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# Background Study for the Science Council of Canada

June 1971  
Special Study  
No.19

Research  
Councils in  
the Provinces:  
A Canadian  
Resource

By Andrew H. Wilson

**ANALYZED**

**Research  
Councils in  
the Provinces:  
A Canadian  
Resource**

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### *Employment*

Served a "sandwich" apprenticeship in marine engineering with Harland and Wolff Ltd., Glasgow, concurrently with University engineering studies.

Served in the Royal Air Force, 1950-51, principally as a Technical Staff Officer at Headquarters, Coastal Command, Northwood, Middlesex, and attained the rank of Flying Officer.

Design engineer (hydraulic equipment) with MacTaggart, Scott Ltd., Edinburgh, 1949-50.

Sales engineer with the Skefco Ball Bearing Co. Ltd. (S.K.F.), Luton and Birmingham, England, and Cardiff, Wales, 1954-57.

Senior mechanical design engineer with Atomic Energy of Canada Ltd., Chalk River, Ontario, 1958-60.

Scientific administrative officer, Physics Division, AECL, Chalk River, 1960-64.

Secretary and chief research officer of the Advisory Committee on Industrial Research and Technology of the Economic Council of Canada and member of the Council's staff, 1964-68.

Science Adviser, Science Secretariat, Privy Council Office, September 1 to October 31, 1968.

Science Adviser, Science Council of Canada, since November 1, 1968.

### *Publications*

Author of research and background papers for the Economic Council and its Advisory Committee, including "Science, Technology and Innovation". Economic Council of Canada Special Study No. 8, 1968.

Author of several other published papers, including "The Chalk River Project". Glasgow University Engineering Society, 1962, and a contribution, "Why Smash Atoms?", for the AECL Review, 1964.

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Member of the Engineering Institute of Canada.

Program chairman of the Chalk River Branch of the EIC, 1960-61.

Member of the Association of Professional Engineers of Ontario.

Member of the Institution of Mechanical Engineers, London, England.

Member of the Canadian delegation to the Policy Conference on Highly Qualified Manpower of the OECD, 1966.

Associated with the organization and administration of the International Conference on Nuclear Structure held at Kingston, Ontario, 1960, and with the International Atomic Energy Agency's Symposium on the Inelastic Scattering of Neutrons, held at Chalk River, 1962.



## Foreword

Several months ago a small group was formed within the staff of the Science Council to examine a wide range of incentives and impediments to technological innovation in Canadian industry. For the purposes of this work, the "process" of research, development and technological innovation has been broadly conceived as including those scientific and technical activities in the laboratory and the manufacturing plant—and outside of them—which are associated with the production of new or improved goods and services for the marketplace. The relevant incentives and impediments are therefore those of an economic, legal, regulatory, institutional or structural kind associated with the generation and application of science and technology.

The work of the staff group has been placed under the purview of the Council's Committee on Industrial Research and Innovation, and this Committee will be the initial forum for the discussion of the information gathered and conclusions reached by the group. We anticipate that the group's work will be published in a series of Special Study reports rather than in a single document.

In February of 1970, the Committee asked that priority be given to an examination of the roles, functions and effectiveness of the Research Councils and Foundations established in the majority of the provinces\* of Canada, and indicated the lines along which this examination should proceed. Mr. Andrew H. Wilson undertook the necessary investigation and research, and the Special Study report which follows records his findings and conclusions. The Committee discussed the report and developed its own views, which it subsequently communicated to the Science Council. The Council now wishes—by means of this Foreword—to make some comments and a number of recommenda-

\*In Nova Scotia, New Brunswick, Ontario, Saskatchewan, Alberta and British Columbia and, more recently, in Quebec. In Manitoba a Council has also been in partial operation for seven years.

tions and suggestions with regard to the present and future activities of the Research Councils and Foundations in the provinces. These recommendations arise directly from the report which follows, and no attempt has been made to touch here on other issues, even when they may appear to have a close relationship to the question of the role of the Research Councils. For example, the Science Council is concerned about the question of the organization and performance of research in the Yukon and the Northwest Territories, but will make its comments on this matter separately.

At this point, it is necessary to emphasize two important factors. First, the Research Councils and Foundations in the provinces of Canada are unique. While several other countries have institutes equivalent to our National Research Council, none has quite the same broad range of industrially and regionally oriented institutes in its states, provinces or districts. Second—and less praiseworthy for Canada—we have tended to neglect the Councils when thinking of a national science policy.

In spite of their relatively small size at the present time, the six older Research Councils and Foundations appear to have become centres of competence which cannot be ignored. They have growth potential. They are quite effective and flexible in operation, and are generally closer to industry than are the universities. They are in a position to assess regional problems and to form an important link between local industry and the centres of competence in both provincial and federal departments and agencies. They are familiar with the problems of small companies, the more technologically oriented of which have perhaps more innovation and growth potential than most other companies. The Councils are, indeed, a Canadian resource and their strengths should be used, and their weaknesses corrected, as part of a national strategy for the application of science and technology to the solution of our economic and social problems. It is clear to us that these institutes have grown and developed to an

extent that their competence can be used beyond the borders of their respective provinces and for the benefit of Canada as a whole.

At the present time, two of the older Research Councils—Ontario and British Columbia—receive the bulk of their incomes from industrial and government contracts. The others rely more heavily on government grant support. All six Councils operate government-supported technical information and other services, and also participate as sub-contractors in certain circumstances in work for industry under federally sponsored cost-shared research and development programs. The Councils have also received considerable provincial or federal government assistance for the provision of buildings and capital equipment in recent years.

The Science Council is aware that direct government assistance to the Research Councils is not always seen to be in the best interests of competing industrial firms or of private consulting or testing organizations. It is clear from the report, however, that the Research Councils are aware that such conflicts can exist, and that they are watchful in such matters. In our view, there is no merit in having direct government assistance discontinued on the grounds that conflicts of interest may arise in the future or that they may arise more frequently in one province than in another.

Equally, we do not take the view that continued government support should be given to Research Councils simply because they are already there. On the other hand, in the light of evidence presented in the report, we believe that the disappearance of any one of the older Councils would be detrimental to the province concerned and to Canada. We believe, also, that they should grow on the basis of their ability to serve.

While recognizing the increased capabilities developed by the six older Councils, especially during the past decade, the Science Council considers that the environment in which the Research Councils operate should be further improved. We are most anxious that there

should be no artificial barriers or impediments preventing the Research Councils from receiving additional basic support from their respective provincial governments or from competing for support for particular projects under contract from provincial or from federal departments and agencies. Some now exist, and are detailed in the report. Consequently, we strongly recommend that mission-oriented federal departments and agencies—and the corresponding provincial departments—examine their procedures to make sure that they remove these barriers and impediments that now prevent these Research Councils from obtaining contracts or from participating in cost-sharing arrangements. We do not, however, favour federal support for the Research Councils in the form of sustaining annual grants.

The Science Council sees great value in the kind of mutually beneficial arrangement wherein the National Research Council (NRC) contracts with the Research Councils in the provinces for the provision of the Technical Information Service and recommends that this be continued. We also recommend that the National Research Council seek means of supporting specific research proposals from the Research Councils and of extending their participation in the Industrial Research Assistance Program.

We also believe that the widely based economic and market expertise of the federal Department of Industry, Trade and Commerce can be of value to the Research Councils.

The Council recommends that companies of all sizes in need of research and development services, for which they do not have an internal capability, should make use of the facilities of the Research Councils in the provinces. Also, with particular reference to small high-technology companies, we recommend that the two senior levels of government make sure that their rules for providing financial assistance directly to these companies specifically permit the contracting out of work by the companies to the Research Councils.

The above comments and recommendations have been made with the six older Research Councils principally in mind. The equivalent agency in the Province of Quebec is now in being and appears assured of rapid growth. Just how this new agency will mature and what strong areas of specialization will emerge are, however, not yet assessable. The Research Council in Manitoba, as noted in the report, has been in partial operation since its legislation was passed in 1963. However, on the basis of the experience of the older Councils, the Science Council would suggest to the Government of Manitoba that the 1963 Act be fully implemented in the near future, including the establishment of a laboratory.

At a later stage, the Science Council will wish to return to the subject of the Research Councils and Foundations in connection with the more pervasive issues touched on in this report which will be expanded in other studies of the innovation process in Canada that are currently under way.

O.M. Solandt  
Chairman  
Science Council of Canada

## Acknowledgements

The author wishes to express his thanks to the officers of the various Research Councils and Foundations to whom he talked for their kindness and frankness and for the background material which they took time to prepare especially for this report. The author also wishes to thank the members of federal and provincial departments and agencies and university people who contributed views and material relevant to the report. Finally, he wishes to thank those who commented on the report and the members of the Council's staff who helped prepare it for publication, particularly Miss F.R. Wark and Mr. L.R. Lafrance.

Andrew H. Wilson  
Science Adviser  
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# Introduction

The research work covered by this Special Study report was requested in February of 1970—as a matter of priority—by the Committee on Industrial Research and Innovation of the Science Council of Canada. The work forms part of a much broader examination of the many aspects of the process of technological innovation in industry in Canada, which is being undertaken by a small group within the Council's staff.

In the opinion of the Committee, the existing Research Councils and Foundations in the provinces have played—and will continue to play—a significant role in stimulating industrial research and innovation in spite of their relatively small size individually and collectively. At the same time, the Committee has acknowledged that the Councils are all at different stages of development, that they have different relationships with their “parent” provincial governments, and that their access to federal support is limited.

The roles, functions and relationships of the Research Councils in the provinces have so far received relatively little attention in published discussions of science policy in Canada. For example, Professor N.H. Lithwick considered federal science policy and Canada-U.S. comparisons at this level in his recent book—but did not discuss the provincial Research Councils.\* In a recent review article for *Science Forum*, Professor G.B. Doern also concentrated on federal policy and institutions, to the exclusion of provincial institutions.† In a chapter on “Science, Technology and the Economy” in its Fifth Review, the Economic Council discussed important functions such as the diffusion of scientific and technical information and the effectiveness of innovative activities in this country, but again ignored provincial institutions. Nevertheless, this Council did have a

broader context in mind. In the chapter, it said in part:\*

“A blend of many different efforts and policies will be required to develop and harness the resources of science and technology to the fullest possible extent. There is no simple policy prescription; it will be necessary to move forward simultaneously on a variety of fronts, both private and public.”

The most extensive discussions of the Research Councils and Foundations in the provinces to date have been those included by the Organization for Economic Co-operation and Development (OECD) in its review of Canadian science policy and in the Proceedings of the Special Committee on Science Policy of the Senate. The OECD review devoted a chapter to “The Dialogue with the Provinces” and discussed provincial efforts, and federal-provincial co-operation, in science.‡ The Senate Committee received oral briefings from representatives of six of the Councils at one of its hearings. Four written briefs were also submitted, two of them extensive.‡ As is now well known, the Committee has been mainly concerned with federal policy but has sought views from many sources in the public and private sectors.

For its part, the Science Council has already reviewed particular aspects of the roles, functions and relationships of the Research Councils and Foundations. For example, their technical information activities were examined in the special

\*Economic Council of Canada. Fifth Annual Review. Chapter 3, Science, technology and the economy. Ottawa, Queen's Printer, September 1968. pp. 53-54.

Another Economic Council publication does, however, include a brief description of the Research Councils in the provinces: Science, technology and innovation, by Andrew H. Wilson. Special Study No. 8, Economic Council of Canada. Ottawa, Queen's Printer, May 1968. pp. 40-42.

†Organization for Economic Co-operation and Development. Reviews of national science policy: Canada. Paris, 1969. pp. 347-362.

‡Proceedings of the Special Committee on Science Policy of the Senate of Canada. No. 50. Ottawa, Queen's Printer, June 3, 1969.

\*Lithwick, N.H. Canada's science policy and the economy. Toronto, Methuen, 1969.

†Doern, G. Bruce. The political realities of science policy-making in the federal government. *Science Forum*, 3(3):21-25. June 1970.

study on that subject prepared for the Science Council.\* But, apart from noting that the Technical Information Service (TIS) of the National Research Council has made significant progress in developing federal-provincial co-operation in the provision of assistance to industry and suggesting that the Service was useful and should be expanded, the Council had no specific recommendations to make in its own report on the subject.†

In its first national science policy report, the Science Council dealt principally with federal responsibilities. Several of its recommendations can, however, be construed as having implications for the roles and functions of the Research Councils in the provinces. For example, there were recommendations that the federal government:‡

a) support Canadian industrial enterprise by improvement and expansion of existing research and development (R & D) incentive programs, by simplifying where possible the administration of the programs, and by deliberately increasing the share of management responsibility placed on the companies involved;

b) further encourage industrial involvement by contracting out federal programs where participation is likely to increase the technological or innovative capacities of the companies concerned; and

c) through its mission-oriented departments actively seek to promote industrial and university work in support of each mission as well as responding to initiatives from the private sector.

The possibility that the Research Councils might participate more actively in the future in federally supported R & D for industry was discussed in a draft report written for the Science Council's Com-

mittee on Engineering Research by David N. Cass-Beggs. In particular, the author said:\*

"It is important that any scheme of federal government support for industrial R & D should be such that R & D done under contract for industry, by the provincial (Research Council) laboratories, should rank as R & D performed by industry. It is also important that provincial (Research Council) laboratories should be regarded by the federal government as part of the industrial R & D strength, and receive a fair share of support through federal government contracts for R & D. This is particularly important where the provincial laboratory is essentially the only industrially oriented R & D establishment in the province."

The above quotation also helps to illumine the problem of the relative neglect of the Research Councils and Foundations in science policy discussions in the past. They are essentially small—but unique—organizations, working actively on behalf of *both* industry and government and supported financially by both. There are differences between them, and the degree of allegiance of one Council may be more strongly given to government than that of its next-door neighbour. The use of the term *provincial* has led people to think of them as agents of this level of government.† Then there is the fact that the Councils operate technical information and industrial and engineering services and some training programs—which are not strictly R & D activities. Not long ago,

\*Paragraph IV.6.9 of the draft report. This report was one of two on the subject of engineering research which was forwarded on completion to the Committee on Industrial Research and Innovation for further consideration.

It should be noted, also, that the Science Council has published a Special Study (No. 11), *Background to Invention*, by Andrew H. Wilson, and that this report includes a short section on the Research Councils in the provinces.

†It is only recently that the Dominion Bureau of Statistics published R & D and manpower figures for the Councils; for example in the DBS report covering Industrial R & D Expenditures in Canada for 1967 (pp. 55-58, DBS 13-532).

\*Scientific and technical information in Canada. Part I and Part II, Chapter 1. Special Study No. 8, Science Council of Canada. Ottawa, Queen's Printer, 1969.

†Science Council of Canada. A policy for scientific and technical information dissemination. Report No. 6. Ottawa, Queen's Printer, 1969.

‡Science Council of Canada. Towards a national science policy for Canada. Report No. 4. Ottawa, Queen's Printer, 1968. p. 24.

this relative neglect became intolerable to the six older Councils themselves. They joined together last year to form the Non-Profit Industrial Research Association of Canada (NIRAC) and have since been active in preparing briefs for submission to federal government agencies in the first instance.\*

Although at the time of writing there are no members of the Science Council who hold full-time appointments in the provincial Councils and Foundations, several of the Science Council members are serving, or have served, on Boards of Management. The Science Council has also invited senior officers of the Councils and Foundations to participate in study groups and committees. For example, Dr. H.D. Smith, the former President of Nova Scotia Research Foundation, was a member of the Study Group on Scientific and Technical Information, and his successor, Dr. J.E. Blanchard, served on the Earth Sciences Study Group. Dr. E.J. Wiggins of the Research Council of Alberta served on the Committee on Water Resources Research and is currently a member of the Committee on Transportation. Several officers have participated in the Council study on Basic Research and National Goals and in professional and panel discussions associated with the Earth and Marine Sciences Study Groups.

With regard to this present report, the Science Council Committee on Industrial Research and Innovation asked that it include information on:

- a) the roles and objectives of the provincial Research Councils and Foundations in their various functions (for example: research, development and technical information dissemination);
- b) the needs which these Councils satisfy, and the communities which they serve;
- c) the similarities and differences in their organization;

d) the ways in which their activities should be supported; and

e) their relationships (collaborative or competitive) with industrial laboratories, consulting groups, university industrial research institutes, and so on.

The research work for this report has been particularly concerned with the past, present and future activities of the six older Councils, namely: the Nova Scotia Research Foundation, the New Brunswick Research and Productivity Council, the Ontario Research Foundation, the Saskatchewan Research Council, the Research Council of Alberta and the British Columbia Research Council.

It has also been concerned with the two newer Councils—the Manitoba Research Council and the recently formed *Centre de recherche industrielle du Québec*—and with Council-type activities in the Provinces of Newfoundland and Prince Edward Island.

One important source of information for the research work has been the published literature, and in this connection the Senate Committee Proceedings and the OECD National Science Policy Review of Canada have provided important insights. The other important source has been a series of interviews with, and communications from, senior officials of the existing Councils and Foundations and representatives of certain federal and provincial government agencies and departments and of the universities. The majority of these interviews took place in May, June and July of 1970, and were conducted by the author, either alone or accompanied by Dr. Pierre Bourgault, also of the Science Council staff. The research work has also made use of other relevant information collected by Council staff members and by the author during his prior association with the Economic Council of Canada.

The format of this report has been organized in such a way that the detailed historical and factual material is presented in a series of Appendices. The body of the report therefore contains discussion material related to the present and the

\*NIRAC is actually open to all non-profit research associations in the country. This organization is discussed later in the report and points from the briefs have been collected in Appendix X.

future and has been arranged to reflect the terms of reference of the study. The “Assessment” and “Conclusion” sections of this report reflect the views of the author and do not necessarily coincide with those of the Science Council or its Industry Committee. The current views of the Committee and of the Council have already been recorded in the Foreword to the report.

# Institutional Characteristics

The various charts, tables and descriptions in this section of the report have been designed to present, in outline, the main institutional characteristics of the six older Research Councils and Foundations. Some information on the institutes in Manitoba and Quebec and on Council-type activities in Newfoundland and Prince Edward Island has also been included.

*Chart 1* shows the dates of establishment of the eight existing institutes and the dates of opening of the laboratories in the six older ones. The oldest Council—the Research Council of Alberta—was founded only five years after the National Research Council and will celebrate its Golden Jubilee in 1971. The youngest—*Le Centre de recherche industrielle du Québec*—came into existence less than a year ago, in December 1969. Its current activities are essentially formative, but it appears that a period of rapid growth may lie ahead—including the establishment of at least one laboratory.

The Manitoba Research Council Act was passed in 1963. The initial plans called for the establishment of an Engineering Services Division, with any required research to be carried out in existing laboratories in the province rather than in one owned and operated by the Council. By 1967, however, the Manitoba Research Council (MRC) had become—and still remains—principally a technical information service with a part-time staff. The MRC is the only Council which is part of a provincial government department.\* The others all have corporate status of one kind or another under provincial law.

Of the six older Research Councils, only those in British Columbia and Ontario have had laboratories from the beginning—although both have recently moved into extensive new administrative and laboratory buildings. The Councils in Alberta—in particular—and in Saskatchewan operated for many years without laboratory facilities or research staffs. In both cases, this situation was found to be in-

effective and laboratories and staffs were acquired. The Nova Scotia Research Foundation operated without laboratories of its own and with a largely part-time professional staff for 23 years. It did, however, maintain a restricted research program of its own, carried out mainly in the universities in the province. It also organized research projects for other agencies and supplied technical information and advisory services. The Nova Scotia Research Foundation laboratory, which was funded through the Atlantic Development Board, was opened just over a year ago.

The New Brunswick Research and Productivity Council remained only a short time without laboratory facilities of its own. A small laboratory and administration building—financed by the province—was opened in 1965. These facilities were significantly expanded in 1968 with a grant from the Atlantic Development Board.

Of the six older Research Councils, the laboratories of those in British Columbia, Alberta, Saskatchewan and New Brunswick are located on or near a university campus. Nova Scotia's new laboratory is one of several around the rim of the Halifax-Dartmouth harbour area. The Ontario Research Foundation's laboratory is the core building of the Sheridan Park Research Community which is located 17 miles west of downtown Toronto.

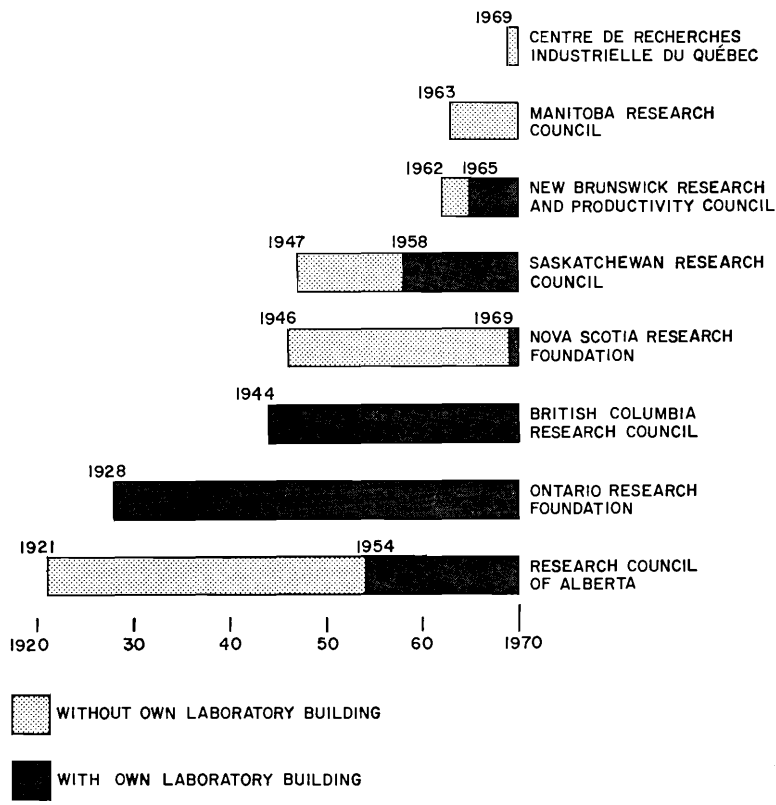
In the Province of Newfoundland, a Research Council Act was passed in 1961 but was never implemented. For several years in the recent past, the Nova Scotia Research Foundation provided a technical information service to Newfoundland industry on behalf of the National Research Council, but this responsibility has now reverted to NRC. The Province of Prince Edward Island has taken no steps towards the establishment of a Research Council. However, for the past five years or so, the New Brunswick Council has been providing Island industry with a technical information service under contract to NRC.

Throughout this report, the financial

\*The Department of Industry, Trade and Commerce.



**Chart-1-Research Councils and Foundations: Dates of Establishment and of Laboratory Opening**



*Source: Annual Reports and founding statutes.*

statistics quoted have been the operating incomes of the six older Research Councils and Foundations and not their expenditures on research, development and other activities. This procedure has been adopted for a variety of reasons; for example:

1. The operating incomes usually equal the current expenditures on all activities, plus a small surplus or minus a small deficit.

2. Research and development are only two of the several different activities of the Councils and Foundations; when considered alone, R & D statistics tell an incomplete story—routine testing, for example, may include some research or development, and the reverse is also true.

3. Operating incomes can be more effectively related to their sources than can R & D funds.

4. The same contract research project will not necessarily be costed in the same way by all the Councils because the Councils have their own accounting procedures and areas of technical specialization.

5. The annual grant procedures followed by the six provincial governments differ.

In other words, the operating income statistics give the clue to the relative sizes of the Research Councils' operations and to their principal sources of funds. Other factors must be taken into account in making qualitative judgements about their operations.

*Chart 2* has been compiled from the most recently available statistics of operating income and employment for the six older Research Councils and Foundations. It would appear that, taken together, these institutes received operating income in the neighbourhood of \$11¾ million during 1969 and employed 771 people, 336 who were scientists or engineers. This works out at only \$35 000 of operating income per professional.\*

Taken individually, the ranking of the six older Councils in order of size according

to their operating incomes in 1969 would be: Ontario, Alberta, Saskatchewan, British Columbia, Nova Scotia and New Brunswick. The employment figures would interchange to relative positions of British Columbia and Saskatchewan.

*Chart 2* indicates the high percentage of contract and other income and the low percentage of provincial grant income received at the present time by British Columbia and Ontario, and the reverse situation in the case of Alberta, in particular, and of Saskatchewan and New Brunswick. In the case of Nova Scotia, grant and contract incomes are more nearly in balance. In all cases, the "other" income represents a very small percentage of total operating income.\* Included in this category for Ontario and Nova Scotia, however, is income from their respective endowment funds. None of the other Councils has a fund of this kind.

Capital expenditures for buildings—including pilot plants—and major equipment items have not been included with the information on *Chart 2* because these kinds of expenditures are less useful for making direct comparisons between the Councils and Foundations. For example, the Atlantic Development Board, a federal agency, supplied the majority of the funds for the new Nova Scotia laboratory and for the large addition to the New Brunswick laboratory. The new Ontario Research Foundation laboratory at Sheridan Park was built with private as well as with public funds. The new B.C. Research laboratory was financed largely with funds from the provincial government—but the actual building is quite a bit larger than is required for the present level of activity at B.C. Research. Nevertheless, *Chart 3* has been included in this report in order to give some indication of the buildings and equipment available to each of the six older Councils. In 1969 these Councils had available to them a total of 670 000 square feet of laboratory, office, pilot plant and other space, and about \$8 million worth of major equipment items. As before, the

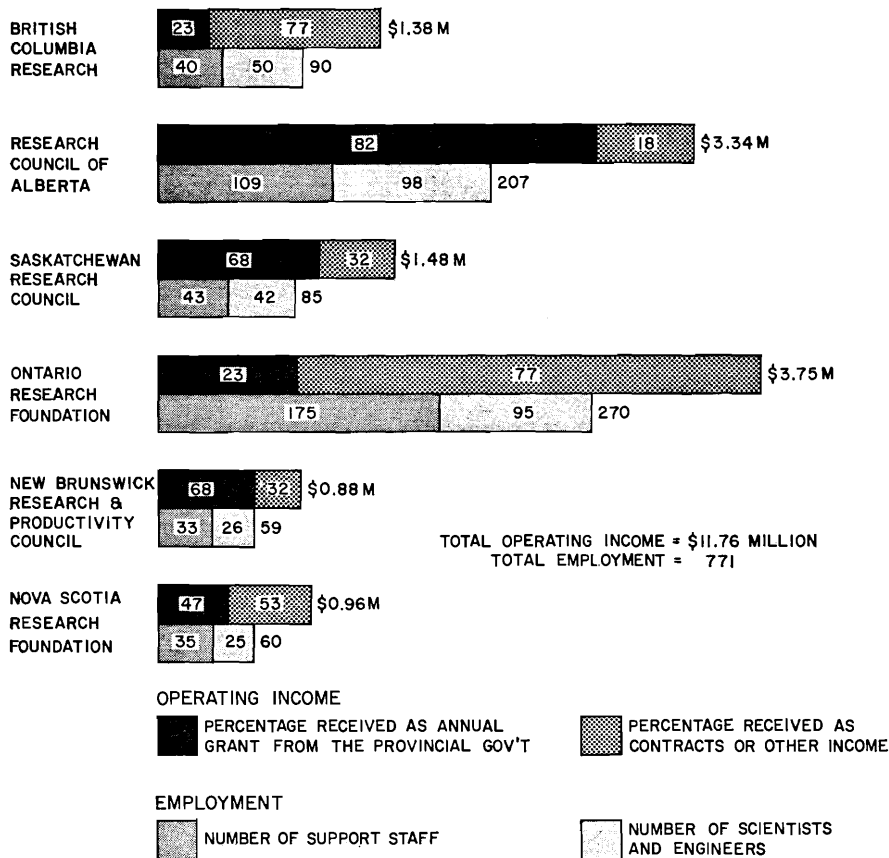
\*In comparison, during 1968-69, the federal government supported 424 scientists with \$21.7 million for scientific activities in fisheries—which works out at \$51 000 per professional. (Science Council of Canada. This land is their land. Report No. 9. Ottawa, Queen's Printer, 1970. p. 31)

\*Zero to 5 per cent.

Ontario Research Foundation led the way in both categories.

