

A Commentary on the Inventory
of Federal Northern Science Projects
1975-1976

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A Commentary on the Inventory
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A. SUMMARY OF RECOMMENDATIONS AND OBSERVATIONS

An examination of the information contained in "The Inventory of Federal Northern Science Projects 1975-76" results in the following recommendations:

- 1) To develop a general policy and program framework, as outlined in Section E of this Commentary, for the planning and assessment of the northern S&T effort.
- 2) To develop this framework using the means outlined in Section F of this Commentary.
- 3) That attention should be given to having the scientific activities conform more closely to some aspects of "The Guidelines for Scientific Activities in Northern Canada". Specifically:

- (i) It would appear that the level of significant local involvement and participation, judged to be 15% of all projects (excluding National Museums of Canada), is lower than that expected by the Guidelines.
- (ii) It would appear that the level of intramural science, 81.5%, is high when compared with 64% for all federal scientific expenditures.
- (iii) It would appear that eleven projects dealing with information management, costing \$774,900, seems small, given the variety and complexity of this problem area.
- (iv) It would appear that, with more than 25% of all projects being of a long-term or continuous nature, special attention should be given to their regular evaluation and review in order to amend or to terminate projects, as required, based on changing conditions.

- 4) Given the importance of the North to the rest of Canada and the special significance of science in this region, a review of the adequacy of the current level of funding for northern science should be considered. The framework suggested in this Commentary could be used for such a review. The total expenditures on northern science for 1975-76 amounted to 8.4% of all northern expenditures and 3.1% of all federal scientific expenditures.
- 5) Considering the environmental and social conditions peculiar to the North and the high cost of health care delivery in this region, a careful examination should be made of the need for more medical research. Expenditures by National Health and Welfare and the Medical Research Council on medical research amounted to only \$92,500 in 1975-76.
- 6) The general policy and program framework, recommended above, should be used by all departments operating in the North and could be provided to the Granting Councils to assist them in making their awards.

B. Statistical Summary of the Inventory

The Inventory involved all federally funded northern S&T projects for the fiscal year 1975-76*.

The total dollars expended was \$43,773,300. This consisted of \$42,377,700 in 472 projects from 16 federal departments and agencies and the 2 territorial governments; and \$1,395,600 in 110 awards from 2 federal granting councils.

Of the \$42,377,700 expenditure in the 472 projects, 98.5% was from the 16 federal departments and agencies and 1.5% from the 2 territorial governments.

This \$42,377,700 expenditure was broken down by field of science (see Appendix ii) as follows:

Environmental Sciences	46.1%
Physical Sciences	19.8%
Engineering Sciences	19.0%
Life Sciences	7.9%
Human Sciences	6.6%
Mathematical Sciences	.6%
TOTAL:	100.0%

This \$42,377,700 expenditure was also broken down according to the type of cost as follows:

Salaries and Wages	34.9%
Capital Costs	11.9%
Other Costs	43.8%

The category of "Other Costs" above, includes among other items, contracts, grants and transfers as follows:

	<u>AMOUNT</u>	<u>% OF TOTAL EXPENDITURE</u>
Contracts	\$7,198,400	17.0
Grants	645,900	1.5
Transfers	<u>1,318,700</u>	<u>3.1</u>
TOTAL:	\$9,163,000	21.6

* For the scope of and terms of reference of the Inventory, see Appendix (i).

These 472 projects involved a total manpower utilization of 13,284.7 man-months which was broken down as follows:

	<u>Government</u>	<u>Non-Government*</u>
Scientific	8,177.7	590.9
Other	2,728.5	636.2
TOTAL:	12,057.6	1,227.1

The frequency of geographic distribution of these 472 projects was as follows:

Yukon	80
NWT	309
North Maritime	43
Northern Provinces	72
North General	63
Canada General	36
TOTAL:	603**

The \$1,395,600 amount awarded by the granting councils consisted of the following:

	<u>No. of Awards</u>	<u>\$Awarded</u>
Canada Council	14	356,100
Medical Research Council	0	0
National Research Council	96	1,039,500
TOTAL:	110	\$1,395,600.

* These figures are incomplete because respondents were frequently unable to report man-power utilization on work contracted out or performed under grants.

** Some projects were assigned to more than one geographic area.

C. Comments on Major Findings of the Inventory

I. General Comments

The \$42,377,700 spent by the federal departments and agencies and the 2 territorial governments in 1975-76 amounted to 8.4% of the total northern federal expenditures and 3.1% of the total federal science expenditure in all of Canada.

