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A Thematic Analysis of National Science Policy in Canada, 1963–1977

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ABSTRACT

This thesis is an analysis of the accommodation of science policy at the federal level in Canada during the 1963 to 1977 period. A general definition of science policy is developed in the first section. This 'national science policy' concept is then used to study changes in the administration of science and research at the federal level. Two distinct sets of developments were found to be responsible for the incorporation of national science policy into the administrative procedures and the political arean.

A THEMATIC ANALYSIS OF NATIONAL SCIENCE POLICY IN CANADA 1963-1977

by

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A THEMATIC ANALYSIS OF

NATIONAL SCIENCE POLICY IN CANADA

1963-1977

ABBREVIATIONS

AECB	Atomic Energy Control Board
AECL	Atomic Energy of Canada Limited
CFUR	Canadian Committee on Financing University Research
DRB	Defence Research Board
DSA	Directorate for Scientific Affairs of the Organization for Economic Co-operation and Development
IT&C	Department of Industry, Trade and Commerce
MOP	Make-or-Buy Program(Contracting out policy)
MOSST	Ministry of State for Science and Technology
NRC	National Research Council
OECD	Organization for Economic Co-operation and Development
PASC	Parliamentary and Scientific Committee
RSC	Royal Society of Canada
SAA	Science Activities Act(C-26)
SCITEC	The Association of the Scientific, Engineering and Technological Community of Canada
SCSP	Senate Special Committee on Science Policy
TBS	Treasury Board Secretariat

A THEMATIC ANALYSIS OF NATIONAL SCIENCE POLICY IN CANADA 1963-1977

I

INTRODUCTION

1. The Thesis and the Framework

This is a study of the accommodation of national science policy in Canada during the 1963-1977 period.(1) It is interpreted as a process by which goals, resources, limitations and boundaries of science and research were attempted to be delineated by government.

This study also seeks to show how new administrative jurisdictions and political concerns evolved.

The period since the early 1960s in Canada offers a unique opportunity to examine the genesis of national science policy because of the short timeframe, the interest that quickly developed and the distinctive activities and events.

This paper is divided into six sections. The first outlines and defines the national science policy concept. The second examines the emergence of the national science policy concept and the tacit governmental acceptance of it in Canada (1963-66). The third and fourth sections trace the simultaneous development of the national science policy perspective and the national science policy administrative approach (1966-74). The fifth section investigates the

convergence of these two series of developments (1974-1977). The final part offers a summary and conclusion.

Internationally, science policy came into prominence in the late 1950s. Great Britain(2), France(3) and the United States(4) were prime movers in the study of science policy and in attempts to put it into practice. The work of the Directorate for Scientific Affairs(DSA) of the Organization for Economic Co-operation and Development also promoted science policy.(5) Many nations, including Canada, took special interest in science policy.

There was a proliferation of studies in Canada since the early 1960s which examined the support, administration and use of science and research by the federal government. The most prominent studies were the 1963 report of the Royal Commission on Government Organization(6) and the special study by Dr. C.J. Mackenzie.(7) Other studies were made by the Science Council of Canada(SCC)(8) and the Senate Special Committee on Science Policy(SCSP).(9) Of note were the extensive collection of briefs presented at the proceedings of the Senate Special Committee on Science Policy(SCSP) by all segments of the Canadian scientific research community and establishment. Academic studies include those by G.B. Doern(10) and F. Ronald Hayes.(11) More recent studies include those of D.G. McFetridge(12) and of D.J. Daly and S.

Globerman.(13)

These studies were accompanied by many institutional developments. The most prominent were the creation of the Science Secretariat in 1964, the establishment of the Science Council of Canada(SCC) in 1966, the creation of the Senate Special Committee on Science Policy(SCSP) in 1967, the 1971 establishment of the Ministry of State for Science and Technology(MOSST) and the accepted changes proposed in the 1976 Science Activities Act(SAA).(14)

Beginning in 1974 there were activities of a slightly different kind. Interest, attention and political rhetoric on science and research as an aspect of policy became politically expedient. This was stimulated by greater governmental interest in science and research policies, more lobbying by the scientific research community of Members of Parliament and by governmental directives to consider specifically science and research in policy.(15)

Do these activities and developments indicate the accommodation of national science policy in Canada?

This study argues that during the 1963-77 period in Canada national science policy was incorporated into the political and administrative process of the federal government. This took place through four particular stages.

The first and second stages took place rapidly. The third was protracted while the fourth is still evolving.

The first stage began in the early 1960s and lasted into the mid-1960s. The basic concepts of national science policy thinking were introducted into the political arena and the fundamental tenets were quickly accepted by the federal government in this period.

The second stage took place from 1964 to 1966. Pressures and controversies rapidly developed against the changes that would occur if national science policy was accommodated. Controversies developed within the scientific research community because of the change this would mean to the support of science and research. And within the federal bureaucracy, pressures developed because of the lack of administrative mechanisms by which national science policy could be integrated into the decision and policy making process. This second stage consisted of political impasse and administrative incapability. It resulted in two paths of development for the third stage.

The third stage lasted from 1966 into the mid-1970s. There are two distinctive and parallel paths of simultaneous developments. The more visible series of events resulted in the wider general acceptance of national science policy thinking. The underlying activities deal with the

institutional accommodation of national science policy into the regular administrative structures. These two series of events are mutually reinforcing but distinctive.

One series of events in this third stage is called the debate-confrontation. The debate-confrontation entailed a direct challenge to the scientific research community and a threat to the scientific research establishment. It pointed out that there were only limited research resources and that there should be greater relevance of science and research to national aims.

The debate-confrontation was initiated within the political arena but rapidly developed into an internal debate within the scientific research community. This served to sensitize the community to national science policy thinking as well as to politicize and make them appear as distinctive, collective entities. The debate-confrontation resulted in the wider acceptance of the national science policy perspective within scientific, bureaucratic and political circles.

The second and parallel series of events termed the institutional-administrative resulted in the development of administrative mechanisms for reviewing science and research resources. Administrative procedures were incorporated into the decision and policy making process to

specialize the distribution of science and research resources. The events and developments of the institutional-administrative series are readily identifiable because of their direct connection with and access to the decision and policy making arena.

The fourth and most crucial stage, gradually evolving since 1974, consists of the convergence of these two series of developments. It is a situation of whether the perceptions of national science acquired through the debate-confrontation will combine with the mechanisms produced by the institutional-administrative developments to fully accommodate national science policy in Canada.

2. The National Science Policy Concept

The National science policy concept serves as an independent variable throughout this paper. It is used to analyse and evaluate the events and developments in Canada. This is an interpretative analysis of the national science policy concept based on a wide selection of the literature in the field.(16) Science policy although appearing ill-shaped, loosely held and in some cases contradictory possesses a discernible base from which fundamental components can be extracted.

Historically, science and research enjoyed different

kinds of support. From the sixteenth century to the present

> scientific investigations were self-supported by amateurs or by interested patrons in a complex set of idiosyncratic arrangements. From the mid-nineteenth century, first in France and Germany and later in the United States and England, research science was conducted within and supported by universities and other higher schools. Since World War II, especially in the United States, science has been ever more decisively shaped by the predominant governmental support of research.(17)

There was since the Second World War greater identification and support of science and research by governments resulting in the institutionalization of it within the general framework of government and state. This occurs when

> the charter, staff, norms, material apparatus and functions of science can be identified through their linkages with other social institutions, and especially with the so-called core institutions of any society like the economy, the family, the educational system, and the political system. (18)

Modern governments attempted to organize their administrative structures to apply and support science and research. In a reciprocal manner science and research developed areas of interest suitable to government. It is within this context that the national science policy concept developed.

Generally the national science policy concept suggests that science and research should be used to aid in economic

growth and social development. The national science policy concept proposes there should be direct linkage of scientific research efforts to national (and/or international(19)) aims.

The national science policy concept combines the following components. They are organized such that the national science policy process is created by: a continuing statement of national objectives and policy priorities; administrative bodies and procedures within the central executive decision and policy making arena to distribute science and research resources according to objectives and priorities; secondarily supported by policies aimed at supplying research and technical personnel establishing a free flow of scientific and technical information, and standardizing scientific, research procedures and information.

The underlying tenets of the national science policy concept assert that science and research resources should be allocated according to national goals and policy aims. For this there must be specialization of administrative procedures to direct and distribute the resources.

The national science policy concept accepts that research forms a continuum from basic to applied research, to technical application and inevitable innovation. The

emphasis is not so much on discipline research or specific areas of science *per se*. Support is based on the relationship of science and research to specific policy concerns. Single, multi- or interdisciplinary research work would be supported in relation to the aims of policy initiatives, e.g., energy, pollution, food, population control, foreign aid, sovereignty.

The interest and attention given to national science policy can be partly explained by the claims of its early proponents: there is a positive correlation between levels of science and research support, economic growth and social development. It should be noted that economic growth and social development are no more than very general and overall goals that can be pursued through many diverse policies. National science policy is directed to the ways and means of attaining policy aims through the selected support of science and research and the specialization of science and research administration.

It should be kept in mind that national science policy is not so much a 'thing' as it is a series of continuing, interrelated activities. As noted by R.W. Jackson:

> Far from denoting a monolithic structure that can be worked out and formalized on paper, science policy . . . comes closer to denoting an open-ended set of continuing activities--a general area of involvement with many policies.(20)

National science policy cannot be laid out as a grand theory, a subjective or objective set of prescriptions for the direction of science and research. It is, however, part of the ongoing political and administrative process that treats science and research as integral and specialized aspects of policy and national aims. National science policy in itself is the process that increases awareness, discussion and decision making on matters involving science and research within the framework of the policy making process.

Interest in national science policy can be identified by increased attention to science and research in political discussions, policy debates and policy initiatives. Science and research are treated as integral aspects of policy. The institutional incorporation of national science policy is accompanied by appropriate administrative procedures that segregate and specialize the review of science and research resources. Therefore, national science policy is expressed as a desire to formally influence and distinctively support science and research to secure national aims; from an administrative perspective, it is an attempt to create a

comprehensive organization by which to manage and control science and research in accordance with national aims and policy objectives.

National science policy in Canada, as presented in this paper, is seen as an attempt to accommodate the specific consideration and the specialized support of science and research in the administrative, decision making and political process. It should not be conceived as a set of rigid prescriptions for the allocation of science and research resources that is considered optimum. It is the particularization of science and research within the policy and political process.

II

NATIONAL SCIENCE POLICY: 1963-66

The first stage in the accommodation of national science policy in Canada consists of the initial introduction of national science policy concepts into the political arena. The 1963 report of the Royal Commission on Government Organization (the Glassco Commission) marked this. The Glassco report was the first semi-official expression of national science policy thinking during this period.

The report identified three areas of general support, "the civil departments, the defence research groups and the independent research agencies,"(1) that had neither formal linkage with general national concerns nor direct administrative attachments to specific policy initiatives. This was evident, for example, in the analysis of water resource research, weather data and forecasting and defence research work as well as in the more or less independent operation of the National Research Council(NRC).

The Glassco Commission proposed a suitable administrative arrangement by which to rationalize the input of science and research into governmental decision making.(2) It recommended a 'central science bureau' be created to act as a secretariat to the cabinet. And that a 'National Scientific Advisory Council' be created that would

be broadly representative of the scientific research community from academic, industrial and governmental sectors. The staff support for the council would come from the bureau and the head officer of the bureau would be the secretary of the council. This approach stressed the input of advice from the scientific research establishment as represented in the council rather than attempting to deal with the effective overall allocation of science and research resources to policy initiatives.

