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INNOVATION

*The Canadian Strategy
for Science
and Technology*

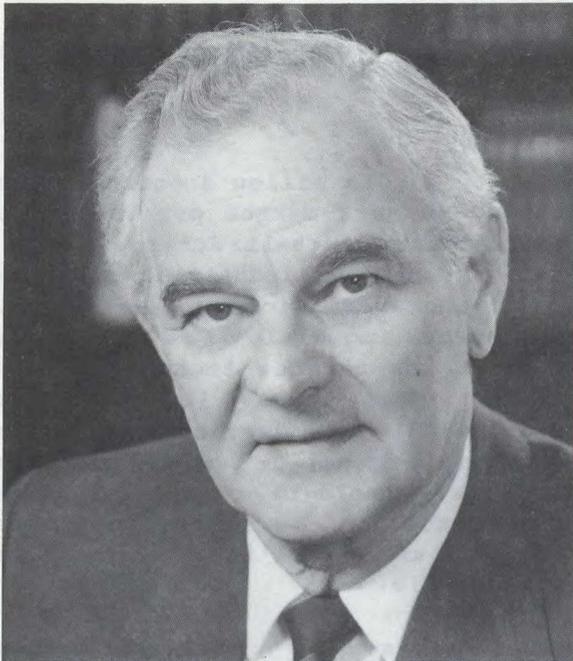


Industry, Science and
Technology Canada

Industrie, Sciences et
Technologie Canada



Canada 



Minister for Science

A MESSAGE FROM THE HONOURABLE WILLIAM C. WINEGARD

The economic environment of the 1990's is one of intense international competition. In order for Canadian industry to maintain or enhance its competitive position in the global marketplace, Canadians need to apply leading-edge technology to all of our industries. We must harness the innovative potential arising from science and technology to ease the transition to a new information and technology-based economy.

The federal government has set Canada on a new course aimed at achieving national economic and social goals through the more effective use of science and technology. InnovAction provides a solid scientific and technological foundation upon which we can build our future competitiveness. Developing a strong human resource base, increasing technology diffusion, exploiting strategic technologies, promoting public awareness, and more effective management of federal resources are key components of the federal science and technology strategy under InnovAction. It is a strategy which responds to the international competitive challenge and demonstrates federal leadership and commitment to science and technology.

Working in concert with industry, educational institutions and other levels of government, the programmes and policies established under InnovAction are helping to ensure Canada's competitive position in the 1990's and beyond. The widely acclaimed Canada Scholarships and Networks of Centres of Excellence programs are two examples of InnovAction initiatives. However, the federal government is not complacent. In order to take full advantage of the rapidly changing economic climate, programs and policies are being reviewed and augmented. New programs to address issues, such as the anticipated shortages in scientific, engineering and technical personnel, are being developed.

I believe that the resolute commitment of the federal government towards science and technology as one of the means of improving Canadian competitive industrial capacity is a key factor in securing our continued prosperity.



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**THE CANADIAN STRATEGY
FOR SCIENCE
AND TECHNOLOGY**

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Science and technology are the keys to a modern, competitive economy. It is clear that our traditional manufacturing and resource-based industries, as important as they are to Canada, will no longer assure us a strong position in the global economy, if we don't complement them with modern technology. That is why we have launched InnovAction, a modern strategy for scientific and technological development.

The Right Honourable Brian Mulroney
August 25, 1989

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SCIENCE, TECHNOLOGY AND THE COMPETITIVE CHALLENGE

Initiatives and Funding

Identification of key priorities for science and technology and funding for initiatives will prepare Canada for the global economy.

InnovAction was launched in 1987 as the first comprehensive federal strategy for science and technology. It identifies the government's key priorities for science and technology and provides funding for initiatives that address these priorities. Its goal is to secure Canada's competitive position in the world of the future.

That world is already upon us, and science and technology are already re-writing the rules of the global economy. As countries become increasingly interdependent through international trade and capital flows, they are turning to science and technology to engineer competitive advantages in the marketplace. These competitive advantages, created through new production methods, value-added products and services and ways of doing business, are rapidly displacing the more traditional comparative advantages enjoyed by many industrialized countries.

