Investing in people, discovery and innovation

Report on Plans and Priorities

1999-2000
Estimates

_____

John Manley
Minister of Industry

Section I: Messages

Message from the Minister of Industry

Our vision of Canada at the dawn of the new millennium is that of a strong and dynamic country poised to be a global leader in the knowledge-based economy of the 21st century. Canada continues to face the challenges of responding to the rapid pace of global change, and of harnessing the benefits of the knowledge-based economy for all Canadians. The government's goal is to create economic growth and more jobs for Canadians, in order to improve incomes and our standard of living.

The Industry Portfolio is …

Atlantic Canada Opportunities Agency
Business Development Bank of Canada*
Canadian Space Agency
Competition Tribunal
Copyright Board Canada
Canada Economic Development for Quebec Regions
Industry Canada
National Research Council Canada
Natural Sciences and Engineering Research Council of Canada
Social Sciences and Humanities Research Council of Canada
Standards Council of Canada*
Statistics Canada
Western Economic Diversification Canada

**Not required to submit Reports on Plans and Priorities*

Our standard of living depends directly on productivity, and improving productivity growth will be one of Canada's key challenges in the years ahead. The Industry Portfolio has a pivotal role to play in meeting this challenge. With 42 percent of federal science and technology funding and many of the government's micro-economic levers at its disposal, the Industry Portfolio has a unique capacity for innovation, research excellence, and partnership. The 13 Portfolio members bring together a versatile array of complementary programs to help improve Canadian productivity and competitiveness by focusing on such strategic priorities as promoting innovation through science and technology, helping small- and medium-sized enterprises to grow, encouraging trade and investment, and promoting economic growth in Canadian communities.

I am pleased to present the Report on Plans and Priorities for NSERC (the Natural Sciences and Engineering Research Council). This Report sets out for Canadians the planned activities, priorities and resources over the course of the next three years. NSERC invests in Canada's capability in science and technology to provide Canadians with a highly qualified workforce, new knowledge, and the creative and productive use of that knowledge to fuel innovation in our knowledge-based economy. NSERC supports both basic university research through research grants and project research through partnerships of universities with industry, as well as the advanced training of highly qualified people in both areas. These plans illustrate how NSERC, as a member of the Industry Portfolio, will contribute to improving Canada's competitiveness.

Canada is well equipped to be a leader in the knowledge-based economy of the 21st century. We have the people, the institutions and the research excellence. We have the vision to not only connect all Canadians, but also to connect them to the global marketplace. We know the challenges that we face and the opportunities afforded to us. By mobilizing our resources, we can be a leader in the new economy. By working together, we can ensure continuing success as we embark on the new millennium.

The Honourable John Manley

Message from the Secretary of State (Science, Research and Development)

Science, research and development are crucial to Canada because our economy - and the global economy - is changing rapidly. Our future success will be built on a virtually limitless resource: knowledge. Our ability to create future wealth will depend on the effective management of knowledge - the ability to create it, acquire it, disseminate it and exploit it. This ability forms the foundation of what is known as a knowledge-based economy.

Science, research and development are all about the search for knowledge - the discovery of new information and new understanding of how our world works. Knowledge is the key to improving the human condition and to improving our quality of life. Search for knowledge must be an ongoing process and a top priority in all sectors because of the potential applications in health and social sciences, education and the environment, business and the economy.

Canadians have worked together to build a society and an economy that are envied around the world. Canada is already a world leader in science, technology, research and development. Our challenge, indeed our opportunity, is to build on our co-operative links and partnerships with all sectors so that we are prepared for the new knowledge-based economy.

The government is committed to maintaining the high levels of success that Canada has attained in the past. We will accomplish this as a nation by continuing our investment in education and the discovery of knowledge and, by sharing, cooperating and working together to improve our economy and quality of life. By continuing to build stronger communities and, thereby, a stronger Canada, we will be able to compete in the new global economy.

Canada has unlimited potential to be a leader in the global knowledge-based economy. I am confident we will remain a strong and prosperous nation with enormous opportunities for all Canadians as we move into the new millennium.

_____

The Honourable Ron J. Duhamel

Management Representation Statement

MANAGEMENT REPRESENTATION STATEMENT

Report on Plans and Priorities 1999-2000

I submit, for tabling in Parliament, the 1999-2000 Report on Plans and Priorities (RPP) for NSERC (the Natural Sciences and Engineering Research Council of Canada).

To the best of my knowledge the information:

- Accurately portrays the Council's mandate, plans, priorities, strategies and expected key results.
- Is consistent with the disclosure principles contained in the *Guidelines for Preparing a Report on Plans and Priorities.*
- Is comprehensive and accurate.
- Is based on sound underlying information and management systems.

I am satisfied as to the quality assurance processes and procedures used for the RPP's production.

The Planning and Reporting Accountability Structure (PRAS) on which this document is based has been approved by Treasury Board Ministers and is the basis for accountability for the results achieved with the resources and authorities provided.