The Glassco Commission recommended that science and research should be formally supported in relation to national desires and specific policy aims.(3) The national science policy perspective was indicated by the proposals to have executive reviewing of the distribution of research resources by a 'bureau' and to have the collective grouping of the scientific research establishment in an advisory 'council'.

The study of research and the federal government by Dr. C.J. Mackenzie, The Report to Prime Minister on Government Science, gave further visibility and revealed tacit governmental recognition of the national science policy concept. This report was for the Privy Council Office(PCO) and was submitted to the government on January 24th, 1964.

The Mackenzie report was not so important in its recommendations but rather in the perspective it advocated.

The report stressed the creation of two bodies: one, a secretariat, to be attached to the Privy Council Office(PCO) and another body called a National Committee on Science Policy, to bring groups of scientists together to advise on national courses for research. Science and research, it was argued, should be effectively utilized in areas of national priority. Administratively, science and research would have to become visible and accessible for government.

Controversies developed between the political arena and the scientific research community in the second stage. The suggested changes threatened the established order. First, pressures developed because of the challenge made that scientific research should receive support in relation to the national relevance of the work. Second, there were administrative difficulties because of the lack of information on the distribution of science and research resources.

The challenge by the political arena to the scientific research community is exemplified in a speech by the Honourable C.M. Drury delivered in June 1964 to the Royal Society of Canada.(4) At that time Drury was the Minister of Industry and chairman of the Privy Council Committee on Scientific and Industrial Research.

Acknowledgement was given by Drury to the "urgent need

for the formation of a Canadian science policy which was truly national in character and domain."(5) His speech indicated that it was not a question of whether there should be greater co-ordination of research but on what grounds resources would be allocated. Drury posed to the scientific research community two basic questions relevant to national science policy thinking. First, "how much of those resources [financial, manpower] should be directed to research and development?"(6) Second, "how do we insure that most effective use is made of that proportion of our resources that is to be allocated to these activities?"(7) The thrust of the argument by Drury was to put the scientific research community in a position of reconciling free and directed research.

In April 1964 the Science Secretariat was established. This followed by two months the submission of the Mackenzie report and indicated important, albeit limited, recognition of the national science policy approach by the government.

The mandate directed the Science Secretariat "to assemble and analyse information about the government's scientific programmes and their interrelation with other scientific activities throughout Canada."(8) It was to be part of the Privy Council Office and report to the Prime Minister.

The importance of the creation of the Science Secretariat was the acceptance in principle by the government of the need of an administrative body within the executive decision making arena to consider research as an aspect or component of policy. This signaled the acceptance by the government of the need to develop "coordinating mechanisms inserted at the supradepartmental level and specializing to the particular function"(9) of reviewing and recommending on the distribution of resources to science and research. It marked, therefore, the first administrative step in the accommodation of national science policy giving impetus and credibility to further developments.

The initial administrative operation of the Science Secretariat would be selective and of necessity ad hoc. It did not have the administrative tools—information on the general distribution of research resources—by which it could immediately and effectively carry out its mandate. It also lacked the administrative prestige and credibility to have a significant impact. The role of the Science Secretariat could broaden only following the development of such attributes.

During the 1964-66 period the Science Secretariat was an informal and reactive centre offering particular science policy advice. The emphasis, however, was on research matters per se and not with the role of science in policy

initiatives. Beginning in January 1965 the Treasury Board Secretariat(TBS) consulted with the Science Secretariat on the Churchill Range for Upper Atmosphere Research,(10) and subsequently on the National Research Council Wind Tunnel project,(11) the High Altitude Research Project,(12) the Intense Neutron Generator Project(13) and the Tri-Universities Meson Facility.(14) And with the December 1968 cancellation of the Intense Neutron Generator project the TBS "saw the Science Secretariat as an agency that would provide some form of independent judgement by which it could more intelligently apportion resources to satisfy the clamouring demands of the departments and agencies."(15) And in the spring and summer of 1968 the Treasury Board attempted to have it transfered to the Treasury Board.(16) By 1968, therefore, science and research were being more selectively dealt with by the executive decision and policy making bodies, albeit in a limited, re-active and ad-hoc manner. A national science policy approach to the administration of science and research had been tentatively accepted in principle and was being accommodated to a very limited degree. And by 1970, the Science Secretariat was a de facto arm of the TBS.(17)

It was extensively proclaimed and documented that since the late 1950s and early 1960s the Canadian government

resources being allocated to scientific research were severely restricted relative to the 1950s and early 1960s.(18) This was made more severe by the high rate of inflation during the 1968-77 period.(19) It was evident in the 1966 Pearson statement(20) at the inaugural meeting of the Science Council of Canada(SCC) that the government was concerned about the increasing rates that resources were being diverted to 'big science' programmes and the lack of controlling mechanisms.(21)

National science policy thinking offered a perspective and administrative plan by which to control science and research to achieve national aims. The existence and operation of the national science policy approach partially explains the restriction in the allocation since research must be identified with some national aim or policy priority. Restriction in general does not entail direction and management. The restriction in resources since the late 1960s is both part of the national science policy approach and partly responsible for the development of administrative mechanisms by which to manage the shortages.

In summary, the early 1960s saw the introduction of national science policy thinking into the political and administrative arenas. The government gave tacit recognition to national science policy and started to put it into practice.

III

THE DEBATE-CONFRONTATION ACTIVITIES: 1966-74

National science policy evolved from the mid-1960s to the mid-1970s by two separate series of events. One, the debate-confrontation, developed out of a challenge for research to be more relevant to national aims. The debate-confrontation, as reviewed below, included a great deal of stock taking on the part of the scientific community. The institutional-administrative developments are less visible although they are crucial for the accommodation of national science policy. These developments are identifiable by their proximity and accessibility to the decision and policy making centre of the Cabinet, Treasury Board Secretariat(TBS) and the Privy Council Office(PCO). These two series of events complemented and reinforced the gradual accommodation of national science policy in Canada. The debate-confrontation will be reviewed in this section and the institutional-administrative events will be dealt with in the fourth section.

1. The Perception of Science and Research in Canada

Historically, science and research in Canada tended to

be isolated and encapsulated, and attached to the public bureaucracy or supported through public bodies or agencies. In a study of the history of technology in Canada J.J. Brown concluded that the encouragement and protection of new invention and technological advancements has been almost non-existent since Confederation.(1) As observed by P. Aucoin and R. French, science and research in Canada "have had neither a major military-industrial-scientific complex to accommodate nor prestigious missions to accomplish."(2) They "seldom generated first order demands on the political system."(3) This is interesting given the importance of science, research and technological advancement to the development of Canada and perplexing given the importance of transportation, communications, agriculture, industry, public health, education, et cetera to Canadian society. Science and research were crucial but did not evolve political roles.(4)

An examination of the 1950s and 1960s debates of the House of Commons shows no interest in science and research from the national science policy perspective, i.e. the general discussion about the role and use of research and technology to secure national goals. Discussion tended to take a case-by-case approach in which responsibilities were delegated to other bodies or agencies, e.g. Canada Council for the arts and social sciences, the Medical Research

Council for medical research and Atomic Energy of Canada Limited for nuclear power research and development. To complement this the popular knowledge and political interest in science and research was non-existent.(5)

What is striking about the period from the late 1950s to the early 1960s and peculiar given the interest and attention directed to national science policy since 1963, is the lack of any demands for a comprehensive and coherent approach for science and research from either administrative or political points of view.

2. The Science Council of Canada

The Science Council of Canada(SCC) was attached to the Science Secretariat from 1966 to 1968. This period served to set the basic orientation of the body so it could promote the national science policy perspective. As pressures and controversies grew it was driven away from the executive decision and policy making arena thus giving way to the debate-confrontation.

The Science Council of Canada started to sensitize the Canadian scientific research community to the national science policy perspective. The SCC attempted to pull the diffuse scientific research community into distinctive groups by promoting the setting of goals, the distributing of resources and the working of the scientific research

community within the larger framework of national goals.

The strong national science policy perspective that the SCC adopted was outlined by Prime Minister Lester B. Pearson at the inaugural meeting, July 1966.(6) As stressed by Pearson, the SCC was to promote the first tenet of the national science policy concept. Research should be directed into areas of policy activity "such as water resources and water pollution; transportation; urban planning and development; automation and employment; public health; .../and/... poverty."(7) Drawing attention to these areas for research became the controlling aim for the SCC.

The first publication following the separation of the Science Secretariat was Towards a Science Policy for Canada.(8) It promoted national science policy thinking. Six very general national goals(9) were followed by twelve more specific research goals:

Main Problems
1) satellite communication systems
2) water resources management and development

Immediate Planning Areas
4) transportation
5) urban development
6) scientific and technological aid to developing areas

Areas of Continuing Consideration
7) health care delivery systems
8) northern economic development
9) energy development
10) resource management
11) oceanography, marine and undersea technology
12) weather prediction, modification and control (10)

This is a subjecive and very political prescription for the support of science and research. It is, in fact, only within the political process that this type of agenda and priority setting can take place. This report, rather than being acted upon by the government, became somewhat of a focal point for debate-confrontation.

The role of promotion is exemplified by the publications of the SCC. There are two principal formats of publication supplemented by two secondary periodical publications. First, the SCC publishes contracted studies of individuals(11), teams(12) and of research associations(13). These are released in a 'Background Study' format.(14) Second, official or 'corrected' SCC versions are released as a 'Report'. These two publications are supplemented by a third periodical, Issues in Canadian Science Policy, containing topical commentary articles, and a fourth, Thoughts, an internal publication of the SCC.

The 'background studies' and the 'reports' are the more important. They are of greater concern to the particular science research groups represented than to either the

scientific research community in general or to the government. Generally, the thrust of these particular 'background studies' is for the greater support of research in the area under examination. It is put into the larger national context. And, along with the 'corrected' SCC report, the stress in on limited resources, national relevance and governmental priorities. These publications attempt to sensitize the scientific research community and promote the national science policy perspective.

In an important albeit secondary way the SCC has supported administrative developments. This was accomplished mainly through the collection and analysis of information in response to inquiries from the Privy Council Committee on Scientific and Industrial Research and the Science Secretariat. Therefore, as well as playing a primary role in the debate-confrontation, the SCC supported institutional-administrative developments.

These administrative studies form a distinctive group in contrast to the research area studies mentioned above. They form a coherent collection when examined from that national science policy perspective(Table I). This selection of studies was compiled by classifying those studies of the SCC, excluding the research area studies, under the headings suggested by the components of the national science policy concept: National Goals; Science, Research and Technological

TABLE I
CLASSIFICATION OF NATIONAL SCIENCE POLICY
STUDIES OF THE SCIENCE COUNCIL OF CANADA

National Goals	Science, Research, Technology and Innovation	Education and Manpower	Information and Research Institutions
1968 -Science Council of Canada, Towards a National Science Policy for Canada, Report No. 4 (October 1968).			
1969		-R.W. Jackson, D.W. Henderson and B. Leung, Background Studies in Science Policy: Projections of R&D Expenditures, Background Study No. 6 (1969).	-J.P.I. Tyas, Scientific and Technical Information in Canada, Background Study No. 8 (1969).
1970	-A.H. Wilson, Background to Invention, Background Study No. 11 (1970)		
1971	-Science Council of Canada, Innovation in a Cold Climate: The Dilemma of Canadian Manufacturing, Report No. 15 (October 1971)	-Frank Kelly, Prospects for Scientists and Engineers in Canada, Background Study No. 20 (March 1971)	-A.H. Wilson, Research Councils in the Provinces: A Canadian Resource, Background Study No. 19 (June 1971)
1972	-P.L. Bourgault, Innovation and the Structure of Canadian Industry, Background Study No. 23 (October 1972).		-SCITEC and A.S. [illegible], National Engineering, Scientific and Technological Societies of Canada, Background Study No. 25.

