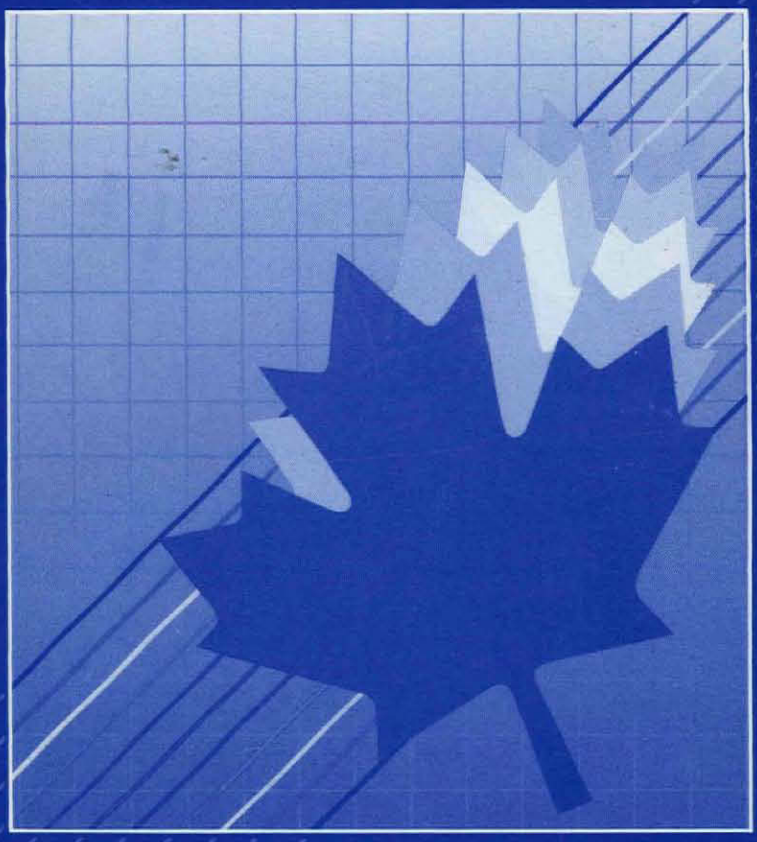
Science and Technology

A DECISION FRAMEWORK

FOR

SCIENCE AND TECHNOLOGY



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A DECISION FRAMEWORK

FOR

SCIENCE AND TECHNOLOGY

Principles and Guidelines for
the Management of the Federal
Government's Science and Technology
Activities

MARCH 1987

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FOREWORD

Over the years, a number of reports have addressed the issue of Canadian science and technology policy. In 1962, the Royal Commission on Government Organization (the Glassco Commission) reviewed federal science and technology activities. It recommended establishing mechanisms to develop a national science policy and the introduction of a central coordinating process to implement that policy. The Special Committee of the Senate on Science Policy (the Lamontagne Committee) also recommended in 1970 the establishment of a central coordinating mechanism for science and technology. More recently, the Task Force on Federal Policies and Programs for Technology Development, chaired by Dr. Douglas Wright, stressed the need for clearly defined research mandates, "demand-driven" research activities, and the need for policies that would bring a more cohesive and rational approach to government science and technology.

The Decision Framework is a management tool to help the federal government invest in science and technology (S&T). It includes a set of principles and guidelines, and an annual reporting process to Cabinet on federal S&T activities. It was prepared by the Ministry of State for Science and Technology at the request of the Prime Minister. It was based on the need of Cabinet and Treasury Board for a context to assess S&T program submissions and also on the need to co-ordinate federal S&T activities, without replacing the line authority that Ministers necessarily have over all the activities of their departments.

The Decision Framework will be used by science-based departments and agencies in assisting them to manage their S&T activities, including the selection of projects and programs. It will be used also by central agencies in assessing new proposals and as the basis for in-depth reviews of specific S&T issues. It will also provide the basis for an annual overview of federal S&T strategic directions for Cabinet and the National Advisory Board on Science and Technology.

This document includes three sections. The first outlines the background and reasons for the Decision Framework. It considers the federal role in S&T, and the international environment which is stressing the need for S&T. The second section summarizes the objectives of the Framework, including the roles of the key actors and the results which are to be expected from the Framework. The final section details the Framework principles, guidelines and the process that Cabinet approved.

