

University Research and the Federal Government

SCIENCE COUNCIL OF CANADA

Report No. 5

University Research and the Federal Government

MALYZED.

SEPTEMBER 1969

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The Right Honourable PIERRE ELLIOTT TRUDEAU, P.C., M.P., Prime Minister of Canada, House of Commons, Ottawa 4, Ontario.

Dear Mr. Prime Minister,

It is my privilege to transmit to you the fifth report prepared in accordance with sections eleven and thirteen of the Science Council of Canada Act. The report expresses the views of the Science Council on the important question of Federal Support of Research in Canadian Universities.

Early in 1967, the Science Council and the Canada Council invited Dr. J. B. Macdonald and a study group of experts in the fields of university research and graduate education to do a comprehensive review of the Role of the Federal Government in Support of Research in Canadian Universities. Dr. Macdonald and his study group presented their report to the Science Council and the Canada Council in February 1969. It was published as *The Role of the Federal Government in Support of Research in Canadian Universities*, Special Study No. 7, in April 1969.

The Science Council, having carefully considered the Macdonald report and other pertinent information, and having discussed the major issues at its meetings in March, May and July of this year, makes the recommendations contained in this report, in the hope that they will serve as guides for federal policy in this very vital sector of scientific activity.

Yours very truly,

ROGER GAUDRY, Vice-Chairman.

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SUMMARY OF MAJOR PRINCIPLES AND RECOMMENDATIONS

The Science Council recommends that all areas recognized by Canadian universities as areas for research, including research in education, be eligible for federal support.

While adhering to the principle that "high quality" should be the primary criterion in the adjudication of awards, the Science Council recognizes the existence of regional disparity in Canada and recommends special grants for its redress.

The Science Council believes that the granting agencies have a role to play in providing broad guidance to the direction taken by university research.

Universities should be encouraged to specialize rather than attempt to develop proficiency in all fields.

The Science Council does not recommend that, as a general policy, the granting councils should pay full overhead on all research projects. However, it believes that the formulae for funding should be flexible to allow coverage of full costs in some circumstances. Mission-oriented departments should normally pay full overhead on the projects which they support.

The Science Council recommends that the present program of providing lump sum grants for computing should be carefully phased-out.

The shortage of space for research is recognized, but is deemed to be inseparable from the general shortage of building space on campuses. A federal-provincial meeting is recommended to resolve this issue.

The Council does not consider that we are producing an over-supply of highly trained manpower. It believes, however, that the flexibility and adaptability of our advanced degree graduates could be improved from the point of view of both training and attitudes, to avoid possible over-supply within some disciplines.

The Science Council believes that a greater proportion of federal funds should come from the mission-oriented departments.

Bearing in mind that they have a role in ensuring the healthy and balanced development of science and scholarship in Canadian universities, the granting councils may provide support for both interest-motivated and mission-oriented research.

The Science Council believes that the natural evolution of events will lead to a separation of the granting function from the laboratories of the National Research Council, but it believes that the interests of university research can, for the present, be served within the framework of the existing structure. In the circumstance where a granting council has major activities other than the support of research in universities, it is considered imperative that funds destined for university research be obtained under a separate parliamentary vote and that their administration be separated at a senior executive level.

The Science Council recommends the creation of an Intercouncil Coordinating Committee to facilitate the implementation of the recommendations and policies proposed in this report, and to cope with the many administrative problems which have been identified by the authors of Special Study No. 7.

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Section I

INTRODUCTION

Evolution of Research

As recently as the early part of this century, research was conducted by only a very small number of individuals and its cost, expressed as it often is today as a percentage of Gross National Product, was insignificant. Since he was not accounting for the expenditure of public funds, the researcher of the time could be content to satisfy his curiosity without concern for the practical benefits of his work. As a rule, practical benefits were not sought and when they occurred, they were often regarded as interesting incidentals.

As the realization developed that research could contribute to the achievement of some of man's economic and social goals, research took on a new dimension and began to gain material support from the community at large. Since then, its growth has been extremely rapid, having approximately doubled every 10 years for the last 50 years. Today research is an activity which consumes a significant fraction of our total human and financial resources. Its performance involves all of society, for it is society as a whole which provides the funds and society which reaps its benefits or suffers the undesirable consequences when the new knowledge is improperly used. Society, as the sponsor and the recipient, is entitled to consideration. Scientific research has evolved tremendously over the past 50 years-the scientists' own concepts of it and of its raison d'être, in many cases, have not kept pace. If scientists are to retain the support of society, so essential to the performance of their work, they must take greater cognizance of society's needs and must make more effort to inform society of the alternatives which are presented as the result of their research.

Two of the most recent developments in the evolution of research have been the increasing importance of large interdisciplinary projects and the need for complex and expensive equipment or installations to do certain types of work. These can involve expenditures of many millions of dollars and will call for an increasing amount of co-operation between governments and the institutions performing research.

Research in Universities

The performance of research in universities is conditioned by the unique advantages that universities have, as well as by their special needs. Universities in Canada represent some of the largest concentrations of highly qualified research personnel and at the same time, they possess a coverage of disciplines found nowhere else in our society. As primary organizers of new knowledge, they are strategically placed to receive and to dispense the fruits of research. The special needs of universities are derived from their role in teaching the new generations of people and in training research personnel. The fulfilment of this role makes it essential that members of faculty remain at the forefront of knowledge in their disciplines while retaining the breadth required to organize and transmit new knowledge effectively. This makes it desirable that academics have latitude in the selection of projects for research. A second point which must be given special consideration in university research is the appropriateness of projects as a means of promoting graduate education.

Federal Involvement in University Research

The Federal Government has recognized the importance of university research for many years and its financial support in this area has been a significant factor in the total budget of universities. In the last decade sharply increased enrolments and rising costs resulted in a more than sevenfold increase in the operating costs of Canadian universities. The demand for research funds rose even more rapidly; and in responding to this need, federal support increased by a full order of magnitude. As is shown in Figure 1, federal support for scientific activities¹ in universities amounted to just over \$100 million in 1968-69. In the field of the humanities and social sciences, the Canada Council distributed about \$16.5 million in fellowships, grants and awards to researchers in the academic community. Significant additional funds for the support of research in the humanities and social sciences were provided by various other federal government departments and royal commissions, which brings the grand total of federal support for university research to approximately \$120 million. This amount represents about 13 per cent of the total operating expenses of universities for that year. Combined provincial contributions, in the form of direct and indirect support of research, totalled about twice the federal contribution. However, provincial costs are partly reimbursed through fiscal-transfer by which the Federal Government grants the provinces 50 per cent of the recognized operating costs of post-secondary education, or \$15 per capita at the option of the province.