National Goals	Science, Research, Technology and Innovation	Education and Manpower	Information and Research Institutions
1973	-A.H. Wilson, *Governments and Innovation*, Background Study No. 26 (April 1973).	-A.D. Boyd and A.C. Cross, *Education and Jobs: Career patterns among selected Canadian science graduates with international comparisons*, Background Study No. 28 (June 1973).	
1975	-A.D. Boyd and A.H. Wilson, *Technology Transfer in Construction*, Background Study No. 32 (January 1975).		
1976 -R.W. Jackson, *Human Goals and Science Policy*, Background Study No. 38 (October 1976).	-A.J. Cordell and J.M. Gilmore, *The Role and Function of Government Laboratories and and the Transfer of Technology to the Manufacturing Sector*, Background Study No. 35 (April 1976).		

Innovation; Education and Manpower; Information, Communications and Research Institutions.

There is only one statement of general goals, Towards a National Science Policy for Canada. This served to direct the research area studies and formed the starting point of the administrative studies. It was published in the official 'Report' format and, interestingly, was followed over eight years later by a 'Background Study', Human Goals and Science Policy.(15)

The bulk of these administrative studies were released in the less official format as background studies. The notable exception was Innovation in a Cold Climate(16) which followed Background to Innovation.(17) The other distinguishing characteristic of this collection of studies is that the majority of them can be classified as internal reports prepared exclusively by the SCC staff, notabley R.W. Jackson, A.H. Wilson and A.P. Boyd. This selection is a coherent expression of the national science policy concept and indicates the underlying orientation of the SCC.

There are two key points that should be kept in mind with reference to national science policy and the SCC. First, the emphasis by the SCC was put on research into broad policy areas and not in discipline research per se. Second, the SCC was in a position to discuss national goals and research with various segments of the scientific

research communiity thereby giving prominence to national science policy thinking. The SCC attempted to sensitize and promote national science policy by pulling the diffuse scientific research community together and presenting them as coherent, distinctive entities with roles in national initiatives.

3. The Senate Special Committee on Science Policy

The national science policy perspective was further promoted by the efforts of the Senate Special Committee on Science Policy(SCSP).(18) The proceedings intensified the debate-confrotation and politicized the scientific research community. The SCSP was also responsible for the development of much information on the structure of the Canadian scientific research establishment and for developing a comprehensive overview of the total scientific effort. The SCC also played a role in this by doing information and administrative studies.(19) This work reinforced the institutional-administrative activities. However, since the SCSP had no formal role or linkage with the executive decision making arena, it is classified as a component of the debate-confrontation.

The formal motion for the SCSP called for an investigation of federal research and development

expenditures, activities, assistance and requirements.(20) The first step was to secure a clear overview of the allocation of resources. This is of prime importance as far as decision and policy making is concerned. The next step would be to make this information part of the budgetary process which would move the consideration of the distribution of science and research resources into the executive and political arena. When the SCSP started work it found little information available; the SCSP became a prime mover in the development of such data and in the promotion of national science policy thinking.

The Committee proceedings were significant in focusing the attention of the scientific research community and establishment on the limited resources available and the need for greater relevancy of research efforts to national aims.(21) The hearings stimulated a great deal of internal stock taking on the part of the research community(22) and resulted in a distinctive albeit pluralistic image of the community.

The Committee proceedings, no less that the SCSP reports, generated neither public visibility nor wide political controversy.(23) This extremely low public, political profile was partly a result of the SCSP being a committee of the Senate and partly a result of the lack of cohesiveness of the scientific research community, i.e. they

did not appear as a political entity. Also, the proceedings were spread over a decade and could not be fitted into any of the day to day topical concerns or political intrigues covered by the popular media.

The Committee hearings, however, were a pointed and selected debate with the diffuse scientific research community. And, given the strong commitment to the national science policy view by the SCSP, it is tenable to suggest that the SCSP gave greater legitimacy to that perspective and forced the scientific research community to conform to that framework by stressing the allocation of resources in relation to securing national aims. The Committee hearings were a direct confrontation in which the Canadian scientific research community and establishment was required to review and explain their organization, support and contributions.

The desire for a more distinctive collective science and research community was expressed by the committee hearings and resulted in the formation in 1970 of the Association of the Scientific, Engineering and Technical Community of Canada(SCITEC). SCITEC has attempted to form itself into an 'umbrella' organization representing and promoting the collective interests of the scientific research community.(24)

There are some other indicators of the pressures of the

debate-confrontation. The periodical Science Forum(25) was established in 1968 to deal with topics on science, research and government science policy.(26) This was complimented by the formation of the Canadian Science Writer's Association.(27) There were papers given at the meetings of the Royal Society of Canada(28) as well as public symposiums like the one held in Toronto in 1969.(29) It was sponsored by the Canadian Institute of Public Affairs and the Canadian Broadcasting Corporation. Present at this were the principal proponents of the debate-confrontation: Dr. O.M. Solandt and Dr. I McTaggart-Cowan of the SCC; Senators M. Lamontagne and Grosart of the SCSP; and C.M. Drury.

This part of the paper argues that from the mid-1960s to the mid-1970s a debate-confrontation took place. It was initiated by the SCC and intensified through the SCSP. The activities of the debate-confrontation attempted to: better delineate the scientific research community and establishsment; promote an awareness within the scientific research community of their role as defined by the national science policy; form more politically active groupings within the scientific research community; increase governmental and political interest in science and research; and secure greater resources for science and research. The core of the debate-confrontation was

the issue of reconciling the objectivity and independence of science with the responsibility of government. The disparity of views has been leading towards a deadlock in which the politician and the administrator want a system in which they can direct science to practical ends by control of the purse strings, and the scientists want the purse held open without strings. (30)

IV

THE INSTITUTIONAL-ADMINISTRATIVE DEVELOPMENTS: 1966-74

The underlying developments from the mid-1960s to the mid-1970s show the incorporation of national science policy approach into the regular institutional structures and administrative procedures. The institutional-administrative developments are identified with the executive decision and policy making arena of the Cabinet, the Treasury Board Secretariat(TBS) and the Privy Council Office(PCO) and with the administrative procedures specializing the review and analysis of science and research resource distribution.

1. The Administration of Science and Research

The general support of science and research in Canada is directly through governmental departments, agencies, and royal commissions, and indirectly through governmental granting bodies. Science and research tended to be internally regulated but not totally impervious to governmental control and political direction.(1)

The National Research Council, created in 1917, supports an extensive array of laboratories as well as distributing

university research monies through a peer group assessment system.(2) During the late 1950s and early 1960s support for the arts, human and social science research support became selective with the establishment of Canada Council. Medical research support became specialized with the establishment of the Medical Research Council in 1960. More direct research programmes were supported through the Defence Research Board.(3) Other programmes, such as nuclear energy(4) had specialized support through particular bodies and policy initiatives. For example, in nuclear research the crown corporations of Atomic Energy of Canada Limited, Eldorado Mines Limited along with a regulatory body, the Atomic Energy Control Board, were established. Most areas of science and research, therefore, were subject to varying degrees of governmental direction and political influence.

In keeping with this diverse administrative approach that had developed since 1867, the support of science and research in the late 1950s and early 1960s included numerous subsidy and tax incentive programmes(Table II).(5) It is seen by the nature of the programmes that the support of research was selective in particular areas. On a wider scope there were the 1961 and the 1962-66 tax incentives for

TABLE 11

EXAMPLES OF INDUSTRIAL ASSIST[illegible] PROGRAMMES

Defence Development Sharing Program(DDSP)
- -established 1959
- -to sustain technological capability in the Canadin defence industry
- -established to support defence production sharing agreements made between Canada and U.S. in 1958
- -costs are shared by Department of Industry, Trade and Commerce, the Canadian firm concerned, the U.S. government and possibly other NATO countries
- -primarily in electronics and aerospace industries

Industrial Research Assistance Program(IRAP)
- -established 1961-76
- -financed and administered by the National Research Council
- -civilian counterpart of the Defence Industrial Research Program
- -covered salaries of scientific and technical staff hired by a firm in order to undertake an authorized project

Defence Industrial Research Program(DIR)
- -established 1961-75
- -improve applied research ability of Canadian firms working in the defence field
- -support may exceed 50%(but only for one year) under the following conditions:
  - (a) high defence risk
  - (b) high technical risk
  - (c) small firm attempting to enter research field
  - (d) financial stress caused by factors outside the control of the firm

Tax Amendment-Section 72
- -established 1960
- -allowed a 100% deduction of capital expenditure for scientific activities (prior to 1960 only 33 1/3% was allowed

Tax Amendment-Section 72(A)
- -established from 1962 to 1967
- -allowed firms to deduct an additional 50% with respect to the increment of expenditures on scientific activities over the base year of 1961

Automotive Adjustment Assistance Program(AAA)
- -established 1965
- -to encourage automotive producers to expand and to become more efficient
- -loans may extent up to twenty years

[illegible] of the Government of Canada (cont'd)
-established 1965, reduced 1976
-assistance mainly in engineering development projects involving risk capital
-companies may claim costs incurred under PAIT projects under Section 72 of Income Tax Act
-under certain conditions, costs incurred under PAIT may be included in applying for a grant under IRDIA
-if the project was commercially successful the firm had to repay loan with interest (eliminated in 1970)
-civilian counterpart of DDSP

Industrial Research and Development Incentives Act(IRDIA)
-established 1967
-replace the special incentive for R&D, Section 72(A)
-grants equal 25% of capital expenditures and 25% of the increase in eligible current expenditures in a base period of the five immediately preceding years
-amendments made in 1970

Defence Industry Productivity Program(DIP)
-established 1965, reduced 1976
-to develop and sustain technological capability of Canada industry for defence and/or civilian export sales
-closely affiliated with other defence programs
-combines former Industry Modernization for Defence Experts Pro and the DDSP

Machinery Program(MACH)
-established 1968
-to increase Canadian industrial efficiency by enabling machinery user to acquire advanced equipment at the lowest possible price
-arose from the Kennedy Round talks
-duty remissions are 15% for most favoured nation and 2.5% for British preference

Building Equipment, Accessories and Material Program(BEAM)
-to increase productivity and efficiency in construction industry

Industrial Design Assistance Program(IDAP)
-to improve the quality of product design and to attract and retain industrial design talent

Pharmaceutical Industry Development Assistance(PIDA)
-direct loans at commercial interest rates
-firms are encouraged to form corporate units that are able to employ competent personnel, perform suitable R&D

Program to Enhance Productivity(PEP)
-to improve productivity in manufacturing and processing industries through efficiency projects

Source: Gilles Paquet, "Taxation and Science Policy," Canadian Tax Journal 19(September-October, 1971), 422 [illegible]

industrial research.(6) The former aimed at creating industrial laboratories and the latter focused on increasing current and capital expenditures on industrial reseach. These, along with the other administrative approaches mentioned above, were in line with the view that the administrative approach for science and research should be diverse, segmented and more or less self-regulating.

