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CANADA

Report of the
National Advisory Board
on Science and Technology

GOVERNMENT COMMITTEE

Presented to the
Prime Minister of Canada



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Government Committee Report

February 1988

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1.0 GOVERNMENT COMMITTEE REPORT

1.1 Introduction

The Prime Minister asked the government subcommittee of NABST (assisted by an ad hoc working group on federal laboratories) to examine the recently completed "Overview of Federal Science and Technology Strategies" prepared by MOSST. The Prime Minister posed two basic questions:

- a) Are federal expenditures on S&T (approximately \$4.2 billion in 1987) allocated properly or do some areas need increased attention while others might be de-emphasized?
- b) Are federal scientific establishments serving national objectives as well as they might and, in particular, is there a proper balance between federal scientific expenditures performed in-house and outside the government?

1.2 Objectives

1.2.1 Goals of Federal S&T Management

Before addressing these questions, it is important to state the goals for the managers of the government's S&T activities.

- a) S&T should be more responsive to and supportive of economic development goals. Progress is being made through:
 - i) the new Technology Centres and Technology Outreach programs,
 - ii) increased funding for the IRAP and Unsolicited Proposals programs,
 - iii) conscious efforts to push more federal S&T activity into the private sector, and
 - iv) an increased use of private sector advisory boards.

There is an evident commitment to make federal S&T activity more sensitive to signals from the marketplace. This effort will have to be continued and intensified.

- b) Federal funding for S&T should be an effective catalyst to foster greater S&T capability in the business and university sectors. The effectiveness of using government's spending power to build capability in the private sector has been well illustrated by the program of Hydro Quebec. (Ontario Hydro, however, has directed its spending internally and consequently has not fostered commercial development in the private sector.) The devolution of federal S&T activities to the private sector, the Technology Centres and

Technology Outreach programs, grants and, particularly, procurement policy, are ways that the government can become involved.

- c) Federal S&T should be undertaken with the utmost efficiency. This requires:
 - i) upgrading management skills within the scientific establishment,
 - ii) more extensive use of incentives and disincentives,
 - iii) rigorous evaluation of the quality of work done within the government laboratories, and
 - iv) in some cases, the devolution of S&T activity to the private sector where greater incentives and flexibility may lead to increased efficiency.
- d) Federal S&T should be more supportive of the larger policy goals of departments and government. The employees in science-related divisions within departments may be regarded as specialists who have particular technical jobs but little to contribute to broad policy objectives. Since S&T is becoming increasingly important in society, senior scientific officials should be more involved in the departmental policy process. The mandates of the various scientific agencies should also be re-evaluated to ensure their relevance to the department's policy role.
- e) The allocation of federal S&T spending should be balanced both within and between departments and between activities carried on inside and outside the government.

This difficult problem, which is discussed below, will require well-designed evaluation procedures.

1.3 Overview

1.3.1 The Federal S&T Overview - 1987

The overview undertaken by MOSST included the presentation of S&T plans by each department and produced the first comprehensive status report of federal S&T activity. This exercise, and the resulting documentation, is an essential starting point for any rational review of S&T spending, priority setting and strategy. Preparation of the report is a useful discipline, but it will become just another addition to the internal government paperburden unless it is a dynamic document with real implications for resource allocation.

The 1987 overview is the first that has been undertaken and is an impressive effort. It is largely a descriptive document that did not clearly indicate implications for action. The fact is that it is more difficult to prescribe than to describe. The overview process is not yet mature enough to generate many solid

recommendations. It is still groping for a methodology that will suggest better allocation of the S&T dollar.

Superficially, the individual departmental plans do not appear to be well-linked with government objectives and are probably driven more by the inertia of existing activities than by a conscious and strategic view of the future. Departments should re-examine their S&T activities in light of the five objectives outlined earlier.

The overview's basic goal is to continuously improve the allocation of federal S&T activity. This challenge might be broken down as responses to the following questions:

- a) Is there the right mix of S&T spending and activity within each department?
- b) Is there the right mix of spending and activity among departments?
- c) Is there the right mix of activity carried out inside and outside government scientific establishments?

Much attention has been focused on this last question (c) in recent years. The Wright Report and the Nielsen Task Force addressed it in some detail. The government has responded with several measures to encourage much closer links between federal scientists and the private sector. These measures appear to be on the right track although more time is needed before it is certain that they will have a real effect. Later in this report, we deal specifically with the question of whether more of the basic science now carried out in government laboratories should be undertaken in universities.

1.4 S&T Programs

1.4.1 Departmental S&T Programs

The main responsibility for managing S&T within a department must remain with the Minister and the minister's deputy. Periodically, there should be a review that goes beyond the routine examination of Treasury Board spending. Accordingly, we believe that departments that have a significant S&T responsibility should be comprehensively audited on their S&T activities approximately once every five years.

This audit would include a review of the mandate and objectives of the S&T agencies and programs within the department. It would determine whether the mandate is appropriate in view of government objectives.

