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SCIENCE AND TECHNOLOGY: THE NEW FEDERAL POLICY

Daniel Brassard
Science and Technology Division

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INTRODUCTION

The world is changing quickly. We are moving into an era with an increasingly integrated global economy in which knowledge and information will be a vital resource. Many have stated that, as we move into the information age, Canada must become a learning society. Crucial to such society is a vibrant science and technology (S&T) component. S&T activities within government, industry and academia are essential and must be aimed at providing Canadian companies with the knowledge and innovation that are necessary for them to compete and flourish on the global scene. In the words of the Auditor General,

> ...science and technology go beyond contributing to economic growth; they contribute to our quality of life. For example, methods to test the food that we consume, means of improving the safety of our transportation modes and the technology available to improve health care quality are all supported by various activities in science and technology, in both the public and private sectors.(1)

The federal government released its long-awaited S&T policy on 11 March 1996. This document, entitled *Science and Technology for the New Century: A Federal Strategy*, was accompanied by *Highlights of Departmental S&T Action Plans*, which summarized the S&T action plans of many of the leading science-based departments. One of the main components of the new policy is a program called Technology Partnership Canada, which is to assist in financing R&D in private industry.

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(1) Auditor General of Canada, Report 1994, Vol. 6, Ch. 9, paragraph 9.10.

This paper will provide a historical perspective on S&T policy in Canada; comment on the process that has led to the most recent version, with reference to various reports on S&T policy; cover the key points in the new policy; and provide some discussion. Much of the historical information is derived from an earlier Library of Parliament paper.(2)

HISTORY OF S&T POLICY IN CANADA

Many studies and reports have discussed ways of improving or creating a comprehensive S&T policy in Canada, and some of these initiatives have resulted in changes. In the words of a recent report, however,

> Thirty years of S&T policy reviews have provided a wealth of good ideas, but these have not been effectively implemented within an integrated S&T strategy.(3)

One of the first initiatives arose out of a suggestion, in the 1963 Glassco Commission report, that government science activities were expanding in a piecemeal fashion without adequate coordination.(4) This led to a report by C.J. McKenzie, a former National Research Council president, that resulted in the creation of the Science Secretariat within the Privy Council Office. In 1970, a Senate Committee under Senator Maurice Lamontagne prepared a number of recommendations, including one for the establishment of an overarching structural framework for science policy and one for a policy that would encourage industrial innovation.(5) In response to these recommendations, a Minister of State for Science and Technology was appointed in 1971 and there were a number of short-lived tax incentives to encourage R&D.(6)

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(2) Ruth Fawcett, "Canadian Science Policy: Developments and Trends," Library of Parliament, BP-222E, November 1989.

(3) National Advisory Board on Science and Technology, *Healthy, Wealthy and Wise: A Framework for an Integrated Federal Science and Technology Strategy*, April 1995, p. 4.

(4) The Royal Commission on Government Organization (Glassco Commission), Vol. 4, Ottawa, 1963, p. 218.

(5) Senate Special Committee on Science Policy, "A Science Policy for Canada," Ottawa, 1970.

(6) Fawcett (1989), p. 6.

In 1985, the federal government issued the background paper *A National Science and Technology Policy*.[7] After consultations between the science ministers from the provinces and territories, Canada's first National Science and Technology Policy was signed by the federal, provincial and territorial science ministers in March 1987. It established a Council of Science and Technology Ministers composed of the federal, provincial and territorial science ministers. The six major objectives, to be reached through cooperation among government, industry, universities and labour, were:

- to improve industrial innovation and technology diffusion through public and private mechanisms;
- to develop strategic technologies for manufacturing, service and resource-based sectors;
- to assure the necessary pool of highly qualified people;
- to support basic and applied research and development;
- to control the impact of technological change on society; and
- to promote a more science-oriented culture.[8]

The next major development was the creation of the National Advisory Board on Science and Technology (NABST) in February 1987. This board provides advice to the Prime Minister on national science and technology goals and policies and their application to the Canadian economy. The Prime Minister chairs this board, which comprises 20 members with backgrounds in industry, government, labour, education and research. NABST has written a number of reports related to S&T in Canada, the most recent of which deals with S&T policy in the federal government and is discussed later.

