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STEMS

Implementation of a Revised
S&T Expenditure Management
System

Phase I Report

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Phase I Report

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Executive Summary

In order to attain the degree of top-down planning and central control judged to be needed to make the attainment of the government's R&D target feasible, the establishment of a Cabinet-approved Federal Science Envelope is essential. The new S&T Expenditure Management System (STEMS) is designed to develop, allocate and administer this envelope.

It is recommended, initially at least, that the interdepartmental entities required by the STEMS (and which we have called Priority Area Committees, or PACs), should be set up to handle only those federal S&T activities which contribute to application areas of recognized importance and which are funded by several departments or agencies. For the moment other federally funded S&T activities should remain under the sole management of their funders, with MOSST reviewing them as at present.

Moreover, it is recommended that the PACs should be set up gradually, the STEMS being applied to each as it is established. The FSE should include all federally funded S&T, but no attempt should be made to apply the STEMS to S&T outside the PACs until MOSST has had at least a year of STEMS operating experience. However, it remains vital to include all federally-funded S&T in the STEMS eventually, in order to prevent seepage of S&T funds to non-S&T activities through

the exercise of management prerogative to reallocate resources.

This implies that all federal S&T resources must eventually be subject to allotment control. MOSST should take the lead in developing such controls, to be applied to the S&T within each PAC as it is set up and extended eventually to all federally funded S&T.

Ideally the FSE should be part of the Fiscal Plan recommended by the Lambert Commission (assuming that this recommendation is adopted), and MOSST should seek Cabinet endorsement of the specific setting of the target for S&T expenditure in the Fiscal Plan. It would be MOSST's responsibility to prepare the S&T section of the Plan, allocating the total FSE among the various PACs and funders of major S&T areas outside PACs. Even if Cabinet does not approve the inclusion of the FSE as an element of the Fiscal Plan, MOSST should seek to ensure that the FSE is submitted for the approval of the Inner Cabinet.

As a mechanism to aid in the transfer of technology, and in the involvement of the private sector in the selection of S&T activities to be funded by government, each PAC should establish some form of Advisory Board. This Board should be represented at all major planning activities of its associated PAC.

The report does not describe the STEMS extensively, but the STEMS reports are attached as appendices 'B' and 'C'. Nor does the report seek to advocate the adoption of the STEMS, since the current project was set up to address the problems of implementation of the system, taking as a datum the approval of the STEMS by senior MOSST management. It does, however, describe briefly the roles of the various participants in the STEMS, the document flow in the planning and budgetary process and a discussion of problems which have to be resolved. It is particularly important that the impact and likely reaction of federal funders of S&T to the placing of allotment controls on S&T resources be fully appreciated before the decision is made to begin implementing the STEMS. These points should be fully and explicitly treated in briefing the Minister on the STEMS.

The STEMS will make MOSST more visible and will make demands on MOSST resources. Although impossible to estimate with any precision, the extra work-load for the Ministry may require two additional persons to deal with the anticipated increase in correspondence (Ministerial plus approaches to MOSST), plus one person per PAC to assist the PAC secretariat and to handle the problems of establishing and allocating the FSE. There will also be changes in the roles of some MOSST Program Review

Officers, and there will be additional demands on the time of the Assistant Secretary and General Directors of Government Branch. Later, if and when more PACs are established, senior officials of other MOSST Branches may become involved in STEMS participation.

The report outlines a methodology devised to select areas for which to establish PACs. The applications of this methodology resulted in the identification of four candidate areas: Food, Health, Energy and Transportation. However, to attempt to establish four PACs initially would be a mammoth task and would forfeit the opportunity to learn from the first one or two implementations. It is felt that the initial implementation should be limited to two PACs, and the selection of the best two from the four candidate areas is felt to require the judgement of senior MOSST management based on perceptions of the likely degrees of cooperation of and the pressures affecting the managements of the relevant lead departments.

This report, therefore, comes to no final resolution of this point. The selection of areas in which to establish further PACs should be deferred so that experience in the initial implementations can be used as additional input to the decision-making process.

1. Introduction

The support of science and technological development (S&T) and its application to the achievement of national goals has recently been reaffirmed as an important policy of the federal government. As an objective of that policy, the present government has set a target of increasing Canada's Gross Expenditures on Research and Development (GERD) to 2.5% of the Gross National Product.

In spite of the reaffirmation of S&T's policy importance, in recent years the government's budgetary allocation for S&T activities has been further eroded as a consequence of the need to restrain the rate of growth in government expenditures. Nor has the institution of separate advice on S&T matters by MOSST been able to stem the general decline in the proportion of government expenditures devoted to the support of S&T. Moreover, MOSST foresees little prospect under the present system of making a serious advance towards the GERD target mentioned above.

A major factor contributing to the difficulty is that S&T, as a means to an end and not an end in itself, cannot be identified as a government function in the budgetary sense. Rather it contributes, to a greater or lesser degree, to

practically all of the functional areas into which the government's activities are classified. Another major factor is the inherent long-term nature of the S&T process. As a consequence the effects of cuts in S&T activities are considerably less noticeable in the short term compared to the immediacy of a department's operational requirements. Finally, S&T activities relevant to several important policy areas, like the policy areas themselves, have become multi-departmental in nature, and S&T cuts in one department can have serious consequences on the achievement of broad policy objectives.

More consideration of the cross-departmental and cross-functional i.e., horizontal, as well as the long-term, nature of S&T activities is needed in the resource allocation process. The existing system of disaggregated decisions on S&T resourcing is not providing this. A new system has been proposed whose essential feature is the approval by Cabinet of a budgetary reserve for S&T activities, i.e. a Federal Science Envelope (FSE). This report examines in detail the implementation of an improved S&T Expenditure Management System (STEMS) to establish and manage the FSE.

2. The STEM Proposal

Senior MOSST management has approved a series of recommendations for the improvement of the S&T management process.

The major recommendations are the following:

1. MOSST should develop annually for presentation to an appropriate Cabinet committee an envelope expressing the overall target for federal support of S&T and within this envelope resource levels for the various priority areas. These targets should be arrived at as a result of extensive consultation with departments and agencies.
2. The terms of approval should clearly recognize the need for a certain latitude in reallocating resources among the various programs in response to changing needs and judgements as to the effectiveness of program proposals. Following Cabinet approval, TBS should establish a reserve for S&T with nominal allocations for each priority area.
3. Interdepartmental committees (PAC's) should be established to plan, co-ordinate, review, evaluate, and make resource allocation decisions concerning S&T activities in the priority areas that have been identified by MOSST. For brevity, the activities of PACs will hereafter be referred to as managing the relevant S&T activities. Each committee would, inter alia, develop a program for its priority area and an allocation among the program components of the resources that

have been allotted to it in the S&T envelope.

4. MOSST should review the program proposals of all S&T funders and recommend to the Treasury Board an allocation of the S&T resources by departmental programs. These resources should be subject to allotment control.
5. Formal processes should be established to:
 - conduct periodic "A" base reviews of the priority area programs
 - ensure adequate consideration of the impact on the S&T program of X-budgets or reallocations of expenditures
 - monitor the utilization of scientific resources and recommend, if necessary, the reallocation of these resources among the various components of the federal S&T programs.
6. Federal expenditures on S&T should receive greater visibility. This would be achieved by including:
 - in the Cabinet discussion paper which annually reviews expenditure trends, an analysis of past and projected S&T expenditures;
 - in the Main Estimates a section devoted to

federal expenditures on S&T.

The project team, having considered the recommendations and the objectives that the process was designed to achieve (Appendix B and C), concluded that there were five essential features of STEMS. Of these, three are principles. The first is the acceptance by government of a federal science envelope (FSE) that has been prepared by MOSST. The second is the establishment of Priority Area Committees (PAC's) to manage S&T areas designated by MOSST. The third is the allocation of resources from the FSE to departments and agencies on the basis of MOSST recommendations. The fourth and fifth essential features of the STEMS are mechanisms (a) the use of allotment control to ensure that departments and agencies utilize the resources for the purposes for which they were intended and (b) the on-going monitoring and evaluation of the programs supported by resources from the FSE.

3. Scope of STEMS

3.1 S&T Coverage in FSE

The possibility of restricting the FSE, for example to Natural Science and Engineering R&D, so that it covers FERD precisely, was considered. The restriction to FERD has some appeal, particularly since government science targets have been set in terms of GERD, but the project team concluded that such restrictions would be undesirable because:

- the federal S&T activities excluded from the FSE would continue to be vulnerable to unwarranted resource cuts;
- the current real level of RSA in natural science and engineering is considered to provide an essential infrastructure in which to conduct R&D;
- S&T in the Social Sciences and Humanities will likely require higher, rather than lower, real expenditure levels in the future to deal with such matters as environmental impact assessments and social awareness of technology;
- exclusion of some S&T elements from the

FSE, and hence from the Cabinet-approved expenditure ceiling which the FSE includes, would imply the absence of priority for those elements and would in fact leave them more vulnerable to cuts than they are at present; and

- MOSST would have to continue special measures, such as an annual publication, in order to present an overall federal science picture which would, inevitably, be of little interest compared with the STEMS total as approved specifically by Cabinet.

Therefore, it is recommended that

the FSE must cover all federally funded S&T.

This is essential not only to protect non-GERD federal science but also to make possible the top down planning and other appropriate management functions which are necessary to ensure and enhance the effectiveness of federal science activities.

3.2 How Many PAC's.

The STEMS calls for the establishment of interdepartmental entities to manage S&T. For reasons which will become clearer soon, those entities have been designated as Priority Area Committees (PACs). The questions arise as to whether all FSE should be under the control of PACs.

The view that all federal S&T should be managed by PACs has some immediate appeal for reasons of conceptual neatness. On examination, however, this view becomes less attractive. Anomalies appear, such as.

- areas of S&T which are almost entirely within the mandate of a single department or agency (such as Statistics Canada's information collection, analysis and dissemination role); and
- areas of S&T which would not fit into any reasonable arrangement of PACs, which would not be treated fairly if forced into barely suitable PACs and which might be managed badly if collected into a "Miscellaneous" PAC with, possibly, MOSST as its lead agency.

In any case, options will be kept open if the other alternative is chosen - that, for the present at least PACs should not be set up to manage all federal S&T. After consideration of various possibilities, and taking into account current practices within PRA for analysis of Program Forecast and Main Estimates submissions, the project team recommends that

Interdepartmental Priority Area Committees (PACs) should be set up to manage specified federal S&T activities which contribute to applications of recognized importance and which are funded by several departments and agencies. All other S&T activities outside the scope of PACs should continue to be managed by their funding departments and agencies, major activities being reviewed by MOSST and more minor activities receiving little MOSST attention other than inclusion in the FSE and its appropriate sub-totals.

A possible outcome of implementing the recommendation using readily available data and assuming the existence of certain PACs, is illustrated in Table 1. Under this management regime 45% of the FSE resources would be under PAC management and 43% would be classified as major non-PAC activities that are subjected to a MOSST review. There would remain some 12% which, as now, would receive little MOSST

attention other than inclusion in relevant sub-totals and totals - dubbed book-keeping in the tables. In preparing this illustration, it was assumed that PAC's had been established to coordinate activities in the areas of Energy, Food, Communications and Space, Health, Oceans, Resources, and Transportation. This selection of PAC's was made for illustrative purposes only and should not be interpreted as a recommendation of the project team. The subject of selection criteria and recommendations re the establishment of PAC's is discussed in Section 6 and Appendix A of this report.

Table 1: Allocation of 79-80 S&T Expenditures to the STEM Management Regimes

	PAC's	MOSST		Total
		Review	Book-keeping	
Communications	40,233	-	-	40,233
CIDA	23,460	-	7,349	30,809
NRC	96,978	116,943	-	213,921
DSS	6,525	9,232	-	15,757
DOT	30,066	-	-	30,066
Stat, Can.	13,973	113,770	-	127,743
EMR	119,402	36,396	-	155,798
DOE	69,265	125,938	-	195,203
Agriculture	140,309	2,300	-	142,609
AECL	85,316	-	-	85,316
ITC	3,969	84,912	-	88,881
DFO	81,682	12,077	-	93,759
DPW	2,605	-	2,943	5,548
NHW	36,880	-	10,377	47,257
MRC	70,115	-	-	70,115
NEB	1,736	-	-	1,736
AECEB	992	-	-	992
CTC	2,595	-	-	2,595
CRTC	601	-	-	601
CBC	3,350	-	-	3,350
PO	591	-	272	863
CLFB	150	-	-	150
DREE	956	-	1,325	2,281
NHB	4,155	-	-	4,155
SLSA	900	-	-	900
DND	-	99,513	-	99,513
IDRC	-	36,867	-	36,867
NSERC	-	120,962	-	120,962
SSHRC	-	36,002	-	36,002

Table 1: Allocation of 79-80 S&T Expenditures to the STEM Management Regime

	PAC's	MOSST		Total
		Review	Book-keeping	
IAND	-	-	13,464	13,464
NFB	-	-	476	476
Nat. Library	-	-	14,932	14,932
Nat. Museum	-	-	46,064	46,064
P. Archives	-	-	9,021	9,021
Sec. State	-	-	10,879	10,879
CMHC	-	-	13,495	13,495
NCC	-	-	1,090	1,090
COL	-	-	862	862
PSC	-	-	212	212
AIB	-	-	40	40
OCA	-	-	12,885	12,885
Economic Council	-	-	11,382	11,382
Finance	-	-	8,655	8,655
N. Revenue	-	-	5,059	5,059
Science Council	-	-	2,441	2,441
MOSST	-	-	4,462	4,462
Justice	-	-	3,655	3,655
Law Reform C.	-	-	2,369	2,369
Sol. Gen.	-	-	3,255	3,255
CAL	-	-	150	150
Emp. & Immigration	-	-	12,806	12,806
Labour	-	-	3,225	3,225
External Affairs	-	-	5,071	5,071
PCO	-	-	1,688	1,688
TBS	-	-	11,739	11,739
Total	836,804	794,912	221,643	1,853,359
	45.1%	42.9%	12.0%	100.0%

3.3 Step-wise Implementation

As noted in section 3.2 above, it is not recommended that all S&T activities be allocated to PACs immediately. To do so would amount to forced implementation of a system for its own sake.

By leaving comparatively large areas of S&T outside the PACs, initially at least, the opportunity arises to implement the STEMS gradually. Clearly, changes in the expenditure management system are most urgent in application areas of national importance and those which involve several departments and agencies. These are the areas for which PACs are most likely to be set up quickly.

Advantage can be taken of this approach to gain experience and to solve detailed implementation problems on a smaller, more manageable scale. Meanwhile, other federal S&T can continue with little change in its expenditure management, except that MOSST's role in it will become more direct and stronger.