The challenge for Canadian business and industry is to make the transition to the new information and technology-based economy before it is too late. No firm — and no advanced nation — can hope to compete on the world stage without world-class scientific and technological resources.

Science, technology and industrial competitiveness will unite to form the basis of Canada's future economic and social prosperity.

The links between science, technology and industrial competitiveness lie at the heart of *InnovAction*. The strategy directs the federal government's national science and technology efforts toward the following five areas:

- increasing industrial innovation and technology transfer
 - developing and promoting strategic technologies
 - managing federal science and technology resources more effectively
 - ensuring the supply and development of human resources required for science and technology
 - promoting public education in science and technology and a more science-oriented culture
-

***InnovAction* demonstrates the federal government's resolve to advance Canada's competitiveness.**

By launching this strategy, the government signalled a commitment to make science and technology a national priority. This commitment remains as strong today as it was when *InnovAction* was first announced. In fact, there is a consensus among industry, universities, the scientific and engineering community and governments at all levels that this commitment is more necessary than ever before.

The Canada-U.S. Free Trade Agreement has, in a sense, opened the door to one of the world's most dynamic markets. Other openings are occurring as a consequence of falling trade barriers in Europe and the growing commercial vitality of Asia. Canadian firms can successfully enter through these openings if they are prepared to compete on global terms.

Speaking to the *Forum of Science and Technology Advisory Councils* in June 1989, Prime Minister Brian Mulroney affirmed the government's intention to focus more and more of our attention and resources on the fundamental building blocks of a competitive society — people, skills training, education, strategic technologies and research and development (R&D).

INNOVATION: PRINCIPLES AND PRIORITIES

InnovAction is an Integral Part of the National Agenda

InnovAction grew out of consultations with government, business and industry, labour groups, the scientific and engineering community and universities. On March 12, 1987, these consultations led to Canada's first National Science and Technology Policy, signed by the federal, provincial and territorial governments.

Development of *InnovAction* was guided by four principles:

- **Greater support from Industry for R&D**
- **Cooperation among all science and technology players**
- **R&D activities for the public interest and commercialization of government technology**
- **Greater efforts to import foreign technology**

The federal government launched *InnovAction* 12 days later, as the first step in putting this National Policy into action. In developing *InnovAction*, the government was guided by four basic principles:

- 1) Industry must play a greater role in supporting science and technology. The private sector should contribute to efforts that will determine its own prosperity, with government acting primarily as a facilitator — stimulating private sector investment, and creating a positive environment for innovation and entrepreneurship.
- 2) Cooperation among all science and technology players is essential. There has been too much fragmentation in our efforts. Industry, labour, universities, colleges and governments must work together to ensure the best return on Canada's science and technology investment.
- 3) While the government must pursue certain R&D activities for the public interest, in such areas as national security, environmental protection, and the promotion of health, safety, social and cultural goals, there is significant unrealized potential for the commercialization of government technology which must be exploited.
- 4) Canadian industry must strengthen efforts to import state-of-the-art foreign technology that serves Canadian needs. Canada can not remain competitive unless it acquires world-class technologies wherever they are available. The private sector and universities should be encouraged to undertake joint efforts with foreign partners, taking part in leading-edge projects otherwise beyond their reach.

Based on these principles, *InnovAction* provides a focus for federal science and technology efforts in five priority areas.

Industrial Innovation and Technology Transfer

InnovAction will encourage greater innovation within Canadian industry.

One priority is to encourage greater innovation within Canadian industry while facilitating the transfer of new technologies from the research lab to the shop floor.

Industrial innovation involves much more than R&D. The innovation cycle includes a series of linked stages — design, financing, production, marketing and management — which are all necessary for the introduction of a new product, process or service to the marketplace. The dynamics of that cycle are continually changing, as new technologies develop at an ever faster rate and new knowledge is gained about how to manage technology to best achieve a positive change.

Companies must adapt to these changing dynamics as smoothly and as quickly as possible if they are to benefit from technological advances. *InnovAction* focuses federal efforts on the transfer, diffusion and application of new technologies through a variety of means, such as technology centres, technology transfer agents and consortia.