In 1987, the government focused some of the federal S&T activities in a single department by forming Industry, Science and Technology Canada (ISTC). The primary goals of ISTC were to improve Canadian industry's ability to compete internationally and to achieve excellence in Canadian science and technology. A new House of Commons Standing Committee (HCSC) was to review this department and would also have responsibility for regional and northern development. After a restructuring of federal departments and parliamentary committees, the relevant department is now Industry Canada and the relevant HCSC is the Industry Committee.

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(7) Government of Canada, "A National Science and Technology Policy Background Paper," Ottawa, 1985.

(8) *Ibid*., p. 6-9.

Research and development had been claimable as a 100% tax deduction since 1961. To try to stimulate industrial R&D in Canadian businesses (which have one of the lowest rates of R&D in the G-7 nations), in 1977 the government devised a tax credit approach that initially consisted of expanding the investment tax incentive to include allowed R&D. Changes were made in 1983 with the introduction of the Scientific Research Tax Credit (SRTC). This was criticized on the grounds that certain provisions allowed people to collect funds without generating further R&D activities. A moratorium was placed on SRTC financing in October 1984 and the SRTC provision was cancelled in May 1985. The government then introduced an R&D tax credit that, with minor modifications, is still in effect. This R&D tax credit is one of the most generous in the world(9) but some have questioned whether it does actually increase levels of R&D. It appears that a part of this tax credit system is now under review.(10)

Since the late 1980s, the government has seen the major important direction for S&T as increasing competitiveness. This trend has resulted in a larger share of grants and government research being aimed at developmental rather than basic research; more partnerships between government laboratories, universities and private businesses; and a general refocusing of government R&D efforts towards competitiveness.

PROCESS LEADING TO NEW S&T POLICY

In the 1994 budget speech, the government announced its intention to review federal S&T, valued at over $7 billion, including the R&D tax credit. The science and technology review was officially announced on 28 June 1994. Its aim was to investigate how federal investment in science and technology could best create economic growth and jobs within the context of sustainable development, while enhancing the quality of life and advancing knowledge. The government proposed a long-term consultation process in its discussion paper *Building a Federal Science and Technology Strategy*:

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(9) Industry Minister John Manley, Speech to the Canadian Advanced Technology Association, 11 March 1996.

(10) *Budget 1996: Budget Plan*, 6 March 1996, p. 175.

> On behalf of the Government of Canada, we invite your views on the issues and questions raised in this document to assist us in developing a Federal Strategy for Science and Technology appropriate to these changing times. Following release of the Strategy early in 1995, the process will be expanded further to seek consensus on a fully national strategy for science and technology.(11)

This review consisted of three tracks: public consultations, an internal review, and a report from NABST. In addition, the Auditor General's 1994 Report to Parliament had a number of comments and recommendations on federal S&T that were also considered when the government prepared its strategy.(12) Although the government's strategy was originally intended to be released in early 1995, a later statement declared, "In 1995-96, the Science and Technology (S&T) Review process will be extended to achieve agreement on a National S&T Strategy."(13)

A. Public Consultation

The public consultation process included five main elements:

- a discussion paper, *Building a Federal Science and Technology Strategy*, and a companion document, *A Resource Book for Science and Technology Consultations,* both prepared by Industry Canada;
- an electronic discussion group under an Internet address;
- submissions of written briefs and ideas from organizations and individuals;
- workshops on science and technology issues held in more than 20 communities across Canada in July and August 1994; and
- five regional conferences and one national conference held in September and October 1994.

Public input was incorporated from local, regional and national workshops and conferences held in collaboration with local hosts and a consortium of private sector organizations. Information from many of these consultations was made generally available via the Internet. This provided the basis for a series of recommendations to assist the government in preparing its S&T policy.

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(11) Secretariat for Science and Technology Review, Industry Canada, *Building a Federal Science and Technology Strategy*, June 1994, p. 1.

(12) Government of Canada, *Science and Technology for the New Century: A Federal Strategy*, March 1996, p. 1.

(13) Part III Estimates, Industry Canada, 1995, p. 3-19.

The key points advised the government to: focus the federal S&T investment, anticipate and adopt the right policies and regulations, increase partnerships and collaboration, capture the full benefits of new technologies, promote a stronger science culture, and manage for results.

B. Internal Review

Each department and agency conducted a review of its S&T policy. In the words of the 1995 Part III Estimates for Industry Canada, "Multi-department, internal task forces analyzed current performance, mission and client needs and proposed direction for S&T activities."(14) Some details were provided in several government reports; the *Summary Report: Interdepartmental Task Force on Science and Technology Review* was derived from four sub-task force reports: *Advancement of Knowledge*; *Enhancing Quality of Life; Towards an Innovation Strategy;* and *An Information System for S&T*.

