Ministry of State
Science and Technology Canada

Ministère d'État
Sciences et Technologie Canada

security classification

cote de sécurité

SCIENTIFIC MANPOWER IN THE FEDERAL GOVERNMENT (PHASE II)

****

BACKGROUND PAPERS

working paper

document de travail

SCIENTIFIC MANPOWER IN THE FEDERAL GOVERNMENT (PHASE II)

****

BACKGROUND PAPERS

B. Bhaneja and D.E. Read

Government Branch
Ministry of State for
Science and Technology

April 1979

ACKNOWLEDGEMENTS

A number of officials from departments and agencies kindly made their time and experience available in the preparation of the background papers. We would like to express our thanks to those who participated: Dr. C.W. Perryman (AECL), Dr. E.Y. Spencer (CDA), Dr. H.R. Eisenhauer (DOE), Mr. H.L. Ferguson (DOE), Mr. I.R. Cameron (DND), Mr. T.S. Sterling (DND), Mr. G.R. Vavasour (DND), Dr. K. Whitham (EMR), Mr. P.J. Choquette (NRC), Dr. R.F. Pottie (NRC), Dr. P.A. Redhead (NRC), Mr. C.D. Stothart (PSC), Mr. D.R. Alton (PSC), Mr. G.P. Soley (PSC), Mr. B. Schumacher (PSC) and Mr. C.E. Leighton and Mr. M. Watts from the Treasury Board Secretariat.

TABLE OF CONTENTS

I. RECENT SCIENCE POLICY INITIATIVES AND THE ROLE OF THE SCIENTIST AND RESEARCH MANAGER IN THE PUBLIC SERVICE

BACKGROUND AND PURPOSE

The employment of science and technology (S&T) in the federal government can be examined in a number of ways. S&T is viewed by departments and agencies as a major resource to be utilized in discharging mandates or in achieving identified goals and objectives. It is also used in responding to recognized national goals that would not necessarily be embraced within the mandate of an individual department or agency. In addition, the aggregate effort of the federal government in S&T is of such magnitude that it includes information and expertise that could be beneficial to other sectors, particularly industry.

Federal departments generally tend to view research, which is investment in additional knowledge, as a means or tool whereby various objectives might be realized, not an end in itself. Science activities must be performed in support of the mission of the department in fulfilling its regulatory, planning, standard-setting, operational, management, or testing functions. To complement and support these and other non-scientific functions where applicable, federal establishments should ensure that they have an adequate in-house S&T capability and competence to successfully undertake tasks entrusted to them.

Science thus has a major contribution to make at the federal level in fulfilling functions implicit in the statutory responsibilities of federal departments and agencies as well as through the introduction of scientific knowledge, analysis, and methodology to long-range planning. It is being used both in solving immediate problems and in examining long-term questions which may not yet be identified as problem areas.

As the results of government research may also benefit other sectors, policies have been formulated in recent years to encourage the performers of research in these sectors, particularly industry, to become aware of and more involved in providing the R&D requirements of government whenever this would be appropriate. Specific policies relating to contracting out have been in effect since 1972 and, more recently, a policy respecting technology transfer from government laboratories to industry has been approved. These directional thrusts have significant impact on the role of the government scientist and research manager. They indicate a need for a more explicit and coordinated approach to transmit these directions to those engaged in performing and managing science activities in the public service.

A statement on the role of the government scientist and research manager can be useful in all of the major phases of personnel management: staffing, job assignment, performance appraisal, training and development, promotion, and transfer policies. In this paper some of these science and technology policies and the current related administrative measures are examined, and their implications for scientific manpower in the public service are discussed. From this is evolved a comprehensive statement of government expectations related to its science activities and of the role and performance of its scientists in support of departmental missions. Such a statement would provide a common basis for developing the procedures pertaining to a scientific personnel management system in the public service and guidelines for agencies, and would also define a desirable role orientation for a federal scientist vis-à-vis his counterparts in industry and the universities.

POLICY INITIATIVES

I. Departmental S&T Missions and Objectives

The scientific and technological effort of the federal government embraces a wide range of activities and is associated with major goals and objectives of the government. The principal S&T functions implicit in the statutory responsibilities of federal departments and agencies can be grouped under the following headings:

* Development of the scientific and technological base required to support major government responsibility areas: defence, health, agriculture, communications, etc.

* Support of regulatory functions by setting standards and monitoring products and practices: food and drug, environment, communications, fisheries, etc.

* Provision of science-based services: surveys, mapping, environmental monitoring, navigation aids, etc.

* The application and use of engineering and the natural sciences to assist industry in Canada with the development of new improved processes, methods, products, systems, techniques and services.

The employment of science and technology in the achievement of departmental objectives can be considered from two points of view. The department looks upon S&T as a major resource which it may use to achieve its objectives. However, from the point of view of the government as a whole, the totality of science and technology programs of departments and agencies has additional meaning and importance in relation to broad national strategies and socio-economic priorities.[1]

The inclusion of government scientific and technological resources and capability in the development of public policy is a relatively new concept. The urgent necessity of reaching decisions on vital issues such as food, depletion of natural resources, conservation of energy, and other problems of this nature, has become obvious. In this area of policy development, both within departments and interdepartmentally, the government S&T capability is expected to contribute in such major areas as the provision of technological forecasts, the development of technological strategies and the effective allocation of scientific and technological resources. The NRC has further commitments as a national laboratory to (a) maintain a base of fundamental research in the natural sciences and engineering, and (b) to provide national scientific facilities for use by the Canadian scientific community.

From the foregoing, it may be stated that the primary function of the government scientist is to participate in the development of scientific knowledge and technology required by a department or a research agency in discharging its mandate. This effort covers the performance of basic and applied research oriented to solving problems and obtaining information identified by the department, or to undertaking functions in planning, regulation, standard setting, operations, management, testing, etc., as well as to providing in certain areas the technological base needed nationally by users outside the federal government.

---

[1] Brief to the Senate Special Committee on Science Policy, presented by the Honourable C.M. Drury, Minister of State for Science and Technology, November 1975.

See also: C.M. Drury, "How the Federal Government Views Questions of Science and Public Policy". Science Forum, 47, October 1975, pp. 28-30.

II. Contracting-out

The federal contracting-out policy states[2] that, since the government has science and technology requirements to support departmental missions, it is in the national interest to encourage the fullest possible participation of Canadian industry in meeting these needs. This would in turn stimulate industrial technological capability and thus provide additional benefits to the economy. The government has therefore provided, subject to overall financial constraints, that "its mission-oriented science and technology requirements in the natural sciences and the human science fields of urban, regional and transportation studies be contracted-out to the private sector, and especially to Canadian industry. This is done to obtain a more even balance in the coming years between scientific activities performed by industry and by the government in support of department missions..."[3]

As a general principle, the government's mission-oriented science requirements are to be contracted-out to the private sector whenever appropriate. Intramural research would be performed by departments in accordance with the following criteria:[4]

a) to safeguard matters of security or policy sensitivity;

b) to establish and maintain a limited in-house competence:

- to enable the department to perform its mission;
- to assess the opportunities presented by the current state of the art; and
- to manage the department's S&T requirement performed in the private sector;

---

[2] Treasury Board Secretariat, Policy and Guidelines on Contracting-out the Government's Requirements in Science and Technology, Ottawa: Administrative Policy Branch, April 1977, p. 4.

[3] Ibid.

[4] Ibid, p. 5.

c) to provide direct support to a regulatory function and associated planning activities;

d) to maintain S&T capability for the development and maintenance of a set of national primary standards and, in some cases, secondary and consumer standards including their relationship to international standards;

e) to the effective support and operation of in-house capital facilities which provide federal testing and research services; and

f) to perform the mission of the department where the S&T capability does not exist in the private sector, is inappropriate to the private sector, and would not be of optimum benefit to Canada to create one.

There has been significant expansion in the scope of the contracting-out policy when compared with its predecessor, Make or Buy policy.[5] Three significant developments have been made in the present policy. First, it is no longer restricted to R&D requirements in natural sciences. It now includes three areas of human sciences: urban, regional, and transportation. Second, it is to be applied to ongoing as well as new federal S&T requirements. Third, there should be a higher proportion of the total Canadian R&D performed by industry.[6]

The Treasury Board Secretariat has defined in detail the typical responsibilities of those involved in contract management:[7] the user departments, Department

---

[5]MOSST, The Make or Buy Policy, 1973-75, Industry Branch, November 1975.

[6]Treasury Board Circular No. 1977-25, May 3, 1977; Circular No. 9048-1, January 6, 1978.

See also: Statement of the Honourable J. Hugh Faulkner on the government plans to implement the expansion of its Make or Buy Policy, News Release, April 26, 1977.

[7]The Make or Buy Policy, op. cit.

of Supply and Services and the private sector. The role to be played by the 'scientific authority' nominated by the user department in contract management is broad and encompassing. A wide range of questions of a scientific and technical nature is to be raised, defined, examined and evaluated by the scientific authority, the user department's representative on the project. The scientific authority is responsible for identification of S&T requirements; definition of technical parameters of requirements; and technical analysis of proposals. Once the contract is awarded, this person is also involved in management and technical evaluation of the work performed. Such departmental supervision over the contract varies, depending on the experience of the contractor. At the completion of the project, the department would also carry out a post-contract evaluation of results.

Summing up, from the foregoing discussion, it is apparent that by widening the mandate of the contracting-out policy and by defining its objective of involving industry to an increasing degree in providing S&T requirements of government, most science-oriented departments would be, in the near future, faced with developing appropriate skills, expertise, incentives and performance-appraisal schemes for the function of scientific authority or its equivalent.

III. Technology Transfer

In recognizing that federal laboratories represent an important Canadian source of technology potentially useful to Canadian industry, the government has agreed that technology transfer should be an objective of all government laboratories. This decision is directed at improving the transfer of technology from all departments, whether or not the technology is primarily developed for industrial purposes.[8]

The intent is not to bias research and development work in these departments away from their mission to support regulatory activities or other internal government purposes. Rather, it is to enable government laboratories to identify research that is of possible interest to industry and, with

---

[8] Statement by the Honourable Judd Buchanan, Minister of Science and Technology, to the House of Commons on June 1, 1978 — "Measures to Strengthen and Encourage Research and Development in Canada".

suitable planning, to transfer the technology and knowledge derived from this research to industry. The policy is intended to assist R&D groups in departments and laboratories with the realization that improved technology transfer can be fully compatible with their mandate to provide support to departmental programs.

The above policy which is aimed at technology transfer suggests that there should be an awareness on the part of government scientists of the needs of the industrial sector, and of the necessity, where appropriate, to align departmental research programs with the economic and industrial strategies of the government. As with the associated contracting-out policy, the technology-transfer policy anticipates that adequate personnel incentives will exist within departments to support the vigorous pursuit of the transfer of technology from government laboratories to industry. Also, it is intended that the exchange of federal scientific personnel with industry should be encouraged, and the knowledge and experience gained thereby would in turn be of benefit to departments.

IV. Long-term Policies to Increase the Level of R&D

In addition to the above policies, the government has announced a number of long-term policies and immediate measures to increase the level of R&D, particularly industrial R&D, and to encourage Canadian industry to take advantage of the results of research conducted by government scientists.

The pertinent policies[9] relating to science state that departments and agencies should undertake:

- to use federal government procurement to stimulate industrial research and industrial development in Canada;
- to establish institutions and other mechanisms on the interfaces between government and industry and between universities and industry, that are responsive to national needs and are specifically devoted to the transfer of ideas,

---

[9] MOSST, Research and Development in Canada: A Discussion Paper, June 1, 1978, pp. 16-17.

innovations, information, skills, manpower and technical capability; and

- to identify national goals as priority areas for research and development growth, and to use the effort necessary to achieve these goals to establish an industrial productive capacity in Canada competitive in world markets.

The long-range objective of the S&T policy is to improve industrial productive capacity in Canada by increasing the level of research and development in the industrial sector. It is implied that government scientists should be able to carry out R&D in the context of the broader problem areas, but this objective may not often be explicitly stated in the organizational mandates. These initiatives anticipate that the scientists will be further involved in programs that involve the transfer of knowledge and skills, development of R&D capabilities in other sectors, and formulation of S&T priorities that are aligned with national goals.

ADMINISTRATIVE MEASURES

The 1970s can be described as a decade marked by financial constraints and decreasing resources for federal departments and agencies. In view of this, there has been increasing emphasis on the efficient use of resources in federal programs so that their benefits are optimized with respect to expenditures. Consequently, over the past decade, the government has been extensively involved in providing policies and guidelines for departmental planning, budgeting and evaluation.

The Treasury Board Secretariat has been stressing to departments the value of rational resource allocation in the preparation of Program Forecasts and Main Estimates. Departments have also been provided guidelines for adopting budgeting techniques such as Program, Planning and Budgeting (PPB) and Management by Objectives (MBO). These emphasize the need for program objectives to become directly translatable to explicit benefits. Implicit in the techniques is the desirability of a cost-benefit analysis of programs during program forecast to bring forward a range of alternative courses of action for consideration by management and to make more apparent the probable effects of each course of action. With regard to scientific programs, it must be admitted that because of risks and uncertainties, it is difficult to predetermine the results. There are

other problems related to indirect benefits and costs, and to placing a monetary or other value on these costs and benefits. However, these problems are not limited to scientific programs but are also faced by other social and economic programs. What is important is that in a systematic approach such as the PPB analysis, the science managers would become more keenly aware of restraints, both internal and external to their responsibility areas, within which programs must be carried out. Such a program development exercise would also be helpful in providing a logical framework for any future review and evaluation of the program.

TBS has affirmed that departments and agencies should undertake periodic evaluations as a component of the management of their programs. A recent circular[10] states that: "Departments and agencies of the federal government will periodically review their programs to evaluate their effectiveness in meeting their objectives and the efficiency with which they are being administered". These evaluations along with an assessment in terms of socio-economic impact are expected to aid in changing the ways in which programs are developed and operated; clarifying program objectives; reducing or eliminating programs which have decreased in priority.

These evaluations (Zero-A Base Review, operational and management audit, performance measurement of a program) aim at assessing what was done in a specified period of time and at what cost. They further seek to interrelate the priorities identified by senior management and the jobs described in the work program. The intent is to orient the governmental activity in a program/project/job format and to assess its effectiveness in terms of the results both as physical output and as impact (expected effect).

In the case of most of the scientific activities, particularly those in research, the evaluations would require that both research managers and scientists should attempt to develop a clear description of a project which will meet the comprehensive objective within some time frame and for a stated cost. Such a management system may be relatively easy in applied engineering research projects (and the related scientific activities), but

---

[10] Treasury Board Circular No. 1977-47, September 30, 1977.

poses a significant challenge to research managers in making decisions about the limits to be imposed on the long-range in-house background research component. However, the research component is essential to maintain both an ongoing in-house expertise, and to provide linkages with new 'jobs' and 'projects' being developed. What is important to note here is that the purpose and expectations of the research component need to be addressed, so they can be known and understood by the program managers, other managers and scientists within the program, and the central agencies. Many science programs are now subject to some type of project review or evaluation system which has been carefully developed in several of the science-oriented departments and agencies.