The strong interest of the Federal Government in university research stems primarily from its desire to maintain strong, first-rate educational institutions that can provide government, industry and universities themselves with the highly trained manpower necessary for the achievement of Canadian goals. Another interest of the Federal Government is in sustaining the flow of new knowledge which contributes to the culture and to the material progress of our society. In this respect the federal interest is not limited to universities, but extends to the scientific and scholarly community as a whole. Thus, the Federal Government has supported and should continue to support meritorious research performed by individuals or groups acting independently of universities, industry or government. However, the increasing complexity of doing research and the growing need for multidisciplinary inputs will result in such independent research becoming a diminishing fraction of the total national research effort. We expect the most rapid growth in future years to come from the industrial and university sectors.

¹ As defined by the Dominion Bureau of Statistics.



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Figure 1.—Federal Support* for Scientific Activities in the Universities 1960-1961 to 1969-70

Further support for the view that the Federal Government should share in a special way in university research, and consequently in graduate training, comes from figures on the mobility of advanced degree graduates.² These figures show that only Ontario retains more than 50 per cent of that portion of its Ph.D. graduates who remain in Canada. In the smaller provinces the fraction remaining is only about 30 per cent. What percentage of the total number of graduates this represents is uncertain, as no reliable statistics are available on movements in and out of the country.

³ Macdonald, J. B., and others. The Role of the Federal Government in support of research in Canadian universities, Science Council of Canada Special Study No. 7. Ottawa, Queen's Printer, 1969. Appendix 2.

Section II

PRINCIPLES GOVERNING FEDERAL SUPPORT

The Macdonald Report

The relationship between the Federal Government and universities in matters of research has been the subject of a comprehensive study by a group commissioned jointly by the Science Council and the Canada Council. The study group was headed by Dr. J. B. Macdonald, formerly President of the University of British Columbia and at present Executive Vice-Chairman of the Committee of Presidents of the Universities of Ontario. Other members of the study group were Dr. L. P. Dugal, Vice-Rector of the University of Sherbrooke; Dr. J. Stefan Dupré, Director of the Centre for Urban and Community Studies, University of Toronto; Dr. J. B. Marshall, at present Executive Officer, Extramural Office, National Research Council; Dr. J. Gordon Parr, Dean of the Faculty of Applied Science, University of Windsor; Dr. Ernest Sirluck, Vice-President and Dean of the School of Graduate Studies, University of Toronto; and Dr. Erich Vogt, Professor of Physics, University of British Columbia. In addition, Dr. Guy Rocher, Professor of Sociology, University of Montreal, served as a consultant.

The report of the study group was published as the Science Council's "Special Study No. 7" and is entitled *The Role of the Federal Government in Support of Research in Canadian Universities*. This document is the most comprehensive in this field and it contains much new information upon which to base meaningful policies. The Science Council wishes to acknowledge its indebtedness to Dr. Macdonald and his co-authors for this most valuable contribution to the fields of university research and graduate education. We believe the study group has identified very clearly the major problems which exist in the government–university research relationships. The Macdonald Report has served as the principal source of background information in the preparation of the present report.

The recommendations contained in the Macdonald Report, and the views which it reflects, are those of the Study Group and not necessarily those of the Science Council. While the Science Council is in substantial agreement with many of the recommendations, it disagreed with others.

The present report expresses the views of the Science Council on those matters which it considers to be of particular importance.

Coverage of All Fields

An essential feature of the healthy development of knowledge in our universities is that it advances in a broad and balanced manner over a wide spectrum of scientific and scholarly activities. This does not imply that all disciplines have equal importance or deserve equal support, nor does it imply that each university should engage in research in all fields. The rising costs of doing research, and the importance of sustaining a critical level of activity in those areas where research is undertaken, make it mandatory for universities to specialize in those areas where they now have, or where there are valid reasons for developing, particular strength. It is important, however, that Canadian universities, when taken collectively, should develop a solid base of expertise over a wide range of disciplines. In order that this may be achieved, it is essential that no legitimate discipline be ignored or deprived.

In Canada three of the federal agencies supporting research in universities do so primarily to assure the healthy development of universities in those major branches of knowledge with which they are concerned. These three agencies are the National Research Council, the Medical Research Council and the Canada Council. (Following upon the precedent set by Macdonald in Special Study No. 7, we shall henceforth denote these three agencies as "the Councils".) By contrast, the other departments of the federal government are mainly concerned with supporting research which is relevant to their respective missions. (Again following the precedent of Special Study No. 7, we shall use the term "mission-oriented" departments to describe these departments.)

Under present arrangements the combined support of the Councils and the mission-oriented departments provides coverage for most, but not all, recognized disciplines. A few are almost totally deprived of federal funds, not because they are judged to be of lesser importance, but because they do not fall within the terms of reference of any of the funding agencies. In particular, the Macdonald study group have singled out business administration, education, law, architecture, nursing, music, art and theatre as fields which have been receiving very little federal support. In some of these disciplines part of the problem may be ascribed to the inadequate quantity and quality of the applications rather than to reluctance of the granting agencies to consider application in these particular fields. Whatever may be the primary causes, we believe this problem has received insufficient attention in the past.

Research in education is in a category by itself and deserves special mention. This field of research has been poorly funded by federal agencies, possibly because of apprehension of constitutional conflicts. As a consequence, this most important discipline has found itself relatively disadvantaged.

Our own view is that the generation of new knowledge can be quite separate from, and independent of, its application. Consequently a federal participation in the support of research in education would not at all touch the constitutional issue and should actively be built up without delay.

The Science Council recommends that all areas recognized by Canadian universities as areas for research, including research in education, be eligible for consideration within the framework of the federal granting agencies, both Councils and Departments.

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Criteria for Support

The quality of the products of our universities (viz. knowledge and educated people) will depend on the quality of the universities from which they come. It has been shown by a recent study in the United States³ that one of the principal factors contributing to the overall standard of a university is the amount and the quality of research conducted within that institution. One of the principal objectives of the federal research support program, therefore, should be to maintain an adequate level of high quality research in each institution.

