

**The status of information on  
scientific activities in universities**

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THE STATUS OF INFORMATION  
ON SCIENTIFIC ACTIVITIES IN UNIVERSITIES

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*(With the Results of a MOSST Inquiry)*

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The modern university, in today's complex societies, has come to occupy a more and more prominent place. From an institution which saw its beginnings in the cloisters of medieval monasteries and whose purpose was the education of a handful of spiritual leaders and the exploration of philosophical truths, it has grown through the stage where it was the fashionable "finishing school" of the children of the rich to become an institution which directly affects the lives of a growing proportion of the population and explores the truths of every imaginable relationship. Much of this growth has occurred during the past half-century. We are still only dimly perceiving the full implications of the changes that have taken place all about us during this time, and still striving to understand the relationships that govern our existence.

For each of us to continue to function well in an ever-more-complex society demands that our human resources be husbanded just as diligently as our forests and our livestock. To these ends, we have already committed a growing portion of our resources and energies and we have accepted the principle that a university education should not be denied to any young person for lack of the necessary financial means to attend. We have, apparently, decided that for a growing proportion of the roles in a modern society, twelve years of

schooling is not enough; that two or four or seven or even ten more years may be required to develop the necessary skills and understandings. We accept that the far greater proportion of the resources necessary to provide this post-secondary education must come, in one way or another, from the public purse, although we have not yet agreed to what extent it is society or the individual who benefits most from this investment and whether or by what formula the individual should repay this investment. As the cost of educating is seen to be greater, this question becomes more and more weighty.

We have also perceived that many of the jobs which only a few years ago seemed to be worthy of a lifetime commitment have disappeared; that many more may disappear within our lifetimes. Thus we have accepted that adult retraining, at all levels from simple skills to complex professions, will demand a growing share of our educational resources. We have yet to develop a coherent policy with respect to the public vs. private sharing of the costs of such retraining. The report of the Wright Commission has urged that adult university education become an integral part of university planning. Under prevailing attitudes, the responsibility for the costs of such education are seen to be the responsibility of the individual - hence the bulk of this study is undertaken on a part-time basis. Yet universities and governments still plan and allocate largely on the basis of full-time enrolments.

The long-standing image of universities as remote centres of scholarly inquiry and fundamental research is being challenged by the urgency of modern problems, such as those of housing, transportation, health-care delivery, poverty, pollution and other problems of technological "fall-out". As the sole repositories of many kinds of specialized expertise which might be brought to bear on such problems, it is felt, universities can no longer maintain their detachment from the real world - especially when considering the rate at which their costs are rising relative to other sectors of the public responsibilities. Thus there is a growing demand for "relevance" in both teaching and research within the universities, as is so eloquently put forth in the recent report by Bonneau-Corry, commissioned by the AUCC<sup>1/</sup> This "service" role of universities is already well-developed in many universities in the United States, especially the "Land-grant" Universities.

Finally, there is growing recognition that there is a finite limit to the public (and private) purse; that while a full range of competence in all disciplines should be available within a given geographic area, every university does not necessarily have to encompass the full range. Decisions in respect of continuing or adding or discontinuing programs will have to be made.

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<sup>1/</sup> Bonneau, L.P. and Corry, J.A. "The Quest for the Optimum" (Report of a Commission to Study the Rationalization of University Research), AUCC, 1972.

Allied with or integral to all of the above issues is the question of university research. It is not the intention, here, to explore the relationships between teaching and research. It is sufficient to say, that, at the present time, both the federal and provincial governments appear to have accepted the principles that universities are a proper locus for the conduct of research; that some proportion (the far greater proportion seems to be presently accepted, though there are indications that the view on this may be changing) should be "basic" or "fundamental" or "curiosity-oriented" research; and that the federal government should underwrite the larger share of university-based research. There has been much criticism of the effects which past funding policies have had on the distribution of research activity among sectors of performance, among regions within Canada, among disciplines within the university sector, and even among researchers within disciplines, and there have been loud calls for new policies for federal support of university research.

Thus it is apparent that there are many major decisions to be made by and for universities in the years just ahead. Wise decisions demand valid information for use by both universities and governments. This information must encompass many areas: "hard" data on costs and expenditures, manpower and facilities; qualitative data on who is doing what, why and how they are doing it; "soft" information on goals and attitudes and policies; and the whole must be developed within an on-going framework of discussion among interested parties and the public.

## II ACTIVITIES OF MOSST

As the federal agency charged with the responsibility of overseeing national activity in science and technology, the Ministry of State for Science and Technology (MOSST) has taken the first steps toward developing the necessary information particularly with respect to research.

Already instituted is an annual survey of scientific activities within the federal government, which collects information on costs, expenditures and applications of research performed by and for government departments and agencies. The results of this survey along with background information, are published by the Ministry in its "Green Book" 1/. Also being published by the Ministry, will be a directory of Industrial Research and Development Units in Canada. Statistical information on government and industrial scientific activities is continually being upgraded. Presently efforts are being made to implement an Inventory of Scientific Activities in the federal government 2/.