Detailed implementation scheduling is the task of Phase III of this project and will not be addressed

here, but approval of implementation principles is essential in order to shape the project more specifically. Therefore, the project team proposes that

The STEMS should be implemented step-wise, applying to each PAC as it is established, that allotment controls be imposed only on S&T activities within PACs at this stage, and that no decision be made on the timing of the extension of the STEMS to S&T still outside the ambit of PACs until MOSST has gained at least a year's experience of operating the STEMS.

However, existing mechanisms, supplemented as necessary, should be used so as to make it possible to implement the following recommendation:

MOSST should prepare some form of FSE paper to Cabinet in the fall of 1980 and should seek to have a science section included in the Main Estimates for 1980/81.

3.4 S&T not managed by PACs

The question of whether all federal S&T should be managed by PACs need not be settled for some time if, as recommended, the STEMS is implemented step-wise. Meanwhile, the recommendation is that non-PAC S&T continue to be managed as at present, without allotment controls as well as without interdepartmental management. The major snag is obvious - there would still remain the possibility of resources being diverted from non-PAC S&T to non-S&T activities. If orderly progress towards a science expenditure target is required, such a situation cannot be allowed to continue for long because

- there will undoubtedly be seepage to some extent out of the FSE, and this will become more serious if there are calls for appreciable expenditure reductions (X-cuts);
- it will become an accepted situation that substantial S&T resources are outside PAC's, and thus their inclusion into PAC's will become increasingly difficult; and

- there may be growing resentment by top management of departments and agencies who are minor members of PACs, based on the allotment controls of their PAC-managed resources while others are perceived to be free of such restrictions.

It is therefore important that decisions be made as quickly as is feasible, after the initial stages of implementation of the STEMS, as to the future management of all S&T not within the scope of the PACs already decided upon. As recommended earlier, the project team considers that experience gained in early implementation of the STEMS (that is, in establishing and participating in and closely monitoring the operation of the first few PACs) will be crucial factors in making this decision.

As a result of a review of the structure of the federal S&T program (Tables D1 and D4, Appendix D), of the purposes served by its component activities and of the distribution of funding by performance sector, the project team concluded that there are at least three kinds of S&T about which the PAC or otherwise decision will pose

special problems:

- S&T which is performed almost entirely as a service to other organizations, such as the program of Statistics Canada;
- S&T almost entirely performed within, or contracted-out by, a single department or agency in support of its own non-science mandate, such as national defence S&T; and
- small S&T activities which seem to have little in common with others and whose inclusion in a PAC would appear to accomplish little other than conceptual neatness.

Some parts of the S&T of the "service" variety might in fact be accommodated within PACs. For example, the Agricultural Statistics activity of Statistics Canada could be managed by a Food PAC. There will, however, be residuals which do not fit into the PACs which have been considered so far, such as the National Accounts activity of Statistics Canada.

Single organization S&T could be brought into the STEMS quite simply, by treating the appropriate department or agency as a quasi-PAC. Its S&T resources would be placed under controls similar to those applied to PACs and it would have relationships and responsibilities within the STEMS similar to those of a PAC, with such modifications as the obvious one of having no problems of resource allocation to many departments and agencies.

The "miscellaneous" S&T remains. Sooner or later, as stated above, all S&T must be brought under allotment control if the objectives of the STEMS are to be achieved. If this is to be the case, it follows that some organization must decide such issues as:

- the "current level" of S&T which is to be the basis of the controlled allotment;
- whether requests to divert resources allotted for S&T to non-science uses should be supported or opposed;
- how to reallocate lapsing S&T resources from or to these miscellaneous activities; and

- whether, and if so how, the advisory board concept should be applied to miscellaneous S&T activities (discussed in the next section).

It is recommended that

MOSST should take the lead role in developing a system of allotment controls to be applied at some future date to all S&T activities, whether these are collected within a somewhat artificial miscellaneous PAC or not

It is possible that experience in setting up and operating PACs will indicate potential benefit in extending PAC coverage as widely as feasible. Should this be so, the problems discussed in this section will diminish in scale. However, it is likely that appreciable time will elapse before one can decide clearly on the establishment of PACs in the Social Sciences and Humanities (which, for example, conceivably could cater eventually for Statistics Canada's National Accounts work and Finance Department's S&T within an Economic Planning PAC).

4. Operation of STEMS

4.1 Development of the FSE

The development of the FSE will supersede the preparation, done annually at present, of a paper setting objectives and guidelines for the review of the S&T components of Program Forecast Submissions. The process needs refinement, however, with more input from major S&T funders. Conceptually, the task consists of recommending, for Cabinet approval, the optimal level for the FSE and its optimal allocation to the various funders.

In fact this problem has no solution. The MOSST aim must be more modest, to construct a reasonable approximation to an optimal FSE and its allocation between S&T areas, bearing in mind

- the best available data on the fiscal framework;
- S&T targets, status and track record of federal S&T expenditures;

- the best available information on the plans of PACs and other S&T funders; and
- for minor funders, lacking specific planning information, a formula approach.

The Lambert Commission has recommended that a Fiscal Plan should be presented to Parliament in late October of each year. It is essential, from MOSST's point of view, that this Plan should include the FSE recommendations as well as the seven broad functions listed on page 82 of the Lambert Commission report, namely: Economic Development, Social Programs, Transportation and Communications, External Policy and Defence, Government Operations, Fiscal Transfer Payments and Interest on the Public Debt. It would have to be made clear, of course, that the FSE is not an additional item but, rather, that it represents a horizontal subdivision of each of the vertical functions

and that its inclusion illustrates the unique importance of science to the achievement of national goals, an importance which has been recognized by the government's announced target for Canada's GERD/GNP ratio.

If the FSE is not incorporated into the Fiscal Plan, a separate Cabinet submission will be necessary. This too must go forward as early in the budget cycle as is feasible - and well in advance of Main Estimates targets. Therefore, in order to take cognizance of the fiscal framework, it will be essential that MOSST be kept informed of the main outlines of this framework well in advance of its presentation to Cabinet, whether the FSE is incorporated in the Fiscal Plan or not.

The project team recommends, therefore, that MOSST should prepare

*a Cabinet document seeking a decision
that the Fiscal Plan recommended by
the Lambert Commission incorporate the
FSE.*

4.2 Allocation of the FSE

As indicated in 4.1 above, the overall FSE would be prepared by MOSST using, as partial input, the latest available planning information from federal funders of S&T together with projections to cover minor funders. When Cabinet response to the FSE has been received, a preliminary allocation will be made on a similar basis, pro-rata on the basis of the background to the FSE submission.

The preliminary allocation will also make provision for a reserve, to be held and disbursed to federal funders of S&T on the recommendation of MOSST, to cover unforeseen priority items, unavoidable cost over-runs etc. and make it possible to profit from unexpected opportunities. No decision is yet possible on the size of this reserve. This will depend, in part, on the degree of which other detailed aspects of the STEMS are approved and implemented, as well as on the number and total resource coverage of the PACs in existence when the reserve is established.

There will be, probably, one or two iterations of a consultative and negotiating process between MOSST,

PACs, federal departments and agencies before the preliminary allocation of the FSE is crystallized into final form. Each PAC and each federal department or agency which funds S&T will then be notified formally, of the expenditure ceiling for the funding of its S&T out of the FSE. PACs will, in turn, allocate their funds to, and notify, member departments and agencies. The expenditure ceilings received by departments and agencies from MOSST and from PACs, together with overall guidance from TBS and knowledge of the Fiscal Plan, will act as guidelines for the preparation of departmental and agency plans and Main Estimates.

Should a department or agency no longer need its former level of S&T resources, these should remain within the FSE and be available first to the corresponding PAC, and if not needed then added to the S&T reserves held by TBS for disbursement on the advice of MOSST. Considerable care will be necessary in deciding the size of these reserves, and in the management. This is a further reason for recommending step wise implementation of the STEMS, since the reserves can be small when the STEMS covers only a few PACs.

4.3 Roles of STEMS participants

The structure, terms of reference and duties of a PAC and the MOSST-PAC interfaces have been extensively explored in the original proposal (Appendix B and C). The project team is substantially in accord with the suggestions contained therein and believe that further discussion within this report is unwarranted. We do, however, feel it necessary to caution that PAC's are essential elements of STEMS and much care should be taken in their selection and the preparation of guidelines that would facilitate their successful operation:

A brief treatment is provided below of the roles of each participant in the planning and budgetary process of the STEMS.

- MOSST - recommends the FSE as part of the Fiscal Plan or as a Cabinet document presented soon after the Fiscal Plan
- disaggregates the Cabinet-approved FSE with resource ceilings for each PAC, and for each non-PAC S&T activity; notifies each and negotiates as necessary to provide a final allocation subject only to appeal to Cabinet.

- receives Main Estimates S&T sub-
missions from PACs, departments and
agencies, checks that PAC alloca-
tions are properly incorporated by
participants, reviews submissions
and prepares a science package for
inclusion, in the Main Estimates
- discusses and negotiates Main Esti-
mates modifications resulting from
Cabinet decisions with PACs, de-
partments and agencies
- manages reserve allocation and
negotiates supplementary alloca-
tion with departments, agencies,
PACs and Cabinet

- PACs
- disaggregate resource ceilings, set
by MOSST on receipt of the Cabinet
 - approved FSE, negotiate modifica-
tions with MOSST to arrive at a
final PAC ceiling, allocate resource
ceilings to member departments and
agencies and negotiate modifications.
 - receive 5-year plan inputs from mem-
bers, integrate these into PAC 5-
year plan

- receive MOSST guidelines on preparation of Main Estimates packages, negotiate modifications if necessary, allocate resources to departments and agencies to perform specified activities, negotiate if necessary, and arrive at final tasking and resourcing
- check, with MOSST, that departmental and agency Main Estimates properly reflect agreed tasking and resourcing
- manage reserve allocation and negotiate supplementary allocations with departments, agencies and MOSST.

Departments
and Agencies

- participate in the work of appropriate PACs
- negotiate resource allocation modifications, as necessary with PACs and MOSST
- submit relevant portions of 5-year plans to PACs
- receive Main Estimates guidelines for PACs and/or MOSST, negotiate modifications as necessary, prepare Main Estimates submissions

- request additional resources from and/
or relinquish resources to PACs and/
or MOSST as appropriate after Main
Estimates

The principal roles of the various participants in the planning and budgetary aspects of STEMS is summarized in Table 6, which illustrates the document flow under the assumption that the present Program Forecast and Main Estimates Systems will continue with little change.

Assuming also that the Lambert Commission recommendation regarding the Fiscal Plan is implemented, the latter document will initiate the Planning Cycle. After the initial year, there will be input to MOSST from each PAC and major departmental or agency funders of non-PAC S&T as a matter of routine, but initially this will not be so. In both cases, it will be MOSST's responsibility to prepare the FSE package. As discussed above this will either be part of the Fiscal Plan or submitted independently to an appropriate Committee of Cabinet. Given the present organizational structure of the government it is recommended that,

if Cabinet does not approve the inclusion of the FSE as an element of the Fiscal Plan, MOSST should submit the FSE annually to the Inner Cabinet for approval.

It will be MOSST's task to interpret the Cabinet decision on the FSE and to prepare a preliminary allocation of resources (within the FSE and with provision for a suitable reserve), to communicate preliminary expenditure ceilings to the PACs and the other departmental participants in federal S&T, to receive appeals, to negotiate with funders, and to arrive at final allocations. These final allocations, it is suggested, would be subject only to appeal to Cabinet.

When Main Estimates decisions are published, MOSST will again discuss and negotiate with PACs, departments and agencies any consequent modification to S&T budgets. Meanwhile, planning should have been in progress for the following years based on the future years' program projections in the Fiscal Plan submitted in advance of the Main Estimates.

TABLE 6

CABINET COMMITTEE(S)	CENTRAL AGENCIES	MOSST	INTERDEPARTMENTAL COMMITTEE	DEPARTMENTS
				5 yr. plans
Decision on FSE	Review & advise on FSE	Prep. of Science FSE	Prep. of integrated 5 yr. plans	
		Guidelines for preparation of M.E. S&T packages		
	Review & recom- mendation	Review & recom- mendation	Allocation of resources by dept. & activities	Submission of M.E.
Decision on M.E.				

Assumption: format and content of P.F. & M.E. submissions will not be drastically altered in the immediate future.

4.4 Advisory Boards

The STEMS is intended to enhance the effectiveness of federal S&T as well as facilitating progress towards the GERD/GNP target. It must seek, therefore, means to channel federal S&T funding in directions which at least take account of the views of the private sector and the provinces. This means that other interested parties should be closely consulted on, and preferably participate in, federal S&T planning.

The areas where private sector planning participation are most urgent and probably easiest to arrange are likely to be those for which PACs will be established first. The opportunity should be taken to set the precedent of requiring that each PAC should contact Canadian industry, the provinces, the universities, non-profit scientific institutions and professional bodies, as appropriate, in order to initiate discussions on how best to arrange for non-federal government input to its planning process. MOSST should be represented at these discussions at Assistant Secretary level to ensure that strenuous efforts are indeed made to arrange for real consultation.

While each PAC should retain flexibility to manage its own affairs it is suggested that some form of Advisory Board be set up, in each case, as a focal point for private sector and provincial input. This Board might be co-chaired by the PAC Chairman and a non-federal member. The views of the Board might be communicated to the PAC by inviting non-federal members, selected by the Board, to attend PAC planning meetings, and/or by the presence of PAC Chairmen and another senior PAC member or head of secretariat as members of the Advisory Board.

There would seem to be no reason why similar Advisory Boards should not be established to facilitate consultation on the planning of major S&T activities not yet managed by PACs. This might be particularly desirable in the case of S&T activities which, from the view point of the STEMS, are perceived to be virtually single-department concerns and which, therefore, are unlikely to be merged with other major S&T into a new PAC in the near future.

The project team therefore recommends that

Each PAC, as it is established, be required

as a matter of urgency to set up appropriate mechanisms for full and frequent consultation with other sectors of the economy, as appropriate, and for the views of all sectors to be taken into account in all major planning activities of the PAC.

5. Implications of STEMS

5.1 Some Problems raised by the STEMS

The terms of reference of this project take as a datum the acceptance of the STEMS. It would be a serious omission, however, not to mention some difficulties which implementation of the system will create.

As indicated in Section 5.2 below, senior managers of science-intensive programs will perceive the system of allotment controls, which is fundamental to the successful implementation of the full scale version of STEMS, as an unnecessary restriction to their freedom to respond to the demands of the Minister to whom they are accountable. This is one major and obvious reason why implementation of the system will be resisted.

A more subtle reason for resistance to the STEMS by individuals is that work managed by a PAC may be perceived as less visible to departmental or agency management than non-PAC work. This perception may well be justified in some cases, but whether valid or not it could lead junior and middle S&T managers to escape PAC management if possible. This may be particularly prevalent when the PACs are being established.