A DECISION FRAMEWORK FOR SCIENCE AND TECHNOLOGY

A. GENERAL CONTEXT

The Federal Government's Role in Science and Technology

The federal government is the largest single funder of science and technology (S&T) activities in Canada. It will spend $4 billion on science and technology in 1987-88. This represents 11% of the government's total non-statutory expenditures. To support this expenditure, the federal government employs approximately 17,000 people in research or 25% of the national total.

Science and technology activities support a number of objectives, including economic and regional development, conservation of the environment, health and safety of Canadians, national security and defence, support of decision and policy making, and basic research for the advancement of knowledge.

By international convention, S&T activities are divided into two categories: natural sciences and engineering (NSE) and social sciences and humanities (SSH). These categories are further divided by Statistics Canada into two specific types of activities: research and development (R&D) and related scientific activities (RSA) which include the collection of geological data by the Geological Survey of Canada, hydrography by the Department of Fisheries and Oceans, and all the work conducted by Statistics Canada to describe the Canadian economy and population. The largest percentage (79%) of federal S&T expenditures is spent in the natural sciences and engineering and the majority of that amount (58%) is spent on research and development.

In addition to its direct expenditures, the government's tax policies, economic and regional development agreements (ERDAs), and procurements give it a key role in setting the nature, level, and direction of S&T within the country.

International Competitiveness

Scientific research and technological development are crucial to the economic and social progress of Canada. In an increasingly competitive international environment, science and technology are being used by other nations to start new industries, re-vitalize traditional ones, capture export markets and create employment.

These changed international dynamics require a far more aggressive Canadian approach to linking science, technology and competitiveness. To this end, the government has recently:

- o strengthened university research by providing additional funds for the three granting councils on a matching basis with industry, and by encouraging corporate-university alliances;
- o announced the establishment of a Space Agency and a major Space Plan, which will benefit all the regions, and which promotes strategic technologies such as robotics and artificial intelligence;
- o streamlined the tax environment for investing in R&D, by abolishing the SRTC, clarifying R&D guidelines, and by providing refundable tax credits for small businesses undertaking R&D;
- o developed science and technology partnerships with provincial governments through special subsidiary agreements and memoranda of understanding under the Economic and Regional Development Agreements;
- o funded the unique research capabilities of the Canadian Institute for Advanced Research;
- o established the National Advisory Board on Science and Technology, to report directly to the Prime Minister; and
- o reached agreement with the provinces and territories on the broad outlines of a National Science and Technology Policy.

These measures have led to considerable progress in meeting the government's objectives of economic renewal, job creation, and national reconciliation; further effort is nevertheless needed if Canada is to meet fully the challenges of a highly competitive international environment.

The Challenge

Although it is evident that Canada's national science and technology effort needs to be augmented, this is a particularly difficult task given the crucial need for fiscal constraint and deficit reduction.

One method of reconciling these priorities is by increasing the effectiveness of federal science and technology expenditures, and of the other instruments of government.

This underlines the importance of managing the government's $4 billion S&T investment wisely, of fostering in-house excellence and of ensuring that the government's policies create an appropriate environment for increased private sector investment in S&T.

To achieve this, the Prime Minister directed the Minister of State for Science and Technology to prepare an annual overview and analysis of the government's S&T activities, and to provide advice on measures to strengthen the effectiveness of federal S&T program expenditures.

This extensive internal review has been completed and a framework has been adopted so that all federal resources dedicated to science and technology can be focussed on national priorities in a consistent manner.

B. OBJECTIVES AND OVERVIEW

What Is the Decision Framework?

The Decision Framework is a set of principles and guidelines for providing overall coordination and direction to the federal government's science and technology activities. It will result in an annual process which provides Cabinet and the National Advisory Board on Science and Technology with an overview of the major thrusts in federal science and technology programs and an appreciation of existing problems and opportunities.

The Decision Framework brings a number of previous federal government decisions and policies affecting the management of science and technology together under one consistent set of principles. These principles are based on the recognition that:

1) science and technology are a means of achieving our social and economic objectives;

2) the private sector must be involved increasingly in setting priorities and sharing the costs of government research in support of industry; and

3) wherever feasible, federal science and technology activities should be performed in the private sector and universities.