### A. 1972 SUMMER PROJECT

To begin the process of providing detail in those parts of the picture of Canadian scientific activity for

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1/ "Scientific Activities: Federal Government Costs and Expenditures 1963-64 to 1972-73," Ministry of State, Science and Technology, Information Canada, 1972.



which only bare outlines exist, during the summer of 1972 six universities agreed to participate in a pilot project which was conducted for the Ministry by Statistics Canada. The purpose of the project was to explore the existing information base with respect to on-going research in universities, and to help each university attempt to answer some questions which were perceived as relevant to its research activity. Thus the form of the project differed from one university to the next. This was not surprising, since the amount of research activity varied greatly among them, the degree of centralization of records varied and the formalization of their information systems varied and also since the relationship of the universities to other government agencies differed. Due to these differences, the outcome of the project at each campus also differed.

### 1 General Procedure

The general procedure was to hire a senior student at each campus, and for Statistics Canada personnel to explain their assignment. To give initial direction to their inquiry, the questions asked in the survey of scientific activities in the natural sciences and

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2/ See accompanying paper on ISA (F. Ogilvie)

engineering in the federal government were provided, and suggestions made as to sources of the necessary information. Two follow-up visits were made during the summer. At the end of the summer, the students submitted written reports. The cooperation and assistance provided by university personnel was invaluable; without it, there would have been no useful outcome.

## 2 Results

It is now possible to outline some general features of the information base at universities, with respect to research, and to describe the major difficulties which will be encountered in developing a system for the comprehensive description of scientific activities.

### 2.1 General Features of Information Sources

In general, there are four or five sources of the desired information on scientific activities, each peculiarly well-suited to providing part of the information but generally in a form which does not allow correlation with the information from the other sources. These sources are:

central offices - the financial office, a research (sometimes located in the graduate faculty) office and a personnel office;

deans and departmental chairmen or offices;  
and principal investigators themselves.

Central Offices:

Because central financial record systems have been designed for internal and primarily budgetary purposes, they tend to be restricted to information which has an associated money transfer. Thus accounts are set up against which expenditures are charged as they are designated by the authorized investigator. Coverage of research, therefore, tends to be restricted to research funded from outside the university, but does not include contract or consulting work which is arranged privately between an investigator and an outside agency. (This is a source of internal conflict if such a contract in fact commits a university as a corporate body).

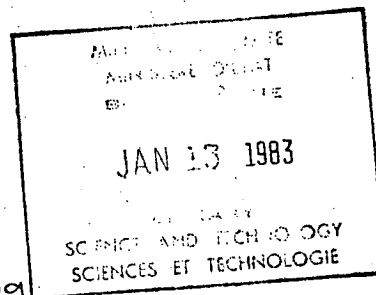
As the volume of research has increased there has been a tendency to establish research offices, or at least to designate an official in graduate offices to oversee the processing of grant applications. The records in such offices generally cover research funded both externally and internally from university research funds. The functions of such an office are generally to check applications for conformity with the rules of

of the funding agency, and to gather and disseminate information on available sources of funds. It is often difficult to distinguish between successful, pending and rejected applications, because notification of an award is usually given directly to the applicant. If either the investigator or the financial office notifies the research office, the date and amount of the award is usually recorded. This appears to be a problem of internal communication, aggravated by the varying practices of the funding agencies. (Those which are particularly remiss appear to be federal mission departments.) Again, private contracts or consulting agreements between investigators and outside agencies are not recorded.

A third central source of information, especially as regards manpower, is a personnel office. Since such records are generally maintained for payroll purposes, it is usually a manual operation to associate personnel records with a project budget.

Deans and Departmental Offices:

It appears that departmental offices or department chairmen offer the potentially most fruitful source of information on facilities, costs, substance and manpower. This is so because elements which are usually not



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part of central records and which are often overlooked by individual investigators are readily identifiable at the departmental level. This would include data on such as major equipment, space, facilities, non-funded research (which is absent from central records and tends to go unreported by individual investigators) support staff which may be paid out of departmental budgets, and the dispensation of departmental funds for research purposes. All may be estimated or at least identified at this locus.

Individual Investigators:

The individual investigator is probably the only source of information on consulting and most contract research which is privately arranged, and is undoubtedly the best source of information on potential applications and on substance, particularly for non-funded research. He is also the best locus for allocating funds and expenditures between research projects, and for resolving many of the problems which were encountered during the summer project and which are enumerated below.

## 2.2 Identified Problems

Most of the problems encountered in gathering comprehensive information about university research can be grouped into two general classes: those arising out of the limited purpose for which existing information is stored, and those arising from the attempt to arrange and classify the information in ways which will allow valid comparisons both internationally and nationally as between sectors of research performance.

The former set of problems arise because the purpose of the centralized information is largely to keep track of money flows; the latter set of problems included definitional problems and the problem of selecting an appropriate unit for analysis. There was also an interaction between this selection and the financial information.

1) Selection of a unit for analysis. There are two possible units which might be used for purposes of analysis. One is the individual investigator, the other is the project. Either has advantages and disadvantages, however the latter was selected because it is the unit upon which much of the funding of research is based, and is usually the term of reference in discussions. It is also the unit of analysis for other sectors of research performance.