A departmental breakdown reveals that two departments with national mandates, FE and EM&R, accounted for almost two-thirds of the total federal expenditure for the 472 northern science projects. This reflects the relative importance of environmental and resource programs in the north. On the other hand, DIAND, the federal department with the most direct responsibility in northern affairs, spent only 8.6% of the total expenditure. The 2 territorial governments accounted for a little over half a million dollars or 1.4% of the total expenditure. Of this territorial expenditure, almost 90% was from NWT and over 92% was in the field of Human Sciences. In other words, two-thirds of the total northern science effort was from two federal departments with national mandates while only 10% was from the federal department and territorial governments most clearly concerned with the north as a distinct region.

The table on page 4 shows the breakdown of the 472 projects by fields of science. It shows, for example, that almost half the expenditure was for environmental sciences. Two points should be made here:

1. Two federal departments, (FE and EM&R) account for some 85% of the environmental sciences expenditure, - and a significant portion of this item is the \$8 million spent by the Atmospheric Environment Service on its northern operations.
2. The Inventory used the Statistics Canada definitions of fields of science rather than those of the original 1972 Inventory, see Appendix (ii).

In terms of the type of cost involved, one-third of the total expenditure was for "salaries and wages" and 45% was for "other costs". These proportions were roughly equivalent to the ANEP proportions of all federal northern expenditures for the same year. The "capital" cost amounted to 12% of the Inventory expenditures but 25% of the ANEP expenditures.

Over \$9 million or more than one dollar in every five of the total federal northern science expenditure was in contracts, grants and transfers. Extramural expenditures (grants, contracts and awards from granting councils) also totaled better than 20% of the total expenditure on northern science.

Government man-months amounted to 90% of the total manpower utilization of over 13,000 man-months reported in the Inventory. And two-thirds of these government man-months were scientific ones. A large majority of the manpower involved in the northern science activities, therefore, consisted of government scientists.

Geographically, at least half of the scientific projects were directly applicable to the NWT. In addition, other projects under 'North General' and 'Canada General' have some indirect application to the NWT. This item on geographical distribution was included in the Inventory not so much for analysis as for subsequent reference. It was felt that the territorial governments might find it useful to have an easily accessible record of where scientific projects had been carried out.

In addition to the \$42,377,700 spent on the 472 northern science projects was \$1½ million in 110 awards from two granting councils, the Canada Council and the National Research Council. The latter accounted for about 9 out of every 10 such awards and 3 out of every 4 dollars spent. The Medical Research Council reported no awards for 1975-76. Although these 110 awards have been included in the Inventory as northern science activities, they are treated separately for the purposes of this Commentary. It is recommended, however, that in any future planning of Canada's northern S&T effort, the work of the Councils should be taken into consideration. While the Councils have a distinct mandate and serve scientific purposes different from departments, it is likely that they would benefit from up-to-date knowledge of northern problems and scientific priorities. It is also important that curiosity-oriented research pertinent to the north continues to be supported and encouraged in Canada.

II. Comments Relevant to the
Guidelines for Scientific
Activities in Northern Canada.

These fourteen Guidelines were approved in 1976. They have a twofold purpose: to offer guidance as to how science should be carried out in the north and, to develop mechanisms and policies which support northern science.

There are several areas where the information in the Inventory sheds light on the effectiveness of those Guidelines.

Local Involvement:

Guidelines No. 1 and 2 state that scientific activities in the north should encourage native participation to the greatest extent possible in research programs and in the uses of S&T. In research affecting the native people, there should be prior consultation leading to informed agreement, participation in the conduct of the research itself, and feed-back of results to northern communities.

Question 12 of the Inventory questionnaire instructed the respondents as follows:

"Please describe briefly any consultation or participation of northern residents in the planning or implementation of this project."

Consultation and, to some degree, participation are difficult concepts to measure. We concentrated primarily on clear local participation and substantive consultation. For example, we excluded from consideration those 45 projects undertaken by National Museums of Canada because they tended to make use of northerners as subjects to be studied rather than actual participants or consultants.

Of the remaining projects in the Inventory, approximately 15% were judged to contain a significant element of local involvement. Those departments with the largest expenditures had the following rates of local involvement in their projects: DOC-45%; EM&R-5%; DFE-23% and DIAND-11%.

