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Technology Transfer from Federal Laboratories to Industry

v.1.

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# Technology Transfer from Federal Laboratories to Industry

v.1.



Government Projects Division
MOSST, May 1980

Appendices to this report are presented under a separate "working paper" document entitled 'Appendices: Technology Transfer from Federal Laboratories to Industry'.

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# EXECUTIVE SUMMARY

## Background

The Cabinet Decision of April 27, 1978 on the subject of enhancing technology transfer from federal laboratories to industry outlined a series of policy measures which should be undertaken by federal departments and agencies. MOSST was given the responsibility of facilitating the implementation and reviewing the status of these measures.

The Cabinet Decision identified the following policy measures for action:

(1) All federal laboratories should have among their objectives the effective transfer of technological developments to Canadian industry.

(2) Each laboratory should prepare an analysis of its current performance and future potential in technology transfer.

(3) Federal laboratories should be actively included in long-range procurement planning by departments and agencies.

(4) The concept of the Pilot Industry/Laboratory Program (PILP) of NRC should be extended to the laboratories of federal departments.

(5) MOSST and DSS should continue to consult closely about streamlining management practices and procedures for contracting-out research to industry.

(6) The possibility of expanding the CPDL's information clearinghouse role should be examined by DITC in consultation with MOSST.

(7) MOSST, in conjunction with TBS, PSC and the departments, should examine the following aspects of personnel policy: the inclusion of technology transfer among the criteria for performance appraisal; the feasibility of term assignments to laboratory director positions; and the identification and removal of impediments to the movement of scientists between government laboratories and industry.

(8) MOSST and DOC jointly carry out a review of the effect of such policies as are used in the Department of Communications (DOC).

Implementation

Based on a series of meetings and consultations with science departments and agencies, it was noted that the following developments had taken place in the implementation of the above policy measures.

Technology transfer is now identified as one of the integral components of departmental programs and objectives. The departments have begun to show technology transfer as a recognizable activity in their program planning systems. A number of policy directives, internal reviews and program developments have taken place in departments and agencies (NRC, Environment Canada, Agriculture Canada, Department of Communications, Public Works, Canadian Patents & Development Ltd.) in order to both enhance departmental technology transfer activities and improve the interface with their respective industry sectors.

Technology transfer is now explicitly recognized among the performance appraisal criteria of the scientists, depending on the nature of the incumbent's assignments. Through a paper entitled "Recent Science Policy Initiatives and the Role of the Scientist and the Research Manager in the Public Service", MOSST has communicated to the science departments a statement of government expectations of its scientific personnel in relation to the management of government S&T programs and facilities.

Serious consideration is now being given by TBS and PSC to broaden the objectives of, and the eligibility requirements for, the Interchange Canada program to include technology transfer, and to widening the scope of the program to include personnel at the PM-5 or equivalent level. This would help to lay a policy base for developing a S&T personnel exchange program between federal laboratories and industry.

DSS has recently undertaken a series of initiatives to streamline administrative procedures for undertaking R&D contracts. In this connection, the DSS Science Centre intends to involve itself with its client departments earlier in the contract formulation process to further its understanding of departmental requirements.

The MOSST-DOC study reviewing DOC's successful innovations, in addition to showing the opportunities for fruitful cooperation between federal laboratories and industry, emphasizes the use of R&D contracts and a closer interaction of federal S&T personnel as the two most significant mechanisms for transferring technology to industry.

Finally, the PILP concept has been implemented as the COPI, and is being utilized by major science-based departments to enhance technology transfer from their laboratories to industry.

There are, however, two measures in which little positive response has been shown by departments. Regarding the involvement of federal laboratories in departmental procurement, most departments (apart from the Department of National Defence and Fisheries Canada) have indicated that their level of S&T procurement is often very small. Nevertheless, in most cases any R&D contracts originate with the departmental laboratories.

The other initiative deals with establishing renewable term assignment positions for a laboratory director. Because this has not been favourably received, it has been suggested that, in addition to the annual performance appraisal of the laboratory director, the program and performance of his laboratory should be subject to periodic review, at least every five years.

Recommendations

Until recently, the technology transfer initiatives within the federal departments and agencies have been mainly concentrated on the 'invention phase' of the technology transfer, stressing support for such information transfer mechanisms as: information reports, journal publications, attendance at international seminars and meetings. Little attention has been given to the subsequent 'innovation phase' which involves such technology development support mechanisms as: exchange of S&T personnel, assessing the commercial viability of a scientific development undertaking of joint/cooperative ventures, encouraging the use of R&D contracts and the COPI program, contracting-in et cetera.

The following initiatives are recommended for further enhancement of the transfer of technology from federal laboratories to industry:

Departments

- Identify a role for departmental laboratories in assisting industry to develop a technological capability, where appropriate; and to identify technology transfer mechanisms (e.g. contracting-out, contracting-in, S&T personnel exchange, information reports et cetera) for a better interface with the respective industry sector.

- Rather than developing a limited-term assignment position for laboratory directors, departments undertake a periodic review of laboratory programs to ensure that these programs meet departmental objectives including technology transfer. The performance of the laboratory director should be judged on the basis of his success in contributing to the mission. To reinforce this, 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.