Evaluation procedures, built around clear objectives, must be incorporated from the outset. Designing evaluation mechanisms that will reveal whether or not the department is making progress toward its goals is extremely important.

The audit would be performed by a group that includes experts and clients from outside and within the government. The career prospects of the department's S&T managers must be linked to the results of the evaluation. Without a credible 'carrot and stick', the exercise would soon become a waste of time.

To prepare for the recommended audit program, departments should review their S&T mandates and objectives and prepare a plan for evaluation.

1.4.2 Allocation of S&T Effort Among Departments and Agencies

To achieve the right balance among federal S&T activities, there must be some means to periodically readjust the allocation of S&T resources between departments - not simply within departments. This is a difficult task that requires a clear and detailed statement of the government's objectives and relative priorities in those areas to which S&T may contribute. More difficult still is developing a feeling for the relative effectiveness of a dollar spent in one area as opposed to another.

It is apparent from the 1987 overview exercise that the government is still very far from being able to reallocate rationally the S&T budget among activities. Consequently, NABST is in no position to give other than superficial advice about which current activities should be beefed-up or de-emphasized.

For example, it is easy to say (as the overview does) that strategic technologies should be emphasized and that more stress be placed on S&T to support our wealth-generating resource sectors. For the latter, it seems that forestry research does not receive nearly the support that the economic importance of the industry seems to imply. However, this may be a superficial observation. There is not enough available information to conclude, for example, that a dollar should be shifted from agriculture to forestry.

Some people have serious doubts about the wisdom of even attempting to systematically make these trade-offs. They argue that a formal, interdepartmental coordinating role for S&T - as MOSST was partly designed to perform - is inappropriate. However, S&T has become a central, and rapidly evolving, force in our economy. As such, it is increasingly in need of more rational management. This is particularly true because of budgetary restrictions at a time of constantly growing demands.

The committee feels that NABST is not yet in a position to recommend designing a process to achieve the best balance of federal S&T activity. We can only suggest that the government examine the attempts made in other countries, e.g., the U.K. and come back with a specific proposal. One thing is certain, however. The agency with responsibility to advise on the allocation of the government S&T effort must have enough authority to be taken seriously. This authority must partly come from the intellectual quality of the agency's recommendations and in part be derived from a real power to override the pleading of entrenched departmental interests. The definition of the mandate of the new Department of

Industry, Science and Technology provided an opportunity to address this question with a clean slate.

1.4.3 Government Laboratories

The Prime Minister's second question deals with the well-canvassed subject of government laboratories. The issues have been examined repeatedly by commissions, task forces and individuals. A common thread in the recommendations is the need for greater devolution of in-house S&T activity to universities and businesses. Government laboratories have become whipping boys and the butt of considerable criticism. Some, but not all, of this is justified. In their favour, government laboratories are needed to fill gaps left by industry and universities and to support departmental missions, often in ways that cannot readily be contracted out. The laboratories represent a significant human and capital infrastructure that is not readily dismantled. Many clients of government laboratories - perhaps a silent majority - are satisfied with the service they provide. They may be reluctant to see devolution to private operators who might be less sensitive to their needs. Government-operated laboratories may also be a better focus for cooperative R&D than a system built around the private sector. Finally, though an unusually high percentage of Canada's R&D is performed by government, the amount is not large when compared to the size of our economy. In fact, most highly developed countries - the U.S. being the notable exception - exceed Canada in the ratio of government, non-defence R&D to GDP. And, if defence is included, the U.S. government spends comparatively far more than Canada.

On the negative side, it is widely accepted that government laboratories are not the best way to foster the commercialization of technologies, since a strong market incentive is almost always lacking. Individual performance incentives within federal establishments are weak because they are neither salary-based (as in the private sector) nor publications-based (as in universities). It is often claimed that administrative overhead expenses in federal laboratories are excessive compared with the private sector. For all these reasons, at least some of the money spent on in-house S&T activity in the federal government would be more productive - both commercially and intellectually - if the same dollars were spent in industry and universities. Even in sensitive areas directly related to the government's regulatory mandates or to security matters, the work could probably be contracted out. To cite one U.S. example, the Lawrence Radiation Laboratory at UC Berkeley performs some of the most classified military work in the United States under contract.

The general question of determining the best balance of activity in and out of government laboratories is too broad to undertake in this report. We have therefore focused on the narrower question of the best balance of basic scientific activity (i.e., curiosity-driven research) between government laboratories and universities. This same issue is raised in the University Committee Report.

1.4.4 Audit of Basic Science Activities

The case for the devolution of fundamental science from government to universities is based on two basic propositions:

- a) The discovery of new knowledge is the main goal of universities but not of the government. Consequently, universities have developed better institutional settings for conducting basic research.
- b) A dollar shifted from government to universities not only assists basic research activity, but also helps support education.