Throughout their existence—and especially since the establishment of their own laboratory facilities—the six older Research Councils and Foundations have developed their own particular areas of research interest and of client service. They have perhaps more in common in the service area than in research. *Table 1* and *Table 2* indicate, respectively, the principal client services and research interests of each of the institutes. In each, the service activities are strongly related to regional needs but also reflect research interests. With regard to research, the listings in *Table 2* show the similar but usually complementary interests of the Councils in Saskatchewan and Alberta, and the strong regional resource base of the activities in these Councils and in the two institutes in the Atlantic Provinces. *Table 2* also shows the manufacturing industry orientation of the two institutes—of the six—which receive the smallest percentage support through provincial government grants and which most actively seek industrial sponsorship for research projects—B.C. Research and the Ontario Research Foundation.

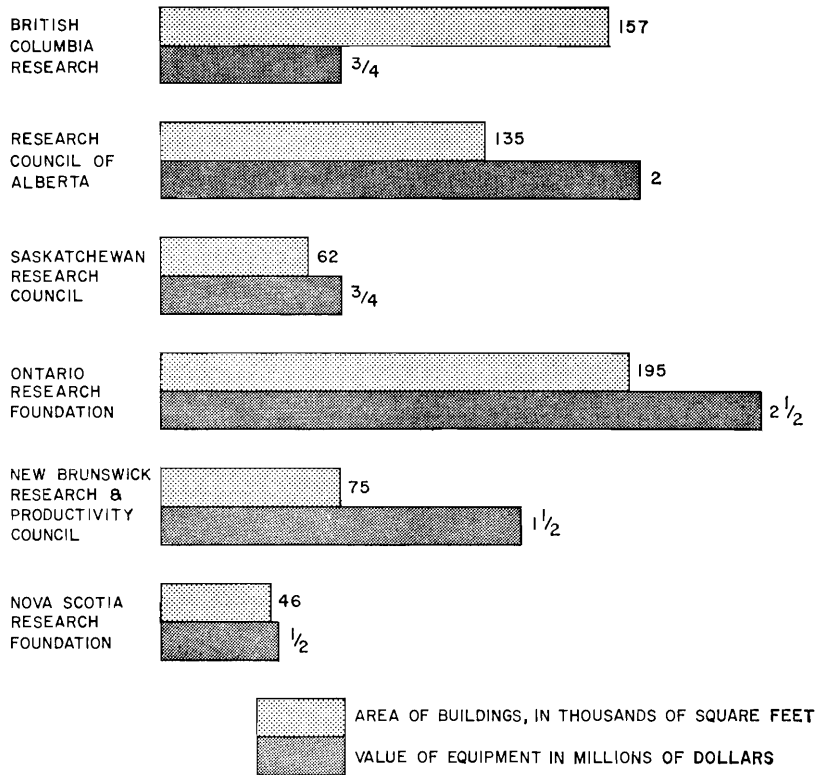
Chart 2—The Six Older Research Councils and Foundations: Recent Levels of Operating Income and Employment



Figures are for fiscal 1968-69 (Nova Scotia), calendar 1969 (Ontario and British Columbia) and fiscal 1969-70 (Alberta, Saskatchewan, New Brunswick).

Source: Annual Reports and private communications.

**Chart 3—The Six Older Research Councils and Foundations: Areas of Buildings and Value of Major Equipment Items (1969)**



TOTAL AREA: 670 000 SQ. FT.

TOTAL EQUIPMENT VALUE: 8 MILLION DOLLARS

*Source:* Annual Reports and private communications.

**Table 1–The Six Older Research Councils and Foundations: Principal Client Services**

The following general services are currently being provided, to different extents, *by each of the six*:

Technical Information; Industrial Engineering; Field Services; New Product Development; and Assistance; Library; Chemical Analysis; Materials Testing and Analysis; Instrument Development, Testing, etc.

In addition, the following special services are being provided:

*Nova Scotia*

Operations Research; Geophysical Exploration; Seaweed Research; Food Chemistry; Glassblowing.

*New Brunswick*

Machine Shop; Hydraulic Testing; Management Advisory Services; Electronic Engineering.

*Ontario*

Pollutant Analysis; Metallurgy; Vibration and Noise Analysis; Mathematical Analysis; Electron Microscopy; Textile Evaluation and Testing; Economic Studies.

*Saskatchewan*

Groundwater Information; Carbon-14 Dating; Information Retrieval.

*Alberta*

Gas and Oil Testing; Product Development; Mathematics and Computing; Information Retrieval; Pollutant Analysis; Metallurgy; Vibration and Noise Analysis; Groundwater Information.

*British Columbia*

Pollutant Analysis; Mining Services; Operations Research; Metallurgy; Vibration and Noise Analysis; Market and Economic Research; Education and Training Courses.

*Note:* The information given in this table is illustrative; it is not necessarily complete.

**Table 2—The Six Older Research Councils and Foundations: Principal Areas of Research**

<i>Nova Scotia</i>	Pesticide Analysis
Regional Geology and Geophysics	Chemical Process Development
Seaweeds	Corrosion and Wear
Foliar Analysis	Wood Science
Chemistry of Soils, Minerals, etc.	Pulp and Paper Technology
Operations Research	Pulping-Industry Wastes Utilization
Electronic Engineering	Organic and Inorganic Building Materials
	Glass and Ceramics
<i>New Brunswick</i>	Composite Materials
Food Microbiology	Powder Metallurgy
Food Products and Formulation	Metal Fatigue
Food Process Effluent Reduction	Mineral Processing
Fluid Power Impacting	Process Metallurgy
Metrology of Fluid Power Systems	Physical Metallurgy, incl. Metal Physics
Precision Electro-Mechanical R & D	Ore Dressing
Mineralogy of Natural Sulphides	Pyrometallurgy
Sulphide Mineral Synthesis	Synthetic Organic Chemistry
Autoprogramming N/C for Machine Tools	Enzymes
	Textiles Finishing and Fibre Modification
<i>Saskatchewan</i>	Instrumentation and Electronics
Regional Geology & Geophysics	High Power Ultrasonics
Minerals (e.g. Potash, Lignite)	Aerothermodynamics
Ceramics and Clays	Combustion Systems
Water Studies	Engineering Evaluation and Development
Groundwater Hydrology, etc.	Structural and Stress Analysis
Pipeline Transportation	Semiconductor Crystals Purification
Meteorology	Physiography
	Economic Studies
<i>Alberta</i>	<i>British Columbia</i>
Petroleum & Natural Gas Studies	Pollution and Waste Studies
Coal	Insect Repellents and Control
Regional Geology	Odour Mechanisms
Groundwater Studies	Marine Borer Control
Soils	Biological Leaching of Ores
Highways	Forest Products & Wood Processing
Pipeline Transportation	Wood Preservation
Meteorology (Hail)	Mechanical Engineering
New Product Research & Development	Process Metallurgy
Biological Cycles (Forest Wildlife)	Electro-Optics
Microbiology	New Materials (e.g. Ferro Cement)
	Operations Research
<i>Ontario</i>	Oceanology
Air and Water Pollution	
Waste Water Treatment & Water Re-use	

*Note:* The information given in this table is illustrative; it is not necessarily complete.

# Roles, Functions and Objectives



Whatever the roles, functions and objectives conceived initially for the Research Councils and Foundations by the provinces in Canada which have them, present-day terminology would identify these institutes as active participants in the process of innovation and in technology transfer in this country. For example, the President of the Ontario Research Foundation, W.R. Stadelman, said in his Annual Report for 1968:

"The Foundation has, on many occasions, assisted industrial firms to place new products on the market. Several of these products...have penetrated the American domestic market. However, this process of innovation by which scientific knowledge, technological ideas and inventions are brought to commercial reality is complex. It is not simply research and development, but includes the tooling and start-up expenses of production and the marketing expenses of introducing the product to the market....

"Technology transfer is the process of transferring known knowledge and inventions from one area to another, and of transferring new or developing technologies from those who know and understand them to those who should know of them and should make use of them. The importance of this process to the future development of Canadian industry may be simply demonstrated. Probably less than 2 per cent of the world's total new knowledge accumulation and new inventions is carried out in Canada at the present time. For Canadian industry to be competitive in a global sense requires that there be no significant technological lag between industry in Canada and industry in the rest of the world....

"The Foundation appears to be ideally organized to provide for the transfer of new technologies to industry in Canada."

There are, quite naturally, points of similarity and difference in the intent and detail of the legislation through which the six older Research Councils and Foundations were set up. For example, the Councils

in Alberta, Nova Scotia and Saskatchewan "shall have charge" or "shall take under consideration" matters affecting scientific research and investigation in their respective provinces. Of the six, these three Councils come closest to being considered as "research arms" within their provincial government structures. In the case of New Brunswick, the Council is to "promote, stimulate, and expedite continuing improvement in productive efficiency and expansion in the various sectors of the New Brunswick economy". This Council is the only one whose Act stipulates responsibility for the development of improved industrial management techniques and productivity, for the extension of industrial research in industry and for the dissemination of technical information.\* The Ontario Research Foundation "shall carry on research studies and investigations" with a manufacturing industry bias for the most part. The objectives of the B.C. Research Council emphasize co-ordination, initiation and application with regard to manufacturing industry.

With the exception of the British Columbia Research Council—which was established under the Provincial Societies Act—the other five older Research Councils and Foundations were constituted as corporate bodies under their respective legislation. With regard to the four *Councils*—New Brunswick, Saskatchewan, Alberta and British Columbia—the intent of the legislation is to make the Council—or people—responsible for the performance of the duties specified. In other words, the "Council" is a policy-making Board of Management of a technical operation in which others perform research and service work. Similarly, with regard to the two *Foundations*, the Boards of Governors are charged with policy-making responsibilities. This distinction between the Board and the working laboratory is now formally recognized in British Columbia where "B.C. Research" is "the research operation of a non-profit independent society (the

\*This particular section of the New Brunswick Act owes much to the Act which set up the National Productivity Council in 1960.

British Columbia Research Council) which conducts research, development and other technical work under contract to sponsors in both industry and government". In New Brunswick, on the other hand, the everyday use of the designation "RPC" (Research and Productivity Council) and the dropping of the provincial prefix in the title is associated with the activities of RPC as a service agency and operation providing aid and assistance to business, industry and government in New Brunswick *and outside the province*.

In the cases of Alberta, Nova Scotia, New Brunswick and Ontario, emphasis is placed in the legislation on work related to the utilization of the provincial natural resources, improvement in the technical performance of provincial industries, the utilization of waste products, the exploitation of industrial materials and, for Alberta and Ontario, the betterment and welfare of people. The Saskatchewan Act does not include details of this kind. The B.C. Act goes part way. As an example, the following is part of the wording of Section 7 of the Research Foundation Act of Nova Scotia:

"...and without limiting or restricting the generality of the foregoing the Foundation may:

(3) Undertake in such a way as may be deemed advisable:

(i) Investigations to improve the conditions of agriculture, fisheries, lumbering and mining or for the economic betterment, welfare and progress of the Province;

(ii) Researches with the object of improving the technical processes and methods used in the industries of Nova Scotia, and of discovering processes and methods which may promote the expansion of existing, or the development of new industries;

(iii) Researches with a view to utilizing the waste products of said industries;

(iv) Investigations into the quality of the materials which are or may be used in, or are, or may be the products of the resources or the industries of Nova Scotia."

All six Acts give the Councils powers

to enter into contracts or to co-operate, or both, with other organizations and agencies for the performance of research and the achievement of their objectives. There are, however, differences in emphasis between the Acts. For example, the Ontario Act says that "the Foundation may carry on research, investigations, studies and operations for other persons upon such terms and conditions as the Executive Committee may determine, subject to any direction of the Board (of Governors)". The wording of the B.C. Act enables the Research Council "to enter into agreements with any person or organization for carrying out research work and for the payment of the same either by the person or organization or by the Council". The New Brunswick Act is less precise. The RPC "shall cooperate and act in conjunction with other organizations and agencies, public and private, in the implementation of programs designed to give effect to any of the objects (of the Council)". The Saskatchewan Research Council may "enter into agreements with the University of Saskatchewan, other universities, government departments and research agencies for the performance, on behalf of the Council, of research projects or the conduct of investigations and enquiries...." The Council may also "carry on research, investigations and studies for other persons or bodies upon such terms and conditions, including remuneration for its services, as may be decided upon by the Council...." In the case of the Research Council of Alberta, the legislation is again less specific. The Council "may have charge and direction of or supervision over the researches that may be undertaken, under conditions to be determined in each case, (i) by or for single industrial firms, or (ii) by such organizations or persons as desire to avail themselves of the facilities offered for this purpose". Lastly, in the case of Nova Scotia, the legislation combines essentially the wording of the Saskatchewan and Alberta provisions.

With the exception of British Columbia and New Brunswick, the Acts establishing the other four older Research Councils

include provisions regarding rights to discoveries and inventions.\* In the cases of Nova Scotia, Saskatchewan and Alberta, the provisions are quite similar and have been designed to ensure that the Councils retain the rights to discoveries, inventions and improvements made by members of their technical staffs—or by people working under contract from the Councils—and empower the Councils to pay “such bonuses or royalties as in (their) opinion may be warranted” to these people. The provision, in the case of Ontario, is broader and more exploitation oriented. It reads as follows:†

“The Foundation may purchase or otherwise acquire any invention or discovery or any right therein and may apply for, purchase or otherwise acquire any letters patent of invention or similar protection of the Dominion of Canada or elsewhere or any licence or other right, title or interest in or under any patent or similar protection and may hold, use, exercise, develop, license, assign or otherwise dispose of or turn such invention, discovery, letters patent or protection to account.”

Of the six older Councils, Alberta is the only one to have the power under its Act to collect information and statistics “as to trades, businesses and industries of the Province” from people engaged in these activities. The Act requires that this information be used solely for the performance of Council duties. In Nova Scotia, New Brunswick and Alberta, the chief executive officers of the Councils are listed members of the Boards of Governors or of Management. In Ontario, Saskatchewan and British Columbia they are not, but, in practice, are closely associated with their Boards. The Chairman of the (New Brunswick) RPC is the only Chairman of the six older Councils who may, under the law, be paid an honorarium. None of them may receive a salary.

As has been mentioned in the previous section of this report, the Manitoba

Research Council Act has not yet been fully implemented. Nevertheless, the Council’s activities to date have been in keeping with the following broad objects of the Council as stated in the Act, namely:\*

“(a) to promote and carry on or cause to be promoted or carried on research and scientific enquiries respecting agriculture, natural resources, industry and other segments of the economy of the province; and

(b) to help to secure for Manitoba the benefits of research and scientific enquiries carried on elsewhere.”

The Council has not complied with the requirement under the Act to undertake research or to “build, equip, and staff laboratories...for the efficient carrying out of its objects and powers”.

The Council of the Manitoba Research Council is the smallest of the existing Councils, having “not more than seven members”. The members may, under the Act, accept honoraria for their services. The Act contains a subsection on the rights of ownership to discoveries and inventions, but like the Ontario Research Foundation Act and unlike the others, also includes a subsection covering the sale or licensing of patented or other information.

The section of the Act which associates the Manitoba Research Council with the provincial Department of Industry and Commerce—a section which appears in no other Act—reads as follows:†

“The Council may utilize the services of such officers and employees of the Department of Industry and Commerce as the Minister may designate, or of any other department or agency of the Government of Manitoba as the Lieutenant-Governor in Council may designate for the purpose; and in addition the Minister may provide the Council with professional, technical, or other assistance for temporary periods or for specific work.”

\*At the federal level, this matter is handled through the Public Servants’ Inventions Act.

†Section 13 of the Research Foundation Act, 1944.

\*Section 4(1), (2) and (b).

†Section 12.

As already noted, the organizing of *Le centre de recherche industrielle du Québec* (CRIQ) is, at the time of writing of this report, only just beginning. The CRIQ is a corporation within the meaning of the Civil Code with its corporate seat in or near the City of Quebec. The general manager and 14 other members constitute the "Centre"—or Board of Management—in the usual way. Members are to receive attendance allowances in addition to the normal travel expenses. The President of the Centre is to be appointed by the Lieutenant-Governor in Council from among the members.

Under Section 17 of the Act, the objects of the Centre are to be:

"(a) research in applied science carried out either in its own laboratories or in those of other research centres;

(b) the perfecting of industrial or scientific products, processes and equipment;

(c) the gathering and diffusion of technological and industrial information and data."

Unlike the other institutes, the CRIQ will require the authorization of the Lieutenant-Governor in Council to make agreements with any other governments or government agency, to enter into certain research contracts or contracts with individuals, to dispose of patents it has acquired, or to acquire (a minor holding of) shares of any corporation. The CRIQ may not carry on commercial undertakings.

The provision of the CRIQ Act concerning inventions is the shortest and most direct of them all. Section 23 reads:

"The inventions, discoveries, improvements, processes and equipment made by a person within the scope of a contract of lease and hire of services which binds such person with the Centre shall be the property of the Centre, unless the contract otherwise provides."

The Newfoundland Research Council Act of 1961 was remarkably similar to the legislation for the five of the six older

Councils, the exception being British Columbia. It was particularly close to that of Alberta and included the same information- and statistics-gathering powers of that Council. The sections dealing with patent rights, however, appeared to be closer to those in the Saskatchewan Act. But unlike the older Councils, the Newfoundland Research Council was to include "representatives of departments of the Government of Canada conducting research in Newfoundland".

The Acts under which the six older Research Councils were established were essentially broad guidelines to the work which the government authorities of the day thought should be undertaken. But as the Councils got older, and "grew up", their activities did not always coincide with the original objectives. Some of them have not yet been accomplished. Others may never be—for example, the involvement of the Nova Scotia and Ontario Foundations in agriculture, and where they are explicitly stated as objectives, the contributions of Councils to the "betterment of rural and urban life" are likely to be made indirectly in most cases. Recently, the Ontario Research Foundation has been considering how to deal with this problem of changing objectives by means of revisions to the existing legislation.

Internal and external pressures for the periodic redirection of the activities of the Research Councils have always been present and have quite often been considerable. They are too numerous to make mention of them all in this report. Some are fairly obvious: the state of the local, regional, Canadian, North American and world economies; new social pressures which draw attention, for example, to air and water pollution; the geography, physiography and demography of each province; the structure, diversity and sophistication of local and provincial industry; the technical, managerial and other levels of skill in this industry and the degree of entrepreneurship; the distance of the province from the markets of North-eastern and Southwestern United States; the rise of Japan; the reduction or increase

n demand for Canadian wheat; local, provincial and Canadian politics; U.S. politics; and so on.

There are, however, a number of more subtle influences on the roles, functions and objectives of each of the Research Councils. In any list of these, the following should be included:

- a) the attitudes and policies of the provincial government of the day, and of their departments and agencies;
- b) the attitudes and policies of the federal government of the day, and of federal departments and agencies;
- c) the attitudes and policies of the universities, as units, and their departments, and the attitudes of individual faculty members;
- d) the underlying trend in Canada towards greater decentralization and more local autonomy;
- e) the personality and experience of the chief executive officer of the Council or Foundation.

The above list does not include an industry factor for two reasons. First, it is the business of the Councils to anticipate what industry will need in the way of help and to attempt to provide it. Second, companies that come to the Councils for help either have the ability to provide the Councils with resources to complete their projects or have no money at all, in which case the Councils themselves must find the necessary resources.

In comparison with the universities, the staff members of the Councils normally operate closer to the point of application of technology and with due regard to time constraints in industry. They have access to pilot plants. Laboratory research operations can continue on a 24-hour, seven-day-a-week basis, which would be unusual in the universities. Council staff are unlikely to have responsibility for teaching and graduate student research, as well as for an industrial project. Interdisciplinary activities can be more easily undertaken. Nevertheless, the universities in Canada have been receiving steadily increasing support in recent years. There are, for example, Industrial Research Institutes in

four Canadian universities\*, and organized industrial consulting is extensive in the larger universities. On the other side of the coin, several of the Councils have made extensive use of university facilities in the past and, until recently, the Nova Scotia Research Foundation was particularly dependent upon them. Also, there are some current examples of Council-university collaboration involving the Alberta Council in particular: the Petroleum Recovery Research Institute is at the University of Calgary; two Council divisions, Soils and Highway Research, are located at the University of Alberta in Edmonton; and the Alberta Hail Study involves McGill University. The basic question to be resolved, however, is not the role of the Research Councils and Foundations in relation to industrial research and innovation, but the role of the universities in this regard.

The degree to which the Research Councils and Foundations are allowed to participate in federal contract, grant and shared-cost programs involving research is an important factor in their overall effectiveness. For example, the Councils may participate extensively on behalf of a company in the PAIT Program†, but only in a very limited way in the IRA Program‡. At one time, the National Research Council gave small sustaining annual grants to the Councils and Foundations for basic and competence-expanding research, but these have been almost completely phased out. Some of the Councils still have extensive projects under the federal-provincial ARDA Program§, but these are approaching completion. The Councils receive relatively few federally supported contracts for research projects not associated with specific programs.

\*Windsor, Waterloo, McMaster and Nova Scotia Technical College. See Appendix XII.

†Program for the Advancement of Industrial Technology: Department of Industry, Trade and Commerce. See Appendix XII.

‡Industrial Research Assistance Program: National Research Council. See Appendix XI.

§Agricultural Rehabilitation and Development Act—currently administered at the federal level by the Department of Regional Economic Expansion.

The six older Councils and Foundations believe that their roles and competences should expand as secondary industry in Canada expands, that Canadian industry will need more assistance in the application of technologies which are increasing in volume, if not in complexity.\* They know that undirected research results in little industrial spin-off. The Councils also believe that their economic and social roles can only be expanded through the governments. The Councils fear, however, that federal departments and agencies, in particular, will tend to retain both technical and non-technical roles unless the incentives for sharing and co-operation become very much stronger. They know that local and regional problems often require local and regional solutions and that a solution found suitable in region A will not necessarily be applicable to region B. Lastly, the Councils dislike the administrative barriers between levels of government which can frustrate action.

The Research Councils and Foundations play a special role with regard to small companies in their own particular regions across the country. Because of the lack of homogeneity in Canada and in Canadian industry, the problems faced in Nova Scotia are not identical with those faced in Alberta, even for small companies. In truth, most of the Councils have not begun to respond to the challenge of assisting something like 30 000 companies.† This challenge is made even more formidable because a great many of the companies need managerial and market help as much, if not more, than they need technical help. However, the provision of market and managerial help is a role which provincial governments are now playing, often in co-operation with the Research Councils.

Governments make the rules for the conduct of business. They administer these rules through their departments and

agencies, and influence the climate for co-operation, collaboration and the division of labour. But in addition to rules, regulations and administration, ministers and their public servants—as well as governors and staffs of the Research Councils—are human beings with prejudices, likes, dislikes and, sometimes, long memories. The factor noted above concerning chief executive officers needs no amplification. Each of them is responsible for making his own operation successful. His personality and experience will be factors in how this is done.

This part of the report may be closed appropriately with a statement made by the President of the Nova Scotia Research Foundation to the Senate Special Committee on Science Policy. Dr. Blanchard said:\*

“Provincial research councils are unique to Canada. They have also played and can (still) play a unique role in the economic betterment, welfare and progress of Canada. They satisfy the regional needs of Canada and this is one of the reasons for a difference in emphasis of the activities of these organizations.”

\*See also Appendix X.

†Federal resources to tackle the problem are also in limited supply. This is one of the points discussed in Appendix XI.

\*Proceedings No. 50. June 3, 1969. p. 6259.

# Internal Activities

It has often been remarked that it is so much easier to start a research program than to stop it. In industry—and in the Research Councils in the provinces—the reverse is more likely to be the case. When the funds available for a particular project have been used up, the Councils have no alternative but to stop work on it. The Councils are, in their own ways, “in business”. Their product is the information which present or future clients are willing or are likely to buy.

The six older Research Councils do not do the same things in the same ways, but the list of their overall activities includes the same items:

- a) the anticipation of the future research needs of potential government and industry clients;
- b) the performance of application-oriented “basic” research;
- c) the provision of basic information on physical and natural resources of the pre-industry or pre-manufacturing kind;
- d) the performance of applied research related to specific problems and specific needs;
- e) the performance of development and pilot plant work related to specific products and processes;
- f) the performance of preliminary investigations and feasibility studies related to new ideas and products with promise;
- g) the provision of a whole range of associated services including product and material testing and evaluation; the investigation of production problems; technical information, industrial engineering services; operations research; and general assistance and advice regarding company operations.

The Councils’ clients are principally federal and provincial government departments and agencies, municipalities, and industrial firms. The firms may be local, provincial, Canadian, American or foreign. The Councils perform much of their work alone, but may also have joint ventures with government agencies, individual companies or groups of them, with university departments, and with one another. The numbers of clients who

“walk through the door” vary from one Council to the next. Those which do this either have been there before and have been satisfied with the service given, or are in financial, technical or some other kind of trouble. The Councils usually have to work hard and use all the means at their disposal to add to their research-sponsoring clientele. But it takes time to build up scientific and technical competence, and perhaps longer to establish a reputation. Once established, Councils find that they often get work “because they are there”.

The internal research activities of the Councils are organized very differently. In Alberta, for example, the relatively high level of activity related to provincial government needs is the result of two factors. The first is the government’s policy of placing research projects in such fields as mineral resources, water supply and highways with the Research Council rather than with the operating departments or agencies. The second is the fact that the policies of the Research Council itself have been geared to the extractive industries and have not, until fairly recently, given much encouragement to the building up of facilities for the performance of contract research related to the needs of the less-extensive manufacturing industries in the province or to opportunities beyond the borders of Alberta.

Like its counterpart in Alberta, the work of the Saskatchewan Research Council (SRC) is based on the problems of the province and is heavily supported by the provincial Treasury. The Saskatchewan Council has also had substantial support from a continuing program under ARDA, but this program terminates in 1972 and must be replaced if the Council’s total effort is to be maintained. In the case of Saskatchewan—and Alberta—the volume of industrial contract research work is quite small. However, from another point of view, both Councils perform a significant volume of indirect or “pre-industrial” research, and provide background information which is essential before industrial activity can begin at all. Some of this



work is, of course, applicable to the existing provincial industries and companies as well. Some—like the SRC slurry pipeline work—has potential application outside of Saskatchewan as well as inside it, and is complementary to the capsule pipeline work which the Alberta Council has undertaken. In addition to applied research and development, the Saskatchewan Council, for example, has a pilot plant. It has also been recently engaged in a limited form of innovation when performing instrument development and pre-production runs of several new instruments for specific clients. The Council's protein chemistry and climatic studies involve it in the broader fields of agriculture, and its data processing and technical information services involve it in industrial management problems.

At B.C. Research, the whole program is geared to serving industry and government through contract research. The new building provides opportunities for expansion and for a gradual shift into the post-R & D aspects of the innovative process, if suitable opportunities present themselves. The B.C. Research program reflects provincial industry's major interest in natural resources and the province's ocean-side location. The program also reflects the forward-looking approach to up-coming problems, as indicated by its early involvement in pollution research. To be successful, however, B.C. Research needs people who have essentially an industry- and mission-oriented outlook, who can react to new situations quickly, and who understand that when the money is finished, so is the research. Senior people travel widely, but frequently have difficulty in convincing industry of its need for research and its need to apply the results of research. Seventy per cent of the contract research performed by B.C. Research resulted from work which was begun in-house. At any one time, B.C. Research has a dozen or so projects ready for sponsorship. Most of its contracts came from larger companies. The job of interesting industry in projects is made more difficult for B.C. Research people by

the naive view some industrial managers still have of research and its applicability to products and processes. Dr. P.C. Trussell, the Director, put the problem this way:\*

"Many businessmen in the past have been afraid of the word 'research'. What they had in mind was a group of greybearded university professors leading numbers of graduate students on endless research projects that have little or no industrial value. There is good research and bad research, of course, and what we are trying to do here is pick up the best of the pure research and apply it to specific industrial uses."

The Ontario Research Foundation (ORF)—as a matter of policy—serves Ontario first. Its activities therefore reflect the diversity of government and industrial interests in the province, although about 85 per cent of ORF's research sponsors have their own operations within 200 miles of Sheridan Park. Having been in business for 40 years, the Foundation is well known, and this factor favourably influences its ability to obtain new contracts and sponsors. Another important factor, in the view of President W.R. Stadelman, is having on staff particular individuals with particular knowledge and skills. ORF has also developed special but broadly based in-house skills—in textiles, for example—over the long period of its existence. Its service activities are well developed in this and other areas. The Foundation performs relatively little research for resource-based departments of the Ontario Government. In this regard, a paragraph from the Foundation's brief to the Senate Special Committee on Science Policy puts its particular point of view this way:†

"There are very compelling reasons why research and development in the resource field should be closely associated with the Provincial Department concerned. While

\*Canadian Business. April 1967, p. 59.