- Identify positions involving research planning and coordination functions for management development purposes in research establishments which are appropriate for rotational appointments, preferably below those of the laboratory directors or the director general.

- Develop a program for the exchange of S&T personnel between federal laboratories and industry to fulfill departmental needs as well as the career development aspirations of an individual scientist.

- Identify cooperative/joint ventures with industry to encourage scientists in participating in an industrial development program.

- Enhance the utilization of R&D contracts and industrial research development programs for technology transfer.

CPDL

- Reassess the role and activities of the Corporation in the context of matching the supply of patentable federal technologies with industry needs, i.e. a clearinghouse role for S&T, in order to promote Canadian industrial development.

PSC

- Provide coordination and a focal point for a government-wide S&T personnel exchange program between government laboratories and industry under the umbrella of Interchange Canada.

MOSST

- Evaluate the effectiveness of the COPI program and determine the appropriate level of support.

- Develop a proposal (with PSC, TBS and science departments) to establish a S&T personnel exchange program under the aegis of PSC's Interchange Canada and the resources required for its administration.

- Assist CPDL to reexamine its role and activities in the context of matching supply of patentable federal technologies with industry needs, i.e. for S&T information, clearinghouse role, in order to promote Canadian industrial development.

- Assist departments in expanding their mandate to include technology development in selected priority sectors, as is already the case in Space.

TBS

- Assist science departments, CPDL and MOSST in examining the resource allocation implications of the above proposals.

- Reexamine, in conjunction with MOSST and science-based departments, the means to increase the availability of S&T services to industry by federal laboratories, and the solution of related financial and administrative issues.

Resources Consideration

Additional administrative costs will be involved in the implementation of three transfer mechanisms: (i) development of S&T personnel exchange programs between government laboratories and industry; (ii) expansion of existing COPI programs; and (iii) expansion of CPDL's information clearinghouse role. Proposals describing the needs, rationale, and the level of resources required for the effective implementation of each mechanism would have to be developed.

BACKGROUND

The need for action to enhance technology transfer from federal laboratories to industry was discussed extensively in a report entitled "Technology Transfer: Government Laboratories to Manufacturing Industry".* Following the publication of this report, the Minister of State for Science and Technology appointed a small Ad Hoc Committee on Technology Transfer headed by the Science Council, including federal and industry officials, to further review the subject. The committee report formed the basis for the recommendations to Cabinet developed by MOSST. The government decision of April 27, 1978 on the subject of enhancing technology transfer from government laboratories to industry outlined a series of initiatives which should be undertaken by federal departments and agencies. The initiatives were:

(1) All federal laboratories should have among their objectives the effective transfer to Canadian industry of technology they develop that is useful to industry (whether the technology is primarily developed for industrial purposes or not).

(2) Each laboratory should prepare an analysis of its current performance and future potential in technology transfer and should prepare, in consultation with its parent department or program, a plan for the improvement of its technology transfer function.

(3) Federal laboratories should be actively included in long-range procurement planning by departments and agencies, with a view to facilitating transfer to Canadian industry of technologies which could assist in meeting future procurement needs.

(4) MOSST should examine, with the main science departments, the possibility and mechanisms of extending to other government laboratories the concept of the Pilot Industry Laboratory Program (PILP) of NRC.

(5) MOSST and DSS should continue to consult closely about the management practices and procedures for contracting-out research to industry, with a view to providing the necessary flexibility consistent with accountability for results.

(6) Department of Industry, Trade and Commerce in consultation with MOSST should examine the possibility of expanding the role of CPDL to include the function of a clearinghouse of information on the technology available for transfer from government laboratories, and the technology needed by Canadian industry.

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

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(7) MOSST, in conjunction with TBS, PSC, and the departments and agencies operating laboratories, should examine the following aspects of personnel policy: the inclusion of transfer of technology to industry among the criteria for performance appraisal wherever appropriate; the feasibility of term assignments to laboratory director positions; and the identification and removal of impediments to the movement of scientists between government laboratories and Canadian industry.

MOSST, in addition, was given the responsibility for the overall evaluation of these measures. At the same time, in conjunction with the Department of Communications, it was asked to:

> "jointly carry out a review of the effect of such policies for transfer of technology as are used in the Department of Communications, to identify further means by which government programs can help promote innovative industrial developments".

Over the past two years MOSST has contacted all science-based departments and agencies, and has held a series of consultations and meetings with a number of them for further clarification of the relevance of these policy measures to the mission of their laboratories. To review the status of progress made on the implementation of these measures during this period, MOSST identified twelve major science-based departments and agencies which had laboratories of their own to carry out intramural scientific activities.[1] The purpose was to assess progress on departmental policies and procedures, to facilitate planning for technology transfer, and to obtain comments on any difficulties they may have met in transfer to industry. To this effect, deputy heads were requested to identify progress made on the implementation of the Cabinet decision.

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[1] These departments and agencies are: Atomic Energy of Canada Ltd. (AECL), Agriculture Canada, Communications, EM&R, Environment, Fisheries and Oceans, Health and Welfare, Indian and Northern Development, National Defence, National Research Council, Public Works Canada, and Transport Canada.