There is little indication of the national science policy administrative approach prior to 1964.(7) There was no effort establishing direct and specialized linkages of science and research to the ongoing policy initiatives or administrative demands to know precisely how science and research resources were being allocated or to administratively tie them to policy initiatives. It should be kept in mind that there existed neither the administrative information on the structure of the Canadian scientific research establishment nor the administrative data on the distribution of research resources by which this approach could be executed. There did not exist central executive concerns for analysis and advice on the distribution of research resources.

2. National Science Policy Administration

Important for an effective national science policy administraive approach is appropriate information on the structure of the scientific research establishment and suitable data on the allocation of science and research resources. The Science Council of Canada, the Senate Special Committee on Science Policy, along with support of Statistics Canada and the Directorate for Scientific Affairs(DSA) of the OECD, were responsible for collecting and developing some of this information and data.

The role of the SCSP is exemplified by the January 1969 memoradum that Senator Maurice Lamontagne sent to Statistics Canada on "The Measurement of Research in the Social Sciences."(8) A year later Statistics Canada released a working paper on "Surveying the Social Sciences: A General Program." Since then there has been the regular collection and publication of data on the human and social sciences that is more compatible with decision and policy making. This specialization of data on research resource allocation took place in the natural sciences also.(9)

This background information and data followed rather than preceded the creation of institutional bodies that were

intended to apply it. To some extent the creation of bodies such as the Science Secretariat created administrative impasse and gaps which stimulated demands for more sophisticated data.

At the confrontation meeting in 1968 with the Directorate for Scientific Affairs(DSA) of the OECD the Canadian government acknowledged that the basic principles inherent in the structural recommendations of the DSA report(10) were similar to what existed in practice and to what was developing. C.M. Drury stated there existed a 'Minister of Science' in himself, assisted by a 'central scientific secretariat' (the Science Secretariat). There was a cabinet committee chaired by himself(the Privy Council Committee for Scientific and Industrial Research), although it had not been extensively used. A general 'science policy council' as suggested by the DSA was created in the form of the Science Council of Canada in 1966, although following 1968 it was not formally linked to the executive decision and policy making arena as proposed by the DSA. The intent to accommodate the national science policy approach was there.

An early example of an attempt to put national science policy into practice is found in the creation of the International Development Research Centre(IDRC) and its relationship to the Canadian International Development Agency(CIDA). In 1971 IDRC was created to supply resources(financial and administrative) for research into problems within the developing regions of the world and to assist those regions to build up their own research capabilities. The IDRC is a specific support body to CIDA specializing in developing research projects in risky areas, in managing some of the CIDA grants for agricultural research and in passing on to CIDA proposals for proven technology projects.(11) Therefore, IDRC is a distinctive body administrating scientific research in the general policy area of foreign aid.

The establishment of the Ministry of State for Science and Technology(MOSST) was a major institutional-administrative development following the Science Secretariat. MOSST was an administrative body

close to the central decision and policy making arena.(12) It was designated to offer analysis and advice on the distribution of science and research resources within the framework of governmental policy initiatives. Within six months MOSST had its Make-or-Buy(MOB) policy accepted by the Cabinet.(13) MOSST was directed by the Cabinet to evaluate MOB as it was carried out by the department of Supply and Services. This would further specialize the administration and consideration of science and research within the government since each department would be required to review their science and research activities and decide which projects could be done by the private sector.

The development of MOSST appears disjointed and tenuous with five ministers since 1971(14), a major reorganization in 1975/76 and numerous discouraging assessments.(15) However, the underlying approach and the thrust of MOSST pursued the accommodation of the national science policy administrative approach.

The first secretary in 1971, Dr. Aurele Beaulnes stated that the prime interest of MOSST would be in "presenting a more logical program for the furture, to go from the present total budget to something more relevant to the needs of

Canada."(16) In 1973 the Assistant Secretary of the Program Review and Assessment Branch, B.M. McGugan, indicated that MOSST was "convinced that a Science Budget Information System could be integrated into the present budgetary process without over loading it."(17) As of October 1974 the Cabinet decided that the Program Review Branch of MOSST should have a closer working relationship with the Treasury Board. This would involve the early screening of the estimates for science and research with the forecasts(18). Work was progressing on the development of a science and research budgetary handbook compatible with the main federal budgetary activities.

In line with this the Program Review Branch was developing a computer program by which to assess proposed science and research programs according to a host of stipulated policy and political criteria. The following were some of the criteria:

1) the broad national goals established by the government(aid to developing countries)

2) the national goals modified from the Science Council's ranking(Towards a National Science Policy for Canada)

3) the specific (or political) goals of the government(northern development, energy conservation)

4) the goals of particular programs(northern ocean technology)

5) goals related to industrial development (19)

These have been developed further and used in the "1976/77 Program Forecasts and subsequent Main Estimates".(20)

MOSST was reorganized during 1975/76 under the direction of Dr. Maurice LeClair following the May 1975 Cabinet acceptance of a basic definition of science policy.(21) The three general objectives for MOSST, as indicated by LeClair, directly refleced this definition. MOSST was to develop policies and advise on:(i) the support of science and technology; (ii) the application of science and technology to national issues; and (iii) to encourage the use of scientific and technological knowledge in the formulation and development of public policy.(22)

MOSST attempted to supply a comprehensive overview of governmental allocations within the budgetary process.(23)

MOSST slowly moved into this area but, as explained to the SCSP by the Assistant Secretary of the Government Branch of MOSST, D.B. Dewar, the TBS receives the program estimates and copies of the science and research submissions are immediately sent to MOSST.(24) These are studied by both the TBS and MOSST at the same time. Analysis and advice are made available to the Minister of MOSST and to the TBS by the time the estimates reach the Cabinet. MOSST is able to secure the data on the distribution of resources when the program forecasts are submitted twelve months before the beginning of the fiscal year. However, as negotiation begins between the TBS and various governmental departments and agencies, MOSST cannot keep track of changes. And when the estimate decisions are made MOSST has just an approximation of the distribution. It is difficult to assess the impact of MOSST given this administrative procedure, the short time these procedures have been in practice and the lack of information on the actual involvement of MOSST.

In 1976 the Minister of MOSST, J.Hugh Faulkner, stated that MOSST may eventually act as "a sort of science arbiter over such difficult matters as energy, food and capitial

consumption and future growth . . .[and] the ministry will be given the task of defining the best options for government."(25) It was suggested that the "Ministry is about to come into its own with deeper involvement in decision-making."(26) In response to a question as to the 'clout' of MOSST, Faulkner told the SCSP that MOSST did not possess so much 'institutionalized muscle' as the TBS exercised whether intelligent or not.(27) MOSST has influence in relation to information, communication and credible, effective advice. Moreover, the flow of information and the relations between the TBS and MOSST is good in light of the fact that the past Secreary of MOSST, Maurice LeClair, is the Secretary of the TBS. All of this does not preclude MOSST from being disbanded or from becoming part of the TBS. Nevertheless, it must be stressed that science and research have become specialized administrative aspects in the distribution of resources.

What is significant about the institutitonal-administrative developments from 1966 to the mid-1970s is that science and research became administratively more distinctive. The growth of basic information and data on the distribution of resources has

specialized the consideration of science and research in the policy process. These institutional developments reflect the national science policy concept, however, concern and attention about the distribution of resources was still lacking.

V

CONVERGENCE: 1974-77

> The development and use of technology is also essential to the Governments's approach to increasing national economic productions. Steps will be taken to obtain greater returns from industrial research and development as well as technological innovation in Canada.
>
> Scientific knowledge and its application is a keystone to meeting the challenges facing Canada, including those in the areas of food, energy or industrial development. The objective of the Governments's science policy is the rational generation and acquisition of scientific knowledge and the planned use of science and technology in support of national goals. The Ministry of State for Science and Technology will be developing national and co-ordinating authority within the Government. Two new graning councils will be formed, one for social science and humanities and the other for natural sciences. (1)

The 1974 Throne Speech acknowledged the importance of science and research to the economic and social condition of the country. The government stated it was going to restructure the science and research support bodies in order to better realize this. The 1974 Throne Speech marked the convergence of the debate-confrontation and the institutional-administrative developments beginning the accommodation of national science policy into the political and decision making process.

The first impact was to direct the attention of the scientific research community, engaged in the debate-confrontation, to the more immediate political arena of the House of Commons. For almost ten years, since the creation of the SCC in 1966 and the SCSP in 1968, the focus of the debate-confrontation was on the reports and proceedings of these two bodies.

The second and related impact of the 1974 Throne Speech was to draw the attention, albeit in a very limited but growing sense, of the Members of Parliament to science policy. Interest and attention from the national science policy perspective had not been pursued—or allowed—within the debates of the House of Commons. The Throne Speech gave the first formal governmental acknowledgement of science policy as a general area of concern open for debate within the House of Commons.

1. Government Delineation of Science Policy

The growing prominence of the national science policy approach was further reinforced in May 1975 by the formal formulation and Cabinet acceptance of a definition of science policy. This was immediately followed by the June 1975(2) debate in the House of Commons on science policy and by the administrative reorganization of MOSST.

The public statements concerning the official thinking on science policy were given by C.M. Drury in the June debate and in an article by Drury published in Science Forum—"How the Federal Government Views Questions on Science and Public Policy."(3)

First, this delineation states that the federal view of science policy is not a "single all-embracing" policy or a "single grand plan."(4) What does exist, however, are "numerous policies for the use of science and technology in relation to the objectives of federal departments and agencies and also in relation to the objectives of the private sector."(5) Therefore, falling within the national science policy concept, this definition asserts that science policy is a supportive administrative activity utilizing science and research to obtain national goals. The statement also contains another national science policy assertion "that a strong national capability in science is basic to an improved quality of life and a strong economy."(6) Moreover, the view of scientific research changed "from unselective support of all science to a more planned application of science in the achievement of specific objectives."(7) In effect "the emphasis should be on dedicating a greater share of Canada's already significant scientific potential to the solution of national problems."(8) The essence of this approach is that science

is a means of achieving social, economic and cultural objectives.

It was also stressed that the objectives of the government were found in the mandates of the various departments and agencies. This forms a basis "for the development of programs and the allocation of resources."(9)

Science policy as defined by the federal government consists of three sub-policy areas:

> —Policy for the support of science: the acquistion of knowledge, the development of research capability, the provision of scientifically trained manpower, and the dissemination of scientific information.
>
> —Policy for the application of scientific and technoligical resources: the wise, economic, and co-ordinated use of scientific knowledge, manpower, and facilities.
>
> —Science in public policy: the introduction of scientific knowldege, reasoning, and methodology into the development of public policy at the strategic level. (10)

This general outline appears to cover all aspects of the national science policy concept by presenting science and research somewhat collectively(11) and by emphasizing the planning, application and utilization of scientific communications.(12)

2. Science Policy and the House of Commons

Since 1974 there were many activities and developments in the House of Commons indicating the growing acceptance of

the national science policy view: two full day debates on science policy; the formation of a group of members from the House of Commons interested in science, research and technology; the proposal by the sub-committee of Procedure and Organization to collect science and research areas into two House standing committees; the creation of the informal Parliamentary and Scientific Committee(PASC); and the lobbying by the scientific research community of MPS, to mention the most prominent. These will be reviewed below.