An important principle of the Decision Framework is that all federal science and technology programs must be related to, and justified in terms of, three major purposes:

1) economic and regional development;

2) support of government missions; and

3) advancement of knowledge and the supply of highly qualified people.

These are explained in greater detail in Section C.

It must be emphasized that in-house S&T competence must be maintained to satisfy certain basic requirements; for instance, where national security, policy or regulatory requirements preclude private sector performance; to meet international responsibilities; or where essential scientific capability is needed for a department to perform its mission.

The Actors

1. MOSST -- The Minister of State for Science and Technology will use the Framework as a tool to provide advice on S&T to the Cabinet. In doing so, he will be fulfilling his role of coordinator of federal S&T activities, without replacing the line authority that Ministers necessarily have over all the activities of their departments.

   As part of the process in the Decision Framework, the Minister will present an annual science and technology overview to Cabinet, and to the National Advisory Board on Science and Technology (NABST), which is chaired by the Prime Minister. This document will be a future-oriented overview of the strategic S&T thrusts of the government. It will be based on a roll-up of annual S&T plans (ASTPs) prepared by individual science-based government departments.

2. Line Departments -- Each science-based department will contribute to the Overview through the preparation of an annual S&T plan (ASTP). The ASTP will describe the strategic directions of a department's S&T programs, identify its clients and beneficiaries, rank the S&T programs by priority, and provide appropriate financial and human resources data. The Decision Framework will be used by departments and agencies in preparing and evaluating new proposals.

3. Central Agencies -- Central agencies, specifically the Privy Council Office, Finance and the Treasury Board Secretariat will use the Decision Framework in assessing proposals.

   For example, the Decision Framework guidelines for a proposal in support of economic and regional development suggest that the private sector have a significant role in the selection, management and funding of the activity. If such a proposal does not meet these guidelines, it will be carefully scrutinized, and probably will not be supported.

4. Cabinet and NABST -- The Decision Framework process will provide both Cabinet and NABST with an annual overview of federal S&T future thrusts, and give them an opportunity to recommend changes to these thrusts.

5. Comptroller General -- The Decision Framework will be used in the periodic review of government-wide issues affecting the management of science and technology. In conjunction with the Office of the Comptroller General and the existing program evaluation groups of science-based departments and agencies, it will also assist in the in-depth review of specific science programs and activities. The principles and guidelines of the Decision Framework will offer an additional policy context against which these reviews can be carried out.

Expected Results

Bringing together all recent policy decisions affecting federal science and technology activities under one framework should contribute to better management and "smarter spending" in an era of constrained resources. It will also allow Cabinet to examine more effectively S&T issues which affect more than one department, and should result in a coordinated federal effort which is more relevant to government priorities.

If applied successfully, the Decision Framework should result in:

1) more informed government decisions in matters of federal science and technology. Federal S&T programs will be related to the three major purposes agreed to by Cabinet and will thus reflect general federal policy. Ministers will be aware of the S&T strategies of other departments and where there may be linkages. Through the Overview process and with the advice of the National Advisory Board on Science and Technology, Ministers will have a forum to discuss the direction S&T is taking and how new initiatives complement the government's overall strategy;

2) improved overall coordination of federal S&T: new initiatives and departmental S&T plans will be linked to a single federal strategy. The Decision Framework should assure Ministers that federal S&T activities are well-coordinated and being performed effectively. It will also prove useful in alerting Ministers to new or emerging S&T issues;

3) stronger S&T activity by the private sector. If some of the government's activities in science and technology were performed in the private sector, chances of economic spinoff would increase. Furthermore, federal support will be used to lever increased contributions by industry to raise the national level of S&T performance;

4) a flexible tool for federal S&T program managers to make their programs more relevant. Effective management of S&T can be enhanced by focussing on the purpose of activities outlined in the Framework. Managers will also have improved chances for their S&T projects to compete successfully with non-S&T initiatives.

C. PRINCIPLES, GUIDELINES AND PROCESS

OBJECT

The object of this decision framework is to provide principles, guidelines, and a process to assist Ministers in improving the leverage and effectiveness of federal S&T policies and programs, and of the $4 billion annually invested by the federal government in science and technology.