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In June 1979, as a part of its evaluation responsibility, MOSST published an interim report on the subject,[2] indicating that few departments at that time had taken all the steps necessary to implement technology transfer measures in their laboratories, and that MOSST would be once again approaching them at the end of the year to be informed on new developments. MOSST, in the meantime, in conjunction with central agencies, was to aim at the removal of administrative impediments to technology transfer.

## PURPOSE

Based on the replies received from departments and agencies, an overview of the progress is given in the following sections which describe departmental efforts under each policy initiative. As departments use different procedures and criteria for assessing progress and effectiveness of their initiatives, a brief description is also provided as Appendix I to this report of technology transfer policy developments, plans and programs by each department and agency.[3]

## POLICY MEASURES

*1. All federal laboratories should have among their objectives the effective transfer to Canadian industry of technology they develop that is useful to industry (whether the technology is primarily developed for industrial purposes or not).*

Major science-oriented departments and agencies now recognize technology transfer as an integral part of their departmental objectives, and in most cases have made it an established performance indicator of their department's research program objectives.

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[2] MOSST, Interim Report: Enhancement of Technology Transfer from Federal Laboratories to Industry, June, 1979.

[3] All appendices have been put together in a separate "working paper" entitled Appendices: Technology Transfer from Federal Laboratories to Industry, May , 1980. See Appendix I.

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*2. Each laboratory should prepare an analysis of its current performance and future potential in technology transfer and should prepare, in consultation with its parent department or program, a plan for the improvement of its technology transfer function.*

Because of the differences in organizational structures, level of decentralization and type of industry users, each department has, over the years, evolved varying procedures and mechanisms for liaising with industry. The Department of Energy, Mines and Resources' Canada Centre for Mineral and Energy Technology (CANMET), for example, identifies sixteen different mechanisms it employs, and takes into consideration during program development, to examine a project's transfer potential and methods of transfer. Somewhat similar approaches are adopted by other departments during their annual program review and development exercises, that is, a program's or project's extramural implications, including technology transfer, are taken into consideration.

*3. Federal laboratories should be actively included in long-range procurement planning by the departments and agencies they support, with a view to facilitating transfer to Canadian industry of technologies which could assist in meeting future procurement needs.*

Little comment was made by departments about their policy or procedures regarding involvement of their relevant laboratories in departmental procurement. Only two of the twelve departments and agencies identified some specific action in this direction. The Department of National Defence pointed out that one of the main roles of its research establishments is to support the capital procurement needs of the department while promoting the development of a self-sustaining defence-oriented technology base in Canada. The Defence Research Establishments of the department assist it in becoming an "educated buyer" of technology and, through either the generation of new technology or its adaption, help the department in carrying out critical analysis for making effective choices.

Fisheries and Oceans Canada, in its response, states that the long-range planning for major procurement in the department is covered by the five-year vessel acquisition strategy plan and the laboratories are consulted in the preparation of this plan.

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*4. MOSST should examine, with the main science departments, the possibility and mechanisms of extending to other government laboratories the concept of the Pilot Industry Laboratory Program (PILP) of NRC.*

The PILP concept, now extended to departments as COPI (Cooperative Program with Industry), has been implemented. The June 1978 R&D package provided $2.0M for the new program. Subsequently, PILP's equivalent, COPI, was initiated in five major science departments - EM&R, Environment, Fisheries and Oceans, Communications and Agriculture. Each department was allocated $400,000 for COPI projects.

COPI is viewed by the participating departments as one of the most effective mechanisms for the transfer of technology to industry. However, one of the major problems of utilizing such a program is that the rate of spending gradually increases as the research moves from applied to engineering and prototype development phases of technology transfer.

A major concern shown by the departments is the small amount of funds allocated for their projects and the uncertainty about the future funding of the program. For an effective technology transfer effort, serious consideration should be given to expanding this program.[4] Prior to this, an evaluation of the program would be required.

*5. MOSST and DSS should continue to consult closely about the management practices and procedures for contracting-out research to industry with a view to providing the necessary flexibility consistent with accountability for results.*

In order to improve the management procedures and practice for contracting-out research to industry, the Science Centre of the Department of Supply and Services is currently working in the following areas:

- Alternative Contract Pricing Basis
- Model Contracts
- Revisions to DSS General Conditions
- More Effective Requests for Proposals (RFP)
- Client/DSS Responsibility Memorandums of Understanding

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[4]For a discussion about the vital role played by development-oriented R&D contracts as transfer mechanisms see MOSST-DOC reports entitled Technology Transfer from DOC: A Study of Eight Innovations , March 1980.

Alternative Contract Pricing Basis

DSS practices and procedures make provision for a broad range of contract types to provide the flexibility needed to cater to the many different procurement situations encountered. There is no one "best type of contract" to suit all situations but rather there is an optimum type of contract to suit a particular set of circumstances. Sound procurement requires the selection of the right contract type. The best, most realistic and reasonable price for a particular requirement may turn sour if the contract type is wrong.