This, in itself, raises some serious questions about the nature of this particular guideline: has local involvement in scientific activities been promoted to the fullest extent? Should some scientific activities of departments, because of their nature, have more local involvement than others? Are specific and detailed guidelines needed to realize this overall guideline for local involvement?

Perhaps the only really effective way, in the long run, of ensuring local involvement would be a conscious policy of nurturing the growth of indigenous science in the north. It must be recognized that despite the large-scale decentralization of government to the two territories since 1962, science is still, by and large, an imported commodity in the north. And scientists themselves, are still a migratory species in the north.

Decentralization is unlikely to be the answer. Most of the large federal scientific establishments have national, as well as, northern mandates and neither they, nor the north, would benefit from wholesale transfer to the north.

But science in the north should not remain an almost exclusive federal preserve. The problem, however, is not only a federal one and cannot be solved only by federal initiatives. The territories have been slow to recognize the importance and relevance of science and to understand the contribution which resident scientists can make to government and society. This oversight is due, in part, to understandable preoccupation with the real problems of growth, change and decentralization in the north. But it is also due to a lingering "anti-intellectual" climate in the north. In the frontier ethic, science is a frill.

This attitude has to change. The territorial governments and legislatures need scientific advice from working, resident scientists thoroughly familiar with the northern setting and society. Northern society itself needs this component if it is to achieve any degree of sophistication in coping with its future. Canada can benefit from permanent groups of resident northern scientists. We suffer badly in this respect in comparison with Finland and the U.S.S.R. And the indigenous northern peoples need to see science as something integral and relevant to their environment rather than as an alien import or threatening imposition.



"Participation" implies more than acquiescence. It represents the need to expand perceptions and broaden horizons. This cannot be done if the territories remain a scientific vacuum.

Extramural Expenditures-
Contracts and Grants:

Guideline No. 5 states that scientists from the academic community and industry should be involved to the maximum extent practicable in government scientific activities. In particular, the 'contract' mechanism should be utilized wherever appropriate.

Question No. 10 of the Inventory Questionnaire specifically asked the respondents to list any contracts or grants to the private sector. These extramural expenditures amounted to \$7,844,300 or 18.5% of the total expenditures. To put this into a larger perspective, the total extramural expenditures of the federal government in all scientific activities amounted to \$492,000,000 or 36% of the total federal expenditures on all scientific activities in Canada. (See Federal Science Programs 1977/78, MOSST, p. 9).

In addition, almost three-quarters of the \$7,198,400 in contract expenditures in the Inventory were from 3 departments: EM&R-37%; IT&C-20%; and DIAND-15%. And over 90% of the \$645,900 in grant expenditures came from only one department, DIAND.

Therefore, the extramural expenditure from the Inventory was centred within only a few departments. Contracts and grants amounted to 18% of the Inventory expenditures and 36% of all federal scientific expenditures. The reasons behind this situation need to be explored more carefully in order to fulfill the mandate of this guideline.

Data Management - The Information Problem:

Guideline No. 8 states that all useful scientific and technical information acquired from research programs in the north should be adequately reported and fed into an appropriate scientific information source.

There were eleven projects in the Inventory which had relevance to data and information management. They were assigned, arbitrarily, to three subcategories:

1. data storage for geophysical information -
five projects
costing \$435,800
2. liaison and general information -
four projects
costing \$244,100
and
3. analysis and organization of existing information -
three projects
costing \$95,000.

The projects ranged from data banks for seismological information to support of the activities of the Arctic Institute of North America. This mix of types of data and information, and means of handling them, suggest that the entire question of information management is a difficult one that should be carefully reviewed.

Specifically, there are two questions. Are existing systems, both northern and national, for information storage adequate? And is there a need for better linkages among information sources for northern related data?

The information problem in the north for science and technology can be defined and described in five interlocking elements.

1. Bibliographies. The Arctic Bibliography is now defunct. Various proposals have been advanced to replace or renew it. Is there a need for a Canadian bibliography specifically built around northern S.T.I?
2. Libraries. Canada has no polar library of the calibre of the Scott Polar Research Institute in Cambridge. Given the facts of Canadian geography, this model is unlikely to prove feasible in this country. Is there a need to develop major regional libraries or a variety of libraries specializing in aspects of northern S.T.I?