Some 98 percent of all new technologies are developed outside Canada. Canadian firms may acquire this technology with help from *InnovAction*.

An area of special interest is the acquisition of foreign technologies. Some 98 percent of all new technologies are developed outside Canada. It is essential that Canadian firms gain access to this technology. The federal government can help, through such programs as External Affairs and International Trade Canada's Technology Inflow Program and through the strengthening of technology exchange agreements negotiated with other countries.

Developing Strategic Technologies

***InnovAction* will facilitate the development of technologies that are of strategic significance to competitive success in a wide range of industries.**

A second priority for *InnovAction* is the development of key technologies such as microelectronics, biotechnology and advanced industrial materials. These are called Strategic Technologies because of their strategic significance to competitive success across a wide range of industries. They are already a major source of new employment and wealth.

The Strategic Technologies share a number of important characteristics. They are inherently knowledge-based, they are spreading rapidly across industrial sectors and they are advancing at an increasingly rapid pace.

As a result, multidisciplinary research — generic research that cuts across industrial sectors — is critical to the development of the Strategic Technologies. However, it is often expensive and beyond the means of Canadian companies operating alone.

For this reason, *InnovAction* focuses on the need to encourage new research partnerships in this area, both within Canada and internationally. Such partnerships can take the form of industrial research consortia formed, within industry or between universities and industry, to pursue pre-competitive research.

Managing Federal Science and Technology Resources Effectively

The Government of Canada is creating a climate for private investment in R&D.

The federal government is by far Canada's largest single investor in R&D. For this reason, *InnovAction* identifies the effective management of this investment as another priority — to ensure the most efficient use of public resources, and to create a climate for encouraging greater investment by the private sector.

The government reviewed the entire range of its science and technology activities in light of this priority and developed a Decision Framework for government departments based on that review — bringing all government science and technology under a single set of criteria.

All federal science and technology programs must conform to the Decision Framework's three objectives.

The Framework requires all federal science and technology programs to be justified in terms of three objectives:

- economic and regional development
- support for government department missions
- advancement of knowledge and the supply of highly qualified people

The Decision Framework also requires that, whenever practical, federal R&D be contracted to and performed in the private sector or universities. In addition, it recognizes that the private sector

must help set the priorities and share the costs of government research that benefits industry.

Science, Technology and Human Resources

Human resources must be developed through S&T education and training.

Technological development and industrial innovation require highly qualified scientists, engineers, technologists and technicians, as well as a skilled work force that can adapt quickly to changing skill requirements. As a result, *InnovAction* recognizes human resources as a key priority.

InnovAction calls on governments and academic institutions to develop stable, long-term funding commitments to scientific education and training. Policies related to research priorities and the maintenance of state-of-the-art research facilities must take into account Canada's need for qualified science and technology professionals, for both today and the years ahead. These policies should help universities develop, attract and keep world-class scientists. They should also reflect the need for specialized scientists and engineers to keep abreast of rapidly changing technologies through retraining and continuing education.

Private Industry has an important role to play in delivering necessary training.

While academic institutions are the main vehicle for delivering necessary training, private industry also has an important role to play. As the primary beneficiaries of a highly skilled work force, they often have the primary responsibility for ensuring that training is focused on current needs. *InnovAction* recognizes this role, encouraging greater participation by industry in developing and delivering training.

Education and Public Awareness

Public understanding of the importance of science and technology is necessary for the development and maintenance of an advanced economy.

InnovAction identifies basic scientific and technological literacy as a further priority for Canada's future. The extent to which we can develop and maintain a world-class, technology-based economy depends on the degree to which Canadians understand the importance of scientific discovery and technological innovation.

Better education and greater public awareness are needed to create a more science-oriented culture in Canada. The children of Canada must be encouraged to enter the scientific disciplines. Moreover, all Canadians must become more knowledgeable about the technologies that are rapidly becoming a basic part of everyday life — Canadians must develop a greater appreciation

of the history, achievements and socio-economic impacts of science and technology.