As noted, these examinations have assumed major significance at the present time when restraint is required in government expenditures. This situation will undoubtedly persist for some time as the former regular growth in essentially all areas of government expenditures cannot be expected to continue and budgetary control requiring the identification of priorities both within each program and among different programs will increasingly become the way of life rather than the periodic exception. Financial restraint will thus affect all programs, including R&D activities, and scientists should become aware of the situation and be kept informed of changes as they occur or are announced. Research managers who have to participate in the performance of the program evaluations are faced with the added responsibility of ensuring that the scientists working with them are informed of the existence, scope and implications of these restraints.

ROLE OF THE GOVERNMENT SCIENTIST AND RESEARCH MANAGER

Foregoing sections have discussed the principal new thrusts in government policies and administrative measures which are having an influence on the science missions of the federal government and thereby on the role of the research scientist and manager working in the public service. However, it must be stressed that, the new policies notwithstanding, science has a major contribution to make at the federal level, in fulfilling S&T functions implicit in the statutory responsibilities of federal departments and agencies as well as through the introduction of scientific knowledge, analysis and methodology to long-range planning. The federal research role is not

merely directed at finding short-term solutions but also at preparing for the unposed questions through carrying out exploratory background research.

Evolving from this discussion of government expectations of its science mission, the roles of the scientist and research manager, in implementing that mission, should be defined. Since the roles will be different, they require separate descriptions. That of the scientist should be stated as being:

- to develop the scientific knowledge and technology required by a federal department or agency to discharge its mandate;
- to carry out R&D work within a management system in general; however, exceptions could apply at the discretion of the manager for certain types of research which could be handled more effectively by another approach;
- to maintain an awareness of the potential application of the research results and be involved, wherever appropriate, through consultation and exchanges with 'user' groups;
- to identify and define S&T requirements that might be contracted out and, where appropriate, manage and evaluate the technical progress of the contracts;
- to participate, when necessary, in project teams involving personnel of different disciplines and backgrounds in order to respond to new departmental thrusts and government priorities; and,
- to maintain and enhance scientific and technical skills and capabilities for carrying out both the defined role in performing science and participating in newer functions such as technology transfer, contract management, interdisciplinary research, project management, etc.

The role of research manager is crucial. Management and coordination functions dealing with research and its development require that the research manager has knowledge of, and experience in, the functions being supervised. Also, he must have the capability to determine the nature and priority of objectives and the resources which

must be committed for their achievement. He must also be involved in the continual assessment of results in relation to departmental objectives and ensure that these are consistent with government science policies. Accordingly, it is necessary that he includes the ongoing and new expectations in all phases of personnel management: selection, job assignment, performance appraisal, promotion and transfer of personnel.

In summary, the principal functions of the research manager in dealing with scientific personnel should be:

- to ensure that a desirable level of scientific excellence is maintained, and a climate conducive to innovative and productive scientific and technical activities exists in the R&D organization;

- to ensure that scientists working with him are fully aware of new policies and procedures which could have an impact on their work or the conditions under which they are expected to perform;

- to encourage scientists to be aware of problem areas in other sectors related to their fields of interest;

- to involve scientists in the transfer of technology whenever appropriate;

- to involve scientists in contract supervision but assume management responsibility for major contracts;

- to use appraisal criteria that give appropriate recognition to all required functions of the scientist whether they are basic or applied research, contract supervision, technology transfer, 'acting' science management, or other functions related to the performance of science and dissemination of the results obtained; and,

- to ensure effective financial management of the R&D organization under his supervision.

DISCUSSION

This listing of government expectations of its scientific personnel raises some pertinent issues.

They indicate a need to develop a more explicit and coordinated effort to transmit changing expectations to those engaged in performing scientific activities in the public service. To match personnel requirements with policy and program thrusts, the principles enunciated can be applied to all major aspects of personnel management: selection, job assignment, performance appraisal, training and development, promotions and the transfer of personnel. Also, it is important that the principles developed here should not be limited to one particular scientist group but to all the occupational groups in the scientific and professional category which are engaged in natural sciences and engineering activities.[11]

With increasing emphasis on these new policy measures, it is necessary that serious attention be given to the importance assigned in performance appraisals to these new functions such as technology transfer and contract supervision by the laboratory management.[12] Specifically, these 'non-traditional' activities may suffer in comparison with other activities that are believed to better reflect the perceived objectives of the mission of the department, or that are more easily measurable, or just more prestigious. Laboratory personnel are, in fact, ordinarily assessed less mechanistically than is sometimes believed, but the average individual is bound to be in-

---

[11] MOSST, Scientific Manpower in the Federal Government (Phase I), Second Draft, November 1977.

A study of thirteen scientific occupational groups in the public service was done. These included: Agriculture (AG), Biological Sciences (BI), Chemistry (CH), Defence Scientific Services (DS), Engineering (EN), Forestry (FO), Meteorology (MT), Medicine (MD), Pharmacy (PH), Physical Scientists (PC), Scientific Research (SE), Scientific Regulation (SG), Veterinary Science (VS).

[12] The revised 1978 Classification Standards for Scientific Research (SE) group, although implying the recognition of policy thrusts such as technology transfer, does not show any significant shift in emphasis from its earlier 1966 version.

fluenced by what he or she understands as being considered important by the laboratory management. Salary and promotion criteria in each laboratory can be designed to fully reflect all functions of the laboratory.

For example, scientists have sometimes complained that, although their scientific authority and expertise are often requested in various management activities, due recognition for the time spent is not always given in their performance appraisal. Work in defining the research objectives of a project, sorting out technical implications of technology-transfer processes, or providing scientific and technical supervision in the management of S&T contracts should also count.

There has been a tendency among research managers to protect their scientists from the encroachment of so-called non-research functions. This has been done by seeking to create intermediary positions such as 'contract analyst', 'technology transfer agent', or 'program analyst'. There is value in developing mechanisms to take away the 'form-filling' load from the scientist and to restrict the purely administrative role, but such an approach cannot fully substitute for the scientific function which can only be provided by those in scientific occupational or management groups. Consequently, such positions may be useful but involvement of the scientist would still be required.

In summation, as the phase one report pointed out, the selection, classification, training and development, and performance appraisal policies and procedures of the scientific occupational groups have been based on assumptions about the role of government science which may have been valid in the public service more than two decades ago. Changes resulting from recent policy and program thrusts now require that management procedures for scientific personnel are kept abreast of these changes by recognizing the current role for federal scientists and research managers.

II. TRAINING AND DEVELOPMENT OF RESEARCH MANAGERS IN THE PUBLIC SERVICE

INTRODUCTION

Concern about the need for and quality of management of scientific research and the innovation processes in Canada has been expressed on a number of occasions since the early 1970s.

Both the Special Committee of the Senate on Science Policy and the Science Council in their studies have repeatedly pointed to the need for devoting more attention to the training of Canadian science managers.[1] Within the government, the Public Service Commission, the Ministry of State for Science and Technology, and the Department of Industry, Trade and Commerce have given focus to these concerns in various reports on the subject. PSC and MOSST initiatives in this matter have focussed upon definition and assessment of the need for training and development of scientific personnel for management of research and technological innovation, particularly inside the public sector. The case for developing a similar capability in the private sector has been taken up by the Department of Industry, Trade and Commerce.

BACKGROUND

In March 1974, the Public Service Commission released its manpower survey report on the personnel trends and requirements of the Scientific Research (SE) group in the public service. The survey report was to serve as an index to discussion of the problems which relate to the SE occupational group. To remedy the deficiencies in the training and development programs of those in the

---

[1] The Special Committee of the Senate on Science Policy, A Science Policy for Canada, Vols. 2, 3 and 4, Ottawa (1970-77), pp. 528 - 529, 797 - 798.

also: Science Council of Canada, Role and Function of Government Laboratories and the Transfer of Technology to Manufacturing Sector, Background Study 35, Ottawa, 1976.

Research Manager (REM) subgroup of the SE group, three major recommendations were made.[2] They are:

1. A unified and coordinated approach to the training and development of research managers should be evolved in the public service.

2. The research management course offered by the Commission's Bureau of Training and Development should be expanded and made available to younger participants to meet the increased demands for their supervision of S&T contracts.

3. To improve interaction between industry and government laboratories, exchange mechanisms must be developed which would provide those in scientific research occupations the opportunity of acquiring some experience in the industrial and applied science sectors of Canadian scientific research.

As a result of the report, along with the findings of another PSC study entitled, "Training Needs of Research Managers",[3] the Commission, in 1974, decided to add a course on research management to its new program of executive development seminars. The three-week course, entitled "Management Development of Research Managers", was later reduced to two weeks.

MOSST's involvement in the area of training and development goes back to the Spring of 1973, when the Ministry, because of general concern about the need for and quality of R&D/Innovation Management education in Canada, decided to carry out an in-depth examination of related issues. The examination included the assessment of existing Canadian and foreign educational programs on

---

[2]Public Service Commission, Public Service Manpower Survey: Scientific Research Group, Ottawa: Manpower Planning Division, March 1974, pp. 63 - 72.

[3]Public Service Commission, Training Needs of Research Managers (Document No. 183) Ottawa: Bureau of Staff Development and Training, August 1972.

R&D management; appropriate curricula for science managers; and a description of various management training strategies which could be pursued by the private and public sectors in Canada.[4]

Some of the recommendations made about meeting the needs of the private sector in this area were subsequently taken up by the Department of Industry, Trade and Commerce to assist Canadian universities in developing suitable R&D management programs.

With the exception of the PSC's executive development courses and seminars on the subject and certain ad hoc development programs being offered by some science-oriented departments, the situation within the federal government since 1973 has not changed significantly. A recent MOSST report dealing with related issues stated that science-oriented departments should seek to "widen the bench-level scientist's knowledge base, and to improve his appreciation of management problems, especially those pertaining to mission orientation and utilization of research results".[5]

PURPOSE

The major aim of this paper is to evolve a framework for a coordinated approach for identifying and developing science managers in the public service in relation to the requirements of science-oriented departments at various levels of management, and to the need for effective and efficient management in government as a whole. In order to realize this framework, an analysis

---

[4] T.E. Clarke, A Technological Innovation (R&D/I) Management Training Program, Ottawa: Ministry of State for Science and Technology, 1975.

also: J.R. Nininger and K.S. Palda, A Feasibility Study into the Establishment of a Canadian-Based R&D/Innovation Management Course, Ottawa: Ministry of State for Science and Technology, March 1974.

[5] MOSST, Scientific Manpower in the Federal Government (Phase I), Ottawa, November 1977.

of broad roles, responsibilities and functions of different levels of science management in departmental science organizations is made; existing developmental programs of the departments and central agencies are examined; and the adequacy of these programs in relation to the federal organizational requirements is discussed.

Certain basic issues must be considered before any program for management training and development can be evolved; namely, what are the government's expectations of its science managers, and are these expectations in harmony with those of public service managers in general? Some of these have already been discussed in the previous paper entitled, "Recent Science Policy Initiatives and the Role of the Scientist and Research Manager in the Public Service".[6]

In recent years, emphasis has been placed on the need for providing high quality, efficient and effective management in the federal government and, as indicated by the Public Service Commission,[7] efforts have been made to develop a service-oriented identity among public service managers. This need for efficient management, however, does not imply uniformity in professional skills. Over and above general management techniques, the specialized skills are equally necessary in functional management. The basic principles of research and development management in many cases may be the same as those of general management (accounting, production, marketing); however, differences can be identified in both the application of these principles in an R&D environment, and in the type of individual supervised. Scientists, by nature of the value system which has evolved from their educational background, are not trained in the philosophy or 'culture' of industry or government which is considerably different from the culture of science.

---

[6] MOSST paper circulated to science-oriented departments and central agencies.

[7] Public Service Commission, DIALOGUE: Human Resource Management, Volume 2, No. 4, 1978.

also: Public Service Commission, Public Service and Public Interest, Ottawa, 1978.

The science manager must bridge the gap between these two cultures so that the R&D performed contributes to the goals of the organization without the morale and motivation, and hence usefulness, of the scientific personnel involved being adversely affected.

The Public Service Commission, in its presentation[8] to the Special Committee on the Review of Personnel Management and the Merit Principle in the Public Service (Chairman: Mr. Guy d'Avignon), declares its conviction that the quality of personnel management in the public service is fundamently dependent on the quality of the manager. Many current problems in personnel management are the "consequences of weakness in the mechanisms for selection, development and removal (if necessary) of management personnel". With austerity as a way of life in the federal government, managers now have to produce as much, if not more, with fewer resources. The problem has thus become one of determining the means by which managers can make the most of resources available to them. Training and development will be one solution to this problem.

The term 'Science Manager' is being used here in the broad sense to reflect a spectrum of management positions ranging from that of a working research scientist supervising the work of one or more scientists, to the assistant deputy minister of the research branch of a federal science-oriented department. Previous related studies have generally been limited to understanding managerial dimensions up to the 'Research Manager' (REM) level.

The process of delegating management responsibilities to scientists working in government laboratories is incremental in nature in that an incumbent will have the level of his responsibilities increased stepwise as opportunity permits. Skills in both 'research' and 'management' are necessary at all levels of management in science-based organizations. However, the intensity of usage of the two types would change with the position

---

[8] Public Service Commission, DIALOGUE: Human Resource Management, Volume 2, No. 4, 1978.

also: Public Service Commission, Public Service and Public Interest, Ottawa, 1978.

occupied over the span of an individual's career. For example, the job of a scientist requires not only a knowledge of his scientific discipline but demands of him a skill and capability to design, execute and effectively manage his project to its successful completion. The senior science manager (usually director general and above), on the other hand, though not involved in the direct supervision of research, requires an understanding of how the research structures and processes operate. He needs primarily an understanding of the potentialities and capabilities of available scientific resources to enable him to effectively correlate the science-dominated missions of the laboratories with the overall departmental missions.