3. Data Banks. These are especially relevant to the deliberate and orderly accumulation of baseline data in the resource-oriented sciences. One topical question is whether information of this kind is still subject to off-shore storage. Another is whether such banks are being integrated wherever possible.
4. Scholars. Should we encourage the development in Canada of centres of northern expertise where knowledgeable scientists "in residence" are available for consultation on problems within their fields? The sophistication of retrieval systems and the sheer accumulation of knowledge have increased the need for informed criticism and interpretation of data.
5. Information on Northern Activities. This function does not deal with scholarly knowledge, as such. It is an outgrowth of the old northern "intelligence" system of the Department of the Interior (c.1920) and the Department of Mines and Resources (c.1940); the need to know who was doing what, where, and when in the north. The original needs persist and to them have been added further information requirements for the issuance of Explorers' Licences and for the regulation of scientists in northern communities. This service is used by both bureaucrats and scientists.

The amount of science done in the Canadian north has increased steadily since the end of the Second World War and especially during the past seven years since the discovery of oil at Prudhoe Bay. The demands on science and the demand for more science in the north are unlikely to wane in the foreseeable future.

A priority for the federal sector is to ensure that this accumulating northern knowledge and know-how does not go to waste through inadequate storage and retrieval systems. The recently established Association of Canadian Universities for Northern Studies may play a useful role in this area.

Long-term Research:

Guideline No. 7 asserts that adequate provision should be made for the scientific evaluation of the progress of an activity. And Guideline No. 9 states that all scientific programs should be reviewed at regular intervals by the A.C.N.D. to ensure that activities remain in keeping with the original purposes of the studies.

This area of evaluation and review is obviously a complicated and multifaceted one. One aspect, however, that the Inventory can comment on is the one concerning "long-term projects". For this purpose a long-term project is considered to be one with a life expectancy of more than five years or with no completion date or of a continuous nature. Within this context, two departments in particular stand out clearly. Roughly one project in three from EM&R and one project in two from DFE were of a long-term nature. And these two departments alone account for approximately 80% of this type of research.

The implications for evaluation and review of such projects are readily apparent. What types of scientific activities are most conducive to this long-term approach? Are the original needs or purposes for such projects still valid; i.e., are they still effective? Are the methods chosen to meet these needs or purposes still the best ones; i.e., are they still being done efficiently? These questions must be addressed if a proper evaluation and review process is to be maintained.

International Projects:

Guidelines No. 12, 13 and 14 deal with international scientific cooperation in the north. Twenty-four projects in the Inventory contained some element of international movement. For the majority of these projects, the international aspect involved the sharing of basic geophysical data on phenomena of world-wide importance. These projects were clearly Canadian ones and, in a sense, the international element was secondary to domestic needs. In other words, the projects would have been carried out almost regardless of their international content.

An exception to this pattern was the Aidjex program (Arctic Ice Dynamics Joint Experiment) which grew out of proposals put forward by the U.S. Office of Naval Research and the Naval Oceanographic Office. In the fiscal year 1975-76, 4 Canadian projects were listed in support of Aidjex costing \$687,300. It is essential that in the future the Guidelines be applied to this kind of project before Canadian participation is agreed upon. Specifically, it must be demonstrated that such large expenditures serve Canadian priorities and needs and that effective Canadian control extends to prior planning and management.

D. The Inventory and the Northern Objectives.

In 1971, the Government approved a northern policy strategy for the 70's. In approving this strategy, Cabinet established seven National Objectives for Northern Canada. These Objectives "were designed as a policy framework for the formulation, co-ordination and implementation of all Federal and Territorial government programs concerned with Northern Canada during this decade". The Objectives, together with an eighth category (Administration and Support), are used as one method of compiling northern expenditure data for the Annual Northern Expenditure Plan.¹

As requested, we have compiled a breakdown by Northern Objective of the dollar expenditures of the 472 northern S&T projects contained in the Inventory. In addition, we are also including an expenditure breakdown by the three "primary objectives" suggested by K. Scott Wood, in his 1974 study entitled: An Approach to Social Reporting on the Canadian North; Institute of Public Affairs, Dalhousie University.

S&T Expenditure Breakdown by Northern Objective
(Northern Science Inventory 1975-76)*

Quality of Life	\$ 5,259,900.
Economic Growth	\$ 8,890,900.
Sovereignty and Security	\$ 2,638,100.
Protection of Environment	\$23,313,300.
Evolution of Government	\$ 20,200.
Social and Cultural Development	\$ 505,400.
Leisure and Recreation	\$ 317,800.
Unallocated	\$ 1,392,100.
TOTAL	\$42,377,700.