From Strategy to Action

New programs and initiatives established under *InnovAction* total almost \$1.5 billion.

The government has translated the *InnovAction* principles and priorities into action through a series of initiatives totalling almost \$1.5 billion.

In January 1988 major new programs were announced: the Networks of Centres of Excellence, the Canada Scholarships Program and Science Culture Canada. Subsequent announcements of initiatives financed by these funds included the Strategic Technologies Program, Sector Competitiveness Initiatives, Business Services of ISTC and increases in the base budgets of the research granting councils.

Details on these and other *InnovAction* initiatives are outlined at the end of this publication.

Since the federal government launched *InnovAction* in 1987, there has been a growing awareness — within all levels of government, in academic institutions and throughout the private sector — that science and technology are crucial to our economic future and our quality of life. More importantly, the momentum for changing awareness into policy, and policy into action, is gaining ground.

INNOVATION IN THE 90s

National Advisory Board on Science and Technology

NABST plays a key role in assessing national science and technology policies and advising on priorities.

To support the federal role in leading Canada's science and technology efforts, the Prime Minister established the National Advisory Board on Science and Technology (NABST). Composed of some of Canada's most eminent scientists, educators and industry and labour leaders, NABST plays a key role in assessing national science and technology policies and their application to the economy.

NABST was a major force behind a number of *InnovAction* initiatives, such as the Networks of Centres of Excellence, the Canada Scholarships Program, and increased funding for the university research granting councils. The Board's recommendations have helped to shape *InnovAction*, and will continue to do so in the years to come.

NABST is currently examining broad policy areas such as National Science and Technology Priorities as well as policies affecting the management of government laboratories, human resource development, financing of industrial innovation and "Big Science" — research activities requiring facilities and resources beyond the reach of single firms or institutions. Its recommendations will be invaluable for setting the direction of federal policies in the 1990s, and are directly relevant to the pillars of *InnovAction*.

National and Regional Conferences on Technology and Innovation

There is a strong national consensus on the economic importance of science and technology.

The Prime Minister hosted the National Conference on Technology and Innovation in January of 1988. This Conference was followed by a series of five Regional Conferences.

The report on these Conferences identifies a strong national consensus on the economic importance of science and technology and on the need for action. The report outlines priorities for action in five key areas:

- development of leadership in business and industry committed to enhancing competitiveness through science and technology

- creation of a financial environment that encourages investment in high-risk advanced technologies
- increased labour-management cooperation in bringing technology to the workplace
- support for an educational and training system that promotes excellence in science and technology
- development of a science and technology culture in Canada — promoting a greater understanding and appreciation of the role of science in our society

The private sector's role in nurturing science and technology has now been defined.

These priorities are consistent with the priorities established under *InnovAction*.

Participants put forward a number of specific recommendations. However, one general conclusion emerged clearly from the Conferences: the **private sector** must now take the lead in harnessing science and technology for economic competitiveness.

National Forum of Science and Technology Advisory Councils

The National Forum of Science and Technology Advisory Councils produced a consensus on the urgent need to improve Canada's performance in science and technology.

This emphasis on private sector involvement is echoed in *The Halifax Declaration: A Call to Action*, a report of the National Forum of Science and Technology Advisory Councils.

The Forum draws together advisory councils from the 10 provinces, the Science Council of Canada and NABST. Their report identifies a number of key issues that should be acted upon by the councils, in their capacity as advisors on science and technology policy.

A clear consensus has emerged from the Forum on the urgent need to improve Canada's performance in science and technology, and on the responsibility of the private sector to "accept this national goal and to make the necessary commitments to create a strong industrial base around science-based innovation."

Council of Science and Technology Ministers

The federal-provincial Council of Science and Technology Ministers (CSTM) has taken steps to translate the emerging concerns about science and technology into action by developing a new national Action Plan.

CSTM has developed a new national Action Plan.

CSTM was established in 1987 to develop, monitor and coordinate the implementation of the National Science and Technology Policy. In September 1989, building on the advice and proposals put forward by the advisory councils, organizations, associations and conferences representing the industrial and research community, CSTM established a task force and developed an Action Plan pursuant to the National Policy. *InnovAction* provides the policy framework for the federal government's contribution to this Plan.