Some of the factors to be taken into consideration in deciding on the applicable type are:

(a) the ability to accurately define and cost the work;

(b) the incentive (profit) offered to achieve specified objectives;

(c) the presence of extracontractual influences;

(d) the responsibilities and risks to be assumed by the parties to the contract; and

(e) the urgent necessity to commence work immediately.

In the past, the Science Centre has utilized the fixed time rate contract almost exclusively. While this is a suitable approach for a broad range of R&D situations, there are cases where an alternative pricing basis would be more appropriate. Science Procurement Managers are therefore currently receiving training in the selection of a variety of contract types related to the specific requirements of the situation.

Model Contracts

While the scientific content of each R&D project is unique the legal or contractual arrangements are not. It is possible, therefore, in the majority of cases to utilize a standard contractual format incorporating standard legal clauses. For some time, the Science Centre has used a standard contract for the IT&C Defence Industry Productivity (DIP) program, however, in

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other cases, the Science Procurement Managers have been left to their own devices in terms of contractual content and format. The Science Centre recently prepared, in conjunction with legal counsel, model contracts for universities and for major R&D projects. The purpose of these models is to simplify the R&D procurement process via standardization and to ensure issuance of an acceptable and legally binding agreement. The Science Centre intends to extend the use of model agreements and contracts to other areas where applicable.

Revisions to DSS General Conditions

DSS General Conditions (DSS 1026, DSS 1031 and DSS 1036) were developed primarily to protect the interests of the Crown in an era of cost reimbursable defence hardware procurements. Many of the requirements are not applicable to present-day non-defence R&D contracts which are frequently directed towards the establishment of a Canadian R&D capability rather than for the procurement of a tangible product for use by the government. These general conditions are therefore being subject to a critical review with the object of developing general conditions more appropriate to present day R&D environment.

More Effective Requests for Proposals (RFP)

The RFP is a means of explaining to performers significant elements of the government R&D requirements, why it is willing to spend money, the important features of the procurement (and thereby what is not important), what the procurement approach will be, what information the government needs, how proposals will be evaluated, the basis for the award and the terms and conditions of the contract. It is essential that the government effectively communicate to industry in clear, concise and meaningful terms what it is we want to buy and how we expect to buy it. Unless special care and sound judgement are exercised in the preparation of the RFP, it can easily invite error on the part of both government and industry and can lead to prolonged negotiations, delay in contracting and unnecessary expense.

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To achieve the above, the Science Centre has issued guidelines for the preparation of more effective requests for proposals. These guidelines include proposal preparation instructions for the contractor covering scientific/technical requirements, management, cost and pricing, contractual (including a model contract) and socio-economic objectives.

The objectives of the Science Centre proposal solicitation process recently introduced are to:

(1) Ensure that the solicitation process is efficient and effective and is clearly understood and fully supported by all participants.

(2) Select the best technical proposal at a fair and reasonable and affordable cost.

(3) Ensure that the performer is capable of successfully completing all aspects of the task, i.e. technical and scientific; management and time; and cost.

(4) Obtain sufficient data from the successful bidder to provide adequate contract definition of the project and to be able to monitor performance and protect the interests of the Crown.

(5) Keep solicitation and bid costs as low as possible, especially for the unsuccessful bidders.

(6) Complete the solicitation process expeditiously.

Client/DSS Responsibility Memorandums of Understanding

The issuance of T.B. circular #1979-20 dated July 1979 entitled "Directives on Cost Control" necessitated improved DSS/client management of R&D projects. This involves the appointment of project/contract steering committees, the preparation of definitive scientific work statements and realistic cost estimates and schedules and the close evaluation of contractors' performance. The respective responsibilities of DSS and the client department are negotiated and commitments to perform specific tasks within a stated time frame are made. DSS, in this way, intends to involve itself in the contract development process with client departments at an earlier stage when the concept of a R&D contract is being formulated. For introducing this new approach to developing R&D contracts, DSS Science Centre will be meeting major departments this fiscal year. The implementation of agreements along these lines should not only facilitate the management of projects but should result in improved DSS/client relations on future joint undertakings.

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*6. Department of Industry, Trade & Commerce, in consultation with MOSST, should examine the possibility of expanding the role of Canadian Patents and Development Ltd. (CPDL) to include the function of a clearinghouse of information on the technology transfer from government laboratories and the technology needed by Canadian industry.*

Departments have made the following suggestions aimed at improving CPDL's operation as the supplier of information on federal technological innovations:

- The company should evolve an effective reporting system to use on a regular basis to obtain, from departments and agencies, information on newly developed technology, which they have available for transfer to Canadian industry.

- CPDL should make more vigorous efforts to promote its patents.

- Closer consultation between CPDL, Consumer and Corporate Affairs and science departments should take place during any review of patents policy.

- The criteria evolved by Industry, Trade & Commerce and the science departments for eligibility for industrial assistance and defence production programs should be considered prior to awarding licences to a private entrepreneur.

- Closer consultation between CPDL and the granting councils, in particular the Natural Sciences and Engineering Research Council (NSERC) would be useful to determine whether the patent rights for R&D supported through federal funds should be retained by the government or the inventor.