¹ Department of Indian Affairs and Northern Development, Working Document of Annual Northern Expenditure Plan 1977-78, 1977.
Advisory Committee on Northern Development, Annual Northern Expenditure Plan 1977-78, 1977.

* Note to reader on following page.

*Note to Reader

1. The allocation of S&T expenditures by Northern Objective was done within MOSST. In addition to normal considerations, two specific guidelines were followed throughout.
 - A. Because of the frequent application of the science effort to several Objectives, it was thought desirable to focus on the principal Objective affected. If there was a significant contribution to a second Objective, the total expenditure was arbitrarily allocated on a 50:50 basis. In only one instance was a project assigned to three Objectives.
 - B. An eighth category entitled "Unallocated" was developed to group those projects which had wide application to several Objectives but no one Objective in particular, or represented effort which can best be described as "housekeeping" (e.g., data management, policy and program planning etc.).
2. The allocation to "Protection of Environment" may appear to be especially high. Two points should be noted when considering this figure:
 - A. Meteorological and sea-state information and services, allocated solely to this Objective using the guidelines stated above, account for \$8 million in expenditures; and
 - B. All baseline data gathering work in the Natural Sciences, without a specifically mentioned application to another Objective, was assigned to this Objective.

S&T Expenditure Breakdown by
three "Primary Objectives"
(Northern Science Inventory
1975-76)

Political Objectives	\$ 2,658,200.
Economic, Social and Cultural Objectives	\$14,656,200.
Environmental and Recreational Objectives	\$23,671,100.
Unallocated	\$ 1,392,100.
TOTAL	\$42,377,700.

Note:

While it was our feeling that the above breakdown by "Primary Objectives" involves less subjectivity, it still suffers from the same drawbacks mentioned in the following text.

It may also be interesting to note, in passing, the comparison for 1975-76 of the A.N.E.P. breakdown of expenditures with those of the science inventory (for the same fiscal year) now under discussion.

TABLE: A.N.E.P. AND INVENTORY EXPENDITURES BY NORTHERN OBJECTIVES 1975-76

<u>Northern Objective</u>	<u>A.N.E.P.</u>		<u>Inventory</u>	
	\$	%	\$	%
Quality of Life	225,928,000	44.6	5,259,900	12.4
Economic Growth	109,076,000	21.5	8,890,900	21.0
Sovereignty and Security	26,731,000	5.3	2,638,100	6.2
Protection of Environment	31,706,000	6.3	23,313,300	55.0
Evolution of Government	19,567,000	3.9	20,200	.1
Social and Cultural	11,831,000	2.3	505,400	1.2
Leisure and Recreation	5,454,000	1.1	317,800	.8
Administration and Support	75,833,000	15.0	1,392,100	3.3*
TOTALS	506,126,000	100.0	42,377,700	100.0

* NOTE: The reader should note that in relating the Inventory expenditures to the Northern Objectives, the eighth category has been entitled "Unallocated" and bears no direct relationship to the A.N.E.P.'s category "Administration and Support".

This comparison, which indicates almost a direct reversal of S&T support to the Quality of Life and Protection of Environment Objectives as compared to the A.N.E.P. figures, helps to underline two important points.

1. Science, as a tool, has greater application in some areas of work than in others. Thus, the relative science expenditures supporting each of the Objectives may be misleading and should be viewed very carefully.
2. Breaking down the S&T effort by Northern Objectives has only limited application.

Science and technology are, and should be, an integral part of federal northern expenditures and should support and be seen to support the government's objectives, policies and programs for the North. The A.N.E.P. is a means of accounting now in place and its authors have worked out, over the years, a method to assist senior program managers in the departments to assign expenditures, at the Activity level, to the Northern Objectives.

As a display mechanism, therefore, A.N.E.P. is an existing technique and probably is useful in meeting certain needs. And the S&T component of A.N.E.P. (approximately 8.4% for 1975-76) will likely continue to be an integral part of A.N.E.P.'s overall accounting.

From the point of view of this Commentary, however, the lack of a mechanism for using the Northern Objectives precludes either the assessment or planning of our northern S&T effort.

- First, the Objectives are necessarily general statements of political or policy intent. They lack the essential element which is needed for scientific investigation; a clear statement of the problem or opportunity.