The Action Plan contains elements spanning six issue areas: national commitment, research and development collaboration, innovation support, technology transfer/adoption/diffusion, human resources and public awareness.

A prime example of federal-provincial cooperative action is the work accomplished for the National Science and Technology Week for October 1990. As part of *InnovAction's* Public Awareness Campaign, the week focuses the attention of Canadians on the role of science and technology in our personal lives, our social and economic well-being and our international competitiveness. To ensure its success, the federal, provincial and territorial governments worked closely with the private sector, non-governmental organizations and the academic community in organizing the event.

Cooperative action is required to fulfill Canada's educational requirements.

Cooperative action is also the key to a comprehensive review of education in Canada, proposed by the Prime Minister and endorsed by the First Ministers at their conference in November 1989. This review will:

- assess Canada's human resource development needs
- report on human resource requirements for the knowledge-based economy of the 21st century
- identify the results of the current systems; from pre-school to university; and skills, technical and vocational training

- develop recommendations that address the changes required
- examine ways of allocating resources more effectively with a focus on results

This education initiative will have significant implications for the development of human resources for science and technology — one of the five priorities for *InnovAction*.

Building on InnovAction: Shaping an Agenda for the 1990s

InnovAction is a solid foundation upon which we can build our future competitiveness.

The links between science, technology and Canada's competitiveness have been central to *InnovAction* from the beginning. The commitment to strengthen those links, and forge new ones, was reinforced by the creation of Industry, Science and Technology Canada (ISTC) as a key economic policy department.

InnovAction remains a cornerstone of ISTC's efforts to foster scientific excellence and competitiveness in Canadian industry. The challenge now is to build upon the success of *InnovAction*, taking advantage of the new opportunities for cooperative action that are emerging.

To meet this challenge the government is currently reviewing its science and technology policies in the context of international competitiveness. Key to developing an innovative economy will be the establishment of a strong human resource base and increased technology diffusion, to take Canada into the global economy of the 1990s. Working in concert with industry, educational institutions and other levels of government, *InnovAction* provides a focus for federal leadership in science and technology — ensuring Canada's competitive position in the new decade and beyond.

INNOVATION INITIATIVES AND FUNDING

Networks of Centres of Excellence

Networks of Centres of Excellence will stimulate leading-edge research.

The government launched a \$240-million, five-year program in 1988 to establish national Networks of Centres of Excellence. The program received applications for support from some 158 groups of university and industrial researchers.

These applications were reviewed by an International Peer Review Committee and an Advisory Committee of eminent Canadians. Fifteen networks have been funded based on recommendations which were received and made public. The new networks will stimulate leading-edge fundamental research, and help develop the world-class scientists and engineers needed for Canada's future industrial competitiveness.

Canada Scholarships Program

Canada Scholarships Program promotes pursuit of the natural sciences, engineering and related disciplinary learning.

The \$80-million Canada Scholarships Program encourages outstanding students to pursue undergraduate degrees in the natural sciences, engineering and related disciplines. In 1989-90, the second year of the Program, 3 400 scholarships, worth \$2 000 annually for four years, were awarded to top students entering their first year of undergraduate study. Recognizing the need to encourage more women to pursue scientific and engineering careers, a minimum 50 percent of the new scholarships are awarded to female students. In recognition of their outstanding academic performance, Canada Scholars are honoured at events in universities, colleges and high schools, most of which involve senior industry, education and government representatives.

Increased Funding for University Research

The base budgets of the research granting councils increased by \$200 million.

In 1988 the government increased the base budgets of the university research granting councils by \$200 million. The additional funding was provided over five years to the Natural Sciences and Engineering Research Council, the Medical Research Council, and the Social Sciences and Humanities Research Council.

Royal Society of Canada

The Royal Society receives a grant to enhance its operations.

In 1989 the government approved a grant of up to \$1 million per year for the five years (1989–1994). The grant is intended to provide support for corporate development, evaluation of research, advancement of women in scholarship and the public promotion of public awareness of science.