The summary report covered a number of recommendations. It indicated that the government must change its policies on the selection, financing, and performance of S&T. It suggested that the government shift the focus of S&T decision-making from inputs to results and a move towards an innovation culture in Canada. Some of the specific recommendations were:

- to improve access by Canadians to the flow of knowledge and ideas;
- to align S&T to national needs for quality of life;
- to strengthen the science and technology infrastructure;
- to strengthen the contribution of federal laboratories to local and sectoral needs;
- to increase the technological collaboration and exchange between firms;
- to strengthen the S&T relationships between levels of government; and
- to re-think federal governance of S&T.(15)

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(14) *Ibid*., p. 3-44.

(15) *Summary Report: Interdepartmental Task Force on Science and Technology Review*, December 1994.

C. NABST Report on Federal S&T Policy

NABST issued a major report, *Healthy, Wealthy and Wise: A Framework for an Integrated Federal Science and Technology Strategy*, in April 1995. This made many recommendations for how the federal government should structure its S&T efforts, including:

- Establish a goal-oriented S&T strategy with clearly defined roles for government, in the context of a model integrating the quality of life, wealth and jobs, and the advancement of knowledge.
- Establish an effective S&T governance system, led by a Cabinet-level S&T Champion, supported by a senior Chief S&T Advisor with a dedicated staff of inside and outside experts, advised by an external advisory board, and implemented by responsible line departments.
- Establish and apply consistent and measurable criteria and performance indicators to help establish priorities and measure outcomes.
- Evaluate and justify federal laboratory activities against strategic needs.
- Establish accountability procedures for federal intramural S&T.
- Encourage industry to focus on value-added products and services fro export to world-wide markets by sharing the risk of acquisition, development and adaptation of new technology.
- Lever government incentives that fund industrial R&D by requiring involvement of SME, universities or colleges.

A full list of the recommendations from this report are included in Appendix 1.

D. Auditor General's 1994 Report to Parliament

A number of recommendations related to federal S&T practices were made in the *Auditor General's 1994 Report to Parliament*, from which the following is an extract:

> Parliamentarians have no basis to hold the government accountable for its spending on science and technology.
>
> 9.91 In conclusion, current reports do not provide parliamentarians with the information they need to assess whether the government's investment in science and technology reflects Canadians' needs and opportunities. Available information does not help parliamentarians direct questions to the government about its strategies and priorities, the way funds are allocated among departments and agencies, the results of the intervention mechanisms used by the government and the research activities it carries out. Parliamentarians are not provided with information on coordination with other stakeholders or on current problems facing science managers.

9.92 We believe that parliamentarians need to be provided with information on government science and technology programs and activities that would answer four basic questions with respect to these programs:

- What are the government's mission and lines of business?

- How does the government carry out its lines of business to achieve its mission?

- What are the government's strategic objectives for realizing its mission, and its plans for managing the significant public resources under its control?

- How did the government do at meeting its objectives, and how much did it cost?

9.94 The government, in consultation with Parliament, should establish a cost-effective reporting framework linked to its accountability structure to provide Parliament, on a regular basis, with information about its performance in managing its science and technology activities overall.

Future Directions for Parliament

Parliamentarians could play an important role in the current science and technology review.

9.95 As described previously, the current government initiative follows 30 years of unsuccessful attempts to establish a national science and technology strategy. Canada must decide what it wants to do. Our audit has shown that an effective, highly focused, national science and technology strategy is critical to survival and growth in today's high-technology economic environment. Ensuring that such a Canadian strategy emerges from the proposals to be put forward by the Minister of Industry could be one of the most important roles for parliamentarians in the near future.

9.96 Several challenges lie ahead. A first challenge for parliamentarians and for the appropriate parliamentary committee will be to ensure that there is a real results-oriented science and technology strategy with real priorities and real direction. A second challenge will be to ensure that there is a concerted effort to implement the strategy and achieve the intended results. Finally, a third challenge will be to ensure that a proper accountability infrastructure is put in place.[16]

(16) Auditor General's Report (1994), Vol. 6, Ch. 9.