As in most countries, there are variations in standards amongst our universities and while we must strive to raise the standards of the weaker institutions, we must not attempt to achieve homogeneity in our universities. Rather, we must form true centres of excellence, building on strength where it already exists and providing the support necessary for such centres to be developed in other carefully selected institutions. The overall federal support program must be administered in such a way as to achieve an equitable distribution of centres of high quality research among the different regional and linguistic groups. Support must not be given as a reward for mediocrity, but it must take need into account and it must be generous where it can be seen to catalyze progress towards higher standards. In the university environment, research and graduate education cannot be totally separated and for this reason, allocations for research should take into account their potential contribution to "research training" and to the general educational "health" of the institution as well as their contribution to "new knowledge".

The special concerns of French-language universities and to a certain extent those of universities in the "have-less" areas of Canada are reflected in the minority report by L. P. Dugal, which forms a part of Special Study No. 7. Many of these universities, because of regional disparities, have been slower to develop than those in the more affluent milieus. In the case of French-language universities, the difficulties of recruiting senior staff have been an added problem. The suggestion that they must now enter into national competition for funds, where the criterion is entirely the scientific or scholarly merit of the proposal, causes these universities some degree of concern. Moreover, there is the belief, in French-language universities, that the dominance of anglophones in the federal scientific community quite unconsciously tends to keep French-speaking researchers on the periphery of the scientific establishment. As a gross assessment of the equitability of the distribution of federal funds we have made an analysis of the regional distribution of the support of university research by the National Research Council, the Medical Research Council, the Canada Council, and several of the federal departments. These data are shown in Table 1.

Because of the variations between universities and between provinces in such things as the distribution among disciplines, the way in which "graduate" and "part-time" students are defined, the distribution of academic ranks,

^aNational Science Board. Graduate education: Parameters for public policy. 1969. (N.S.B. 69-2)

	Atlantic Region	Quebec French	Quebec English	Ontario	Prairies	British Columbia	Canada, Mean
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
Federal Support*	4 326	9 280	9 582	31 523	14 086	8 832	12 938
Federal Support* per Graduate Student (all disciplines)	2.7	2.6	3.0	2.5	3.1	2.7	2.8
Federal Support* per Full-Time Faculty Member (all disciplines)	2.6	4.3	6.9	5.0	4.6	4.9	4.7
NRC Support per Graduate Student in Science and Engineering	3.7	3.8	3.1	3.6	3.7	4.5	3.7
NRC Support per Full-Time Faculty Member in Science and Engineering	6.0	8.0	9.9	9.1	8.1	9.1	8.4
NRC Support per Man Year of Research by Faculty Members in Science and Engineering	15.0	21.0	21.0	20.0	20.0	20.0	20.0

Table 1.—Regional Distribution of Federal Support to University Research 1967-68

*Based on 77.6 million in federal grants, contracts, scholarships and fellowships for which regional breakdowns were available and clearly applicable.

etc., the precise significance of these data is open to some question; the reader is therefore cautioned not to attempt to use it for precise comparison.

The comparison based on support per graduate student shows quite a uniform distribution and gives no indication that a language group or region has been significantly favoured or neglected. Comparisons based on support per full-time faculty are more variable and show the Atlantic Provinces as receiving significantly less than the national average. Also, it is the subject of concern that the numbers of active research scientists, per head of population, are significantly lower in French Canada than in other parts of the country. While we do not believe that these imbalances are the result of discriminatory practices by federal granting agencies, we do believe that federal policies for their redress are not now adequate.

The Science Council therefore recommends that the Federal Government increase its efforts to correct the existing disparities and further suggests that this can be best achieved by assisting in the development of centres of excellence in these areas. The Strategic Development Grant suggested by Macdonald and supported by the Science Council provides the instrument with which to do this. (See page 27)

Active Role of the Councils

Macdonald and his committee have suggested that the granting councils should play an entirely passive role in providing support for university research. They see the councils as responding to proposals originating from universities and awarding their support purely on the basis of whether or not the proposal represents "good research".

The Science Council believes that this basis alone is not sufficient and that, in addition, the granting councils must play an important role in giving broad guidance to the direction to be taken by university research. In other words the granting councils must always be able to support good research which is purely interest-motivated but also they must be willing and able to stimulate research activity in important areas where development is lagging.

The areas of research pursued by universities and the fields of training of their advanced degree graduates are not the concern of universities alone; they are also the concern of the nation. We do not believe that the sum of the policies of individual university researchers necessarily provides the best policy for the nation.

There is need in Canada to achieve more co-ordination and a closer co-operation between the sectors of universities, government and industry. *Within the university sector itself, it will be increasingly necessary to specialize and to concentrate efforts in order to achieve the standards of excellence which we desire.* The Science Council believes these objectives can be more readily achieved if the granting councils, as well as the mission-oriented departments and agencies, play an active role in the broad orientation of our university research effort.

University Research Cost

In the accounting practice of most universities the direct costs of research include materials and supplies, salaries of research and research support personnel, travel and services for which there is a direct charge against a project. All other costs including academic salaries, administration services, heat, light, power, plant maintenance and the cost of services not readily assigned against a particular project fall in the general category of indirect costs. These indirect costs of doing research are as real as the direct costs and they can be very substantial. It has been estimated by the authors of Special Study No. 7 that the indirect costs of research, exclusive of academic salaries, average about 35 per cent of the direct costs. The question of who should pay these costs has been raised by these authors, with the suggestion that when the Federal Government undertakes to support a project, it should cover the total cost including all indirect costs.

The Science Council believes that this question does not have a single answer covering all situations. Research in the university is normally associated with graduate education and for this reason the participation of the Federal Government in university research should be viewed as a partnership with the university in an activity having the two components of research and education. As there can be very considerable variation in the relative research to education content of projects, so there should be flexibility in the way in which the costs are shared.

Consequently, the Science Council does not wish to make a general recommendation on the manner in which costs should be shared but rather to indicate general principles to be used as guides in arriving at a distribution of costs approximate to the situation.

We begin by noting that we consider federal contributions to university education, which are presently done by the fiscal transfer mechanism, as an entirely separate question and we will not discuss this issue here.

The first point we wish to make concerns academic salaries—in this, we fully support the recommendations of the study group that the full costs of all academic salaries be paid by the universities. Where it becomes necessary for a member of the faculty to devote temporarily most or all of his time to a research project, appropriate arrangements may be made in the exceptional case to compensate the university from project funds. Similarly, in developing a new centre of excellence where initially the teaching role of some or all of the academic staff may be minimal, arrangements should be possible to meet some or all of the academic salaries from the grants for a limited period. *Regardless of these interim arrangements, in principle the university should remain responsible for the salaries of academics.* We believe, however, that present formulae for appointing academic staff frequently do not give adequate consideration to the needs of those departments with large research activities but relatively small teaching loads.

