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Science and Technology for the New Century

Summary

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Canada

Science and Technology for the New Century

Summary

March 1996

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1. Introduction

Science and technology (S&T) are central to the success of a modern country like Canada. They are vital resources and strategic investments for building a more innovative economy now and into the 21st century.

Science and technology have had a significant role in Canada's development. These knowledge-based activities have given Canadians the tools to build a strong economy and a caring social system, sustain our rich natural environment, and enjoy peace at home and a respected place among nations. They have provided Canadians with a standard of living second to none, a status recognized by the United Nations.

The government understands science and technology's critical role in the health and well-being of Canadians, and in our ability to create sustainable employment and economic growth. The federal government makes a major contribution to the country's S&T effort — over \$5 billion in 1995-96. It is responsible for over a quarter of the country's total research and development investment. This investment must be very wisely managed if Canadians are to receive the maximum possible return. Consequently, the government announced a fundamental review of its S&T effort in its first budget. This review was dedicated to giving Canadians a federal strategy with “real priorities, real direction, and a real review of results.”

The S&T Review began in June 1994. By the end of the public consultations, more than 3000 Canadians had offered their views and best advice. At the same time, federal departments and agencies carried out an internal review of S&T policies and programs. The National Advisory Board on Science and Technology (NABST) also gave the Prime Minister its assessment of the federal government's S&T effort in its June 1995 report, *Healthy, Wealthy and Wise*.

Science and Technology for the New Century is the government's response to this wide-ranging review. It presents a federal strategy that will allow Canada to take advantage of the worldwide economic shift to knowledge-based industries. It shows how Canada will put in place S&T policies, programs, institutions and relationships so that we can maximize economic opportunities and strengthen our social fabric.

For its part, the federal government is fundamentally re-evaluating where and how to invest its S&T resources to best put them to work. This approach has three essential themes. First, effective new institutions, relationships and networks — a stronger national innovation system — must be established to enhance Canadians' abilities to gain and share knowledge and information. Second, the links between job creation, economic growth, quality of life and advancement of knowledge must be well understood and strengthened. Finally, the federal government must improve its approach to partnerships with business, academic institutions, other governments and voluntary organizations.

Science and Technology for the New Century sets out a realistic, practical and attainable plan for implementing this approach by establishing the way departments and agencies undertake and invest in S&T. The plan:

- defines national goals;
- describes the federal government's core S&T activities;
- outlines a new governance system based on mechanisms for receiving expert external advice, improved interdepartmental coordination and more effective management; and
- introduces operating principles to guide departments and agencies in performing and investing in S&T.

2. Adapting to a Changing World

There can be no doubt that our economy is undergoing a major transformation, unlike any since the Industrial Revolution. Knowledge and information — their applications and technologies — are at the root of it.

Evidence of this economic and societal shift is pervasive. From 1984 to 1994, there was a net gain of more than 800 000 jobs for those with advanced post-secondary education, while there was a net loss of almost 1.4 million jobs for Canadians with high school training or less. Although they accounted for only a third of total employment, high-knowledge industries contributed more to recent job growth in Canada than all other industries combined. Furthermore, a recent study by Statistics Canada found that two key factors in the success of fast-growing small firms — the economy's job generators — are their research and development (R&D) performance and their ability to adopt new technologies.

But we have some way to go. By international standards, Canada's S&T effort has room for improvement, particularly in the development, adoption and commercialization of technology. What matters most in enhancing Canada's capacity for innovation is the exchange of knowledge and information; cooperation among governments, business and universities; and forging partnerships for mutual benefit.

To build a more innovative economy, the federal government is taking a systematic approach to strengthening the Canadian innovation system. This involves understanding how it functions, playing on strengths and redressing weaknesses, engaging all the participants and getting the federal government's own S&T role right.

3. Setting Goals

The bedrock of the federal S&T strategy is a set of coherent national goals to which our S&T resources can be directed. The government has examined today's challenges and those of the coming century. It has set three related goals for building a strong, forward-looking, dynamic Canadian innovation system:

- sustainable job creation and economic growth;
- improved quality of life; and
- advancement of knowledge.

The S&T Review showed the pervasiveness, potential and importance of science and technology in creating jobs and growth, providing a high quality of life and advancing knowledge. These goals are inherently related. They underlie the government's core priorities, the new governance system, and the operating principles that will focus and guide the federal effort in science and technology.