†Proceedings No. 50. June 3, 1969, p. 6315.

there are an almost unlimited number of problems bearing on resource development, the funds available for their solution will always impose limits on the amount that can be done. An important consideration, therefore, is the selection of goods which will yield the most benefit to the Province for the funds expended. In selecting these research objectives and placing a priority on them, the important decisions must be made by department specialists who are expert in the particular resource area and who are intimately aware of the extent and nature of the problems in the field. Moreover, to be of economic value, research must be put to use, and this responsibility for application of knowledge in the resource field lies with the particular Government Department concerned."

However, as the brief also points out, there is a critical size of R & D effort below which the work is likely to be uneconomically and inefficiently performed. In cases such as these, and where it has the necessary resources, the ORF can help the departments.

As the newest fully active Council, the Research and Productivity Council in New Brunswick has most recently faced the problem of initiating a research program. Dr. Bursill described how this program evolved in his evidence before the Senate Special Committee. He said, in part:\*

"We chose initially to set up those special areas of competence, firstly in food science and technology, because we thought at that time that this was a major point in New Brunswick and it would be very desirable. That department has expanded gradually—at least, I should say that we have not expanded our food capabilities but that the department itself has expanded because it has been called upon to do so in the field of chemistry.

"Secondly, we have taken a very considerable interest in the field of mineralogy....

"Third, we are in the field of mechanical engineering in which, for example, (our) hydraulic engineering fits....

"Fourthly, we have gone into electronic engineering which acts principally as a service, but not necessarily so. It undertakes a number of special duties such as product testing, for example.

"Finally, we have what we call management engineering, in which we are rather heavily weighted relative to the other research councils because we consider that to increase productivity by the most direct methods possible in New Brunswick is a particularly desirable activity for us."

When interviewed, Dr. Bursill expressed the view that, even now, only the mineralogy and management services are viable. The others are sub-critical, and this situation is unlikely to change until further general support to build up research activities and technical competence can be obtained.

The Nova Scotia Research Foundation entered a new phase when its laboratories opened in 1969. New activities became possible, and the Foundation is in the process of taking advantage of some of them. It has, for example, added an Engineering Physics Division and a glass-blowing shop, and has begun to take a much greater interest in innovative and service activities. The main thrust of the Foundation's increased effort is likely to be in the direction of the marine sciences and oceanography. Some work in these areas, such as that on seaweeds, has of course been going on for a long time. The sponsorship of projects in all areas of competence has, however, been at a disappointingly low level in the past, but the search for ideas, problems and clients by Nova Scotia Research Foundation has been low-key up until now. One advantage that can be seen in regard to future activities is that the Foundation will have the facilities to proceed with the development of potentially exploitable products and inventions which originate in the government laboratories in the Halifax-Dartmouth area as a whole.

\*Proceedings No. 50. June 3, 1969. pp. 6274-6275.

At a more general level, the six older Research Councils and Foundations perform technical information and industrial engineering services under contract from the federal and provincial Councils. There are differences of opinion among the chief executives of the Councils as to the value of these activities as they are performed by the field or industrial service divisions and to the Councils themselves. These views range from enthusiasm to doubt. The needs of the various provinces also vary considerably, as do the abilities of companies to grasp and make use of the information and advice received. New Brunswick, with its specific productivity mandate, has broadened the basis of its information service to a management service, and requires that the service be self-supporting through contracts or fees. Even with the little publicity they receive, the field and industrial service divisions of the various Councils are usually fully occupied. The contacts made by these divisions often serve to introduce companies to other services—and areas of competence—of the Research Councils. In many cases, however, the companies which receive field service help are among the least able to support contract research.

From the beginning, the activities of the six older Research Councils have served the economies of the provinces but, increasingly, they are tending to look more closely at the needs of society and of the physical environment. And by becoming increasingly interested in innovation-oriented activities, they have become more directly concerned about the marketplace and about the creation of employment opportunities. These ends are also being served by means of the increased testing facilities which are available at most of their laboratories. Nevertheless, the views of the Councils with regard to the process of innovation are reflected in their attitudes and actions in matters such as patenting. As has been discussed already, the legislation which established the majority of the Councils deals with patents, but the degrees to which the relevant sections are implemented—and the oppor-

tunities to do so—vary.\* For example, the two Councils most concerned with industry are British Columbia and Ontario. Patents, to B.C. Research, are a source of income which can be used to perform more competence-building research. Ontario's royalty and licence earnings, on the other hand, are negligible, and are not looked upon as serious sources of income. In Alberta and Saskatchewan, the Councils have essentially no royalty or licence income.

All the Research Councils have good library facilities which appear to meet the needs of their own staffs and make important contributions to industrial and field service work. All the Councils have had some association with PAIT programs but not, thus far, with the NRC/IRAP program. The Councils do, when asked, assist firms in the provinces with applications to Ottawa for assistance. Not all of the Councils are active in giving training courses or equally active in sponsoring seminars and conferences.

The following additional points are also of importance:

1. Industry contracts for research performed on behalf of the larger companies often last from two to five years—contracts with government departments can last longer.
2. The Councils are most sensitive about safeguarding the interests of their clients.
3. The Councils are also aware of the parts they play in keeping "local" talent at home, but they are not normally interested in hiring professional people who have little or no industrial experience.
4. The Councils have done very little hiring in recent years and increases in operating incomes reflect, for the most part, increasing research costs for salaries and equipment.
5. Most Councils use committees to help manage both technical and administrative aspects of their operations.

\*Sponsors are usually responsible for taking patent action on any work performed by the Councils on their behalf.

# External Environment and Relationships

Canada is less of a homogeneous country than are most others, and in addition to those geographical, climatic, cultural and other differences between regions and within regions, there are the problems of time and distance. Between Newfoundland and British Columbia, for example, there are 4½ time zones and 4 000 miles. The characteristics of the local environments in which the various Research Councils and Foundations operate play a natural part in the kinds of activities which can be undertaken. The following are some of the characteristics which affect each of them.

Nova Scotia and New Brunswick are among the longest settled parts of Canada. Traditions—and memories—seem to be stronger and longer there than in most other parts of the country. There may be more reluctance to understand science and technology or their application. For a region which once had a high proportion of the trade of what is now Canada, there remain relatively few larger companies, and the smaller ones seem to prefer limited progress—or none at all—to investment in a riskier way of life.\* The two provinces also differ from one another. For example, New Brunswick has no equivalent of the \$30 million research complex in the Halifax-Dartmouth area of Nova Scotia. This particular metropolitan area has become one of the largest centres of scientific research in the country from the point of view of the diversity and the size of the research operations. It has also become one of the world's foremost centres of oceanography and marine science. In it are the Bedford Institute, the federal Fisheries Laboratory, the Atlantic Regional Laboratory of the National Research Council, a Defence Research Establishment, Dalhousie University, Nova Scotia Technical College—and, of course, the Nova Scotia Research Foundation.

It is interesting to note that the Foundation is now being presented with two important challenges. The first is the use of its new facilities for the further develop-

ment of discoveries and inventions made in its own and in the other laboratories, which would not otherwise be exploited. The second is taking part in the design, development and production of new *research* equipment for the laboratories. These challenges will have to be met in economic—and Nova Scotia—terms. And if they are successfully met, the possibilities for the establishment of a series of small high-technology companies to complement those that are already in the area should increase. Halifax-Dartmouth stands close to the New England market.

The RPC in New Brunswick is not exactly bereft of opportunities or important assets. It has, for example, what appears to be one of the best-equipped machine shops in the Atlantic region and it has spare capacity. The Council is the youngest of the six older ones, and as noted in the previous section, still has sub-critical elements. Government research activity in the province is not extensive. The Council has a strong technology bias and competitive spirit. It has already enjoyed successes in the province and beyond. The New England market is also close.

At the other end of the country, there is another highly competitive laboratory with a strong technology bias in a province whose manufacturing is still largely based on the primary industries, but whose horizons are gradually being lifted through the interest of the Japanese and through business opportunities which are opening up in other Pacific Rim countries. But the most immediate opportunities for industry in the province are not even in the primary industries. They are in tourism.

In many ways, B.C. Research operates like a small edition of the Stanford Research Institute, but without the advantage of a well-known name or impressive list of clients. It gears itself to what there is in the province, and prepares for what it feels may come in the way of secondary manufacturing industry. It has had to overcome strong resistance from senior industrial managements in long-established companies, but with time and

\*These remarks are not intended to be critical of the people or of their institutions, but have been included for the sake of realism.

success has gained ground. In this province, as in the country as a whole, the managements of older established small and medium manufacturing companies are slow to change, and often the managements of the small new high-technology companies lack some of the essential ingredients of commercial success. Growth in this sector tends to be slow from B.C. Research's point of view. Only occasionally do new clients walk through the front doors, so this Council is not in a demand environment and must be careful that new attempts to seek local clients are not over-extended from the point of view of cost.

As mentioned earlier, the Research Council of Alberta is heavily supported by the provincial government. Industrial contracts have not so far been numerous nor has the Council looked beyond provincial borders for work of this kind. The preponderance of extractive industries and the relative lack of manufacturing industries has, of course, influenced the policies and programs of the Council. But—more important—the situation with regard to contracts has been influenced by the branch plant nature of much of Alberta industry, by the limited autonomy of these plants, and by the access which they have to R & D resources in Eastern Canada or elsewhere. Also, as a province, Alberta has no public tradition of technological invention or innovation, although it has a tradition of research based on the research of the university. Nevertheless, the Research Council mounts a strong effort to help companies of all sizes and industries through its Industrial and Engineering Services Branch and its pilot plant operation.

Two interesting features of the environment in Alberta concern the cities of the province. The first is the rivalry between the two largest—Edmonton and Calgary. The second is the fact that they both have populations of around 400 000, but the third and fourth largest cities have populations of only 25 000.

Saskatchewan has two main cities, but is at present enjoying less success than its neighbour in selling its staples—wheat and

potash. A public tradition of technological invention and innovation in Saskatchewan, where the population is also smaller, appears to be even further away than in Alberta. The Research Council at Saskatoon, therefore, has an even more difficult job to do. It performs perhaps a higher percentage of its work under contract than the Research Council of Alberta, but the majority of the contracts are from the federal government. Saskatchewan still has undeveloped and underdeveloped resources. It has few manufacturing companies, and those it has are—with exceptions—apparently prepared to grow slowly.\* Saskatchewan is the Canadian province farthest from the large North American centres of population and, consequently, from the most attractive markets for manufactured products.

By comparison, Ontario would appear to have everything, and it has—to a degree. Ontario has the strongest manufacturing industry of any province in the country, but this industry is concentrated in a relatively small area. The remainder of the province is, in some ways, reminiscent of the Western Provinces with a few major centres of population and large unsettled and undeveloped areas. The potential “market” for the Ontario Research Foundation should be in the neighbourhood of 15 000 companies in the province alone. But not all of these companies have the capacity to benefit from research and services available at the Foundation. Even if the available “market” is limited to 3 000 companies, the task for the Foundation is still formidable.

Individual relations between the Councils and their provincial governments have been formed, over time, on the basis

\*A list of Saskatchewan companies *possibly* able to take advantage of federal assistance programs for R & D (PAIT, IRDIA, IRAP) has been prepared by I.S. Evans, Head of the Industrial Services Division, Saskatchewan Research Council, and communicated to the author. Of the 90 or so companies listed, 8 per cent were thought to be already in R & D, 35 per cent were considered able to do R & D, and the remaining 57 per cent were not thought able to do it. Forty-five per cent of the companies were branch plants or subsidiaries of U.S., Canadian and other parent companies.

of formal and assumed responsibilities, personalities, understanding and lack of it, interest and indifference, physical distance, and operational success or lack of it. There are, of course, day-to-day contacts with provincial departments and agencies for which contract work is being performed—including the Development Corporations or their equivalent agencies. Relations with federal departments are generally less frequent although a number of departments, such as Regional Economic Expansion, Energy, Mines and Resources, and Forestry and Fisheries, have active programs with the Councils.

Between some universities and some Councils, fairly close relationships exist—in Edmonton and Saskatoon, particularly. In the former, relations also appear to be good between the Council and the University of Calgary. But again, it is necessary to distinguish between person-to-person co-operation and co-operation between institutes. For example, in Ontario and Nova Scotia, competition could arise between the Foundations and the Industrial Research Institutes or, in any province, between the Councils and the professors who consult with industry in organized groups. While it is desirable that more and more university staff members become involved in the solution of industry's problems, and that industry should lure graduating students at *all* levels in increasing numbers, there are a variety of ways in which these aims can be achieved without giving rise to questionable competitive practices, damaging to both the Research Councils and the universities. The functions of the universities—teaching, research and public service—and of the Councils—research and other services in direct support of industry, research and other services under contract to industry—can all be performed for the national good. The problem is not the curbing of participation; it is deciding on the *method* of participation. None of the Research Councils would quarrel with the hypothesis that the universities should be asked to do for industry what they can actually do better than the Councils.

There are also possibilities of conflict between the Research Councils and consulting firms. However, it is clear that all the Councils make a practice of recommending that prospective clients make use of these firms, including testing laboratories, whenever this appears to be more appropriate. The Councils perform routine testing under contract—but usually under one of two conditions: that there are no alternative commercial laboratories; or that there is an additional requirement for research and development to be performed on the testing techniques themselves. In at least two provinces where there are Councils—Saskatchewan and New Brunswick—there are only a few consultants and commercial laboratories, and in Saskatchewan their numbers have been going down steadily as the economic climate has become worse.

The Councils have experienced recently a growing volume of inquiries and contracts with cities and municipalities. Some of this work has, of course, been promoted by pollution problems. The Saskatchewan Council, for example, has been receiving between 100 and 200 inquiries a year on water problems from municipalities.

The relationships between the Councils and the industries and companies in their provinces are quite naturally influenced by the kinds of industries, the sizes of companies, the ownership and control of companies, the markets served, the calibre of overall and technical managements within the companies, the locations of industrial concentrations with respect to the locations of the Councils, the Councils' reputations, how hard the Councils' field service people knock on companies' doors and how long they stay around to answer questions and solve problems. There are, of course, many other factors. The Councils all have different problems. In Saskatchewan and New Brunswick there are not many companies anyway. In Ontario there are too many companies for the Research Foundation to provide field services to everyone at the present level of effort—but far too few companies in Ontario have

been placing contracts for research and other work at the Foundation. Nevertheless, the policies which the Councils and Foundations adopt—either because they must or because they choose to—undoubtedly affect their relationships with industry.

The policies of departments of governments which are responsible for economic expansion and the reduction of regional disparities also influence the relationships of the Councils with industry. For example, a city which already has a well-developed secondary manufacturing infrastructure—including small tool and die firms, electronic sub-assembly shops, specialized machine shops, electroplating shops, and so on—is in a better position to attract a large new high-technology company, even if it is a branch plant, than is a city without this infrastructure. But if the infrastructure is also built up quickly, the city will gain more than just a big company. The Research Councils are aware of these kinds of situations and are anxious to help.

Finally, three other points regarding relationships should be considered:

1. Municipal representation on the Boards of the Councils is small. In view of the kinds of services which the Councils could give—and the municipalities could receive if they knew more about the Councils—it would seem that this is one problem which should be examined by the provinces and the Councils.

2. There are very seldom any exchanges of personnel—as distinct from hirings—between the Research Councils and the National Research Council and other federal agencies. This too would seem to merit some consideration.

3. There is a general lack of dialogue between the Councils, the provinces, and the federal government on the many ways in which the environment and the relationships could be improved.



# Financial and Other Forms of Support

The principal operating income statistics for the six older Research Councils and Foundations have been given already in the section of this report on "Institutional Characteristics". As was noted in that context, the incomes of the Councils in New Brunswick and Nova Scotia, for the most recent year for which statistics were available, were just less than \$1 million, while those for British Columbia and Saskatchewan were between \$1 and \$2 million, and those for Alberta and Ontario were in the neighbourhood of \$3½ million. The growth patterns of the operating incomes of the six Councils have been remarkably dissimilar. An indication of these patterns is given in *Chart 4*, which follows.

Over the last ten and the last two years, the overall operating income "growth leader" has been the Nova Scotia Research Foundation. The majority of this growth has, however, taken place in this institute since 1965 and reflects its expanding role and the acquisition of its new laboratories. During the last two years, only the New Brunswick RPC has grown faster—as might be expected with a new institute with new laboratory facilities. The growth rates of the Alberta Council and the Ontario Foundation have also been substantial, reflecting expanded activities particularly in the last two years which have included, in the case of the Alberta Council, the operation of its new pilot plant and a steady rise in industrial contracts and, for Ontario, the move to the Sheridan Park laboratories, an increasing volume of industry-sponsored projects, and a new method of basic support from the provincial government.\* The growth rates for the Saskatchewan Council and B.C. Research have been about half those for the Alberta Council, reflecting, in Saskatchewan, the relative dependence of the Council on government support in the form of grants and contracts and, in the case of B.C. Research, the combination of relatively stable provincial govern-

ment grant support and the ups-and-downs of the open market for industrially sponsored research and development work.

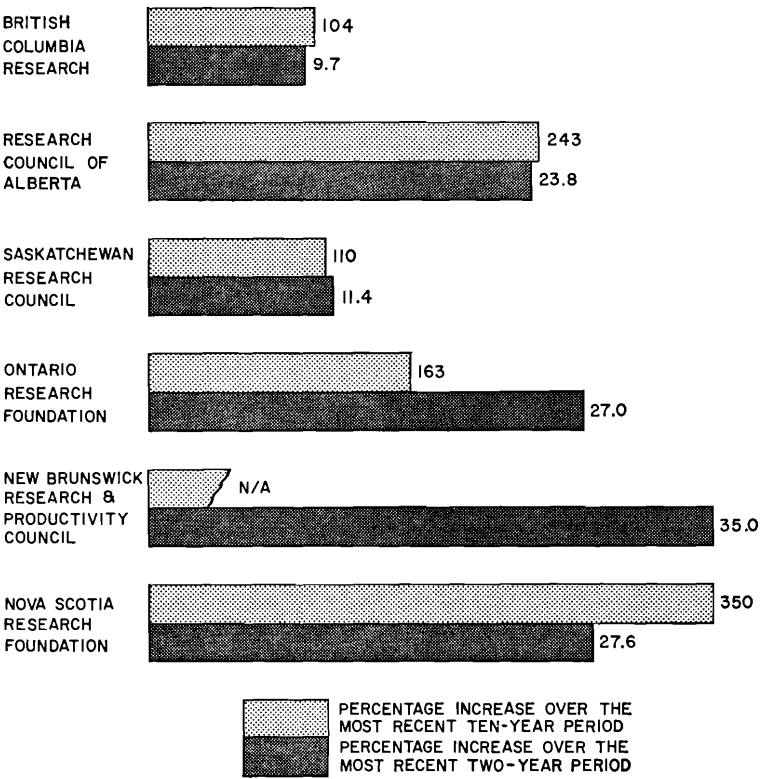
As noted earlier in this report, the Ontario and Nova Scotia Research Foundations both have endowment funds which, at the beginning, provided most of their operating incomes. They now provide only about 4 per cent of this income. All six Councils rely heavily for essential service and exploratory research support on the annual grants received from their respective provincial governments. In percentage terms, these grants account for two-thirds or more of the operating incomes of the Councils in Alberta, Saskatchewan and New Brunswick at the present time, and for about half in the case of Nova Scotia. These grants are relatively lower for the Ontario Foundation and B.C. Research—currently at 23 per cent—but this was not always the case.

During the first eleven years of its existence, the government grant provided B.C. Research with the major portion of its income. Earned income from contracts exceeded the grant for the first time in 1956. By 1969, the grant had increased only about 60 per cent over its 1956 level, while earned income had increased over five times. The present philosophy at B.C. Research is to stress the importance of increased earned income business and increased royalties, but to judge its performance record on the basis of products developed and exploited rather than on the basis of contract earnings by themselves.

For the past three years, the Ontario Research Foundation has had an arrangement with the Ontario Government whereby the provincial grant each year is equal to the contract income received from the industry sector. This dollar-for-dollar arrangement was proposed as an incentive by ORF itself to encourage the Foundation to seek out new industrial contract work. As noted above, this arrangement is not favoured by B.C. Research. It could not operate at all in the other four Councils because the percentage of total operating income represented by industrial contracts is at present too small

\*During this two-year period, the Ontario Research Foundation's *industrial* income increased by 49 per cent.

**Chart 4—The Six Older Research Councils and Foundations: Growth of Operating Incomes**



*Source:* Annual Reports and private communications.

and the switch to a dollar-for-dollar grant would mean a severe drop in provincial grant income.

In 1969, as far as can be estimated, the six provincial governments provided about \$5 million in annual grants to the Research Councils and Foundations. The *total* contract income amounted to another \$6 million, of which between \$4 and \$4½ million came from industry—75 to 80 per cent of it going to ORF and B.C. Research. The remaining \$1¾ to \$2 million of contract support came mainly from the provinces rather than from the federal government—with the largest share going to the Alberta and Saskatchewan Councils. Contract income from the two levels of government included work under cost-shared programs—such as PAIT and ARDA—and under the Technical Information Service program of the National Research Council.

Major expenditures on new buildings, pilot plants and equipment have been made by the six Councils during the past five years. With the exception of the new ORF laboratories, for which a portion of the capital was raised in the private sector, the funds came from the two senior levels of government, the sale of existing assets, and from cash reserves. The ORF also has an agreement with the province for the purchase over a five-year period of new equipment valued at \$1 million. Capital expenditures rose to a peak in the fiscal year 1968-69, but have tapered off since then because the major building projects have been completed.

To place the financial support of the six older Research Councils and Foundations in some kind of perspective, the following expenditures by governments and others are of interest:

1. The total federal government expenditures on science during fiscal year 1969-70 have been estimated at \$700 million, and included in this sum, were payments by its departments and agencies to educational and non-profit institutions for research and experimental development amounting to \$120 million.\*

2. During fiscal year 1969-70 approxi-

mately \$52½ million was paid out by the federal Department of Industry, Trade and Commerce under three main incentive programs:†

Industrial Research & Development Incentives Act: \$22.7 million;

PAIT: \$5.7 million;

Defence Industrial Productivity Program: \$24.0 million.

3. During the same year, \$10 million more was paid out under:‡

NRC's IRA Program: \$6.2 million;

DRB's Defence Industrial Research Program: \$4.1 million.

4. The latest available statistics show total expenditures on all provincial activities for the following provinces:§

British Columbia (1968-69): \$925 million;

Alberta (1968-69): \$723 million;

Saskatchewan (1968-69): \$344 million;

Ontario (1967-68): \$2 553 million;

New Brunswick (1968-69): \$287 million;

Nova Scotia (1968-69): \$245 million.

5. The total revenues for certain cities in Ontario for 1968 have been given as follows:¶

Toronto: \$241 million (Metro Toronto: \$410 million);

Ottawa: \$72 million;

Windsor: \$40 million;

Sarnia: \$12 million;

Belleville: \$7 million;

Smiths Falls: \$2 million.

6. The annual sales of various companies, for the periods stated, were as follows:#

Leigh Instruments Limited, Smiths Falls, Ontario, June 30, 1968: \$6 489 000;

Electrohome Limited, Kitchener, Ontario, December 31, 1968: \$35 655 000;

Bombardier Limited, Valcourt, Quebec, March 31, 1968: \$53 402 962;

\*Dominion Bureau of Statistics, Business Finance Division, Scientific Activities Surveys Section.

Federal government expenditures on science. Advance Statements Nos. 1 and 2 (6602-512). June 1970.

†Advance Statement No. 1.

‡Advance Statement No. 1.

§Published provincial sources.

¶Ontario Department of Municipal Affairs. Summary of financial reports of municipalities (1968). November 1969.

#Financial Post Survey of Industrials (1969).

B.C. Forest Products Limited, Vancouver, B.C., December 31, 1968: \$118 684 000;

The Steel Company of Canada, Limited, Hamilton, Ontario, December 31, 1968: \$589 613 000.

7. A U.S. non-profit corporation, The Rand Corporation, is shown in its Accountants' Report dated January 31, 1969, to have had a total revenue (reimbursable costs and fees earned from contract operations) of almost \$25 million in 1968.

The Research Councils and Foundations are continuously seeking additional financing for their various activities. One source from which new funds would be welcomed—particularly for research aimed at the maintenance of existing competence and entry into new fields—is the federal government. The Councils' reasons for addressing themselves to federal departments and agencies include the following:

1. The provinces already contribute significantly through annual grants to operating income, and particularly to exploratory projects.

2. In the United States, the non-profit research institutes—which correspond most closely to the provincial Councils—have been heavily supported by the U.S. Government, particularly in the defence and space fields.

3. The small size of the Councils, their relatively slow rate of growth in facilities and capabilities (until recently), and the label "provincial" which they have borne have helped discourage federal departments and agencies from supporting research by the Councils except in a limited way through specific contracts.

4. In the provinces, federal contract and grant funds for exploratory-type research have been awarded to faculty and to departments and institutes in the universities.

5. Federal departments and agencies appear to have followed the policy of performing exploratory research related to their responsibilities either in-house or, less frequently, in co-operation with the corresponding provincial departments or

with the universities, and do not appear to have considered supporting much of this work in the Research Councils and Foundations.

In support of their position with regard to additional federal support, the Research Councils list their operational flexibility, their application- and industry-orientation, their existing skills and facilities, the depth of their knowledge in certain areas, and their record of collaboration and co-operation. They point to their locations across the whole country, to their wealth of local and regional knowledge and contact with what is happening, and to their experience in the various phases of the innovation process. The Councils also express concern about the slow growth of industrial research in Canada and about the apparent ineffectiveness of federal pressures to change this situation.\*

The Research Councils also have views on the kinds of programs in which they would prefer to participate with the federal government. These include:

- a) increased contracting out of work right across the spectrum of research and development activities by federal departments and agencies;

- b) competitive tendering by industry, the universities *and the Research Councils* for projects to be carried out in Canada under a shared-cost arrangement with the government;

- c) the extension of the Negotiated Development Grant program now operated by the National Research Council in certain universities;

- d) permission to submit unsolicited proposals to the appropriate departments and agencies for R & D work associated with the solution of Canadian economic and social problems;

- e) the establishment of a generous new tax-based general incentive program which will encourage more companies in Canada to contract out research to the Councils, and especially those companies which have insufficient research capacity and

\*Recent changes in PAIT, for example, may have improved one of the federal incentives, but it is rather early to draw conclusions.

expertise of their own;

f) the revision of the NRC/IRA program to allow the Research Councils to participate in whole projects and not just during the first year;

g) the insertion of R & D incentive clauses in both federal and provincial programs which assist with the establishment or relocation of manufacturing plants;

h) establishment of a special annual grant to the Research Councils for unspecified research—with continued support to be dependent on performance—to replace the NRC grants of between \$10 000 and \$25 000 which have now, with one exception, been discontinued.

The six older Research Councils and Foundations want continued and improved provincial support, but they are now actively looking to the federal government for help. They also believe their competence has increasing relevance for service to metropolitan areas, cities and municipalities. Most of all, they want more work from industry itself. They all know that in periods of austerity and poor profit margins, the normal public and private sector resistance to starting new ventures is increased. Nevertheless, they figure they have a role to play in the solution of national—that is, Canadian—economic and social problems and would like to have the means to play it.

# Current and Future Problems

The particular problems articulated in this part of the report are those which will require solution in the near future if the Research Councils and Foundations are to play their part as a sub-system within the Canadian system of institute activities associated with bringing improvements to the Canadian economy and society. The list which follows is particularly relevant to the six older Councils, but it by no means exhausts the problems which they now face or will face over the next few years.

1. The use of the term "provincial" to describe the Research Councils and Foundations is no longer as appropriate as it may have been at one time. The last ten years have seen significant changes take place in the activities of the older Councils.

2. The present climate of business uncertainty and the climate of austerity in the spending of governments have combined to create an environment in which the steady growth and progress of the Councils during the past ten years may be interrupted. (On the other hand, this situation has forced the Councils to look farther afield for opportunities to apply their expertise and services.)