OVERVIEW OF THE NEW S&T POLICY

A. General

The new 38-page federal government policy paper is broken down into six chapters that discuss setting goals, establishing priorities, creating new institutions and mechanisms for governance, and providing direction. The report recognizes at the outset the importance of S&T:

> Science and technology (S&T) play a critical role in the health and well-being of Canadians and in the country's ability to generate sustainable employment and economic growth. ... *Science and Technology for the New Century* recognizes that the world's advanced economies are undergoing a fundamental transformation to knowledge-based industries. Canadians must respond with policies, programs, institutions and partnerships that will maximize our economic opportunities and sustain our social fabric.(17)

The paper concludes by recognizing that it is only the first step in a larger process:

> This paper is an important milestone, showing the government's commitment to do its part by deploying its S&T investment wisely. In the months ahead, the federal government will work with the provinces and territories, the private sector, universities, the research community, not-for-profit organizations and others toward developing a full national S&T strategy for the Canadian innovation system.(18)

A summary of the key themes covered in the various chapters are detailed below.

> Chapter 2 explains the importance of establishing partnerships and networks for developing an innovation system to enhance the ability of Canadians to share knowledge and information.
>
> Chapter 3 elaborates on the connections between the goals of job creation and economic growth, quality of life and advancement of knowledge, as well as the need to pursue these three in an integrated and mutually reinforcing way.

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(17) *Science and Technology for the New Century: A Federal Strategy* (1996), p. 1.

(18) *Ibid*., p. 35.

Chapter 4 explains how a change to an emphasis on the federal government's role as a partner with business, academic institutions, other governments and voluntary organizations should stimulate increased S&T activity.

Chapter 5 addresses the need for better governance of the federal S&T effort.
Chapter 6 sets out a common set of principles to further improve the management of S&T effort in federal departments and agencies.

Chapter 7 concludes that success will ultimately depend on Canadians' collaboration in the national innovation system.

Overall, the plan attempts to define national goals; describes what the federal government sees as its core S&T activities; and outlines a new governance system based on mechanisms for receiving expert external advice. The plan also tries to improve interdepartmental coordination and provide for more effective management. Lastly, the plan introduces operating principles that are meant to guide departments and agencies in performing and investing in S&T.

The policy restates the government's view of the goals of S&T: sustainable job creation and economic growth; improved quality of life; and advancement of knowledge. These goals reflect the long-held views of many Canadians and were explicitly stated in the background paper at the outset of this review.

The core federal government S&T activities are viewed as:

- funding and performing scientific research to support the mandates of departments and agencies;
- supporting research in universities, colleges, hospitals and other non-governmental research institutions and Networks of Centres of Excellence;
- supporting private sector research and development; and
- providing information and analysis, and building networks.

B. New Institutions and Mechanisms for Governance

Major new institutions and mechanisms for governance to support the activities in the plan are described. The policy paper makes the following changes:

- It replaces NABST with a new Advisory Council on Science and Technology. This group will meet with the Economic Development Policy Committee of Cabinet to review the Canada's performance in S&T, identify emerging issues, and advise on a forward-looking agenda. To permit a review of Canada's performance in becoming more innovative and more competitive internationally, a new S&T information system for Canada will be created.

- Departmental S&T performance will be more accountable through a new expenditure management system and annual reports. Each science-based department and agency will be required to set clear S&T targets and objectives, establish performance measurement indicators based on outputs, develop evaluation frameworks, and maintain mechanisms for external advice and review. The Outlook documents[19] from science-based departments and agencies will include an S&T plan. These Outlook documents are public documents available to all Canadians and accessible for review by parliamentary committees.

- A new framework for human resources management in the federal science and technology community is proposed that would better manage federal scientific personnel. The various stakeholders are working on new approaches to several areas such as rewards, recognition and incentives; recruitment; and rejuvenation.

- To improve intergovernmental cooperation and coordination of Canada's S&T effort, the government plans to initiate discussions with representatives of provincial and territorial governments, as well as with other interested parties. These discussions are intended to identify opportunities to strengthen the Canadian innovation system as well as the federal government's S&T strategy. To help attain this objective, federal science-based departments and agencies are to develop strategies for working with their provincial and territorial counterparts on S&T activities of mutual interest.

- The coordination across departmental lines (horizontal, crosscutting issues in S&T) will be led by the Minister of Industry, supported by the Secretary of State (Science, Research and Development). A committee composed of representatives of external bodies that advise federal science-based departments and agencies will assist in this endeavour.