CPDL, a Crown corporation, was transferred from NRC in April 1978 to the responsibility of the Minister of Industry, Trade and Commerce. This was done with a view to assisting this agency to develop a closer interface with industry. The agency has not yet overcome its transition problems and has not outlined any new policy directives or programs for the organization.

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It is necessary that in order to expand its information clearinghouse functions, CPDL should ensure that: the agency role in this area is clearly defined; there is no duplication of effort with other federal agencies (such as NRC's Technical Information Services and Consumer and Corporate Affairs' Patent Bureau); whether the existing information clearinghouse system within CPDL is adequate to match federal patentable technologies with industry demands; the methods of improving existing systems and the resources needed to undertake such an effort.

*7. MOSST, in conjunction with TBS, PSC and the departments and agencies operating laboratories, should examine the following aspects of personnel policy: the inclusion of transfer of technology to industry among the criteria for performance appraisal, wherever appropriate; the feasibility of term assignments to laboratory director positions; identification and the removal of impediments to the movement of scientists between government laboratories and Canadian industry.*

A meeting of departmental Human Resources Planning officers was called by the Treasury Board Secretariat to discuss personnel policies affecting technology transfer from federal laboratories to industry. This was mainly to find ways of clarifying administrative procedures and any other impediments to the implementation of the stated policy initiatives.

Technology Transfer as a Performance Appraisal Criterion

All of the science-oriented departments indicated that, wherever appropriate, technology transfer is now among the criteria included in the performance appraisal of scientists. The weighting given to technology transfer, however, would vary from one task to another depending on the nature of the assignment for which the incumbent provided services.

TBS has communicated to the Interdepartmental Advisory Committee (IAC) for Scientific Research (SE) occupational group that it should include "technology transfer" and "contract management" under the definition of 'Productivity' in its performance review and appraisal procedures for research scientists.

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In April 1979 MOSST issued a paper entitled "Recent Science Policy Initiatives and the Role of the Scientist and Research Manager in the Public Service" underlining the government's expectations of its scientific personnel as well as describing new and ongoing science policy thrusts. More than 300 copies were sent to the science-based departments at their request.[5]

The new TBS performance review and employee appraisal guidelines (PMM 115-10) provide sufficient scope and flexibility to science-oriented departments to accommodate the new and ongoing functions of science management as outlined in the above-mentioned MOSST role paper. At the TBS interdepartmental meeting, science departments were asked that in accordance with new TBS guidelines they consider the new functional thrusts in any redesigning of performance appraisal systems.

Feasibility of Term Assignments to Laboratory Director Positions

In the MOSST examination it was noted that the systems of accountability within the government and the university (on which the "term assignment" model was based) were different. Unlike a department head at a university, the laboratory director is more than an administrative head - he is a line manager, responsible for all aspects of the laboratory and responsible for the achievement of program results for which he is judged on a wide array of activities such as relevance, timeliness, efficient resource allocation, communicability of results as well as maintaining scientific quality of the program.[6]

Instead of a "term assignment" laboratory director position, two recommendations were made to the science departments:

(i) departmental laboratories should undertake a major "A-base review" of their work at least every five years to ensure that they continue to respond to departmental missions as well as maintain excellent quality of research capability; and

(ii) the use of rotational assignments to positions (below Director or Director General) involving primarily program coordination should be encouraged for the management development training of scientific personnel.

In both these areas, some departments have already taken useful initiatives.

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[5]MOSST, Recent Science Policy Initiatives and the Role of the Scientist and Research Manager in the Public Service, April 1979.

[6]MOSST, Scientific Manpower in the Federal Government (Phase II) Summary Report and Background Papers, April 1979. For Summary Report, see Appendix II - Appendices: Technology Transfer from Federal Laboratories to Industry, May, 1980.

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S&T Personnel Exchange

In the MOSST study on "Scientific Manpower in the Federal Government" it was found that the exchange between scientific personnel in government laboratories and industry has been negligible.[7] Several measures were identified for encouraging the movement between two sectors to exchange ideas, information, skills and technologies.

Meetings were arranged with PSC and TBS on the subject to seek expansion of the objectives of the Interchange Canada program and its eligibility requirements in order to bring the existing Interchange Canada policy, as stated in the Personnel Management Manual (PMM) chapters, in line with current practices of the program.

The proposed policy, among other aspects, reflecting government's concern on technology transfer, refers to the transfer of knowledge and skills as one of the program objectives. S&T personnel to the PM-5 level or its equivalent will be eligible to apply for the Interchange Canada under the proposed modification to the policy. TBS is currently reviewing the modifications to make appropriate changes in the PMM chapter.

At the October 1979 TBS-sponsored interdepartmental meeting, a number of suggestions were made by the departmental representatives on the interchange program. These are:

- For exchange with industry, departments will have to be delegated wider responsibilities because of their closer interface with their respective industry sector. The Interchange Canada Office should only act as an umbrella organization to facilitate such departmentally initiated exchange.

- Clarification will be required on aspects related to proprietary rights of the S&T work performed on exchange programs. Justice and PCO may be able to advise PSC on the related matters.

- Provision also needs to be made for short-term interchange (less than six months) assignments.

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[7] Ibid.