3. There are problems associated with the funding of two particular kinds of Research Council activities—industrial contract work, and "seed money" for the maintenance of existing competence and entry into new fields. The seriousness of these problems varies from Council to Council.

4. At the present time, only a limited number of manufacturing companies in Canada have the competence to avail themselves of the expertise and services of the Research Councils—if they can be persuaded to do so.

5. This persuasion presents a challenge to the Councils, but an even bigger challenge is the devising of methods to upgrade the basic technical competence of the thousands of manufacturing companies that now have limited expertise of their own. However, upgrading can be time consuming and expensive and should

perhaps involve other provincial government agencies, federal government agencies, and agencies in the private sector.

6. Another problem is the degree to which the Research Councils should become involved in innovative activities of an entrepreneurial kind. (The opportunities to perform such activities have been taken up by two of the Councils, but the others are well aware of the possibilities.\*)

7. The Research Councils co-operate at present in research with federal and provincial agencies, with companies and universities, and with one another. They wish to extend this co-operation.

8. With the exception of the Ontario Research Foundation, the other older Research Councils are in provinces which experience net outflows of scientifically and technically trained people. The Councils represent opportunities to stem the flows a little—and to encourage experienced people to return. However, the Councils have had relatively few openings in recent years. They prefer professionals with a particular type of industry-biased outlook. And they are finding that the colleges of technology are now developing graduates who are as useful as bachelor graduates, if not more so.

9. As industry-oriented institutes, the Research Councils must concern themselves about the relevance of their present and future work for industry and about the problem of "missing the boat" in the marketplace.

10. The smaller Councils, in particular, face a difficult problem each time a large contract which has been going on for several years is terminated. While the termination date is usually known well in advance, replacement contracts may take a while to negotiate. Existing competence—and people—may be lost in the process.

11. The Research Councils are some-

\*There is, of course, the semantic problem of what "innovation" is. There is also the "bandwagon" problem—innovation is becoming the new "motherhood" activity. There is a third problem. We apparently lack a history of successful innovation. But is the lack more apparent than real?



times criticized for not performing *all* of their services free. They challenge this view on the grounds that totally free services inevitably reduce the Councils' effectiveness and waive their right to refuse particular kinds of work. They will, however, perform *some* free services. The problems are: Which services, through which mechanisms, and with support from which agency?

12. The Research Councils maintain they are not seeking favoured treatment from federal agencies. They are simply seeking equal opportunities to receive federal support, and point to the support given to the universities for research and graduate education.

13. The Research Councils are about as different from one another as are the regions of Canada. They reflect the history, natural resources, manufacturing sophistication and other aspects of the provinces to which they belong. The problem, then, is to provide assistance to the Councils to enable them to become and remain centres of competence rather than to make them do so in like fashion.

14. The right of individual Research Councils to exist at all has been questioned so often that it has come to be regarded as a normal hazard. But recently the questioning has extended to the Councils collectively. For example, critics cite their small size and apparent lack of support from industry. They also cite the fact that universities have more collective expertise than the Councils with which to contribute to the solution of industry's technical problems. Critics also point to the existing network of federal laboratories throughout the provinces and to the possibilities for duplication.

15. The operations of a Research Council, like those of any other public or private institute, constantly involve problems of politics and personalities, rivalries, jurisdictional disputes at first-hand or second-hand, interference, and the narrow versus the broad outlook. The Councils are anxious to solve these problems. But they cannot be all things to all men. They are vulnerable to threats to their

existence. They must be allowed to exist as "institutional individuals" or not at all.

This report has had very little to say about Research Council-type activities in Quebec, Newfoundland and Prince Edward Island and will have nothing to add about problems specific to these provinces. The situation with regard to Manitoba is different. The main problem with regard to the Manitoba Research Council (MRC) is: What happens next?

The present technical information and licence-encouraging activities and the new Industrial Enterprise Fellowship Program are not the kinds of *research* that the Council was established to perform, nor are the current operations of the Council likely to encourage the performance of substantially more industrial research in the province or to foster the growth of centres of industry-oriented research in existing non-industrial laboratories. The University of Manitoba has expressed interest in establishing an Industrial Research Institute along the lines of those already active in Ontario and Nova Scotia, and is consulting with the Department and the Manitoba Research Council. But it is not clear that a laboratory-equipped Council as described in the MRC Act should be ruled out as a more appropriate alternative to such an Institute—especially since there are MRC committees actively looking into the prospects for both research and production in four particular groups of industrial products—building systems, materials, electrical and electronic, and food.

In his presentation to the Senate Special Committee on Science Policy, a former Minister of Industry and Commerce, the Honourable Sidney Spivak, indicated that Manitoba could make better use of federal assistance and incentive programs for R & D if the work was performed in industry. The province, and MRC, did not need a laboratory facility. The principal function of the MRC would be advisory.\* However, there are others in Manitoba who might not quarrel with the Minister's

\*Proceedings No. 61. June 12, 1969. p. 7319.

short-term arithmetic, but who ask about the needs of those Manitoba companies which cannot afford even a cost-shared research laboratory. They might also point to experience in Saskatchewan and Alberta where it has been shown that a Research Council without its own laboratory is likely to be ineffective.

# Assessment

Why are there Research Councils and Foundations in Canada of the kind discussed in this report when parallel or equivalent organizations do not exist in other countries? Dr. E.J. Wiggins of the Research Council of Alberta commented on this point in his remarks to the Senate Special Committee on Science Policy.\*

“One answer is that the system was introduced at a comparatively early stage in Canada’s scientific history, and has evidently worked well enough to persist. Interestingly, several of the provincial groups were started through the efforts of the same Dr. Henry Marshall Tory who had so much to do with the National Research Council in its formative years. A more scientific answer is that the geographical dispersion of the Canadian population has caused the provinces to feel that their scientific and technological needs could not always be adequately met by the central government, due to both distance and regional differences. Also, they have undoubtedly felt that an independent effort would give them an advantage in developing their local economy and in broadening their industrial base. The geographical factor has presumably not operated so strongly in most European countries while in the United States powerful private interests often arrived on the regional scene at an earlier stage in history.”†

In the past, the use of the term “provincial” has helped to set the six older Research Councils apart from federal government research agencies, on the one hand, and from industry, on the other. The Councils have never been confused with the universities, although the universities nowadays aspire, in part, to be of greater service to industry. The relationship which each Council enjoys with its province is unique, and the bonds

which bind them together vary in strength. None of the six older Councils is a department of the provincial government, and none has thus far achieved real national stature. While history, geography and institutional differences cannot be ignored, it is clear that in the future the Councils and Foundations will be better served—and better able to give service—if they are considered to be “the Research Councils *in* the provinces”.

Another point of distinction must be made at this stage. It is important to distinguish between the Councils as Boards of Governors or of Management and the Councils as the technical operating arms of a legal entity. This distinction has been made formally in two cases. In the West, B.C. Research is the technical operator of the non-profit independent society, the British Columbia Research Council. In the East, RPC is the service agency and operator of the New Brunswick Research and Productivity Council. Throughout this report, the attempt has been made to ensure that the meaning of the word “Council” is clear from the context each time it is used. In practice, the technical operation is normally much more in evidence than the Board of Management.

This report has presented no evidence to show that the Newfoundland Research Council Act should now be implemented or that a Council should be established in Prince Edward Island. Instead, the report may assist the appropriate authorities in these provinces to examine these possibilities.

Six provinces now have active Councils, and another—in Quebec—has been established recently and is being organized with dispatch. In Manitoba, however, the Research Council Act has not yet been fully implemented. It would be inappropriate to conclude that this Act *ought* to be implemented in full as soon as possible. Nevertheless, bearing in mind the earlier experience of the Councils in the other Prairie Provinces, and in Nova Scotia, the existence of a laboratory-equipped Council operation in Manitoba has certain appeal:

\*Proceedings No. 50. June 3, 1969. p. 6256.

†With regard to the United States, however, it is interesting to note that U.S. authorities examined the provincial Research Council system in Canada before framing the U.S. State Technical Services Act.

a) as a focal point for scientific and technical competence related to new and existing industries in the province;

b) as an alternative to any other form of general industry-oriented R & D laboratory which might be set up within the government departments or in a university; and

c) as a testing facility, to fill gaps which exist in the province.

It would be wrong to assume that the existing Research Councils and Foundations—and the six older ones in particular—will limit their interests to companies in secondary industries. At the present time, the six older Councils are assisting primary industry companies, and most are gradually turning their attention to the extensive opportunities which exist to help the service industries. Two of the six—Saskatchewan and Alberta—are deeply committed to work which is in a sense “pre-industrial” and “pre-habitation” in that it is concerned with water supplies, climate and other factors which could make industrial activities or human habitation—or both—possible in areas where they do not now exist. They are performing a significant amount of research which is done in government departments in some provinces.

With regard to Canadian manufacturing industry in general, it is clear that the individual Councils and Foundations are having problems. As the Ontario Research Foundation sees it, at least 95 per cent of all such companies in Canada are too small to afford to build and maintain research laboratories of their own, but some 15 to 20 per cent of all the companies—most of which are small—can afford to *sponsor* research projects in contract research organizations such as the Councils. Along with the remaining 5 per cent of companies—which are larger and which can usually afford to have their own laboratories—this 15 to 20 per cent group provides the Councils with their principal Canadian industrial clients.\*

\*See Ontario Research Foundation Brief to Senate Special Committee on Science Policy. Proceedings No. 50. June 3, 1969. pp. 6320-6321.

Unhappily for the Saskatchewan, Alberta, New Brunswick and Nova Scotia Councils, the majority of these “eligible” clients are in the Provinces of Ontario, Quebec and British Columbia. This means that the Prairie and Atlantic Region Councils must seek industrial contracts from outside their provinces or rely more heavily on government-sponsored contracts. In the case of Alberta, in particular, the choice has been made to a large extent because the government uses the Council extensively as a research “arm”. In New Brunswick, however, the RPC has been making a strong attempt to secure extra-provincial work.

The six older Research Councils can be distinguished from university departments and research laboratories in a number of ways. For example, they are oriented towards technology rather than to science. Their research is very “applicable” research. They have had to develop interdisciplinary capabilities in which economic considerations are often of paramount concern. They have fewer administrative difficulties in meeting industry or research deadlines and no conflict with teaching, graduate student supervision, or publication pressures. Accountability and cost consciousness are important—more so in some Councils than in others—and flexibility of thought and of action are strong points. The scientists, engineers and technicians employed by the Councils are quite often unusual people who combine a flair for technical problem-solving with a business outlook. The location of several Councils near or on university campuses—and their work for, or within, these universities—have not blurred the distinction between the two kinds of institutions.

One particular facet of the desire of the universities in Canada to get closer to industry has recently been attracting some attention. This is the establishment, with federal Department of Industry assistance, of the Industrial Research Institutes (IRI) at three Ontario universities and at one in Nova Scotia. The oldest IRI is under three years old, and in keeping with institutes

the world over, all four are having initial teething troubles. In the department's view, the Institutes are an experiment and there are indications that the "IRI technique" will not be widely applied until evidence suggesting it is both feasible and effective has been gathered. These Institutes, together with other methods of organizing faculty participation in industrial technical problems, have drawn attention to the whole question of the preferred methods for crossing the industry-university interface—a question which hinges on the basic roles and functions of different kinds of institutions, of which universities and Research Councils are only two.\*

Canada has Research Councils or Foundations in most provinces, but it has few Research Associations on the European model which serve specific industries rather than regions.† It may be postulated that, from the industry point of view, it would be more effective to have Associations than Councils because the former should have more relevant expertise and more incentive to engage in specialized research projects. Unfortunately, the Associations in Europe have not been equally good or equally effective. Some of them actually perform more like technical information centres than sources of new, advanced research with applicability to a particular industry.

Comments on the subject of Research Associations were made in another Science Council Special Study.‡ For example, on the basis of extensive interviews with representatives of Canadian industry, it became clear that reaction to the establishment of more Associations in Canada would be unfavourable—and particularly

unfavourable to the statutory establishment of Associations in each of the major industries—for reasons such as the following:

1. The business environment in North America is intensely competitive, and Research Associations appear to flourish best in those industries in which competition is relatively less intense and technology is slower moving.

2. Research Associations function most effectively when their members are concentrated in small geophysical areas.

3. Some Canadian companies have access to the R & D work of international corporations and of groups of international affiliates.

4. Help is already available (in Canada) where there is a provincial Research Council or Foundation or a federal laboratory.

The same report also mentioned that the principal reasons for certain Canadian manufacturing companies placing contract research with the Research Councils were as follows:\*

- a) to take advantage of expertise which the companies did not have time to acquire themselves;

- b) to make use of experimental facilities which they did not have and had no reason to acquire;

- c) to concentrate on development work in-house.

The six older Councils are not equally "good". Granted they perform in different environments, but this very variety helps to highlight strengths and weaknesses. This variety also throws into focus the fact that the needs of the Councils for growth and development are not necessarily the same—nor will they necessarily be the same in Quebec or Manitoba.

There are a number of ways in which the value and effectiveness of the six older Research Councils and Foundations might be assessed. For example, comparisons might be made of relatively recent and of longer term operating income growth rates, as shown in *Chart 4* of this report.

\*The problems of this particular interface, and the others, will be discussed at greater length in one of the later Special Study reports associated with the Science Council work on the innovation process.

†The largest institute of the Research Association type in Canada is, of course, the Pulp and Paper Research Institute at Pointe Claire, Quebec. Most associations in Canada are quite small and some serve regional rather than national interests.

‡Wilson, Andrew H. Background to invention. Special Study No. 11, Science Council of Canada. Ottawa, Queen's Printer, 1970. pp. 59-60.

\**Ibid.*, p. 59.

The numbers and dollar amounts of industry and government contracts received might be compared over a period of years. Changes in technical interest with income and facility growth could be considered, along with changes in the qualifications and utilization of staffs and the sophistication and utilization of machine shop and laboratory equipment. Such comparisons are complicated by differences in the terms of reference of the Councils, by the environments in which they work, and by the formal relationships they have with provincial and federal governments, with universities and with each other. It is, in fact, very difficult to compare the value and effectiveness of one Council with another by a system of awarding "Brownie points", and very difficult to do it on a local or provincial basis because the Councils have no direct competitors in their provinces with whom they can be compared. In spite of these difficulties, two published assessments made by the Ontario Research Foundation and by the Saskatchewan Research Council are of interest for the purposes of this report.

The Ontario Research Foundation assessment was included in the Foundation's brief to the Senate Special Committee on Science Policy.\* It indicated that during the decade 1958-68 about 3 500 firms spent in excess of \$9.0 million on research and development in the Foundation, and the annual value of industrial contracts rose, during the same period, from \$475 000 to over \$1 million. Also, according to a study made by the Canadian Manufacturers' Association and published in *Industrial Canada* in October 1961, more than half of 381 Canadian companies reporting research activities to the Canadian Manufacturers' Association had availed themselves of outside assistance for specialized projects. The 10 most frequently mentioned sources of such assistance were: Ontario Research Foundation (62 times); National Research Council (38); Department of Mines and

Technical Surveys (18); B.C. Research Council (18); Pulp and Paper Research Institute (16); University of Toronto (9); McGill University (9); Forest Products Laboratory (9); University of Montreal (6); and the Research Council of Alberta (5).

At its meeting in May 1969, the Saskatchewan Research Council asked the Director to prepare a statement in which an attempt was made to assess the value of the work done by the Council from its inception to the present. Dr. T.E. Warren presented this statement three months later and the following paragraphs were included in his conclusion:\*

"It is probably safe to assume that the contribution of the Council to the cumulative gain in net value of commodity products (in Saskatchewan) from 1947 to 1968 is not less than one tenth of one per cent of the total.†

"This is not, however, a complete measure of the value of the Council's work. The future benefit of the work that has been done up to the present should be included. This may be about an order of magnitude greater than the past benefit because of the accumulation of results from extended studies, the growth of the Council's effort and the normal delay between discovery and application.

"Capital gains, such as the increase in property value due to discovery of ground-water resources, also make a contribution but have not been defined well enough to permit even approximate evaluation.

"The benefits that have been indicated can be compared with the following costs. The cumulative operating expenditure for 1947 to 1968 was \$9.9 million of which \$7.5 million was provided by annual grants from the Province of Saskatchewan. The remainder was obtained mainly from contracts and grants in support of specific

\*Warren, T.E. Value of the work of the Saskatchewan Research Council. Saskatchewan Research Council, August 1969. p. 15.

†The cumulative gain in net value is given on p. 6 of the report as \$8 billion, measured in 1968 dollars. The figure to which Dr. Warren alluded was, therefore, \$8 million.

projects. The cost of buildings and facilities not included in operating expenditure was one million dollars.”

A quantitatively based and comprehensive examination of the value and effectiveness of the six older Research Councils and Foundations lies beyond the scope of this report. Instead, their work has been evaluated more qualitatively than quantitatively and with due regard to the historical, environmental and other factors which are affecting their operations at the present time or which are likely to be important in the years immediately ahead. On this basis, the Councils in Alberta and Saskatchewan can be rated as well established and effective. The Councils in Ontario and British Columbia are well established and effective, but because of their industry dependence, they are also more vulnerable. However, both have the will to survive. Nova Scotia Research Foundation has received a new lease on life with its new laboratory. The New Brunswick RPC is perhaps the most vulnerable because, from where it is situated, the problems of continued growth and development are more complex. As a group, however, the Research Councils perform valuable services throughout the country.

The most appropriate measure of the future is to ask the Councils how they see their own development. All of the Boards of Governors and Management are addressing themselves to this question. So far, they have few answers because a great deal of forward looking, at the present time, must be speculative. For example, if there should be a single federal agency established to spearhead all activities at this level associated with research, development and innovation in industry, will it permit greater Council participation than is possible at the present time? When will government austerity end and industry profit levels rise again? Will there be more research, more innovative-production work, a lower level of field service activity, more clients from beyond the provincial border?

The views of the Research Councils from Ottawa and the views of Ottawa from the Councils can be very different. But two things stand out clearly. The first is that no Council should take on contracts for research or for the provision of services on behalf of a federal department or agency unless it can fulfil its obligations to do so. The second is that the Acts, under which the National Research Council and the federal Department of Industry, Trade and Commerce were established, give them authority to help the Research Councils to a greater extent than they now do. In the past, arguments for the provision of such help seem to have ended in frustration and, particularly, when the small size of the aggregate revenues of the six older Councils is considered, it seems amazing that these two federal government agencies have not had more to spare for them.

It is clear that the provincial governments and their departments and agencies have made use of their Councils, but could do more. Similarly, the mission-oriented technical departments and agencies of the federal government, and some of the cost-shared programs, have helped. It is clear, however, that most of the Councils have the ability and resources to contribute both directly and indirectly to the welfare of their province *and* to the welfare of the country as a whole. It is also clear that the full range of possible collaborative, corporative and financial arrangements for federal and provincial support of activities in the Research Councils has not yet been explored.



# Conclusions

This report has been written in order to provide background material upon which policy recommendations can later be based. The following conclusions should help to draw the material together.

1. The six older Research Councils and Foundations in the provinces are centres of competence and have roles to play in national as well as provincial policies involving science and technology.

2. These older Research Councils have not achieved their present levels of competence in a few short years. The growth and development of competence in the newer Councils will also take time. On the other hand, the destruction of these centres of competence could be accomplished relatively quickly by a variety of methods originating internally or externally.

3. The Research Councils in the provinces in Canada are unique and their main strengths lie in their applied research and industrial orientations, and in having the kinds of flexible organizations and people who can work in an environment of this kind.

4. The term "provincial" has tended to be misleading when applied to the six older Councils. They are more than simply research "arms" of provincial governments and have acquired skills which can be applied beyond provincial boundaries. The phrase "Research Councils in the provinces" appears to be the more appropriate collective term.

5. None of the Research Councils in the provinces is the "junior edition" of the National Research Council, and none should ever be so. The role of the National Research Council is quite different. This should not, however, prevent the NRC from continuing its assistance to the Councils either financially or materially when such help is appropriate and in their mutual interest.

6. The six older Research Councils have received invaluable support from the provincial governments in the past in the form of annual grants. The amounts and the conditions for the payment of these grants have varied from Council to Council and from time to time. There is

no best type of grant which should be made in all cases. However, it is reasonable to assume that provincial government help through the annual grant method should continue and that it should be generous, especially in those provinces in which the industry base is limited.

7. In the past, the six older Research Councils have received contracts for research from mission-oriented, resource-based and essentially socially motivated departments and agencies of the federal and provincial governments. It will be to the advantage of the Councils *and* of the departments and agencies that this practice should continue and that there should be no barriers to its expansion into other departments and agencies.

8. Each of the Research Councils in the provinces must reconsider the kinds of technical information and other associated services it wishes to perform for the benefit of the industries it serves. In the past, the contracts from the National Research Council to perform TIS services have been valuable to the Research Councils as well as to the industries, but these contracts have had specific objectives in mind. If these objectives do not coincide with those the Research Councils see in their future, then—unless changes can be negotiated—the Councils should make alternative arrangements for support, or should discontinue these particular services.

9. The Department of Industry, Trade and Commerce appears to be a federal agency which can assume responsibility for providing additional fully funded competitive or negotiated contract assistance to the Research Councils in the provinces. This department has a direct interest in the techno-economic aspects of research, development and innovative activities and in the growth and development of Canadian manufacturing industry.\*

\*This conclusion—and several others—would be changed if, for example, the federal government established a new agency to spearhead innovation-oriented activities or gave this kind of overall responsibility to an existing agency.

10. At the present time, a Research Council may participate in a PAIT program, but participation in the NRC's IRA Program is restricted. It will be to the advantage of the Councils and of Canada if these latter restrictions are removed.

11. *Le Centre de recherche industrielle* in Quebec has only recently been established and is in the process of being organized. Some of the conclusions of this report will be of interest and relevance to the Centre.

12. In the case of Manitoba, it appears from the outside that the continuation of the present activities of the Research Council cannot be justified in the longer term because the Department of Industry and Commerce has the capability to absorb them. A decision will have to be made to close out the Council operations or to increase them to the level originally envisioned in the Act. The experience of other Councils indicates that continuing half-measures are likely to be ineffective.

13. All of the Research Councils in the provinces have a particular role to play with regard to small companies, of which there are a great many in Canada.

14. Nevertheless, companies of all sizes in Canada should make more use of the skills and facilities of the Research Councils in the provinces.

15. Each of the six older Research Councils operates in a different environment and has a different growth history. At the present time, some Councils appear to have under-utilized resources, while others have unrealized potential. Some appear to spend a lot of time seeking out new business from industry or new forms of support from governments. Others enjoy a relatively stable existence. While a competitive environment tends to stimulate activity, good laboratories need continuity and stability. Each must therefore seek and reach the most appropriate size for viability, for the performance of its roles and functions and for the achievement of its objectives.

It is clear that the implementation of recommendations based on some or all of these conclusions will require the good-

will of provincial and federal governments and the many agencies concerned. The need for Research Council initiatives in the search for contracts will continue. It is also clear that current budgetary restrictions in the government sector, and the currently unfavourable climate in most sections of industry, are likely to make achievement in the short run more dependent upon the revision of existing priorities rather than on the provision of substantial new financial support. There is therefore the danger that the outcome of talks between some or all of the parties involved could easily become contests between irresistible forces and immovable objects from which no party derives satisfaction. In this kind of situation, this present report can do no more than state one final conclusion:

16. Each Research Council or Foundation in the provinces is a provincial resource. Collectively, they are also a Canadian resource.

# Appendices

## Notes on Appendices

The Appendices which follow have been compiled from the following principal sources:

- a) the legislation establishing the various Councils;
- b) recent Annual Reports and other reports and brochures of the various Councils;
- c) interviews with, and communications from, Council officers;
- d) articles and papers by officers of the various Councils;
- e) interviews with, and communications from, officers of provincial Departments of Industry and Commerce, or the equivalent departments, and the Annual Reports of these departments;
- f) proceedings of the Special Committee of the Senate of Canada on Science Policy;
- g) the legislation establishing the relevant federal departments and agencies; and
- h) interviews with, and communications from, officers of the federal Department of Industry, Trade and Commerce and the National Research Council.

Few financial details are given in the Appendices because these have already been covered in the discussion material in the “Institutional Characteristics” section and in the section on “Financial and Other Forms of Support”.

## Appendix I

### Newfoundland and Prince Edward Island

There are at present no institutes in the Provinces of Newfoundland or Prince Edward Island resembling the Research Councils in the other provinces. In P.E.I., it would appear that none has ever been contemplated. In Newfoundland, an Act was passed in 1961 but was never implemented. Details of its origin and some of its provisions are given below.

About five years ago, an agreement was reached between the Technical Information Service (TIS) of the National Research Council (NRC) and the New Brunswick Research and Productivity Council (RPC) whereby the RPC would operate a service in Prince Edward Island on behalf of the National Research Council. Prior to this, NRC/TIS had been sending a representative to the Island for several weeks each year. The contractual arrangement between RPC and NRC is still in force.

Shortly after the RPC service to P.E.I. was started, the proposal was made whereby the Nova Scotia Research Foundation would perform a similar service in Newfoundland. An agreement was reached and remained in force until quite recently when it was terminated at the request of the Foundation.

Between 1954 and 1960, the Newfoundland Research Committee served as the focal point for discussion-type activities associated with science and research in the province. In its executive role, the Committee arranged meetings, seminars and symposia on a regular basis on topics of national and provincial interest, and provided a forum for the public exchange of ideas and for the discussion of current research work. The majority of the participants were government or university scientists. The work of the Committee has been credited with helping to stimulate further research in laboratories in Newfoundland.

During 1960, the Committee undertook

responsibility for initiating the idea of a Research Council for Newfoundland and agreed to help the Department of Resources to draft an appropriate Act. The Council was conceived as the natural but more formal and influential successor to the Committee. In concept, it resembled existing Councils in other provinces. It was designed to promote research as well as to continue to foster exchanges of views and experience.

The Newfoundland Research Council Act\* came into force on April 1, 1961, but no action was then taken—and none has been taken since—to implement it.†

Among the provisions of the Act were the following:

“3.(2) The members shall be appointed‡ by the Lieutenant-Governor in Council and shall include

(a) a representative of the National Research Council resident in the Province;

(b) two members of the faculty of the Memorial University of Newfoundland;

(c) representatives of departments of the Government of Canada conducting research in Newfoundland;

(d) representatives of departments of the Government of Newfoundland; and

(e) representatives of industry.

5.(1) The Lieutenant-Governor in Council shall designate one of the members to be the Chairman of the Council, another to be Vice-Chairman, another to be Secretary and another to be Director of Research.

5.(7) The Director shall supervise and direct the work of technical and other officers appointed for the purpose of carrying on the work of the Council and he shall submit to the Council nominations for any technical or other officers required by the Council.

9. A member other than the Director shall not receive pay or other emolument for his services, etc. etc.

\*Bill 23.

†The Research Committee, it should also be recorded, has not met again.

‡Not less than eight, not more than twelve, normally for three years.

12.(1) There shall be a fund to be known as the Newfoundland Research Council Fund to which shall be credited in an account to be kept by the Minister of Finance all money received by the Council by way of contribution, grant, gift, donation, bequest or otherwise for the purposes of this Act and all moneys received as fees for services, proceeds of sales of property or patent rights and licence fees.

17. The Council may enter into agreements with any board, council, foundation or other agency established for the purpose of carrying out objects similar to those of the Council and may, with the approval of the Lieutenant-Governor in Council, accept such financial assistance as may be available to it, directly or through the Government of Newfoundland, by that board, council, foundation or other agency and any money received under this section shall be paid into the fund.

19. The Council shall consider matters pertaining to research and investigation in the fields of pure and applied sciences as they affect the economy of the Province and such particular matters as may be brought to its attention by the Lieutenant-Governor in Council or the Minister.

20. Without limiting the powers of the Council conferred upon or vested in it generally by this Act, the Council may:

(a) promote in such a way as deemed advisable,

(i) the utilization of the natural resources of the Province,

(ii) research with the object of investigating or improving the technical processes and methods that are or might be used in the industries of the Province,

(iii) research with a view to utilizing the waste products of the industries of the Province,

(iv) the investigation at the request of any of the industries of the Province of the materials that are or might be used in, or of the products of, the industries making the request, and

(v) research, the objects of which are the betterment, welfare and progress of

urban or rural life in the Province;

(b) have charge and direction of or supervision over research that may be undertaken under conditions to be determined in each case,

(i) by or for individual firms, or

(ii) by such organizations or persons as desire to avail themselves of the facilities offered for this purpose;

(f) enter into arrangements with any person or organization for carrying out research work and for payment for that work either by the person or organization or by the Council;

21.(1) The Director may, for the purpose of obtaining information and statistics as to the trades, businesses and industries of the Province, require any or all persons engaged in a trade, business or industry to furnish such information, etc. etc.

