of Consulting Engineers of Canada has stressed the importance of inventories and surveys as an intelligent data base not only for government but for individual companies as well. Electronic companies have consistently expressed interest in the national data market as witnessed by various unsolicited proposals for under-ice geophysical and hydrographic surveys, environmental monitoring, including a proposal by Philips Electronics and several other companies which were presented to government on behalf of the Air Industries Association.

In the Human Sciences, intramural government expenditures are of the order of $200 million per year, with payments to "Canadian business enterprises" of some $10 million per year. The Human Sciences are broken down into the same statistical categories as the Natural Sciences: R&D and RSA. R&D accounts for about 25 per cent of the total expenditures in Human Sciences with average departmental expenditures of $2.5 million in 25 departments and agencies. With respect to RSA, and mainly the sub-category of data collection, one agency accounts for nearly half of all expenditures: Statistics Canada.

Research in the human sciences pertains to the large fields of labour, immigration, native people, health care, social welfare, urban conditions, community development, educational problems, recreation, history and economics. A growing number of contracts for human sciences is now being handled by DSS, generally in the field of economics and sociology.

However, from the point of view of "increased industrial capability," there are three specific categories of human sciences that deserve attention, not only because of their intrinsic value to Canadian industry, but also because of their derivative industrial importance. These activities can be broadly described as urban studies, transportation studies and regional studies. In each one of these activities, it would appear that participation by the private sector can have additional economic spin-offs that are not being achieved by keeping the work within government, or by contracting to Canadian universities. Annual increments in these three fields of activity have been on the order of $10 million.

As a general conclusion, it appears that the two large categories of scientific activities that are not covered by the policy — Related Scientific Activities and Human Sciences — contain significant opportunities for industrial participation that are fully consistent with the original policy objectives.

6. Summary of Conclusions (Subsidiary Criteria)

As to the subsidiary policy issues, we can say that:

- *University contracts have been used in accordance with the policy guidelines and not to the detriment of the contracting-out policy, nor in unfair competition with industry.*

- *Non-profit institutes have tended to regard federal research contracts simply as an immediate source of income. That, by itself, is not in keeping with the objectives of the contracting-out policy.*

- *Payments for R&D to "other performers" seem to be grants rather than contracts and are related to government objectives other than industrial technology.*

- *Federal-provincial relations will be of increasing importance under the Make-or-Buy policy, particularly in joint research programs where the research pertains to areas under provincial jurisdiction.*

- *The two large categories of scientific activities that are now excluded from the policy — Related Scientific Activities and Human Sciences — contain significant opportunities for industrial participation that are fully consistent with the original policy objectives.*

GENERAL CONCLUSIONS

For many decades Canada has followed the general practice of conducting research and development in government laboratories in the expectation that results would flow to the private sector. (A notable exception has been the Department of National Defence which has traditionally contracted-out much of its R&D requirements). This model of government research embodies problems of technology transfer. It would be presumptuous to claim that the contracting-out policy has solved all of these problems, but it is evident from this review that within definite limits the Make-or-Buy policy has, in a very short time, significantly shifted practices and attitudes in respect to transferring R&D to private industry.

It is evident from our review that government departments as well as industry have responded to this new initiative with mutual benefits. It is equally evident that the possibilities for an extended program of contract R&D either requires a reduction in government staff (and one must keep in mind that there must be a reasonable in-house capability maintained in order to contract-out knowledgeably and intelligently), or a substantial increase of funds allocated to this end. Unavoidably, in today's situation, this means a re-allocation from some other activities; a process which of course raises extraordinarily difficult questions of priorities.

How large might one envisage a program of contracting-out becoming over the next few years and hence what is the possible magnitude of the re-allocation problem? The effects of the policy to date have been most pronounced in the fields of electronics, transportation and the more diffuse sector of scientific services — those industrial sectors where the objectives of government and industry most closely coincide in the context of current departmental missions. Meanwhile, major new concerns are emerging related to energy, food, and the problems of exercising sovereignty over adjacent arctic and two hundred miles of ocean.

The nature of these problems is such that the governmental, industrial and university sectors will be strained to meet the demands placed upon them. For the moment, however, the problem of more fully developing Canada's industrial capability seems to be a matter of greatest urgency. In this regard, the extension and intensification of the Make-or-Buy policy seems to be an appropriate and effective mechanism to meet government as well as industry goals.