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- More project-oriented interchange assignments should be developed, taking into consideration the balancing of both 'personal accomplishment' and 'departmental requirements'.

- In order to raise the level of interest among scientists to seek greater participation in interchange programs, departments should evolve career developmental plans for those seeking to utilize Interchange Canada. This will be to match anticipated job opportunities within the department (over the next 2-3 years) with the outside developmental assignments.

- IAC, in its 'guide to employee appraisal', should consider making provision for assessing a scientist's work who is away from the department on an interchange assignment.

MOSST intends to work together with the science departments and the central agencies to encourage the exchange of S&T personnel between the public and the private sector as a means of technology transfer as well as to seek establishment of PSC as a focal point in furthering such effort.

Conflict of Interest

The relationship between the government's conflict of interest and post-employment guidelines and its policy on the transfer of technology and privatization has been reviewed by the Post-Employment Advisory Committee for Governor in Council Appointees, also acting in its capacity as CORE COSO (the permanent members of the Committee of Senior Officials)**. As a result of its deliberations, the Committee concluded that, while the guidelines as general principles must be applied to situations involving the permanent transfer of scientific or technical personnel to the private sector, each individual case should be examined to determine if in fact a conflict exists. Factors such as the nature of the employee's duties in the past as well as the relationship of the particular firm to the government should be considered. The Committee also agreed that in instances of conflict between the government's desire to transfer scientific and technical personnel to the private sector and the application of the post-employment guidelines, the existence of such a conflict should not in itself constitute a barrier to the transfer and that any trade-offs required would normally be in favor of the effective transfer of technology. The Committee expressed the view that departments, while encouraging technology transfer, should closely monitor this activity to ensure the early identification of problem areas.

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**The CORE COSO at that time consisted of the Clerk of the Privy Council, the Chairman of the Public Service Commission, the Secretary of the Treasury Board, and the Secretary to the Cabinet for Federal-Provincial Relations.

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The Advisory Committee also concluded that the temporary transfer of employees such as might occur under exchange programs for scientific and technical personnel similar to Interchange Canada do not create difficulties essentially because the employees in question remain employees of the government.

Departments with enquiries as to the application of the post-employment guidelines to situations involving the transfer of public servants should address them to the Post-Employment Advisory Committee for Public Servants currently chaired by Commissioner Szlazak of the Public Service Commission.

*8. MOSST and DOC should jointly carry out a review of the effect of such policies for transfer of technology as are used in the Department of Communications, to identify further means by which government programs can help promote innovative developments.*

In response to the above policy initiative, in November 1979 both MOSST and DOC agreed to jointly conduct a study of DOC's innovation -transfers to industry with the following terms of reference:

- to identify the factors, processes and mechanisms that have contributed to the successful transfer of technology from DOC to industry; and

- to prepare a report on DOC's relevant activities that would be useful to other departments in their efforts to increase technology transfer.

Eight innovations from DOC's Space and Research sectors were chosen for detailed examination as case studies. These are: Scanning Electron Microscope (SEM), Low Cost Earth Terminals (LCET), Field Effect Transistor Amplifier (FETA), and Delta Codec from the Space sector; and Telidon, Fibre Optics coupler, Mobile Radio Data System (MRDS) and Syncompex from the Research sector.

A detailed examination of the DOC technology transfer case studies pointed to the following factors as important in the successful transfer of technology from DOC laboratories to industry:[8]

(a) Perceived Need for Technology: The technology transfer process begins with a perceived need which may be identified

[8] For a detailed examination, see MOSST-DOC reports entitled Technology Transfer from Department of Communications: A Study of Eight Innovations, Government Projects Division, MOSST, March 1980.

in terms of departmental mandate and its S&T requirements through mechanisms such as task forces, research advisory committees and marketting studies.

(b) The two most effective mechanisms for transferring federal technology to industry are through: (i) use of research and development contracts and (ii) interchange of S&T personnel with industry. Both mechanisms have proven to be effective in developing personal contacts and professional relationships among the generators and the recipients of the technology. In most cases, as the work progressed, because of the joint nature of the effort of the federal and industry S&T personnel on the development of the technology, the originator-recipient distinctions became blurred.

(c) Small to medium-sized high technology companies are often most receptive to adopt federal technologies. These companies, though having smaller operations, are seen to be eager and enterprising in establishing a unique product line. The large firms have their own source technology and are constrained by their existing expertise and specialized market.

(d) S&T personnel with engineering orientation are vital to a research team seeking technology transfer. Experience of interaction with industry or the user by either the professionals or the engineering support staff helps to expedite the workability of the innovation.

(e) Continuity of the S&T personnel throughout the duration of the project encourages cross-fertilization of ideas and contributes to developing team spirit.

(f) The support of the senior management (particularly at the Director General and the Assistant Deputy Minister levels) is critical to a project for it indicates the relative status of the project in terms of the departmental priorities and influences the allocation of capital and human resources to the project.

(g) S&T personnel must be satisfied that their technology development activities are taken into consideration in their performance appraisal.

(h) Canadian Patents and Development Ltd. (CPDL) has an effective role to play in technology transfer by making available to industry patentable federal technologies. Opportunities exist for CPDL to adopt a more aggressive marketting role in improving industry interface with government laboratories.