Later, the advantage of PAC membership should become apparent in the form of accessibility to the lion's share of new resources. It is important, therefore, that considerable care be taken in setting up each PAC to ensure that the criteria for inclusion are well specified and

consistently applied. The subject of criteria for the establishment of the PAC's as discussed in Appendix A of this report.

Another difficulty is conceptual. The STEMS assumes that all S&T is best managed interdepartmentally - at least, all S&T to be managed by PACs. This may not be so in all cases. Some S&T funded by Consumer and Corporate Affairs Canada, for example, might be intimately inter-related to a regulatory function of that department. If the S&T were related to foodstuffs, it might be managed by a Food PAC (if one were established). It is then possible that the apparent advantages of grouping the S&T with similar science activities (the advantages exploited by the STEMS, better planning and resource allocation decision-making) could be negated by the inevitable weakening of the S&T - regulatory linkage. Care will be necessary to identify such cases where the existing vertical integration linkage needs preservation. Mechanisms may be needed to ensure that departments and agencies have sufficient protection in the event that PACs reallocate their resources with insufficient regard to the needs of their members - almost always, of course, this will arise only in the case of very minor members of the PACs.

5.2 Allotment Control

The STEMS requires that funds and person-years intended for S&T activities be retained for S&T. This means that the resources currently devoted to S&T plus additional S&T resources, less resources whose withdrawal from S&T is approved, will be placed under allotment control or some mechanism having similar effects. The fact must be faced that this restricts the freedom of action now enjoyed by managers by reducing their ability to reallocate resources within their Main Estimates totals.

This freedom to reallocate resources was welcomed by the Lambert Commission. Indeed the Commission's recommendations seem to lean towards allowing managers more freedom, within expenditure ceilings, together with accountability for achieving agreed objectives. There is an obvious need, therefore to reconcile the STEMS proposals with the Lambert Commission recommendations of greater freedom.

What the STEMS sets out to achieve, inter alia, is orderly and

effective progress towards the appropriate federal government contribution to a national S&T target. An earlier section of this report attempted to show that such progress is unlikely unless there is both considerable top-down planning of S&T and prevention of seepage of S&T resources through X-budget cuts or other means.

The Lambert Commission recognized the need for top-down planning - it is central to the theme of accountability. The apparent conflict between the Lambert philosophy and the STEMS reduces, therefore, to a question of the level at which centralized planning and control is to operate. Science has unique contributions to make in most government functional areas, and the adoption of a national target for GERD indicates government recognition of R&D expenditures as a proxy for the stimulation of the economy by S&T. These two points are sufficient justification, in the opinion of the project team, for imposition upon managers of the constraints implied by the STEMS.

While the allotment controls required for implementation of the STEMS would prevent reallocation of resources intended for S&T to non-science activities, no barriers should be placed in the way of transfers in the opposite direction. On the contrary, managers should be free to supplement the S&T resources allocated to them, should they wish to do so, by diversion of non-science resources.

There will be little likelihood of voluntary transfers of resources into S&T from non-science, however, if these dollars and/or person-years become locked in to S&T. It is therefore proposed that

Departments and Agencies should be free to direct non-science resources into S&T activities if they wish. These resources must be reported as S&T expenditures, but any excess of actual S&T expenditures, over the Program allocation of S&T resources through PACs or MOSST will not become subject to the STEMS and will be available for reallocation as desired by the department or agency.

Because allotment controls are crucial to the STEMS and because they are the feature most likely to be resisted, both by federal S&T funders and by central agencies, it is essential that their implications be made clear to the Minister when discussing the STEMS with him. It is recommended, therefore, that

Briefing material for the Minister on STEMS, including briefings on the proposed Cabinet document to establish the annual presentation to Cabinet of the FSE, provide clear statements of the implications of allotment controls on S&T person-years and dollars, of the likely resistance to these and of the futility of any attempt to implement the STEMS without them.

5.3 The MOSST Role and Profile

There can be no doubt that implementation of the STEMS will lead to a more active participation by MOSST in the management of science. It will also make MOSST's continuing budgetary role more visible, since disbursement of expenditures in the S&T reserve will require MOSST recommendation as will requests to transfer S&T funds under allotment control.

The Setting up of Advisory Boards, as discussed in section 4.4 of this report, will also make MOSST's role more prominent, in this case to the science community outside the federal government. It is important that the Minister be fully briefed that he should expect an increase in the number of requests and complaints from his Cabinet colleagues on behalf of their departments and agencies, from other Members of Parliament on behalf of constituents and from universities, industry, the provinces and non-profit S&T institutions.

The other side of the coin is MOSST's increased influence and the protection of S&T against arbitrary resource cuts. If the Minister is successful in obtaining sufficient resources to make appreciable progress towards the federal contribution to the GERD/GNP target, then the STEMS will make this achievement more visible. Similarly, disappointing progress will also be very visible.

5.4 MOSST Senior Management Involvement

The main impact of the STEMS on MOSST top management time, once the system is implemented, will take the form of the requirement for high-level MOSST representation on each PAC. The level should, in all cases, be Assistant Secretary and in no case should it be below General Director.

Also, representation usually will come most appropriately from Government Branch. This may impose too great a burden on the Assistant Secretary, Government Branch. A possible solution might be negotiated with PACs should this situation arise. For example, a designated General Director could serve as alternate for the Assistant Secretary, it being understood that the Assistant Secretary would endeavour to attend when important policy issues were on the agenda.

The burden on General Directors will also be considerable. This may be shared, however, between Government Projects and PRA Divisions. Later, if appropriate PACs are established, Assistant Secretaries and/or General Directors of other Branches might be invited to serve as MOSST representatives.

The Secretary will become more visibly involved in the S&T planning and budgetary processes. He will no doubt be required to attend meetings of appropriate Cabinet Committees to explain and defend the FSE proposed by MOSST, and he will be likely to receive more requests for information, interviews, etc., as well as solicitations for funds for S&T, because of MOSST's higher profile.

5.5 Demands on Other MOSST Resources

Because of the likely increase in approaches to MOSST to seek funds for S&T, for information, etc. referred to above, implementation of the STEMS will increase the pressure on Communications Services Division and officers who are approached by that Division for data. The size of the increase and workload is difficult to estimate, but it would be prudent to alert the Minister to the possibility that the Ministry may have to seek a small increase in its "overhead" resources following the implementation of the STEMS because of the quite dramatic increase in the Ministry's responsibilities and visibility.

As well as the overhead increase - which might require two person-years including one secretary, together with some term or contract effort and some continuing computer costs to implement MOSST's own Management Information System (MES) needs - there will be increased demand on MOSST personnel below the General Director level.

PRA Division will find its budgetary and planning roles considerably increased

as MOSST's role of budgetary recommendation to Ministers and co-ordination of the FSE for presentation to Cabinet grows. The role of Program Review officers will change, since detailed project reviews will be undertaken largely by PACs and MOSST Program Review of PAC-managed S&T will focus on larger aggregates and inter-PAC decision-making.

It is desirable that MOSST should offer assistance in the establishment and operation of PAC secretariats. Although these secretariats should be kept as small as reasonably possible, their ability to respond quickly and with high quality analytical content to the PACs will determine, to a large extent, the effectiveness of the whole STEMS. MOSST should be prepared, therefore, both to support PAC proposals to spend resources on setting up secretariats and also to second suitably experienced, high calibre personnel to assist in the secretariats, initially at least. MOSST might benefit by one-year renewable secondments to PACs, provided of course, that suitable career development can be planned for the MOSST officers on completion of the secondments.

The STEMS, though changing the nature of the MOSST Program Review activities somewhat, will not decrease PRA's workload. The reverse is more likely, particularly if the Division is expected to handle much of the anticipated increase in calls for information, etc. There will be even more need for both Program Review and Program Assessment officers to liaise with PACs in order to fulfill their science planning and budgetary roles. Therefore, it appears that resources must be sought elsewhere for secondment to PAC secretariats.

The most obvious source, after PRA, is Government Projects Division (GPD). Secondments of GPD officers would have the added advantage, in most cases, of increasing their experience by involving them in new activities. However, the prime purpose of these secondments should be to assist the PAC secretariats, and it is vital that seconded personnel be given sufficient prior background in the planning and budgetary process, and particularly in the STEMS, to enable them to be useful immediately on secondment. Initially, the implementation of the STEMS is not likely to require additional MOSST resources. This assumes that the Project Management Committee will agree to allocate some of its contract budget to

cover the cost of any initiatives to provide consultant advice to PACs on establishing their MIS, and to pay for any needed upgrading of MOSST's own information storage and retrieval systems to match the systems recommended for PACs. It also assumes that, initially, person-years will be made available on a project basis to handle additional work-loads involved in establishing and assisting PAC secretariats.

In the long-term, implementation of the STEMS is likely to call for about 1 additional person-year for each PAC established, plus 2 person-years for increased MOSST overheads (replies to Ministerial letters, enquiries directed to the Ministry, etc.). The extra cost involved should be amply repaid by the effectiveness of the federal S&T program, and it represents a very small fraction of the total increase in the FSE.

6. Recommendations for PACs

6.1 Methodology

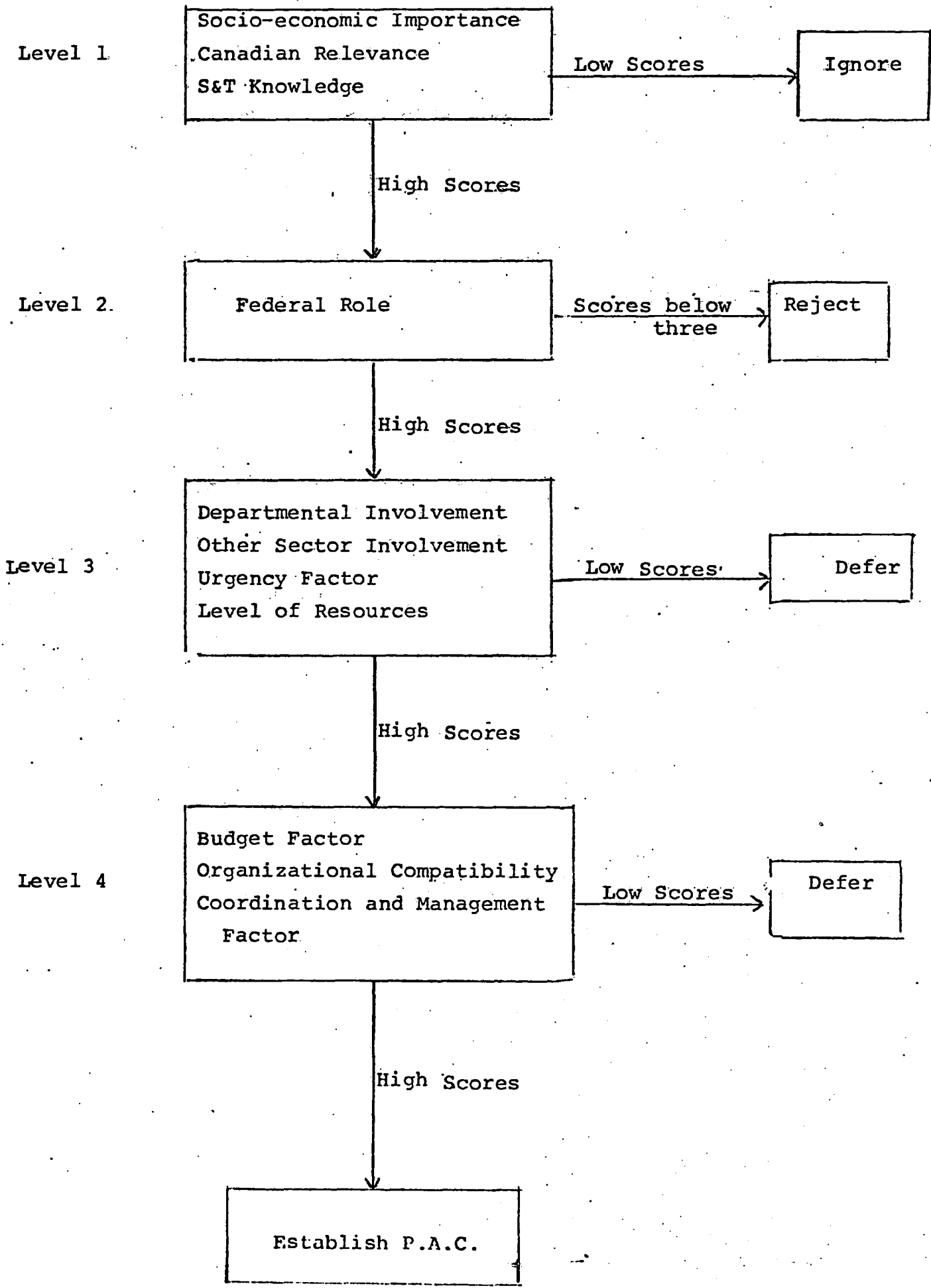
As elaborated in Appendix A, a four-stage screening process was developed as a possible aid to the selection of S&T priority areas as bases for establishing Priority Area Committees (PACs). It is important to note that the process explicitly provides for rejection of a candidate area if it is perceived that a federal role is minimal or non-existent. The list of factors by stage is given in figure 1.

This methodology was applied in the first instance to the S&T Application Areas currently used in Program Review. It has been applied to three other sources of PAC candidates: the S&T priority areas identified in MOSST provincial discussions, R&D priority areas developed in a MOSST internal document, and the industrial sector strategy studies initiated by D.I.T.C.

6.2 Current S&T application Areas as Candidates

The S&T application areas identified in the survey of federal scientific activities (listed in figure 2) were used both as a test of the screening process and as a

P.A.C. Selection Process



CURRENT S&T APPLICATION AREAS

Advancement of science	Northern development
Communications	Oceans
Culture and recreation	Official languages
Construction (exc. housing)	Policy development
Developing nations	Resources - Forestry
Energy	- Mineral
Environmental issues	- Water
- Air	- Other
- Land	Security - Domestic
- Water	- National
- Other	Defence
Food - Agriculture	Social development
- Fisheries	and welfare
- Others	Space
Health	Transportation
Housing and urban dev't	Other

set of candidate areas for PACs. There were no "surprises" in the test: areas such as Energy, Food, Health, Northern Development, Oceans, Natural Resources and Transportation were among the top rankings by the four respondents carrying out the test, while Culture and Recreation, Housing and Urban Development, Official Languages and both Domestic and National Security never received high rankings. These results correlate reasonably with the conventional wisdom about priority S&T areas and suggest that the screening process could be a useful aid, at least in suggesting which areas should be tackled first in a step-wise implementation of PACs.

6.3 S&T Areas in Federal-provincial discussions

The following S&T areas have been identified by one or more provinces as being of interest to them.

Communications

Energy

Food

Forestry and Forest Products

Health Care

Information Technology

Materials

Mining and Metallurgy

Oceans

Transportation

Screening by one of the respondents involved in the test of the process suggests that in a step-wise implementation of these PAC candidates one might start with Oceans and Transportation in that order, followed by Energy and Food. As subsequent candidates, Communications, Forestry-Forest Products, Information Technology and Mining-Metallurgy rank equally.