APPENDIX A

STATISTICAL TABLES

TABLE I

Intramural Expenditures on Mission–oriented R&D (Schedules A and B - Departments and Agencies)

Year	Current Intramural R&D	Less Admin Cost of Extramural R&D	Less Free Basic Research	Plus Feasibility Studies	Current Intramural R&D	Capital Intramural R&D
			($000)			
A. Natural sciences and Technology						
1970–71	230,195	5,000	5,100	3,505	223,600	36,302
1971–72	244,809	6,000	7,139	3,156	234,826	39,688
1972–73	269,771	7,227	11,985	3,985	254,544	38,715
1973–74	291,882	10,040	18,050	3,928	267,720	40,107
1974–75	321,742	12,284	21,728	4,213	291,943	43,522
1975–76	349,224	13,907	22,469	4,466	317,334	72,209
B. Human Sciences				(1)		
1970–71	20,617	1,350*	–	**	19,267	497
1971–72	25,790	1,837	–	**	23,953	1,867
1972–73	32,068	1,901	–	**	30,167	1,486
1973–74	37,473	3,842	18	1,912	35,525	1,724
1974–75	48,718	4,179	–	2,396	46,935	1,906
1975–76	52,162	5,544	–	2,692	49,310	2,237

**Estimated*

***Not Available*

(1) Economic and Feasibility Studies.

SOURCE: Statistics Canada: Education, Science and Culture Division, October 1975.

TABLE II

Mission–oriented R&D Contracts to Industry (Schedule A and B – Departments and Agencies)

Year	Contract R&D	Less Free Basic R&D (1)	Plus Feasibility Studies (2)	Mission oriented R&D Contracts
		($000)		
A. Natural sciences and Technology				
1970–71	9,768	–	826	10,594
1971–72	12,444	–	2,047	14,491
1972–73	19,597	–	175	19,772
1973–74	29,219	–	264	29,483
1974–75	33,882	–	600	34,482
1975–76	47,636	–	1,497	49,133
B. Human Sciences			(3)	
1970–71	1,536	–	**	1,536 (4)
1971–72	1,882	–	**	1,882 (4)
1972–73	2,211	–	**	2,211
1973–74	3,660	–	458	4,118
1974–75	4,692	–	622	5,314
1975–76	8,202	–	598	8,800

(1) Assumed not applicable to contract work. No breakdown available.

(2) All reported feasibility studies assumed to be contracts. Historical series in error for 1971-72 and 1972-73. Data have been revised as shown here.

(3) Economic and feasibility studies.

(4) May include some grants - no breakdown available.

*** Not available.*

SOURCE: Statistics Canada: Education, Science and Culture Division, October 1975

TABLE III

R&D Contracts to Universities and Non-profit Institutions (Schedule A and B – Departments and Agencies)

	Year	Contract R&D	Less Free Basic R&D (1)	Plus Feasibility Studies	TOTAL
			($000)		
A.	Natural sciences and Technology				
	1970-71	2,452	—	–	2,452
	1971-72	2,609	–	35	2,644
	1972-73	4,052	–	26	4,078
	1973-74	4,159	–	81	4,240
	1974-75	5,461	–	120	5,581
	1975-76	7,639	–	172	7,811
B.	Human Sciences			(2)	
	1970-71	**	–	**	**
	1971-72	**	–	**	**
	1972-73	2,897 (3)	–	**	2,897 (3)
	1973-74	1,957	–	911	2,868
	1974-75	2,143	–	1,160	3,303
	1975-76	3,408	–	1,222	4,630

(1) Assumed not applicable to contract work. No breakdown available.

(2) Economic and Feasibility Studies.

(3) Includes "Other Canadian Sector."

** *Not available.*

SOURCE: Statistics Canada: Education, Science and Culture Division, October 1975

TABLE IV

R&D Contracts to Other Performers

	Year	Contract R&D	Less Free Basic R&D (1)	Plus Feasibility Studies	TOTAL
			($000)		
A.	Natural sciences and technology (excluding AECL)				
	1970-71	2,380	–	1,020	3,400
	1971-72(r)	2,076	–	8,705 (2)	10,781
	1972-73(r)	4,109	–	12,400 (2)	16,509
	1973-74	3,807	–	11,309 (2)	15,116
	1974-75	7,473	–	17,469 (2)	24,942
	1975-76	7,087	–	19,134 (2)	26,221
B.	Human Sciences			(3)	
	1970-71	**	–	**	**
	1971-72	**	–	**	**
	1972-73	125 (4)	–	**	125 (4)
	1973-74	1,471	–	113	1,584
	1974-75	1,415	–	289	1,704
	1975-76	1,904	–	287	2,191

(1) Assumed not relevant to contract work.