Public Awareness Campaign and Science Culture Canada

The Public Awareness Campaign operates in conjunction with the provinces and territories.

In 1988 the federal government announced initial funding of \$10 million for the Science Culture Canada program and a national Public Awareness Campaign as the first steps in an effort to increase the public's understanding of science and technology.

Science Culture Canada is designed to increase public awareness of scientific and technological achievements and to stimulate appreciation of the importance of science and technology. The program provides project and core funding for activities organized by both the public and private sectors.

The Public Awareness Campaign, in cooperation with the provinces and territories, has launched national advertisements, a travelling interactive computer exhibit, regional science teacher awareness projects and a publication on Canadian achievements in science and technology. The Campaign took the lead in organizing the first-ever National Science and Technology Week for October 1990.

Federal Microelectronics Strategy

The capacity of Canadian industry to develop and apply advanced microelectronics technologies has been enhanced.

The Federal Microelectronics Strategy is designed to increase the capacity of Canadian industry to develop and apply advanced microelectronics technologies. The Strategy encourages greater cooperation among provincial governments, universities and industry, and incorporates programs managed by ISTC, National Defence, Communications Canada and the National Research Council. These programs include:

- ISTC's \$60-million Microelectronics and Systems Development Program

- the federal Microelectronics Technology Office (providing a central source of microelectronics information for industry, government agencies and universities)
- \$7 million in additional funding to the Natural Sciences and Engineering Research Council to support research and education in software development

Canadian Manufacturing Advanced Technology Exchange

CAN-MATE provides a centralized source of information and advice to help Canadian manufacturers adopt advanced technologies.

The Canadian Manufacturing Advanced Technology Exchange (CAN-MATE) is a joint initiative established by the federal government and the Canadian Manufacturers Association.

CAN-MATE provides a centralized source of information and advice to help Canadian manufacturers adopt the advanced technologies they need to compete in world markets.

CAN-MATE has four mandates designed to:

- foster greater cooperation between the private sector and more than 70 technology centres across the country
- monitor developments in, and exchange information with, other countries for the benefit of Canadian industry
- define and coordinate cooperative technology projects at the request of industry
- advise governments on how to encourage advanced manufacturing technologies in Canada

Technology Centres Policy

Direction for the management of key federal laboratories and technology centres will be provided.

The Technology Centres Policy provides direction for the management of key federal laboratories and technology centres. The Policy is designed to make these Centres more responsive to private sector needs and to allow market forces to play a greater role in technology development and diffusion. It increases the role of industry in establishing technology centres and allows industrial clients to participate actively in their management.

Technology Outreach Program

The Technology Outreach Program provides start-up, and in some cases sustaining, support for new technology centres. It is designed to accelerate the acquisition, development and diffusion of technology and management skills in industry, especially in small and medium-sized firms.

National Biotechnology Strategy

The government established a new National Biotechnology Strategy with an annual budget of \$11.9 million. The Strategy is designed to create a strong research base in biotechnology, increase the supply of highly qualified personnel, enhance scientific cooperation and technology transfer, and foster a positive environment for the commercialization of biotechnology.

ISTC Core Programs

Funding of more than \$400 million is provided for three core programs designed to improve competitiveness.

Funding of more than \$400 million was announced for three core programs administered by ISTC:

- Strategic Technologies Program supports alliances between industry, research institutions, and/or foreign partners for research and development of Strategic Technologies
- Sector Competitiveness Initiatives carried out in cooperation with industry and other departments, will enhance the international competitiveness of specific industrial sectors
- Business Services helps companies strengthen their market development capabilities, and helps entrepreneurs acquire and implement new technologies

In addition, the Advanced Manufacturing Technology Application Program (AMTAP) will provide funding for firms to commission technological and commercial feasibility studies on upgrading their manufacturing operations.

Increased Funding for Related Programs

Increased funding has been made available to a number of key initiatives to support *InnovAction* priorities, such as:

- \$28 million in new funding for the National Research Council's Industrial Research Assistance Program to expand its services to small and medium-sized businesses
- \$12.3 million in new funding for the Technology Inflow Program administered by External Affairs and International Trade Canada