6.4 MOSST Proposals for R&D Priority Areas

A set of R&D priorities developed by the Government Branch is listed below, with brief annotation identifying significant differences in content compared to similar areas mentioned in the preceding paragraphs.

Communications and Space Technology

- would include elements of Information Technology

Climate

- would include "cold weather technologies"

Food

- would not include Fisheries

Materials

- would include mining and refining, recycling of materials

Oceans

- would include Fisheries

Poisons, Contaminant and Pollutants

- probably equivalent to Environmental Issues

Energy

Health Care

Forestry and Forest Products

Transportation

More detail on the components of these priority areas is to be found in Annex 1 of Appendix A. From the perspective of operating STEMS and the experience of the Program Review group, some realignment of components in some of

of the areas would be appropriate. In the Food area, PRA Division holds the view that it should include both Agriculture and Fisheries. The pros and cons of combining Communications and Space Technology are elaborated in Appendix A. On balance we believe their combination under a PAC is not appropriate. The inclusion of mining and metallurgy - the latter is essentially extractive metallurgy - under Materials is arguably anomalous.

If the above changes were accepted, these R&D priority areas with the exception of Climate, would bear the same relative priority ranking as discussed in preceding paragraphs. That is, Food, Health, Energy and Transportation would be initial PAC's.

Climate R&D is seen as a relatively important area for government support, but the early establishment of a corresponding PAC does not appear necessary: the majority of the R&D would be carried out under the aegis of one department (Environment). The absence of a PAC does not preclude interdepartmental and inter-sectoral mechanisms for advice and information exchange. But such mechanisms do not imply the need for a PAC.

6.5 Some Proposed Exclusions

In a similar vein, we recommend that,

PAC's should not be established based on Environmental Issues, Northern Development, Oceans and Materials.

Again, there needs to be interdepartmental and inter-sectoral sharing of information and provision of advice, but the planning and programming, and consequently resource allocation and management, is more appropriately vertical rather than horizontal in nature. For example, materials technology can be a key factor over a gamut of activities from nuclear power through consumer goods (eg., textiles and fabrics) to the construction industry. The materials research required will best be determined by the client sector.

Consider also Development and Oceans: these application areas correspond to umbrella policies which are intended to involve more fully in our socio-economic activities our northern and ocean areas. These policies impose planning and programming requirements in other policy areas such as transportation, social development, fishing, off-shore resource development, national defence. There are cross-impacts, of course, but the resourcing process has a vertical rather than a horizontal imperative.

6.6 Industrial Development as a PAC

In the MOSST document examining the implications of the GERD target (1.5% of GNP), a PAC on Economic and Industrial Development is assumed and well over 1/3 of the targeted Federal R&D funding in 1983/84 is assigned to it. In addition, the industrial sector strategic studies being conducted by DITC undoubtedly reveal, or will reveal, the need for a federal S&T support to a greater or lesser degree depending on the sector. Both imply that such a PAC is a foregone conclusion. These are some contra-indicators, however:

- Many of the potential or proposed PAC's have, as one of their underlying, if not explicit, objectives industrial and economic development, so the selection of what to include in this PAC would be difficult and likely arbitrary.
- Frequently, several federal S&T application areas are relevant to a given industrial sector (see figure 3). It is surely necessary and more appropriate to have the industrial sector input taken into account in the planning and programming of the government's S&T activities in given areas.
- Identifying and labelling only part of the

government's S&T as in support of economic and industrial development could engender public misconception and criticism about the apparent level of government commitment to industrial development

On balance it is concluded that

The establishment of a PAC concerned with industrial and economic development is seen as embracing S&T activities which are too wide-ranging and too arbitrarily chosen.

6.7 PAC Recommendations

As a result of the admittedly limited amount of application of the methodology devised to select areas in which to establish PACs, it appears that the initial STEMS implementations should take place in Food, Health, Energy and Transportation. One then has to decide on the best number of PACs to establish in the first instance. To attempt to set up four at once would demand an impossibly large amount of MOSST resources and could jeopardize the viability of the STEMS. At the other extreme, the setting up of a single PAC might imply a lack of urgency or of commitment to the STEMS. On balance, it is proposed that

*two areas should be selected for
initial implementation of the STEMS
by the establishment of PACs, and
these areas should be selected
from four candidates, namely
Food, Health, Energy and Trans-
portation.*

The methodology does not indicate clearly which two of the four should be selected. Therefore it has been

concluded that less tangible factors should influence the choice, factors such as the perceptions of senior MOSST management as to the "climate" for implementation in the various lead agencies and major participants and the likelihood of favourable Ministerial reactions. Accordingly, it is recommended that

senior MOSST management choose, based on their perceptions of the non-technical problems and opportunities associated with implementation of the STEMS within the relevant departments and agencies, the best pair out of the four specified areas in which to establish the first PACs.

7. Other Aspects

7.1 The Flow of Management Information

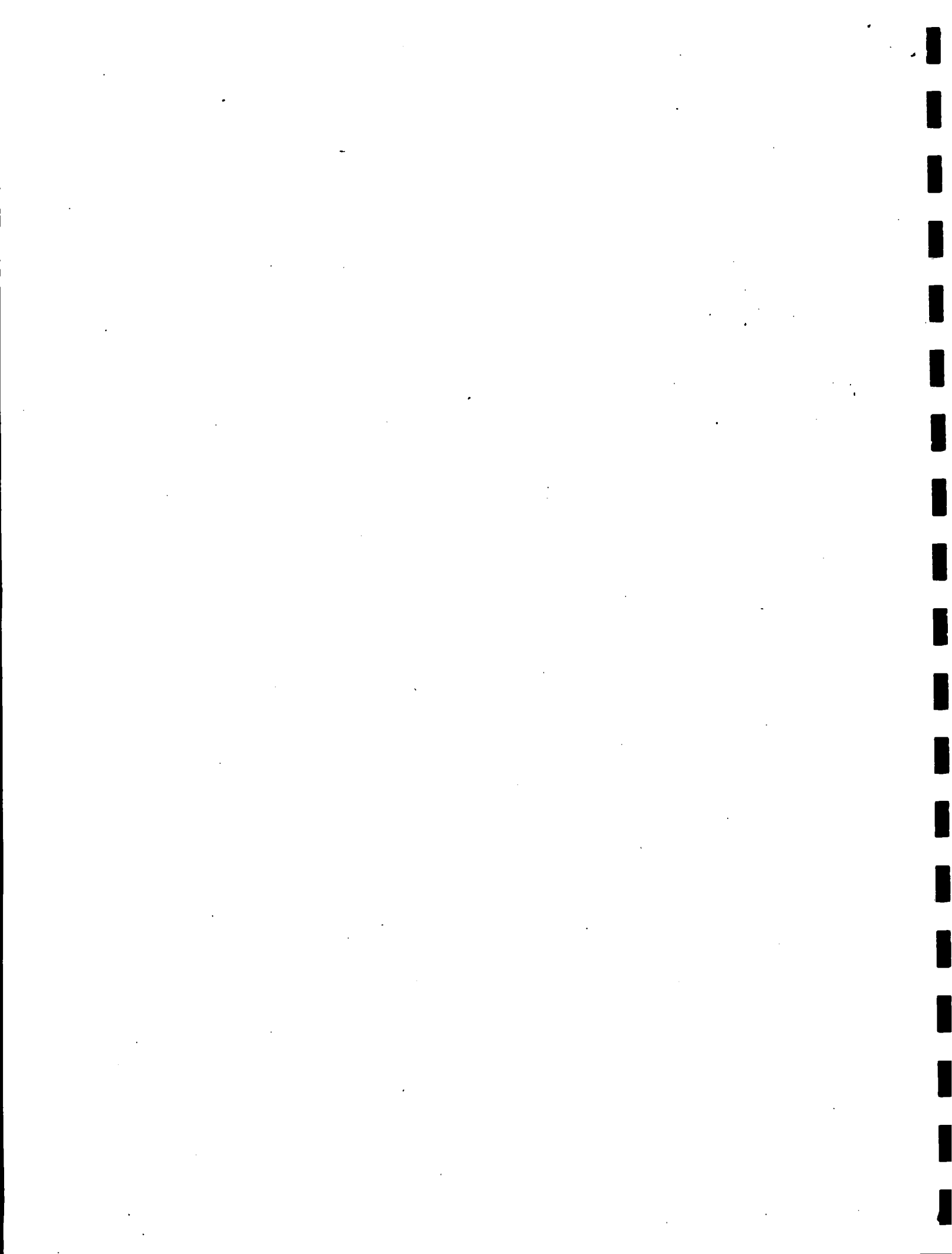
Section 4 of this report included an outline of the flow of budgetary documents envisaged within the STEMS. The flow of planning information was touched on briefly, but in no detail. In addition to these two types of information, good management also requires flows of cost-accounting and of progress information.

Since each PAC will manage the S&T it covers, it will be each PAC's responsibility to set up a management information system (MIS) to meet its own needs. Advantage should be taken of the opportunity to require of PACs, also, that their MISs should all be capable of producing readily the kinds of aggregate information required by central agencies. This does not mean that the PAC MIS should be available to MOSST, or to TBS or to others. It means merely that MOSST should attempt to specify clearly its own needs for data from the PACs, and in consultation with other central agencies, its best estimate of their data demands, so that MOSST can communicate these to the PAC. The MOSST representative on the PAC, plus any MOSST officer assisting the PAC secretariat, should then try to ensure that the required

data are collected and stored so as to respond as easily as possible to these anticipated demands.

There will, of course, be unforeseen demands for information from PACs, such as calls for data aggregated in unusual fashions. PACs, and PAC members, would be wise to store their data in very disaggregated states, particularly if they are stored on computer files. It might be advisable for MOSST to retain a consultant to advise each PAC, at MOSST expense, on setting up its MIS. This service would not be imposed on PACs, but acceptance of the consultant's recommendations by a PAC would be encouraged by ensuring that the MIS could respond readily to anticipated demands. Moreover, by accepting the consultants' recommendations, the PAC would avoid possible future criticism that its MIS could not respond adequately to unforeseen information needs.

More work on this matter will form Phase II of this project. Input to it can be expected, also, from a parallel project on the information needs of top MOSST management.



SELECTION OF PACS

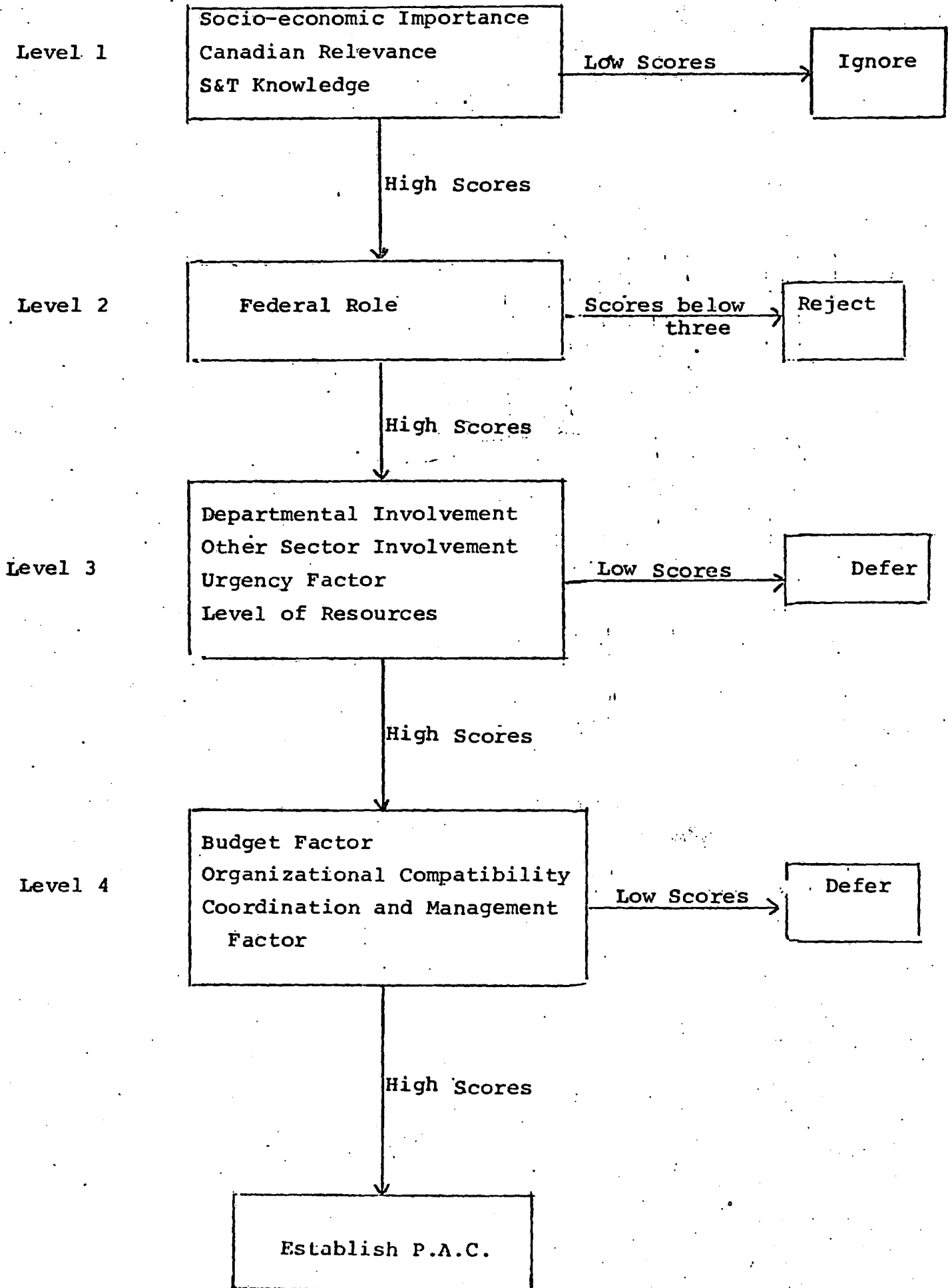
1 Development of the selection process

As the result of a trial rating of the S&T application areas used in the Main Estimates Science Addendum with a trial set of criteria and an attempt to apply weighting factors to these criteria, it seemed that it would be more appropriate to group the criteria and operate the selection process in a decision tree mode - see figure 1. An elaboration of the scoring scheme for each criterion is provided in figure 2. Weighting factors have not been used in the decision tree mode. It perhaps requires little comment other than to note that if there is no federal role for some candidate area, there is no need to consider it further as a possible PAC candidate.

2 Current S&T application areas as candidates

The 20 S&T application areas in the MESA - plus major subdivisions under Environmental Issues and Natural Resources - provide an obvious candidate list, since they have already been identified as S&T areas which the government supports. Moreover, as they have been identified as more or less important areas on some basis, they provide some test of the validity of the selection process. Four PRA respondents (three for P.R. and one from P.A.) rated these S&T application areas using the rating scheme shown in figure 2.