22.(1) All discoveries, inventions and improvements in processes, apparatus or machines made by a member of the technical staff of the Council and all rights with respect thereto are hereby invested in the Council."

## Appendix II

### Nova Scotia

The Nova Scotia Research Foundation (NSRF) was established through the Research Foundation Act of that Province of 1946, which is described in the preamble as “an Act to provide for the examination of and research respecting the utilization of the natural resources of the Province or the expansion or development of industry within the Province”.

The following are extracts of specific sections of the Act:

“3.(2) For the purposes of this Act, there shall be established an endowment fund ...and the income from (this) fund shall, subject to such directions as may from time to time be given by the Governor in Council, be administered by the Board of Governors....

(3) The work of the Foundation shall be under the general direction and control of a Board of Governors who may be appointed by the Governor in Council for such terms not exceeding three years as the Governor in Council may determine.

(4) The President of the Foundation shall be *ex officio* a member of the Board\*....

7.(1) The Foundation shall have charge of all matters affecting scientific and industrial research within the Province which may be assigned to it by the Governor in Council and shall advise the Governor in Council on questions of scientific and technological methods affecting the utilization of the natural resources or the expansion or development of industry in the Province, and without limiting or restricting the generality of the foregoing the Foundation may:

(2) Assist and coordinate surveys and studies to promote the knowledge and utilization of the natural resources of the Province.

(3) Undertake in such a way as may be deemed advisable:

\*In addition to the President and the Secretary of the Board, there are currently twelve other members.

(i) Investigations to improve the conditions of agriculture, fisheries, lumbering and mining or for the economic betterment, welfare and progress of the Province;

(ii) Researches with the object of improving technical processes and methods used in the industries of Nova Scotia, and of discovering processes and methods which may promote the expansion of existing, or the development of new, industries;

(iii) Researches with the view of utilizing the waste products of said industries;

(iv) Investigations into the quality of the materials which are or may be used in, or are, or may be the products of the resources or the industries of Nova Scotia:

(4) Have charge of and direction or supervision over researches which may be undertaken under conditions to be determined in each case, by or for an industry or group of industries or by such organizations or persons as may desire to avail themselves of the facilities offered for the purpose:

(6) Enter into agreement with governments, universities and colleges, scientific bodies and laboratories, and persons for researches to be undertaken with or without financial assistance from the Foundation:

(7) Publish or cause to be published from time to time such scientific and technical information as may be deemed advisable:

(9) Build, equip and staff laboratories and library for the efficient carrying out of its objects and powers:

8.(1) All or any discoveries, inventions and improvements in processes, apparatus or machines made by a member or a group of members of the technical staff of the Foundation, or others working under its auspices may be patented by the Foundation and all rights in such patent shall belong to the Foundation. All such inventions or patents may be made available to any person or persons or to the public under such conditions and payment of such fees or royalties, or otherwise, as the Board may determine, subject



to the approval of the Governor in Council.

(2) All income from fees or royalties obtained from such inventions or patents shall accrue to the Foundation and may be used or expended as part of the income of the Foundation.

(3) The Board may pay to its technical staff and to others working under its auspices who have made valuable discoveries, inventions or improvements in processes, apparatus or machines such bonuses or royalties as in its opinion may be warranted."

From its establishment in 1946 until 1969, the Nova Scotia Research Foundation operated no research laboratories of its own but made use of facilities in the universities in the province. During the summer of last year, the Foundation moved into new and extensive facilities at Dartmouth on a 10-acre site provided by the government of the province. The building itself was constructed under a grant of \$1.5 million made by the Atlantic Development Board. The Board also granted funds for the purchase of laboratory equipment valued at \$600 000. While some of the Foundation's research will still be conducted elsewhere, most will now be done in-house and expanded activities have become possible. An Engineering Physics Division has already been added. The new laboratory also has well-equipped instrument and glassblowing shops.

The scientific and technical activities of the Foundation are now concentrated in seven specialized divisions, three of which are predominantly scientific and three are technical. The *Library* at NSRF is the seventh division. All the divisions perform services for one another, for other scientific establishments in the Halifax-Dartmouth area, and for industry and government.

The recently established Engineering Physics Division is going to concentrate on R & D in electronic and mechanical engineering, and will increase the Foundation's capacity to take part in new

product development, particularly in the field of marine science and technology. For example, it will provide competence in the latest techniques of non-destructive testing of materials and structures including the use of ultrasonics, X-rays, microwave and medium frequency electromagnetic fields.

The kinds of projects performed and services provided by the five older scientific and technical divisions may be illustrated as follows:

*Geophysics:* Mineral investigations for government and industry (for example, salt, potash, industrial minerals, base metals);

Site investigations for civil engineering (including groundwater, seabottom and land foundation studies);

Surveys (gravity, magnetic E-M, hammer seismic, borehole logging, and continuous seismic profiling);

Data storage and processing;

Geology (including the preparation of surficial deposit maps for Nova Scotia, watershed area maps of the Atlantic Provinces and other special maps, and structural and other geological studies of particular areas of the province).

*Chemistry:* Chemical analyses for industry, and research into the methods of analysis;

Research on processes utilizing limestone, dolomite, anhydrite, and coal;

Study of agglomeration of fine particles;

Water analysis;

Evaporite and other mineral analyses;

Soil fertilization studies (including apple and pear leaf analysis, tomato tissue analysis, and a soil testing program);

Other foliar analyses involving vegetable crops and forest silviculture.

*Applied Biology:* (formerly the Seaweed Division) Underwater survey of seaweed beds in the Northumberland Strait;

Conservation work in Southwestern Nova Scotia;

Studies of seaweed harvesting equipment;

Taxonomic studies;

Ecological studies of Nova Scotian seaweeds;

Studies of Irish moss harvesting;

Preliminary checklist of marine algae of the Maritime Provinces;

Field and greenhouse tests with seaweed liquid extracts.

*Technical Services:* Technical information service to industry including information on processes, materials and equipment;

Industrial engineering assistance to improve corporate performance;

New product assistance;

Field service on corrosion analysis and non-destructive testing;

Aerial photo library.

*Operational Research:* Study of future marine railway requirements in the Atlantic area and economic effects of installing additional facilities;

Analysis of the Foundation's computer needs;

Data collection in preparation for fishing fleet simulation model;

Mixed inter linear programming and algorithm development;

Network analysis in water resources research;

Operational research studies for industry and government.

The Foundation has recently been concerned with newly discovered salt deposits in Cape Breton, located near the Canso Strait, and the new superport. These deposits could be valuable in new petrochemical developments in the area. It has also carried out hydrosonde surveys in the Bay of Fundy in connection with a federal-provincial feasibility study on the potential use of Fundy tides for generating electricity, and has participated in a project to measure the winter ice conditions in the Gulf of St. Lawrence by using an earth satellite. One of the Chemistry Division's most successful programs has been the application of foliar analysis as a method of predicting the fertilizer requirements for Nova Scotia fruits and vegetables. The Foundation has also participated in the "Operation Oil" clean-up of the oil spilled in Chedabucto Bay. But perhaps the Foundation's best known longer term work has been on seaweeds.

It pioneered in botanical and ecological research on industrial seaweeds in Canada and for 20 years has been one of the foremost research laboratories in the country. For Nova Scotia fishermen, seaweed harvesting is a million dollar industry, and is growing.

In the early days of the Foundation, and up until the new laboratory was built, many of the professional staff members were employed on a part-time basis. Only a few of them have continued their affiliation in this way. The full-time staff of the Foundation now numbers about 60, of whom roughly 25 are scientists and engineers, 25 are technicians and the remainder are support staff. The new laboratory building will permit the gradual provision of new and expanded research and other services, and the staff will be increased as the new demands are made.

During the fiscal year 1968-69, the operating income of the Foundation approached \$1 million, made up, in round figures, as follows:

Recoveries from research activities	\$468 000
Grant from Province of Nova Scotia	451 000
Investment Income	43 000
<b>Total</b>	<b>\$962 000</b>

Included in the first item above is the grant from the National Research Council for the support of the Foundation's technical information and industrial engineering services. These services are given free to client companies. For several years the Nova Scotia Research Foundation operated TIS-industrial engineering services for the Province of Newfoundland. As mentioned in Appendix I, these services have now been terminated.

The members and secretary of the Board of Governors of the Foundation, together with several outside experts, participate in the work of five committees (Selection; Review; Building; Research; and Potash). There is also an Executive Committee of the Board of Governors of which the President of the Foundation is Chairman.

In order to attract scientists to work on projects related to the Province of Nova

Scotia—and to draw the attention of others to the work being done—the Foundation has sponsored or co-sponsored a number of international conferences on subjects such as coal, seaweed and oceanography. The Foundation's view would be that these efforts have been successful.

## Appendix III

### New Brunswick

The New Brunswick Research and Productivity Council is the youngest of the six older provincial institutes. The Act which established the Council received assent on April 13, 1962.\* From a modest beginning in office accommodation in downtown Fredericton, the Council has grown considerably and now occupies extensive laboratory, workshop, library and office facilities adjacent to the campus of the University of New Brunswick. The grant for the initial laboratory building was provided by the province. The later and larger structure, which was opened in 1968, was financed by a grant from the Atlantic Development Board. The Board also assisted with the financing of new equipment.

The New Brunswick RPC Act includes the following provisions:

“3. The Council shall consist of not less than eight and not more than thirteen members chosen from the fields of industry and commerce, organized labour, government, and higher education, to be appointed by the Lieutenant-Governor in Council....

4. (1) One member of the Council shall serve as Executive Director and shall be appointed to hold office during pleasure.

(2) Each of the other members of the Council shall be appointed to hold office for a term of three years....

(3) One member other than the Executive Director shall be appointed to be Chairman of the Council....

10. The objects of the Council are to promote, stimulate and expedite continuing improvement in productive efficiency and expansion in the various sectors of the New Brunswick economy, and without limiting the generality of the foregoing, the Council shall,

(a) assist, encourage and where necessary conduct research, studies and in-

\*R.S.N.B. 1961-62, Ch. 46.

vestigations in the field of industrial and scientific technology, particularly those related to

(i) the conservation, development and utilization of the natural resources of the Province,

(ii) the development and utilization of the by-products of any processes involving the treatment or using of the mineral, timber or other resources of the Province, and

(iii) the improvement and development of industrial materials, products, and techniques; and

(b) cooperate with the National Productivity Council\* to foster and promote

(i) the development of improved production and distribution methods,

(ii) the development of improved management techniques,

(iii) the maintenance of good human relations in industry,

(iv) the use of training and retraining programs at all levels of industry,

(v) the extension of industrial research programs in plants and in industries as a means of achieving greater productivity, and

(vi) the dissemination of technical information; and

(c) cooperate and act in conjunction with other organizations and agencies, public and private, in the implementation of programs designed to give effect to any of the objects described in clauses (a) and (b).''

The record of activity for the RPC for the fiscal year 1968-69 includes the following items:†

a) there were almost 6 700 professional man-days of productive effort;

b) 160 jobs were undertaken, varying in size from a man-day to a man-year, of which 108 were initiated by clients and 52 in-house;

\*This Council was terminated late in 1963 and the Economic Council of Canada took over responsibility. This latter Council terminated its productivity promotion activities in 1967. The RPC, however, retains its mandate.

†The 1969-70 Annual Report not published at the time of writing.

c) 274 technical inquiries were answered;

d) 6 seminars were held, attended by 105 representatives from 22 companies;

e) in total, RPC dealt with 138 companies or firms in New Brunswick;

f) 156 confidential reports were issued to clients, and RPC published 9 technical publications of its own—including the monthly *Food Science Abstracts*—and applied for 3 patents;

g) 3 papers by RPC scientific and engineering staff were published;

h) a staff member was given unpaid leave to provide advice under the U.N. Development Program in electronic data processing in Bulgaria;

i) under RPC policy, activities were confined to mission-oriented research and technology.

At March 31, 1970, RPC staff totalled 59, of whom 26 were qualified scientists or engineers—10 with Ph.D.s—and the remaining 34 were technical and other support staff.\*

The recent departmental activities at RPC included the following:

*Chemistry and Food Science:* Chemical and microbiological analysis service and research work;

Food product development—particularly fish;

Industrial chemistry, on a small scale.

*Mineral and Material Sciences:* Identification and description of ores, rocks and mill products;

Particular problems of applied mineralogy;

Sulphide studies;

Studies of silver and other ores in New Brunswick;

Experimental studies on the synthetic system zinc-indium-sulphur;

Synthesis of semiconductor compounds;

Inorganic constituents of shale oil;

Application of the electron microprobe to bearing failure;

Updating of bibliography of New Brunswick geology.

*Fluid Power Engineering:* Operation of a comprehensive fluid power laboratory;

\*Private communication.

Design, manufacture and testing of hydraulic impact equipment and parallel theoretical studies.

*Electronic Engineering and Instrumentation:* Operation of an electrical standards laboratory;

Electrical calibration and product testing services for industry;

Control techniques feasibility studies.

*Engineering Services:* The design and manufacture of new experimental apparatus and the modification of existing equipment;

Free machine shop advisory service to industry;

Maintenance of a mechanical catalogue library, which is also at the service of industry;

Limited design and development work under contract;

Limited special parts manufacture.\*

*Industrial Services:* Technical information service provided free to clients, under contract with National Research Council and in association with NRC/TIS.

RPC also services Prince Edward Island under contract with NRC.

*Management Engineering:*† Industrial consulting service including marketing, corporate development, organization and labour relations, plus industrial engineering, operational research and feasibility studies;

Survey of machine tool capability and utilization in New Brunswick;

The promotion of product diversification and the possibilities for manufacturing under licence in the province.

The new RPC *Library*, with a stacked capacity of 30 000 volumes, is expected to provide sufficient space for five years growth at the present rate of acquisition.

The Annual Report of the RPC gives a full alphabetical list of the Council's clients during the year. Since the list includes more than a hundred names, the following 15 have been extracted as a sample:

Fraser Companies Ltd., Newcastle, N.B.  
General Foods Ltd., White Plains, N.Y.  
Geological Survey of Peru, Lima, Peru  
Geophysical Engineering and Surveys Ltd., Toronto, Ont.

Guyana Marketing Corporation,  
Georgetown, Guyana

H.S. Gill and Sons Ltd., Nashwaakias, N.B.

H.B. Industries Ltd., Sussex, N.B.

Hanna Mining Company, Cleveland,  
Ohio

Heath Steele Mines Ltd., Newcastle, N.B.

Home Enterprises Ltd., Moncton, N.B.

Horsrell's Machine & Iron Works,  
Fredericton, N.B.

Industrial Enterprises Inc., Charlotte-  
town, P.E.I.

Industrial Power and Communications,  
Hillsborough, N.B.

Irving Refining Ltd., Saint John, N.B.

Jenkins Bros. Ltd., Summerside, P.E.I.

The provincial government grant to RPC is at present fixed at \$600 000 per year. In fiscal 1969-70, RPC earned additional operating income from contracts, fees, etc., of just over \$276 700, for a total revenue of \$876 700.\*

Between the time the Council began its operations and the end of fiscal 1968-69, RPC had made capital expenditures of \$2.4 million, including a total of just over \$1.8 million donated by the Atlantic Development Board.

The aim of the RPC—as far as its internal operations are concerned—is to achieve a much larger proportion of its operating income from contract work, but the Council is too new to have made much headway in this regard. The present policy is to use the provincial grant principally for research which seems likely to lead to contract work for New Brunswick industry in due course. In an oral presentation to the Senate Special Committee on Science Policy, the Executive Director of RPC, Dr. Claude Bursill, said:†

\*The machine shop operated by this department is one of the best-equipped in the Atlantic Provinces.

†This department is financially self-supporting.

\*Private communication. Formal report not published at the time of writing.

†Proceedings No. 50. June 3, 1969. p. 6270.

“There is an overwhelming duty which we feel, of course, is to New Brunswick and to a lesser extent to Prince Edward Island, in so far as we are involved with (that Province). The result of this, of course, is that by far the greater proportion of all our work is for New Brunswick industry. There is very little industry in New Brunswick and we have to try to make some good guesses as to what kinds of industry might fit and what we can perhaps do to entice industry or get some of the local companies to provide for it. We sometimes engage ourselves in programs which are rather far in advance of what local companies can do or are likely to be interested in until they see some results.”

Later in the Proceedings before the Senate Committee, Dr. Bursill said:\*

“In New Brunswick we have only been going for four years so we have not undertaken what you would call really long-term projects. As we are set up, and even temperamentally, considering the sort of people we have now on our staff, we would tend to avoid long-term projects. They are not the kind of thing that interests us. We plan rather carefully before we start (an in-house) project in order to determine, as it seems to us, what the criteria of success are. We have learned that the criteria of success have a way of altering quite rapidly over quite short periods of time.

“I would say that we have more or less an unwritten policy in this matter. We try to restrict all our projects to those which in our terms will pay off (in) under four years.”

The RPC is a technological institution, not a scientific one. Its operations are geared to industry-type needs, to problem-solving and to managerial assistance. Although the Council still performs work for departments of the Government of New Brunswick, it does not function as

the research “arm” of that government. The Council has dropped the qualification “New Brunswick” from its everyday title.

\**Ibid.*, p. 6274.

## Appendix IV

### Quebec

For many years there has been interest on the part of successive provincial governments in the Research Council concept. Towards the end of the Lesage Administration, for example, legislation was introduced to create a government-supported industry-oriented research organization, but it was never passed. However, on December 12, 1969, assent was given to legislation\* creating a body to be called *Le Centre de recherche industrielle du Québec* (CRIQ). The Act came into force immediately.

The following are extracts from specific sections of the Act:

"2. The Centre shall be a corporation within the meaning of the Civil Code and shall give general powers of such a corporation, with such special powers as are assigned to it by (the) Act.

4. The Centre shall consist of a general manager and fourteen other members appointed by the Lieutenant-Governor in Council after consultation with the most representative bodies in the fields of science and industry. Except in the case of the first appointments, the members shall also be consulted.

6. The general manager shall be appointed for ten years and the other members for three years.

10. The president of the Centre shall be appointed from among its members by the Lieutenant-Governor in Council.

13. The general manager shall devote his time exclusively to the work of the Centre and the duties of his office.

17. The objects of the Centre shall be:

(a) research in applied science carried out either in its own laboratories or in those of other research centres;

(b) the perfecting of industrial or scientific products, processes and equipment;

(c) the gathering and diffusion of tech-

nological and industrial information and data.

19. The Centre shall not, without the authorization of the Lieutenant-Governor in Council:

(a) make an agreement with any governments or governmental body;

(b) enter into a contract with any person to participate in research;

(c) enter into any other contract with any person which binds it for more than two years;

(d) contract a loan which would raise to more than \$500 000 the total of the amounts borrowed by it and not yet repaid;

(e) dispose of patents which it has acquired or permit the same to be used;

(f) acquire shares of any corporation.

20. The Centre shall not acquire a majority interest in the shares of any other corporation, or carry on commercial undertakings.

23. The inventions, discoveries, improvements, processes and equipment made by a person within the scope of a contract or lease and hire of services which binds such person with the Centre shall be the property of the Centre, unless the contract otherwise provides.

24. With the approval of the Lieutenant-Governor in Council, the Centre may pay the members of its scientific staff or its technicians an additional remuneration established according to the results of their research.

25. The Minister of Finance shall pay to the Centre, out of the consolidated revenue fund, each year over a period of five years, a sum of four million dollars.

29. The Minister of Industry and Commerce shall have charge of the carrying out of this Act."

The CRIQ is in the process of being organized and details are not yet available.

The CRIQ should not be confused with another Quebec institution—*l'Institut national de la recherche scientifique* (INRS)—which is also new. It was created on December 16, 1969, by the Government of Quebec under Article 50 of the Act

\*Bill 71.

which established the University of Quebec. In his announcement, the then Minister of Education, the Honourable Jean-Guy Cardinal, said:

“L’INRS consacrera ses efforts à la recherche fondamentale, à la recherche appliquée et à l’enseignement supérieur, constituant ainsi, par une liaison constante avec les autorités gouvernementales et les autres organismes parapublics, l’un des instruments collectifs de développement du Québec. Dans ce cadres, l’Institut collaborera avec le gouvernement à l’aménagement, à l’administration et ou développement du complexe scientifique de Sainte-Foy.”

An examination of the proposed roles and functions of the INRS and the CRIQ leads to the conclusion that the latter will be more nearly equivalent in concept to the Research Councils and Foundations elsewhere in Canada. The indications are, however, that the Province of Quebec is moving quickly to support industry-oriented research and development activities and is prepared to allocate substantial resources to them through both the INRS and CRIQ. It seems likely that the CRIQ will also have both administrative and laboratory facilities at the new scientific complex to be located at Sainte-Foy, Quebec.

## Appendix V

### Ontario

The brief presented to the Senate Special Committee on Science Policy by the Ontario Research Foundation (ORF) began with the following paragraphs:\*

“The Ontario Research Foundation is a multi-disciplinary applied research institute which undertakes work, under contract, for industrial and governmental clients. It is not a department, agency nor commission of the Ontario Government, but is an independent corporate body operating in the public interest.

“The Foundation was established in 1928 by the joint efforts and equal financial contributions of Canadian industry and the Ontario Government. Since its establishment, the Foundation has grown steadily in physical size and industrial esteem, and now provides more direct assistance to Canadian industry than any other research institute in the country. Recently the Foundation played a leading role in the initiation and development of the Sheridan Park Research Community. Again, as in 1928, Canadian industry and the Ontario Government participated cooperatively and shared the cost of O.R.F.’s new buildings in Sheridan Park.”

The (Ontario) Research Foundation Act of 1944 and its subsequent amendments include the following sections:

“3. The objects of the Foundation shall be the carrying on of research, studies and investigations, particularly those having for their objects

(a) the conservation, development and utilization of the natural resources of the Province;

(b) the development and utilization of the by-products of any processes involving the treating or using of the mineral, timber or other resources of the Province;

(c) the development and improvement

\*Proceedings No. 50. June 3, 1969. p. 6305.



of methods in the agricultural industry and the betterment, welfare and progress of farm life;

(d) the mitigation and abolition of disease in animal or vegetable life and the control and destruction of insect or parasitic pests; and

(e) the improvement and development of industrial materials, products and techniques.

4. (1) The affairs of the Foundation shall be managed and its powers may be exercised by a Board of Governors consisting of not more than twenty-five members who shall be appointed by the Lieutenant-Governor in Council and the members of the Board shall be the members of the Foundation.

6. (1) There shall be an Executive Committee of the Board consisting of the chairman and vice-chairmen and two other members who shall be elected by the Board from among its members...at each annual meeting, etc. etc.

(2) The Board may delegate all or any of its power to the Executive Committee and may revoke or amend any such delegation.

12. The Foundation may carry on research investigations, studies and operations for other persons upon such terms and conditions as the Executive Committee may determine, subject to any direction of the Board.

13. The Foundation may purchase or otherwise acquire any invention or discovery or any right therein and may apply for, purchase or otherwise acquire any letters patent of invention or similar protection of the Dominion of Canada or elsewhere or any licence or other right, title or interest in or under any patent or similar protection and may hold, use, exercise, develop, licence, assign or otherwise dispose of or turn such invention, discovery, letters patent or protection to account."

As mentioned in its brief to the Senate Committee,\* ORF has been considering

possible modifications to Article 3 of the Foundation Act of 1944 to reflect more closely its current role. The suggested new wording might be as follows:

The objectives of the Ontario Research Foundation shall be to contribute to the development of the Province through the techniques of scientific research and development by:

(i) Providing a research and development staff and facility for the benefit of industry, commerce and government within the Province, and

(ii) Carrying on scientific research, development, and other scientific and technical studies, investigations and activities particularly those having for their objects,

(a) the development, utilization, or conservation of the resources of the Province,

(b) the improvement and development of industrial materials, products, processes and techniques for industry, commerce and government upon terms and conditions determined on a non-profit basis consistent with the necessity of maintaining the viability of the Foundation.

As a matter of policy, the ORF is obliged to give first call on services to industry in Ontario, but finds that in practice it is often difficult to classify client companies as being clearly "Ontario" or "non-Ontario". With the agreement of the government of the province, ORF therefore makes its services available to all Canadian companies on the same terms, but gives first priority to an Ontario company—whenever this is possible—when it comes to the exploitation of new opportunities resulting from research work performed initially with provincial support. Companies that clearly have no direct Canadian connections—and foreign government agencies—are not given the same privileges as Canadian companies. Contract work for them is undertaken under conditions which will have some benefits for Ontario and Canada.

In order to increase its usefulness to

\**Ibid.*, pp. 6312-6313.

industry, ORF has set up a special department—*Project Development*—to co-ordinate suggestions from the scientific staff with regard to work which might possibly be sponsored by industry under contract, and takes these suggestions, in the form of research proposals, to companies which it believes will be interested. The Foundation, therefore, does not rely exclusively on industry to initiate contract research proposals.

The role of the Foundation with regard to the Ontario Government is to assist such departments as require R & D assistance under an appropriate contract arrangement and, in the reverse direction, ORF will suggest R & D programs which, in its view, particular departments might consider performing themselves or contracting out. The Foundation's contacts with the federal government, however, are less frequent. For several years ORF received a sustaining research grant each year from the National Research Council—most recently, for \$25 000—but this has now been discontinued. Contract research has also been undertaken in the past, for federal departments, and has been fully paid for. The ORF participates with the NRC/TIS—and with the Ontario Department of Trade and Industry—in performing a free technical information and field service for Ontario. It is the view of ORF, however, that these latter services “must remain the direct responsibility of government and not of the Foundation”.\*

The ORF believes that in-house basic research is needed to provide background information for applied research for industry, to maintain the competence of the staff and to retain their services, and to attract new contract work. To increase its industry contract volume, the Foundation has to increase its basic research. The Foundation has also to acquire other skills and activities which it perceives, on looking ahead, show promise of becoming important in due course, and it has to do preliminary studies of new and potentially useful ideas to which its attention has

been drawn. The Ontario Government has provided ORF with an annual grant to help meet these particular kinds of needs. Since 1967 these “back-up” funds have been equal in amount to the income earned by the Foundation from Canadian industrial sources. This form of financing was suggested by ORF because it is directly related, on the one hand, to the cost of maintaining the Foundation as a contract research facility and, on the other, to ORF's contribution to the economy. It also provides a powerful incentive to ORF to seek industrial contract work.

The preamble to several recent Annual Reports of the Ontario Research Foundation has included the statement that, since its establishment over 40 years ago, the ORF has provided thousands of companies—from the very small to the very large—with research and development services which have ranged from short-term investigations and feasibility studies, through product and process development, to long-range fundamental scientific investigations. During each of the decades of the Foundation's existence, its income has roughly doubled. Its income in 1969 was \$3.75 million, about 18 times that of the early years. Contract income has grown at an even more rapid rate. In 1969, contract income was \$2.5 million, of which over 70 per cent came from industrial clients and the remainder from governments. Engineering has been the fastest growing area—about 40 per cent per year for 1968 and 1969—and this has led to the separation of the two areas in the original Engineering and Metallurgy Department.

The total staff of the Foundation at the present time is 270, of whom 95 are professional, 125 are technical staff and 48 are support staff. ORF staff serve on almost 50 outside organizations, ranging from the American Society for Testing Materials, through the Canadian Research Management Association, to the Ontario Economic Council and the Advisory Board to the Industrial Research Institute at the University of Waterloo. During 1969, ORF staff published 27 papers and

\**Ibid.*, p. 6322.

presented another 38 lectures and conference papers. Four patents were issued, and several more patent applications were made.

The scientific and technical work of the Foundation is organized into 10 departments—one of them, Engineering, new in 1969—which have until recently been reporting through the Director of Research. The Director, in turn, reported to the President, as the Secretary, Treasurer and the Heads of Project Development and Corporate Relations still do. Some details of recent ORF work are given in the following paragraphs.