- Second, the assignment of S&T projects to one or more of the Objectives - either for purpose of planning or accounting, - is a highly arbitrary process. It is not difficult, in fact, to find relevance to all seven Objectives for most of the S&T done in the North.
- Third, some activities in support of Objectives require more scientific support than others. Thus, relating S&T effort to the Objectives does not present a valid picture of the government's main scientific thrusts in the North.
- Fourth, the Objectives offer no guidance on several important elements in science planning; the kind of science required, where is it required, when is it required, who can best do it, and what type of product is needed.

E. A Suggested Framework for the Planning
and Assessment of the Northern S&T Effort

One of the major conclusions of this Commentary is that a more fully articulated policy and program framework is needed which will provide for better planning and assessment of our northern effort. While the northern S&T effort is our primary concern in this Commentary, it is our belief that any mechanism which might be used to guide this effort must, in fact, be derived from a general framework for our federal northern activities. Our northern S&T efforts must support the National Objectives for the North.

While this is not a new concept, it is one which we believe requires further attention. Given the existing financial climate in the government and your present review exercise, this would appear to be an appropriate time to take a fresh look at this problem. Consequently, we are taking this opportunity to present our initial thoughts on a process which might be used to develop a more comprehensive policy and program framework.

The apex of such a framework would be the Northern Objectives. From these would be derived a set of sub-objectives which would be specific statements of intent, more clearly defining the main elements contained in each Objective. The sub-objectives would then form the basis for the establishment of goals. These goals, which would be time-phased and preferably quantifiable and attainable, would translate into shorter range activities. The S&T effort and the specific science component which would be required to help achieve the Objectives would be identifiable after carefully examining the sub-objectives and especially the goals referred to above. This process would not be a static one but rather a continuous one. The framework would be subject to regular review and assessment as changing conditions warranted.

It must be recognized, however, that much scientific investigation is of a long-term nature and is not necessarily directed to a specific goal but rather to an ongoing government responsibility. In addition, much scientific work cannot be subject to stop and start situations. Careful consideration must, therefore, be given to the inherent differences of science when using this framework to help direct the scientific effort.

An assumption, which runs throughout the process just sketched, is that some form of prioritization would be required. While this subject is often a sensitive one, the fact remains that in reality, weighting of programs and activities is already taking place (Treasury Board at the central level and senior managers at the departmental level). Why not take this opportunity to make this prioritization and consequent allocation of resources as rational and efficient as possible? An existing document, "Priorities for the Seventies", represents a good attempt at dealing with this problem. (See Appendices iii and iv). What is needed is more recognition of their usefulness, better definition especially at the lower levels of the structure, wider application, and regular review of their applicability and the progress achieved towards their attainment.

The framework outlined here should be developed from a process which:

- grows out of the Northern Objectives;
- identifies particular problems and opportunities, which are sufficiently explicit to serve as planning tools for scientific managers in the selection of S&T activities and projects;
- is capable of reflecting the changing social, economic and political realities in the north; and
- permits periodic review by senior managers in consultation with central agencies.

In short, such a framework would provide a means of more effectively using science to achieve national objectives in the North. As such, it would have an integral role in the continuing formulation of policies and strategies for science in this country.

The framework, as outlined, may be criticized by scientists and engineers as yet another bureaucratic road-block, as an unnecessary process for planning and implementing essential research activities in the north. This criticism can be valid. Such a framework to help identify, plan, and evaluate scientific needs should not be injected into the planning process without careful assessment of its use and possible benefits. The argument which can be advanced in favour of such a framework is one already made: the Northern Objectives are not adequate or sufficiently detailed to be useful in planning northern S&T effort in the 1970's. And yet, the need for this type of comparison remains. Science is part and parcel of Canada's total northern effort. And on an arctic frontier, technological innovation is usually the crucial factor in development and change. Science is too important to be left out of the process of national planning for the north.

There are positive arguments in favour of developing such a framework for northern S&T.

- rapid change is now a fact of northern life; changing emphasis in northern objectives, in social and economic problems, in resource opportunities and social goals. Such a framework is a way of reflecting this element of change in S&T programs, and, properly designed, is a way of minimizing its undesirable side-effects on scientific research;
- statements of sub-objectives and goals from which the scientific components are identified can incorporate the resources of several departments and agencies into cooperative activities;

- the national mandates of the large science departments are not always sensitive to northern needs and situations. Such a framework can be a means of adjusting the pace and thrust of national science programs to specific northern situations; and
- this framework can also be used to better measure the effectiveness of northern S&T effort to the Northern Objectives. In general, the use of A.N.E.P. provides only for a measurement of inputs and often a very subjective one at that. No assessment is possible under the existing framework. As previously demonstrated, relating science effort to Northern Objectives can seriously distort the scientific effort and is neither an adequate or fair yardstick to measure its success or its future.