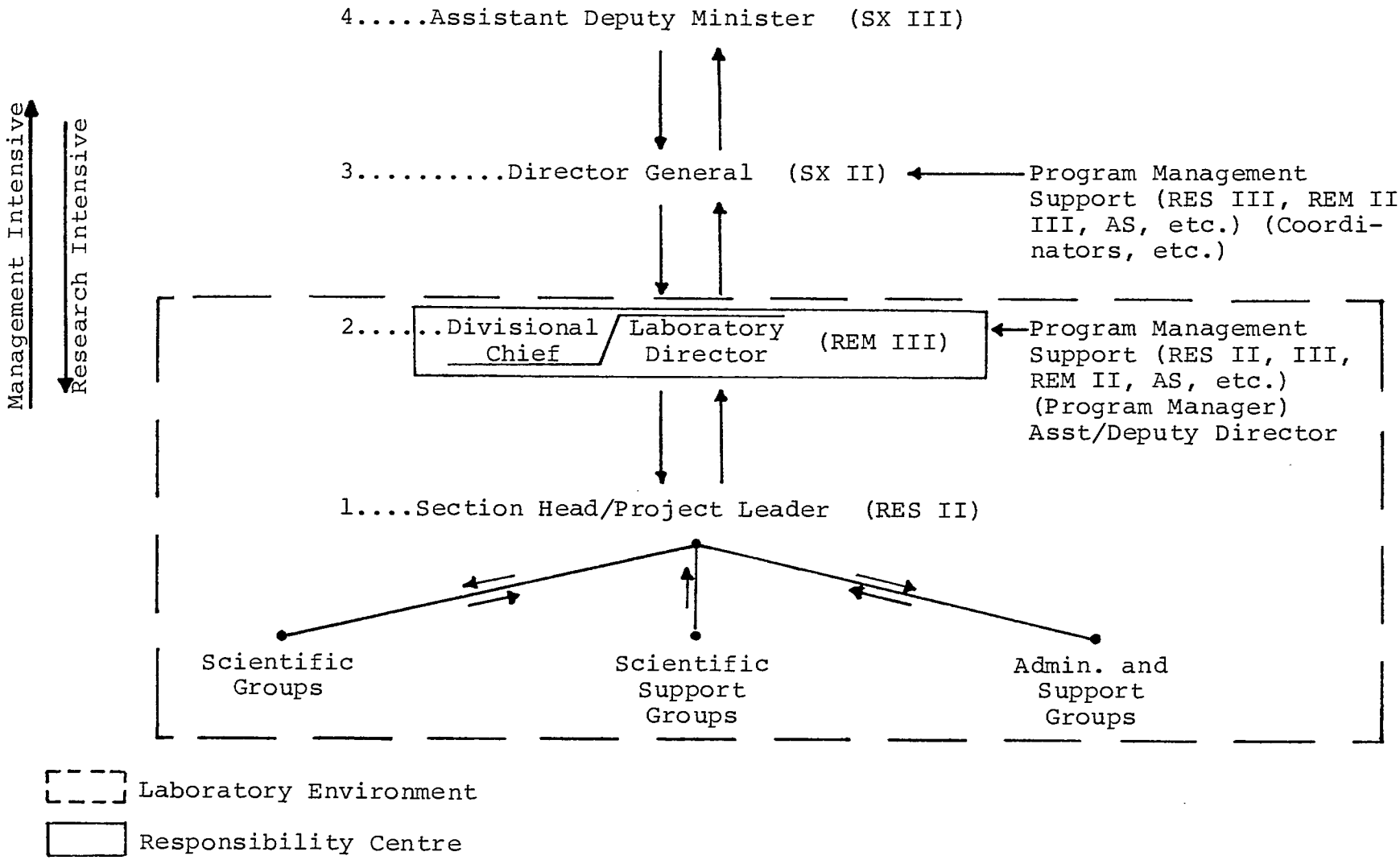
RESEARCH MANAGEMENT POSITIONS

In a simple typology of the R&D organization within a federal science-oriented department, four main levels of positions with management responsibilities can be identified (Figure 1). Figure 1 illustrates an interactional relationship among these four levels of management positions: Section Head/Project Leader, Laboratory Director, Director General and Assistant Deputy Minister.

As Figure 1 shows, the research-intensive functions decrease and are gradually replaced by management concerns when a person moves from management levels (1) to (4). Up to the level of laboratory director (2), the management functions are essentially related to direct management of research processes, organizational structures and personnel within a laboratory environment. They demand of a manager not only administrative capabilities but also an ability to understand, appreciate, guide, supervise, and evaluate both the program being performed and the personnel involved. A great deal of emphasis in recent years has been placed on assessing the value of the work in terms of impact on the user, whether government department, industry or the general public. The head of a laboratory is thus responsible for both the scientific accountability of work performed and the administrative accountability of the resources allocated.

Above the level of laboratory director in most of the science-oriented departments, that is, the director general and the assistant deputy minister, the nature of science management functions becomes less research intensive and relatively more distant from the direct administration of the program and its personnel. Positions at these levels are more involved in responding to, and transmitting concerns about the administration of programs

Figure 1: A Simple Typology of Four Formal Levels of Management Position in an R&D Organization Within a Science-Oriented Department.



raised within and outside the department. Some of the concerns would include the relevance of a program to the departmental mission, administrative policies of central agencies, allocation of resources among competing departmental priorities, etc. These science management functions are of a generalized nature and thus would be expected to be similar to functions performed at the same levels in non-science federal organizations.

ROLES AND ACTIVITIES

Section Head/Project Leader

'Section Head' in a research organization is the first formal position where most professionals obtain their own project or area of responsibility. The work of the section head is predominantly of a scientific nature that usually goes into depth in one specialty area or on a single complex multidisciplinary problem area which may consist of more than one study.

Three principal activities of a section head are:

(a) to develop a greater breadth of scientific and technical skills and apply these skills in his specialty areas (e.g. coordination of working arrangements, project management);

(b) to begin dealing with the external environment for the benefit of others in the organization (e.g. working out relations with client organizations — users, contract management, technology transfer arrangements); and

(c) to act as a mentor in developing the junior scientists, and in overseeing their work and evaluating its scientific and technical merit.

The position of section head within a specialty demands performance of a combination of several roles: scientific leader, project leader, scientific authority in management of contracts, professional consultant, and, finally, that of a technology transfer agent.

Laboratory Director/Division Chief

A laboratory director/division chief has usually three to six section heads working for him. His task, compared to that of a section head, is more diversified as he has the responsibility of managing several specialities within one or several disciplines.

The position is characterized by a wide range of activities related to:

- providing leadership and exercising influence over the future direction of the organization (e.g. scientific effort in a major specialty area, identification of new opportunities, and assessing options for problem solving);
- evaluating scientific and technical merit of the program as well as its relevance to the missions of the organization;
- staffing, job assignment, performance appraisal of scientific personnel;
- providing scientific and technical advice to senior departmental personnel;
- responding to both internal and external organizations (e.g. guidance for program development from advisory committees of experts, users and senior-level government officials);
- allocating financial and manpower resources (e.g. priorising of projects within constraints on manpower and financial resources); and
- developing strategies about science activities which could be contracted out, and effecting the transfer of research results to potential users.

At this level, the task of the incumbent is to combine appropriately the roles of "internal entrepreneur" and "idea innovator".[9] These roles, dealing with program

---

[9]Paul H. Thompson and Gene W. Dalton, "Are R&D Organizations Obsolete", Harvard Business Review, November-December 1976, pp. 109 - 110.

choice and the establishment and maintenance of a creative atmosphere, tend to be more of an art than a science. They require of the manager a comprehensive knowledge in the laboratory's field of specialization and significant experience in conducting and managing science activities. Such a background is useful for the laboratory director not only in maintaining credibility as a direct supervisor of highly skilled personnel, but also in effectively orienting the interest of existing staff to new areas of inquiry, while possibly maintaining expertise in their original speciality. This would result from the director's continual involvement in project evaluation to identify those to be continued and encouraged, and those to be terminated or transferred to an outside performer as a contract.

To assist him with these science management functions, he may have the services of a scientific program support staff comprised of program managers, and sometimes an assistant director. Most of these persons would have previously served as section heads or have been active research scientists.

Director General and Assistant Deputy Minister

The director general and the assistant deputy minister may head large programs, but normally operate outside the laboratory environment and do not directly supervise individual scientists. These managers formulate policy and are engaged in setting up the determinants for success of the programs carried out in their organization. They do long-range and intermediate planning and monitor the programs under their responsibility to see if they are moving in the right direction. In conjunction with their immediate staff, they also initiate and approve broad programs. In this, they are involved primarily in screening and priority setting of programs and component projects.

A majority of activities at these senior management levels are concerned with the environment external to their organization, to obtain resources, provide justification for allocation of resources, and transmit relevant outside policy decisions to their R&D personnel. Nevertheless, a broad understanding of research structures and processes is still essential for these positions in order to evolve realistic strategies for identifying opportunities and important 'markets' compatible with the talents available in their research organizations.

Discussion

From the foregoing description of broad roles and activities of different levels of science management personnel in science organizations, two things are apparent. First, science management within federal science-oriented departments covers a wide range of management activities; and second, management requirements of science managers in these organizations are different from one level to the other. Any development program of education and training for federal science managers should therefore take into consideration these varied managerial dimensions which relate to managing both the laboratory and the interface with groups outside the laboratory, and which deal with external environmental impacts that may have repercussions on departmental R&D activities.

CURRENT TRAINING AND DEVELOPMENT (T&D) PROGRAMS* FOR SCIENCE MANAGERS

T&D Programs

Federal departments and agencies report their employees' participation in training programs to the Treasury Board Secretariat as a part of an "Annual Training Review". In this report, training sources are categorized as follows: (i) Departmental, (ii) Interdepartmental (primarily the Public Service Commission), (iii) Outside Training (by a private agency or institution outside the public service), and (iv) outside normal working hours.

An examination of the data for thirteen major scientific occupational groups in the scientific and professional category for the year 1977-78 shows that the most frequent training source used was the 'Outside

---

*The terms 'Training' and 'Development' have been used interchangeably because the developmental process of employee growth is a combination of knowledge obtained through increased experience and responsibility on the job, and by upgrading his education and skills. However, a distinction between the two has been made in the concluding section of the paper in order to study policy implications for immediate job-related 'training' and future individual and organization-related 'development'.

Training' (15,293 man days), followed by 'Departmental' (13,324 man days); very few members of these groups made use of the 'Interdepartmental' training facilities (3,790 man days). The type of training received dealt predominantly with upgrading scientific and technical skills. Participation in management development remained low and limited to only a few groups.[10]

In a survey of management training and development programs for science managers, only a few examples of such programs could be identified at departmental and interdepartmental levels. At the interdepartmental level, the major example is the PSC course, "Management Development for Research Managers". At the department level, two examples are described.

Public Service Commission

As a part of its executive education program, the Public Service Commission offers an in-residence course of two weeks to federal science managers. The course, entitled "Management Development for Research Managers", is running into its fifth year and so far has been utilized by more than 206 participants. The course, as its objective states, intends to provide federal science managers the opportunity to look beyond departmental and functional boundaries, improve managerial abilities and increase their knowledge of government policies and procedures related to their role. A preliminary examination of the course content suggests an orientation towards developing an awareness of the external environment in which government science operates rather than to help acquaint science managers with techniques of program/project management in the laboratory setting. The course has, over five years, attracted a wide spectrum of individuals ranging from section heads in laboratories to research coordinators from organization headquarters.

Under its executive education program, the Commission has also arranged a series of two- to three-day seminars on special science policy related issues, e.g. science and public policy, energy needs and nuclear options, policies and poisons.

---

[10] See Appendix "A" for an explanation of data on participation in training by 'source' and 'type' of training for thirteen scientific occupational groups in the scientific and professional category.

Science management also forms a part of the PSC's twelve-week course for the Career Assignment Program (CAP). The candidates selected for this senior management development program learn about a broad range of managerial attitudes, skills, and techniques.

Departments

1. Environment Canada

Atmospheric Environment Services (AES) of Environment Canada has been working on a formal management staff T&D plan. The program is being developed because of a concern about retirement of personnel at various levels of management within AES, and the availability of talent to replenish these positions. Consequently, training on the job will be provided at middle-management levels which serve as a prime feeder group for the upper levels of management. The rationale for developing managers within the department has been ascribed to the specialized nature of the task performed by meteorologists in AES. It is felt that application of the relevant management principles, techniques and skills requires a thorough knowledge of the organizational environment in which meteorologists must operate.

The AES Management Orientation Program is designed to provide management experience through a two-year rotational program at AES headquarters, for employees judged to possess potential for senior positions. The potential is determined in a variety of ways (e.g. satisfactory performance in supervisory position, project leadership, leadership in community organizations, post-secondary management/administrative courses, etc.). It has been aimed at employees in the scientific and professional category, normally at the MT-5 level and above, and the SE-RES 2 level and above. Other eligible groups include ENG, SC, PC, LS, etc.

The rotational program would consist of three assignments over a two-year period — one assignment of one year's duration and two six-month assignments. Assignments are selected to provide a broad view of AES, and exposure to AES policies and procedures and to other Services, Departments, and Central Agencies. Whenever possible, the management trainee is also sent on management courses.

2. Energy, Mines and Resources

EMR's Canadian Centre for Mineral and Energy Technology (CANMET) has, over the past few years, evolved an internal management development program. It is principally directed at scientific staff. To familiarize those at the section head or senior scientist levels (RES 2 and above) in laboratories with broader management responsibilities, selected candidates spend two months in the director general's office, and another two months at the headquarters on a rotational basis. The headquarters assignment is generally either in the office of the ADM of Science and Technology or the ADM Planning and Evaluation.

The department, under a 'management-of-science' lecture series, has also offered half-day seminars on topical R&D management issues.

DEPARTMENTAL TRAINING PLAN

The development of training programs either within a department or interdepartmentally would require that the opportunities for improving the quality of management at the various levels of a scientific organization are identified and analysed, and that training and development programs can be shown to provide an effective solution.

At present, T&D officers in departments and agencies are expected to identify organizational requirements in an "Annual Training Plan" which is submitted to the TBS and PSC. In the past, this plan has usually been based on comments made by an individual on his annual performance appraisal plus his supervisor's commendation. These comments would tend to reflect the individual's preference in career aspirations rather than to identify the weaker points in the performance of his duties in relation to organizational goals. A concise strategy is thus needed to integrate the individual's desires for improvement with the short- and long-term goals and objectives of the organization.

In a study of practices and procedures to identify training needs in the public service, a TBS study in December 1975 found that of nineteen departments surveyed, only two actually prepared an annual training

plan.[11] Several of the departments interviewed did not identify training needs or plan for them, except to circulate material such as the PSC's course calendar and to register departmental personnel for these courses. Although most of the departments had a training policy, written and circulated, only one of the departments surveyed followed its own policy closely. The study indicated that the major reason for this was that training units in the past had been assessed by the number of people attending courses, the number of days spent on courses or the amount of money spent on training, rather than by their usefulness in improving the effectiveness of the organization and the performance of the individual.

A sampling of current practices in science-oriented departments reflects a similar pattern. Apart from educational training only a few departments normally develop a T&D plan or strategy for professional development in the scientific occupational groups. Other than the identification of individual requests on annual appraisals, little effort is made to coordinate organizational needs with individual aspirations and available training resources.

It would be desirable for line management to recognize the importance of a training and development plan for employees, and be actively involved in its preparation. This would help them assess the value of the program, with a view to improving certain aspects of an individual's job performance. In this way, the line manager could effectively focus attention on training, its purpose and cost.