It caused problems, however, in the allocation of both funds and expenditures, because it often happens that

- a project may be funded from more than one source
- a single award may support more than one project
- facilities, supplies and/or personnel funded under one project may be shared with other projects
- projects carried out by more than one investigator may be reported by both (or all) or reported by none.
- "Area" grants and "equipment" grants are not always associated with projects.

Selection of the investigator as the unit for analysis would not necessarily alleviate these problems.

It was found that a review of the departmental results, after cross-checking with financial and research records, with the department chairman was the best way of correcting for these problems.

2) Problems of coverage, already noted. For policy purposes it would be desirable to have information on substance and manpower utilization for all research including that which did not involve directly attributable income or expenditures.

3) Limitations of the accounting system. In general, it was not possible readily to identify accounts by principal investigator or by project.

It was done manually by the students but was very tedious. At the present time, many universities are in the process of computerizing their accounting systems. Since it is difficult to make changes at a later date, it is highly important that this capability be incorporated at the beginning.

Therefore it is most important to identify data needs before computerization is completed.

4) Problems of time definition. To define a time period for the study, the federal fiscal year (FFY) was chosen, as it coincides with much of the funding. However, it presented problems in that it does not coincide with the academic year, and may not coincide with the actual start or termination of a project. Thus there was a tendency to double-count held-over funds.

5) Problems of definitions and classification of information. The definitions used in the project were those developed for use in the federal government survey, and conform to those used internationally by OECD. One major problem arose in attempting to have investigators classify their projects as "basic" or "applied". This was strongly resisted as it was felt that it might be prejudicial to future grant applications. Therefore, presently the application



of the definition is most highly subjective.

A second major problem arose in explaining to investigators the concept of multiple potential applications and attaching dollar values to these. A third less serious problem involved classification by discipline, when the categories provided seemed too broad. It appears that this question could be eliminated, since departmental titles appear to give adequate information.

6) Problems of legitimacy. The success of any venture which involves the free gift of information is likely to be highly dependent upon the legitimacy which is associated with the request. In this study, reactions varied from complete cooperation almost to hostility, and the degree of response and quality of the information given was highly correlated. Thus it is important that the need for information be fully justified and accepted.

### 2.3 Information Gaps

The major information gap appears to be the great lack of information on research in the social sciences and humanities. This is associated with the lack of external funding for these researches.

There was little information which could be associated with projects with respect to personnel engaged in research. This is particularly true of students.

The information on the substance of the research was not fully analysed for two reasons: one was that for many of the projects reviewed there is already on file, in the Information Exchange Centre, an adequate description of the project. As coverage is extended beyond the natural sciences and engineering, this kind of information will become desirable. The second reason was that the students were not sufficiently knowledgeable about the sciences or about the classifications to be able to classify substantive information from grant applications. Provision of a code of standard classifications on application forms and records could alleviate this problem.

#### 2.4 In summary:

This project provided valuable insight, both to participating universities and to MOSST and Statistics Canada, into the existing information base with respect to research at universities.

Many potential problem areas have been identified, and major deficiencies outlined. The cost of the project to the universities was in overhead and supplies only, apart from the immeasurable assistance given. It is obvious that the cost of complete coverage of research information is dependent

on many factors: the state of the current information system, the size of the research effort, and the degree of cooperation received. To give an idea, at one university reporting about \$6M. in assisted research funds in 1971-72, it is estimated that approximately 80% of this research was covered by one student during the summer, at a direct cost of approximately \$2000.

The potential advantages of a centralized information bank, with suitably controlled access, cannot be overstated, when it is considered that with such a facility both universities and other users could be provided with answers to queries, eliminating the multiple requests for essentially the same material which now occur. MOSST recognizes the commendable efforts which universities and regional associations are making toward the development of regional information systems. It is hoped that coordination can be achieved on a national basis, with MOSST supplying whatever help is necessary, acting as the central keeper and the honest broker, and eventually serving as the buffer between information seekers and university researchers. As a result of this past summer's enquiry it has become apparent that there is an urgent need for potential users of university research data

to define the elements which must be included if the information is to be useful for policy and planning purposes.

B. OTHER ACTIVITIES

In the context of examining scientific activities in the university sector, MOSST has recently sponsored two conferences - one of University Presidents and one of Deans of Engineering - to discuss the implications for science policy of university research. The meeting with CAURA representatives is another in an on-going series of consultations in which it is hoped that greater understanding among parties concerned with research can be developed, and specific undertakings launched.

MOSST is currently engaged in a pilot study of the indirect costs associated with the conduct of research. It is also engaged in consultation with provincial authorities with respect to the development of a university research information base. While the anticipated lengthy process of consultation and needs-definition is taking place, MOSST is preparing to undertake limited-scope projects of the sort described in this paper, to illuminate potential problem areas or areas of particular concern or interest. Specific suggestions for such projects are being sought. It is particularly important

that data needs be defined by all potential users, so that the necessary capability be built into evolving data systems during this critical formative stage.

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