The Commentary is not the place to define and describe, in detail, a process for developing a framework which could be used to plan and assess our northern S&T effort. But it may be useful to point out that there now exist additional guidelines and source documents which could be of great assistance in identifying some elements of this framework. Both Volumes of the Berger Report made specific recommendations on science priorities for the North and Report No. 26 of the Science Council has also done a good deal of the spade-work on the subject.

F. Coordination of the Planning
and Assessment Process

This Inventory - and to some extent the Commentary, result from a series of events which began in 1970 with a Cabinet Decision asking for an interdepartmental program of research in the north which would be related to the government's objectives for the region.

There were a number of attempts to produce such a paper. The first was the Mont Gabriel Seminar of October 1972 which identified gaps in northern scientific knowledge. The present Guidelines for Scientific Activities in the North were one result of the seminar but no paper was produced for Cabinet which tried to identify actual research priorities on a broad interdepartmental basis.

During 1973 and 1974, several documents were drafted on the subject but none was referred to Cabinet until 1976. Two approaches were tried during this period. The first was an attempt to assign research priorities by geographical region in the north. When this was not found to be feasible, it was suggested that Cabinet be asked to approve, in principle, the drawing up of northern S&T priorities by three major fields; sociological, ecological, and geophysical science and that IAND, FE and EM&R, respectively, be constituted as the lead agencies for producing priorities within each of these fields. Several drafts were written on this theme and one was actually submitted to Cabinet Committee but was withdrawn by IAND before it was considered. Since that time no further attempt has been made to come to grips with the problem.

It is the argument of this Commentary that the assignment of research priorities for northern S&T will remain an almost intractable task until a conceptual framework is drawn up along the lines suggested in Section E above. The seven National Objectives for the north are not an adequate road map for planning the directions of northern S&T in the future.

If it is agreed that this approach to a framework - or something like it, should be tried, the question is by whom and how? It is assumed that it cannot be done by one department. An interdepartmental mechanism is likely essential and the task might be performed by a special group under the aegis of deputy-heads, - similar to the work done by the Task Force on Northern Oil and Gas of 1969. Such a group already exists, namely the Policy Committee of the ACND. This approach has obvious advantages in terms of the authority of the mandate.

The most obvious agency for this task is the ACND which under its revised terms of reference of 1952-53, is still charged with responsibilities which include the joint planning and co-ordination of federal northern programs including their financial implications. And it remains the one major interdepartmental coordinating body for the north which reports to Cabinet, - through the Minister of Indian Affairs and Northern Development. The ACND has the mandate; can its role be restored to one of co-ordination?

If the ACND were chosen for this task, the actual work could be divided into two phases:

1. The ACND Policy Committee could assume the responsibility of drawing up a general framework derived from the Northern Objectives.
2. Subsequently, a small inter-departmental group of senior science managers, perhaps headed by the Chairman of the Committee on Science and Technology, could be given the responsibility of identifying the key scientific components from this framework and recommending on priorities. This likely would become an annual task and would involve not only planning but assessment, as well.

It has been found by this Ministry during its experience with interdepartmental S&T co-ordination of this nature, that the mechanisms to support committee deliberations are of vital importance. Whatever committees are used, they must be backed up by very effective staff. The usual procedure has been to strike a task force drawn from the membership of the committee and appoint to it a very small group of draftsmen who have extensive experience in the preparation of policy documents. The staff, - working under broad instructions and terms of reference prepare the necessary written documents in advance of meetings. They are also responsible between meetings for bringing together the variety of views and proposals from the members of the task force and incorporating these into working documents for circulation prior to meetings.

It has also been found most useful to include central agencies, such as staff of the Treasury Board, in the deliberations of the task force.

The final recommendations and documents of the committees could be sent by the ACND to Cabinet for consideration and approval.