The two full day debates in the House of Commons, both motions of the Progressive Conservative Party, took place on June 9th, 1975 and May 17th, 1976.(13) These were the first debates on science policy per se in the Commons. They are noteworthy because they will set the tone and orientation for future debates by members and statements by government.

The debates on both these occasions did revolve around the national science policy concept in relation to: an identification of goals for science and research within policy initiatives; a utilitarian view of science and research as a policy tool; science and research as supportive and integral components of policy needing administration; and a positive relationship between the selective allocation of science and research resources and economic development. There were demands for the greater

relevance of science and research to national aims and a desire for the stonger direction of research to policy priorities.

These debates are important since they were the first attempts by the House of Commons to use the information available on the Canadian scientific research establishment and data on the allocation of science and research resources. To some extent these debates were a response to pressures from the scientific research community about the shortages of funds and an indication of what has been termed an 'emergent national policy' or industrial strategy as suggested by Donald V. Smiley.(14)

A direct linkage between the debate-confrontation and the House of Commons is seen in the establishment of the Parliamentary and Scientific Committee(PASC).(15) This is an informal collection of members from both the Senate and the House of Commons as well as representatives from SCC, SCITEC and the scientific research community at large. The two trial meetings, in November 1976 and February 1977, were on a 'Nuclear Option for Canada' and on 'Renewable Energy Resources'. The emphasis is clearly on the role of science and research in broad policy initiatives. The PASC took on a more official form in May 1977(see Table III). The formation of this group and the attention of MPs indicates

TABLE III

PARLIAMENTARY AND SCIENTIC COMMITTEE
MARCH 19, 1977

President	Maurice Lamontagne, Senator and Chairman of the SCSP.
Vice Presidents	Allister H.G. Grosart, Senator and Chairman of the Steering Committee of the SCSP.
	Bill Kempling, Member of Parliament and science policy critic for the Conservative Party.
	Max Saltsman, Member of Parliament(NDP)
	Dr. Larkin Kerwin, FRSC.
	Dr. Peter A. Forsyth, FRSC.
	Dr. Josef Kates, Chairman of the Science Council of Canada.
Chairman	Dr. Frank Maine, Member of Parliament(Liberal
Vice Chairman	Dr. Harvie Andre, Member of Parliament (Conservative).
Deputy Chairmen	Ross Milne, Member of Parliament.
	Henry Hicks, Senator.
Honorary Treasurer	John Godfrey, Senator.
Honorary Secretaries	Dr. Hugh R. Wynne-Edwards,* FRSC
	Dr. Maurice Foster, Member of Parliament.
Secretary	John Y. Harcourt, Executive Director of SCITEC

*In September 1977 Dr. Wynne-Edwards was appointed as Assistant Secretary of the University Branch of MOSST.

an interest which did not exist so visibly before.

Of special note is the lobbying by various segments of the scientific research community.(16) This appears to be a result of the debate-confrontation and, of course, the shortages of resources.

There were two-day lobbies in March 1976, December 1976 and April 1977. They were organized and initiated by the Canadian Federation of Biological Societies.(17) Various other science and research groups have joined in this. At the second and third the following organizations were represented:

Canadian Association of Physicists
Canadian Association of University Teachers
Canadian Federation of Biological Societies
Canadian Society for Civil Engineering
Canadian Society for Clinical Investigation
Canadian Society of Mechanical Ingineering
Chemical Institute of Canada
Humanities Research Council of Canada
Social Science Research Council of Canada
SCITEC

These lobbies were organized to impress the MPs with the needs of the Canadian scientific research community. The three basic demands were:

1. The development of national policies for continuity and stability in the support of research.

2. The immediate restoration of 1970-71 levels of research funding as a minimum level for the survival of Canada's research capability.

3. Regular consultation with the organized scientific community on federal research funding policies and priorities. (18)

These clearly reflect national science policy thinking by stressing the need to set national priorities, allocating and increasing research funds, and managing or directing science and research to pursue national policies or priorities. This suggests that the message of the debate-confrontation had been picked up by the scientific research community and is being transfered to the more immediate political arena of the House of Commons.

In September 1976, just following the second debate in the House of Commons on science policy, a Commons sub-committee on Procedure and Organization proposed collecting budgetary areas relating to science and research expenditures by concentrating them in two new committees: the Renewable Resources, Forestry and Fishing committee and the Science, Environment, Energy and National Resource committee.(19) If accepted, this would bring scientific research more sharply into focus in the Commons and would accommodate some of the estimate categories being evolved

though MOSST and the TBS.

3. Institutional-Administrative Adjustments

In September 1976 the Canadian Committee on Financing University Research(CFUR) was established. In order to improve the consultation and collaboration among universities, provincial governments and the Federal government the CFUR is to develop recommendations on programs and policies for science and research. The composition will by thus: the chairman will be the Minister of MOSST; the three heads of the federal granting councils plus six others will also represent the federal government; the provincial representatives will be the deputy ministers responsible for universities; the university presidents and representatives of the university commissions and councils. The general aim is to have the financing of research more clearly reflect the needs of the universities, the scientific research community and, more notably, the priorities of the federal and provincial governments.

The Science Activities Act(SAA) was introduced in the House of Commons December 2nd, 1976 and passed June 29th, 1977.(20) The bill has a wide scope although the impact can only be assessed following its operation. It does affect all the major federal granting structures: Canada Council,

the National Research Council(NRC), the Medical Research Council as well as Canadian Patents and Development Limited, the Defence Research Board and the Science Council of Canada(SCC).

First, the bill proposes the creation of a 'social sciences and humanities research council' and a 'natural sciences and engineering research council'. The former will leave Canada Council free to focus on the arts and "reflects the growth in size and quality of the social sciences and humanities in this country and the new perception of their importance to the attack on socioeconomic problems, to national sovereignty, and to out cultural development."(21)

The latter council would split the granting responsibility from the research function of the NCR. The mandate of the Medical Research Coulcil will be expanded "to remove the restiction preventing its support of research in the public health field."(22) Moreover, a co-ordinating function is to be fulfilled by the Secretary of MOSST and reporting to the Minister of MOSST. The council "will have an advisory and co-ordinating role rather than a directive role."(23) Therefore, it will serve not to overrule the particular granting bodies, but to help harmonize:

> It will also make recommendations to [the Minister of MOSST] on the balance between the budgets of the councils, recognizing of course the responsibility of individual ministers for the budget and administration of each council.(24)

The SAA would also move the responsibility of the Canadian Patents and Development Limited from NRC to Industry, Trade and Commerce and replace it with an advisory council on defence research reporting to the Minister of Defence; and broaden the scope of the SCC to have it play a public information role.(25)

Many of the proposed changes in the SAA followed rather than preceded many of the administrative changes. They were reflected to a large extent in the data on science and research resource allocations, the 1975/76 reorganization of MOSST, the science and research budgetary procedures, the de-emphasis of the Defence Research Board and the National Research Council and in the creation of the CFUR.

In the context of this analyasis the SAA reveals a convergence of the debate-confrontation and the institutional-administrative events. The shift of the debate-confrontation to the Commons and the introduction of the SAA brought the two series of developments closer together to further accommodate national science policy.

In line with the continuing administrative adjustments the government has introduced legislation to alter nuclear

regulation, research and support.(26) This bill proposed to replace the Atomic Energy Control Board(AECB) with a 'Nuclear Control Board'. It will shift research, development and commercial promotion to the Department of Energy, Mines and Resources and designates the new board to regulate licences for any nuclear operations and facilities,i.e. nuclear reactors, uranium and thorium mine operations, heavy water plants and nuclear waste management. The Nuclear Control Board would hold public meetings, distribute information as well as conduct inspections of operations involving nuclear materials. This board would report to the House of Commons through MOSST.

The developments reviewed in this section of the paper attempt to show the convergence of the debate-confrontation and the institutional-administrative events. They reveal an interesting pattern showing the beginning of the distinctive identification of science and research as integral components of policy both administratively and politically, a growing acceptance of the national science policy perspective and a specialized administration of science and research. Science policy is seen more and more as an area of general interest, discusssion, debate and for administration. The institutional-administative adjustments

reveal attempts to establish within the decision and policy making arena appropriate administrative procedures by which to activate the national science policy administrative approach.

The activties prior to the 1974 Throne Speech consisted of a closed discussion within the scientific research community, a study of the scientific research establishment and a development of administrative tools and procedures for the accommodation of national science policy. Following 1974 there appears a gradual shift of attention for the debate-confrontation from the SCC and the SCSP to the House of Commons. By this it appears that the national science policy perspective gained greater credibility within the scientitic research community, burearcratic and political circles. It has been identified with an 'industrial strategy' to some degree by the House of Commons. With the debates in the House of Commons, the introduction of the SAA and other administrative developments the two series of activities appear to be moving closer together.

VI

CONCLUSIONS

1. National Science Policy as the Policy Process

The components of the national science policy concept—the need for setting goals, the positive relationship stipulated between the allocation of research resources and the attaining of policy goals, the role of education and technical manpower policies, and the linking of research to policy goals—are readily identifiable in the events and developments of this period. The national science policy concept is consistent with the underlying themes and thrusts of the Glassco and Mackenzie reports, of the Ministry of State for Science and Technology(MOSST), the Cabinet definition of federal science policy, the reorganization of MOSST, the nature of science policy debates in the House of Commons and the intent of the Science Activities Act(SAA). These activities and developments emphasized different components of the national science policy concept. The Science Council of Canada(SCC) dealt more with the setting of national science policy goals behind broad policy initiatives of interest to the government. The Senate

Special Committee on Science Policy(SCSP) dealt more with presenting the national science policy concept stressing the allocation of resources. And MOSST dealt more with linking research to national aims administratively.

The national science policy concept has not undergone extensive revision although giving the appearance of undergoing extensive critical analysis by the work of the SCC and the SCSP. This has affected neither the form nor the nature of the national science policy concept as it was originally conceived. The components of the national science policy concept created and defined each other giving the activities a structure, a form and impetus that was impervious to critical analysis. Once the components were identified and suggested relationships were accepted, they became the underlying structure that supported the more visible developments directing both the debate-confrontation and the institutional-administrative events. The national science policy concept was the process.

2. Summary

This paper has focused on some of the changes in attitudes toward and the administration of science and research in Canada during the past fifteen years. A basic

definition of the national science policy concept was given first followed by a review of the relevant activities and developments in Canada. A distinction was made between two very different but mutually reinforcing series of developments: the debate-confrontation and the institutional-administrative.

The activities of the debate-confrontation, reinforced by the institutional-administrative events, are responsible for the wider acceptance of the national science policy perspective. This took place wherever science and research became persistent areas of interest, discussion, debate and study from a policy and political point of view. In turn, the national science policy administrative approach became established through the institutional-administrative developments, reinforced by the debate-confrontation. This was followed by the convergence but not the total integration of the two series of developments

Debate-Confrontation: The national science policy concept gained visibility through the reports of J.C. Glassco and Dr. C.J. Mackenzie. They launched contemporary interest in the national science policy concept by proposing that science and research should be distinctive and integral components of policy. The creation of the Science

Secretariat gave a degree of credibility to the national science policy concept and marked tacit governmental acceptance of it.

The preliminary but very tenuous involvement of the Science Secretariat in numerous research policy decisions sparked controversies in such cases as the Churchill Range for Upper Atmosphere Research, the Queen Elizabeth II Telescope, the High Altitude Research Project, the Intense Neutron Generator project and the Tri-Universities Meson Facility. As controversies intensified a division developed between the Science Secretariat, which pursued more concrete administrative developments, and the Science Council of Canada, which focused its efforts on aspects of the debate-confrontation.