Projects initiated at the request of mission-oriented agencies, for the furtherance of their missions, should allow for all direct and indirect costs except academic salaries. The amount should be, as much as possible, the actual total cost to the university, but where the indirect costs are not actually known, we would consider 35 per cent of direct costs as a reasonable estimate.

Large-scale projects involving many people, and at times requiring new buildings, present special problems for universities and should be given special consideration. Not to allow overhead on such projects could, in some cases, cause serious financial hardships to the universities, forcing them to rob academic programs to pay their share of what may be a research project having only a very small direct educational component. Such cases should be individually negotiated from the general premise that the university contribution should be related to the direct contribution which the project will make to graduate education in the university. In keeping with our earlier recommendation, academic salaries should normally be covered by the university and should be its major contribution.

Certain research institutes associated with universities have research as their principal activity and have little or no involvement in the graduate teaching programs of the university proper. These institutes present a totally different problem; for them the receipt of full overhead including salaries is essential to their very existence. It would be expected, however, that the bulk of the research conducted by these institutes would be supported by the mission-oriented agencies. Moreover, we believe that these agencies should normally be prepared to pay the full costs of the work which they support. When the granting councils consider there is justification, the same principles of "total funding" should apply.

Participation in Capital Expenditures

For research to flourish in Canadian universities, it is necessary to do more than meet the current, direct and indirect, expenditures. In addition, substantial capital outlays are needed to cover the costs of buildings, of library facilities, of computing facilities and of major equipment. Without the availability of these, it would be pointless to offer grants covering operating expenses. University researchers would not be in a position to accept them. The Federal Government, at some time or other, has contributed towards each of these capital costs but a clear federal policy has not evolved in all cases.

Major equipment generally, has received favourable consideration from the National Research Council and has been funded under special grants. This practice has been successful in the past and should be continued.

Computing centres have likewise enjoyed favourable consideration from the National Research Council. Over the past five years, NRC lump sum grants have covered about one-third of the total capital and operating costs of computing facilities in Canadian universities. This practice of awarding lump sum grants has been a very effective means of stimulating the rapid development of this important aspect of university research and the National Research Council's foresight in establishing this as an area of priority, several years ago, is to be highly commended. However, computing centres are now sufficiently evolved in most universities that operating costs are becoming a more significant factor than acquisition costs.

As a result, we believe it is time to begin very carefully phasing-out this method of financing in favour of a formula that associates the costs of computing more directly with the projects that utilize the facilities. Accordingly, we recommend that computing costs be recognized as legitimate direct expenses by all three granting councils and by the mission-oriented agencies.

As this latter program is implemented, the relative level of support from lump sum grants may be correspondingly reduced.

It is quite advisedly that we recommend that the present "lump sum" program be "very carefully" phased-out.

The field of computing services is unsettled and very competitive at the present time; there have been instances of commercial firms, on both sides of the border, offering services to university researchers at prices below full cost and which cover only a portion of the heavy overhead burden associated with computing facilities. If forced into open competition under these conditions there are real dangers that the excellent computing facilities, which many of our universities have acquired, might be soon decimated. This situation will bear careful watching over the next few years and may eventually require some corrective action on the part of the Canadian government (e.g. anti-dumping legislation).

Facilities for research on computers themselves and facilities for research on computer applications present a totally different situation and require special consideration. Unlike service computers, facilities of this type need not be available to all universities.

In this, as in many other areas, we must aim to concentrate our resources so that those facilities which we do undertake to develop may be truly first rate and entirely adequate for the job.

We believe that such facilities should be established, as needed, in a few carefully selected universities in different regions of Canada. Special funding would be provided under one of the general types of grants which are discussed in a later section of this report.

Federal support of university libraries has been almost entirely limited to that provided by the Canada Council. In the fiscal year 1967-68 this amounted to one million dollars for acquisition of books and approximately one-half million dollars in capital grants for library buildings. While this amount represents a great improvement over previous years, it falls far short of the amount which would be required to raise the standards of our university libraries to an acceptable level. Recent studies of our national and our university libraries have revealed a situation which is a cause of national embarrassment. We suggest that problems facing university libraries be referred to the body which the Council expects will be created to guide our national information policy. (Recommendations on this body will appear shortly in the Council's report on Scientific and Technical Information Dissemination.) As a means of alleviating the problem of inadequate library materials, which frequently faces the researcher, the Science Council recommends that the cost of books relating to the subject matter of a research grant be allowed as a legitimate direct expense of the project and become the property of the university library.

Despite the substantial building programs undertaken by most major universities in recent years, the factor which most limits the expansion of research and graduate programs at the present time is the shortage of building space. With the sharp increase in enrolment which is forecast in the years immediately ahead, this problem could reach crisis proportions within the next five years. The most recent estimates of the capital requirements for university buildings, given in Special Report No. 7, place the figure at \$1.987 billion for the period 1968-69 to 1974-75. It is further estimated that of this total, \$817 million, or \$117 million per year, can be directly ascribed to buildings or portions of buildings used for the purpose of research.

The Science Council recognizes the magnitude and the urgency of this problem but considers it would not be wise to attempt to categorize buildings or even parts of buildings as "used for research" or "used for teaching", even though such a categorization might be "useful" to delineate the areas for federal and provincial initiative. The accuracy of such a separation would be very questionable in practice. Moreover, it is our view that, in order to derive a maximum of benefit from research, it should be conducted in as close proximity as possible to the teaching activities.

Considering that the problem of buildings for research is part of the larger problems of a general shortage of space in universities, we recommend that a federal-provincial meeting be held in the near future to consider the problem of building space generally, and of building space for research in particular.

Growth of Graduate Enrolment

Enrolment in the graduate schools of our universities has shown unprecedented growth during the past decade, rising from 4 600 full-time graduate students in academic 1958-59 to more than 30 000 in 1968-69. Projections to academic 1975-76 are given by Macdonald in Special Study No. 7. These data show a continuation of this trend although at a somewhat reduced rate. Several factors contribute to the strong demand for graduate education:

(a) it is the continuation of a trend toward higher average educational attainment, which has existed since the birth of our country, and which is now being reflected most strongly at the highest academic levels.

(b) the population in the age group from which most entries into graduate school occur has been rapidly rising and will continue to increase at an "above-normal" rate until the early 1980s.

(c) the demand of modern society for more skilled and less unskilled manpower is creating more general concern with education.