The role of departmental training and development (T&D) officers is significant. The T&D officers can greatly benefit from a closer liaison with senior levels of management both with respect to setting standards which are expected to be met, and in introducing to management new opportunities for T&D in the field of science management

---

[11] Treasury Board Secretariat, Training Need Identification in the Public Service, Personnel Policy Branch, December 1975.

also: Treasury Board Secretariat, Evaluation of Departmental Training, Personnel Policy Branch, November 1975.

that are available within and outside the department. Awareness of the 'state of the art' (theories, techniques, skills, etc.) in the management of science could be an asset to a T&D officer. The possibility of linking in-house, on-the-job training assignments with the Public Service Commission's education courses and other programs could also be examined. For this purpose a comparison would be required of the costs for externally purchased course modules with internally developed programs which could be done on the basis of course content, fees, dislocation costs, etc.

The preliminary activity required would be to develop an information base which could assist in providing an overview of the short-term and long-range manpower situation in federal R&D organizations combined with anticipated or existing functional requirements of various levels of science management, particularly at the laboratory level. In the recent past, departments have generally made use of such tools as succession planning for SXs, annual training review, etc. However, these tools have often been used independently of each other. An enriched information base linked to organizational needs could strengthen and integrate all of the available human resources planning instruments.

Treasury Board Secretariat is currently examining a policy on the personnel management planning process in order to coordinate various planning initiatives in this area with the budgetary process.

In recent years TBS, in conjunction with the Staff Development Branch of the Public Service Commission and user departments, has formed interdepartmental committees on training and development for specialized occupations in financial administration, electronic data processing, and personnel management. This interdepartmental committee device, which is essentially a consortium of major T&D users, seeks to develop a series of initiatives for training groups of personnel in particular or specialized areas. The trainees may be drawn from more than one department and sometimes more than one occupational group as has been the case for participants in the financial administration and electronic data processing training programs. The interdepartmental committee is entrusted with the task of coordinating the training needs of departments in a particular field, and carries out the selection of trainees. A similar interdepartmental committee could evolve training and development programs for science managers. Such a committee could determine: the similarities and differences in the needs of various science departments in an area; the appropriate 'mix' of general

and functional management; and the methods of financing the T&D programs. Another important issue for the committee would be the consideration of mechanisms for integrating human resources planning, which is of generally long-term nature, with the available programs for training and development (e.g. education courses, on-the-job assignments, exchanges with other sectors, secondments, etc.). The membership of this committee could consist of departmental line managers and training and development personnel of major users, along with representatives from the Staff Development Branch of PSC, the Personnel Policy Branch of TBS and MOSST.

TREASURY BOARD POLICY

The Treasury Board makes a distinction between 'Training' and 'Development'. According to government policy, training refers to the process of combining instruction and practice to give employees the skill, knowledge and experience necessary to do their present jobs efficiently and effectively. Development, on the other hand, refers to the planned growth of the knowledge, skill and experience of employees so that they may assume more responsible and complex duties at some time in the future.[12]

To ensure that resources for T&D are effectively spent, and that there is better identification of training and development needs and evaluation of the results, the TBS policy directive of March 1977 states that federal departments and agencies:

with regard to training,

> "shall introduce and maintain systems to ensure that all training undertaken at public expense contributes to job effectiveness, and that the value of training is measured against quantitative and qualitative criteria related to work performance"; and

---

[12] Treasury Board Secretariat, Personnel Management Manual 110-7 and 110-9.

Further discussion of T&D-related mechanisms is provided in the two following papers of this report: "Temporary Movement of Scientists Between Government Laboratories and Canadian Industry" and "Renewable Term Appointments for Laboratory Director Positions".

with regard to development,

> "all employee development undertaken at public expense is based on organizational needs, that only employees with potential for development are selected, and that the value of development toward meeting manpower requirements is measured".[13]

To comply with these measures, departments and agencies have been asked to develop their own plans and systems for identifying needs to make it a part of the Annual Training Review.

DISCUSSION AND CONCLUSIONS

It will be a truism to state that the quality of personnel management in the public service is fundamentally dependent on the quality of public service managers. Many of the current problems in personnel management are the consequence of weaknesses in the mechanisms for identification, selection and development of management personnel. There has not been the necessary rigour in establishing strategies for their selection, training and development. According to the Public Service Commission's report submitted to the "Special Committee on the Review of Personnel Management and the Merit Principle in the Public Service" (Chairman: Guy D'Avignon), greater integration of management disciplines could contribute to a change in public service values by putting greater emphasis on the purely specialist dimension. It goes on to state,

> "In other words, the personnel systems would underline the word 'management' while recognizing that each person so identified brings with him or her specialized knowledge and experience, and this will be a marked contrast to the present practice of underlining the speciality, then drawing distinctions as to whether a person is or is not performing management responsibilities".[14]

---

[13] Treasury Board Secretariat, Personnel Management Manual, 110-7, March 22, 1977 (TB748265 of 13/3/77).

also: Treasury Board Secretariat, Training and Education in the Public Service: 1976-77.

[14] Public Service Commission, DIALOGUE: Human Resources Management, Vol. 2, No. 4, 1978, p. 5.

Unlike accountants, lawyers or economists, who may have been exposed to some aspects of business or public management during their training, scientists and engineers have generally suffered from a lack of this exposure. The introduction of training courses for management as a part of education curricula in science and technology faculties has been very recent. While it is important that those managing science should have the necessary skills, experience and aptitude for management (with a general knowledge of personnel, financial management and the machinery of government), the science function in the public sector requires an understanding of both the sociology and economics of scientific activity, its structure and processes. It demands an awareness of the nature of invention and innovation processes, determinants of R&D expenditures, techniques for R&D administration (project management, matrix management, contract management, project control and evaluation), knowledge of government S&T goals and priorities, diffusion and transfer of technology, etc.

A major emphasis in the PSC courses and seminars for scientific personnel discussed earlier has been to develop an awareness of general management rather than research planning and management in a laboratory setting. Hence, these courses have been oriented largely to senior managers. There has been little recognition given to those managerial skills needed in a laboratory environment by the section head, program manager, and assistant laboratory director that are different in many ways from those of comparable levels outside the laboratory in a general management setting.

There is a need for training seminars and courses in science management for both the junior and senior levels of management. In the former, such a program could be aimed at the scientist who has just been or is expected to be appointed to managerial responsibilities. In the latter case, a program could be developed which could also be of interest to those officers who are of a non-scientific background, but who must frequently consider scientific and technical issues in their work. Thus, at the junior level, it might be useful to discuss the environment in which the government scientist operates, and provide training in such areas as the supervision and motivation of scientists, contemporary project management techniques, techniques of technology transfer and preparation of a research budget. In programs aimed at the senior levels, emphasis could be placed on issues related to setting of R&D goals, priority areas, and liaison with agencies inside the government (other departments, and agencies — TBS,

PSC, PCO, MOSST) and outside sectors (provinces, industry and universities).[15]

The PSC, in order to encourage departments to utilize its training and development resources, should consider seeking greater participation from departmental research managers and Training and Development (T&D) officers in the preparation of its curriculum, particularly for developing modules of management training at various levels within science organizations. Such an approach would enable T&D programs to respond better to departmental needs because of being prepared to departmental specifications.

It may also be desirable for the PSC to evolve model career profiles to be used for providing guidance to those interested in science management and to recommend to individuals appropriate course structures which correspond with their career aspirations as well as the personnel needs of their organization.[16]

Several opportunities exist also for training and development programs at the departmental level. A combination of educational courses and on-the-job assignments oriented to subject management in a particular techno-economic sector could be developed along the lines of the Career Assignment Program (CAP) aimed at middle-management positions. Apart from a varied range of managerial assignments, the educational programs in departments could examine the structure of industry in the particular sector, the dynamics of intra-sector and inter-sector linkages, the concept of client/user/customer, and new methods of evaluating sectoral performance. The departmental T&D efforts in this regard could benefit significantly from a closer association with relevant sectoral groups whether they be in industry, university or government.

---

[15] See Apendix "B" for a list of course modules for science managers. The curriculum illustrates the broad scope of T&D programs that could be developed for science managers.

[16] Appendix "C" suggests a framework for a career profile for federal science managers which may be used by the Public Service Commission for counselling and course development purposes.

RECOMMENDATIONS

Resulting from an examination of current activities of science-oriented departments and the Public Service Commission related to training and development of science managers in the federal government, the following recommendations are made:

- The Treasury Board Secretariat in conjunction with the science-oriented departments and the Public Service Commission should consider establishing an interdepartmental committee on training and development (T&D) of science managers to identify the T&D needs of science departments, and to coordinate the effort required for effective action at departmental and central agency levels.

- Departments in consultation with the PSC should identify those areas in the training programs which could be developed internally and those to be acquired from interdepartmental and external sources. This would also involve a comparison of sources for course content, fees, dislocation costs and course development charges.

- For centrally established programs, the Public Service Commission should examine the feasibility of developing a series of course packages/ modules for training and development of science managers at various levels of management, based on identified needs. Active participation of departmental science managers and training and development officers should be sought for developing these courses which would emphasize training and development needs of existing personnel through creating an awareness of contempory R&D management skills and techniques.

- As part of its executive education program, the Public Service Commission should examine the feasibility of including in their courses on executive training content to familiarize managers with or without a scientific background with the purpose or use of scientific activity in a government setting and its linkages with other sectors.

- Science-oriented departments should develop in conjunction with the March 1977 policy directive of the Treasury Board on "Identification of Training and Development Needs and the Evaluation of Results" sufficient information to integrate human resource planning systems within departments with training and development requirements of the various levels of science management.

- Departments should encourage both the science managers and the training and development (T&D) officers to become aware of available opportunities and to set up the desired program standards to develop appropriate T&D plans for each research establishment.

- Departments should encourage on-the-job training assignments for development of science managers, combined with an educational curriculum to improve skills in particular areas of management. Such career assignments can be developed through rotational positions within the laboratory setting, or outside it within the department, interdepartmentally or through exchanges with other sectors.

APPENDICES

APPENDIX "A"

NOTE ON THE UTILIZATION OF TRAINING BY TYPE OF PROGRAM AND SOURCE BY MEMBERS OF MAJOR SCIENTIFIC OCCUPATIONAL GROUPS IN THE PUBLIC SERVICE

PURPOSE

The purpose of this short note is to examine the nature of the participation of major public service scientific occupational groups in management-based training programs. This discusses data received by the Treasury Board Secretariat from federal departments and agencies, as a part of its "Annual Training Report" for 1977-78.

METHOD

Departments and agencies report their employees' participation in training programs by the source giving the training as well as the type of training provided. For the purposes of the annual training review, training sources are categorized by the TBS as follows:

1. Departmental — conducted within a departmental or agency organization;
2. Interdepartmental — provided by a department or agency other than the home department of the employee (primarily Public Service Commission);
3. Outside Training — provided by a private agency or institution outside the Public Service;
4. Outside normal working hours — evening, weekend or correspondence courses.

The type of 'training' has been divided into seven categories as follows:

(i) personnel management
(ii) financial management
(iii) administrative
(iv) technical and professional
(v) EDP training
(vi) orientation for new employees
(vii) pre-retirement

The first three of these categories essentially relate to management-based training. The category 'technical and professional' covers a variety of areas. However, with reference to its usage by scientific personnel, it has been largely confined to upgrading the scientist's educational background in natural sciences and engineering. Categories (v), (vi), and (vii) are self-explanatory.

Tables 1 and 2 provide data for thirteen scientific occupational groups on the sources and types of training for the year 1977-78. The following inferences can be made from the data in these tables.

CONCLUSIONS

General

1. A majority of persons in the scientific occupational groups use available opportunities for training primarily to upgrade their scientific and professional skills. The training source which is most frequently used is the 'Outside Training' source. Training is either given at an educational institution (e.g. university) or provided by a private agency.

Sources

2. A correlation of the training sources utilized on the basis of activity and the population of respective occupational groups shows that those in the Engineering (EN) group are the most frequent users of all types and sources of training opportunities. Participants from the Scientific Research (SE) group ranked sixth. A list of users of training sources in descending order is as follows: (i) Engineering (EN), (ii) Scientific Regulations (SG), (iii) Physical Scientist (PC), (iv) Chemistry (CH), (v) Meteorologist (MT), and (vi) Scientific Research (SE).

3. Participants from groups such as Veterinary Science (VS) and Meteorologist (MT) have made use of training provided predominantly inside the departments. The utilization of outside training sources, on the other hand, is mainly done by members of the Chemistry (CH), Engineering (EN), Forestry (FO), Medicine (MD) and Scientific Research (SE) groups. With regard to interdepartmental training sources (Public Service Commission), all of these groups have generally used them to a more-or-less similar extent.

Type of Training

4. As mentioned earlier, the type of training received by these occupational scientific groups has been essentially limited to upgrading their scientific expertise and skills. In some cases, however, individuals have made use of management-based programs; for example, members of the Engineering (EN) group taking MBA and MPA courses.

5. Of those who participated in training programs from the various scientific occupational groups, the following proportion took the management development courses (personnel/financial/administrative). As noted below, the Scientific Research (SE) group ranked only sixth with 17% of its training participants as having taken one of these courses.

(1) Forestry (FO)	- 77%	of total participants in training program
(2) Biological Sciences (BI)	- 71%	" " " "
(3) Veterinary Sciences (VS)	- 68%	" " " "
(4) Engineering (EN)	- 51%	" " " "
(5) Physical Sciences (PS)	- 42%	" " " "
(6) Scientific Research (SE)	- 17%	" " " "

The foregoing, however, does not indicate annual participation rates in management development programs in terms of overall population for each group. If the above data is examined as a percentage of overall population, a reordering takes place in the ranking of these groups as shown below.

(1) Veterinary Sciences (VS)	- 25%	of total population of the VS group
(2) Engineering (EN)	- 18%	" " " EN "
(3) Chemistry (CH)	- 16%	" " " CH "
(4) Physical Sciences (PC)	- 14%	" " " PC "
(5) Forestry (FO)	- 9%	" " " FO "
(6) Scientific Regulation (SG)	- 8%	" " " SG "
(7) Scientific Research (SE)	- 6%	" " " SE "

APPENDIX "A"

TABLE 1: SOURCES OF TRAINING (1977-78)

OCCUPATIONAL GROUP	DEPARTMENTAL		INTERDEPARTMENTAL		OUTSIDE DURING NORMAL HOURS		OUTSIDE NORMAL WORKING HOURS
	No.*	Man-Days	No.*	Man-Days	No.*	Man-Days	No.*
Agriculture (AG)	162	803	61	228	30	98	7
Biological Sciences (BI)	47	112	68	322	55	921	17
Chemistry (CH)	111	169	38	164	136	315	12
Engineering (EN)	799	4,674	367	2,035	655	7,337	149
Forestry (FO)	8	29	3	13	8	56	3
Medicine (MD)	7	23	14	59	29	141	2
Meteorology (MT)	172	3,774	19	130	4	16	12
Physical Sciences (PC)	130	322	30	110	66	251	26
Pharmacy (PH)	7	9	6	32	2	20	1
Scientific Regulation (SG)	246	526	39	94	49	151	23
Scientific Research (SE)	92	195	43	199	55	3,758	4
REM	25 } 228	32 } 466	9 } 79	65 } 504	11 } 120	34 } 4,024	-
RES	111	239	27	240	54	232	-
Veterinary Science (VS)	103	1,915	5	25	73	1,505	1
Defence Science (DS)	55	502	19	74	74	458	1
		13,324		3,790		15,293	

* No. refers to number of training activities.