The intensified controversy and the growing interest in national science policy resulted in the creation of the Senate Special Committee on Science Policy(SCSP) in 1967. Both the Science Council of Canada(SCC) and the Senate Special Committee on Science Policy were established in response to the involvement of the Science Secretariat in the 'big science' issues of the day. The separation between the SCC and the SCSP also drew attention away from the administrative mechanisms and tools being slowly developed to accommodate the national science policy administrative

approach. It should be noted, however, that what was developing through the efforts of the SCC and the SCSP was a clearly differentiated perception of science and research and desires to deal with them as aspects of policy.

The events of the debate-confrontation encouraged the national science policy perspective. These events resulted in pressures for comprehensive information on the allocation of research resources. This was accomplished through the hearings of the SCSP and by the investigations of the SCC. Significant data was developed by Statistics Canada.

The national science policy perspective was not readily acceptable to the scientific research community. This may be seen in the splitting of attitudes on such 'umbrella' organizations as SCITEC and in the lobbying of Parliament. Some representatives of the scientific research community warned that research had become too closely associated with governmental objectives.(1) Despite such controversy, science and research during the decade became clearly associated with governmental policy through the national science policy approach. With a better understanding of the allocation of science and research resources it follows that research became necessarily identified with national aims. Today the lobbying activities by some segments of the

scientific research community is an indicator of a growing acceptance of the national science policy perspective.

In contrast to the scientific research community the national science policy perspective was readily acceptable in principle to the government. This may be seen in the creation of the Science Secretariat and the institutional-administrative events. The Treasury Board Secretariat saw very quickly the need and advantage of having an advisory body at the 'supradepartmental' level and of having data on the allocation of resources to science and research. This is even more evident in the evolution of the Ministry of State for Science and Technology(MOSST), the increasing use of research estimates in the budgetary process and in the May 1975 delineation of the federal concept of science policy.

But the most obvious evidence of the development of national science policy may be found in the House of Commons since the 1974 Throne Speech. The two full day debates revolved around the relationship of science and research to economic growth, the role of research in national aims and policy initiatives, and the need for an 'industrial strategy'. The Parliamentary and Scientific Committee(PASC) was established and interest was expressed in collecting different aspects of science and research into two House

Standing Committees.

Institutional-Administrative: The effective operation of the national science policy administrative approach is difficult to substantiate. The associated events and rhetoric of the debate-confrontation indicates a desire to link science and research visibly to the ongoing political and administrative process. Still this does not mean that an effective administrative organization has been yet established.

The creation of the Science Secretariat and its tenuous involvement in a few of the 'big science' research policy decisions was only an indication that attention was being directed to the specialized administration of research. It was an ad hoc administrative approach that stimulted the development of sophisticated and compatible data on science and research resource allocation. This marked the acceptance in principle of the national science policy administrative approach by the government but required only slight administrative reorganization. This was further formalized by the establishment of MOSST in 1971. MOSST, supported by the Treasury Board Secretariat(TBS) and the SCC, pursued the development of appropriate administrative mechanisms to incorporate research resource allocations into

the decision and policy making process. Incorporation of this data into the estimates indicates the gradual acceptance of the national science policy approach.

The May 1975 Cabinet acceptance of a definition for federal science policy and the reorganization of MOSST in 1975/76 shows greater commitment to the national science policy administrative approach. Following the delineation of the federal science policy MOSST was reorganized by identifying the Government Branch with budgets and expenditures. It placed the review of Make-or-Buy(MOB) policy and the development of 'future studies' in the Industrial Branch. The Univeristy Branch is to be concerned with reviewing university grants. The was accompanied by the growing involvement of the Government Branch in the budgetary process, the continued expansion of the Make-or-Buy policy(2), the coalescing of the review of university funding through the University Branch and the changes proposed by the Science Activities Act(SAA).

MOSST is a small department not involved in large prestigious programmes. However, it has been noted that smaller departments may be more capable of influencing decisions:

> Contrary to some bureaucratic theories, under the parliamentary system the most prestigious employments are in departments with relatively small budgets. The deputy heads of these agencies do not want to maximize their budgets; they want to maximize their power and influence. They fight about their own budgets only to the extent that it affects the quantity and quality of their staff advisers relative to others with whom they compete. (3)

If this is so then a small department such as MOSST—suitably staffed, concerned about doing its job, close to the TBS and the Cabinet—could be powerful and influential. This demands that MOSST have the data by which to formulate and direct advice as well as access to the central decision and policy making arena. To this MOSST appears appropriately suited.

The role of MOSST is to co-ordinate and make science and research reactive to ongoing national concerns and policy interests. The Ministry provides a comprehensive review of governmental allocations to science and research, and thus participates to some extent in the policy and decision making process. It gives advice on the distribution of resources although input comes at the end of the budgetary negotiation process. MOSST knows where the resources go but has little political power to direct the distribution. Research resources are clearly not being directed to further national aims.

The national science policy administrative approach is further exemplified by the more selective allocation of resources based on the interest of numerous governmental departments through the Make-or-Buy(MOB) policy. So far electronics, transportation and high technology research have been emphasized. The government has cut back on the less selective industrial incentive programmes and has undertaken a complete review of them. The Make-or-Buy policy is to be continually expanded linking private research establishments more firmly to governmental research projects.

MOSST is currently studying and attempting to co-ordinate research in wide policy areas of the government: ocean, space, food, energy and transportation research. The Ministry is developing ways of dealing with these policy areas collectively in relation to science and research and is attempting to attach diffuse research efforts found inside and outside the government with them.

A secondary indicator of the national science policy administrative approach may be found in the restricted flow of research resources since the late 1960s. This general restriction indicates an ability to influence but not to control or direct. However, the creation of shortages was an impetus forcing the growth of administrative mechanisms

for science and research resource allocation.

The growing involvement of the House of Commons with science policy and the increased lobbying activities by the scientific research community are significant. The debates and the analysis of Canadian science policy can only take place within the framework supplied by the information and data developed. Discussions, analysis and even policy initiatives will be shaped by this and by the components and relationships indicated by the national science policy concept.

At this stage only a very tenuous conclusion can be offered concerning the existence and effective operation of the national science policy administrative approach in Canada. The effective operation of the national science policy administrative is not clearly demonstrated although the national science policy perspective has gained a large degree of legitimacy.

3. Future Development

The most important future developments concerning science, research and science policy will take place in

House of Commons and in the Ministry of State for Science and Technology. All indicators point to the convergence of the debate-confrontation and the institutional-administrative developments. The two distinct series of developments have reached points where they may integrate. If it became accepted that science and research should be integral components of policy and if the information and data on the distribution of research resources became part of the decision and policy making process this would mean the full integration of the national science policy approach.

With this interpretation and analysis there are three major issues which will shape further development in Canada:

- -the perception of science and research in the House of Commons
- -the involvement of the scientific research community
- -the administration of science and research by the federal government

The view of science and research that evolves within the House of is crucial. Science and research is being viewed by the House of Commons in four ways: (i) as an aspect of an industrial strategy; (ii) as a component of policy; (iii) as a budgetary item; and (iv) as a collection of distinct disciplines of fields of research.

The debates in the House of Commons emphasized the utilitarian aspects of research by stressing an industrial strategy approach and to a lesser degree research as a component of policy. The lobbying activities have stressed the budgetary aspects and the need to support scientific fields but the thrust of organizaions such as SCITEC and the Parliamentary and Scientific Committee(PASC) put the emphasis on the utilitiarian aspects of research within policy initiatives. The proposal by the House of Commons standing committee on Procedure and Organization to have budetary areas of science and research placed in two committees suggests that there is a trend to have the review of the allocation of research resources.

It is difficult, however, with these four views to predict which will gain pre-eminence. If the utilitarian views persist there will be greater demands for research resources to be directed to national policy priorities. In this case aspects of science and research will be perceived as distinct components of policy. More realistic questions may be posed within the operational realities of government as to whether or not the goals are reasonable and attainable though the support of research and at what costs.

The institutional-administrative developments have indicated the direction and given the adminstrative

framework for the management of research. The setting of priorities is more within the purview of the political and decision making arena. However, science policy and the related political process may or may not be incorporated into the overall policy process. This depends on the perception of science and research that evolves or fails to evolve in the House of Commons. To some extent this perception will be influenced by the activities of the scientific research community.

What the involvement of the scientific research community will be is both perplexing and interesting. During the period of the debate-confrontation a very diffuse Canadian scientific research community gained a more distinctive, coherent appearance. Information and data on the Canadian scientific research establishment, bodies such as SCITEC, PASC and the lobbying have further coalesced the scientific research community.

The prominence of research as a component of policy and the reaction of the scientific research community to this are key factors. If research becomes more visible as a component of policy and if the scientific research community perceives it in that context then groups of scientist will identify and collect behind particular broad policy initiatives of the government. What will be crucial,

therefore, will be the degree of involvement by the scientific reseach community and whether or not particular scientific research groups form and start competing among themselves for resources. If is likely that numerous scientific factions competing for resources behind particular policy interests of the government will evolve. For example groups of scientists from different fields promoting 'environment policy' will form in order to to secure support for research. This policy approach is being reinforced by the efforts of MOSST. They are attempting to co-ordinate energy, oceans, food, transportation and space research. Various scientific research groups are identifying with these broad policy initiatives. Further study should be done of these science research groups to see whether or not they are forming behind policy areas and if they are influencing the distribution of resources or the allocation of resources is influencing them.

The third issue area is the administration of science and research by the federal government. The analysis of national science policy in Canada shows that specialized institutional structures and administrative procedures have been incorporated into the Canadian system. It is difficult to know whether this will be effective or not since the science policy administrative approach has been neither

fully integrated into the political and decision making process or fully accepted by the scientific research community. However, with the existence of the present administrative procedures (especially the budgetary) priorities can be set and reflected in allocations. Again, whether or not this will come about depends on the perception of science and research in the House of Commons, the Cabinet and the involvement of the scientific research community.

The analysis revealed that although specialized administrative procedures have developed their utilization is still open to question. The administrative developments have gained a degree of legitimacy and perhaps some degree of stabilization. The main issue is whether or not there will be greater centralization and control of science and research within the executive administrative and decision making bodies—the TBS and the Cabinet. None of these bodies has assumed fully responsibility for science policy. If this administrative approach is to be successful it must be placed firmly within the larger operational framework of the policy and political process. The national science policy concept requires the allocation of resources to science and research in direct relation to policy (and political) priorities. For example, if, as suggested by

John W. Langford, Canada desires to become an 'Arctic Power' it should develop a 'Canadian Arctic research and development policy'.(4) If science and research are politically and administratively supported and if resources are appropriately allocated, it becomes a means of securing policy goals.

NOTES
SECTION 3

1. For reviews of the literature in the field of 'science and government' see, J.C. Cairl and P.R Gallagher Jr., "Government Science and Technology: A Bibliographic Essay," Public Administration Review 28,4 (July/August, 1968), 371-381; M. Gibbon, "Some Aspects of Science Policy Research," in Paul Halmos, ed., The Sociology of Science(Great Britain, 1972), 54-137; and K. Kreilkamp, "Towards a Theory of Science Policy," Science Studies 3 (February, 1973), 3-29.

2. See, for example, J.D. Bernal, The Social Function of Science(London, 1939); M. Goldsmith, ed., Decision Making in National Science Policy(London, 1968); and N.J. Norman, Science, Technology in British Politics(London, 1968).