(d) the greater availability of graduate student support in the form of fellowships, research assistantships, studentships, etc., which has made

it possible for many to undertake graduate studies without having to rely on support from parents or sponsors.

Despite these very rapid enrolment increases of recent years, Canada still produces substantially fewer advanced degrees proportionately than does the United States. In the academic year 1967-68, Canada produced 59^4 doctorates per million of population compared to just over 100^5 doctorates per million of population, for the same period in the United States.

The comparison with the United States is even less favourable if it is made in terms of the number of citizens of each country to receive doctorate degrees. If one assumes the division between the number of Canadians and non-Canadians receiving degrees to be in the same ratio as the enrolment in graduate schools of science and engineering (viz. 1:1), then the number of Canadians receiving Ph.D. degrees in Canada becomes 30 per million compared to approximately 84 for the number of Americans receiving Ph.D.s in the United States. There are, however, some indications that Canada is catching up with the United States in the output of advanced degrees. Projections by the National Research Council⁶ for the academic year 1975-76 predict a Canadian output in all fields of 175 doctorates per million of population compared to 160 per million predicted by the National Science Foundation for the United States in that year.

Employment Opportunities

Recent projections by the National Research Council indicate that, if present trends continue, the number of positions available in research and university teaching in science and engineering will be appreciably below the number of doctorate and masters degrees awarded. This result may be somewhat surprising in the light of the comparative figures, between Canada and the United States, which were just considered. We must remind ourselves, however, that the per capita expenditure for research in Canada is less than one-third of what it is in the United States. This must not be taken as an implication that we are producing too many persons with advanced degrees. On the contrary the Science Council believes that it is in the interests of Canada to have many highly educated people. The economic value of education is accepted in our modern society and higher education is itself a major goal of Canadians.

The Science Council, therefore, does not believe that we are in the process of producing an over-supply of persons with advanced degrees. It is concerned, however, that opportunities be made available so that we may retain in Canada, and make the most efficient use of, this valuable resource.

It is probable that the number of "research trained" persons will exceed the number of openings for careers purely in research during the next decade. However, Canada will continue to have a great need for skilled teachers,

⁴ National Research Council, Office of Economic Studies.

⁵ National Science Board. Graduate education: Parameters for public policy. Washington, 1969.

⁶ National Research Council, Office of Economic Studies.

business managers and highly educated persons generally to carry us forward in a world which, day by day, becomes more complicated and more competitive.

In order to utilize better this valuable resource, it will be necessary to institute corrective measures both in and outside our universities.

Outside the framework of our universities, we must improve research opportunities principally in the industrial sector. The growth in this sector, during the past few years, has fallen far short of expectation. We believe that urgent priority must be given to creating in Canada an atmosphere which will favour innovation and industrial growth.

Within our universities we must remain flexible and be prepared to adapt our graduate training programs to the changing requirements of society. In particular, the Science Council believes that more emphasis should be placed, at this time, on developing the business, management and teaching skills of advanced degree graduates. It also believes that we should strive to develop more adaptability in our graduates. Many of our M.A. and Ph.D. graduates are very reluctant to enter fields of employment which do not coincide with the narrow specialty in which they did their graduate work. This problem may be corrected in part by providing a broader base for graduate training and in part by correcting the attitude, too often found amongst our young Ph.D. graduates, that the subject of their thesis has irrevocably determined their field of work. Added to this is frequently the attitude that only research of a most fundamental nature is worthy of their attention. The prevalence of these attitudes results in some industrial employers hiring bachelor level candidates, which they train on the job, in preference to those with advanced degrees who would better fill the position. These are but some of the manifestations of a generally unsatisfactory relationship which exists between universities and industry in Canada. This is a problem to which we will have to devote much more attention in future and in which we believe the National Research Council has an important role to play.

Projections of manpower resources and requirements, such as those produced by the Forecasting Committee of the National Research Council and by the Department of Manpower and Immigration, will become increasingly important as a source of information upon which governments and universities can base meaningful policies and from which students may make "informed" choices of discipline. We recommend that the National Research Council undertake such forecasts regularly on at least a biennial basis.

Foreign Students

The number of foreign students in Canadian graduate schools is large, particularly in the natural sciences and engineering. Approximately 50 per cent of all doctorate students in science and engineering in Canada are neither Canadian nor landed immigrants.⁷ By way of comparison, foreign

⁷ National Research Council of Canada. Projections of manpower resources and research funds 1968-72. Forecasting Committee. Ottawa, 1969.

students make up about 17 per cent of doctorate candidates in science and engineering in the United States.⁸ The Science Council would not question the desirability of training these large numbers of foreign students, many of whom came from developing countries, if the situation had been arrived at as part of a conscious policy to assist developing countries or to enrich our scientific and cultural environment. The fact that it has arisen in a *de facto* manner, as the result of departments importing large numbers of foreign students in order to achieve a rapid expansion of their research programs, leads the Science Council to believe that the situation should be critically examined. The significance of training relatively large numbers of non-Canadians cannot be properly assessed at present as we lack statistics on their movements after graduation. Likewise, we lack information on the number of Canadians, doing graduate studies abroad, who return to Canada after graduation.

Financial Support for Graduate Students

While there can be no denying that the Federal Government has a profound interest in the production of qualified research manpower and in the research which graduate students perform as part of their training, the fact remains that graduate training per se is education and constitutionally belongs in the provincial sphere. However, in the same way that the Federal Government has assumed part of the cost of universities generally, so it should assume a share of the cost of graduate student support. It is even more justified in this latter case as advanced degree graduates are the most mobile of all graduates.

It is in the interest of the country that the candidates for advanced degrees be those graduates displaying the best capabilities in terms of intelligence, academic preparation and motivation, rather than those having the best financial resources. A study conducted in the United States in 1961 indicated that only 1.2 per cent of the population who possessed an intelligence score of 130, considered average for a Ph.D., actually got a doctorate.9 We do not imply that these figures apply to Canada in 1969, but nevertheless they are an indication that we are not making the best use of the talent we have available. Yet in very few human activities is the output, in terms of economic, social or cultural value, more dependent upon the quality of the man than it is in research. For this reason, it is most important that we make available sufficiently generous financial support to attract our best talent to graduate schools. It is equally important that the largest possible portion of these persons remain in Canada after graduation. One way of achieving this is by increasing the ratio of Canadians to non-Canadians taking advanced degrees.