_____

T.A. Brzustowski, President

_____

Date

Section II: Departmental Overview

A. Mandate and Mission

NSERC (the Natural Sciences and Engineering Research Council) is the national instrument for making strategic investments in Canada's capabilities in science and technology. NSERC, which functions at arm's-length from the federal government, is funded directly by Parliament and reports to it through the Minister of Industry.

Mandate

Created in 1978, NSERC's legal mandate, its functions, and its powers are defined as follows:

> "*The functions of the Council are to promote and assist research in the natural sciences and engineering, other than the health sciences; and advise the Minister in respect of such matters relating to research as the Minister may refer to the Council for its consideration*" **(Natural Sciences and Engineering Research Council Act, 1976-77, c.24).**

Mission

In January 1994, the Council adopted the following mission statement:

> *The Natural Sciences and Engineering Research Council fosters the discovery and application of knowledge through the support of university research and the training of scientists and engineers. The Council promotes the use of this knowledge to build a strong national economy and quality of life for all Canadians. NSERC fulfils its mission by awarding grants and scholarships through a competitive process and by building partnerships among the universities, governments and the private sector.*

As stated above, NSERC focuses on the university sector. Universities play a vital role by helping to create new knowledge and by putting it to productive use. They also provide young people with the skills to contribute to these essential activities.

The federal science and technology strategy, *Science and Technology for the New Century* (March 1996), commits the federal government to three related goals for building a dynamic Canadian innovation system: sustainable job creation and economic growth; improved quality of life; and advancement of knowledge. NSERC is committed to working towards these goals within the framework of the *Industry Portfolio's Action Plan.*

B. Objective

The Council's ultimate objective is to advance Canada's prosperity and high quality of life by supporting the creation of knowledge in the natural sciences and engineering (NSE) in Canada, and by ensuring people are trained to create and use that knowledge. To achieve this, NSERC supports research in Canadian universities that meets the highest international standards of excellence and it supports the education of young people in that research.

As a result, Canada has access to leading-edge science and technology from around the world and highly qualified people expert in it. Partnerships with industry connect researchers with those who can use the new knowledge productively and enhance Canada's capacity for innovation: this in turn contributes to wealth creation. New knowledge in NSE also enhances our quality of life through its impact on policies, regulations, practices and institutions.

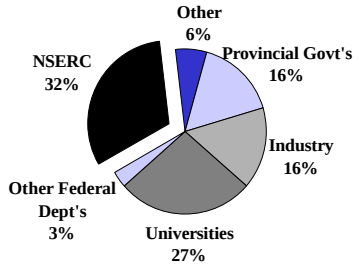
C. Operating Environment

Market Position and Clients

Universities

NSERC is the single most important funder of research and development (R&D) in the natural sciences and engineering in Canadian universities. In 1997, NSERC provided direct funding for nearly one-third of the $1.1 billion in R&D carried out by Canadian universities in this sector. Since other funding from universities, industries and governments is often contingent upon NSERC funding, it's estimated that the Council is directly and indirectly responsible for slightly more than half of the total funding. This is made up of the 32 percent directly from NSERC and a portion of the 27 percent that represents the universities' contribution to the indirect costs. Figure 1 gives a breakdown by source.

Figure 1: University R&D Funding in the Natural Sciences and Engineering, 1997



Total: $1.1 Billion

Source: Statistics Canada

NSERC has a substantial client base. The Council supports nearly 8,800 university researchers, over 9,000 university students and postdoctoral fellows, and over 2,700 university technicians and professional research staff. In addition, NSERC has entered

into partnerships with a growing number of industries and government departments. Figure 2 provides details of NSERC's client support, as well as estimates of the share of the population for eligible individuals and organizations that NSERC supports, and trends over the past 10 years.

Figure 2: NSERC Clients, 1997-98

Canadian Clients	Number Supported or Participating	Share of the Population	Trends in Share of the Population Over Past 10 Years
Individuals:			
University Researchers	8,774	60% – 65%	Small Increase
Undergraduate Students	658	1%	Peaked at 4%[1]
Master's/Doctoral Students	7,188	35% – 40%	Stable
Postdoctoral Fellows	1,500	40% – 50%	Stable
University Technicians and Professional Research Staff	2,775	30% – 40%	Stable
Organizations:			
Universities	59	75%	Stable
Companies Performing R&D[2]	719	9% – 11%	More than doubled
Federal Science Departments[2]	11	65%	More than doubled
Provincial Science Departments[2]	8	25% – 40%	More than doubled

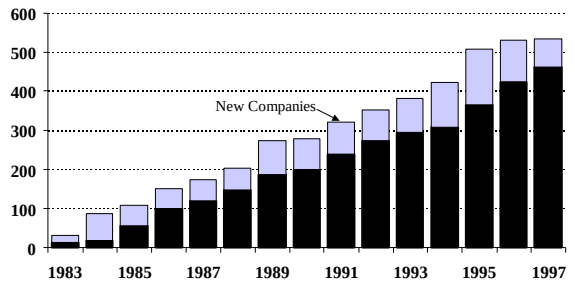
Source: NSERC

1. Expected to be stable at 4 percent as a result of the 1998 federal budget.
2. Organizations in partnership with NSERC.