3. R. Gilpin, France in the Age of the Scientific State (Princeton, New Jersey, 1969).

4. V. Bush, Science, the Endless Frontier(Washington, D.C., 1945); M. Blissett, Politics in Science(Boston, 1972); S.S. Blume, Towards a Political Sociology of Science(New York, 1974); P. Phillip, The Brain Bank of America: An Inquiry into the Politics of Science(New Jersey, 1975); H. Brooks, The Government of Science(Cambridge, Massachuettes, 1968); R. Gilpin and C. Wright, eds., Scientists and National Science Policy Making (New York, 1964); D.K. Price, Government and Science(New York, 1955) and The Scientific Estate(Cambridge, Massachuettes, 1965) D.J. de Solla Price, Little Science, Big Science(New York, 1963); C.P. Snow, Science and Government(Cambridge, Massachuettes, 1961); and G. Teeling, Science, Technology and the State(New York, 1965).

5. See for example, D. Wilgress, Co-operation in Scientific and Technical Research(Paris, OECD, 1959); Alexander King, "Science in the OECD," in D.G. Mesthene, ed., Ministers Talk About Science(Paris, OECD, 1965), 14-24; Alexander King, "Science International," in M. Goldsmith and A. Mackay, eds., The Science of Science(Great Britain, 1968), 140-158; and Alexander King, Science Policy: The International Stimulous(Great Britain, 1974).

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7. Report to Prime Minister on Government Science(Ottawa, Privy Council Office, 1964).

8. See for example the following Science Council of Canada reports: A Space Program for Canada, Report No. 1(Ottawa, 1967); Towards a National Science Policy for Canada, Report No. 4(Ottawa, 1968); University Research and the Federal Government, Report No. 5(Ottawa, 1969); and A Policy for Scientific and Technical Information Dissemination, Report No. 6(Ottawa, 1969). The Science Council of Canada has published twenty-five 'reports' and thirty-eight 'background' studies from 1963 to 1976.

9. Canada, Senate Special Committee on Science Policy, A Science Policy for Canada I,II,III,IV(Ottawa: 1970, 1972, 1973 1977).

10. Science and Politics in Canada(Toronto, 1972). See also G. B. Doern, "Scientists and the Making of Science Policies in Canada," Ph.D. Dissertation, Department of Political Studies, Queen's University, Kingston, Ontario, 1969.

11. The Chaining of Prometheus: evolution of a power structure for Canadian science(Toronto, 1973).

12. Government Support of Scientific Research and Development: an economic analysis(Toronto, 1977).

13. Tariff and Science Policy: applications of a model of nationalism(Toronto, 1976).

14. See Hugh Faulkner, "How the Federal Government is Reorganizing Research Funding Granting Councils," Science Forum 54 (December, 1976), 39-40.

15. See Canada, Senate Special Committee on Science Policy, Proceedings, 14 (June, 1977), 17-20. Special guidelines were developed by the Advisory Committee on Northern Development for scientific activities in northern Canada. They are to be applied by the Department of Indian and Northern Affairs.

16. For example, J.S. Dupre and S.A. Lakoff, eds., Science and the Nation(New Jersey, 1962); M. Goldsmith, ed., Technological Innovation and the Economy: A Science of Science Foundation Symposium(London, 1970); S.A. Lakoff, ed., Knowledge and Power(New York, 1966); L. Lederman and M. Windus, Federal Funding and National Priorities(New York, 1971); T.D. Long and C. Wright, eds., Science Policies of Industrial Nations: Case studies of the United States, Soviet Union, United Kingdom, France, Japan and Sweden(New York, 1975); J. Primack and F. von Hippel, Advice and Dissent: Scientists in the Political Arena(New York, 1974); Leslie Sklair, Organized Knowledge; a sociological view of science and technology(Great Britain, 1973); Edward Shils, ed., Criteria for Scientific Development: Public Policy and

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17. R.G. Krohn, "Patterns of the Institutionalization of Research," in S.Z. Nagi and R.G. Corwin, eds., The Social Context of Research(London, 1972), 32-33.

18. Sklair, Organized Knowledge, 107.

19. See Antony J. Dolman, ed., Reshaping the International Order(New York, 1976), 39-40, 152-156, and Annex 6, 260-273.

20. Human Goals and Science Policy, Science Council of Canada, Background Study No. 38(Oshawa, 1976), 15.

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1. Royal Commission on Government Organization, Scientific Research and Development, 291.

2. Doern, Science and Politics, 6.

3. For a detailed discussion of the recommendations of the Glassco Commission see Doern, Science and Politics, 8-10, and Hayes, The Chaining of Prometheus, 44-49.

4. C.M. Drury, "A Partnership in Science between Government, Industry, and the Universities," Transactions of the Royal Society of Canada 2,4 (June, 1964), 355-361.

5. Ibid., 355.

6. Ibid.

7. Ibid.

8. Canada, House of Commons, Debates, Ottawa, 30 April 1964, 2752.

9. J.E. Hodgetts, The Canadian Public Service: A Physiology of Government, 1867-1970 (Toronto, 1973), 134.

10. Doern, Science and Politics, 61.

11. Ibid., 62.

12. Ibid., 66.

13. Ibid., 70.

14. Ibid., 118-119.

15. Ibid., 73.

16. Ibid., 73.

17. Hayes, The Chaining of Prometheus, 81.

18. See, for example, the following: "Short Comments for Canada," Nature, 220(5 October 1968); M.W. Johns, "The growing crisis in Canadian science and how to avert it," Science Forum 1,6 (December, 1968),3-6; "Gloom in Canada," Nature 223 (August, 1969), 766-768; "Can Canada do more with less," Nature 227 (4 July 1970), 9; Walter Hettich, "Federal Science Policy and Social Science Research in Canadian Universities," Canadian Public Administration 14(Spring, 1971), 112-128; "Federal grants to Canadian

Science losing purchasing power study finds," Globe and Mail, 5 November 1974; "R & D cuts reducing Canada to a technological colony," The Financial Post, 24 January 1975; "Ottawa plans to increase expenditures on science," Globe and Mail, 24 January 1975; "Canada urged to increase spending for research," The Toronto Star, (15 July 1976); "Scientists fight R & D cutbacks- future jobs will be killed," The Financial Post, 24 January 1976.

19. See Harold Harvey, "Inflation; a powerful tool in Government Science Policy," Canadian Public Policy, 2,3(September, 1973), 439-450.

20. Lester B. Pearson, "Address by the Prime Minister, Inaugural Meeting of the Science Council of Canada," Ottawa, 5 July 1966 as cited in Canada, Science Council of Canada, First Annual Report, 1966-67, Appendix C(Ottawa, 1967), 28-32.

21. See motion by C.M. Drury to establish the Science Council of Canada in House of Commons, Debates, Ottawa, 17 March 1966, 2848.

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2. Knowledge, Power and Public Policy, Science Council of Canada, Background Study No. 31 (Ottawa, 1974), 56.

3. Ibid.

4. See for example, B.G. Ballard, "Organization of Scientific Affairs in Canada: The system avoids the dangers of changing political views and ensures a high level of competence," Science 129 (20 March 1959), 754-759. Doern conclued that the "establishment of an arm's length relationship with the political sector tended to reduce the outside political forces which had been a more salient reality" in the case of the National Research Council. "This tended to leave the NRC with more manourerability. Because this outside force was less often felt, the NRC forces . . . became much more the relevant framework for internal decision-making." Doern, Science and Politics, 51.

5. See O. Dubas and L Martel, Media Impact: Interim Report, I (Ottawa, 1973); and Science, Mass Media and the Public, II (Ottawa, 1975). This study was commissioned by the Ministry of State for Science and Technology.

6. Pearson, "Inaugural Address to the Science Council of Canada," 30.

7. Ibid., 31.

8. Science Council of Canada, Towards a Science Policy for Canada, Report No. 4 (Ottawa, 1968).

9. The six very general goals were: national prosperity; physical and mental health and high life expectancy; a high and rising standard of education, personal freedon, justice and security; increasing availability of leisure and enhancement of the opportunity for personal development; world peace based on a fare distribution of the world's existing and potential wealth. Science Council of Canada, Towards a National Science Policy for Canada, 13-18.

10. Ibid., 35-47.

11. See P. Kruus, Basic Research, Background Study No. 21 (Ottawa, 1971); H.R. Robertson, Health Care in Canada: a Commentary, Background Study No. 29 (Ottawa, 1973); and F.H. Knelman, Energy Conservation, Background Study No. 33 (Ottawa, 1975).

12. See J.B. Macdonald, L.P.Dugal, J.S. Dupre, et al. The Role of the Federal Government in Support of Research in Canadian Universities, Background Study No. 7(Ottawa, 1969); P.N. Smallman, D.A. Chant, D.M. Connor, J.C. Gilson, A.E. Hannah, D.N. Huntley, E. Mercier, M. Shaw, Agricultural Science in Canada, Background Study No. 10(Ottawa, 1970); and R.A. Blais, C.H. Smith, J.E. Blanchard, et al. Earth Sciences Serving the Nation, Background Study No. 13(Ottawa, 1971).

13. See D.C. Rose and a Study Group of the Canadian Association of Physicists, Physics in Canada: Survey and Outlook, Background Study No. 2 (Ottawa, 1967); Study Group of the Chemical Institute of Canada, Chemistry and Chemical Engineering: A Survey of Research and Development in Canada, Background Study No. 9(Ottawa, 1969); and Allen S. West and the Management Committee of SCITEC, National Engineering, Scientific and Technological Societies of Canada, Background Study No,. 25(Ottawa, 1972).

14. In the preparation of some of the studies the 'Delphi' approach was used. It brings together those involved with initial work and information supplied by the SCC staff. See for example, the account for the preparation of "Basic Reseach and National Goals," in Thoughts 4 (June, 1970).

15. Jackson, Human Goals and Science Policy.

16. Science Council of Canada, Innovation in a Cold Climate: the Dilemma of Canadian Manufacturing, Report No. 15(Ottawa, 1971).

17. A.H. Wilson, Government and Innovation, Science Council of Canada, Background Study No. 26(Ottawa, 1973).

18. Senator Maurice Lamontagne made the motion in his maiden speech in the Senate, Debates, Ottawa, 29 June 1967, 250-255.

19. See for example, A.H. Wilson, Background to Invention, Background Study No. 11(Ottawa, 1970); R.W. Jackson, D.W. Henderson, and B. Leung, Background Studies in Science Policy: Projections of R & D Expenditures, Background Study No. 6(Ottawa, 1969)and A.H. Wilson, Governments and Innovation, Background Study No. 26(Ottawa, 1973).

20. Canada, House of Commons, Debates, Ottawa, 2 November 1967, 364.

21. The first round of hearings of the SCSP went from March 12th, 1968 to June 1969. Subsequent hearing continued during various sessions to 1977.

22. See for a list of individuals, groups, agencies and departments giving briefs to the SCSP in Senate Special Committee on Science Policy, A Science Policy for Canada I, 298-304, 305-327.

23. At the first round of hearings of the SCSP there were notable 'science policy' experts such as Dr. Alexander King, Dr. J. Spaey, M. Goldsmith and Dr. C. Wright.