C. Providing Direction

The policy establishes that seven operating principles for S&T policies and programs are to be followed by all departments when preparing their S&T plans. These principles are to:

- increase the effectiveness of federally supported research;

- capture the benefits of partnership;

- emphasize preventive approaches and sustainable development;

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(19) Federal departments and agencies have since 1995 been required to prepare for their respective HCSC an annual Outlook document of their aims, priorities and activities for the next several years.

- position Canada competitively within emerging international regulatory, standards and intellectual property regimes;
- build information networks to form the infrastructure of the knowledge economy;
- extend international S&T links; and
- promote a stronger science culture.

To assist departments and agencies to follow the seven operating principles, the government directs that:

- departments are to establish advisory committees;
- federal research facilities and programs are to establish and follow a rigorous schedule for submitting its proposed research activities to an expert review by clients, stakeholders and peers in order to ensure the scientific, economic and environmental excellence of its research;
- departments are to establish partnerships with the other stakeholders;
- more federal R&D should be transferred to the private sector;
- all areas of the government are to build information networks;
- departments are to promote a stronger science culture; and
- departments are to try to improve regulatory systems and be more active in standard-setting.

D. Technology Partnerships Canada

A program associated with this new policy that has received considerable press coverage is Technology Partnerships Canada. With initial funding of $150 million, to increase to $250 million by fiscal year 1998/99, this program is designed to encourage research and development and high technology projects in Canada. The fund takes an investment approach to technology; it can invest between 25% to 30% of the cost of a project, with all investments being fully repayable.(20) The targeted areas are aerospace and defence industries; environmental technologies; and enabling technologies (such as advanced manufacturing technologies and biotechnology). The eventual funding distribution between the various areas is expected to be approximately $200 million annually for aerospace and defence industries and environmental technologies; and approximately $50 million annually for enabling technologies.(21)

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(20) Industry Canada, Fact Sheet "Technology Partnerships Canada."

(21) Discussions with B. Deacon, Director General and Manager Coordination and Management Services, Industry Canada, 14 March 1996.

The program has an advisory group with members from the private sector and is chaired by the Minister of Industry. This group will meet quarterly to assess market trends and benchmark Canadian firms against foreign competition. An interdepartmental board, composed of members from the supporting departments, including National Defence, Environment Canada and Industry Canada, will be reviewing the cases. The special operating agency managing this program is already accepting submissions.(22)

DISCUSSION

The long delay from input to a finished product, in this, the government's first serious attempt to prepare a policy for federal S&T activities, may have had various causes but raised doubts as to whether the goal would be achieved. An abundance of input has led to delivery of a well presented S&T policy, however. Many good points from previous government policies and the input process are incorporated, but there remain a number of areas where advice was ignored or where implementation presents problems.

The new Advisory Council on Science and Technology will not fulfill the advocacy role of the NABST, nor is it intended that it will prepare numerous reports.(23) The policy paper states:

> The government believes that NABST's more public functions, those related to mobilizing the broader scientific community and influencing Canadians' attitudes toward S&T, would be best served by institutions at arm's length from government.(24)

The question remains: which arm's-length institution did the government have in mind?

The policy lays the groundwork for greatly improved transparency, accountability and governance of federal S&T assets. The annual Departmental Outlook documents, with their S&T component, should provide better S&T information for the public, S&T stakeholders, and Parliament. It remains to be seen how complete these documents will be and how much scrutiny

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(22) *Ibid*.

(23) Andrei Sulzenko, Executive Director S&T Review, Industry Canada, House of Commons Standing Committee on Industry, *Minutes of Proceedings and Evidence*, 2nd Session, 35th Parliament, 26 March 1996, 02:10.

(24) *Science and Technology for the New Century: A Federal Strategy* (1996), p. 15.

they will receive. Parliament has not yet had an opportunity to examine its role of oversight and accountability under this new federal reporting regime. Will Parliament modify the committee structure so as to monitor federal government scientific activity collectively, or will each committee review the S&T component relevant to its own area? Many such details have yet to be made available. For example, by what mechanism will the public or S&T stakeholders gain access to the Advisory Council on S&T and eventually to Cabinet? What review, if any, will be involved in the selection of the members of the departmental advisory bodies?

> All departments ... will establish advisory bodies with external representation and ensure that the composition of these bodies benefits from a broad, multidisciplinary constituency.(25)

Some of the stakeholders in the departments' user communities could be in conflict of interest. Will the members be selected from the larger scientific committee that is being served? Such lack of detail could lead to future problems.