P.A.C. Selection Process



FACTORS	SCORING					WEIGHT
	1-2	3-4	5-6	7-8	9-10	
<u>Level 1</u> Socio-economic Importance	Only indirect contribution to socio-economic goals.	Direct social implications but no direct economic aspects perceived.	Economic opportunity to improve living standard; important fraction of economic resources.	Economic barrier or aid to existing or improved living standard.	Critical societal or economic factor threatens society.	
Canadian Relevance	Not a Cdn. problem; no opportunity for Canada	Not relevant but Canada can contribute to international efforts	Cdn. contribution to international efforts relevant to Cdn. needs/opportunities.	Problem shared with a few other countries.	Uniquely Cdn. problem or opportunity.	
S&T Knowledge	Significant new S&T not needed.	Some gaps in understanding, continuing effort needed.	Existing base "running thin".	Basic research indicates significant new technology can be developed.	Major new insights require major technical barrier.	
<u>Level 2</u> Federal Role	No federal responsibility; no apparent bottleneck.	Shared responsibility or other performers need temporary assistance.	Shared responsibility. Long term federal assistance needed.	Federal lead role needed.	Exclusive Fed. responsibility.	
<u>Level 3</u> Departmental Involvement	Exclusive to one dept.	2-3 other departments.	More than 2 depts. involved only 1 heavily involved.	More than 2 depts. involved at least 2 heavily involved	5 or more departments heavily involved.	
Other Sector Involvement	Essentially federal activity	Opportunities to involve other sectors exist	Joint action required; some initiatives and mechanisms exist.	Significant new involvement of other sectors needed.	Confrontation exists of imminent; or joint programs exist, or other sector(s) in critical state.	
Urgency Factor	Present schedule adequate	Emerging Problem	Existing problem	Major effort required	Requires crash program.	
Level of Resources	None explicitly directed to problem.	Some activity of some relevance.	One of several roughly equally resources areas.	< 5% of total S&T	> 5% of total S&T	
<u>Level 4</u> Budget Factor	Budget Adequate	Budget tight	Budget "hurting"	Substantial increase needed.	Massive injection of new resources needed.	
Organizational Compatibility	Completely new; requires reorientation of existing system.	Major change to existing but overall system remains	Significant change to existing system.	Existing activity requires minor modification to boundaries.	S&T activity already exists with satisfactory boundaries.	
Coordination & Management	Effective system with min- or modn. req'd. mgt. info. readily available.	Integrated mgt. info. system operating with some gaps.	Basically sound but significant aspects need improving. Mgt. info exists in several depts.	Major gaps in coordination & mgt. system; major gaps in mgt. info.	Coordination & mgt. or planning & resource allocation ineffective; major overhaul needed; new area	

Subsequently, an acceptance level was set for each respondent's rating scores so that with level one criteria, eight (plus ties) candidate areas were chosen, with level three criteria, four (plus ties) candidates were chosen from those already chosen at level one, and similarly with level four criteria, two (plus ties) candidates were chosen. At level two of course, any candidate with a score below three would be rejected outright. In the following table the data refers to the number of respondents who "selected" the S&T area as a priority

<u>Application Areas</u>	<u>Level One</u>	<u>Level Two (Reject)</u>	<u>Level Three</u>	<u>Level Four</u>
Advanc't of Science	1		1	
Communications	2		1	
Culture & Recreation				
Const'n (excl. Housing)	1			
Develop'g Nations				
Energy	4		4	1
Environmental Issues	1			
Food	4		3	3
Health	3		2	2
Housing & Urban Dev't				
Northern Development	4			
Oceans	3		1	
Official Languages				
Policy Dev't	1			
Resources	4		4	3
Security - Domestic		1		
- National				
Social Dev't & Welfare	2			
Space	2			
Transportation	4		2	1

It may be of interest to note that when the selection criteria were used in an unstructured fashion both Space and Communications were selected by a majority of the respondents.

Selection under Level four criteria favour those areas where there is adequate S&T activity but where additional resources are needed and/or the interdepartmental coordination and management bears improvement. It is a moot point whether, in a stepwise implementation of STEMS, one should start where completely new mechanisms are required, as indicated by the level four criteria (Food, Health, Resources) or by upgrading or modifying existing mechanisms (Energy, Transportation).

It is important to note that this set of S&T application areas do not include economic and industrial development, one of the PACs envisaged in the paper on Implications of the GERD Target.

Another "complication" in using these application areas as PAC candidates is that there are at least three basic rationales underlying them. Some are based on the technology involved,

others have a commonality of the end product or service (i.e. commodity) and others have been established because of some environmental commonality. Consequently one is screening "apples and oranges" with the same yardstick:

<u>Application Area</u>	<u>Primary Selection Basis</u>		
	<u>Technology</u>	<u>Commodity</u>	<u>Environment</u>
Advancement of Science	----- n/a -----		
Communications	x		
Culture & Recreation		x	
Construction	x		
Developing Nations			x
Energy		x	
Environmental Issues			x
Food		x	
Health		x	
Housing & Urban Dev't		x	
Northern Development			x
Oceans			x
Official Languages		x	
Policy Development	----- n/a -----		
Resources		x	
Security - Domestic		x	
- National		x	
Social Dev't & Welfare		x	
Space	x		
Transportation		x	

3 S&T subject areas in federal-provincial discussions as candidates.

The following areas have been identified by one or more provinces as being of interest or concern to them:

Communications	Information Technology
Energy	Materials
Food	Mining & Metallurgy
Forestry & Forest Products	Oceans
Health Care	Transportation

These differ from the application areas in Section 2 in that Information Technology and Materials are new areas and the Resources area has been subdivided in Forestry and Forest Products, and Mining and Metallurgy. These were screened by one of the respondents (DLR) on the same basis as in section 2 (see figure 3). With level one criteria,

Environmental Issues, Health Care and Materials would not be initially accepted as candidate PACs. A further reduction to four candidate areas with level three criteria would drop out Communications, Forestry-Forestry Products, Information Technology and Mining-Metallurgy. If further choice among the four remaining - Energy, Food, Oceans and Transportation, - were necessary, application of level four criteria would rate Oceans first, Transportation next and Energy and Food tied.

Figure 3.

Factor	Application Area*	Communications	Energy	Environment	Food	Forestry-Forest Prod	Health Care	Info. Technology	Materials	Mining & Metallurgy	Oceans	Transportation	Climate**
1		5	8	5	7	4/5	6	6/7	3	6	5	5	5
2		6	6	6	6	7	6	6	4/5	6/7	9	6/7	6
3		7	8	5	5	6	4	6/7	6/7	5	8	7	7
		18	22	16	18	17/18	16	18/20	13/15	17/18	22	18/19	18
		x	x		x	x		x		x	x	x	
4		5	6	4	6	4	5	7	6	4	6	8	8
5		4	9	6	8	1	4	3	7	3	9	9	4
6		8	7	6	7	8	6	6	7	8	6	7	2
7		4	8	5	4	5	5	6/7	6	5	3	6	4
8		5	10	7	10	5	9	3	4	5	6	9	3
		21	34	24	29	19	24	18/19	24	21	24	31	13
			x		x						x	x	
9		2	5	4	3	6	2	5	4	4	6	4	6/7
10		9	9	6/7	8	8	7	5	2	7	8	6	7
11		2	2	5	5	4	4	7/8	8	4	6	8	3/4
		13	16	15/16	16	18	13	17/18	14	15	20	18	16/18
			3		3						1	2	

* These application areas were identified as of interest to one or more provinces in the discussions conducted by MOSST with provincial officials.

** The area of Climate S&T was specified in a MOSST paper on R&D priority areas.

4. Government Branch S&T priority areas as candidates.

The R&D priority areas in the draft document (see Annex A.1) are in macroscopic terms, identical or very similar to application areas identified in section 2 above, with one exception ... Climate. Concerning the components of some of these areas, however, some realignment would be desirable, based on Program Review's assessment of problems, opportunities, etc., within the federal programs. For example, Food should include all fisheries activities; as currently outlined it is entirely agriculturally - oriented. On logical grounds why exclude Forestry and Forest Products from Materials? But more to the point, a Natural Resources area including Forestry and Mining and Metallurgy would correlate with the resources industry. Further, Materials, i.e., materials research by and large, has to relate to the required use of materials, i.e., it should be a component of say Construction, or nuclear power reactors or whatever.

At first glance, the combination of Communications and Space Technology as one area is appealing since a major use of satellites is in communications. On the other hand, communications development certainly involves more than satellite deployment, and satellite systems are used in other applications than just as a component in communications networks. On the other hand, there are some indications of a possible separate Space agency with

would favour maintaining the separation. Whether bubble technology and other computer-oriented technology should be subsumed in this area, however, is perhaps open to further consideration. With some realignment of components, Poisons, Contaminants and Pollutants can be considered equivalent to Environmental Issues.

With these changes, the proposed R&D priority areas would bear the same relative priority ranking as was established in section 2.

Climate cannot, of course, be aligned with any of the previously considered application areas. Based on a screening by one respondent (DLR) on the same basis as was reported in Section 2, it would be accepted under level 1 criteria but would rate quite lowly under level 3 criteria (see figure 3).

SUMMARY OF PRIORITIES

1. Food

R&D in the area of food should be directed toward increasing the volume of production, enhancing product quality, and eliminating or reducing the deleterious effects on soil of agricultural practices. Priorities for R&D should be:

higher and more dependable yields from plants and animals;

agricultural pest controls;

environmentally benign agricultural practices;

horticulture;

nutrition; and

food safety.

arable land inventory

food processing distribution & retailing

new food products

(See also 4 Oceans for fisheries)

2. Energy

R&D in the area of energy should be directed to achieving national self-sufficiency and resilience.

Priorities for R&D should be:

energy self-sufficiency
end-use efficiency in transportation, space heating,
and industrial processes;

heavy oils and oil sands;

discovery, production, and transportation of frontier
natural gas;

mining and use of coal;

increasing hydro-electrical capacity and reducing
losses in delivering electricity;

nuclear technologies; improving reactor safety
safe disposal of nuclear wastes
renewable resources. advanced fuel cycles

3. Climate

R&D in the area of climate is needed to increase its predictability in order to make possible the planned adaptation of man to changing climatic conditions.

Priorities for climate-related R&D should be:

data collection and analysis to develop diagnostic competence;

basic research to develop predictive competence;

the study of the effects of human activities on climate, and vice versa; and

"cold weather technologies".

4. Oceans

R&D in the area of oceans should be directed to marine resource management, marine environmental protection, and ocean support services. Priorities for R&D should be:

maintaining fish stocks at highest sustainable yield levels for harvesting purposes;

improved technologies for fishing, processing, storage, and delivery of seafood;

exploiting offshore hydrocarbons;

protecting the marine environment against pollution and cleaning up pollution when it occurs; and

ocean support services including ice-breaking, navigation aids, hydrography, communications, and ice, water-state, and weather forecasting.

5. Materials

The properties of materials are frequently the key to solving crucial problems in a wide range of areas, including industry. Priorities for R&D should be:

mining and refining;

ensuring the availability and adequacy of materials for large new undertakings, for Canadian conditions (notably winter), and for new energy technologies;

substitutes for scarce and expensive materials;

energy thrift in the production of materials;

the use of the most suitable materials; and

recycling of materials.

6. Forestry and Forest Products

R&D in the area of forestry and forest products should be directed to obtaining best use of the resource and to curtail its depletion. Priorities for R&D should be:

insect and disease control;
innovative techniques and new uses for wood;
better practices of forest management; and
alleviation of forest fire losses.

7. Poisons, Contaminants, and Pollutants

The toxic properties of substances introduced into household and industrial products and affecting the environment and the health of man are often unknown or not understood. Priorities for R&D should be:

the possible toxicity, immediate and long term, of new substances;

the secure control, safe transportation, storage, and disposal of stable, toxic organochlorides;

the secure handling, transportation, and storage of the products and by-products of nuclear reactors;

the effects and methods of control of elemental poisons;

decontamination;

the pathways and fates of hazardous or toxic substances;

in-plant recycling of pollutants to eliminate their discharge into the environment;

waste treatment and residues management; and

non-toxic substitutes for harmful products.

8. Transportation

Canadian conditions dictate the need for a highly efficient national transportation system. No revolutionary breakthrough in transportation technology is expected in the foreseeable future. What is therefore needed is persistent effort in carefully selected areas covering almost the whole spectrum of transportation.

In addition to the several transportation modes which will require R&D, i.e., freight and passenger rail, marine, aerospace, highways, and urban transit, special priority problems are:

the development of more energy-efficient automobiles;

marine fishing vessels;
transportation of energy;
Arctic transportation; - hull design ice studies
inter-modal linkages;
electronic and information guidance systems; and
transportation safety, in particular the safe
transportation of hazardous materials.
urban transportation including light rail

9. Communications and Space Technology

Effective and inexpensive communications systems are crucial to the meeting of Canada's needs. - As well, satellites and space communications technology offer important support services to activities that are essential in Canada.

Priorities for R&D should be:

A. In communications

· fibre optics;
bubble memory technology;
microcomputers and microprocessors;
interference and techniques for multiple use of frequency bands;
network expansion; and
home and business terminals.

B. In space technology

satellite services for direct broadcasting, aeronautical and maritime navigation, mobile communications, and search and rescue;
satellite-supported services (e.g., health);
remote sensing for ocean, land, and atmospheric surveillance; and
smaller and cheaper earth stations.