The *Applied Microbiology* Department undertakes applied research largely in the field of waste water treatment and the related field of enzymes. Examples of current projects include the following:

A Central Mortgage and Housing Corporation (CMHC) project with two main objectives—to optimize a system which will render a high-density population free from water input pipes, sewage output pipes, and household refuse or garbage output, and to be achieved without producing air pollution; to collect sufficient engineering data so that economic extrapolation may be made for smaller, larger or less-dense population units;

The Ontario Department of Trade and Development has been supporting several areas of research. One was to devise a replacement for the septic tank which would treat domestic waste water and produce a non-eutrifying pathogen-free effluent—a project aimed at the cottage country. Another was to develop stabilized water-soluble derivatives of enzymes of potential value to industry;

During 1969 a project to determine the effect of chlorination of municipal wastes was completed;

The Applied Microbiology Department also performs service work for other departments and for industry.

The activities of the new *Engineering* Department during 1969 included work in electronics and instrumentation, mechanical development and testing, mathematical analysis, combustion development,

noise and vibration, and chemical engineering. For example:

Contract work for Gulf Oil Canada Limited on the development of a low excess air, high efficiency burner in a range of capacities to suit industrial applications\*;

Engineering work on water recycling and garbage disposal for CMHC;

Environmental testing of a stainless steel-concrete composite building panel for an industrial client;

For another industrial client, work on the aerodynamic design of two turbines. Also, the development of computer programs suitable for turbine design and gas turbine performance analysis with the client's computer system;

Work for Atomic Energy of Canada Limited, Power Projects, involving strain gauge tests for the moderator valves for the Pickering Reactor and development testing of resistance temperature detectors;

Development of controls on vulcanizing heat-pads for Vulcan Equipment Limited.

Service work in the Engineering Department increased by about 30 per cent in 1969 over the previous year. This work was primarily in areas of mechanical, vibration, pneumatic or hydraulic testing of components and plastic products.

The Department of *Materials Chemistry* specializes in:

Inorganic building materials—portland cement, gypsum and asbestos;

Organic building materials—protective and decorative coatings, adhesives, asphalt and plastics;

Glass and ceramics—container glass, semiconductor glasses for thick-film electronics, raw materials for use in the glass and ceramic industries, special glasses based on germania and the adsorption of polyphosphates by clay materials.

Recent work within this Department has included:

A project for Cassiar Asbestos concerned with the improvement of the quality and uniformity of asbestos fibres;

\*A new Gulf Oil Refinery in Nova Scotia, to be operating by 1970, will use 26 units developed by ORF for process heating applications.

Department of Highways of Ontario projects on the stripping of asphalt from aggregate in asphalt concrete and on the development of a technique for measuring water in concrete *in situ*;

An industry-supported project to develop special compositions for rigid and foamed plastics for anchoring bolts in concrete and for pipeline insulation;

A CMHC project on a novel method for manufacturing building bricks;

A study for the Glass Container Industry Research Corporation on the relationship between phase separation and the working properties of container glass;

Nine special projects supported by funds from the Ontario Department of Trade and Development.

The Department of *Metallurgy* is particularly concerned with contract research, but some effort is devoted to more basic studies to explore new ideas and train staff. During 1969, the pilot plant used by several groups of the department was moved from Rexdale to new and larger quarters close to the ORF Building at Sheridan Park. During 1969, also, an increased amount of industrial metallurgical service work was carried out, including mechanical testing and short-term investigations of considerable variety. The work of the department is now divided between two divisions: physical metallurgy and process metallurgy.

Recent industrial contract work in the Physical Metallurgy Division has included:

A limited study of the evating of prosthetic implants to develop a porous implant surface—for Wellesley Hospital;

A feasibility study on composite materials for the Steel Company of Canada;

For AECL, Commercial Products, studies of diffusion for specific metal combinations;

Dislocation studies, through metal physics research.

The Process Metallurgy Division includes the ore dressing and process metallurgy groups. During 1969, these groups were involved in research projects such as the following:

A pellet binder investigation for the

Ontario Department of Mines;

A product processing study of Lake St. Joseph magnetite ore for Steep Rock Iron Mines;

In conjunction with the Department of Materials Chemistry, an industry-sponsored project involving sand glass and clay recovery from a Northern Ontario deposit;

Work for Atlas Steels in the development of powder metallurgy products;

Work on the beneficiation of light metal materials for the Ethyl Corporation of Canada;

Preliminary work on nickel recovery for Stone and Webster;

Fly ash tests associated with a pilot plant under construction at Lakeview, for an industry sponsor;

Exploratory research on powder metallurgy, high temperature reactions, the atomization of liquid metals, and ultrasonic extrusion.

The Department of *Organic Chemistry* is particularly interested in tree and wood utilization including paper, organic synthesis in a few selected areas, and pesticide residue analysis. During 1969, two-thirds of the staff time was devoted to contract and service work and the remainder with back-up research studies. The following are examples of specific projects:

In conjunction with the company's scientists, a study for Fraser Companies Limited on the separation and identification of substances in kraft pulp bleach effluent which are toxic to fish;

A project for the Canadian Wood Council on the development of an economical, desirable, fire-retardant treatment for wood building materials;

A second study related to fire-retardant wood, supported by an extramural research grant from the federal Department of Fisheries and Forestry;

A study of the technical aspects of the Company's vanillin production from spent sulphite pulping liquor, for the Ontario Paper Company;

R & D work for Dominion Cellulose—for the 20th consecutive year—on paper

properties;

Wood science studies for the Ontario Departments of Lands and Forests and Trade and Development.

The pesticide laboratory within the Organic Chemistry Department is one of the few non-government establishments working in this exacting field. It has done work for OECD and for the Canadian Wildlife Service, for which the major project on pesticide residues in 1969 was undertaken. The laboratory also did analytical work for the Alberta Department of Lands and Forests, the Province of Ontario, and several private companies. In November 1969, work was started on a project for the Defence Research Board.

The major activities of the Department of *Physical Chemistry* are related to pollution, and air pollution in particular. During 1969, approximately 70 per cent of the industrial and government contract work was concerned directly or indirectly with this area. The following are some project details:

A program for the American Electroplaters' Society to study the application of reverse osmosis to the treatment of electroplating wastes;

For CIL, work on the development of a process for the recovery of sulphur from smelter effluents;

Two projects for the Ontario Department of Energy and Resources Management—one concerned with the development of an automatic analyser for monitoring levels of atmospheric sulphuric acid aerosols in the parts per billion range, and another to review new concepts for the abatement of air pollution—particularly sulphur dioxide emissions—from thermal power plants;

Studies for Dominion Foundries and Steel Limited on, for example, methods of improving the resistance of galvanized steel to white rust formation during storage in high humidity conditions;

With support from the Ontario Department of Trade and Development, a number of internal projects aimed at developing new skills and examining specific ideas with industrial potential—

for example, exploratory studies of a catalytic method for removing malodorous constituents in waste gases from kraft mills.

The Department of *Physics* continues to work mainly in the general area of solid-state physics. The more fundamental aspects, such as ion implantation and the growth of crystals of compound semiconductors, are supported by the Ontario Department of Trade and Development and application-oriented projects by contract from industry. Some examples of departmental projects are the following:

An investigation of thin-film temperature sensors for a Canadian manufacturer;

Work for AECL on the growth and evaluation of large single crystals of germanium for gamma-ray spectrometers;

A study of the possibilities of applying ion implantation to the measurement of the initial stages of mechanical wear or other surface disturbances such as erosion;

Fundamental studies on the deposition of thin films of tantalum by vacuum evaporation, and the development of methods for preparing thin films of amorphous tantalum which become superconducting at low temperatures.

The scope of services available from the Electron Microscope Laboratory of the Physics Department has been increased markedly in the past year by the availability of an electron probe microanalyser. With this instrument, for example, a non-destructive and virtually complete analysis of the chemical composition of the surface of a sample can be made. The instrument has been applied to a wide variety of tasks for external clients and other Foundation departments.

The work of the Department of *Physiography* has, for many years, been concerned with the description and interpretation of surface features in Southern Ontario. A revised map for this region and an extension northward to North Bay has recently been completed.

The work of the *Textile* Department during 1969 covered both industrially sponsored and more basic work designed to develop the department's ability to

serve industry. Some examples are as follows:

For the Ontario Department of Financial and Commercial Affairs, an investigation to determine if reliable methods could be developed for distinguishing between new and used materials used as padding in upholstered furniture, mattresses and other stuffed articles;

Work under contract to the federal Department of Supply and Services for the development of the Canada Standard sizing system for children's clothing;

A second contract with the Department of Supply and Services to investigate methods for the quantitative analysis of mixtures of textile fibres:

The General Textile Laboratory continues to provide services such as the evaluation of textile fibres, yarns and fabrics, performance testing, analyses, and colour fastness assessments. Some 96 companies—28 for the first time—made use of the laboratory during 1969. The applied research work of the Textile Department is supported by the Ontario Department of Trade and Development, and its broad objective is to modify the chemical and physical structures of textile fibres and to improve their performance.

Lastly, the main aim of the Department of *Field Services* is to help Ontario companies—most of them small secondary manufacturers—with the solution of innovation-type problems. The work was sponsored by the Ontario Department of Trade and Development and by the Technical Information Service of the National Research Council. Unlike the other five older Councils, the ORF's industrial engineering service is supported by the province and not by NRC. In addition, the Field Services Department regularly undertakes the technical evaluation of new ideas and gives assistance and advice on technical subjects under a program sponsored by the Ontario Development Corporation (ODC). And, on a contract or continuing basis, the department conducts some techno-economic studies for industry and government.

The department made a total of over

4 000 contacts during 1969, as follows, for an estimated 2 500 different organizations including nearly 100 companies in Northern Ontario:

New client contacts	681
Investigations in ORF laboratories	806
Minor inquiries, serviced mainly by telephone	1 945
(The above comprises 1 636 calls for information or advice and 309 referrals to other, mostly commercial, laboratories)	
Field engineering visits	1 084
Evaluations for ODC	98

The techno-economic and other studies performed by the department in 1969 included:

A study of the Canadian specialty steel industry for the Northwestern Ontario Development Council to determine if changing technology might favourably influence the economics of steel manufacture at Thunder Bay;

A study for the Ontario Department of Energy and Resources Management on the industrial energy situation in Northern Ontario and a forecast of energy demand up to 1980;

A series of overview market studies for Economic Consultants Limited of the manufacturing possibilities for a proposed complex of metal-fabricating industries.

## Appendix VI

### Manitoba

The Manitoba Research Council (MRC) was established by legislation in May of 1963\* largely as a result of the work done for the Commission on Manitoba's Economic Future (1962-75) and the Commission's subsequent recommendations. One of the studies for COMEF was specifically related to research and development activities in the province.

The objects of the Council, as stated in the Act as passed, are as follows:

"4.(1) (a) to promote and carry on or cause to be promoted or carried on research and scientific enquiries respecting agriculture, natural resources, industry or other segments of the economy of the province; and

(b) to help secure for Manitoba the benefits of research and scientific enquiries carried on elsewhere.

(2) Without limiting the generality of the foregoing, the Council may

(a) advise the Minister† respecting research and scientific activity concerning the economy of Manitoba; and the methods of achieving integration and co-ordination of research and scientific activity in the province and increasing co-operation in research efforts between public and private, provincial and extra-provincial agencies;

(b) propose or undertake with the object of improving the technical processes and procedures used in the industries of Manitoba and of discovering processes and methods which may promote the expansion of existing, or the development of new industries and fuller utilization of the waste products of industries;

(c) have charge of, and direction or supervision over, research which may be undertaken, under conditions to be determined in each case, by or for single industrial firms or by such organizations or persons as may desire to avail them-

selves of the facilities offered for the purpose;

(d) disseminate the results of research directly through its own activities and indirectly through cooperation with appropriate governmental and non-governmental organizations, and to further this purpose

(i) publish from time to time, such scientific and technical information as the Council may deem necessary, and

(ii) provide technical information services for the use of manufacturing and processing firms in Manitoba;

(e) apply for or acquire by purchase, assignment or otherwise, any invention or patent of invention for industrial, or other processes of any nature or kind whatsoever, or any rights therein, and to sell, grant, assign, or otherwise dispose of the same or any interest therein, and

(f) build, equip and staff laboratories and libraries for the efficient carrying out of its objects and powers."

The other sections of the Act which are of particular interest are the following:

"5.(1) The Council shall consist of not more than seven members appointed from time to time by the Lieutenant-Governor in Council, one of whom shall be appointed chairman and another vice-chairman for terms not exceeding three years.

6.(5) A member of the Council may be paid, and he may accept payment for, any reasonable travelling and other out-of-pocket expenses incurred by him, in discharging his duties; and a member may be paid, and he may accept, such honorarium as the Lieutenant-Governor in Council may determine.

7.(1) The Council may appoint such advisory committees whose members may be chosen from outside the members of the Council as it considers advisable, and it may fix the rules governing their procedures.

8.(1) Where a discovery or invention respecting, or an improvement in, any process, apparatus, or machine is made by a person employed by, or working under the direction of the Council, the full right

\*Bill 87.

†The Minister of Industry and Commerce.

of ownership and control thereof is vested in the Council; and the Council may apply for a patent in respect thereof under the *Patent Act* (Canada) and, if such a patent is granted, the full right of ownership and control thereof is vested in the Council.

8.(2) Subject to the approval of the Lieutenant-Governor in Council, the Council may grant or sell any such discovery, invention, improvement or patent, or grant a licence or permit for the use thereof, to any person or to all persons, under such conditions and on payment of such fees or royalties as the Council may fix, or without conditions, fees and royalties, or any of them as the Council may determine.

(3) The Council may pay to a person to whom subsection (1) applies, a bonus or a royalty of such amount as, in its absolute discretion, the Council deems reasonable.

9.(2) The Council may establish and charge fees and service charges, to be paid by a person, firm, corporation or association utilizing the services of the Council.

12. The Council may utilize the services of such officers and employees of the Department of Industry and Commerce as the Minister may designate, or of any other department or agency of the Government of Manitoba as the Lieutenant-Governor in Council may designate for the purpose; and in addition the Minister may provide the Council with professional, technical, or other assistance for temporary periods or for specific work.”

The first members of the Manitoba Research Council were appointed early in 1964, and the appointment of a part-time Director became effective on September 1 of that year. The initial plans called for the establishment of an Engineering Services Division to foster and promote technical information dissemination, technical training and industrial engineering services. The need for a small laboratory was not seriously considered at that time. The first major activity of the Council was the examination of existing research facilities and research needs in the province and

the co-ordination of its own efforts with those of other organizations. The Council planned to make use of existing research laboratories in Manitoba, and university laboratories in particular. In the technical information service and training fields, particular attention was to be paid to the needs of the numerous small- and medium-sized companies in the province. The Council has not actually received assistance from the Technical Information Service of the National Research Council because it was—and still is—part of the provincial Department of Industry and Commerce (and NRC has continued to maintain its TIS Winnipeg office).

By 1967 responsibility for the day-to-day activities of the MRC had passed from the Director to a senior member of the Industry and Commerce Department who also became the secretary of the Council. This arrangement has continued up to the present time. The present role and functions of the Council are as follows:

(i) To find licensors for products or processes suitable for Manitoba industry and to bring them to the attention of suitable licensees. (The MRC publishes a newsletter, *Technology for Industry*, to help fulfil this function.)

(ii) To disseminate technical information.

(iii) To continue liaison with the University of Manitoba with regard to their proposed Industrial Development Institute.\*

(iv) To promote the development of activities that will result in Manitoba becoming a centre of excellence in building systems, food products, electronics, and materials research.

(v) To promote research and development in Manitoba industry and to encourage the use of federal R & D assistance programs such as PAIT and IRAP.

The Manitoba Research Council is also proposing to introduce an Industrial Research Fellowship Program which—it is hoped—will result in new products and

\*This Institute is apparently similar in concept to those four others established in Ontario and Nova Scotia with assistance from the federal Department of Industry, Trade and Commerce. At the time of writing, no decision on its establishment has been made. (For details, see Appendix XII.)



technology in Manitoba. The first Fellowship of up to \$20 000 is to be awarded on March 1, 1971, on a competitive basis to a *team* from any of the provincial universities or community colleges on the recommendation of the Council. The object of the competition is to encourage and assist individuals in these Manitoba institutions to use their skills to help create industrial enterprises in the province on the basis of technical innovation and economic feasibility.

The Manitoba Department of Industry and Commerce appeared before the Senate Special Committee on Science Policy in June of 1969. In response to a question regarding the existence of the provincial Research Council the Minister at that time, the Hon. Sidney Spivak, said in part:\*

“While we do not have an actual physical (laboratory) facility we do have a research council, in fact, to guide and advise the government....We use (it) as a technical information centre to assist in licensing arrangements for our manufacturers, and I can say that since May of this last year we have had 29 firms dealing with specific licensing opportunities that we have been able to identify for them.”

Mr. Spivak went on to suggest that there were better ways to utilize federal R & D assistance programs than to invest in a public research facility. His view was apparently based on the premise that companies would be prepared to ask a laboratory of this kind to perform only R & D which was of little commercial value. The companies would perform the more valuable work in their own or other private facilities—out of reach of their competitors.

## Appendix VII

### Saskatchewan

The Saskatchewan Research Council (SRC) was established by an Act of the provincial legislature in 1947 because it had become apparent that the advance of science and technology would present the province with new and important challenges and opportunities. The duties of the Council were laid down as follows:

- a) to operate as a centre of knowledge concerning the technical aspects of provincial resources and industrial activities;
- b) to provide the government with information to be used in formulating development and conservation policies;
- c) to act, when required, in the capacity of a research and development branch of provincial government departments and crown corporations;
- d) to participate with other agencies in the search for new natural resources;
- e) to investigate methods for industrial utilization of natural resources; and
- f) to assist industry in technical matters.

Between 1947 and 1958, the Council had neither research staff nor laboratory facilities and carried out some of its objectives by providing support to the University of Saskatchewan for mission-oriented research projects. This method of operation had limitations, and in 1958, a research laboratory was built for the Council on the university campus at Saskatoon and a permanent staff was recruited.

The legislation which governs the operations of the Saskatchewan Research Council at the present time received assent on March 31, 1954, and came into force the following day.\* Several minor amendments have been made since then. The members of the Council now number 20, appointed by the Lieutenant-Governor in Council, and the present Chairman is the provincial Minister of Education who is also the Minister responsible. The Council is a corporate body and has its official

\*Proceedings No. 61. June 12, 1969. p. 7219. This quotation has been slightly edited.

\*R.S.S. 1954, c. 90.

headquarters in Regina. The members hold office for three years. The executive officers include the Director, Assistant Director, Administrative Officer and five Division Heads. The following are extracts from specific sections of the Act:

“7. The Council shall meet at such times and places as the Chairman may appoint, but not less than three times a year.

10. The Council shall take under consideration matters pertaining to research and investigation in the fields of the physical sciences, pure and applied, as they affect the economy of the Province of Saskatchewan, and such particular matters as may be brought to its attention by the Lieutenant-Governor in Council.

11. Subject to such regulations as the Lieutenant-Governor in Council may prescribe, the Council may:

(c) purchase such land, works, materials and equipment and maintain such facilities as it deems necessary for the conduct of its operations;

(d) enter into arrangements with the University of Saskatchewan, other universities, government departments and research agencies for the performance, on behalf of the Council, of research projects or the conduct of investigations and enquiries, as it deems advisable;

(e) carry on research, investigations and studies for other persons or bodies upon such terms and conditions, including remuneration for its services, as may be decided upon by the Council and approved by the Lieutenant-Governor in Council;

(f) purchase or otherwise acquire any invention or discovery or any right therein, and apply for, purchase or otherwise acquire any letters patent of invention or similar protection of Canada or any other jurisdiction, or any licence or other right, title or interest in or under any patent or similar protection, and hold, use, exercise, develop, license, assign or otherwise dispose of or turn such invention, discovery, letters patent or protection to account;

(g) publish as a result of its research, enquiries or investigations such documents, pamphlets, articles or monographs

as it deems advisable.

12.(1) All discoveries, inventions and improvements in processes, apparatus or machines made by a member or members of the technical staff of the Council and all rights with respect thereto are hereby vested in the Council.

(2) The Council may...pay to its technical officers and to others working under its auspices, who have made discoveries, inventions or improvements in processes, apparatus or machines, such bonuses or royalties as in its opinion are warranted.

13.(1) Where an application for a patent has been made or a patent has been obtained with respect to any discovery, invention or improvement resulting from work carried out under a grant for research provided by the Council, the Council shall be deemed to have an interest in the rights by such application or patent.

(2) For the purpose of continuing titular control and administration of such rights, the Council shall require the assignment thereof to it, and the Council, the inventor and the sponsor, if any, of facilities used by the inventor shall together determine their respective interests in the said rights and in the net proceeds, if any, of the exploitation thereof.

14.(2) Subject to the approval of the Lieutenant-Governor in Council, the Council may acquire real property necessary for its purpose and sell, lease or otherwise dispose of any real property acquired by it.

15.(1) There shall be a fund to be known as the Saskatchewan Research Council Fund to which shall be credited all moneys appropriated by the Legislature for the purposes of this Act, all moneys received by the Council by way of grant, bequest, donation or otherwise for the purposes of this Act and all moneys received as fees for services, proceeds of sales of property or patent rights and licence fees.

18. The Council may enter into agreements with any board, council, foundation or other agency established for the purpose of carrying out objects similar to those of the Council, and may...accept such financial assistance as may be available to it,

directly or through the Government of Saskatchewan, by such board, council, foundation or other agency.”

The Saskatchewan Research Council has five main operating divisions. Their recent activities and projects are described in what follows:

*Chemistry:* Development of processes for the utilization of potash;

Water studies—including the use of tritium as a means of estimating the magnitude of groundwater contributions to surface waters;

Alternate crops for the Prairies—for example, kochia—in co-operation with university departments;

Partial or major utilization of bark by simple chemical treatments;

Growth inhibitors;

The utilization of lignite and lignite products for the purification of industrial and domestic sewage;

Carbon-14 age measurements;

Routine analytical services performed from time to time for outside agencies and other divisions of SRC;

Trace analyses of contaminants in water and in waste effluents.

*Engineering:* Technical and economic feasibility studies, pilot plant investigations and basic engineering research;

Specialized technical assistance to industry, on request;

Equipment design, construction and maintenance services for the other divisions. Examples: Study of mass transfer fundamentals of solution mining to provide basic data for the development of a method applicable to Saskatchewan potash;

Study to improve the drying behaviour of Saskatchewan clays;

Development of pipeline transportation of materials such as coal and metallic ores in slurry form\*;

Developments of methods of separating components of a slurry at the pipeline exit;

Study of the hydrological balance of Big Quill Lake—as part of the Canadian

program for the International Hydrological Decade (IHD);

Small drainage basin studies;

Study of prairie sloughs and potholes—also an IHD program;

Idylwyld underpass storm drainage study (Saskatoon);

Desalination of water by natural freezing.

*Geology:* Groundwater geology studies—a continuing project between the SRC and ARDA;

Bridge site investigations at Nipawin and Leader;

Study of the physical environment of Saskatoon—joint project with NRC;

Groundwater information services;

Groundwater hydrology studies—joint project with ARDA—including problems of groundwater pollution. (A total of 26 observation wells have been constructed in selected hydrogeologic environments. The SRC also has a fully automatic hydrogeological observatory at Duck Lake, Saskatchewan);

Precambrian geology and geochemistry—including the Hanson Lake project and research into special aspects of base metal ore deposits;

Stratigraphic studies of cretaceous rocks.

*Physics:* Research projects have received some financial support by grant or contract from ARDA, the Meteorological Branch of the Department of Transport, the Canada Department of Agriculture, the National Research Council, and a mining company. In addition, arrangements have been made with the university whereby several SRC physicists have become associated with departments in order to participate in joint work or have undertaken consulting work for outside agencies;

The meteorological research can be divided into two fields of study: in atmospheric physics, projects are under way on precipitation development and on pesticide spray droplet studies. The climatology work may be classified under two project headings—agrometeorology and topoclimatology;

Geophysics research may be divided into three sections—groundwater geophysics

\*The SRC operates a slurry pipeline laboratory off-campus in Saskatoon.

work, geophysical investigations associated with the thickness of salt formation above the workings of the International Minerals and Chemical Company potash mine at Esterhazy, and gravity investigations involving the study of the gravity field of certain areas and how it relates to the various rocks which lie under those areas;

The general physics work includes natural potential studies aimed at the improvement of techniques for locating ore bodies under lake areas in Northern Saskatchewan, and the development of a manometer to facilitate water-level recording where it is not feasible to use a float-controlled recorder directly.

The Government of the Province of Saskatchewan offers graduate research scholarships tenable at either campus of the university. The Saskatchewan Research Council administers these. The Council also administers a program of grants-in-aid for university research. In 1969, these grants were awarded as follows:\*

Department of Animal Science—Research on New Protein and Fat Sources for Use in Milk Replacers for Calves;

Department of Chemistry and Chemical Engineering—Research in Fluid-Solids Systems;

Department of Civil Engineering—Aerated Lagoon Investigations;

Department of Crop Science—The Effect of Potassium and Sodium Chloride Dusts on the Growth of Crop Plants;

Department of Geophysical Sciences—Rheological Properties of Prairie Evaporites; Petrology and Structure of Anhydrite Beds in Prairie Evaporites and their Relationship to the Winnipegosis Formation, Saskatchewan; Sedimentary Strata of the Prairies; Stratigraphic Studies in Cretaceous Rocks; Pre-Cretaceous Microfossil Sequences and Biostratigraphy of Saskatchewan; Studies of Natural Sulphides; Structural Geology of Saskatchewan; and Palynological Studies;

Department of Horticulture—Irrigation Studies with Vegetable Crops;

Division of Natural Sciences (Regina)—Production of Pure Inorganic Salts;

College of Pharmacy—Culture of Medicinal Plants; and Extractives of Saskatchewan Plants;

Department of Soil Science—Evaluation of Soil Contamination in the Vicinity of Potash Refineries; and the Use of C-14 in the Dating and Characterization of Soil Organic Matter.

The disbursements and administrative expenses for the above projects for the year ending March 31, 1969, were approximately \$66 000. The electronics and precision instrument laboratories have provided all divisions of the SRC with facilities for the designing, building and testing of electronic, electromechanical and precision mechanical devices.

*Industrial Services:* The Technical Information Service personnel visited 255 plants during 1969, answered 291 technical inquiries and 868 general questions;

TIS also published *Catalyst*—formerly *The Suggestion Box*—monthly with a circulation of 4 000. Selected topics in particular issues were: February, The Council Program; July, Helping Inventors; September, Think About the Future;

The Industrial Engineering Service covers managerial functions, office administration and production operations. Its bulletin, *Why?*, became *Industrial Engineering Management Science* and has a monthly circulation of over 2 000. Selected topics in 1969 were: April, Engineering Design for Marketing Effectiveness; and December, Management Techniques: The Myths, The Advantages. Under the heading of Information Retrieval and Dissemination, the “Index to the Saskatchewan Research Council Reports and Council Supported Research” has been completed and distributed. The SRC has participated in three programs—the TIS (Ottawa) K.W.I.C. Index, the Canada Selective Dissemination of Information (SDI) program of the National Science Library, and the Alberta Information Retrieval Association SDI program;

The Industrial Services Division operates the SRC Library;

\*Saskatoon campus unless otherwise specified.

Saskatchewan has the nucleus of an integrated information system and SRC efforts are continuing to expand this nucleus.

The statement of operating income for SRC for the year ending March 31, 1970, includes the following information:\*

Administration	\$291 168†
Chemistry	168 054
Engineering	309 926
Geology	353 086
Physics	207 243
Industrial Services	127 476
<b>Total</b>	<b>\$1 456 953</b>

†Includes \$66 000, for the university program described on the previous page.

The main source of SRC income—about two-thirds—is the grant received from the Government of Saskatchewan. The remainder is covered by contracts for research from industry, contracts and grants from government departments, and federal-provincial shared-cost programs such as ARDA and, indirectly, PAIT.

The staff of the SRC at the present time numbers 85, about half of whom are scientists and engineers. Approximately 25 summer students are employed each year. Both Council and senior staff members participate in the work of the Technical, Appointments and Forward Planning Committees of SRC. Staff members are also active in many outside scientific and technical committees.