ELEMENTS

The elements of the decision framework are:

Principles:	to set out the thrust and priorities for the conduct of federal science and technology;
Guidelines:	to provide ministerial guidance to science-based departments and agencies in reviewing existing programs and planning new proposals;
Framework Process:	to enable Ministers to provide strategic direction to the overall effort through the expenditure management process.

PRINCIPLES

1) Science and technology are a vital means to support social and economic development, and other government goals.

2) In-house performance of S&T is appropriate where it is essential for the conduct of departmental missions. Federally funded science and technology activities should be performed in the private sector and universities if appropriate and feasible to do so.

3) Federal support will be used to lever increased contributions by industry and the provinces to raise the national level of R&D performance. It will favour initiatives that forge stronger linkages among the industry, universities, and government sectors.

4) The effective management of federal science and technology resources can be enhanced by focussing on the purpose of activities according to three categories and related objectives:

a) Economic and Regional Development

To assist industries become more productive and internationally competitive, increase private sector investment in R&D and innovation, and build on regional strengths.

b) Government Missions

To support research and development, and related scientific activities, that are relevant to departmental missions and government priorities, and that maximize benefits that are secondary to departmental missions.

c) Advancement of Knowledge

To ensure an adequate supply of highly qualified scientific and engineering personnel, and a stream of new knowledge to lay the basis for future economic and social development.

GUIDELINES

1. Economic and Regional Development

Objective: to assist industries become more productive and internationally competitive, increase private sector investment in R&D and innovation, and build on regional strengths.

a) Government support of R&D for economic and regional development purposes should be determined by a sector strategy that identifies, inter alia: (i) the competitive context and market opportunities; (ii) the potential gains in output, growth, and jobs; (iii) the timing of results; (iv) whether the technology can be acquired or imported at lower cost than developing it.

b) Climate-setting policies (taxation, trade, investment, patents, and regulation) and procurement will generally be relied upon to stimulate private sector R&D and innovation; however, direct incentives will be needed to support small firms, strategic initiatives, and in circumstances where foreign countries provide such assistance.

c) R&D for economic and regional development should be performed in the private sector (or for the private sector by universities) if the capability exists, unless there are compelling reasons to do otherwise.

d) The government will support strategic investments in R&D for the resource, manufacturing, and service sectors, which emphasize emerging technologies (such as advanced materials, information technology, and biotechnology), provided the industrial capability exists to exploit them commercially.

e) In areas of strategic importance where little or no industry capacity is present, federal R&D programs should include a "commercialization strategy", leading to the development of new and viable firms with strong market links.

f) The private sector should be directly involved in setting priorities and selecting projects for federal science programs for economic development.

g) The private sector will generally be required to match or contribute significantly to the funding of R&D projects to ensure commitment and relevance of R&D expenditures.

h) Federal R&D programs should build on well-identified regional strengths by providing the required technology support for local entrepreneurs, and by strengthening existing provincial S&T centres and networks through such mechanisms as ERDAs and MOUs.

i) The federal government will favour alliances among firms, joint international programs, personnel exchanges, and secondments to encourage technology diffusion and training.

2. Government Missions

- national security, territorial integrity, and defence;
- equality, health, and safety of Canadians;
- protection of the environment, development and conservation of natural resources;
- cultural development; and
- policy-making and regulation.

Objective: to support research and development, and related scientific activities, that are relevant to departmental missions and government priorities, and that maximize benefits that are secondary to departmental missions.

a) All R&D and related scientific activities must be closely tied to the mission objectives and sector strategies of departments with expected results, timing, and impact established.

b) These science and technology functions should be funded by the federal government but performed outside whenever it is feasible and cost-effective to do so. There are circumstances where S&T activities, in support of government missions, should, and must, be performed internally:

(i) in-house S&T competence must be maintained or established where:

- national security, policy, or regulatory requirements preclude private sector performance;
- essential scientific capability and expertise are needed for a department to perform its mission, or manage contracts for work performed in the private sector;
- federal government capability and expertise are required for international participation in the negotiation and implementation of agreements, and the exchange of information;
- a capability is required in departments to assess the current state-of-the-art in science and technology, or the support of procurement decisions;