SOURCE: Annual Training Report, 1977-78, PMM 110-9.

TABLE 2: TYPES OF TRAINING (1977-78)

OCCUPATIONAL GROUPS	Personnel Management*	Financial Management*	Administrative*	Technical and Professional*	EDP Training*	Orientation for New Employee*	Pre-retirement*
Agriculture (AG)	-	-	-	1	-	-	-
Biological Sciences (BI)	22	1	4	11	-	-	-
Chemistry (CH)	27	41	3	119	5		
Engineering (EN)	296	-	177	452	117	29	-
Forestry (FO)	8	1	1	3	-	-	-
Medicine (MD)	6	-	4	23	-	-	-
Meteorology (MT)	2	-	-	576	117	-	-
Physical Sciences (PC)	41	11	27	53	46	12	-
Pharmacy (PH)	-	-	-	2	-	-	-
Scientific Research (SE)	81	4	46	883	19	3	-
Scientific Regulation (SG)	30	18	3	195	1	11	-
Veterinary Science (VS)	149	-	-	70	-	-	-

* In number of persons.

SOURCE: Annual Training Report, 1977-78, PMM 110-9.

APPENDIX "B"

TRAINING AND EDUCATION OPTIONS

The following outline of a curriculum is meant to be illustrative of the scope of a science management education program. These educational courses could be supplemented with on-the-job training.

1. S&T policy and related administrative measures for senior managers:

    - priority areas
    - R&D goals
    - resource allocation
    - central agencies
    - liaison
        - industry
        - university
        - others
    - issues

2. Research management (inter-disciplinary):

    Levels of management

    - senior
    - intermediate
    - junior
    - program
    - laboratory
    - project

    A long list of subject areas could be identified for providing R&D management courses to cover major problems faced by science managers. Courses under this heading could include topics such as: supervision and motivation of R&D personnel; project management techniques; planning, controlling and scheduling of R&D activities; project selection and evaluation; performance evaluation — individual and organization; determinants of successful technological innovation.

    In such courses, the emphasis would be on the application of requisite skills and techniques to the above three levels of R&D management.

3. Subject-matter management:

- energy
- environment
- food
- oceans
- health

The program could introduce participants to understanding organizational linkages, the concept of client/user, and the application of techniques such as technological forecasting and technology assessment for the better management of subject matter in the above areas.

4. Functional programs:

- S&T contract management
- Technology Transfer
- Patenting and Licensing of R&D

APPENDIX "C"

A PROPOSED CAREER PROFILE FOR SCIENCE MANAGERS IN THE PUBLIC SERVICE

A general career profile for those involved in science management within a federal science-oriented department follows. The proposed profile could be used as a counselling model by the Public Service Commission for individual career development. Through a system which combines experience, course work, and outside on-the-job training, it identifies possible benchmarks for progression of an individual's career from research scientist to an experienced science manager.

- The potential science manager demonstrates competence as a researcher and as the leader of his project in a scientific speciality.

- Next, he or she is exposed to an opportunity for managing a project or a number of studies in his specialty area (the level of a normal, competent research scientist). Before advancing to this stage (as a section head), he should be exposed to some management training especially pertaining to project management through educational programs.

- The scientist wishing to pursue a research management career is provided with the opportunity to serve as an 'apprentice' or 'developmental' research manager at a salary comparable to that of research scientist peers. (This may relate to such occupational designations as research coordinator, program manager or the assistant/deputy laboratory director.)

- The apprentice science manager prior to any upgrading of position is asked to work in another departmental laboratory, regional office or headquarters. Whenever appropriate the apprentice research manager may be asked to obtain a defined minimum of extra-governmental (in industry, universities, provincial governments, etc.) research experience through an exchange program.

- A successful apprentice manager, in following such a career pattern, would become an excellent candidate for senior science manager positions.

III. TEMPORARY MOVEMENT OF SCIENTISTS BETWEEN GOVERNMENT LABORATORIES AND CANADIAN INDUSTRY

INTRODUCTION AND BACKGROUND

It has been recently pointed out that the probability of successful technology transfer is greatest when the original idea with all its ramifications and the requisite background knowledge is fully understood at the place of application. Report No. 24 of the Science Council of Canada, entitled "Technology Transfer: Government Laboratories to Manufacturing Industry", states that this need can be met by movement of personnel who have this knowledge from the place of origin to the place of application through, for example, secondment, transfer or formal change of employment.[1]

The value of such a recommendation was reviewed by an Ad Hoc Committee on Technology Transfer appointed in 1976 by the Minister of State for Science and Technology. In April 1978, as a part of the Cabinet decision on technology transfer policy initiatives, MOSST, in conjunction with other central agencies and science-oriented departments, was asked to examine the "identification and removal of impediments to the movement of scientists between government laboratories and Canadian industry".

PURPOSE

In view of the above, this paper seeks to examine existing arrangements for the exchange of scientists between government and industry. These include the centrally managed exchange program (Interchange Canada) as well as

---

[1] Science Council of Canada, Technology Transfer: Government Laboratories to Manufacturing Industry, Report No. 24, Ottawa, December 1975, p. 46.

also: Science Council of Canada, The Role and Function of Government Laboratories and the Transfer of Technology to the Manufacturing Sector, Background Study No. 35, Ottawa, April 1976.

Science Council of Canada, The Movement of Scientific and Engineering Personnel Between the Federal Government and Industry, Ottawa, November 1976 (a contract by Donald Watson).

MOSST, Enhancement of Technology Transfer from Federal Laboratories to Industry, Discussion Paper, March 1, 1978.

recent efforts made at the departmental level. The paper also discusses available administrative mechanisms for both transferring industry personnel into the public service and transferring federal personnel out to industry on a temporary basis.

INTERCHANGE CANADA

Organization

Administered by the Public Service Commission (PSC), Interchange Canada facilitates the temporary transfer of personnel between the federal government and other sectors through its Executive Interchange Program. This program, in operation since 1971, is aimed at helping "established executives broaden their experience through assignments in other sectors".[2] The program was approved by Treasury Board as part of the education and development program for the public service. It is available only to departments and agencies for which the PSC has sole authority for appointment, as defined in the PSSRA schedule I, parts I and II.

The objectives of the program are to enable departmental executives to:[3]

- acquire and exercise new managerial skills in a different setting;
- improve their awareness of Canadian regional problems and interests;
- develop a better understanding of problems, work methods, and areas of common interest to executives at all levels of government and the private sector;

---

[2]Public Service Commission, Interchange Canada, Ottawa, p. 1.

[3]Treasury Board Secretariat, Personnel Management Manual (PMM) 120-7, pp. 1 - 2.

- become familiar with new viewpoints, management systems and work environments; and

- develop a spirit of cooperation and mutual confidence between executives from the public and private sectors.

Eligibility for this program has been restricted to Senior Executive Officers and certain equivalents.[4] In February 1978 the program was modified to enhance communication between public servants and clients. A government statement recommended that "the Public Service Commission be invited to increase the scale of the Interchange Canada program to include public servants at all officer levels and to relate the program to a greater cross-section of Canadian society".[5] A number of scientists in SX Equivalent Groups who are in managerial positions have made use of this program.

The Public Service Commission coordinates all interchanges and arranges the terms of each assignment. The length of an assignment is flexible but is usually for two years with an extension of one year. The sponsoring organization absorbs the employer's costs of pension and insurance plans as well as removal costs. On-the-job expenses are the responsibility of the host organization.

PSC ensures that potential interchange candidates come through departments and that, in the event an interchange is arranged, a position of at least the level held on leaving is available on their return. The intent of such an approach is that, because of the requirement for job security on return, the PSC's Interchange Canada office would not be inundated with inquiries and requests from individuals from either the private or public sectors who do not have the support of their employer.[6] Table 1 shows the extent of the exchange as of 31 January 1978, from the federal government to industry and other sectors and vice versa (see page 50).

---

[4]Treasury Board Secretariat, Personnel Management Manual (PMM) 120-7, p. 3.

[5]Cabinet Document 48-78RD, February 9, 1978, subject: Service to the Public.

[6]Letter from Director General, Staffing Branch, PSC, to the Assistant Secretary, Industry Branch, MOSST, January 28, 1977.

TABLE 1

EXECUTIVE INTERCHANGE PROGRAM

	1971	1972	1973	1974	1975	1976	1977	1978	TOTAL
FROM:									
Private sector	-	4	1	41	22	88	47	1	204
Universities	-	2	-	12	14	10	10	1	49
Other levels of government in Canada	-	-	-	2	2	2	2	-	8
Foreign governments and international agencies	-	1	-	1	2	-	1	-	5
TOTAL	-	7	1	56	40	100	60	2	266
TO:									
Private sector	-	4	2	7	13	19	27	4	76
Universities	-	-	2	1	1	4	3	2	13
Other levels of government in Canada	1	2	1	3	8	6	11	1	33
Foreign governments and international agencies	-	-	2	2	3	11	10	3	31
TOTAL	1	6	7	13	25	40	51	10	153

31 JANUARY, 1978.

With specific reference to those in the scientific occupational groups of the scientific and professional category of the public service, an examination of the program since its inception in 1971 showed that, of the 153 executive and equivalent-level personnel who made use of the program for temporary transfer outside the federal government, only twenty-six persons had a scientific and technical background. Of these twenty-six, fifteen persons made use of the program for transfer to industry. Over the same period, there was virtually no movement of industrial scientists to the federal sector under this program. Further, this one-way exchange was mainly at the management level and not between scientists working in government and industrial laboratories.

Survey Questionnaire

To understand the implications of the secondment of scientific personnel to the private sector under the Executive Interchange program, a survey questionnaire was sent to the fifteen federal scientists and research managers who had participated in the program.[7] The objective was to develop a general profile of the participants as well as to obtain their comments on the usefulness of the program as a means for technology transfer.

Based on the responses of these scientists and technologists, it was seen that most of them, prior to their posting in the private sector, had occupied such middle-management positions as research coordinator and program manager (often REM II level positions). In general, they had previously worked outside the government and changed jobs four or five times during their career. Prior to their interchange assignment, the majority had been employed an average of fourteen years in the public service. As mentioned earlier, none had held the position of laboratory director; also, none could be described as a bench-level or field scientist.

The public service scientific personnel who participated in the interchange program were generally involved in activities in the private sector similar to those carried out in government. Assignments were not tied to

---

[7]See Appendix "A" for the questionnaire sent to the Executive Interchange Program participants.

any specific industry-government S&T transfer project or oriented to meet any definite need in industry or government department. The experience gained in the private sector was described in terms of "personal accomplishment".

Two major criticisms of the program were made by respondents. Firstly, the program was poorly advertised both within and outside the public service. Secondly, there was a lack of effort on the part of parent organizations to make use of ideas, knowledge or experience gained during their stay in the private sector.

In responding to an item in the MOSST questionnaire about the need for developing a specific S&T personnel exchange program aimed at technology transfer from government laboratories to industry, more than half of the respondents were in favour of developing such a program, whilst others felt that the mandate of the existing interchange program could accommodate policy thrusts identified in the government's decision to enhance technology transfer from government laboratories to industry.

Discussion

Adequacy of the centrally managed Interchange Canada program with special reference to the exchange of scientific and technical personnel between government and industry can be assessed from two points of view. These are: (a) adequacy of the program for enhancing technology transfer between government laboratories and industry; and (b) adequacy in terms of the number of scientific personnel who have made use of it over the past seven years.

From an examination of the objectives it is apparent that, by definition, the program has been developed primarily "to help executives in the federal public service learn more about management practices elsewhere". However, the exchange of scientific personnel at the laboratory level could be effective in other ways such as for the transfer of technology, and need not necessarily be limited to gaining experience in learning only management practices in the private sector. Nevertheless, efforts at broadening the program beyond the acquisition of managerial experience may lead to a deviation from its original intent, making it too diffuse for either effective executive development or technology transfer purposes.

At the same time, it should be pointed out that, in addition to Interchange Canada, the Public Service Commission operates two other management development

programs. These are the Career Assignment Program (CAP) which is internal to government but is based on inter-departmental transfers, and the Auditor General's Exchange Program. The Auditor General's program was evolved three years ago on the premise that departments and agencies were in a better position to establish direct exchange relationships with their client groups. In this regard, the Office of the Auditor General has made use of the Interchange Canada mechanism to arrange a number of temporary transfers for auditors to the private sector and vice versa.

The adequacy of the PSC's interchange program can also be assessed in terms of the number of scientific and technical personnel who have made use of the program for temporary transfer to industry. Movement of S&T personnel in either direction, as stated earlier, has been limited to a small total number and to few occupational groups. Since 1975, the PSC has allowed officers below the SX level to participate in the program "provided there is clear evidence that the officer and the proposed assignment are of the highest calibre".[8] However, in spite of this practice and the government's recently stated desire to "increase the scale of Interchange Canada" so that public servants at all officer levels would be eligible for participation in the program, these new thrusts are not yet included in Treasury Board policy and related PMM chapters.

Such a modification might have encouraged more S&T personnel in managerial ranks to participate in exchange arrangements. But so far those scientists who have made use of the program are generally earning salaries of $30,000 and above. They mainly belong to REM subgroups. From a population of 277 REMs (1977), less than ten REMs have made use of this program over the past seven-year period. If this program were to be aimed at laboratory-level S&T personnel, it would have to be extended to include those below the $30,000 salary level. This would have significant ramifications for other occupational groups in the scientific and professional category.[9] As

---

[8] John J. Carson (PSC), "Interchange Canada: The Federal Manpower Exchange Program", The Canadian Business Review, Winter 1975, Volume 2, No. 1.

[9] Under its special program for the Auditor General's office, the exchange has included junior level auditors, officers who have just completed their articling and are at the AUII level with a current salary range of $23,000 to $26,000 per annum and with only three years experience.

identified by MOSST in an earlier report on scientific manpower, there are thirteen occupational groups in the scientific and professional category that could be described as performing scientific functions.[10]

From the foregoing, the following conclusions can be drawn about the adequacy of PSC's Interchange Canada - Executive Interchange Program for exchanging scientific personnel between government laboratories and industry.