4. Establishing Priorities

Setting priorities is difficult, for it means carrying out some activities at the expense of others. It is particularly hard today as governments in Canada deal with budget deficits and debt loads.

To get its own house in order, the federal government undertook a major evaluation of its roles and priorities in the Program Review leading up to the 1995 budget. This resulted in difficult but necessary cuts to program spending in virtually all areas, including science and technology. The advice received during the S&T Review was crucial in helping departments and agencies to set S&T spending priorities.

Despite reduced expenditures, the federal government maintains a major commitment to S&T: \$5.5 billion in 1995-96. Moreover, the government provides considerable indirect assistance through the Scientific Research and Experimental Development tax credit. This assistance amounted to over \$1 billion in 1992, the most recent year for which information is available.

The S&T programs and projects launched in the past two years with new or re-allocated funds illustrate this commitment and involve new forms of partnership. They include:

- CANARIE (the Canadian Network for the Advancement of Research, Industry and Education), which is accelerating construction of the Information Highway;
- the Health Intelligence Network, a recent Health Canada initiative, directed to strengthening Canada's national surveillance and disease-monitoring capacity;
- Western Economic Diversification Canada's Biotechnology Partnerships program, which engages financial institutions in improving access to capital for small businesses in emerging industries; and
- Agriculture and Agri-Food Canada's Matching Investment Initiative, which co-funds projects with industry to ensure that research priorities are met and technology is transferred.

Program Review resulted in substantial re-engineering and refocusing of federal S&T activities. The scope of this effort is reflected in action plans prepared by the Treasury Board Secretariat and the following major S&T departments and agencies:

- Agriculture and Agri-Food Canada
- Environment Canada

- Fisheries and Oceans
- Health Portfolio
 - Health Canada
 - Medical Research Council of Canada
 - Hazardous Materials Information Review Commission
 - Patented Medicine Prices Review Board
- Human Resources Development Canada
- Industry Portfolio
 - Atlantic Canada Opportunities Agency
 - Business Development Bank of Canada
 - Canadian Space Agency
 - Federal Office of Regional Development (Quebec)
 - Industry Canada, including the Communications Research Centre
 - National Research Council
 - Natural Sciences and Engineering Research Council
 - Social Sciences and Humanities Research Council
 - Standards Council of Canada
 - Statistics Canada
 - Western Economic Diversification Canada
- National Defence
- Natural Resources Canada
- Transport Canada

The individual action plans present detailed information on department and agency S&T priorities. They describe innovations and partnerships to carry out mandates and deliver essential programs and services to Canadians. The plans are available from the departments in electronic form. A summary of action plan highlights is also available.

With smaller budgets, it is critical to invest our resources strategically, so that Canadians obtain the maximum economic, social and scientific returns. This means focusing on core

activities, and creating better delivery mechanisms through internal and external partnerships. The government has determined that its core activities will include:

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

A principal role for government in S&T is to undertake activities that provide a “public good.” This includes research and development that leads to optimum public policy, that the private sector would not likely carry out on its own, or that can be carried out in partnership with the private sector and the academic community.

Sound science is central to sound policy and decision making. Government has regulatory roles in drug licensing, food inspection, fisheries conservation and environmental protection, among others. Discharging these responsibilities requires the effective use of S&T in testing, assessing risks, anticipating and avoiding threats to health and safety, and lessening harmful effects.

These research activities require increasingly strong collaboration between the federal government, the provinces and territories, and the private sector. Recognizing this, the federal government will encourage opportunities for cooperative efforts and partnerships with other participants in the Canadian innovation system.

The federal government also considers support for research and the training of graduate and post-graduate students in post-secondary

and other institutions to be a core activity. Such vital investment in research and human capital generates discoveries essential to Canadian innovation, and ensures our ability to adopt and adapt technologies from other parts of the world.

The federal government has steadily increased support for private sector R&D. Programs to this end have included assistance through the tax system, industry-led consortia in pre-competitive research, and assistance to specific firms for technology development for high-risk commercialization.

Although one result of Program Review was the end of many business subsidy programs, Canada still needs, as part of an overall technology plan, an effective, market-driven tool to stimulate the development and commercialization of key technologies. Accordingly, the government will introduce Technology Partnerships Canada to stimulate increased private sector investment in high technology product and process development in globally competitive, footloose and high-growth industries.

The program will be designed to share risk with private sector participants, earn royalties from successful projects and reinvest them to help support new initiatives. The government will seek the best advice available in the public and private sectors to target sectors and technologies critical to Canada’s economic growth, such as aerospace and defence, environmental and enabling technologies, and industries converting from military to civilian production.