⁸ National Science Foundation. Graduate student support and manpower resources in graduate science education, fall, 1965 and fall, 1966. Washington, 1968. (Office of Planning and Policy Studies)

^o U.S. National Research Council, Office of Scientific Personnel, National Academy of Sciences. The high school backgrounds of science doctorates. Washington, 1961.

For these reasons, the Science Council recommends that appropriate forms of financial support be made readily available to all highly qualified Canadians, so that financial constraints should not be a barrier to any such Canadian students.

At present, adequate support is available in most fields of the natural sciences and engineering, but in the social sciences and the humanities many students have little or no access to support. This shortage of funds for support no doubt results in large numbers of talented graduates passing up graduate school in favour of immediate employment.

Administrative Procedures

Special Study No. 7 examines very closely the mechanisms and the procedures by which federal support to universities is administered. Weaknesses in the present system are pointed out and many excellent recommendations for improving administrative procedures are made in this report. Although not in agreement with all of the recommended changes, the Science Council believes that all federal agencies supporting university research should examine these recommendations carefully and implement changes where necessary. A few of the more fundamental issues will be reviewed below.

(a) Confidentiality in University Research

One of the most jealously guarded privileges of the academic community has been the right to do investigations openly and to publish findings without restriction. In this way, universities have become the principal platform for generation and dissemination of new knowledge, as well as one where fundamental issues affecting man and his universe can be exposed to the test of open and unmuzzled scrutiny. The Science Council considers it important that universities retain the intellectual independence which will permit them to continue to perform this role in society. To accept sponsorship under conditions that systematically limit the general accessibility of research findings seriously undermines the ability of universities to perform this role. On the other hand, university researchers must recognize that certain information can only be given with the understanding that it is confidential and that it will be handled in a responsible manner. Raw data in such fields as taxation, civil or criminal law, finance are notable examples. To enter into a confidentiality agreement regarding data which he himself did not obtain is in no way an infringement on the freedom of the researcher; to enter into a confidentiality agreement regarding the results which the researcher himself will generate is another matter.

Much of the significant research that is conducted today has associated with it some degree of confidentiality. In most cases, this merely requires that disclosure of the findings be delayed for a moderate period of time; time to submit official reports in the case of royal commissions and study groups, time to apply for patents or to make internal reports in the case of missionoriented agencies and industries. Where there are restrictions on immediate disclosure of findings of the results of research, these should be clearly worked out in advance, and stated in writing, and should be subject to formal review procedures in both the university and the agency concerned.

(b) Involvement of University Administration

The task of university management is sufficiently difficult that agencies of the federal government should avoid taking any actions which undermine the universities' authority and render its task of administration more difficult. There can be no justification for royal commissions entering into agreements with individual professors, which take large portions of their time for extended periods, without even advising the university administration. Nor should a council grant leave fellowships to professors without consulting the interested members of the administration. The practice of making payments for supported research directly to the principal investigator should never be allowed. No federal agency should approve a university research project without prior endorsement of a responsible administrator of the university. The principle here is simple. The university is responsible for the support of its academic staff and for providing them with the facilities needed to perform their duties; in return it is entitled to their services. If a federal agency wishes to employ the services of academics or sponsor research in university facilities, it must involve the administration, who may have to make arrangements to replace the academic concerned in some or all of his duties or to provide the needed space and services for the project.

(c) Need for Greater Uniformity and Simplicity in Administrative Procedures

The task of university administrators and researchers alike is needlessly complicated by the great variety of grant arrangements and of the regulations by which they are governed. Each agency, it seems, has its special forms and its special rules to cover essentially the same types of grants or contracts. While recognizing that a single agreement form and a single set of rules cannot adequately cover all circumstances, it is our firm opinion that a few types of agreements governed by relatively simple sets of rules could be formulated to cover the needs of all the federal agencies sponsoring research in universities. The format and the regulations of these legal instruments is a matter which should be investigated by the Intercouncil Co-ordinating Committee, whose formation is recommended in a later section of this report. (See page 26.)

Section III

MECHANISMS FOR FEDERAL SUPPORT

Support from Mission-oriented Agencies

In an earlier report, *Towards a National Science Policy for Canada*, the Science Council expressed the view that "a major failing in Canadian science has been the performance of too much basic research remote from the training of new scientists and the performance of too much applied research far from the point of innovation". It went on to recommend that "(federal scientific organizations) to an increasing extent should be the initiators and co-ordinators rather than the performers of R & D".

The Science Council holds to the validity of this recommendation and urges departments and agencies of the federal government, when considering new programs or expansions of existing programs, to develop these in the university or industrial sectors whenever possible.

Fundamental research projects are most easily adapted to graduate students' training programs and should be funded in universities to the largest possible extent. It is recognized, of course, that a certain amount of fundamental research will need to be done intramurally for overall balance of the departments' research programs as well as for reasons of expediency. Although much of the applied research and development required by the departments outside of the health field, can be performed most effectively intramurally or by industry, consideration should also be given to universities to perform this kind of work. Applied research can be an appropriate medium for graduate training and the more intimate contact which it would produce between academics and those concerned with the practical problems of the outside world would have a salutary effect on all. In the academic year 1967-68, the mission-oriented departments provided approximately \$17.5 million for the support of scientific research in universities. This represented only about 20 per cent of the total direct federal support for that year and less than 7 per cent of the intramural research expenditure of the departments. The Science Council believes that an increase in the proportion performed in universities could be effected with benefits to both the departments and the universities concerned. We, therefore, encourage the departments to adopt policies whereby the amount of research contracted out to universities is systematically increased.

Most of the research support by the mission-oriented departments in the past has been mission-oriented or applied. This we expect will continue in future. However, there are areas of mission-oriented research of national importance which do not lie within the interests of government departments and agencies and for which the granting councils will have to continue to provide support.

Support from the Granting Councils

Although we foresee that the mission-oriented agencies will commit an increasingly large portion of their research budgets to research done in universities, there will continue to be a vital need for support from an agency or agencies whose major concern is the balanced development of knowledge in Canadian universities.

Where the mission-oriented agencies will support university research in areas proper to the furtherance of their missions, other agencies must be concerned with supporting the kinds of research which give depth and balance to the universities and upon which the universities may build strong "research training" programs.

As was pointed out earlier, the Science Council believes that there is need for universities to pursue the discovery of knowledge which is of a fundamental nature although its relevance to Canadian goals may not be immediately evident. Such research is necessary to the advancement of knowledge on a broad front and to the maintenance of balance in the development of science and scholarship. Support from the mission-oriented agencies, of necessity, develops along specific lines corresponding to the requirements of their particular missions and leaves large areas along the frontiers of knowledge to be attended to in other ways. Support in these areas is the proper responsibility of agencies who have the broader mission of concerning themselves with the overall maintenance of a viable scientific and scholarly community.