(2) CIDA foreign payments. Not included in review.

(3) Economic and feasibility studies.

(4) Foreign plus provincial and muhicipal governments only.

** *Not available.*

SOURCE: Statistics Canada; Education, Science and Culture Division, October 1975

TABLE V

MISSION-ORIENTED R&D CONTRACTS AWARDED BY DSS BETWEEN April 1, 1973 and September 30, 1975 $250,000 AND OVER

Company	Short Title	Amount $
Montreal Engineering Company, Montreal, P.Q.	Ground-fish Survey	381,518
Computing Devices of Canada, Ottawa, Ontario.	Automatic Data Link	344,625
E.W. Brooker & Associates, Edmonton, Alta.	Geological Survey MacKenzie	322,560
Space Research Corporation, Montreal, P.Q.	155 MM Projectile	439,900
Computing Devices of Canada, Ottawa, Ontario.	Digital Scan Converter	298,060
Canadian General Electric, Toronto, Ontario.	Multi-spectral Image Analyzer	350,500
Surveyer, Nenniger & Chenevert, Montreal, P.Q.	Telescope Design	800,000
Canadian Marconi Co. Ltd., Montreal, Quebec.	AN/GRC 103 Radioset	301,000
Atlas Steel Company, Welland, Ontario.	Shaft Electric Furnace	303,314
Leigh Instruments, Ottawa, Ontario.	Mechanical Strain Recorder	431,841
RCA Limited, Ste Anne de Bellevue, P.Q.	CTS Program	2,500,000
SPAR Aerospace Products, Toronto, Ontario.	CTS Program	3,400,000
SED Systems, Saskatoon, Saskatchewan.	Satellite Terminal	828,128
SED Systems, Saskatoon, Saskatchewan	Satellite Terminal	425,000
Computing Devices Co., Ottawa, Ontario.	Hydrographic Survey	291,000
SPAR Aerospace Products, Toronto, Ontario.	RMS Study	249,549*
MacDonald-Dettwiler & Associates, Vancouver, B.C.	Portable ERTS Station	1,303,408

Company	Short Title	Amount $
Canadian Thin Films, Burnaby, B.C.	Airborne Magnetometer	249,816
Sciex Limited, Toronto, Ontario.	Trace Gas Analyzer	348,582
Canadian Marconi Company, Montreal, P.Q.	New Telex Exchange	597,187
SPAR Aerospace Products, Toronto, Ontario.	RMS Simulator	366,235
F.F. Slaney & Company, Vancouver, B.C.	Yukon Land Inventory	285,000
Huntec (70) Limited, Toronto, Ontario.	Seabed Mapping	360,786
Surveyor, Nenniger & Chenevert, Montreal, P.Q.	Telescope Design	700,000
RCA Limited, Ste Anne de Bellevue, P.Q.	CTS Remote Users	2,262,806
Trigg, Woollett & Assoc., Edmonton, Alberta.	Geochemical Lake Survey	298,000
Canadian National Railways, Montreal, Quebec.	Train, Track Interaction	421,000
Hermes Electronics, Dartmouth, N.S.	Ocean Data System	2,126,850*
Innotech Aviation Limited, Dorval, P.Q.	Remote Sensing	2,515,395
DeHavilland Aircraft, Downsview, Ontario.	Augmenter Wing	248,597
SPAR Aerospace Products, Toronto, Ontario.	RMS Breadboard Phase	2,000,000
Great Lakes Paper Company, Thunder Bay, Ontario.	Closed-cycle Bleaching	1,158,000*
SED Systems, , Saskatoon, Saskatchewan.	Satellite Communications	258,000
Canadian Marconi Limited, Montreal, P.Q.	Telescope Control System	713,416
MacDonald Dettwiler Vancouver, B.C.	Mobile Radio System	343,499

**Contract resulting from Unsolicited Proposal.*

Source: Science Centre, Department of Supply & Services, R&D Bulletin, April 1973 - October 1975.

LIST OF TABLES