Finally, the federal government can promote and build the information networks that link Canadians to each other, and foster international connections. The Information Highway is a key element, with its implications for government services, the growth of new industries, culture, networking, intergovernmental cooperation and

job creation. Another is the widespread diffusion of information and analyses. Through its activities, the government has much S&T-related information to share with Canadians. It can also provide analyses of this information so that Canadians can make informed decisions on investment and production, health, safety, sustainable development, lifelong learning and promoting a science culture.

Several initiatives are under way to improve public access to information, analyses and government services. These include Strategis, an Internet product offering a vast array of economic and technological information relevant to Canadian business, and the Government Online project, which provides for electronic communications between government and clients.

Information networks, products and related policies are pivotal to our ability to learn about, adopt and adapt leading-edge technologies and improve our innovative capacity. They take time, effort and resources to develop, but a modest investment brings a big payoff; this is a priority in the government's S&T effort.

5. Creating New Institutions and Mechanisms for Governance

The institutions that guide and carry out S&T, and the way they are arranged and function together, can either encourage or impede invention and the exchange of ideas. Other G-7 nations have well-established S&T governance systems linking and capturing the synergies between government, business, finance and academic institutions. Developing more effective Canadian institutions is a priority for the federal government.

In Canada, the federal governance system for S&T will have four main elements:

- expert external advice;
- a decision-making mechanism for stronger coordination of the government's overall S&T effort;
- an effective, transparent and accountable management system common to all departments and agencies; and
- improved intergovernmental cooperation and coordination.

Advances in S&T occur so rapidly, and carry such potential for systemic economic and social change, that the government must be able to consult with the best-qualified advisors from the scientific community, industry, finance, economics and other fields. Accordingly, the government will establish an Advisory Council on Science and Technology composed of eminent Canadians who are leaders in these areas. Council members will be formally appointed by and report to the Prime Minister. The Minister of Industry will lead the government's regular interface with the Council

The government realizes that to be a more effective partner in the Canadian innovation system, it must get its own house in order. Achieving greater coherence while preserving flexibility, responsiveness and ministerial accountability requires more rigorous review of priorities and greater coordination of activities. To improve the governance of S&T at the ministerial level, the Economic Development Policy Committee of Cabinet, as part of the government's overall planning and accountability framework, will review federal S&T performance and make recommendations to Cabinet on S&T priorities. The committee's review of S&T performance will be based on an annual report to Cabinet on science and technology activities in the federal government. The Advisory Council on

Science and Technology will meet with the Economic Development Policy Committee of Cabinet to review the nation's performance in S&T, identify emerging issues and advise on a forward-looking agenda.

The third element in the new governance system consists of new institutions and mechanisms to improve the management of the government's S&T investment. This means improving the coordination of S&T activity among federal departments and agencies. To this end, the Minister of Industry, supported by the Secretary of State (Science, Research and Development) will lead the coordination of S&T policy and strategies across the federal government. Supporting this effort will be a committee of representatives from external advisory bodies to federal science-based departments and agencies, which will advise the government on horizontal, crosscutting issues.

Measures will also be taken to improve management of S&T activities by individual departments and agencies, based on the new Expenditure Management System. Each department and agency will prepare an S&T plan as part of its overall business plan for Cabinet review of results. It will prepare a report on priorities, key initiatives, spending plans, management challenges and performance measures in S&T. It will be expected to develop a best-practices management strategy for S&T personnel. Each department and agency will set S&T targets and objectives, establish output-based performance indicators, develop evaluation frameworks, and maintain mechanisms for external advice and review.

These changes will make a big difference in the way the federal government manages its S&T assets and activities — a difference Canadians will soon see because of the increased transparency and accountability that will result.

Recognizing the importance of the federal S&T work force — scientists, engineers, technicians, analysts and laboratory managers — and the distinct challenges its members face, the Treasury Board Secretariat is working with science-based departments and agencies on a human resources strategy for the federal S&T community. After extensive consultations, *A Framework for the Human Resources Management of the Federal Science and Technology Community* was developed. The framework is designed to provide practical policies and cost-effective tools to align S&T organizations and staff with the direction and business of their departments. A management structure has been established and is putting the framework into action.