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(i) Because the R&D costs rise dramatically as the technical development gets closer to the preproduction phase, the availability of funds to support the development phases of industrial R&D becomes vital for successful technology transfer to industry. The funding of R&D-related activities such as product engineering, marketting, prototype development, field trials and demonstrations et cetera is far more expensive than initial R&D. The activities are critical for the advancement of the development as well as to allow better identification of the eventual product/process technique and for the commercial exploitation.

(j) The transfer in a majority of the cases studied was related primarily to the fulfillment of departmental requirements. However, there appears to be a gap between the responsibility of line departments and the programs of the departments explicitly concerned with industrial development. One possibility is to extend the mandates of line departments to cover R&D-related activities that are closer to the production phase.

(k) The purchase by the government of equipment developed by industry on the basis of technology transferred from federal laboratories has considerable impact in fostering the industrial capability in that S&T field in the country. The department through DSS can actively solicit industry proposals with a high degree of innovative content and be ready to provide special support for such innovations. The initial purchase of such technology by the government ensures the development of a new product line and to build confidence in the marketability of the product.

(l) Closer consultation between DSS and federal laboratories as well as streamlining of procedures related to R&D contract management can play an important role in reducing the time span of innovation developments.

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## PROPOSALS FOR NEW INITIATIVES

### Contracting-In

The provision of scientific and technical services to industry by federal laboratories is a useful complement[9] to the technology transfer measures discussed above. During consultations with departments, MOSST's attention was drawn to a lack of recognition of this avenue of support, in the policy measures stated in the Cabinet decision.

Three types of situations are identified by the departments where federal S&T expertise or facilities usefully serve industry:[10]

1. In support of government's contracting-out research and development activities in order to meet departmental program requirements and needs. This may involve the use of federal equipment and expertise.

2. To assist industry in solving its scientific-technical problems as requested either by an individual company or on a sectoral basis through the use of unique facilities and/or specialized personnel not available in the private sector.

3. To familiarize industry with the relevant R&D programs, expertise and facilities having potential use for industry, which are available in federal laboratories.

In addition, a number of general conditions must normally be met before an S&T activity is performed in federal laboratories for industry:

(a) Lack of availability of the service in the private sector.

(b) Support of intramural research program.

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[9] The Science Council study on the subject, based on its survey of a sample from the Canadian manufacturing companies, concluded that: "the expertise and the facilities of government R&D establishments are their major attraction to manufacturing industry, approximately two-thirds of the firms indicated these as the most important reasons for contracting a government establishment".

Arthur J. Cordell and James Gilmour, The Role and Function of Government Laboratories and the Transfer of Technology to the Manufacturing Sector, Science Council of Canada, Background Study No. 35, April 1976, p. 303.

[10] See Appendix III in MOSST, Appendices: Technology Transfer from Federal Laboratories to Industry, May, 1980.

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(c) Benefit to the Government of Canada and the Canadian public.

The work done on behalf of industry under departmental programs falls into two categories: the services that are provided because of "collective political choice", and those that are provided on the basis of payment for the use of services.[11] For the latter, where services of public importance are rendered by the government to individuals at their specific request, the cost of the services is generally borne by individuals. The nature and extent of the services provided, however, varies from department to department depending on factors such as the mandate of the R&D establishment, ongoing programs, and the availability of both expertise and facilities for outside use.

A major reason for the cautious attitude of departments in the past has been due to their concern that any increase in the provision of services may require further diversion of their financial and human resources. Some of the reluctance in undertaking work for industry may be due to a lack of a clear role for government laboratories in this area. In the context of the government's industry development policy thrusts, there is a need for a clearer definition of principles and criteria under which services can be provided by federal laboratories to those outside the government. Guidelines from the Treasury Board Secretariat on the handling of financial and administrative matters, e.g. fee-structure, revenue earned and man-year allocation, in the three situations identified could be helpful to science departments in enabling them to respond effectively to each situation.

In view of the government's decision on technology transfer, departments should consider evolving a role for their laboratories in industrial R&D and other activities to include the provision of scientific and technical services (see Appendix IV for initiatives developed by the National Research Council along similar lines). Such an initiative by departments would help in providing a stronger basis for effective planning of their laboratories work in relevant areas to serve industry and other users.

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[11] According to Treasury Board's Guide on Financial Administration for Departments and Agencies of the Government of Canada (page 10.2, Part II, 1973): Public Services arising out of "collective political choice" refers to the services which satisfy the needs of the public as a whole and from which everyone stands to benefit. Since everyone benefits, it is considered equitable that the costs of the service be borne through general taxation. Services to the Public refer to services of public importance rendered by government to individuals or groups of individuals, either at their specific request or arising from their actions. Since the services are usually rendered at the option of identifiable individuals/groups, the cost of the services should be borne by them.

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## DISCUSSION & CONCLUSIONS

The main purpose of the April 1978 Cabinet decision was to seek removal of impediments to technology transfer and to improve the interface between the government laboratories industry. The discussion paper accompanying the Cabinet Memorandum identified three principal impediments in this area:[12]

1. frequent lack of a clear mandate and significant priority for technology transfer to industry;

2. inadequate mechanisms for transfer (or lack of knowledge of existing mechanisms); and

3. lack of incentives or resources to pursue technology transfer.