(ii) the technical facilities and expertise are not available in the private sector and should not be created there.

c) Basic research that must be performed in federal laboratories should relate to the mission of a client department or agency. Whenever applicable, it should be linked through grants, contributions, and contracts to universities and industry.

d) Maximum advantage should be taken of: (i) contracting-out, (ii) contractor-operated, government-owned facilities, and (iii) other mechanisms such as cost-recovery and exchanges of personnel, to maximize opportunities for the spin-off of technology to industry for commercial exploitation.

e) Linkages should be strengthened with provincial and regional centres, universities, the private sector, and other countries through personnel exchanges, joint projects, technology transfer, and greater use of ERDAs and MOUs to support and rationalize federal and provincial initiatives.

3. Advancement of Knowledge

Objective: to ensure an adequate supply of highly qualified scientific and engineering personnel, and a stream of new knowledge to lay the basis for economic and social development.

a) Support for research and development, in the advancement of knowledge category, will strive for the development of world class excellence - in terms of proposals, researchers, and institutional competence.

b) Scientific activities for the advancement of knowledge should generally be performed in the universities where the opportunities for training are maximized.

c) R&D activities for the advancement of knowledge should be selected through peer review which would include the participation of informed experts including industry and university leaders. Peer review would also be applied to internal government research as appropriate.

d) Federally funded university researchers should be encouraged to assist the local IRAP network especially where no other technology support centres are available.

e) While maintaining the necessary critical mass and standards of excellence, federal funding (in coordination with provinces, universities, and the private sector) should favour regional specialization in disciplines that are linked to regional economic strengths, and build on existing capabilities of national or international competence.

f) The potential for spinoffs due to novel techniques and instrumentation in research for the advancement of knowledge should be a factor in the selection and support of projects.

MANAGEMENT PROCESS

1. Annual Departmental/Agency Reports

In January, all major science-based departments and agencies will prepare a strategic plan and assessment of their major S&T activities (in a form to be agreed between the Chief Science Advisor and the responsible deputy head) that will:

- provide a strategic overview of activities for the current and next three years by outlining the purpose of major S&T programs, expected results, impact, and timing. These will be related to sector strategies, departmental missions, and government priorities;
- indicate the intended beneficiaries of the work, their means of participation in priority setting and financing, and commitment to exploit the results;
- identify major policy instruments, including R&D, to achieve mission objectives and a ranking of R&D programs by priorities, including: (i) what new activities will be launched, (ii) what areas of major significance in research will not be pursued due to lack of resources, and (iii) what activities could be phased out to fund the new priorities;
- include program information such as financial and human resources for the major activities and the timeframe for their allocation.

2. Periodic In-depth Reviews

Each year there will be in-depth reviews of: (i) the program of a major department or agency (with the concurrence of the responsible Minister), and (ii) a horizontal issue in science and technology of broad interest to the government. These reviews will be conducted by MOSST in cooperation with the selected department and central agencies. Outside experts will be involved in the reviews.

3. General Overview

MOSST will present to Finance, TBS, and PCO a synthesis of the annual departmental plans outlining key horizontal S&T issues and priorities, with a view to obtaining their advice on the fit with government objectives and priorities.

4. Bilateral Meetings

The Chief Science Advisor will invite each deputy head, and his senior scientific advisor, to review annual plans with him. This will allow them to consider government priorities in relation to the major thrusts of departmental plans. These bilateral sessions may be extended to include several agencies or departments to ensure collaboration on horizontal items of mutual interest.

5. S&T Overview

The Minister of State for Science and Technology will consolidate these Annual Plans and provide an overview of all federal activities in science and technology. The overview will address the following issues.

(i) Progress toward the alignment of S&T activities with the guidelines and priorities established by Cabinet.

(ii) Key issues, gaps, or duplication in the overall federal effort taking into account the regional, national, and international context.

(iii) Periodic in-depth reviews of S&T programs or issues.

(iv) Special reports of Advisory Groups established by departments, e.g. in accordance with the Technology Centres Policy.

(v) Potential or actual impact of policy initiatives in other areas (taxation, investment, patents, procurement, labour adjustment, freer trade) on science and technology.