Terms of Reference of Northern Science Inventory

For the purposes of this Inventory, a federal "Northern Science Project" was defined as follows:

- i). "Science" is the generation and dissemination of knowledge of man, his society, institutions and of the physical universe and comprises:
 - research and development including the innovation and testing of equipment and structures;
 - the gathering, processing, collating and analysis of data on natural and/or human phenomena and the dissemination of this information;
 - technical or research operations connected with the establishment of standards; and
 - grants in aid of research and other forms of assistance to individuals or institutions.
- ii) A "project" refers to that level of detail which appears as a self-contained item within the activity or sub-activity costs of departmental Main Estimates.
- iii) "Northern" refers to all federal scientific projects in the two Territories and the contiguous ocean areas and to federal projects south of 60° that are distinctive because they relate to the problems or phenomena associated with an arctic or sub-arctic environment.
- iv) 1975-76
Included all federal Northern Science Projects that were supported in whole or in part from the 1975-76 budget.

Scientific Activities by Fields

Definitions used in the Compilation of the Inventory

The life sciences include the biological sciences, which deal with the origin, development, structure, function and interaction of living things, and the clinical medical sciences, which are concerned with the use of scientific knowledge for the identification, treatment and cure of disease.

The physical sciences are concerned with the understanding of the material universe and its phenomena. They include the subfields of astronomy, chemistry, physics and other physical sciences.

The environmental sciences are concerned with the properties of the solar system that affect man's survival and welfare. They include the fields of atmospheric sciences, geological sciences, oceanography, and other environmental sciences.

The mathematical sciences employ logical reasoning with the aid of symbols and are concerned with the development of methods of operation employing such symbols.

The engineering sciences are concerned with studies directed towards developing engineering principles or towards making specific scientific principles usable in engineering practice.

The human sciences encompass the disciplines generally referred to as the "social sciences and humanities". No distinction is made between the two groups of disciplines since it is not clear that such a breakdown is possible or desirable for statistical purposes. Thus, the human sciences include all disciplines involving the study of human actions and conditions and the social, economic and institutional mechanisms affecting them.

APPENDIX (iii)

Priorities for the Seventies

The Government's order of priorities in the North, as set out in the Northern Development Policy for the 1970's, is as follows:

- (i) To put into rapid effect the agreed guidelines for social improvement;
- (ii) To maintain and enhance the natural environment through such means as intensifying ecological research, establishing national parks, ensuring wildlife conservation;
- (iii) To encourage and stimulate the development of renewable resources, light industries and tourism, particularly those which create job and economic opportunities for native northerners;
- (iv) To encourage and assist strategic projects (key to increased economic activity in the region or Territory with solid economic and social benefits) in the development of non-renewable resources and in which joint participation by government and private interests is generally desirable;
- (v) To provide necessary support for other non-renewable resource projects of recognized benefit to northern residents and Canadians generally.

APPENDIX (iv)

Guidelines for Social Improvement

As part of its Northern Development Policy for the 1970's, the Government established the following Guidelines for Social Improvement to be acted on by all departments and agencies involved in the North:

- (a) consciously create in government and industry employment opportunities for native people through attractive incentives, meaningful targets and where necessary imposed obligations;
- (b) re-orient employment practices of government and industry in order to provide intensive training, not only in preparation for foreseeable employment but including on-the-job training;
- (c) liberalize education and training techniques to produce more quickly qualified native practitioners in all professions and skills including teachers, nurses, mechanical engineers, communications technicians, management personnel, aircraft pilots and mechanics among others, with full provision for continuity and upgrading;
- (d) train and provide experience for native northerners in executive and administrative posts, especially at municipal levels and even at the risk of higher costs and some mistakes;
- (e) improve opportunities and mechanisms for consultations involving native peoples, industry and government; for social and economic development of the native bands and communities; for hearing grievances;
- (f) maintain opportunities for traditional pursuits (hunting, fishing, trapping), encouraging a shift to analogous activities (campsite supervisors, tourist guides, game and fire wardens) for native peoples, and expanding well-established programs providing cultural outlets for the indigenous peoples so that they will be involved increasingly in all phases (including marketing);
- (g) ensure sensitive counselling of native peoples and would-be immigrants, closest liaison with industry and effective cooperation as a group on the part of all government departments and agencies concerned with people programs;
- (h) strengthen communication links (telephone, data, radio, live television for education and entertainment) among communities in the North and between the people of the North and fellow Canadians in the South;
- (i) improve transportation facilities for movement of people within the regions of the North and to and from the North;
- (j) safeguard the culture (language, arts, handicrafts, traditional pursuits) of native peoples in the course of education, training, employment and community life; above all their right to choose what is to be preserved.