The function of providing this kind of support has been filled by the National Research Council, the Medical Research Council, and the Canada Council. It is largely as a result of the support from these three institutions that Canada has been able to develop universities whose standards rate high on international scales. In recent years the level of funding from all three Councils has risen very rapidly. In the five-year period from the academic year 1963-64 to 1968-69, the annual support for university research from the National Research Council grew from \$12 million to \$60 million. In the same period, Medical Research Council support rose from \$5 to \$27 million, while Canada Council fellowships, scholarships and research grants to universities increased from about \$1 million to \$16 million.

This very significant change in the scale of federal support for university research and the changing needs of university research has led Macdonald and his study group to re-examine the mechanisms and structures through which this support is administered. They have pointed out a number of weaknesses in the overall granting system and have proposed, for their correction, extensive modifications to the basic structures of the three existing councils. In our review of this question, we begin by examining the basic requirements of university research, in particular how these requirements have changed in recent years and how they are likely to change in future years. The very rapid increase in graduate enrolment, coupled with the increasing sophistication of research, has made research budgets very substantial portions of overall university budgets. The result is that universities have become increasingly dependent for the operation of their research programs, and indirectly for their graduate teaching programs, upon the support provided by the Federal Government. Areas of research which are unable to get funding from the councils or from any of the government departments become neglected and are retarded in their development.

A recent trend in research in Canada and elsewhere is that toward multidisciplinary projects. We consider that this trend is desirable and one which will become increasingly important in the future. Its development will demand a much greater degree of co-operation between the various funding agencies than has hitherto existed. It will also require much more effective co-ordination within the universities themselves at department and faculty levels alike.

As knowledge expands, new disciplines will be born and old disciplines will evolve to no longer fit the established pattern. Our system of support must have the capability of recognizing these changes as they occur and it must also possess a mechanism to ensure that support from the funding agency can be re-oriented as required.

Although there are many structures which could adequately accommodate these needs of university research, the Science Council believes there are certain principles which are of fundamental importance and which must apply regardless of the details of the structures which are adopted. These principles are the following.

Comprehensiveness of Support

We have pointed out in Section II that agencies supporting university research on behalf of the Federal Government should collectively encompass within their terms of reference all disciplines recognized by Canadian universities as areas for research. The responsibility for ensuring that this is the case rests with the granting councils. This does not imply that the granting councils should themselves support research in all areas. They may well find that certain sectors are satisfactorily covered by the mission-oriented departments or in other ways. What is important is that their activities be coordinated, among themselves and with federal departments, in such a way that all areas may be eligible for consideration within the federal support structure.

Separation from other Activities

The Science Council holds the view that university research is an activity of vital national importance and consequently the level of funding directed specifically to this purpose is a matter to be decided at the political level. Moreover, the mechanism which is employed should provide for the voice of university research to be heard at the ministerial level. The view expressed by the Macdonald study group, and supported by many in the scientific community, is that this could be achieved most satisfactorily by completely separating university granting activities from other activities. In accordance with this view, they have recommended that laboratories be separated from the granting functions of the National Research Council. Similarly, they have recommended that the support of research in the humanities and social sciences be separated from the patronage of arts; the latter remaining with Canada Council, while a new organization would be created to handle the former.

The Science Council has given careful consideration to these two recommendations. It considers that the natural evolution of events will lead to the separation of the granting function from other activities in all of the Councils in the not-too-distant future. However, it has concluded that the interests of university research can, for the present, be served within the general framework of the existing Councils, provided their internal administrative structures meet certain basic requirements.¹⁰

In the case where a granting council is engaged in activities other than the support of research in universities, we consider it essential that the university research support function be separated from other functions at a senior administrative level and that funds destined for university research be obtained under a separate parliamentary vote.

In this connection, we note with approval that the National Research Council has in recent years adopted the practice of requesting funds for its intramural laboratories, its university support program, and its industrial support programs under three separate parliamentary votes. We consider it essential that this separation be retained when the new format of the estimates is adopted next year. Likewise, we strongly endorse the recent moves which it has made to separate the administration of these three functions at the level of vice-president. We believe that Canada Council should institute similar practices. The Medical Research Council engages primarily in the support of research in universities and thus presents no special problem at present. If it exercises its authority to operate laboratories, similar practices will become necessary.

The need for a separate parliamentary vote and for separate administration of funds does not apply to the mission-oriented departments. These departments must justify their budgets in terms of their particular mission rather than in terms of the needs of university research. Accordingly, the criterion for supporting a particular project in the universities must be its relevance to the needs of the department for information or for manpower of a particular skill. Decisions of this type must be left with those persons responsible for the operation of the department.

¹⁰ While this represents the official position of the Science Council on this question, some members held strongly to the view that phasing-out procedures, leading eventually to a complete separation of the National Research Council granting activities from its laboratories should be initiated immediately.

Adjudication by Experts

The needs of different branches of knowledge differ very considerably and as a consequence the allocation for research must be in the hands of persons having the special understanding and knowledge, which comes only to those who are themselves actively engaged in the field.

The National Research Council, for many years, has adjudicated grants, with good success, by means of review committees drawn from experts actively engaged in research in the disciplines concerned. The Medical Research Council also uses review committees but, in addition, applications are first appraised by one or more external examiners. In the method employed by Canada Council, the application is first reviewed by two or more "assessors" drawn from experts in the field before being considered by the "Academic Panel". Canada Council's Academic Panel differs from NRC's and MRC's Review Committee in that there is a single Academic Panel composed of persons representing a broad range of disciplines. The National Research Council and the Medical Research Council have many review committees, each composed of persons who are expert in the discipline of application considered.

While we recognize that the standards of evaluation in the social sciences may be based on different values than those employed in the physical sciences, we believe that more standardization in the mechanisms and the methods of adjudication used by the three councils should be sought. We believe there are some good features in the three basic approaches which are presently used. The techniques employed by the National Research Council and the Medical Research Council have been relatively free from criticism, so we believe that their experience should be of particular value in arriving at improved procedures for adjudication which are acceptable to both grantors and grantees in each of the major fields.