The new policy advocates transparency and external input but there have recently been major changes to federal S&T. As part of the program review process, cuts may have been made without the benefit of the longer term objectives expressed in the S&T policy and without the extensive external review that is now to be part of the S&T process. Had the associated/affected scientific community been fully involved in the review of S&T assets, it might have alerted the government to problems likely to flow from the elimination of essential national facilities or knowledge base. In the best of all worlds, the policy framework would have preceded the cuts.

One of the NABST recommendations that the new government policy has ignored was for an S&T champion at the cabinet level, with a Chief S&T Advisor.

> A federal S&T strategy needs a **senior Cabinet Minister to act as a strong S&T champion** and as an agent of change both within government and across the country. This Minister would be designated by the Prime Minister to develop the government's overall S&T strategy and priorities, and to ensure that the government's S&T efforts are appropriately designed so as to be integrated into major policy initiatives. Individual Ministers would remain accountable for the implementation of those aspects of the strategy that fall within their mandates.

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(25) *Ibid*., p. 23.

> **The Cabinet Minister should be supported by a Chief S&T Advisor.** This individual would be a well-respected scientist or policy-maker appointed as a senior civil servant, to ensure continuity. The Chief S&T Advisor would lead the setting of cross-departmental priorities that govern and influence the S&T activities in all departments, and would provide advice and help coordinate areas of multidisciplinary interest or resource demands that go beyond the mandate of any one department.(26)

This new S&T policy contains many good ideas and outlines in very general terms how it will attempt to implement them. Putting federal S&T assets in order before attempting a larger review of the Canadian Innovation System is a logical first step(27) which should improve the credibility of the government. Many of the ideas and concepts described in the paper, such as transparency and accountability, can, however, be ascertained only after the system has been in operation for at least a year and many of the details have been sorted out. Two sayings sum up the concerns and reservations arising from this policy: "the proof is in the pudding," and "the devil is in the details."

CONCLUSION

The new federal S&T policy is an important first step in improving the effective utilization of federal S&T resources. Only time will tell if the plan is implemented effectively and the desired transparency and improved efficiencies are attained. Moreover, if Canada is to compete in the 21st century, federal S&T activities must be recognized as only part of a larger mosaic of networks, organizations and activities that make up the Canadian Innovation system.

> Innovation is as much regional and local as it is national. A climate for innovation is created by the leadership and drive of clusters of firms in an industry, along with the financial institutions serving them; responsive education and training institutions; local research bodies; boards of trade; municipal, territorial and provincial governments; entrepreneurs; and many others.

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(26) "Healthy, Wealthy and Wise ..." (1995), p. 10-11.

(27) Alan Nymark, Assistant Deputy Minister, Industry and Science Policy, Industry Canada, House of Commons Standing Committee on Industry, *Minutes of Proceedings and Evidence*, 2nd Session, 35th Parliament, 26 March 1996, 01:12.

> Canada's challenge is to put our knowledge to work to create an effective and resilient innovation system that maximizes the synergies from activities performed at all levels and across all sectors and regions. This is critically important for a mid-sized country like Canada, which has more limited resources than its major trading partners, but equivalent competitive challenges. But our size should be no obstacle; smaller economies than ours have succeeded in creating innovation systems that work well for them. We must take a more deliberate approach to building the Canadian innovation system, by understanding how it functions, playing on its strengths and reducing its weaknesses, engaging all the participants, and getting the federal government's role right. This will be a cornerstone of the federal government's strategy in building a more innovative economy.(28)

It would seem that much remains to be done.

(28) *Science and Technology for the New Century: A Federal Strategy* (1996), p. 4.

APPENDIX

APPENDIX 1

Recommendations from the NABST Report, *Healthy, Wealthy and Wise: A Framework for an Integrated Federal Science and Technology Strategy*

Listed below are the recommendations from the NABST report in the order they were presented.

Establish a goal-oriented S&T strategy with clearly defined roles for government, in the context of a model integrating the quality of life, wealth and jobs, and the advancement of knowledge.

Establish an effective S&T governance system, led by a Cabinet-level S&T Champion, supported by a senior Chief S&T Advisor with a dedicated staff of inside and outside experts, advised by an external advisory board, and implemented by responsible line departments.