## Appendix VIII

### Alberta

The Research Council of Alberta (RCA) is the oldest of the provincial institutes in Canada. In concept, it dates back to 1919. But there were no organized activities until 1921 when a recommendation by a university-provincial government committee, appointed to study the economic potential of the natural resources of the province, was implemented.

During the 1920s and 1930s, the Council operated within the University of Alberta at Edmonton and its staff were usually also employed by the university. Some full-time staff were hired between 1943 and 1947, but they held equivalent university positions. In 1952 the RCA staff became essentially independent of the university and another major build-up started. By the time the Council had moved to its new building in 1955, it had a full-time staff of 65 and was operationally independent in most respects. Although two research divisions of the Council—Highways and Soils—are still physically located within the Departments of Civil Engineering and Soil Science at the university, the Council's research, service and administrative activities are now concentrated in the laboratory on campus and at the pilot plant facility which was opened in 1966 at Clover Bar on the outskirts of the city. This latter facility is the location of the Council's Product Research and Development Division.

The RCA was formally established as an Alberta Corporation under the Research Council Act of 1930. In its amended form, this Act includes the following provisions:\*

“3.(1) The Research Council shall consist of not more than ten members designated from time to time by the Lieutenant-Governor in Council and shall include:

(a) not less than two members of the Executive Council (Cabinet) of Alberta,

\*Private communication. Formal report not published at the time of writing.

\*R.S.A. 1955, Ch. 287.

(b) the President of the University of Alberta, and

(c) the Director of Research.

3.(2) Members of the Research Council, other than those mentioned in subsection (1), hold office for a period of two years, or until their successors are appointed.\*

4.(1) A chairman of the Research Council shall be appointed by the Lieutenant-Governor in Council from among the members of the Research Council who are members of the Executive Council.†

8. The Research Council:

(a) shall have charge of such matters affecting scientific and industrial research in Alberta as may be assigned to the Research Council by the Lieutenant-Governor in Council, and

(b) shall advise the Executive Council of Alberta on questions of scientific and technological methods affecting the expansion of industries, or the utilization of the natural resources of Alberta.

11. Without limiting the general powers of the Research Council conferred or vested in (it) by this Act, the Research Council may

(c) promote in such a way as is deemed advisable

(i) the utilization of the natural resources of Alberta,

(ii) researches with the object of investigating or improving the technical processes and methods that are or might be used in the industries of the Province,

(iii) researches with a view to utilizing the waste products of the industries of the Province,

(iv) the investigation, at the request of any of the industries of Alberta, of the materials that are or might be used in, or of the products of, the industries making such a request, and,

(v) researches, the objects of which are the betterment, welfare and progress of the urban or rural life in the Province,

(d) have charge and direction of or supervision over the researches that may

be undertaken, under conditions to be determined in each case,

(i) by or for single industrial firms, or

(ii) by such organizations or persons as desire to avail themselves of the facilities offered for this purpose,

(h) apply for or acquire by purchase, assignment or otherwise an invention or patent of invention for industrial or other processes of any nature or kind whatsoever, or a right therein, and sell, grant, assign or otherwise dispose of the same or an interest therein, and

(i) publish from time to time such scientific and technical information as the Research Council deems necessary.

12.(1) The Director of Research...may, for the purpose of obtaining information and statistics as to the trades, businesses and industries of the Province, require any or all persons engaged in such a trade, business or industry to furnish such information with regard to that trade, business or industry and any agricultural, industrial or commercial activities as the Director...considers proper.

14.(1) All discoveries, inventions and improvements made in processes, apparatus or machines by a member or a number of members of the technical staff of the Research Council

(a) shall at the discretion of the Research Council be vested in the Research Council, and

(b) shall, subject to the approval of the Lieutenant-Governor in Council, be made available to the public under such conditions and payment of fees or royalties or otherwise as the Research Council may determine.

(2) The Research Council may...pay to its technical officers, and to others working under its auspices, who have made valuable discoveries, inventions or improvements in processes, apparatus and machines such bonuses or royalties as in the opinion of the Research Council are warranted."

The Annual Report of the RCA for 1969 sums up the mission of the Council in the following way:

\*Alternate members may also be appointed, raising the membership above ten.

†Currently the Minister of Mines and Minerals.

"The Research Council of Alberta seeks to encourage the development of the Province by conducting research on problems of particular concern to Alberta, and by providing technical information and assistance on request. The Research Council of Alberta is primarily concerned with the physical resources and industries of the Province, and its activities are therefore complementary to those of the Human Resources Research Council. However, there is much common ground since the interactions between technological and social problems are becoming more numerous and evident....

"The programs of the Research Council may be considered as falling into three main categories: studies of the natural resources of Alberta; technical assistance to the manufacturing industries of the Province; and research on other problems of concern to Alberta that may not fall within these specific areas. A continuing effort is made to keep a suitable balance between short-term applied projects that have an immediate impact on the provincial economy, and longer-term, more speculative research. The latter type of research is equally important in that it enables Council to keep in touch with the relevant frontiers of scientific activity and lay the groundwork for new developments in the future."

*The Fuels Branch* of the RCA is primarily concerned with Alberta's fossil fuel resources of coal, petroleum and natural gas. It is interested in the efficient use of these fuels and with the development of secondary manufacturing industries based on them. In addition to work of a general nature, the branch is also able to carry out privately sponsored work on the development of new products and processes. The branch has a number of operational divisions whose present programs are as follows:

*Petroleum and Natural Gas:* Exploration geochemistry, including studies of the formation and occurrence of oil, gas and associated water in sediments. The current emphasis is on the geochemistry of forma-

tion waters\*;

Transportation, particularly work on the capsule pipeline method for transporting solids;

Processing studies designed to provide basic information for improving the utilization of Alberta's hydrocarbon resources (for example, catalytic reactions, gas separation processes).

*Coal:* Coal geology, including exploratory drilling to establish strip-mineable coal in the Fox Creek and Athabasca regions, and in view of the rapid expansion of coal mining in the Foothills, a survey of the probable environmental effects of mining and coal combustion in Western Canada;

Transportation, involving field trials of the capsule and paste slug methods in pipelines;

Organic chemistry, including systematic greenhouse and laboratory studies related to coal-based fertilizers, studies of the deterioration of coking coal by weathering, and attempts to produce industrially useful chemicals by the controlled oxidative degradation of coal;

Coal pyrolysis mechanisms, and carbon research with particular reference to pollution control and DDT residues;

High temperature chemistry, using plasma generating and high intensity arc facilities to investigate the formation of industrially important elemental boron from boron halides and the direct reduction of complex iron ores;

Analytical services, including routine analyses, studies and assistance required by other sections, and collaboration with industry in meeting requests for information about the locations and qualities of coal in Western Canada.

*Gasoline and Oil Testing:* This laboratory provides testing and inspection services for petroleum products and related materials to government departments and, in special cases, to companies

\*This latter work has been extended to surface water measurements and a comprehensive sampling of the waters in the Mackenzie River basin has been carried out in co-operation with the University of Calgary and the Inland Waters Branch of the federal Department of Energy, Mines and Resources.

and individuals. It has also handled a number of fire investigations.

*Mathematics and Computing:* The RCA has its own PDP-9 computer as well as a terminal to the University of Alberta's IBM 360-67. Computing staff assist with computer programming. Work is also being done on the application of a small computer to specific experimental programs, such as the one on capsule pipelines.

*Special Projects and Microbiology:* Research on organic sulphur-containing compounds;

Studies of nitrogen-containing feed supplements for cattle;

Survey of microorganisms that can metabolize Athabasca bitumen;

Investigations of medical significance related to biosynthesis of fatty acids and metabolism of amino acids.

*Product Research and Development:* The laboratories and pilot plant of this division are at Clover Bar. This facility was designed to accommodate fairly large development projects, particularly in the chemical and process industries field. The Clover Bar facility is located close to several industrial research laboratories and to refineries and chemical plants with which RCA has frequent contact. Its off-campus location is attractive to some industry sponsors, but is sometimes a handicap because of its distance from the campus laboratories. The principal concern of the division is applied research, development, and engineering related to products and processes—which it may perform for other RCA divisions. It operates on a non-profit basis and provides the following services to industrial clients:

It will undertake projects under cost plus overhead contracts and will provide the client with equipped and suitably staffed laboratories and (or) pilot plants;

It will make laboratory and pilot plant equipment available to industry at a nominal charge;

It will lease pilot plant space to clients who will provide their own staff and equipment;

It will combine the above three services at a client's request;

It will make division staff available to work on projects located in the client's premises.

The staff of the Product R & D Division are also heavily engaged in applied problems especially related to the Athabasca tar sands and gas processing.\* Work is also being done on a number of other chemical problems.

*The Earth Sciences Branch* of the Council is concerned with the rocks and soils of the province and their contained groundwater resources. A major portion of the branch program is the evaluation of Alberta's physical resources and studies directed to the improvement and utilization of the resource materials. A fair proportion of the projects undertaken by this branch—and by the Highways Research Division—are carried out by government departments in some of the other provinces.

The Earth Sciences Branch has three divisions, whose particular interests have recently been as follows:

*Geology:* Industrial minerals, including projects concerned with the ceramic potential of certain clay deposits in the Fort McMurray area, with the distribution of quartzite in alluvial gravels of Alberta rivers, with salt deposits, sulphur, silica sand uses and specifications, and with the suitability of certain sand for industrial uses;

Sedimentary petrology and stratigraphy work involving an extensive helicopter-supported mapping program and geological survey—a joint program of research with the Alberta Department of Agriculture and the Geological Survey of Canada—in the Oyen area of the province, and micropaleontological and microfloral studies in Northern Alberta;

Surficial geology, including mapping and map compilation in the Edmonton and Medicine Hat regions and field and helicopter-supported mapping elsewhere;

Precambrian geology involving a heli-

\*Over the years, various divisions of the Research Council of Alberta have made major contributions to the work leading to the commercial exploitation of the Athabasca tar sands.



copter-supported mapping program in Northeastern Alberta.

*Groundwater:* Groundwater engineering work to expand the basic groundwater information filing system, the maintaining of an observation well network of 80 wells, the continuing of the production of the Alberta Hydrogeological Information Map Series, the mapping of bedrock topography in several areas of the province, and assisting and advising municipalities, industries and others on hydrogeological matters;

Hydrogeological survey programs throughout the province which will be of value in local and areal water supply studies, in regional planning, in forestry and agricultural problems, and in engineering and geological investigations;

Hydrogeological research studies which are part of the Alberta Watershed Research Program, and studies such as those associated with generic relationships between various morphologic and geologic phenomena.

*Soils:* This division forms part of the Alberta Institute of Pedology, a co-operative body established in 1968 by agreement between the University of Alberta, the Canada Department of Agriculture, and the RCA to provide information relative to the soil resources. The work includes soil surveys and analyses, research related to the classification, composition and genesis of soils in Alberta, the interpretation of soil information, the compilation of the information gathered, and the provision of co-operation and assistance to other interested institutions.

*The Highways Research Division* carries out a co-operative research program with the support of the provincial Departments of Highways and Agriculture and the Department of Civil Engineering at the University of Alberta, as follows:

Highway engineering, including observations of in-service behaviour of various pavement types in the provincial highway system, studies of surface roughness, the development of non-destructive, testing procedures to measure *in situ* strength properties of layered pavement systems,

and low temperature studies of asphalts and asphaltic mixtures;

River engineering and surface water hydrology including detailed hydrographic surveys of river bed profiles and scour development adjacent to bridges, field work involving topographic surveys and hydraulic measurements at 110 hydro-metric gauging stations, evaluation of sediment sampling methods and the measurement of bed load and suspended sediment, the laboratory measurement of boundary shear stresses in open channel flow, and the measurement of river ice forces on bridge piers.

*The Alberta Hail Studies Project* is a large co-operative investigation into all aspects of Alberta hail storms, the objectives of which are to determine the causes and behaviour of hail storms, and through cloud-seeding experiments, to develop effective methods for alleviating hail damage. Each summer the RCA operates a field observation program at Canadian Forces Base, Penhold. The Council is also responsible for the design, operation and evaluation of the cloud-seeding experiments. Field observations are being used to develop a theory of hail storm dynamics and hailstone growth. The observations are analysed by the Stormy Weather Group of McGill University under contract to the Meteorological Service of Canada which also provides forecasting, personnel and instrumentation for the project. Use is also made of a weather radar system developed by the National Research Council.

The Research Council of Alberta is engaged in a *Biological Cycles Research Program* in co-operation with the Department of Wildlife Ecology of the University of Wisconsin, but the Council's main role is catalytic rather than research-performing. Several other public and private agencies in Canada and the United States also provide support. The overall program is directed towards a broad understanding of the ecosystem, and particularly that in the vicinity of the field research station at Rochester, Alberta, which has both artificial and natural components.

The initial studies have been directed towards the problem of cyclic fluctuations in forest wildlife populations.

*The Industrial and Engineering Services* offered by the Research Council of Alberta are directed to the manufacturing industries of the province to help solve problems through the provision of technical information, industrial engineering and management-oriented services, some mechanical and metallurgical investigations and air pollution studies. In more detail, these are as follows:

*Technical Information Services:* These are provided in association with the National Research Council. Of approximately 1000 inquiries per year, some 900 are handled by RCA staff and the balance referred to NRC. Some laboratory testing and investigation may also be undertaken, and facilities are being developed for increasing problem-solving effectiveness in chemical, metallurgical and mechanical areas.

*Industrial Engineering Program:* This program complements TIS and is also provided in association with NRC. It is mainly oriented towards the solution of operating problems, but is being extended by RCA towards the solution of economic and management problems brought about by the complexity and sophistication of today's business environment.

*Mechanical Engineering Programs:* Investigations are being undertaken by a mechanical engineering group which require special instrumentation and knowledge not otherwise readily available. One such study involved strain measurements in composite pipes, including the design and instrumentation of cyclic testing facilities. In another, help was given to a geophysical company in the development of a new patentable exploration technique and supporting instrumentation.

*Information Retrieval:* This is a very rapidly expanding activity. In co-operation with the National Research Council, and working jointly with the University of Alberta and the University of Calgary, the Research Council of Alberta is now able to offer computerized searches for

any relevant literature in Chemical Titles, Chemical Abstracts Condensates, Engineering Index (COMPENDEX), Institute for Scientific Information (ISI) Source Tapes, and Technical Briefs (prepared by the Technological Developments Section of NRC). In one recent six-month period, about 500 questions were submitted by subscribers.

*Some Other Activities:* Technical assistance is offered to provincial departments. The Industrial Development Branch of the Department of Industry and Tourism, for example, refers technical aspects of the industrial development inquiries it receives to the RCA;

Assistance is offered to companies wishing to apply for R & D assistance under federal cost-shared programs (PAIT and IRAP);

Staff members have served, or are serving, on professional, educational and government committees.

The Research Council of Alberta has been active in two other joint research programs which have not yet been mentioned. The first is the Petroleum Recovery Research Institute (PRRI) which conducts research related to the enhanced recovery of oil and gas from underground reservoirs. This Institute is financed by the Government of Alberta and by a group of 37 petroleum and natural gas companies. It has its own full-time staff and equipment and occupies space in the Engineering Building at the University of Calgary. The RCA provides technical assistance and purchasing, personnel and accounting services. The second is the Solids Pipeline Research and Development Association (SPRDA) which is made up of 22 companies with interests in the fields of rail and pipeline transportation, commodity movement, and pipe manufacture. The Association was formed to conduct R & D work on the pipeline transportation of solids, with particular emphasis on the capsule pipeline. All of the work has been carried out by the Research Council and by private consultants under contract to the Association. Financial support has been given by the member companies, through the

federal PAIT program, and from the Alberta government.

Another way of examining the activities of the various divisions of the Research Council of Alberta is to classify them functionally rather than on the basis of specific disciplines or problems. Such a classification would include four categories of activities: Resource Inventory; Resource Utilization; Assistance to Manufacturing Industry, in particular; and All Other Activities.

*The Resource Inventory* category would cover exploration, mapping, and evaluation of natural resources, together with the development of techniques and basic concepts which could be used by private industry in their own exploration programs. The majority of the work of the Earth Sciences Branch would fall into this category: sedimentary geology and stratigraphy; Precambrian geology; surficial geology; industrial minerals geology; bedrock topography mapping; the hydrogeological survey program; hydrogeological research; and soil surveys, classification and analysis. In the Fuels Branch there are the coal geology and strip coal exploration programs of the Coal Division, and the petroleum geochemistry program in Petroleum and Natural Gas.

*The Resource Utilization* category would cover production, transportation and processing of natural resources, but would exclude their conversion into other products. Some of the programs falling into this category would be oil sands extraction methods, pipeline transport of heavy oils, coal-in-oil slurries, and solid commodities in capsule form, gas processing and sulphur recovery, helium recovery, petroleum processing, enhanced recovery of oil and gas, the development of water supplies and related service work, industrial minerals beneficiation, and the environmental effects of mining. The divisions and branches involved would include Product Research and Development, Petroleum and Natural Gas, Coal, Groundwater, Geology and the PRRI.

*Assistance to Manufacturing Industry* would include all research and service

work which is performed for the benefit of existing industry, and also research work which is undertaken in the hope of attracting new types of industry in the future. Much, but by no means all, of this latter work would be based on conversion of Alberta natural resources to other products. This category would also cover most of the activities of the Industrial and Engineering Services and Product Research and Development Divisions. There is also a considerable amount of such work in the Fuels Branch—for example, the programs of the Coal Division in activated carbons, carbon products, coal chemicals, and high temperature processes for production of metals and chemical products; the work in the Special Projects Section and Petroleum and Natural Gas Division on agricultural chemicals, synthetic feed supplements, fertilizers, and other chemical products; and the microbiological conversion of Athabasca bitumen and other raw materials to edible products. The interests of numerous divisions in air and water pollution would also fall into this category to varying degrees.

The final category would include such things as our Hail project, the Highway and River Engineering programs, the Biological Cycles program, and possibly also the Gasoline and Oil Testing Laboratory. These programs are mainly in the nature of public services which are not specifically related either to resource development or to industrial activity, although this again is rather arbitrary. The hail studies project, for instance, is directed toward improving the economics of the agricultural industry, and several of the others have indirect inputs to various industries.

The Research Council of Alberta has an Advisory Committee Structure which includes Council and staff members and qualified representatives from industry, universities and government. The list includes a Technical Advisory Committee—which deals with research fields on a broad basis—and Advisory Committees on Coal, Petroleum and Natural Gas, Geology, Groundwater Geology, Hail Studies,

Highway Research, and Industrial and Engineering Services.

The full-time staff of the RCA numbers over 200, of whom about 100 are scientists or engineers, 80 are technicians and the remainder are technical or clerical support staff. The Council employs some 75 university students each summer for field parties and other temporary work.

During 1969 the Council published or had in press four soil survey reports, two geology bulletins, three geology reports, one report on hail studies and a map report. Members of the Council's staff had 30 contributed papers published by scientific and technical journals during the year and others were in press. In the period 1965-69, 13 patents were issued to RCA staff for work carried out at the Council.

The largest single source of financial support for RCA activities is the Alberta Government, which provides an annual grant and substantial contract funds. Revenue is also obtained from contract research for industry—and amounts to about 15 per cent of total revenues—from federal departments, and from cost-shared projects under the federal-provincial ARDA agreement. The total revenues during 1969-70 were in the region of \$3.34 million.\*

## Appendix IX

### British Columbia

British Columbia Research is the technical operation of the non-profit, independent society, the British Columbia Research Council. In this province the distinction between the Council and the laboratory facilities and their operation is recognized in a formal way. B.C. Research is one of the most industry contract-oriented of the six older provincial institutions.

The British Columbia Research Council was set up in May 1944 under the Societies Act of that province. The Declaration made in accordance with this Act stated that the objects of the Society (the Council) were:

- “(a) The coordination of the work of existing and prospective research units.
- (b) The initiation of new industrial and scientific research work into any field of particular interest to the Province of British Columbia.
- (c) The acquisition and operation of laboratories and other necessary buildings and facilities.
- (d) The application of the results of research to the establishment of new industries, trade extension programs and the coordination of the work of laboratories and field units with industrial and market extension of the Province.
- (e) The providing of fellowships, scholarships, bursaries and rewards and pecuniary and other aids facilitating or encouraging original scientific and industrial research.
- (f) To provide for the publication of the results of research work.
- (g) To enter into arrangements with any person or organization for carrying out research work and for payment of same either by the person or organization or by the Council.
- (h) To enter into such arrangements as are necessary with any person or organization with regard to patents arising out of work done by or for the Council.
- (i) For the purpose of more advantage-

\*Private communication. The Annual Reports of the RCA do not include financial information.

ously or conveniently carrying out the above objects, to invest the funds of the society in companies having as one of their objects the pursuit of industrial and scientific research and development.\*

(j) On dissolution, to pay and transfer to Her Majesty the Queen in the Right of the Province of British Columbia and for only a public purpose the assets remaining after payment of debts and liabilities.”†

In practice, the Board of Management acts for the Council. The constitution and by-laws of the Council require that the Board consist of not more than 21 members, that the Chairman be the Minister of Industrial Development, Trade and Commerce of the province, and that the members be drawn from the federal and provincial governments, from the universities, from organized labour, and from industry in the province. Members of the Board hold office for three years, with the possibility of a second term. The Board is empowered to appoint an Executive Committee to act in day-to-day matters. It also appoints the Director of B.C. Research. He is the chief executive officer of B.C. Research which “conducts research, development and other technical work under contract to sponsors in both industry and government and offers services in the fields of applied biology, applied chemistry, applied physics, engineering, economics, market research, operations research, industrial engineering and technical information”.‡

The B.C. Scientific and Industrial Research Council, as the institution was first called, evolved from the War Metals Board whose operations were in the hands of government and university people. The new Council added industrialists, and became industry-oriented. Its early programs were limited to applied research. In 1951 Professor G.M. Shrum became Director—while retaining his affiliation with the University of British Columbia—and the program of research became

much more extensive. Until 1956, the major part of the Council’s operating income came in the form of a grant from the provincial government. The present Director took office in 1961 and the Council’s activities in industrial research began a period of substantial growth. In three years the “earned” portion of the operating income doubled, and this kind of growth trend has continued. In the year ending on December 31, 1969, B.C. Research received almost exactly \$1 million—75 per cent—of its income from sponsored projects.

Of the six older provincial institutions, B.C. Research is perhaps the one which least resembles a government research “arm”. Its annual grant is now the smallest in terms of percentage of total income, although a number of projects are usually sponsored each year by provincial government departments. A substantial portion of the new \$3.3 million B.C. Research laboratory and office building was paid for by the Government of British Columbia.\* B.C. Research uses its provincial grant—and its earnings from royalties—to establish new skills which, it anticipates, will become the basis of sponsored research projects at the end of two to three years.

The new building is somewhat larger than is necessary for the immediate requirements of B.C. Research, and the additional space is to be rented out on a short term to industrial or other tenants for research, development or other activities compatible with the objectives of B.C. Research. Because it sees its role as broader than research for industry and embracing the innovation process as a whole, B.C. Research may itself undertake small-scale manufacturing in the future. B.C. Research is “in business” to a greater extent than are the other Councils and Foundations. It competes for contracts on a continental basis with other non-profit laboratories. The Director and his senior colleagues spend a signifi-

\*Added to the Declaration in April 1970.

†Added to the Declaration in April 1970.

‡B.C. Research. 26th Annual Report. 1969.

\*The remainder of the cost was met by B.C. Research through the sale of the old building and from cash reserves built up over the years.

cant proportion of their time attempting to interest North American and sometimes European companies in taking licences or in supporting the additional research work required prior to the marketing of a new product or the introduction of a new process. At any one time, B.C. Research will have between 12 and 15 projects with innovation potential which are ready for sponsorship.

Most of the contract research sponsored at B.C. Research comes from large- and medium-sized companies and from government agencies. Between thirty and forty per cent comes from funding sources outside Canada, mostly in the United States. Another forty per cent comes from sources in British Columbia, and the remainder from the rest of Canada. As a general rule, if the contract work has worthwhile scientific content and is helping to maintain or upgrade useful skills, B.C. Research will usually perform the work at cost. If the work is more routine, it will probably cost the client more. Seventy per cent of the contract work performed by B.C. Research has developed from work started in-house.

The Annual Report of B.C. Research for 1969 lists the following numbers of research clients for that year as follows:

Architects, Engineering Services and Contractors	10
Food Industries	4
Forest Products Industries	24
Associations, Foundations and Research Organizations	6
Government of Canada	8
Government of British Columbia	6
Government, Municipal	9
Government, Foreign Countries	5
Manufacturing	43
Mining	33
Petroleum Industries	5
Shipbuilding	9
Transportation	7
<b>Total</b>	<b>169</b>

The work of B.C. Research is performed in six divisions—Applied Biology, Applied Chemistry, Applied Physics, Engineering, Management Services, and Insect Control and Odour Research. Out of the present total staff of 90, 50 are professionals, 20 are technologists and the

remainder are in the support classifications. The following lists will serve to illustrate the recent activities of B.C. Research:

*Technical Services Available:*

Technical information service;  
Industrial engineering service;  
Operations research;  
Electrical and mechanical engineering and metallurgical services;  
Water quality control research;  
Toxicity of water pollutants;  
Biological leachability of ores;  
Vibration and noise analysis;  
Industrial fermentations;  
Ecological studies;  
Air pollution studies;  
Economic studies;  
Industrial market research;  
Mine planning;  
Marine piling testing;  
Marine borer control;  
Oceanology;  
Optical alignment.

*Group Research Programs involving Consortia of Companies:*

Odour control, kraft pulp mills;  
Water quality control, kraft pulp mills;  
Biological leaching of metals;  
OR techniques, etc. applied to mineral exploration;  
Marine borer control.

*Research Projects now Open to Sponsorship by Individual Companies or Government Departments:*

Production of bleaching agents;  
Mineral processing (process efficiency determination);  
Copper /molybdenum flotation;  
Protein from natural gas;  
Stripping of phosphates from effluent;  
Oxygen transfer into water for waste;  
Gas pollutant monitoring system;  
Non-poisonous control of insects;  
Hydraulic drive of trailer wheels;  
Ice removal from pavement;  
Mobile highway scanning;  
Rotating shaft horsepower and speed monitoring;

Colour sorting (for fish, fruits, etc.);  
High voltage switching device;  
Wave climate studies.

*Process Available for Licensing and Sub-licensing*

Fuel-log process;  
Underwater coating for steel;  
Fire-retardant coating.

In 1969, the net royalties received by B.C. Research were the highest ever, amounting to \$83 000. These funds are being used to finance in-house research projects. In the same year, the publication and patents-granted record of the laboratory was as follows:

	Publications	Patents Granted
Air quality control	1	2
Insect control	7	—
Marine wood-borers	4	—
Microbiological leaching	2	1
Mining and metallurgy	2	—
Odour mechanisms	4	—
Pulp bleaching	2	—
Water quality control	4	—
Miscellaneous	9	1

B.C. Research operates a Management and Productivity Centre which organizes courses of instruction on technical and management-related subjects. Such courses have been given at several places in British Columbia and in the Yukon. B.C. Research has also sponsored series of lectures on its own and other research from time to time. It has an extensive technical library, and publishes a monthly bulletin called *Guidelines*.

The British Columbia Research Council proposes to set up a joint stock company as a subsidiary operation of B.C. Research for the following reasons:

1. To permit promising projects to qualify for federal government cost-shared and other R & D incentive programs (PAIT, IRAP, IRDIA and the Defence Industrial Research Program) as a means of helping with innovation based on developments made by B.C. Research.
2. To provide a company that local inventors may approach for development

and commercialization of their inventions.

3. To attempt to achieve better geographical distribution of federal government R & D assistance by making it possible to have applied research projects at B.C. Research and at local universities qualify through the company.

4. To act as an incentive to industry in British Columbia to use federal government R & D incentive programs.

During his appearance before the Senate Special Committee on Science Policy, Dr. W.N. English said:\*

“Our ultimate goal and aim (at B.C. Research) is to be a completely independent non-profit research agency serving our Province by our very presence there, the fact that we are available to work on local problems. We have a strong sense of responsibility towards this area, but we do not hesitate to go into other Provinces. However, we do not go into Provinces in which there is a Research Council or Foundation without discussing it with them, and we do not compete with them. The Regions of competence of our specialists are different, so we complement each other.”

\*Proceedings No. 50. June 3, 1969. p. 6270. Dr. English is head of the Division of Applied Physics at B.C. Research.