10. Health Care

Given the morbidity characteristics of Canada's population, health care-related R&D priorities should be:

the causes, prevention, and treatment of:

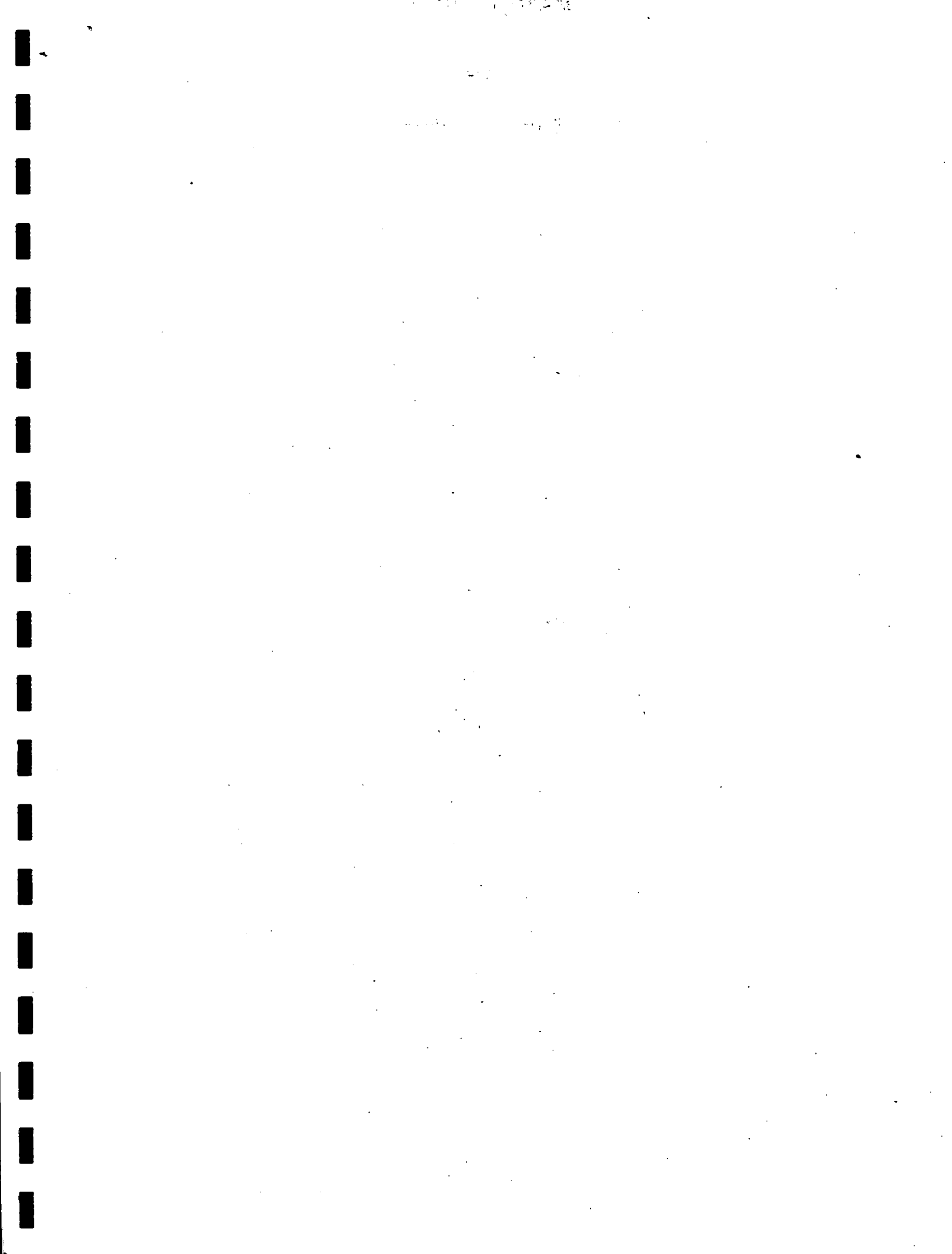
high incidence chronic diseases, notably cardiovascular diseases, cancer, and cerebral vascular diseases;

abuse of mood-altering drugs; and

mental illness;

health care equipment and delivery services;

biological drugs; and
environmental pollutants and contaminants.
radioisotopes for medical purposes



Appendix B

RECOMMENDATIONS FOR IMPROVEMENTS
TO THE SCIENCE EXPENDITURE MANAGEMENT PROCESS

Government Branch, MOSST.
February 20, 1979

Introduction

There have been numerous studies and/or reviews conducted in Canada in an effort to come to grips with the implications of science and technology for this country. The most extensive of these was the Senate Special Committee on Science Policy. From the perspective of the current expenditure management process one of the interesting questions raised was "Either government expenditures devoted to science and technology raise specific problems of planning and control requiring a special review and assessment procedure or they do not". Also, MOSST was given, as part of its mandate, the task of providing assistance to the government in assuring a better organization of the government scientific establishment and encouraging the effective and co-ordinated application of science and technology by departments and agencies. This paper, as did the Senate Committee, makes the argument that under present conditions this task cannot be carried out effectively without some changes to the way science is handled within the expenditure management process.

The new process basically incorporates the determination of a science "envelope", the need for horizontal planning for science at both the "government function" level and the operational level in departments, and the necessity to protect the science component against the unintended effects through X-budget cuts or A-base reallocations. One primary task assigned to MOSST by the government is to advise on the priorities the government should set for expenditures and use of manpower in the development and application of science and technology in the national interest. It is these priorities which would be stipulated in the proposed science "envelope". Procedures are proposed to

In Canada, the Federal Government is the most important agency for ensuring that this problem is properly handled. Through direct expenditures it pays for 42% of the research and development carried out in the country. Through its taxation and other policy instruments it exerts a strong influence on the other 58% most of which comes from the industrial sector. How the Federal Government treats science and technology therefore has a determining effect on how well the science and technology process serves the country.

In addition, the very size of Federal expenditures on science and technology makes them a significant portion of the overall Federal expenditure budget. At about \$2 billion or nearly 4% of the total expenditure budget, it is larger than expenditures on foreign affairs, about two-thirds of expenditures on transportation and communications, more than one-third of the totals for defence or for economic development and support. In simple good housekeeping terms therefore, without reference to its significance in the pursuit of national purposes, science and technology expenditures demand good management.

These considerations, plus others arising from the tendency of science activities to be distributed horizontally across other programs and consequently difficult to manage, led to MOSST being given, along with responsibilities for policy development, the job of advising the government on how to organize its efforts and on the allocation of its resources in science and technology. The government, while confirming that the purpose of scientific activities was to support objectives external to itself, was making provision for a coherent view of its science and technology activities as a distinct component of functions.

ensure that government decisions on the size and allocation of the overall science effort can be reconciled with the existing system of expenditure planning and control.

It is recognized that, in the longer term, changes of a more significant nature may be needed to the expenditure management process generally. Interim improvements to the planning and control process for science expenditures should take into account the likely direction of changes for expenditure management generally. The changes proposed in this paper have been developed with this broader context in mind.

Background

The activities described by the phrase "science and technology" are powerful instruments for shaping the future of a society. Success in the acquisition of new knowledge through indigenous discovery or participation in world-wide scientific activities, and its application to the solving of problems or the opening up of opportunities, are essential conditions to building a good economy, society and quality of life. Careful management of the science and technology process is therefore a proper and important part of national policy.

Science and technology does however pose special problems in policy planning. The benefits of good management of the process (or the damage resulting from bad management) tend to be rather far off, and the inputs it demands in terms of investments in people and things tend to be costly. It requires special effort and attention therefore to ensure that through science and technology we make wise and adequate investments for the long-term. In a period of budget constraint and urgent competing demands, the difficulty is especially great.

The existing expenditure budget process provides for decision-making on science matters within the program and departmental structure. It does not however make adequate provision for identifying and dealing with the most important questions arising from the idea of science and technology as a coherent functional component in its own right, - such questions as: is the size of the effort right? is it internal allocation among performing sectors and broad problem areas right to address national problems and government policy objectives? What is lacking is a process of strategic planning and control to deal with questions like these as well as the questions of relevance, adequacy and necessity within specific departmental programs that are the focus of attention under existing procedures.

The problems caused by this deficiency are especially serious at the present time because a period of expenditure constraints and cutbacks co-incides with a period when the government has declared a high priority for science and technology. This current priority for science and technology, and in particular for R&D, is due to the government's belief that R&D is a badly needed and very profitable investment that the country should be making. This belief has been further substantiated by studies done in other countries where, for example, it has been shown that in the period 1948-71, 33% of British economic growth, 30% of the American, 22% of Japanese and 13% of Canadian economic growth can be attributed to research and development advances. The government has announced a target for increased R&D in Canada that will require very substantial increases in effort by both the private and public sectors.

In 1979-80 federal science and technology expenditures will be about \$1.9 billion. For the 1983 GERD/GNP national target of

1.5% to be reached, total R&D spending in Canada will need to grow by an average of 18% annually in real terms or about 24% annually in current dollar terms. This expansion will largely be achieved by the private sector but it will still be necessary for the government's science expenditures to expand at a rate of 8.1% annually in real terms or 13.2% in current dollar terms. As the current projected growth of the federal expenditure budget is 1% less than GNP, science and technology will need to be accorded special resource consideration. Despite this new priority, it has been estimated that the 1979/80 Main Estimates will actually show an increase in federal spending on science of \$18.3 million whereas just to counter inflation, an increase of \$119.3 million would be needed.

There are deficiencies in the current processes for science expenditure revision and program control, as well as in strategic planning. These are particularly evident when departments take decisions on their science activities without the effects on other departments being taken into account or their implications followed through in the other departments. Similarly, cuts made by Cabinet or Treasury Board in one science program may have effects on other programs dependent in some way on it, without the problems being resolved.

Some of these problems have already affected science and technology projects. Although science is a component of a program it also responds to specific objectives outside the program. Moreover, programs may be cut back without an adequate assessment of the implications of science on the overall economic and social structure. The long-term nature of most scientific undertakings is rarely displayed and therefore what is proposed as an immediate solution to a current problem, i.e. restraint, often can have significant repercussions in the future both within the program it directly supports and beyond it.

RECOMMENDATIONS

As indicated in the introduction, the recommended changes postulated here could be introduced in the short term and accommodated by the existing expenditure management system.

It is desirable that the recommendations specified below be implemented as soon as possible to ensure the means whereby the government objectives for R&D in Canada can be achieved. If they are not in place for the 1980/81 resourcing cycle, support for science will more than likely be again inadequate in terms of the government's stated goals, without any deliberate decision being taken that the goals should be changed. Already, since the Minister's June 1, 1978 announcement, a potential year of progress towards the 1983 GERD/GNP target has been lost, requiring difficult steps in the remaining four years.

1. An envelope expressing the overall target for the size of science expenditures, beginning with 1980/81, should be developed by MOSST.
2. MOSST has identified those priority areas which are science intensive and which have a significant impact on the functional objectives of government. These include transportation, health, food, space, communications, oceans and energy. The target for the overall science envelope and the targets for the scientific activities within the priority areas should be submitted by MOSST to Ministers (the Cabinet Committee on Planning and Priorities?) for approval. These targets are being developed by MOSST through extensive consultations with the relevant science departments. The terms of approval

should recognize the need for a certain latitude in re-allocating science resources among the priority areas to respond to changing needs and judgments about the effectiveness of program proposals, as the detailed planning process proceeds. The current Objectives and Guidelines for 1980/81 Program Forecast and Main Estimates being prepared by MOSST, (which addresses the questions of size of effort and its allocation by functional area), could be the basis of the paper which Ministers would consider. Following approval, TBS would establish a reserve for science as a whole, with nominal allocations for each priority area.

3. Where they do not already exist, interdepartmental committees should be set up which correspond to each of the priority areas designated by MOSST. These committees would be under the chairmanship of a lead department which would also provide the Secretariat support. These committees would develop a science program submission for each priority area. MOSST would interact with these committees at two levels. At the operational level a MOSST representative would be an active participant in each of the committees and would provide advice and assistance at all stages in the project proposal/review process. The committees would prepare a resource package for funding, as a result of their deliberations, reflecting both reallocations of existing funds and, if necessary, demands for new funds. The targets for scientific activities in each priority area would be the expenditure ceilings for these committees in developing a resource package.

4. This science package would be forwarded by the lead agency in the form of a Treasury Board Submission to MOSST for analysis and review prior to its consideration by Treasury Board. At this stage MOSST senior management would be able to assess not only the quality of program content in each package, but also the aggregate effort of all the priority areas, and would bring to bear other factors which may be necessary in the overall context of science and technology objectives and government expenditure plans. As part of its review process MOSST might recommend, within the overall science expenditure target, science expenditure levels below or above the targets for individual priority areas or might recommend an unprogrammed reserve for unforeseen but high priority projects which may occur during the fiscal period. MOSST advice concerning the packages and revisions to the targets for each package would be forwarded to TBS, and Treasury Board authority requested. Following the Treasury Board decision, resources could be presented in the estimates of the appropriate departments. Allotment controls would be placed on departments by TBS for the expenditures on departmental science activities which had been identified as falling within the responsibility areas of the various committees.
5. Operationally the various committees would, as specified in Appendix A, carry out a continuous program/project monitoring exercise to determine possible over/under utilizations and recommend the necessary corrective action within the agreed reserve limits. Changes which require interdepartmental resource transfers or allotment transfers would be approved by TBS with MOSST recommendation.

6. A formal process would be established by the committees to undertake periodic "A" base reviews of their areas. Each committee would be asked to develop a plan to carry out these "A" base reviews.
7. A formal process would also be established to ensure adequate consideration for science activities when X-budget cuts or reallocations amongst "A" budgets are proposed.

A suggested procedure would be:

- TBS gives MOSST early notification of all major proposed resource reallocations, including X-budget exercises.
 - MOSST would review the proposed plans for reallocation as to the S&T implications and make recommendations to TBS on the appropriate response by priority areas within the context of science expenditure targets.
 - If the TBS alters MOSST's recommendations, its Treasury Board précis should note MOSST concurrence with the Secretariat's recommendations or state the reasons for disagreement.
 - Following Treasury Board or Cabinet decisions, MOSST would work with the committees on the implementation of the changes, at the level of programs/projects.
8. The annual analysis for Cabinet of expenditure projections should include an analysis of past and projected science expenditures, beginning with the January/February 1980 paper.

9. There should be a section within Chapter 1 of the 'Blue Book' on science expenditure. This might present such tables as science expenditures by priority area and science expenditures in relation to the various functional elements of the federal budget.

CONCLUSION

The suggested changes to the current expenditure management process are necessary if the government wants to assure an orderly and effective planning of its science expenditures and a decision process whereby it can manage the attainment of its science goals and priorities. Without these changes MOSST will be unable to satisfy its mandate and a further erosion in the government support of science and technology will likely occur despite the government's announced commitment to science, and in spite of the national target set for R&D by 1983.

These short term measures are consistent with the way in which the expenditure management system is likely to be modified to deal with similar problems in functional components other than science. The MOSST experience with planning and control problems in science expenditures may indeed throw light also on the broader questions the government and Treasury Board are facing in the question of reconciling expenditure management to policy objectives.



THE INTERDEPARTMENTAL COMMITTEES
(TRANSPORTATION, ENERGY, SPACE, OCEANS ALREADY EXIST)

FIVE MAIN DUTIES

- a) Set up goals and objectives, and a strategy for its particular priority area. Obviously MOSST will be an active participant in the goal and objective setting exercise particularly from the view of the overall government science and technology policies. The committee will also be involved in the setting of appropriate targets for their respective priority area.
- b) Identify those programs/projects within each priority area which are currently going on in the various government departments. As these various initiatives are identified it may be necessary to amend the membership of the Committee to assure that all participants have a voice in the resource allocation process.
- c) Organize the preparation by departments of program proposals responsive to its goals, priorities and strategy, within the allocation made for the priority area, and prepare recommendations on the package of proposals. Also, once allotment controls have been established, it is proposed that a continuous program evaluation be carried out by each Committee, in conjunction with performance measurement, to identify either redundant activities and/or inefficient areas and to establish, if necessary, a pool of available resources for redistribution by the Committee, up to the reserve allocation target. This pool would remain under the control of the Committee and would be used to either expand existing operations or to finance new priority projects.
- d) Forward its package of projects/programs, within the established nominal reserve allocation, to MOSST and then TBS for review.