- The program is aimed at executive development and not the transfer of technology from government laboratories to industry. This is partly because the program is based on a Treasury Board policy (and managed within that policy by the PSC) which states that the program be used by deputy heads for training and development of public servants.

- The present interchange assignments are not tied to a joint government-industry venture or oriented to specified needs of either sector. They are essentially aimed at indirect transfer of 'personal' experience with the object of career development of an individual.

- As the Executive Interchange is aimed at SX or equivalent levels (PMM 120-7), it cannot, by definition, attract working scientists. Consequently, those working in government laboratories, either at the laboratory director or the working scientist levels, have not made use of the program.

- It has attracted essentially those S&T managers who have previously worked outside the government. Because of the SX or equivalent level stipulation, very few younger scientists have made use of the program.

---

[10] MOSST, Scientific Manpower in the Federal Government (Phase I), November 1977, p. 4a.

In 1977, a preliminary count of the strength of personnel in the thirteen occupational groups was 9,493.

- Of a population of 277 Research Managers (1977), less than ten REMs have made use of this program for interchange with industry over a seven-year period.

- The program has not been given wide publicity either within or outside the public service. It is left to deputy heads to determine how many, and who, of their executives would benefit from this particular development program.

- In accordance with the intent of the February 1978 government decision to increase the scale of the Interchange Canada program, corresponding changes will be needed in the existing Treasury Board policy and the related chapters of the Personnel Management Manual.

In summary, it is evident that, in order to enhance the movement of scientific personnel between government laboratories and industry, a substantive modification would be required in the existing Interchange Canada program. A possible alternative for a centrally managed secondment program would be a separate R&D personnel exchange program either as a component or independent of Interchange Canada (for example, one similar to the program for the exchange of the Auditor General's staff). Such a program should have, as a specific objective, the transfer of technology from government to industry at the laboratory level, and could be given due publicity in both sectors to explore possibilities of government-industry S&T joint ventures to meet government objectives. Criteria for eligibility for the program would have to be related to a mix of the needs of the individual seeking interchange, departmental requirements, and industry sector needs.

EXCHANGE INITIATIVES OF SCIENCE-ORIENTED DEPARTMENTS AND AGENCIES

In recent years, few initiatives have been taken by science-oriented departments and agencies to evolve their own programs of exchange of scientific personnel with industry. In some cases where such programs have been developed, a large part of the exchange has been directed at providing an opportunity to industrial scientists and technologists to work in federal laboratories. The arrangements have ranged from a two-week to a two-year stay of industry personnel in science-oriented departments and

agencies. These interchanges have mainly taken place in the Departments of Communications, Energy, Mines and Resources, and Fisheries and Oceans and in Atomic Energy of Canada Ltd., and the National Research Council.

Department of Communications

An industrial exchange program which covers the movement of scientific personnel between DOC and industry has been in operation in DOC since 1971. Its major objective is to develop and stimulate communication, understanding and a working rapport between the Department of Communications and industry.

Exchanges take the form of assignments selected to satisfy an operational need while exposing the incumbent to experience not available in the parent organization. The program operates within a flexible administrative framework and can be adapted to satisfy various personal and operational needs.

In practice, developmental objectives are identified for individuals by the parent organization and participating organizations are asked to identify assignments to satisfy these objectives. The purpose of this program is aimed primarily at middle-management levels in both industry and government. Candidates are selected primarily on the basis of their potential and their ability to meet an identified need.

Assignments usually last one or two years during which time the employee remains on the payroll of the parent organization and is entitled to all salary increases he would have received had he not participated in the industrial exchange program. The department, therefore, considers itself responsible for the man-year. Vacation leave and sick leave are calculated in the same manner as with the parent organization. The participants are entitled to all other fringe benefits which they received with the parent organization. The receiving organization reimburses the original employer, on a monthly basis, for all 'costs' incurred by the employee on loan. The receiving organization normally pays reallocation costs. However, while on this program, the employee's hours of work, statutory holidays and travelling expenses are governed by the regulations of the receiving organization.

All participants in this program are subject to the rules and regulations applying to the protection of information.

With regard to the employee's performance while on assignment, it is evaluated by the receiving organization with a copy to the parent organization.

These terms and conditions are generally outlined in a 'Letter of Understanding' between the host and sponsoring agency. The departmental program is preferred for the non-executive staff as it is totally administered departmentally and provides flexibility to both host and sponsoring agency in establishing direct contacts on scientific and technical projects. The senior executive staff, on the other hand, is encouraged to make use of the Executive Interchange Program.

Since 1975, five persons have come into DOC on the departmental industrial exchange program from the private sector to work in departmental laboratories. In the opposite direction, four DOC personnel (3 RES at levels 1 and II, and 1 REM) have worked in the industry sector for one-year periods. The number of transfers in recent years has been low because of budgetary constraints.

Atomic Energy of Canada Ltd.

Two main techniques used by Atomic Energy of Canada Ltd. (AECL) to transfer technology from its laboratories to potential users are (a) industrial development contracts, and (b) attachment of industrial staff to AECL design offices and laboratories.[11] Both of these have one important thing in common, namely, the opportunity for dialogue between the laboratory and the industrial company at all levels from the professional engineer to management personnel. This enables each side to specify a mutually agreed objective but with each of the parties recognizing the constraints under which the other has to operate.

---

[11] C.W. Perryman (AECL), Transfer of Nuclear Technology to Canadian Industry, paper presented at the Industrial Technology Transfer Symposium, Toronto, October 21, 1977.

Dr. Perryman is the Director, Applied Research and Development, Chalk River Nuclear Laboratories, AECL.

also: J.S. Nelles (AECL), Expanding the Manufacturing Base, paper presented to the meeting of Innovation Canada Inc., June 15, 1978.

AECL encourages the attachment of industrial staff to its laboratories. In June 1978, AECL had thirty-one professionals and senior technicians from Canadian industrial and engineering firms attached to its laboratories. Also, thirty-four professionals were attached from Canadian power utilities. The 'attached staff' work alongside AECL staff, becoming working members of AECL technical teams. The minimum period of attachment is normally one year.

A variety of situations exists in which such attachment of industrial personnel takes place. The following two cases reflect the scope of the attachment program.

Case I

An industrial firm may ask AECL to permit its staff to 'learn' about technology developed in AECL laboratories. AECL provides space for the industrial staff but the cost (salary, benefits, etc.) are borne by the company.

Case II

In the case of technology under development, which AECL considers may be of long-term (a decade or two) interest or benefit to industry, members of that industry are encouraged to attach staff to AECL laboratories (e.g. work on fuel fabrication from uranium to thorium). In this case, AECL reimburses 1.5 times the salary of the individual to the company. The additional fifty percent of salary covers other aspects such as fringe benefits, pension, accommodation, etc.

Between these two extreme cases of personnel attachment, there are a number of intermediate situations where AECL and the company share the cost with the proportion borne by each party determined by the nature of the project.

Under AECL's terms and conditions of employment for the attached staff from industry, it can refuse to accept a person nominated by the sponsoring organization. The person from industry must satisfy AECL requirements related to such issues as competence, conflict of interest, and security. The individual must work under AECL technical and administrative direction.

Energy, Mines and Resources (EMR)*

The department through its CANMET laboratories has joint field projects with industry. However, few temporary postings to laboratories in either direction have been made. No direct or formal program of exchange of scientific personnel between government and industry laboratories exists. The movement between the two sectors is largely on an ad hoc basis.

Duration of the exchange on either side ranges from two to six weeks. This is usually to put in operation or under test new technologies developed within CANMET laboratories (e.g. installation and testing of ion exchange techniques for uranium plants, equipment needed to measure cyanide in plants, etc.). To date, ten to fifteen persons from industry have participated. Salaries and expenses are paid by the respective employers.

National Research Council (NRC)

As part of its mandate to carry out "research in direct support of industrial innovation and development", NRC, over the years, has encouraged the stay of outside professionals in NRC laboratories for a short period of less than a month for the purposes of technology transfer. Movement of scientific personnel between industry and NRC laboratories has been described as one of the elements of its strategy for industrial R&D support.[12] To stimulate efforts in this direction, NRC has announced a series of initiatives. They include: (i) a planned series of visits of NRC personnel to industry and visits of members of particular industrial sectors to NRC laboratories; (ii) the operation of the Canada Institute for Scientific and Technical Information (CISTI) as an additional direct means of putting NRC resources at the disposal of industry; and (iii) the Program for Industry/Laboratory Projects (PILP) for bringing together NRC and industry personnel on a specific project.

---

*The Department of Fisheries and Oceans also has a program at the Patricia Bay and Bedford Institute Laboratories whereby space and facilities are made available to industry and technical assistance is provided to permit companies to carry out their own development.

[12]National Research Council, Report of the President, 1977-1978, Ottawa, p. 74.

Discussion

Conclusions from the foregoing examination of scientific personnel exchange arrangements between the government and industry at the departmental level can be summarized as follows:

- Only a few science-oriented departments or agencies have evolved substantive scientific personnel exchange programs with industry on a direct basis.

- Existing arrangements for the temporary transfer of scientific and technical personnel at the departmental level point to a wide variety of administrative arrangements reflecting several possible situations and approaches for direct exchanges at this level.

- Movement of scientific personnel as a result of departmental programs has been mainly in one direction — moving industrial scientists or technologists to work in government laboratories. Very few opportunities are provided for the temporary transfer of scientists working in government laboratories to the industry sector. Some of the obvious reasons for such a situation are: (a) lack of recognition of industrial experience by government laboratories; (b) lack of cooperative industry-government S&T ventures; (c) lack of adequate research facilities in the industry sector; (d) reluctance to move in a period of uncertainty; and (e) financial and manpower constraints.

The value of departmentally managed interchange programs is self-evident. Wherever implemented they have been useful in the secondment of those scientific professionals below the senior executive level. The departmental interchange programs are usually tied to a specific project and as such they generally respond to defined requirements within the federal department and industry. The wide range of situations under which interchange has taken place in some science-oriented departments and agencies suggests inherent flexibility in the departmental approach. Federal science departments can learn much from each other's experience in this regard.

ADMINISTRATIVE MECHANISMS

Transfer of S&T Personnel to Industry

The Public Service Terms and Conditions of Employment and Regulations (PSTCER) recognizes only three conditions of employment: (a) normal, (b) leave with pay, and (c) leave without pay. It describes the circumstances under which (b) and (c) may be authorized. Section 61 of PSTCER, while defining the conditions of leave from work under the above two, does not yet include assignments of scientists and technologists to industry. Similarly, Section 6 of the Public Service Superannuation (PSS) regulations, while defining the conditions of payment of superannuation contributions for public servants at the single rate during leave without pay, does not make any provision for services which may be performed in industry in the public interest. Further, use of the 'secondment' mechanism is limited to temporary transfers between federal departments and cannot be used between the government and non-government agencies.

In view of the government decision to enhance technology transfer from government laboratories to industry, these mechanisms should be examined to ensure that suitable amendments are made to facilitate the interchange of personnel between the two sectors when it is in the public interest.

In the transfer of scientific personnel to industry, any of the following situations could arise. These situations are based on a deputy head's possible decision as to the need or desire to exchange personnel in order to meet his program objectives.

1. Relocation of employee and his position to an industrial site with employee remaining functionally and administratively responsible to the DM, although providing advice and assistance to industry.

2. Employee is required by the department to work in industry to transfer knowledge or experience for a finite term, but in this case is responsible to the industrial supervisor.

3. Employee requests to serve in industry for a finite term at the invitation of industry under the responsibility of an industrial supervisor.

However, the departmental head determines such service to be in the public interest and of benefit to Canada.

4. Employee requests to leave the public service to work in private industry on a permanent basis.

As stated earlier, in view of the government's decision on technology transfer, these situations would need further examination by the Treasury Board Secretariat.[13]

Transfer of Industry Personnel to Departments

At present, three main administrative mechanisms are used for the temporary employment of industry personnel in the public service. They are (a) term appointment, (b) Special Assignment Pay Plan (SAPP), and (c) Personal Service contract.

Treasury Board in recent years has discouraged the use of personal service contracts, especially in those cases in which an 'employer-employee' relationship prevails.[14] The TBS concern is that this would contravene both the Public Service Employment Act and the Public Service Staff Relations Act. Furthermore, TBS feels that the department may use the contract as a means to circumvent man-year restrictions on departments.

The restriction on using the personal service contract mechanism has been cited as a hinderance by some of the science-oriented departments who have, in the past, had industrial personnel working on a temporary basis in

---

[13] For information and discussion of related administrative mechanisms, see: a draft paper by MOSST's Industry Branch entitled "Bulletin on the Exchange of Scientific Personnel Between Government and Industry", 1977.

also: "A Discussion Note on Transfer of Scientific and Technological Knowledge of Industry" by C.E. Leighton, Personnel Services Branch, Treasury Board Secretariat, June 27, 1977.

[14] Treasury Board Circular No. 1974-43.

their laboratories. There are certain S&T contracts that, because of their nature, require close, personal, day-to-day contact that could be construed as being of an employer/employee relationship. For such projects, close liaison between industry personnel and the staff of the government laboratory would be necessary.

It would appear that the interpretation of this administrative procedure might be broadened when dealing with S&T activities to foster implementation of the contracting-out and technology transfer policies. Accordingly, TBS might wish to re-examine this mechanism to identify exceptions on a case-by-case basis.

CONCLUSIONS AND RECOMMENDATIONS

The magnitude of movement of S&T personnel between government and industry at the laboratory level, as this examination has shown, has been of a limited nature in either direction. Over the past five years, only thirty persons with scientific and technical background have moved to industry on temporary assignments, through either departmental or central agency interchange programs. Inflow of S&T personnel from industry to the federal government has been somewhat greater but has been limited to only a few departments and agencies.

The modest efforts which have been made at the central agency level have been largely on an ad hoc basis, at the personal initiative of the incumbent and without any serious consideration of the enhancement of technology transfer to industry. Similarly, at the departmental level, with the exception of some technology-intensive departments, little examination of the value, need and extent of such an exchange program for laboratory personnel has been carried out. The general trend indicates that utilization of the program has been largely dependent on the aspirations of the individual scientist rather than on management deciding that appropriate personnel exchanges meet government objectives for R&D, transfer of S&T, contracting out, etc.

There are attitudinal and administrative barriers to be overcome in facilitating such an exchange of S&T personnel between the two sectors. Some major impediments have been discussed earlier. A precondition for successful secondment of S&T personnel requires an environment in which the two sectors see mutual benefits in working with each other on a scientific and technical level. Most of all, it anticipates that the work of interest to various

industrial sectors is being carried out in government laboratories and industrial organizations, and that the staff of their respective laboratories have something useful to contribute.

There is value in both central and departmental R&D personnel exchange programs. The major strength of a centrally managed exchange program is that it avoids duplication of effort which may result if the programs were to be carried out on a departmental basis. However, the strength of a departmentally managed program lies in that it is generally the departments who have (or would like to have) closer links with industry and have a better feel for the specific needs of their S&T personnel. Before they could be utilized effectively either separately or in conjunction, these alternative approaches would require further examination to define more fully their respective advantages and to resolve such problems as those associated with their funding and with the staffing required for their administrative functions.