Establish and apply consistent and measurable criteria and performance indicators to help establish priorities and measure outcomes.

Allocate an amount of funding from the federal health care budget, in the range of $100 to $200 million annually, for health services and health determinants research. This amount is roughly equivalent to 1 percent of federal spending on health care.

Allocate an amount of funding from the federal social programs budget, in the range of $200 to $300 million annually, for research into the efficiency and effectiveness of social programs. This amount is roughly equivalent to 0.5 percent of current federal spending on social programs (unemployment insurance, social assistance, education and seniors).

Develop a first-class data management and access system, ensuring timely and affordable access to Canadian government-held data for researchers and students. An important step in this process is for government to support the Data Liberation Initiative

Establish targets and benchmarks (or indicators) by which to measure progress in all areas that fall under the umbrella of quality of life, including environmental quality, personal safety, defence, and cultural heritage, as well as health and social programs. A federal mechanism established to coordinate federal S&T (as recommended in Chapter One) should have as part of its mandate the responsibility to ensure that departments, agencies and granting councils give priority to collaborative and multidisciplinary research in the area of quality of life.

Facilitate ready access to the network for all Canadians.

Establish and maintain an effective and accurate system of S&T data collection and performance measurement to support government decision-making on S&T investments that are intended to create wealth and jobs.
Evaluate and justify federal laboratory activities against strategic needs.

Establish accountability procedures for federal intramural S&T.

Government should facilitate, rather than engage in, market-driven S&T.

Improve the business climate and reward system for successful entrepreneurs and innovators, by revising overall tax structures and removing barriers that inhibit business expansion.

Encourage industry to focus on value-added products and services for export to world-wide markets by sharing the risks of acquisition, development and adaptation of new technologies.

Provide incentives to support entrepreneurs and new companies that commercialize research results from universities and government laboratories.

Facilitate and build on successful examples of partnerships, pre-competitive consortia, clusters and networking.

Lever government incentives that fund industrial R&D by requiring involvement of SMEs, universities or colleges.

Use government procurement policies to help elevate the capabilities of Canadian suppliers and their SME and research partners.

Encourage the environmentally responsible exploitation of resources, consistent with long-term sustainability.

Use S&T to create evidence-based regulations.

Work with the private sector to set realistic but high environmental standards and challenge firms to meet them.

Provide funding for selected industrial R&D activity, on a risk-sharing, repayable basis, to increase the innovative capacity of Canadian firms.

Encourage collaboration amongst large companies, SMEs, universities and colleges.

Manage federal funding centrally, with guidance from an independent advisory board.

Help Canadian firms to take advantage of new technologies and apply them effectively in new ways of doing business.

Establish and maintain a sound policy climate and infrastructure for the Information Highway.

Facilitate ready access to the network for all Canadians.
Emphasize the need for training in entrepreneurial and technological skills to be relevant, aimed to help industry compete.

Encourage significant industry involvement in upgrading workforce capabilities.

Ensure that the systems and tools for learning and work are appropriate to industry’s needs.

Challenge the granting councils to lever increased funds from research clients and convince the provinces, industry and non-governmental organizations to become partners in the national investment in basic and applied university research.

Include in the S&T strategy, a process for collaboration with the provinces to identify and maintain a base level of support for S&T research infrastructure in Canadian universities.

Require science-based departments and agencies (SBDAs) to carry out regularly scheduled, rigorous, external evaluations of their activities, based upon department-specific criteria consistent with the priorities inherent in a federal S&T strategy.

Encourage and strengthen strategic collaborative research arrangements among government, university and industrial laboratories and promote cross-sectoral and multidisciplinary partnerships.

Develop, in collaboration with other sectors, an interactive database of national and international scientific and technological expertise, and a national database of ongoing R&D in Canadian research facilities, as well as the communications infrastructure to make this knowledge accessible.

Improve intellectual property safeguards on the information highway, through the removal of any administrative and technical barriers that may limit the effective operation of copyright legislation.

Create an integrated plan for science culture development, which includes a formal evaluation process for existing federal programs. This plan must include all parties currently involved in science culture initiatives, such as the federal and provincial governments and independent organizations.

Encourage the Council of Ministers of Education, Canada (CMEC) to establish a national science and mathematics curriculum.

Encourage the Council of Ministers of Education, Canada (CMEC) to require that recertification of science teachers become mandatory, and be contingent upon regular attendance at workshops in science training and education.