## Appendix X

### The Non-profit Industrial Research Association of Canada (NIRAC)

NIRAC was formed in 1969 to promote recognition of the existence, the value and the potential of non-profit industrial research institutes in Canada and to ensure for them a place in any national science policy. Membership is open to all institutes of this type in this country. The present members are the six older provincial institutes: the Nova Scotia and Ontario Research Foundations, the Research Councils of Alberta and Saskatchewan, New Brunswick Research and Productivity Council, and B.C. Research.

The growth in size and numbers of non-profit contract research institutes has, of course, been more marked in the United States than in Canada. Much of the U.S. growth has resulted from needs related to defence and space, but a significant portion of it has had industry sponsorship.

In Canada, contract research work currently accounts for more than half of the incomes of B.C. Research and the Ontario Research Foundation and has been rising in the other institutes. In this country the recognition problem for the six present NIRAC members seems to arise from their affiliations with provincial governments and from the differences in their respective roles, functions and objectives. They are, statistically speaking, not wholly "government" nor wholly "industry" and, operationally speaking, some are more active "industrially" than others.

Nevertheless, the six present NIRAC members can, between them, claim to be widely competent in applied research and even in economic and market research. They can claim experience in interdisciplinary work, in the post-laboratory phases of the innovation process, in joint ventures and co-operative projects, in providing technical assistance services to Canadian firms, and in providing advice to foreign countries through agencies such as the United Nations.

The NIRAC members have also developed

views on the industrial development of the regions of Canada with which they are familiar, and on the kinds of government programs and measures which would encourage Canadian research, development and innovation more effectively than has been the case in the past. The following were among the programs suggested by NIRAC members in a document dated February 3, 1970. These programs also serve to illustrate the larger role which the members wish to play:

#### *"Suggested Canadian Government Programs for Encouraging R & D:*

##### *1. The Shared Contract Program*

This program would invite industrial companies, universities, research institutes and any agencies incorporated in Canada, to submit proposals for research and development projects to be carried out in Canada. Proposals would be vetted on economic and technical feasibility by a competent scientific board and those approved would be financed in an agreed upon proportion (for example, 50:50) by the submitter and the Government under a contract agreement. The results of the projects and any patents associated therewith would be entirely the property of the submitter. The submitter, if he wished, might sub-contract part or all of the research to be done by a third party in Canada. Exploitation of the product, process, instrument or equipment resulting from such projects would have to accrue to the benefit of Canada and would normally be carried out in Canada. Permission to exploit or to licence outside Canada will be granted by the Government where this can be shown to be more beneficial to Canada than wholly Canadian exploitation. Government staff would monitor the contract through visits and progress reports and Government support could be terminated if acceptable performance standards were not met.

##### *2. The Government Contract*

One of the obligations of the Science Council of Canada is to advise the Government of specific areas in which R & D should be done to improve the economic



and social welfare of Canada. Many of these areas will be ones generated by social impact, usually requiring substantial funding and not have sufficient or immediate profit motivation for industry to undertake on its own. Such areas might be research on pollution, building design and construction, transportation, communications, and urban problems. In addition, projects may be initiated by Government departments including the Department of Defence. The Government would request submissions from Canadian industry, universities, research institutes and any other competent Canadian groups *on a competitive basis* for undertaking research and development on specific problems which the Government would propose. The Government would pay the full cost on such contracts, allowing a fixed rate for overhead charges, and the results of such work would be the property of the Government and any patents relating thereto. If it is wished, the Government could insist upon strict confidentiality of the work. This program should allow for co-sponsoring by the Federal Government and Provincial Governments, with a sharing of costs and benefits.

### 3. *The Superior Talent Program*

This program is intended for individual or small groups of residents in Canada of superior talent who have particularly imaginative research proposals and who need funds for pursuing the research. This program would allow for the research to be done personally by the submitter or to be supervised by him and carried out in his own laboratory or in an outside contract laboratory with total costs of the project being borne by the Government in the form of a grant. The profits from direct industrial exploitation of the results, or from licensing of patents\*, would be allowed to accrue only to residents in Canada.

### 4. *The Tax Incentive Program*

All R & D expenses incurred by a tax-

paying operation during a year would be written off as an operating expense and the Government would allow a non-taxable rebate of 10 per cent on all R & D expenditures made during a year including those for labour, buildings and equipment."

### *"Points Bearing on Suggested Programs:*

1. Programs 1, 2 and 3 above should be administered by one Federal Government agency using a Government scientific body, such as a remodelled National Research Council and widely based advisory groups with rotating membership, to assist in the technical evaluation on proposals and on contract bids.

2. The Government of Canada should consider entering into contracts with the members of NIRAC to publicise the Canadian Government research incentive programs among private firms. The members of NIRAC, as industrial research organizations and through their continuing associations with industrial companies across Canada, are well fitted to perform this function, particularly through personal contacts. The NIRAC members can also be of substantial service acting as intermediaries in the preparation of research proposals on behalf of companies on the one hand, and of assisting the Government in assessing requests for research assistance on the other. The NIRAC members have been carrying out this work in a limited, unofficial capacity heretofore; it could be expanded on an official basis to make research incentive programs better understood and more usefully applied across Canada than in the past. This could be achieved by extending the TIS function at the various provincial institutes.

3. The above suggested four programs are presented as alternatives and/or modifications to existing programs.

4. The Government of Canada should carefully examine those clauses of the White Paper on taxation which deal with or affect the operations of industrial companies. The NIRAC members feel that the Government policy should favour the establishment of new enterprises and their development into profitable operations.

\*In programs 1 and 3 the submitter of the proposal will be free to decide the firm in Canada which will act on his behalf in applying for patents on any discoveries arising from the project.

Ultimately the corporate tax returns will depend on the number of profitable commercial operations in Canada and the size of their profits; the Government will be the loser if the tax bite restricts new enterprises in their early stages of development.

5. The Department of Regional Economic Expansion has a program of assisting industry to establish manufacturing plants in certain designated areas of Canada. In addition to providing these incentives to new industry the Department should consider the incentives necessary for these industries and existing industries to innovate on a scale that will keep them viable.

6. It is suggested when new industrial research operations are being planned by the Federal Government that first consideration be given to their establishment regionally at provincial research institutes. These Provincial institutes can offer close and effective association with industry, Provincial government and universities and can provide economies by supplying administrative, technical, library, pilot plant and shop services and by seeing that research programs are properly scheduled, reports submitted on time and that effective use is made of research funding under approved accounting practices. The NIRAC members would particularly welcome the opportunity of expanding their ties with university departments that are interested in working on programs directed to industrial applications.”

## Appendix XI

### National Research Council Assistance

The National Research Council (NRC) is older, by a few years, than the Research Council of Alberta which was the first of the Councils in the provinces. The provisions of the present NRC Act which broadly determine the functions of the federal Council are as follows:\*

“7. The Council has charge of all matters affecting scientific and industrial research in Canada that may be assigned to it by the Committee (of the Privy Council on Scientific and Industrial Research).

13. Without thereby limiting the general powers of the Council conferred upon or invested in it by this Act, it is hereby declared that the Council may exercise the following powers; namely:

(c) to undertake, assist or promote scientific and industrial research, including, without restricting the generality of the foregoing,

(i) the utilization of the natural resources of Canada,

(ii) researches with the object of improving the technical processes and methods used in the industries of Canada, and of discovering processes and methods that may promote the expansion of existing or the development of new industries,

(iii) researches with the view of utilizing the waste products of said industries,

(iv) the investigation and determination of standards and methods of measurement, including length, volume, weight, mass, capacity, time, heat, light, electricity, magnetism and other forms of energy, and the determination of physical constraints and the fundamental properties of matter,

(v) the standardization and certification of the scientific and technical apparatus and instruments for the government service and for use in the industries of Canada, and the determination of the

\*R.S.C. 1952, c. 239, as amended.

standards of quality of the materials used in the construction of public works and of the supplies used in the various branches of the government service,

(vi) the investigation and standardization, at the request of any of the industries of Canada, of the materials which are or may be used in, or of the products of, the industries making such a request, and

(vii) researches, the object of which is to improve conditions in agriculture;

(d) to have charge of, and direction and supervision over, the researches which may be undertaken, under conditions to be determined in each case, by or for simple individual firms, or by such organizations or persons, as may desire to avail themselves of the facilities offered for this purpose;

(fb) to establish, operate and maintain a national science library;

(g) subject to the approval of the Minister, to publish and sell or otherwise distribute such scientific and technical information as the Council deems necessary;

(h) to carry on work and manufacturing of an experimental and developmental nature with respect to matters referred to in paragraphs (c) and (d) so as to render the processes, methods or products to which the said matters relate more available and effective in useful arts and manufacturing and for scientific purposes and otherwise; and

(i) to license, sell or otherwise grant or make available to others, Canadian or other patent rights or any other rights, vested in or owned or controlled by the Council, to or in respect of any discovery, invention or improvement in any art, process, apparatus, machine, manufacture or composition of matter, and to receive royalties, fees and payments therefor."

The National Research Council has almost completed the phasing out of the modest sustaining grants which, for many years, it gave to the six older Research Councils in the provinces to help them build up competence. In place of these grants, NRC is tentatively examining ways in which specific proposals from the

Councils can be supported. NRC has, however, made provision recently for some participation by the Councils in the Industrial Research Assistance Program. The principal continuing NRC support for the Councils has come from Technical Information Service agreements. The following are some notes on these latter two programs.

*The Industrial Research Assistance Program* (IRAP) was initiated in 1962. It is specifically designed to encourage the establishment of a number of competent research teams in manufacturing companies in non-defence areas, and is a shared-cost program. It is, broadly, the research partner of the PAIT program of the Department of Industry, Trade and Commerce.\* The administration of IRAP is handled by NRC. Committees with representation from industry, government and the universities have been set up to identify guidelines and ground rules and to approve grants.

The industrial companies make the proposals, which are examined and assessed by the appropriate NRC staff people and approved by the appropriate committee. Liaison officers from NRC are appointed for each approved project. Grants made under IRAP are non-returnable. They are renewable, subject to satisfactory progress. The work involved may be generally classified as applied research. The actual grants cover the salaries of research personnel added to the company's staffs on a permanent basis, the salaries of university professors serving as advisers, and of summer students.

Until very recently it was not possible for the provincial Councils or Foundations to participate at all in IRAP projects. Although provisions which prohibit full participation still remain, the Councils may now perform research on behalf of a participating company—with NRC approval—during the first year of an IRAP project. Thereafter, the companies must assume full responsibility and use their own

\*Some highlights of this program are given in Appendix XII.

scientific resources.\* The reason for the continued prohibition lies in the fact that the IRA Program was intended to promote the establishment of new research facilities, and the expansion of existing ones, in Canadian industry. Until this basis is changed, the relative exclusion of the Councils will continue. Present budget restrictions make such a change unlikely in the short term.

About half of the 130 or so companies which have participated in IRAP since it began have been new to research. About a quarter of the total number could be classified as "small". Some companies have successfully exploited their IRAP projects, but the "failure rate" has been high.

Between fiscal 1965-66 and 1969-70, IRAP support for industry has been estimated at just over \$30 million, having risen from around \$4 million to \$7 million annually.

*The Technical Information Service (TIS)* of the National Research Council was established 25 years ago to assist the 31 000 or so small Canadian manufacturing companies, in particular, to keep up to date with technology in their respective fields of interest.† When it first began, TIS concentrated on providing a free inquiry/answer service, but this was soon extended to include the establishment of field offices from which visits to both small and larger companies could be made. These offices also provided an avenue through which companies could seek help directly. In 1962, TIS was expanded to include an Industrial Engineering Service to give free advice and assistance to small companies, in particular, and to encourage the acquisition of trained staff. In 1964 the Technological Development Section was set up to provide selected information covering all areas of technology relevant to Canadian industry, by mail, on an interest profile basis. This

\*At the time of writing, however, there have been no projects approved which include the partial participation of a Council or Foundation.

†For its first year of existence, TIS was part of the Research and Development Branch, Department of Reconstruction and Supply.

section has also published Technical Reviews which are summaries of the study of an art written for laymen, and has arranged for loans of films from the National Science Film Library to industry at a nominal charge.

In 1952, in order to avoid the duplication of services, the five provincial Research Councils or Foundations then existing agreed to take over NRC's TIS work in their respective provinces in return for an annual fee. The New Brunswick Council joined the Service shortly after it was established in 1963 and, a year or two later, took on responsibility for visiting Prince Edward Island. A similar agreement was reached with the Nova Scotia Research Foundation regarding the service in Newfoundland, but this agreement has now been terminated. The actual services provided by these Councils are, however, not limited to those covered by the TIS agreement with NRC and, in their full extent, vary from Council to Council. In Manitoba, the Research Council operates a service of its own as part of a provincial department. The National Research Council therefore, still maintains an office in Winnipeg to serve that province and the Yukon and Northwest Territories. NRC also has offices in Ontario, where the Research Foundation no longer receives support covering Industrial Engineering Services, and in Quebec. None of the Councils participate in joint activities with the Technological Development Section.

A typical agreement between the NRC and a provincial Council to pay for the NRC element in its total Technical Information Service, or whatever it may be called, will normally include a specified gross amount. Where applicable, the allocation to defray the cost of industrial engineers employed by the Council on NRC's behalf will be specified. The provincial Council, for its part, must agree to provide coverage to the satisfaction of the National Research Council. The provincial Councils may, of course, make full use of the personnel and facilities of the NRC in Ottawa in the discharge of their duties.

The Councils may also make proposals to NRC for the improvement of the Service as a whole. The NRC is, however, reluctant to go beyond its own terms of reference or to extend its limited resources for the solution of local problems which are not also relevant to national problems.

The National Research Council's Technical Information Service, as a whole, is a modest service and the rationale for this was put forward by the National Research Council in its first brief to the Senate Special Committee on Science Policy. Since this rationale is important for the purposes of this present report, it has been quoted (almost) in full, as follows:\*

"In considering the future development of TIS in the next five years it is felt that the existing activities of TIS are meeting definite industrial needs in fields more than large enough to occupy a service many times the size of our present organization. Advances in mechanical retrieval and transmission of information will assist our services, but will give us a greater mass of material to read, select and disseminate, involving more manpower.

"The manpower factor also is involved in the amount of publicity given to TIS activities. Criticism is sometimes directed at TIS that the service is not well known or sufficiently publicized. This is true to some extent but there are two major reasons for it. One is that companies do not need to use the service daily. Changes of personnel occur frequently in industry and we often find, when a company executive indicates he has never heard of TIS, that we have helped his company many times over a period of several years.

"Furthermore, TIS always has a backlog of work and must be careful to preserve a balance between the number of field officers, who are the salesmen, and the Ottawa staff, who are the producers. It is definitely harmful to publicize a

service which cannot meet the demand created by publicity. Unlike a business, which can expand as advertising increases the demand for its products, TIS expansion is related to a more or less fixed rate of growth, governed by its share of NRC's budget and manpower allocation.

"It is felt, therefore, that the major hindrance to the effective performance of TIS functions will continue to be the lack of manpower and budget to meet both the existing and potential requirements for technical information.

"Small industry is becoming more sophisticated, a trend which is noticeable in the queries received in recent years....

"The Province of Quebec presents some special problems. Bilingual engineers are most difficult to obtain, being few in number and greatly in demand in industry....

"From time to time the provision of information free of charge is queried, frequently based on the old cliché that the only information industry holds in high regard is that which has to be paid for. However, a small industrialist generally is not prepared to pay for something, the effectiveness of which he cannot assess or evaluate in advance—particularly if it is software rather than a product or process. If it is costly by his standards he will get along without it, regardless of its potential value.

"If TIS were obliged to charge for its services, it would either die or its efforts would be chained to a small circle of clientele whose needs could be served by a commercial organization, if one could be found.

"The possibility of extending TIS operations to meet the needs of large companies has been a continuing consideration for several years. The field service type of operation is not considered suitable for large companies, due to the size, complexity and sophisticated nature of their organization and technical information needs....(The) basic differences between large and small companies present problems but our future development will attempt to meet the needs of both sectors of industry."

\*Proceedings No. 3, October 23, 1968. Appendix H. pp. 206-208.

In 1968, for example, the Technical Information Service as a whole handled over 15 000 verbal or written inquiries, approximately 2 600 registered manufacturers received Individualized Checklists and requested nearly 30 000 Technical Briefs, and over 500 mainly small manufacturing companies received industrial engineering assistance.

The Report of the President of the National Research Council for 1969-70 includes the following statement:\*

"To assist the National Research Council in the STI field, the Federal Government ...approved the creation of an Advisory Board on Scientific and Technical Information. This was also one of the recommendations contained in the Science Council Report No. 6.† The following terms of reference for the Board were approved at the March 1970 meeting of the National Research Council:

1. The Board shall formulate broad policy guidelines for the continuing development of and (in concert with existing information organizations) for the implementation of a national STI system in Canada.

2. Without limiting the general responsibilities set out in (1), the Board shall be given the following duties:

(i) to advise Council on the activities and priorities necessary to undertake, assist or promote the dissemination of scientific and technological information in Canada, including

(a) the expenditures to be made for this purpose under the covering Parliamentary vote including, *inter alia*, grants-in-aid of research scholarships to promote the training of information specialists, and contracts to further a national STI system,

(b) the activities of Council committees dealing directly with scientific and technological information,

(c) participation in the activities of in-

ternational organizations in the field of STI and on arrangements for international collaboration,

(d) the best use of existing STI resources in Canada,

(e) the development of existing and, where necessary, new scientific and technological publications and other means of disseminating information relevant to Canadian interests and needs;

(ii) to appoint such committees as it may require with membership not necessarily restricted to Board members.

(iii) to take charge of such other matters affecting the dissemination of scientific and technological information as may be assigned to it by Council,

(iv) to review from time to time its duties and responsibilities and to recommend to Council such changes as may seem desirable.

Since the above terms of reference are broad, the Board will have an important role to play in future policy decisions on NRC's role in promoting a national STI dissemination network. While not wishing to prejudge or limit the initiatives of the Board, it is intended that the broad principles governing the future development of a national STI system should be the following:

(i) The system should be user-oriented and should meet the needs of users in all parts of Canada.

(ii) In developing the system, primary emphasis would be placed on rapid response to specific requests for scientific and technical information rather than a broad unsolicited diffusion.

(iii) The integrated national system should be built upon existing resources and systems.

(iv) The system should be designed so that it would respond to queries in either of the two official languages.

These principles will also serve as a guide in selecting the Advisory Board such that its membership includes both users and processors of scientific and technical information, an adequate geographical representation, and a balance between the universities and industry...."

\*In English: pp. 28, 30, 32. In French: pp. 29, 31, 33.

†A policy for scientific and technical information dissemination. Report No. 6. Ottawa, Queen's Printer. September 1969.

The members of the Advisory Board were appointed in June 1970. The Board includes one representative from the six older provincial research institutes, Dr. H.W. Habgood of the Research Council of Alberta.

## Appendix XII

### Notes regarding the Federal Department of Industry, Trade and Commerce

This Department has, at the present time, no special policies and programs which relate to the provincial Research Councils and Foundations. It has, instead, a broad range of programs applicable to the industry sector. For the purposes of this present report, some brief comments and information will be given on only three of these programs: the Program for the Advancement of Industrial Technology (PAIT), the Industrial Research and Development Incentives Act (IRDIA), and the Industrial Research Institutes (IRI) Program.

In accordance with the Act under which the Department was established:\*

“16. The Minister of Industry, Trade and Commerce shall

(a) promote the establishment, growth and efficiency of manufacturing, processing and tourist industries in Canada, contribute to the sound development and productivity of Canadian industry generally and foster the expansion of Canadian trade;

(b) develop and carry out such programs and projects as may be appropriate to

(i) assist manufacturing and processing industries to adapt to changes in technology and to changing conditions in domestic and export markets,

(ii) assist manufacturing and processing industries to develop their unrealized potential, to rationalize and restructure their productive facilities and corporate organizations and to cope with exceptional problems of adjustment, and

(iii) promote and assist product and process development and increased productivity, the greater use of research, the application of advanced technology and modern management techniques, the

\*Statutes of Canada, 1968-69. 17-18 Elizabeth<sup>II</sup>, Ch. 28.

modernization of equipment, the utilization of improved industrial design and the development and application of sound industrial standards in Canada and in world trade....

17. The Minister of Industry, Trade and Commerce, in exercising his powers and carrying out his duties and functions under this Act:

(a) shall, where appropriate, make use of the services and facilities of other departments, branches or agencies of the Government of Canada;

(b) may, with the approval of the Governor in Council, enter into agreements with the government of any province or any agency thereof respecting the carrying out of programs for which the Minister is responsible; and

(c) may consult with, and organize conferences of, representatives of industry and labour, provincial and municipal authorities and other interested persons.”

The PAIT, IRDIA and IRI Programs were, of course, all started in the Department of Industry before its amalgamation with the Department of Trade and Commerce.

From the start, provincial Research Councils and Foundations have been generally permitted to undertake contract work for individual industrial firms which were receiving PAIT support for this work—unlike the situation, until recently at least, with NRC’s IRA Program.\* Relevant extracts from the *PAIT Program* description are as follows:†

“1.1 The basic objective of the PAIT Program is to promote the growth of efficient, competitive manufacturing and processing industries in Canada by providing risk capital for product and process development projects, the results of which will be marketed at home and abroad....

3.1 Assistance under the Program is available to companies incorporated

in Canada, to groups of companies organized as consortia, and to trade associations to the extent that they can satisfy the requirements of the program.

4.1 PAIT assistance has been concentrated mainly on the engineering development phase of product and process innovation projects. Activities associated with the engineering development phase may be conducted either in-house or by sub-contractors (firms, consultants, universities, research councils and foundations).

6.1 PAIT assistance is provided in the form of a conditional loan which may be provided to qualified applicants for up to 50 per cent of the estimated cost of the project without reference to Treasury Board for contract authorization.

8.1 PAIT conditional loans must be repaid to the Crown with interest if the project is successful and the results are exploited commercially....

10.1 The PAIT applicant company undertakes that the product or process resulting from the project will be produced or used by the company in Canada and that the company will, within a reasonable period of time, exploit the results in accordance with sound industrial practice....

10.2 The major condition imposed on the PAIT applicant company is the requirement not to transfer technical data or inventions, whether or not patented, methods and processes resulting from the project to any other government or to any person, company, partnership or firm outside of Canada for the purposes of production, without the prior consent of the Minister; and place the same restriction on any transfer it may make to another Canadian company, firm, partnership or person.”

The PAIT Program was established in 1965, but for the first few years, was less successful than was hoped. In the spring of 1970, a number of changes were made. For example, the loans of up to 50 per cent of approved project costs became grants with no repayment conditions, assistance in excess of 50 per cent was made available on a repayment basis in

\*See Appendix XI.

†Senate Special Committee on Science Policy. Proceedings No. 42. April 30, 1969. pp. 5386 and 5388.



the event of success, and the list of eligible expenses was extended to include non-development activities such as the preparation of industrial designs, production drawings and specifications. Part 10 remained unchanged.

Some recent statistics on PAIT were given by a senior official of the Department when announcing the above changes:\*

“In the four years since the Program was established, 220 projects estimated to cost a total of over \$62 million have been approved for support. This represents a government contribution of over \$30 million, of which about \$20 million have been expended to date. To June 30, 1969, 49 projects had been concluded. Thirty-two projects had been completed successfully and the results put into use. The remaining 17 projects had been terminated because of technical failure, marketing problems or other reasons. Benefit on terms of sales resulting from the 32 successful projects over the first five years are estimated at over \$128 million, about half of which will be export sales.”

*The Industrial Research and Development Incentives Act*† received assent on March 10, 1967. It replaced the Tax-Based Incentive Program whose provisions were then included as Section 72A of the Income Tax Act. The specific objectives of IRDIA are:

“(a) to encourage an increased growth rate in industrial research and development by:

(i) inducing Canadian corporations to undertake new and expand existing scientific research and development programs, the results of which, if successful, will be exploited by the corporations;

(ii) inducing Canadian corporations to provide well equipped facilities for such work.

(b) to encourage the establishment of

independent research and development laboratories, research associations and technical consulting services whose purpose is to provide specialized support services for industrial research and development;

(c) to encourage greater cooperation between industry and universities on research related to industrial problems.”

The incentive is available to all taxable Canadian corporations carrying on business in Canada. The activities which qualify under the Act must meet the definition of scientific research and development used for the purposes of the Act. Assistance is provided in the form of tax-free grants or, at the request of the company, as a credit against income tax payable. The grants equal 25 per cent of all *capital* expenditures made by the applicant company for R & D carried out in Canada, but the expenditures must be related to its business. The R & D may be carried out directly by the company or on its behalf. Regarding eligible *current* expenditures, the additionality principle is applied. Grants are equal to 25 per cent of the increase of these expenditures over the average of like expenditures made in a base period consisting of the five immediately preceding years.

Some recent figures relating to the IRDIA Program are as follows. The actual disbursements were just over \$2 million in fiscal 1967, but rose to over \$10 million in the first nine months of fiscal 1968. Applications for fiscal 1967 were 533, but applications for 1968 have been approximately 45 per cent higher. About 5 per cent of the assessed applications were rejected and claims were reduced in about 18 per cent of them.\*

*The Industrial Research Institute Program* has the following objectives:†

a) to foster a closer relationship between universities and industry, thus assisting the universities to improve their understanding of the problems of industry, and

\*Dr. S. Wagner, General Director, Office of Science and Technology, at Chateau Laurier, Ottawa. February 23, 1970.

†Statutes of Canada, 1965-67. 14-15-16 Elizabeth II, Ch. 82.

\*Senate Special Committee on Science Policy. Proceedings No. 42. April 30, 1969. pp. 5397-5398.

†*Ibid.*, p. 5408.

helping industry to become acquainted with the latest pertinent scientific and technical developments;

b) to facilitate transfer of science and advanced technology to industry;

c) to provide scientific services for industrial firms unable to maintain research facilities and personnel of their own.

The Program was authorized under a Treasury Board Minute dated December 13, 1966.

Discussions regarding the IRI Program began in 1965. During 1966, the University of Windsor—which had participated actively in these discussions—submitted a formal request to the Department for a grant to assist in the establishment of an Institute to serve local industry. The preliminary proposal had been endorsed by the Windsor Chamber of Commerce. The Windsor request was granted in December, and approval was subsequently given for assistance in the establishment of Institutes at the Nova Scotia Technical College, McMaster University and the University of Waterloo. The four Institutes began to acquire staff and to make preliminary contacts with industry during the following year.

To qualify under the Program, the Institutes must be wholly owned by a Canadian university and must utilize the facilities of the university to conduct contract research on behalf of industry. Assistance from the Department is available in the form of a grant for the three-year period following the establishment of the Institute to cover:

a) salaries and wages, etc., of the manager and assistant manager (if any) of the Institute and of its secretarial and clerical staff;

b) travel expenses incurred by the manager and his assistant;

c) rental of offices and office equipment, and the cost of office supplies, printing, telephone and telegraph services;

d) other administrative expenses as may be approved by the Department.

Each Institute operates with the guidance of an Advisory Board or Board of Directors, including a representative from

the Department's Office of Science and Technology.

During the fiscal year 1969-70, the departmental subventions to the four Institutes were as follows:

Windsor	\$36 000
Nova Scotia	\$40 000
McMaster	\$50 000
Waterloo	\$48 700

During their respective third years of operation—roughly fiscal 1969-70—the incomes of the four Institutes for contract research activity have been estimated as follows:

Windsor	\$59 500
Nova Scotia	\$105 700
McMaster	\$250 000
Waterloo	\$300 000

In addition to research contract work for industrial sponsors, the Institutes have also arranged supplementary education programs. At McMaster, for example, a "subsidiary" Institute of Metalworking was set up in the spring of 1970 with assistance from the Department of Industry, Trade and Commerce.

Department officials say that the IRI Program is still essentially in the experimental stage.

# Publications of the Science Council of Canada

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First Annual Report, 1966-1967 (SS1-1967)  
Second Annual Report, 1967-1968 (SS1-1968)  
Third Annual Report, 1968-1969 (SS1-1969)  
Annual Report, 1969-1970 (SS1-1970)

## **Reports**

Report No.1, A Space Program for  
Canada (SS22-1967 /1, \$0.75)  
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Neutron Generator: Initial Assessment  
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Resources Research in Canada (SS22-  
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