However, some basic science must be carried on inside government laboratories to provide a link between the frontiers of new knowledge and the applied work that makes up the bulk of the lab's activity. A certain amount of basic research may also be needed to maintain morale within certain federal laboratories. Some government facilities - such as the Herzberg Institute of Astrophysics - could not readily be transferred to universities. In most cases, if not all, universities have access to the appropriate facilities. Finally, there is some government basic science of undeniable quality and some that may relate to the mandate of specific departments and might not be pursued with enough motivation if it were left to universities.

For these reasons, it is unclear precisely which activities could, or should, be transferred to universities. Accordingly, we recommend that the government undertake a detailed, department-by-department and laboratory-by-laboratory, analysis of basic science activity to identify their potential for devolution to universities.

1.4.5 Upgrading Performance Standards

Critics and supporters of government scientific establishment agree that the disciplines and incentives for government scientists are seriously inadequate. Many shortcomings of in-house S&T would be overcome if tougher performance standards were introduced and if career progress were tied closely to results. The government must offer greater progress for exceptional performance or reductions in pay or rank for sub-par performance - a 'carrot and stick' approach.

To assist the evaluation, external peer review should be used frequently - particularly for curiosity-driven work. In work of a more applied nature, standards of productivity should be established and client groups consulted on performance evaluation.

A program such as this must be introduced with considerable sensitivity and only after extensive consultation with the federal scientific establishment. We recognize that performance norms in many S&T fields, and in government work, are not always easy to specify objectively and precisely. But it is no excuse to

argue that since we can't do the job perfectly, we shouldn't do it at all. There must be more incentives not only to increase the efficiency of government S&T spending, but also - perhaps paradoxically - to improve the morale of government laboratories. The best way to foster greater pride is to reward excellence and to weed out incompetence. In the long run, everyone will benefit.

We are aware that a serious undertaking along the lines recommended will be long and arduous. At first it will foster anxiety and resistance. If the government wishes to tackle this problem, it must be prepared to make a lasting commitment with the necessary political and bureaucratic backing. There is no other undertaking for government laboratories that has the potential for greater payoff.

1.4.6 Overcoming the Obstacles to Reform

The government has received much sound advice over the years about how its scientific establishment should be reformed. Typically, the recommendations have been duly approved. But problems persist. The difficulty lies in the mechanics of implementation. We will make no headway until we understand and address the factors that block the implementation of sensible recommendations.

It is easy to spot the reasons why the government's scientific establishment - like any established interest group - resists change. Over the years the establishment has become well adapted to its environment so that change is gradual and occurs only at the margin. The status quo may be defended on many grounds:

- a) Scientists have often carved out comfortable niches and are reluctant to re-tool or to find themselves in the private sector or in universities where performance standards may be much harsher.
- b) There are many bureaucratic reasons related to turf jealousies that add stability to the status quo.
- c) Existing programs are defended on the basis that they are essential to maintain mandate responsibilities.
- d) When the question of devolution to the private sector or to universities is raised, it is often argued that outside laboratories have neither the capacity nor the willingness to take on the work.
- e) Many clients of government laboratories or suppliers to the laboratories are satisfied with the status quo and may be alarmed about 'privatization'. Such clients often have strong political support and can suddenly become vocal when change is threatened.

No policy of reform in the government laboratory system can succeed if it does not address blockages of this kind. We recommend that the government now devote less effort to trying to determine yet again what reforms should be undertaken and instead concentrate on how to implement those that have already been suggested.

Incentives must be introduced to encourage the desired behaviour. For example, government science managers should be promoted if they accomplish the transfer of appropriate activities from government to the commercial sector or universities. Programs should be developed to help build the capacity of the private sector to absorb more scientific work now done in-house. If programs are to be shifted from the government to the private sector, adequate assurances of funding continuity must be given and personnel benefit packages must be made portable.

We can say with confidence that if the implementation issues are not addressed vigorously, nothing important will happen.

1.5 Recommendations

1.5.1 Summary of Recommendations

In response to the Prime Minister's questions - i.e., how can government resources in support of S&T be better allocated and how can the government laboratory system be improved? - we have recommended that:

- a) A comprehensive science audit be performed in each science-related department approximately once every five years.
- b) A methodology and set of procedures must be developed for allocation of S&T resources across the government (i.e., interdepartmentally), so that shifts of emphasis can be made rationally. This will require a more detailed articulation of the government's objectives and priorities for S&T. A great deal of thought, consultation, and continuing review will be needed. The design of such a major undertaking should be considered when defining the mandate of the new Department of Industry, Science and Technology.
- c) A thorough examination should be conducted of the basic (i.e., curiosity-driven) science activities of each department to determine which programs would be better carried out in universities.
- d) The personnel management systems of the government's scientific establishment should be overhauled. The introduction of more rigorous performance standards and much stronger incentives and disincentives will encourage excellence and weed out mediocrity.

- e) Factors that impede the reform of the government laboratory system should be identified and addressed systematically. The current problem is not identifying what should be done, but rather how to do it.