This step would enable MOSST, in preparing advice to Treasury Board, to apply such overall considerations as industrial policy, other S&T priorities, etc., to the package and determine whether changes need to be made. This review may identify targets which can or will not be met and provide the opportunity for adjustments as necessary.

- e) Produce 5 year planning documents which are needed to demonstrate the long term nature of science and technology activities. These documents would initially be necessary for all new proposals or changes to existing ones but ultimately would be extended to all activities under the responsibility of the Committee. Any agreement by MOSST and TBS to fund proposals would accommodate this five year time horizon and would be a commitment to fund for this entire time frame.



Appendix C

Science and Technology Expenditure
Management System

Gerry Westland
March 29, 1979

Introduction:

The paper of February 20, 1979, proposed certain changes to the expenditure management system in order to protect the interests of science and technology (S&T). To further explain these improvements to the science expenditure management process, of which the establishment of committees is a central feature, it is necessary to elaborate on the role of the committees and the manner in which they will interact with line departments and with such central agencies as MOSST and TBS. The need for a committee structure and its duties were set out in the original paper and they do not need further justification here.

It is interesting to note that the Science Council of Canada has long argued that the growth and well-being of S&T in Canada are best assured by the channelling of funds through major programs to reach specified objectives. The Council contends that these major programs should be organized as large, multi-disciplinary, mission-oriented projects in which all sectors can participate to solve some important economic or social problems. The present proposals apply this concept to the federal government, through the proposed committee structure.

New Science and Technology Expenditure Management System (STEMS)

Appendix A illustrates the new STEM system. This system satisfies two basic principles:

- I The existing budgetary process is not to be disrupted in terms of timing.
- II The budgetary flow is to be as unified as possible i.e. no distinct science versus non-science process.

It is therefore proposed that the STEMS begin in September, or about 18 months before the relevant fiscal period with the preparation of the "science framework" letter addressed to a designated Cabinet Committee. This framework letter would result from extensive discussions with all the sectors, both as performers and funders, and would take into account the five year plans prepared by the committees themselves. This letter would request Cabinet approval of the general thrust and global dollar amount. This approval would be reflected by the central agencies, including Finance, in preparing and forwarding a fiscal framework to Cabinet for decision. This framework would become the basis for the TBS Program Forecast call letter to the departments, which would be sent to each committee also. The committees would, in consultation with member departments, prepare a summarized package for MOSST recommendation. MOSST would forward its recommendations to TBS who approve and/or make changes. The approved package would then go back to the committees, who would work with the departments in developing the detailed Program Forecasts. The departments would forward the total Program Forecast documentation to TBS (both science and non-science). TBS would carry out its normal review exercise, this time in direct consultation with MOSST, and forward the results of its review to the TB Ministers.

The Ministers' decisions would then be the basis of the Main Estimates target letters which would be sent to the committees as well as to the departments. Where required, the committees would work with the departments to develop a program/project package. As part of this process the committees would forward a summary of their intentions to MOSST for recommendations. The MOSST recommendations would then go to TBS for review and

approval. Once approval has been obtained, the formal Main Estimate documents, both science and non-science, would be prepared by departments.

In parallel to the above, MOSST would prepare a much more detailed and up-to-date memorandum for submission to the relevant Cabinet committee highlighting the needs of the various science priority areas and indicating the changes that have occurred since the broad letter of intent was endorsed by Cabinet. This memorandum would become an input to the Main Estimates Expenditure Management Framework and thereby an input to the Main Estimates review process to be carried out by TBS in conjunction with MOSST.

Once the Cabinet decision on the Main Estimates has been made TBS will prepare the Estimates for printing and presentation to Parliament. During this latter stage the committees would be setting up operational plans and departments would be budgeting to assure their successful achievement. During the year any necessary supplementary estimates would be submitted by the relevant committees to MOSST for recommendation, MOSST would forward the submission to TBS and ultimately Cabinet and Parliament.

Also attached as appendix "B" are brief summaries of the changes in the role of each of the major participants in the proposed STEMS. It is, in fact, a narrative summary of the new demands placed on each participant by the "starred" activities in the document-flow system description of appendix "A".

Significant Concerns:

Any committee type structure which is to be used to effectively manage resources to achieve certain objectives will face some major issues. These issues must be recognized and addressed, if not formally by the committee itself then by the committee members, all of whom are charged with management responsibility. These are discussed below to remind the reader that the establishment of committees will not automatically result in efficient and effective management.

First of all the likelihood of compromise policies and options for their achievement must be appreciated. With the various perspectives of committee members and the fact that committee etiquette discourages a member from criticizing a proposal which does not effect his/her department, a management environment must be established which encourages frank discussions on all submissions. Many managers conclude that this is almost impossible to accomplish and that the committees will only be able to make nebulous decisions.

Secondly, senior management accountability, responsibility and appraisals of performance are all oriented toward organizational concerns which will make it difficult to obtain any agreement to commit funds for interdepartmental ventures. In order for the committees to be effective it will need a strong commitment from its members towards a common goal. Further a management assessment process will be necessary to account for this new two-dimensional responsibility. Whether this process is invoked by TBS, the committee itself, or whether it results from general acceptance of good management practices or is stimulated by the Lambert Commission, is not material.

Finally, the mandates for the committees will need to be expressed in sufficiently strong terms to clarify for senior managers the relative priorities of departmental and committee objectives, both in order to satisfy committee requirements and to meet the needs of the relevant departments.

Committee Terms of Reference:

The terms of reference discussed in this section are obviously rather general in nature and will need to be made explicit on a committee by committee basis. These terms of reference evolve from the previously approved duties and also incorporate the management mandate necessary to assure an effective mechanism.

The committee's area of responsibility will be defined when the formation of the committee is approved, based on extensive consultation amongst MOSST, TBS and relevant departments. Within the context of this definition, the committee will be responsible for;

- the identification, prioritization and coordination of all the relevant activities, either current or proposed, carried out by Federal Government departments.
- assuring that the resources are properly balanced among each of the approved programs/projects (as it will be the sole entity with the authority to apply to central agencies for these resources).

- resolving problems such as cooperation/conflict with other committees and/or member departments.
- managing the resources so identified in an effective and efficient manner including the reallocation of resources as necessary.
- establishing proper accounting systems to support management and setting up evaluation methodology to cover the relevant activities.
- supplying information, as necessary, to central agencies on activities within its responsibility area.

The committee's goals and objectives must be recognized as taking precedence over those of departments in the identified area of concern.

Allotment controls at the departmental level will be implemented by TBS to cover all the resources for the total of those activities, either programs or projects, which the committee has identified as necessary to achieve its goals and objectives.

Committee Structure:

The committee will consist of a senior departmental manager from each member department who will meet on a periodic basis, supported by a full time secretariat. The membership will be limited to those departments which have a significant

input to the committee's sphere of responsibility. Each committee will also have MOSST representation on an active participant basis. The committee will be chaired by the senior manager from the designated lead department.

The secretariat will report to the committee as necessary and will be located and supported by the lead agency. The personnel for the secretariat will be assigned by the member departments of the committee. The size of the secretariat will be decided by the committee.

Committee Duties:

The committee will be charged with at least the following duties. These duties are not comprehensive but rather are representative of the kinds of activities the committee will be expected to perform.

- I. Set up goals and objectives and a strategy for its particular area of science and technology.
- II. Identify those programs/projects which are going on in the various government departments.
- III. Prepare program/project packages for MOSST/TBS recommendations to Ministers.
- IV. Recommend to MOSST and TBS on allocation targets, in total and by department.
- V. Within the established allotment controls, engage in regular program evaluation in conjunction with performance measurement to identify either redundant activities and/or inefficient projects.

- VI. Redistribute any lapsing or unneeded funds within approved targets to projects of either a higher priority or utility.
- VII. Produce 5 year planning documents, initially for all new proposals or changes to existing ones, but ultimately for all activities within the committee's responsibility.

Resource Allocation:

The resources are to be allocated to the departments directly through the committee approval process. Each department will be accountable for its share of the committee's activities and will submit proposals as part of their own Program Forecasts and Main Estimates. Allotment control will be used as the expenditure control.

There are a number of positive features to this approach for resource allocation such as;

- it will not necessitate significant changes to the current department resourcing process, the main exception being the implementation of allotment control.
- it protects the interests of the departments vis-à-vis other committee members particularly from the point of view of management values.
- it causes minimum disruption of departmental management accounting systems.

However there are some negative aspects which should be appreciated and which will need to be overcome:

- given the likelihood of departmental/committee conflicts in terms of mandate or priorities, this process allows an "end-run" to occur by appealing directly to departmental ministers.
- the concept of matrix management will need to be fully implemented which, given the current environment, may be difficult to do, particularly in terms of resource difficult.

Conclusion:

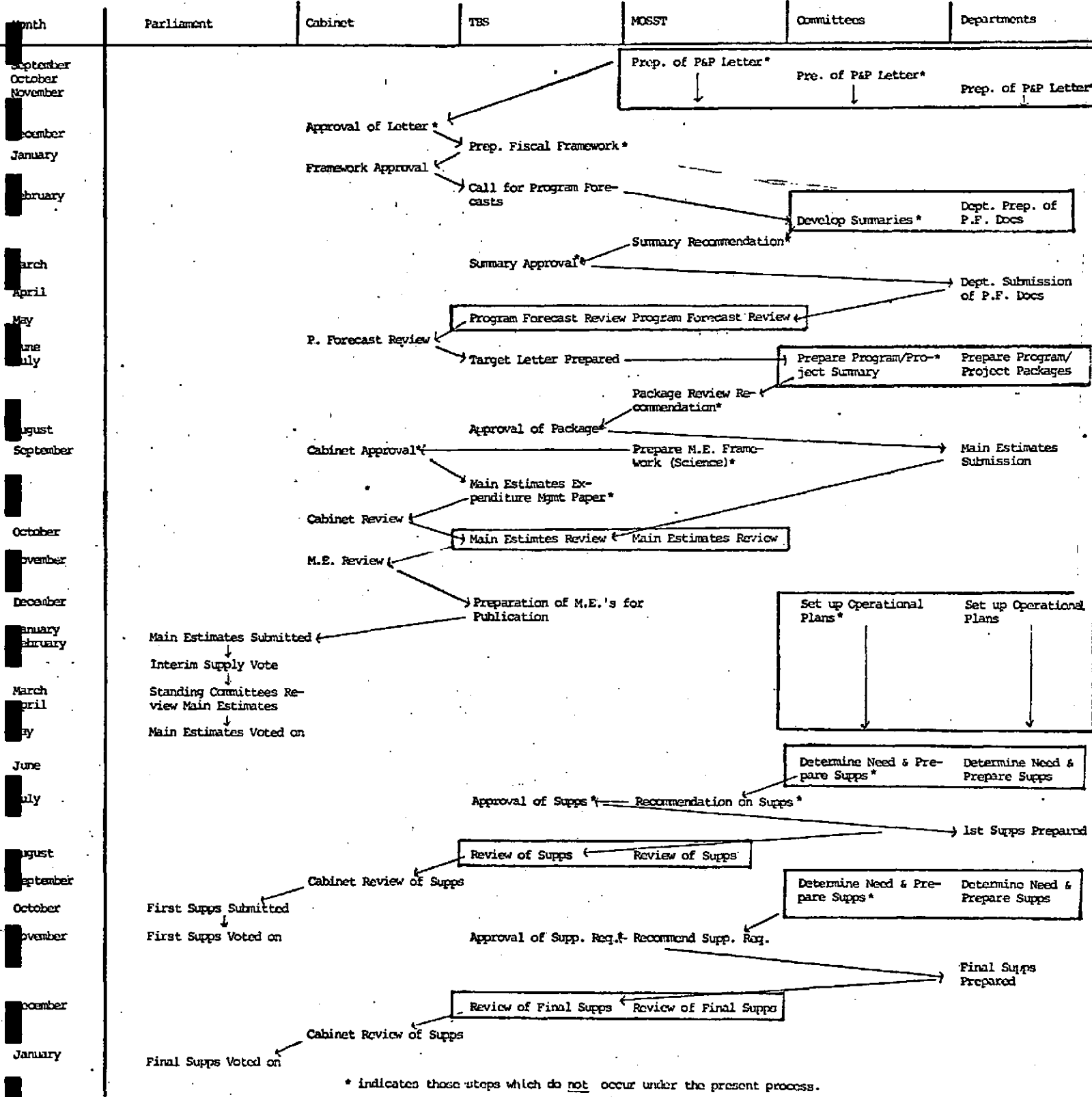
With the revised expenditure process outlined in both the previous paper and this one, the next stage should involve three steps. One should be to start on the proposed memorandum to Cabinet for the 1980-81 Main Estimates review (it is already too late for the Program Forecast review) and a second step should be the identification of the MOSST officers who will work with the committees. For the first step, extensive consultations will need to take place, other branches will become involved and management input will be necessary as to content, etc. Although the second step will not require the assignment of specific individuals, management direction must be provided as to who will be responsible for what within which organizations. The third step, whose importance should not be underestimated since it is vital to the success of the STEMS, consists of an educational process to ensure full understanding and a co-ordinated approach by MOSST reps.

Although this stage should not begin until some indication is given as to the acceptability of the MOSST proposals, still it is important to allow enough lead time to complete this stage of the system.



Appendix A

Science & Technology Expenditure Management System (S.T.E.M.S.)



Science and Technology Expenditure Management System
Major Participants (New Demands)

Parliament

There will not be any new involvement on the part of Parliament with the S.T.E.M.S.

Cabinet

The proposed system will involve the Cabinet in only two additional instances. Both of these will necessitate the consideration of science as a major priority area in support of the functions of government. One interaction will occur prior to the approval of the fiscal framework, while the other will require approval before the main expenditure management framework. This approval will set resource levels to be applied to the relevant science areas. The term Cabinet is used since the actual Committee of Cabinet which will be involved may vary. Whatever the choice, it is not relevant to the S.T.E.M.S., only the approval from the government of the day.

Treasury Board Secretariat

There are a few changes to the current expenditure management process as far as TBS is concerned. The first occurs with the need for TBS to consider the "science priority" letter when consolidating the Fiscal Framework package for ministerial consideration. A similar process is involved with the preparation of the Expenditure Management Framework as the "science" memorandum, establishing priority targets, will need to be incorporated. The other instances where a new

role will occur is in the early approval by TBS, based on MOSST recommendations, for those Program Forecast, Main Estimates and Supplementary Estimates expenditures proposed by the committees. These approvals precede the formal processes for the M.E.'s, P.F.'s and Supps as currently exist. They are essentially a commitment to fund on the part of TBS if the packages are properly prepared together with the non-science proposals as one departmental submission.