Finally, an effective governance system for S&T in Canada demands closer cooperation and coordination among governments. Efforts in this direction must be made real through concerted, pragmatic actions to deal with issues of overlap and duplication; specific opportunities for collaboration; and the sharing of information, analyses and best-practices techniques. We must build on existing relationships between federal and provincial departments. And where they are needed, we must develop new institutions and instruments, whether through regional arrangements or bilateral agreements.

To shape this process, the government will begin discussions with the provinces and territories to identify new, practical forms of partnerships and other mechanisms for cooperation and coordination of S&T activities in areas of mutual interest. In support of this, federal science-based departments and agencies will develop explicit strategies for working with their provincial and territorial counterparts.

6. Providing Direction

Government-wide direction is needed on the way priorities are put into operation and how and when the desired results are to be achieved. Accordingly, all federal departments and agencies will be guided by a common framework of operating principles. The principles strongly reflect the advice received throughout the S&T Review process.

The operating principles are:

1. *Increase the effectiveness of federally supported research by:*
 - using expert reviews and advisory bodies to ensure scientific excellence and relevance;
 - making sure that government spending on S&T gains full value for money and strengthens the research and technological capacity of Canadian firms; and
 - transferring knowledge and technology to the private sector.
2. *Capture the benefits of partnership by:*
 - launching collaborative ventures between federal departments and industry, universities, labour, business organizations and other levels of government;
 - integrating the social sciences in the federal research effort; and
 - providing broader private sector access to federal research facilities.
3. *Emphasize preventive approaches and sustainable development by:*
 - making foresight, risk assessment and prevention an integral part of federal S&T;
 - improving the delivery of federal programs and services to Canadians through more effective use of new technologies; and
 - working toward the goal of greater efficiency in industry and other sectors.
4. *Position Canada competitively within emerging international regulatory, standards and intellectual property regimes by:*
 - streamlining regulations and adopting new approaches to regulation;
 - participating in the development and setting of international standards; and
 - ensuring that intellectual property policy relating to federally supported research increases private sector commercialization and partnership opportunities.
5. *Build information networks by:*
 - transferring knowledge and making data and analysis available to potential users; and
 - providing relevant, timely information services through the Information Highway to encourage innovation, particularly at the community level.
6. *Extend science and technology linkages internationally by:*
 - promoting international collaboration for Canadian firms; and
 - collecting and disseminating intelligence on international S&T.
7. *Promote a stronger science culture by:*
 - making full use of the Information Highway and reaching out to the community, including young people in schools, universities and colleges.

The way departments and agencies apply these principles to their S&T activities will vary depending upon their roles and responsibilities. Although they will not apply equally to all departments, the operating principles will serve as the benchmarks against which results will be measured and evaluated.

The action plans of the major science-based departments and agencies show in detail the way these operating principles and related management practices are being implemented.

7. Moving Ahead

Canadians challenged the federal government with a wealth of advice during the S&T Review. The government in turn has set many challenges for itself and is obligated to see them through. A comprehensive list of the commitments to action in this paper is provided in the Annex.

Science and Technology for the New Century outlines a realistic, pragmatic and achievable plan for the federal government's contribution to reaching our long-term goals for S&T. The individual reports of the key S&T departments and agencies show the plan in action. They will be regularly reviewed and renewed, drawing on the proposals made during the S&T Review.

Science and Technology for the New Century is an important milestone, demonstrating the government's commitment to use its S&T investments wisely. Ultimate success, however, depends on the dedicated collaboration of Canadians in the national innovation system. For it is only through a genuine partnership among all players in the economy that our overall S&T effort will meet Canada's domestic and global challenges — and allow us to maintain our place as the world's best country in the new century.