24. Doern, Science and Politics, 139.

25. Science Forum: A Canadian Journal of Science and Technology was established through the efforts of David Spurgeon—a science writer and presently editor of Science Forum and publication director of the International Development Research Centre—beginning in 1966. The first publication was in 1968. This journal was aimed at the scientific research community in general. It has an editorial board composed of university, government and industrial representatives. In 1968 the mix was 73/15/12% while in 1977 it was 66/27/7%. The inaugural editorial stated that Science Forum was "designed primarily to become a national forum in which Canadian scientists and engineers can discuss their vital issues." Science Forum 1,1 (February, 1968),2. Accordingly the first four articles dealt with the then current debate over the Intense Neutron Generator.

26. For example: Sir H. Melville, "Making Policies for Science," Science Forum 1,1 (February, 1968), 19-22; R. S. Richie, "Has Canada Acquired a Science Policy? An Overview," Science Forum 1,3 (June, 1968), 3-5; G.J. Maule and I.A. Litvak, "Federal R & D Incentives; are they needed? are they adequate?" Science Forum 2,4 (August, 1969), 21-24; J. Gordon Parr, "New Perspectives on Science Policy from the OECD," Science Forum 4,5 (October, 1971), 13-23; S.A. Norman, "Where all the money goes; federal expenditures on science and technology," Science Forum 5,1 (February, 1972), 11-14; R. J. Uffen: how science policy is made in Canada," Science Forum 5,6 (December, 1972), 3-8; and T.C. Clark, "Why is the federal governmentment starving universities of research funds?" Science Forum 9,1 (February, 1976), 6-8.

27. See David Spurgeon, "Canadian science writers form new association," Science Forum 4,2 (April, 1971) 20, and David Spurgeon. "Science Writers and Government Policy," Nature 254 (13 March 1975).

28. See F.R. Hayes, "Co-operation Between Universites and Government," 349-353; N.G. Thorpe, "Basic Scientific Research—Its Importance and Support," 339-347; and J.W. Spinks, "The National Research Council Forecasts of Support Needed for Basic Research [illegible]," 327-335, Transactions of the Royal Society of Canada

2,4(June, 1964); H.E. Gunning, "Towards a Constructive National Science Policy for Canada," 290-296; A.F. Douglas, "Towards a National Science Policy of Any," 297-302; F.R. Wynne-Edwards, A Review of the Current Status of Science Policy in Canada," 303-312, Transactions of the Royal Society of Canada, VII (June, 1969).

29. Canadian Institute of Public Affairs, Proceedings of a Conference on 'A Science Policy for Canada'(Toronto, 1970).

30. Hayes, The Chaining of Prometheus, 184.

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2. See M. Thistle, The Inner Ring: The Early History of the National Research Council of Canada (Toronto, 1966), and Doern, Science and Politics, 21-51.

3. See D.J. Goodspeed, A History of the Defence Research Board (Ottawa, 1958).

4. For full accounts see W. Eggleston, Canada's Nuclear Story (Toronto, 1965); G.M. Griffiths, "CANDU- A Canadian Success Story," Physics in Canada 30,1 (January, 1974), 2-12; George C. Lawrence, "Canada's Nuclear Beginnings in the War Years Laid the Groundwork for Today's Success," Science Forum 54 (December, 1976), 35-38; F.H. Knelman, Nuclear Energy, The Unforgiving Technology (Edmonton, 1976).

5. See detailed account in A.H. Wilson, Government and Innovation, Science Council of Canada, Background Study No. 26 (Ottawa, 1973), 55-77.

6. For further description and analysis see Economic Council of Canada, Committee on Industrial Research and Development in Canadian Industry (Ottawa, 1966); W.R. Laimer, "Scientific Research Expenditures," Corporate Management Tax Conference, Canadian Tax Papers No. 41, Canadian Tax Journal 19 (September/ October, 1971), 429-435; and R.E. Slitor, "The Tax Treatment of Research and Innovative Incentives," American Economic Review 56 (May, 1966), 220-221.

7. For example see: B.G. Ballard, "Organization of Scientific Affairs in Canada; the system avoids the dangers of changing political views and ensures a high level of competence," Science 129 (20 March 1959), 754-759; and Doern, Science and Politics, 21-53.

8. See Canada, Statistics Canada, Federal Government expenditures in the human sciences, 1959-1970 (Ottawa, 1972), 7.

9. See the Statitics Canada, Historical Series: Federal Government Activities in the Natural Sciences, Fiscal Years 1963-64 to 1976-77 and Federal Government Activities in the Human Sciences, Fiscal Years 1974-75, 1975-76, 1976-77. See also the following, Statistics Canada, Public Finance: Federal

and development expenditures in Canada 1963-1971(Ottawa, 1974); Industrial Research and Development Expenditures in Canada,1967(Ottawa,1970); Federal Government Expenditures in the human sciences, 1969-1970(Ottawa 1972); Expenditures of Provincial Non-Profit Industrial Research Institutes(Ottawa, 1967); Selected Statistics on Technological Innovation in Industry(Ottawa, 1975); Federal Government activiteis in the natural sciences, 1974-76(Ottawa, 1976); Industrial research and development expenditures in Canada, 1973-1975(Ottawa,1976); and Federal government activities in the human sciences, 1975-1977(Ottawa, 1976).

10. OECD, Directorate for Scientific Affairs, Review of National Science Policy—Canada (Paris, 1969), 421-435.

11. Canada, International Development Research Centre, On Common Ground: Report on the Activites of the IDRC, 1976-1977(Ottawa, 1977), 3.

12. For a valuable study of the concept and creation of the 'ministries of state' see Aucoin and French, Knowledge, Power and Public Policy.

13. See "Government decides to transfer much new research to industry to create jobs and aid economy, Globe and Mail 18 July 1973, B3; and Canada, Ministry of State for Science and Technology, The Make-or-Buy Policy, 1973-75 (Ottawa, 1975).

14. The past four ministers are the A. Gillespie, Jeanne Sauve, C.M. Drury, J.H. Faulkner. The current minister is Judd Buchanan.

15. For example, see Aucoin and French, Knowledge, Power and Public Policy; The Ottawa Citizen, 1 December 1975; and comments of MP H. Andre in House of Commons, Debates, 9 June 1975, 6560.

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17. B.M. McGugan, "Towards a Science Budget," (Speech prepared for delivervy at a meeting of The Canadian Association of Physicists, The Chemical Institute of Canada, the Canadian Society of Chemical Engineering, The Ottawa Biological Society and The Spectoscopy Society of Canada.) Ottawa, 23 October 1973, 16.

18. J. Carruthers, "The First Three Years of the Science Ministry: What has been achieved?" Science Forum 7,5(October, 1974), 8-11.

19. Ibid., 10-11

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23. See for example the Ministry of State for Science and Technology publications: Science Activities—Federal Government Costs 1958-59 to 1971-72; Science Activities Federal Government costs and expenditures, 1963-64 to 1972-73; Federal Science Research, 1972-74, Natural and Human Science; Federal Science Programs, 1977-78; Federal Science Activities, 1978-79; and Federal Science Expenditures and Manpower, 1976/77-1978/79.

24. See Canada, Senate, Senate Special Committee on Science Policy, Proceedings, 8, Ottawa, 25 May 1977, 14-16.

25. M. Simmons, "Faulkner's tiny science ministry has a big issue to handle," Kitchner-Waterloo Record, 10 November 1976.

26. Ibid.

27. Senate Special Committee on Science Policy, Proceedings, 25 May 1977, 14.

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1. Canada, House of Commons, Debates, 27 February 1974, 3.

2. Canada, House of Commons, Debates, 9 June 1975, 6561-6562.

3. Science Forum 47 (October, 1975), 26-30.

4. Debates, 9 June 1975, 6561.

5. Drury, "How the Federal Government Views Questions of Science and Public Policy," 26.

6. Ibid., 27.

7. Ibid.

8. Ibid.

9. Ibid.

10. Ibid.

11. Drury stated that the government is concerned with manpower in relation to the "support of higher education, immigration, employment, and the ability of Canada to cope with future science and technology problems. A study has been launched by the Ministry of State for Science and Technology in conjunction with Statistics Canada to examine the relationship between education, employment in the highly qualified manpower market. The data from this study are now being processed, and analysis of the results should lead to a better understanding of the underlying mechanisms and provide a basis for forecasting future demands and supply." Drury, "How the Federal Government Views Questions of Science and Public Policy," 28.

12. Drury noted "that Canada needs a national system for storing, retreiving, and disseminating scientific and technological information. In December 1969, the Cabinet directed the NRC, 'under the general direction of the National Librarian, to develop in concert with existing information organizations, a national scientific and technical information system, to encompass the natural sciences and engineering.' In October 1974 the National Science Library and the Technical Information Services of the NRC were merged in the newly formed Canadian Institute for Scientific and Technical Information." Drury, "How the Federal Government Views Questions of Science and Public Policy," 28.

13. See Debates, 9 June 1975, 6561; and Canada, House of Commons, Debates, Ottawa, 13 May 1976, 13480-13509.

14. "Canada and the Quest for a National Policy," Canadian Journal of Political Science 8,1 (March, 1975), 55-57.

15. Impetus for the PASC came from the SCSP and from the Parliamentary Secretary to C.M. Drury, Frane Maine (Wellington).

16. See, for example, L. Dotto, "Scientists come out fighting as research money frozen," and "Scientists arguing for survival," Globe and Mail, 18/19 March 1976.

17. Dr. John Cown of the University of Ottawa was spokesman for the groups that represented thirty-six scientific research organizations and lobbied forty-nine MPs during the two day campaign. This was the third such lobby. See "Research groups lobbying MPs to increase stability in grants," Globe and Mail, 28 April 1977.

18. SCITEC, "SCITEC News," SCITEC Bulletin 7,1 (January, 1977), 17.

19. Canada, House of Commons, Standing Committee, Procedure and Organization, Proceedings, 20 (30 September 1976), 66-67.

20. See L. Dotto, "Science Policy Changes and the Granting Bodies— What do they mean?" Science Forum 39 (June, 1974), 20-21; and speech by C.M. Drury to the Social Science Research Council, Montreal, 17 October 1974.

21. Canada, House of Commons, Debates, Ottawa, 13 December 1976, 1939.

22. Ibid.

23. Ibid.

24. Ibid.

25. These trends were further reinforced by the creation of a committee in the National Research Council to encourage Canadian university scientists to do research related to national problems. There has been an increase of $4.5 million to finance research in three areas: energy, oceanography and enviornment toxicology. This programme will probably be shifted to the Natural Sciences and Engineering research council now being created. L. Dotto, "NRC encouraging research on problems of national importance," Globe and Mail, 20 October 1977, 31.

26. J. Carruthers, "Ottawa seeks more control of nuclear research matters," Globe and Mail, 26 November 1977, B 13.

NOTES
SECTION VI

1. See Donald C. Rowat, "The Decline of Free Research in the Social Sciences," Canadian Journal of Political Science 9,4 (December, 1976), 537-547.

2. The Make-or-Buy policy was extended by Cabinet to consider 'unsolicited proposals' of research from the private sector. See Ministry of State for Science and Technology, 1973-74 Annual Report (Ottawa, 1974). The policy was extended further in 1977. See L. Dotto, "Government Extends Its Policy on Contracting Out Research," Globe and Mail, 27 April 1977.

3. D.G. Hartle, A Theory of the Expenditure Budgetary Process (Toronto, 1977), 95.

4. "Marine Science, Technology and the Arctic: Some Questions and Guidelines for the Federal Government," in E.J. Dosman, ed., The Arctic in Question (Toronto, 1976), 163-192.

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