MOSST

MOSST will definitely need to take a more active and visible role in the new STEM system.

For instance MOSST will work with the Committees in preparing the "letter" to Cabinet which will establish general science expenditure targets. It will also assess and make recommendations on the summary expenditure plans of the Committees as part of the Program Forecast exercise. MOSST's involvement in the formal review of both the Program Forecasts and the Main Estimates will be more significant and will involve both the science and non-science submissions (comments however, will only be made on the science issues while the non-science will be looked at to assure that any science implications are accounted for). MOSST will prepare a cabinet memorandum on the various science targets as part of the Main Estimates Expenditure Management Framework. As in the preliminary approval process to the Program Forecasts, MOSST will review and comment on the actual programs and projects which will be forwarded by departments through the Main Estimates cycle. A similar role for MOSST will occur with all Supplementary Estimates submissions.

Although MOSST will not have actual approval authority, its recommendations will need to be considered by TBS in allocating resources and if there are disagreements, both the MOSST and TBS positions will need to be made known to the Cabinet for decision.

Departments

Beside the extensive involvement with the Committees through their membership, and the preparation of documents for the Committees, there is only one new stage to the current expenditure management system. This step involves consultations with MOSST and the Committees in the establishment of the original cabinet letter on science targets.

Committees

The role and responsibilities of the committee have been discussed in this paper.

Appendix D

Tables illustrating the Structure,
Purposes and Funding Distribution
of the Federal S&T Program

Table D1: Expenditures by Application 79-80 FY

	Natural			Human			Total		
	\$'000	%	#	\$'000	%	#	\$'000	%	#
Advancement of Science	177,483	12.4	4	36,002	8.6	4	213,485	11.5	2
Communications	21,025	1.5	12	11,423	2.7	10	32,448	1.8	15
Culture and Recreation	18,136	1.3	14	58,039	13.9	2	76,175	4.1	10
Construction (excl. Housing)	19,536	1.4	13	-			19,536	1.0	17
Developing Nations	17,630	1.2	15	19,249	4.6	6	36,879	2.0	13
Energy	203,994	14.2	2	3,453	0.8	15	207,447	11.2	3
Environmental Issues	53,516	3.7	9	2,184	0.5	17	55,700	3.0	11
Food	181,852	12.7	3	12,472	3.0	9	194,324	10.5	4
Health	107,912	7.5	5	13,043	3.1	8	120,955	6.5	6
Housing and Urban Development	5,092	0.4	17	13,218	3.2	7	18,310	1.0	18
Northern Development	9,503	0.7	16	2,564	0.6	16	12,067	0.6	19
Oceans	36,454	2.5	11	-			36,454	2.0	14
Official Languages	-			6,955	1.7	14	6,955	0.4	20
Policy Development	1,992	0.1	19	140,832	33.7	1	142,824	7.7	5
Resources	92,129	6.4	7	7,537	1.8	13	99,666	5.4	9
Security	102,641	7.1	6	11,278	2.7	11	113,919	6.1	7
Social develop. & Welfare	3,083	0.2	18	24,793	5.9	5	27,876	1.5	16
Space	44,063	3.1	10	-			44,063	2.4	12
Transportation	91,184	6.4	8	10,278	2.5	12	101,462	5.5	8
Other	248,451	17.3	1	44,363	10.6	3	292,814	15.8	1
TOTAL	1,435,676	100.0		417,683	100.0		1,853,359	100.0	

Table D2: Expenditures (\$'000) in Priority Areas of Application, 1979-80

	<u>DOC</u>	<u>CIDA</u>	<u>NRC</u>	<u>DSS</u>	<u>DOT</u>	<u>SC</u>	<u>EMR</u>	<u>DOE</u>	<u>Agr.</u>	<u>AECL</u>	<u>ITC</u>
Communications	15,842	6,389	3,660	1,484	202	185	144	-	-	-	-
Space	24,391	-	16,871	456	-	-	175	2,170	-	-	-
Energy - Panel	-	-	15,291	190	3,064	940	20,321	1,761	-	76,271	1,500
- Other	-	-	16,225	118	-	-	52,704	-	-	7,073	88
Food - Agriculture	-	2,557	10,035	87	-	5,342	-	749	135,034	-	1,964
- Fisheries	-	1,278	-	880	-	-	100	-	-	-	-
- Others	-	1,278	-	-	-	-	-	-	-	-	60
Health	-	4,288	8,665	249	-	4,241	1,070	-	-	1,972	275
Oceans	-	-	2,955	1,465	-	-	5,640	-	-	-	82
Resources											
- Forestry	-	1,278	-	74	-	-	-	23,155	-	-	-
- Minerals	-	2,557	-	879	-	-	36,526	-	-	-	-
- Water	-	1,278	-	438	-	-	15	17,102	-	-	-
- Other	-	-	-	-	-	-	640	10,539	5,000	-	-
Transportation	-	2,557	23,276	205	26,800	3,265	2,067	13,789	-	-	-
Sub-total	40,233	23,460	96,978	5,525	30,066	13,973	119,402	69,265	140,309	85,316	3,969
Others	-	7,349	116,943	9,232	-	113,770	36,396	125,938	2,300	-	84,912
Total	40,233	30,809	213,921	15,757	30,066	127,743	155,798	195,203	142,609	85,316	88,881

Table D2: Expenditures(\$'000) in Priority Areas of Application, 1979-80

	<u>DFO</u>	<u>DPW</u>	<u>NHW</u>	<u>MRC</u>	<u>NEB</u>	<u>AECEB</u>	<u>CTC</u>	<u>CRTC</u>	<u>Others</u>	<u>Total</u>
Communications	-	-	-	-	-	-	-	601	3,941 ¹	32,448
Space	-	-	-	-	-	-	-	-	-	44,063
Energy - Panel	-	-	-	-	1,736	-	-	-	-	121,349
- Other	6,439	2,459	-	-	-	992	-	-	-	86,098
Food - Agriculture	-	-	-	-	-	-	-	-	163 ²	155,931
- Fisheries	27,919	-	-	-	-	-	-	-	-	30,177
- Others	-	78	6,800	-	-	-	-	-	-	8,216
Health	-	-	30,080	70,115	-	-	-	-	-	120,955
Oceans	25,539	-	-	-	-	-	-	-	773 ³	36,454
Resources										
- Forestry	-	-	-	-	-	-	-	-	42 ⁴	24,549
- Minerals	-	-	-	-	-	-	-	-	133 ⁵	40,095
- Water	-	-	-	-	-	-	-	-	-	18,833
- Other	-	-	-	-	-	-	-	-	10 ⁶	16,189
Transportation	21,785	68	-	-	-	-	2,595	-	5,055 ⁷	101,462
Sub-total	81,682	2,605	36,880	70,115	1,736	992	2,595	601	10,117	836,819
Others	12,077	2,943	10,377	-	-	-	-	-	494,303	1,016,540
Total	93,759	5,548	47,257	70,115	1,736	992	2,595	601	504,420	1,853,359

Table D2: Expenditures in Priority Areas of Application, 1979-80

Notes

- 1 CBC \$3,350k; PO \$591k.
- 2 CLFB \$150k; DREE \$13k.
- 3 DREE \$768k; NFB \$5k.
- 4 DREE \$42k.
- 5 DREE \$133k.
- 6 IAND \$6k.
- 7 NHB \$4,155k; SLSA \$900k.

Table D3: Expenditures (\$'000) by the Major Funders in the Other Areas of Application, 1979-80

	<u>DOE</u>	<u>DFO</u>	<u>NRC</u>	<u>DSS</u>	<u>EMR</u>	<u>IDRC</u>	<u>SC</u>	<u>DND</u>	<u>ITC</u>
Advancement of Science	305	4,425	48,905	2,886	-	-	-	-	-
Culture and Recreation	-	-	-	88	-	-	-	-	-
Construction (excl. Housing)	3,910	-	11,601	73	1,009	-	-	-	-
Developing Nations	-	-	-	-	12	36,867	-	-	-
Environmental Issues									
- Air	2,050	-	-	586	50	-	-	-	-
- Land	2,184	-	-	1,377	2,740	-	-	-	-
- Water	19,601	2,194	-	733	250	-	-	-	-
- Other	17,599	-	3,807	-	-	-	-	-	-
Housing and Urban Development	-	-	-	149	670	-	2,770	-	-
Northern Development	-	3,446	884	1,040	1,773	-	-	-	-
Official Languages	-	-	-	-	-	-	-	-	-
Policy Development	908	-	-	320	1,884	-	101,562	-	2,593
Security									
- Domestic	-	-	-	-	-	-	-	-	-
- Defence	-	2,012	1,192	953	820	-	-	99,513	-
Social Devel. & Welfare	-	-	3,024	368	-	-	952	-	-
Others	79,381	-	47,530	659	27,188	-	8,486	-	82,319
Total	125,938	12,077	116,943	9,232	36,396	36,867	113,770	99,513	84,912

Table D3: Expenditures (\$'000) by the Major Funders in the Other Areas of Application, 1979-80

	<u>NSERC</u>	<u>SSHRC</u>	<u>Agr</u>	<u>Sub-total</u>	<u>Others</u> ¹	<u>Total</u>
Advancement of Science	120,962	36,002	-	213,485	-	213,485
Culture and Recreation	-	-	-	88	76,087	76,175
Construction	-	-	-	16,593	2,943	19,536
Developing Nations	-	-	-	36,879	-	36,879
Environmental Issues						
- Air	-	-	-	2,686	-	2,686
- Land	-	-	-	6,301	-	6,301
- Water	-	-	-	22,778	-	22,778
- Other	-	-	2,300	23,706	229	23,935
Housing and Urban Development	-	-	-	3,589	14,721	18,310
Northern Development	-	-	-	7,143	4,924	12,067
Official Languages	-	-	-	-	6,955	6,955
Policy Development	-	-	-	107,267	35,557	142,824
Security						
- Domestic	-	-	-	-	9,279	9,279
- Defence	-	-	-	104,490	150	104,640
Social Development and Welfare	-	-	-	4,344	23,532	27,876
Other	-	-	-	245,563	47,251	292,814
Total	120,962	36,002	2,300	794,912	221,628	1,016,540

¹ Refer to Table 4 for details

Table D4: Expenditures (\$'000) by Areas of Application of Other Funders of S&T, 1979-80

	<u>IAND</u>	<u>NFB</u>	<u>NHW</u> ¹	<u>N. Lib.</u>	<u>N. Mus.</u>	<u>P. Arch.</u>	<u>S. State</u>	<u>DPW</u> ¹
Culture and Recreation	4,729	471	288	14,932	46,064	9,021	582	-
Construction	-	-	-	-	-	-	-	2,943
Environmental Issues								
- Other	229	-	-	-	-	-	-	-
Housing and Urban Develop.	136	-	-	-	-	-	-	-
Northern Development	4,924	-	-	-	-	-	-	-
Oceans	-	5	-	-	-	-	-	-
Official Languages	-	-	-	-	-	-	5,881	-
Policy Development	405	-	218	-	-	-	-	-
Resources								
- Other	10	-	-	-	-	-	-	-
Security								
- Domestic	-	-	-	-	-	-	-	-
- Defence	-	-	-	-	-	-	-	-
Social develop. & Welfare	130	-	9,871	-	-	-	4,074	-
Others	2,901	-	-	-	-	-	342	-
Total	13,464	476	10,377	14,932	46,064	9,021	10,879	2,943

¹ Refer to Table 2 for expenditures in the priority areas.

Table D4: Expenditures (\$'000) by Areas of Application of Other Funders of S&T, 1979-80

	<u>DREE</u> ¹	<u>CMHC</u>	<u>NCC</u>	<u>COL</u>	<u>PSC</u>	<u>AIB</u>	<u>CIDA</u> ¹	<u>CCA</u>
Culture and Recreation	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-
Environmental								
- Other	-	-	-	-	-	-	-	-
Housing and Urban Devel.	-	13,495	1,090	-	-	-	-	-
Northern Development	-	-	-	-	-	-	-	-
Oceans	-	-	-	-	-	-	-	-
Official Languages	-	-	-	862	212	-	-	-
Policy Development	-	-	-	-	-	40	1,278	1,617
Resources								
- Other	-	-	-	-	-	-	-	-
Security								
- Domestic	-	-	-	-	-	-	-	-
- Defence	-	-	-	-	-	-	-	-
Social develop. & Welfare	-	-	-	-	-	-	2,098	1,202
Other	1,325	-	-	-	-	-	3,973	10,066
Total	1,325	13,495	1,090	862	212	40	7,349	12,885

Table D4: Expenditures (\$'000) by Areas of Application of Other Funders of S&T, 1979-80

	<u>Ec.C</u>	<u>Fin.</u>	<u>N. Rev.</u>	<u>Sci. C</u>	<u>MOSST</u>	<u>Jus.</u>	<u>LRC</u>	<u>Sol. Gen.</u>	<u>CAL</u>	<u>E&I</u>	<u>Lab</u>
Culture and Recreation	-	-	-	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-	-	-	-
Environmental											
- Other	-	-	-	-	-	-	-	-	-	-	-
Housing and Urban Develop.	-	-	-	-	-	-	-	-	-	-	-
Northern Development	-	-	-	-	-	-	-	-	-	-	-
Oceans	-	-	-	-	-	-	-	-	-	-	-
Official Languages	-	-	-	-	-	-	-	-	-	-	-
Policy Development	11,382	8,655	5,059	2,441	4,462	-	-	-	-	-	-
Resources											
- Other	-	-	-	-	-	-	-	-	-	-	-
Security											
- Domestic	-	-	-	-	-	3,655	2,369	3,255	-	-	-
- Defence	-	-	-	-	-	-	-	-	150	-	-
Social Devel. & Welfare	-	-	-	-	-	-	-	-	-	2,932	3,225
Other	-	-	-	-	-	-	-	-	-	9,874	-
Total	11,382	8,655	5,059	2,441	4,462	3,655	2,369	3,255	150	12,806	3,225

Table D4: Expenditures (\$'000) by Areas of Application of Other Funders of S&T, 1979-80

	<u>PO¹</u>	<u>Ex. Af.</u>	<u>PCO</u>	<u>TBS</u>	<u>Total</u>
Culture and Recreation	-	-	-	-	76,087
Construction	-	-	-	-	2,943
Environmental					
- Other	-	-	-	-	229
Housing and Urban Develop.	-	-	-	-	14,721
Northern Develop.	-	-	-	-	4,924
Oceans	-	-	-	-	5
Official Languages	-	-	-	-	6,955
Policy Development	-	-	-	-	35,557
Resources					
- Other	-	-	-	-	10
Security					
- Domestic	-	-	-	-	9,279
- Defence	-	-	-	-	150
Social Devel. & Welfare	-	-	-	-	23,532
Other	272	5,071	1,688	11,739	47,251
Total	272	5,071	1,688	11,739	221,643