Co-ordination of Activities

The needs of the "in-between" disciplines and the growing importance of interdisciplinary research make it essential that the activities of the granting agencies be very well co-ordinated. Because of this, many believe that the most appropriate mechanism would be a single granting council separated into three or more strong and relatively independent committees representing the major branches of knowledge. However, we have three well-established institutions serving us in this function and it would be unwise to attempt such a fundamental re-organization at this time. The Science Council believes that the immediate needs of university research in Canada will be better served by making the necessary modifications to the existing system than by creating a new agency or agencies.

Except for the question of co-ordination, most of the immediate problems alluded to above, and discussed in some detail by Macdonald in Special Study No. 7, can be corrected by modifications where necessary within the existing Councils.

For the problem of co-ordination we recommend the formation of a permanent Intercouncil Co-ordinating Committee along the lines suggested by Macdonald.

A suggested composition for this committee could be the following:

- -the chief executive officer of each of the three granting councils, or his representative;
- ---one other member of each council who is not an employee of the council;
- -three representatives from the Association of Universities and Colleges of Canada, one for each of the major branches of knowledge;
- -the Chairman of the Federal Advisory Panel on Science and Technology for reasons discussed later.

The Science Council recommends that the chairmanship of the committee be rotated annually amongst the three principal representatives from the councils. Continuing staff, as required, would be financed by the transfer of funds from the granting councils.

The principal functions of this committee would be to ensure the "coverage" of all disciplines and to provide mechanisms for the support of interdisciplinary projects. It would serve as a forum where common problems confronting the councils in their granting functions could be discussed and resolved. It would also provide the link through which universities could air their views and a means whereby federal policies, in matters of research support, could be communicated to the administrative heads of universities. Macdonald and his study group have well identified numerous administrative problems and have offered certain solutions. We suggest that the Intercouncil Co-ordinating Committee immediately examine these problems and consider the solutions offered by Macdonald, as well as other solutions which may appear appropriate.¹¹

So that this committee may be effective in co-ordinating the support of research to universities by the Councils, they will need to know the level and areas of support being given by all other departments and agencies.

It will be necessary, therefore, that each agency provide the committee with full information on research support activities. Conversely, the Intercouncil Co-ordinating Committee must be ready to make available to any department, upon request, details of the granting activities of all other federal agencies in the sector in question. A similar exchange of information, will be necessary between the Co-ordinating Committee and granting agencies at the provincial government level.

Types of Grants

In order to look after the different needs of university research, a number of different types of grants are required. The Science Council believes

¹¹ There exist anomalies in the present granting system which were not dealt with in Special Study No. 7. These should be examined and appropriately dealt with by the Intercouncil Co-ordinating Committee.

that the following six types of grants, most of which are already in use, will adequately cover all essential needs.

(a) Individual Project Grants

Project grants, awarded to individuals, traditionally have been the main instrument for the support for research in universities. They are the proper support instrument of "little science" and lend themselves very well to the types of research projects upon which to base graduate programs. The Science Council recommends that this form of support be continued where it already exists and that its coverage be extended to include those disciplines which presently fall "in-between" the coverage of the granting councils.

(b) Program Grants

As an instrument of support for small or intermediate size projects involving a group of investigators, who may or may not belong to the same department, the Science Council recommends the use of program grants. The procedures for adjudication and administration of these grants would be similar to those presently used for individual project grants.

(c) Major Grants

The Science Council has expressed the view that universities should become increasingly concerned with major problems relevant to Canadian goals. In this category, we would include such issues as urban development, pollution, mental health, etc. Investigations into problems of this kind are likely to be interdisciplinary and to require broad and continuing programs that could not be accommodated under either the individual project or the program grants discussed above. What is needed is a type of grant geared to the requirements of "big science". The Science Council recommends that funding be made available, in the form of major grants, to support large interdisciplinary programs which are significant to the realization of Canadian objectives. It would be the responsibility of the granting agencies to devise the special adjudication and administrative procedures appropriate to these large interdisciplinary programs.

(d) Negotiated Development Grants

A country with limited resources such as Canada must make the most of those resources that it has. Where particular strengths exist in universities, they must be cultivated and developed into true centres of excellence. The Negotiated Development Grants recently developed by the National Research Council are ideally suited for this purpose and should be continued. Grants of this type should also be made available to all of the disciplines in which Canadian universities do research.

(e) Strategic Development Grants

As we discussed in an earlier section, certain universities, because of regional disparities, have been slower to develop than others in the more affluent milieus of the country. So that these universities may move into

a front-line position along with their more richly endowed sisters, it will be necessary to build strengths where there is now no more than encouraging prospects and a strong desire to excel. The instrument with which the Federal Government can give new strength to these institutions is the Strategic Development Grant. This type of grant would be similar to the Negotiated Development Grant except that it would be designed to respond to a need rather than to build on strength.

(f) General Purpose Grants

Several agencies presently give universities non-adjudicated grants to be used at the discretion of the university. Examples are the General Research Grants, amounting to $7\frac{1}{2}$ per cent of the previous year's individual grants, which are paid by the National Research Council, and the \$24 000 allocated to medical deans by the Medical Research Council. These funds have provided universities with a certain degree of flexibility in the administration of their research programs and they have been particularly useful in providing a limited amount of "start-up" support for new members of faculty. The Science Council believes that this type of grant is a very desirable feature of the overall program. The costs of research are never totally predictable and the limited flexibility provided by these non-adjudicated funds is needed to cover unforeseen contingencies.

The Science Council therefore recommends that the practice, initiated by the National Research Council, of awarding General Research Grants be adopted by all granting councils.

Liaison between the Granting Councils and other Federal Agencies Supporting Research

At present, alternate sources of funds are available to researchers in many fields. In our view, this is a desirable feature of our present system and one which should be continued. Grants and awards must be managed by people and this alone is sufficient reason to expect that, where a single source of funds is available, some meritorious projects may not get funded. There is merit in allowing a second opportunity to seek support for projects, which may have failed under the first scrutiny through the application of conventional wisdom.

The existence of two or more sources of support increases the possibility of unnecessary duplication and it may increase the likelihood of some areas being overlooked if each source operates in isolation. For this reason the many federal bodies supporting research should have some liaison among themselves. An effective method of doing this would be by establishing a formal link between the Intercouncil Co-ordinating Committee, recommended earlier, and the Advisory Panel on Science and Technology of the federal government (the latter is a panel at the deputy minister level which serves the more formal Privy Council Committee on Scientific and Industrial Research). A suitable formula would be for the chairman of the Advisory Panel on Science and Technology to be one of the members of the Intercouncil Co-ordinating Committee.