Annex: Commitments to Action

NEW INSTITUTIONS AND MECHANISMS FOR GOVERNANCE

1. The government will replace the National Advisory Board on Science and Technology with an Advisory Council on Science and Technology. It will meet with the Economic Development Policy Committee of Cabinet to review the nation's performance in S&T, identify emerging issues and advise on a forward-looking agenda.
2. To improve the governance of S&T at the ministerial level, the government will take the following measures:
 - The Economic Development Policy Committee of Cabinet will review federal S&T performance and make recommendations to Cabinet on S&T priorities.
 - The committee's review of S&T performance will be based on an annual report to Cabinet on science and technology activities in the federal government.
 - The Advisory Council on S&T will provide its own views and advice as input to the committee's review of S&T priorities.
3. The Minister of Industry, supported by the Secretary of State (Science, Research and Development), will lead the coordination of S&T policy and strategies across the federal government.
4. This effort will be supported by a committee composed of representatives of external advisory bodies to federal science-based departments and agencies. This committee will advise the government on approaches to horizontal, crosscutting issues in federal S&T.
5. Each science-based department and agency will prepare an S&T plan describing and integrating the approach that it will take within its overall business plan. This S&T plan will form the basis for Cabinet review of results.
6. Each federal department and agency responsible for S&T expenditures will prepare a report on its priorities, key initiatives, spending plans, management challenges and performance measures in S&T as part of its annual Departmental Outlook.
7. The Treasury Board, together with other S&T stakeholders, is introducing *A Framework for the Human Resources Management of the Federal Science and Technology Community*. To implement this framework, science-based departments and agencies, the Public Service Commission, the Professional Institute of the Public Service of Canada and the Treasury Board Secretariat are working in partnership on new approaches to:
 - management and scientific development and training;
 - classification;
 - rewards, recognition and incentives;
 - the work force and mobility; and
 - recruitment and rejuvenation.
8. Each science-based department and agency will 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.

9. The government will create a new S&T information system for Canada designed to measure the country's progress in becoming more innovative and more competitive internationally.
10. To improve intergovernmental cooperation and coordination of Canada's S&T effort, the government will initiate discussions with representatives of provincial and territorial governments, as well as with other interested parties, on the federal government's S&T strategy and to identify opportunities to strengthen the Canadian innovation system.
11. In support of these efforts, federal science-based departments and agencies will develop explicit strategies for working with their provincial and territorial counterparts on S&T activities of mutual interest.
4. Federal departments and agencies will work toward the objective of strengthening the research and technological capability of Canadian firms when deciding which research activities should be conducted in-house and which should be contracted out.
5. The transfer of knowledge and technology is an explicit objective of federal S&T, and departments and agencies will be closely evaluated on their efforts in meeting it.
6. All science-based departments and agencies will develop strategies for promoting partnerships and collaborative S&T arrangements with industry, the provinces, universities, and other stakeholders.
7. Federal departments and agencies will develop strategies for increasing interdepartmental collaboration to combine resources and eliminate duplication.

PROVIDING DIRECTION

1. Each federal research facility and program will 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.
2. All departments and agencies that have not already done so will establish advisory bodies with external representation and ensure that the composition of these bodies benefits from a broad, multidisciplinary constituency.
3. Departments and agencies will regularly and systematically assess whether their performance of S&T might be better carried out by others.
8. Federal departments and agencies will develop explicit strategies to integrate the social sciences in their S&T activities. Departments will work with the Social Sciences and Humanities Research Council to identify research areas in the social sciences that will better inform policy development in priority areas.
9. Federal departments and agencies will take measures to improve access to their facilities and encourage an open-door approach to others engaged in scientific research.
10. Federal departments and agencies will specifically incorporate foresight, risk assessment and prevention practices in their S&T activities to improve their ability to anticipate and address issues before they become problems.

11. Federal departments and agencies will make greater use of new technologies to improve the design and delivery of their programs and services to Canadians.
12. The federal government will seek the advice of the National Round Table on the Environment and the Economy in establishing specific targets to help industries and other sectors become significantly more eco-efficient within a generation, and in understanding the implications of those targets for the development of new technologies.
13. Federal departments and agencies will aggressively seek opportunities to improve the regulatory systems in which their clients operate in order to reduce regulatory burden and enforcement costs without compromising standards of quality, public safety and sustainable development.
14. Federal departments and agencies will work with their clients and with a refocused Standards Council of Canada to increase participation in the development and setting of international standards. They will also develop plans for the systematic dissemination of information on new and emerging international standards and other innovation policy issues.
15. The federal government will start immediately to review its intellectual property policy in order to determine what improvements can be made to increase opportunities for commercialization and partnerships with the private sector.
16. The transfer of knowledge and the sharing of scientific information and data with Canadian researchers, schools, universities, libraries and industry will be a key function of all federal departments and agencies.
17. Federal departments and agencies will develop information services for dissemination via the Information Highway aimed at encouraging innovation, particularly at the community level.
18. As an extension of their domestic mandates, federal departments and agencies will develop explicit plans to promote international S&T collaboration for the benefit of Canadian firms. As well, they will develop specific approaches for gathering and disseminating international S&T intelligence. Our missions abroad will have a key role in this enterprise.
19. Making full use of the Information Highway, departments and agencies will develop action plans to reach out to the community, including young people in schools, universities and colleges.