(vi) major institutional changes or financing requirements for the management and support of science and technology.

6. PM's National Advisory Board on Science and Technology

The Minister of State for Science and Technology will present the S&T Overview to the National Advisory Board for comments. The Board's advice can then be incorporated in the development of policy and the management of programs.

7. Report to Cabinet

In June, the Minister will submit an Annual S&T Report (including the views of the Advisory Board) to CCERD and CCSD. Cabinet will use this document to set strategic directions and priorities.

8. Directions for PEMS

The annual S&T report will be used by Finance, Privy Council Office, and Treasury Board Secretariat in the preparation of the MYOP, input to fiscal framework and budget, and the fall planning meeting of the Planning and Priorities Committee.

9. Programs and Projects

Any initiatives that come forward outside the context of a department's annual plan will be reviewed for compliance with the guidelines.

10. Public Report

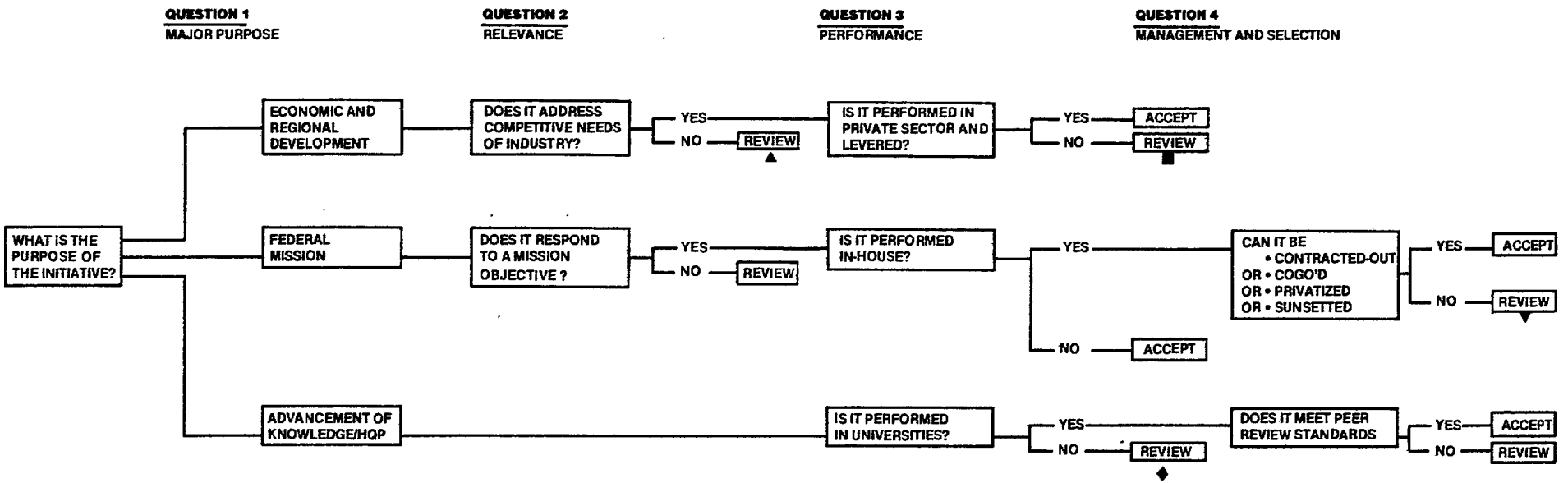
A Science and Technology Report will be released in October which will incorporate appropriate parts of the departmental plans, overview, and observations of the PM's National Advisory Board.

11. Parliamentary Committee on Research, Science and Technology

The Annual Overview will normally be referred to the Parliamentary Committee on Research, Science and Technology for review and comment.

D. ANNEX

SCIENCE AND TECHNOLOGY FRAMEWORK GUIDELINES



Exceptions include:

▲ New technologies where no established industry exists.

◆ Exceptional national facility.

■ Regional or strategic importance.

▼ Conditions for in-house

(i) National security, policy or regulatory requirements.
(ii) Essential capability needed for mission and contracts.
(iii) International commitments, exchange of information.
(iv) Assessment of state-of-the-art in S&T, and procurement.