In view of the federal government's decision to enhance technology transfer from government laboratories to industry, it is recommended that:

- Based on the approach followed by the Office of the Auditor General, the Public Service Commission, in conjunction with the Treasury Board Secretariat, should examine the Interchange Canada program for the purpose of using this mechanism to establish a specific exchange program for R&D personnel with the objective of promoting technology transfer from government to industry at the laboratory level, as well as developing managers. Criteria for eligibility would be related to the needs of the individual, department and industry sector.

- The Treasury Board Secretariat, in conjunction with MOSST and science-oriented departments, should take steps to modify existing policies, relevant Personnel Management Manual (PMM) chapters, and related mechanisms to remove identified impediments to exchanging of scientific personnel between government laboratories and industry in the following areas: leave of absence, pay

and benefits, secondment and personal services contracts in order to facilitate such exchanges and to improve their effectiveness in technology transfer and contracting-out, and their response to other government policies for R&D.

- The Treasury Board Secretariat, in conjunction with MOSST, the Public Service Commission and science-oriented departments, should develop a long range plan for the gradual increase of exchanges between the government laboratories and industry.

- In view of the limited nature of movement of scientific personnel between government and industry, the Public Service Commission and the Treasury Board Secretariat should publish and circulate a bulletin on available programs, mechanisms and criteria for exchanges between the two sectors, in industry as well as in federal departments.

APPENDIX "A"

INTERCHANGE CANADA

MOSST QUESTIONNAIRE

Personal

1. Name:

2. Address:

Position

3. Present Position (Title and Classification):

Career Movements

4. Number of years spent outside the Public Service before joining the federal government:

5. Number of years in the Public Service:

6. Number of job changes in the past:

7. Number of years in your present position:

8. Title and classification of position before Interchange:

9. Title and classification of position(s) after Interchange, if different from 3:

Interchange

10. Interchange with (name of company):

11. Interchange in the same field/position (level and responsibilities:

12. How did you come to know about the 'outside' position (through Department, Public Service Commission, other)?

13. For how long was the interchange?

14. What opportunities did job in private sector offer the interchange of technology?

.../2

Experience

15. Did you find the interchange experience valuable in
    - personal terms?
    - professional terms?
    - academic terms?

Impediments

16. Did you encounter administrative impediments which could be improved with respect to:
    - applying for and arranging the interchange?
    - drawing salary, pension and other benefits?
    - leave of absence mechanisms?
    - performance-appraisal?
    - returning to your department or to the Public Service?

Comment

17. Are you satisfied with present methods used to transfer federal skills and talents to the private sector?

18. What suggestions do you have for making the Interchange Canada program more attractive to persons with scientific and technical background?

19. How effective do you consider the interchange program to be as a mechanism for technology transfer from government to the private sector and from the private sector to government?

20. Would you recommend it to your colleagues?

21. Should a new program dealing specifically with exchange of S&T personnel be developed?

22. Any other comment?

*As a point of contact for any clarification, Dr. Bill Bhaneja can be reached at (613) 593-4832.

BB/bw

IV. RENEWABLE TERM AND ROTATIONAL APPOINTMENTS

INTRODUCTION AND BACKGROUND

The directors of laboratories and establishments have significant influence on the programs and general climate within their organizations. The impact which the heads of these organizations have on their staff is a result of the combination of the incumbent's personal style and institutional circumstances. Emphasizing the vital role of the laboratory director, the Science Council report on government laboratories points out:

> "Laboratories, and the R&D establishments of which they may be part, tend to have considerable inertia — like other organizations. They have a momentum which is a function of their existing staff and facilities and of their past commitments. The flexibility which still remains within them will depend on staff adaptability and on the foresight and resourcefulness of their heads, who must possess skills in personnel management as well as in science."[1]

Nevertheless, it is imperative that the importance of the role is fully reflected both in the choice of a head and in terms of his or her appointment. In particular, a major problem results from the contemporary pace of techno-economic development. It is, consequently, sometimes difficult for a single individual, however competent, to sustain indefinitely the initial level of creative direction in the face of the extremely heavy administrative demands on his or her time.

The above report recommended that to alleviate such a situation "renewable term appointments be instituted for research heads, with single term appointments becoming normal practice".[2] The recommendation was further studied by the Ad Hoc Committee on Technology Transfer appointed by the Minister of State for Science and Technology. Based on the observations of the Committee, the government in April 1978 decided that MOSST should, in conjunction with

---

[1] Science Council of Canada, Technology Transfer: Government Laboratories to Manufacturing Industry, Report No. 24, December 1975, p. 37.

[2] Ibid, p. 47.

central agencies and departments, examine "the feasibility of renewable term assignments to laboratory director positions".[3]

PURPOSE

This paper, while exploring the possibility of implementing such an administrative mechanism within federal laboratories, seeks to study the cases where mechanisms similar (or close) to the concept of 'renewable term' have been established both within and outside Canada. In view of these experiences outside the public service, the paper seeks to identify possible potential impediments to implementing such mechanisms within federal laboratories.

Renewable term appointments apply when the director is appointed for a fixed term and the incumbent's performance is reviewed against the mandate at the end of the term to consider renewal of the appointment. Single term appointments are generally encouraged. Criteria for renewal would be based, in part, on the broad functions of a laboratory director which would assess the incumbent's ability to determine policies for research administration including the interface with potential users: i.e., examine the place of the laboratory within the department, the civil service and the country; set goals for growth of the laboratory; and, continue re-examining the purpose of the laboratory.

RENEWABLE TERM MECHANISM

University

Since the early sixties, the academic administration in Canadian universities has been making increasing use of renewable term appointment mechanisms at all senior levels of management. In a study of the academic administration of one Canadian university, the following four levels of a term management position were noted: president

---

[3] MOSST, Enhancement of Technology Transfer From Federal Laboratories to Industry, Discussion Paper, March 1, 1978.

(six-year term), vice-president (six-year term), dean (eight-year term), chairman (three-year term).

In this university, nominations for the position of chairman of an academic department are made by the teaching staff within the department to elect one of their colleagues. Workers and technicians have also been given a minor voice in some cases in the nomination of the chairman.

The appointment is for a three-year term subject to the approval of the university president. The term can be renewed any number of times if colleagues re-nominate the person for the position and the president accepts.

In the case of the dean of a faculty, the post is advertised and the selection is made by a search committee comprising academic and university administration staff. The appointment is for a six-year period and the general tendency has been to hire a person from outside the university to get a breath of fresh air into the faculty.

For both of these positions, the major function is to oversee the academic development of the department and faculty, respectively. However, administration both at the faculty and departmental level is largely autonomous and is generally independent of the university administration. The roles are essentially of a coordinative nature where consensus on most of the important decisions is reached within a committee structure, particularly those pertaining to setting up a curriculum and research program.

Although the teaching load of the incumbents of these administrative positions is kept light, they are expected to continue performing both their teaching and research functions. A general tendency is not to stay in these positions for over ten years as the feeling is that the incumbent will likely become too removed from any active research. There is a monetary compensation paid for these administrative duties. Such administrative appointments are not considered to be a necessary pre-requisite for promotion to the next level in professional rank. This is mainly based on the performance of the academic functions (teaching and research).

A major problem faced by those in these administrative positions seems to be one of reintegrating into the academic mainstream of the faculty after the term is completed. The use of sabbaticals has been made for this purpose. Instead of a six-year waiting period for eligibility for these sabbaticals, those holding the position

of chairman or dean can now make use of sabbaticals after five years. One solution to the salary-levelling problem is that the extra stipend is not taken away from the incumbent at the expiry of his or her term, but the salary is 'red circled' until the person returning to the academic position catches up with the level of salary drawn as an administrative head.

National Research Council (NRC)

The position of a 'group director' in the laboratory divisions of the NRC is a recent innovation for evolving renewable term appointment positions. The appointment of a group director is on a three-year, renewable term basis which is made by the Council.

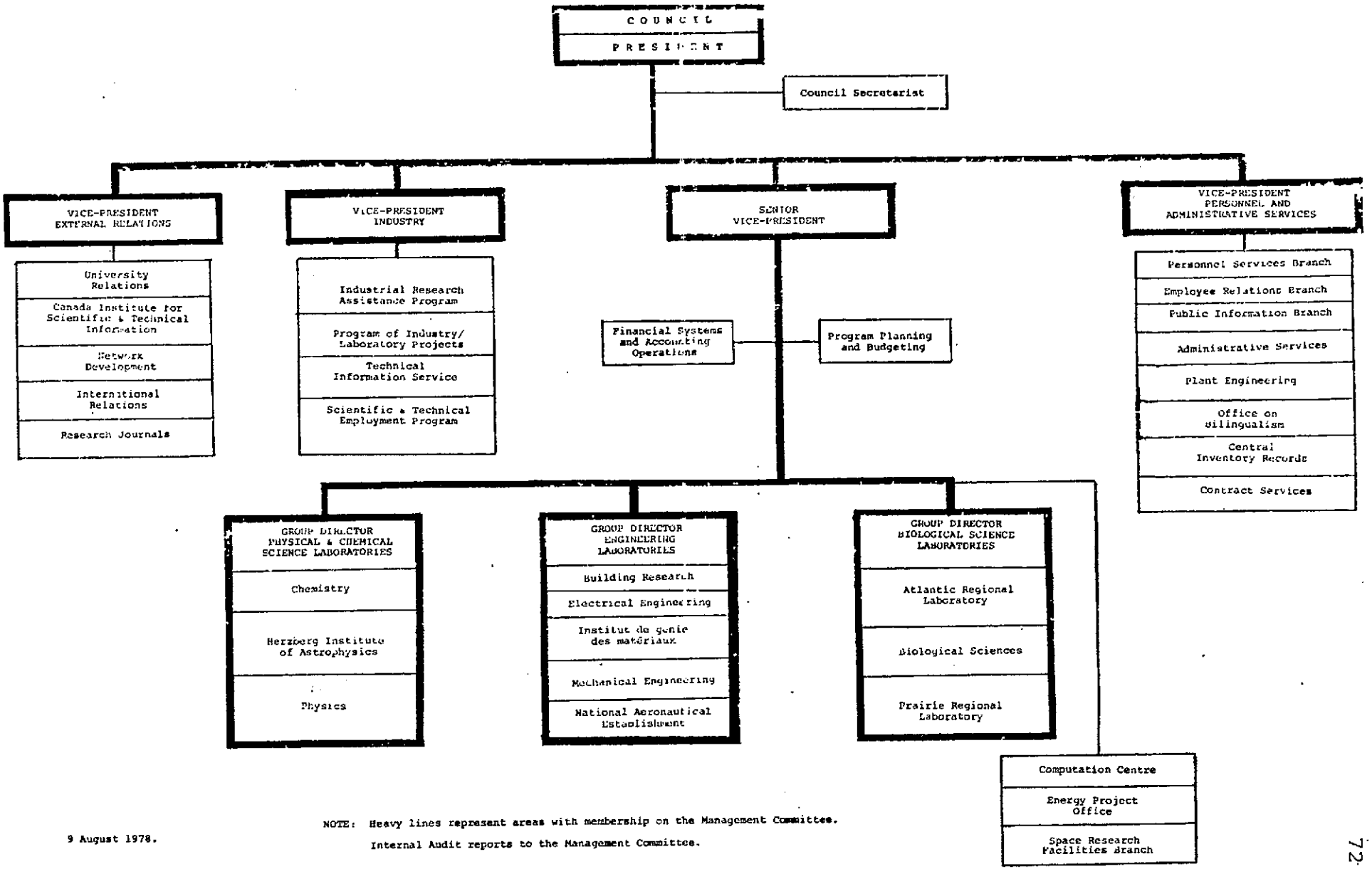
NRC has three of these group directors who report to the Senior Vice-President. The group directors hold essentially coordinative portfolios responsible for a group of three or more divisions in their specialty areas. At present, NRC laboratory divisions are divided into three groups: (i) Physical and Chemical, (ii) Engineering, and (iii) Biological Sciences. See Figure 1.

The group director has a dual portfolio. As director of a division he is responsible for the activities of that division. As a group director, while continuing to provide direction to his own division, he has specific responsibility for forward planning and resource allocation for all divisions in his group. Each of these divisions is headed by a director.

Decision-making is generally of the collegiate type, more persuasion and consultation than authoritative direction. The group director is appointed by the Council from the divisional directors.

The group directors are members of the Management Committee (the senior managerial committee at NRC) which is chaired by the President. Their position is renewable, subject to the approval of the NRC Management Committee and the Council. The first appointments to the group director positions were made in 1974-75. Because of the three-year term appointment for this position, two of the original three appointees have been replaced (one retired and the other returned to concentrate on his division). The third appointee has had his term renewed for another three years.

Figure 1



NOTE: Heavy lines represent areas with membership on the Management Committee.

Internal Audit reports to the Management Committee.

9 August 1978.

International

An examination of recent practices pertaining to the renewable term appointments of directors of government laboratories outside Canada illustrated some interesting initiatives in this area taken by France, Germany, Australia and the U.S.

France

A review of a laboratory director's appointment every four years is a part of the recently established mechanism for evaluating government laboratories. Two principal questions are posed: (a) does the laboratory justify its continued existence? and (b) should the mandate of the laboratory director be renewed? Such a review of the mission of the laboratory and the position of its director has only been in practice since 1977.

West Germany

West Germany has developed two types of renewable mechanisms for government scientific organizations.

In its 'Limited Company' type research agencies (somewhat like our Crown corporations), which have been set up under the responsibility of industrial technology-oriented ministries (e.g. Ministry of Research and Technology and the Ministry of Defence), the appointment of a laboratory director (often a project director) has been on a five-year contract. The contract is renewable.

In the second type of government research establishment (e.g. in ministries such as Agriculture, Food, Forestry, etc.), although the position of director must be filled by a national competition, the appointee can function until retirement. The practice of renewable term appointment has been introduced at a higher level, that of the director-general.

The director-general is appointed for a specific term of two years, and the term can be renewed just once. The position is elective as the person is chosen by a group of laboratory directors and a scientist representative from each laboratory. The director-general "wears two hats", one as head of the group of laboratories and the other as continuing director of his laboratory. He

is paid extra for the additional duties and returns to his former position at the expiry of the term. The renewable term position in many ways resembles NRC's 'group director' position.

Australia

The Council of Scientific and Industrial Research Organizations (CSIRO), the leading Australian research agency, could be described as an agency equivalent to Canada's NRC. Since the early 1970s, the CSIRO has instituted a policy requiring that all chiefs of its divisions should be appointed on a term basis. Initially, the incumbents for the positions were offered tenured appointment to the CSIRO, but for a term (usually five or seven years and, on some occasions, three years) with the understanding that, if it were not mutually agreed to extend the term, a senior research job at a reasonable rate of salary (sometimes at a lower level) would be guaranteed at the end of the term.