### Mandate

The departmental replies to the Cabinet decision indicate that adequate measures are being taken to highlight technology transfer as one of the integral components of departmental programs and objectives. These departments now show technology transfer as a recognizable activity in their program planning systems. There are, however, some departments (e.g. Communications) who have emphasized the need for an "integrated" innovation-development mandate to promote technology development closer to the production phase of the innovation-chain.

### Mechanisms

A number of mechanisms and incentives were identified by the Cabinet decision to promote technology transfer from government laboratories to industry. These ranged from the inclusion of technology transfer as a criterion of performance appraisal, improvement in the DSS research contracting procedures to the implementation of COPI as the means of transferring technology to industry.

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[12] MOSST, Discussion Paper: Enhancement of Technology Transfer from Federal Laboratories to Industry, March 1978, Serial No. MOSST-1-78DP.

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Technology transfer is now explicitly recognized in the performance appraisal of the scientists, depending on the nature of an incumbent's assignments. DSS's Science Centre is also currently involved in examining ways of streamlining administrative procedures for undertaking R&D contracts.

The COPI program as a mechanism for technology transfer has already been implemented and the departments using the program have asked for its expansion. Our preliminary examination suggests that the industrial research development programs such as COPI could provide one of the most effective vehicles for the transfer of technology in the innovation development phase of the R&D cycle.

'Exchange of visits' between scientists and their counterparts in the industry, when interwoven around a series of technology development contracts, as the MOSST-DOC study showed, is another effective mechanism for technology transfer. Although the departments are supportive of exchange mechanisms, exchange programs between government laboratories and industry are at present almost nonexistent. TBS and PSC are working together to revise the stated Interchange policy to expand the objectives and eligibility requirements for the Interchange Canada program.

Finally, CPDL has yet to reassess its role and activities with a view to marketing federal technologies in the context of promoting and assisting Canada's industrial development.

## RECOMMENDATIONS

Until recently, the technology transfer initiatives within the federal departments and agencies have been mainly concentrated on the 'invention phase' of the technology transfer, stressing support for such information transfer mechanisms as: information reports, journal publications, attendance at international seminars and meetings. Little attention has been given to the subsequent 'innovation phase' which involves such technology development support mechanisms as: exchange of S&T personnel, assessing the commercial viability of a scientific development undertaking of joint/cooperative ventures, encouraging the use of R&D contracts and the COPI program, contracting-in et cetera.

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The following initiatives are recommended for further enhancement of the transfer of technology from federal laboratories to industry:

Departments

- Identify a role for departmental laboratories in assisting industry to develop a technological capability, where appropriate; and to identify technology transfer mechanisms (e.g. contracting-out, contracting-in, S&T personnel exchange, information reports et cetera) for a better interface with the respective industry sector.

- Rather than developing a limited-term assignment position for laboratory directors, departments undertake a periodic review of laboratory programs to ensure that these programs meet departmental objectives including technology transfer. The performance of the laboratory director should be judged on the basis of his success in contributing to the mission. To reinforce this, 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.

- Identify positions involving research planning and coordination functions for management development purposes in research establishments which are appropriate for rotational appointments, preferably below those of the laboratory directors or the director general.

- Develop a program for the exchange of S&T personnel between federal laboratories and industry to fulfill departmental needs as well as the career development aspirations of an individual scientist.

- Identify cooperative/joint ventures with industry to encourage scientists in participating in an industrial development program.

- Enhance the utilization of R&D contracts and industrial research development programs for technology transfer.

CPDL

- Reassess the role and activities of the Corporation in the context of matching the supply of patentable federal technologies with industry needs, i.e. a clearinghouse role for S&T, in order to promote Canadian industrial development.

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PSC

- Provide coordination and a focal point for a government-wide S&T personnel exchange program between government laboratories and industry under the umbrella of Interchange Canada.

MOSST

- Evaluate the effectiveness of the COPI program and determine the appropriate level of support.

- Develop a proposal (with PSC, TBS and science departments) to establish a S&T personnel exchange program under the aegis of PSC's Interchange Canada and the resources required for its administration.

- Assist CPDL to reexamine its role and activities in the context of matching supply of patentable federal technologies with industry needs, i.e. for S&T information, clearinghouse role, in order to promote Canadian industrial development.

- Assist departments in expanding their mandate to include technology development in selected priority sectors, as is already the case in Space.

TBS

- Assist science departments, CPDL and MOSST in examining the resource allocation implications of the above proposals.

- Reexamine, in conjunction with MOSST and science-based departments, the means to increase the availability of S&T services to industry by federal laboratories, and the solution of related financial and administrative issues.

Resources Consideration

Additional administrative costs will be involved in the implementation of three transfer mechanisms: (i) development of S&T personnel exchange programs between government laboratories and industry; (ii) expansion of existing COPI programs; and (iii) expansion of CPDL's information clearinghouse role. Proposals describing the needs, rationale, and the level of resources required for the effective implementation of each mechanism would have to be developed.