Being a relatively recent innovation, CSIRO has now a mixture of 'permanent' and term-appointed chiefs. Within the next two to three years, the suitability of this innovation can be judged when the terms of recently appointed chiefs expire. Until now, only one individual has completed his term and decided to return to the bench. He was given the opportunity for a lengthy overseas trip for a 'sabbatical'. The sabbatical would serve two purposes — to allow the retiring director to "get back to the bench", and to take him out of the division during the first year under the new chief. The change of division chief also helps to conduct an external assessment of the quality and orientation of the division's work.

In October 1978, as a result of the recommendations of an independent inquiry committee set up by the Australian government on the workings of CSIRO, major administrative reforms were introduced in this agency. The work of existing divisions will be reorganized into six research institutes, and their directors are to be appointed on a renewable term of up to five years.

United States

The U.S. Bureau of National Standards has over the years made use of coordinative portfolios similar to the group director (NRC) and the director-general (Germany). This is generally done at a level above the laboratory

director. However, because of the higher salaries paid to directors in the private sector, government laboratory directors do not generally tend to stay in the public sector for long periods.

Industry

Unlike the universities and the public sector, a senior manager in industry has relatively far more flexibility in the establishment and dismantling of positions. Both increases and decreases in productivity and profits influence the hiring, transfer and layoff of personnel. As such, formalization of renewable term mechanisms has rarely taken place.

DISCUSSION

The proposal for renewable term assignments for laboratory directors is made on the premise that any such appointment will seek to remove inertia from an R&D organization, leading to both the rejuvenation of managerial personnel and improving the adaptability of staff in responding to changes occurring within and outside the organization. It would be simplistic to assume that the practice of renewable term appointments is the only way to achieve these objectives. An examination of some of the other techniques has been made in the earlier MOSST background papers on the "Training and Development of Research Managers in the Public Service" and the "Temporary Movement of Scientists Between Government Laboratories and Canadian Industry". The adoption of any of these instruments for improving the productivity of the scientific organization and the development of skills of its S&T personnel is at the discretion of the deputy head of a department.

The position of a government laboratory director demands fulfillment of line management responsibilities of its incumbent. Government laboratories could rarely function as an autonomous body as do most academic departments of universities in managing their research work. The director of a government laboratory, while fulfilling his line functions, has always to be prepared to explain and justify the work performed in his research establishment, not only in terms of the mission of the laboratory, but also the mandate of the department, and the priorities of government. As well, the work performed must respond,

where appropriate, to the needs of research users outside the government. Again, unlike the university system where the faculty and university administrators to a large extent function independently of each other and their responsibility towards a mandate or society is broad, such isolation both in scientific and administrative matters is becoming increasingly difficult for the director of federal laboratories.

The earlier description in this paper of the practice of rotational appointments in the three sectors (university, government (international), and industry) points to two main types of term assignments: (a) renewable, and (b) rotational.

Renewable Appointments

The first type, the renewable term, appears to be potentially possible in those areas where research tasks are well-defined and could be carried out in a project format (e.g. given the time frame, stated costs and identifiable results). Such assignments would be most suited to the technology-intensive, industrial research-oriented government R&D establishments which mainly undertake applied, development, and demonstration projects.

In this type of assignment, the candidate for the position may be sought from outside the organization on a fixed term basis (say five years). The contract could be renewed, subject to the continued need for such services.

The practice of appointing outside personnel at the senior executive level for a limited term is not uncommon in the public service. Over the past decade, several such appointments have been made at the SX level either through the Executive Interchange Program or directly by the deputy head of a department for a two- to three-year period. However, the possibility of undertaking scientific and engineering projects at the laboratory level through a director appointed for a fixed term would be limited to only a very few cases. Federal laboratories are generally engaged in a number of projects at a time, involving activities ranging from basic research to development. These would undoubtedly have completion times far beyond a single term of the director which would make the continuity of direction very difficult.

Rotational Appointments

The second type, the rotational assignment for research managers, appears to have been successful in those cases where the managerial function demands mainly the skills which relate to coordination, consultation, and persuasion.

The levels at which rotational managerial assignments can be provided within federal laboratories needs further examination. Justification of rotational positions for the R&D organizations engaged in long-term exploratory/background research (basic, fundamental, free-mission oriented, etc.) can be made far more easily by designating such positions either below the level of a laboratory director (e.g. assistant/associate director) or through a coordinative rotational portfolio of a 'program director' at a level below the director general so essentially equivalent to that of the laboratory director. In the latter position, the program director would be responsible for the forward planning of a specialty area for a group of laboratories. Such a rotational portfolio, without creating an additional layer in the classification hierarchy, could provide valuable experience to the incumbent in acquiring management perspectives outside his laboratory.

Both these rotational assignments are oriented to the early identification of talents at two different levels of management, in terms of the nature of functions and responsibilities.[4] As an assistant or associate director, the incumbent is an apprentice looking at the management of a laboratory with the director of the establishment essentially being the incumbent's mentor. The responsibilities of the program director, on the other hand, relate to a broader combination of staff and, possibly, line responsibilities where the incumbent is entrusted with the coordination and forward planning required for a group of laboratories. The grouping would vary from department to department and could be made on the basis of a speciality as well as other factors such as projects, programs, disciplines, or geographic regions. The assignment by nature of its responsibilities would require horizontal coordination as well as responding to senior management.

---

[4] See: "Training and Development of Research Managers in the Public Service", Paper II of this report, pp. 27 - 28.

In either case, to avoid the loss of the incumbent's scientific expertise, the appointment should be for two to three years, with an added provision for renewal at the discretion of management. It must be pointed out here that, as government laboratories perform a diverse range of science activities of a basic and applied as well as developmental nature, and that the organizational nomenclature of science departments and agencies varies according to their sectoral functions, size and level of decentralization, the criteria for establishing the above two rotational positions would have to be evolved by each department.

Promotion/Demotion Dilemma

Some of the major issues which have emerged in other institutions where the rotational assignments/positions have been tried are: should the incumbent, at the completion of his assignment, be given the opportunity to move upward in the organization or should he return to his original position; what use is to be made of the skills and experience gained in the rotational assignment; should the incumbent's salary be reduced to scale on returning to his original position; and, finally, should the departure from a rotational assignment be perceived as a demotion by colleagues or the organization.

The advantage of maintaining the dual portfolio is that the feeling of job insecurity when the rotational assignment ends is alleviated. This has been underscored in the university model where, in addition to his rotational assignment, the incumbent has continued his teaching and research work, and thereby has found it easier to slide back into an academic career. The dual portfolio is particularly important for those in highly specialized scientific areas. Because of the limited number of positions in these areas, it might be difficult to create a similar position for the returning person.

For holding a dual portfolio, the incumbent is usually compensated for the additional duties and responsibilities through an increase in salary. However, concern has been shown about the possibility of a drop in salary when the individual returns to his original single portfolio. In other sectors where this mechanism has been tried, the individual's existing salary is 'red circled' (frozen) till the salary level catches up with the salary drawn. In most cases, such extra salary could be adequately justified by drawing on the individual's skills and experience gained in the rotational managerial position.

This experience within the NRC laboratories has been utilized in program development. The talents of scientists familiar with management activities could also be put to good use in preparing the laboratory's policy/position papers, acting as advisor to the director general's office, developing liaison with outside clients, etc.

Administrative Impediments

Appointments of personnel to positions in the public service are governed by the Public Service Employment Act (PSEA) and the Public Service Terms and Conditions of Employment and Regulations (PSTCER), and also by collective bargaining for those groups which do not fall within managerial exclusions. In the past, because of the requirement of appointment to position, the deputy head of a department has found himself lacking the flexibility to move managerial personnel where their services are most needed and would be most beneficial to the organization.

Direct appointment to SX groups (from outside), if justified by the department under special circumstances, is often far simpler than such appointments to the REM or other occupational groups. Section 21 of the Public Service Employment Act provides no right of appeal for appointments to those in levels above SX 1. Similarly, according to Article 8(1) of the Public Service Staff Relations Act, those "employed in a managerial or confidential capacity" are subject to managerial exclusions while direct appointments to other groups raise several collective bargaining related issues. These could range from staffing to promotion, demotion, security clearance, and reappointment of the incumbent.

In a broader discussion of the role and effectiveness of a manager in the public service, the PSC and TBS are, at present, involved in an examination of the implications of some of the above issues. The inclusion of the rotational positions in their examination would be desirable as the availability of these two mechanisms for federal laboratories would be expected to enhance the flexibility of the deputy heads in making appointments.

CONCLUSIONS AND RECOMMENDATIONS

From the preceding discussion, it is concluded that it would be difficult to implement the recommendation that renewable term appointments involving outside personnel be made for research heads of federal laboratories.

The Science Council recommendation which proposed that "renewable term appointments be instituted for research heads, with single term appointments becoming normal practice" has been based mainly on the university model. This recommendation was made without making sufficient distinction between the roles and functions of institutional heads in government laboratories and those on university faculties. The university faculty, to a large extent, operates in an autonomous fashion, often independent of university administration. The function of the faculty or department head relates to coordinative and administrative duties. The federal laboratory director, on the other hand, performs essentially a line management function and, by the nature of his place in the departmental organization, is accountable to various levels of management for achievement of program results, personnel, finances and work carried out in the laboratory. He must not only justify his performance but that of his laboratory in terms of its mission and also in terms of the mandate of the department, changing government priorities, as well as the needs of users outside the federal government.

This paper, nevertheless, suggests two alternatives. First, departmental laboratories require a major review of their work at least every five years to ensure that they respond to the mission of the departments. At the same time, the regular appraisal of the laboratory director would be augmented in that his position and performance could be assessed according to criteria such as relevance of work, efficiency of effort, and the communication of results. External assessment could be added to examine the quality of work performed.

Second, the rotational position should be used for training, development, and early identification of managerial talent in an R&D organization. It could be used effectively to designate positions below that of the laboratory director

(e.g. assistant or associate director) or that of the director-general (e.g. the program director) for a two- or three-year term. Federal departments could consider the examination of these mechanisms for their science establishments and the possibilities for implementing them.

In spite of the usefulness of the rotational mechanisms for injecting fresh ideas into the R&D organization, there are administrative impediments related to staffing the position. TBS and PSC, in their study of enhancing the effectiveness of managerial talent in the public service, should give consideration to the possibility of their implementation. This could lead both to improving the managerial talents in research organizations as well as to providing flexibility to the deputy heads of a department in making such appointments.

Based on the foregoing considerations, the following recommendations can be made:

- The laboratory director, being a line manager, is responsible for producing research results in support of the department's mission, and for managing the personnel and assets of his laboratory to this end. His performance is judged on the basis of his success in contributing to the mission; criteria such as relevance, timeliness and communicability of results (as well as their scientific quality) are applied. In order to ensure that this response to the departmental mission continues, regular annual appraisals should be augmented by a major review of his performance and of the work of the laboratory at least every five years.

- Further to the foregoing recommendation, rotational appointments should be considered for positions involving primarily coordination of R&D activities, for the purpose of training and development, at levels below the laboratory director and the director general.

- Departments and agencies should identify those positions in research establishments, and in research planning and coordination, which are appropriate for rotational appointments and develop the necessary criteria for defining the positions based on the nature of the S&T functions, organizational structure and nomenclature, and the size and geographic distribution of the research establishments.

- The Treasury Board Secretariat and the Public Service Commission should, in the context of the Public Service Employment Act (PSEA) and the Public Service Terms and Conditions of Employment and Regulations (PSTCER), examine ways to facilitate the use of rotational appointments, by developing criteria necessary to select and appoint candidates, appraise their performance, and return the incumbents to line functions so as to benefit both the individuals and the organizations.

- The Treasury Board Secretariat and the Public Service Commission, in conjunction with MOSST, should examine the possible impact of any new government personnel policy proposals (e.g. Senior Manager classification) on movement of federal scientific personnel within a department.

BIBLIOGRAPHY

Atomic Energy of Canada Limited. Transfer of Nuclear Technology to Canadian Industry, a paper presented by Dr. C.W. Perryman, Director, Applied Research and Development, Chalk River Nuclear Laboratories, at the Industrial Technology Transfer Symposium, Toronto, October 21, 1977.

--------. Expanding the Manufacturing Base, a paper presented by Mr. J.S. Nelles to the meeting of Innovation Canada Inc., June 15, 1978.

Carson, John J. "Interchange Canada: The Federal Manpower Exchange Program", The Canadian Business Review, Winter 1975, Vol. 2, No. 1.

Drury, C.M. "How the Federal Government Views Questions on Science and Public Policy", Science Forum, 47, October 1975, pp. 28-30.

Edstrom, Anders and J.R. Galbraith. "Transfer of Managers as a Coordination and Control Strategy in Multinational Organizations", Administrative Science Quarterly, June 1977, Vol. 22, pp. 248-263.

Institute of Public Administration of Canada. Executive Manpower in the Public Service: Make or Buy. (Kenneth Kernaghan, ed.)

Ministry of State for Science and Technology. Brief to the Senate Special Committee on Science Policy, November 1975.

--------. The Make or Buy Policy, 1973-75. Industry Branch, November 1975.

--------. A Technological Innovation (R&D/I) Management Training Program. 1975.

--------. Scientific Manpower in the Federal Government (Phase I). November 1977.

--------. Measures to Strengthen and Encourage Research and Development in Canada. June 1, 1978.

--------. Enhancement of Technology Transfer from Federal Laboratories to Industry. Discussion Paper. 1978.

National Research Council. Report of the President, 1977-78.

Public Service Commission. Public Service Manpower Survey: Scientific Research Group. March 1974.

--------. Public Service and Public Interest. (Submission of the Public Service Commission to the Special Committee on the Personnel Management and Merit Principle) 1978.

--------. DIALOGUE: Human Resource Management. Vol. 2, No. 4., 1978.

--------. Interchange Canada.

The Special Committee of the Senate on Science Policy. A Science Policy for Canada. (Chairman: Senator M. Lamontagne) Vols. 2, 3 and 4.

Science Council of Canada. Technology Transfer: Government Laboratories to Manufacturing Industry, Report No. 24. Ottawa. December 1975.

--------. The Role and Function of Government Laboratories and the Transfer of Technology to the Manufacturing Sector, Background Study No. 35. Ottawa. April 1976.

--------. The Movement of Scientific and Engineering Personnel Between the Federal Government and Industry. (A contract study by Donald Watson) November 1976.

Thompson, Paul H. and Gene W. Dalton. "Are R&D Organizations Obsolete?", Harvard Business Review, November-December 1976.

Treasury Board Secretariat. Policy and Guidelines on Contracting-Out the Government's Requirements in Science and Technology. Administrative Policy Branch. April 1977.