Companies

The number of companies that have contributed to NSERC's collaborative university-industry research programs has continued to grow (see Figure 3). Since the inception of these programs, more than 1,200 firms have participated, rising from less than 50 companies in 1983 to more than 500 businesses in 1997. On average, 100 new firms work with NSERC every year.

Figure 3: Number of Companies Contributing to NSERC's University-Industry Programs



Source: NSERC

NSERC is well known to companies heavily involved in R&D. Forty-three of the top 50 Canadian R&D companies (as ranked by the Globe and Mail, 1997) have funded university research jointly with NSERC.

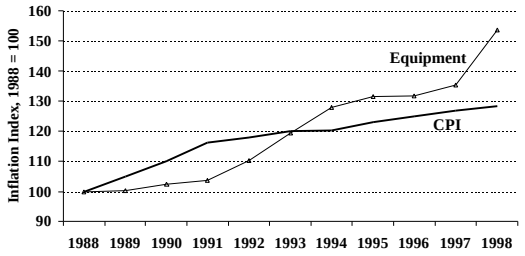
Challenges

The rising cost of research

The cost of performing leading-edge, world-class research is rising, creating greater dependence on NSERC funding. This is due to:

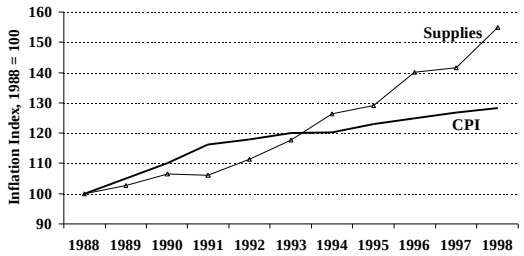
- *The dollar*: The weak Canadian dollar makes it expensive to import scientific instruments (a majority of the purchases) and to conduct international research activities. As the Asian and Russian financial crises unfolded this past summer, leaving the Canadian dollar to hover around 67 cents US, the situation became even more acute.
- *Inflation*: The prices for tools like scientific monographs and journals are going up much faster than the Consumer Price Index (CPI). For example, all subscriptions have risen by about 10 to 20 percent due to the combined effects of the devalued dollar, rising subscription costs and inflation[1]. Figure 4 shows the difference between CPI and research equipment while Figure 5 compares the CPI with the price of supplies and materials.

Figure 4: Research Equipment Price Index[2]



Source: U.S. Bureau of Labor.

Figure 5: Supplies and Materials Price Index[3]



Source: Research Associates of Washington.

[1] University Affairs, *"Libraries at the mercy of a falling dollar"*, December 1998, p. 19.

[2] Research equipment price index based on U.S. producer price index for engineering and scientific instruments. Assumes 100 percent sourcing from U.S. Exchange rates (Canadian dollar per U.S. dollar): 1988 (1.231), 1989 (1.184), 1990 (1.167), 1991 (1.146), 1992 (1.209), 1993 (1.290), 1994 (1.366), 1995 (1.372), 1996 (1.364), 1997 (1.385), 1998 (1.540).

[3] Supplies and materials price index based on "Supplies and Materials" price index compiled by Research Associates of Washington for their university R&D price index. Assumes 100 percent sourcing from U.S., and exchange rates as listed above.

- *Expensive research methods*: To conduct world-class research, Canadian researchers must adopt modern research methods. For example, DNA-research methods are now standard across all life sciences. These modern techniques are more expensive than traditional methods.
- *Indirect costs becoming direct*: Many services that used to be free now carry user fees that must be paid out of NSERC grants. For instance, ship time, transportation to northern research stations and access to national facilities now carry user fees. This means NSERC grants have to pay for much more of the total cost of research than before.

Impact of the Canada Foundation for Innovation

Over the next five years, the federal investment of $1 billion for the creation of the Canada Foundation for Innovation (CFI)[4] will translate into $2.5 billion in investment in much-needed infrastructure. However, while the CFI will strengthen the capacity of Canada's universities to conduct research, it will also create challenges for all sectors. NSERC, which funds the direct costs of research, anticipates a large increase in demand for funding to operate the new facilities and laboratories.

The CFI estimates that about 10 percent of the value of its awards will be needed to operate the new facilities annually. Since about $1 billion worth of the awards will fall within the natural sciences and engineering (NSE) disciplines, at least another $100 million (10 percent of $1 billion) per year will be required in operating money. Therefore, since NSERC funds over half of the NSE's direct research costs, it expects demand for funding will increase by at least $50 million per year. If the Research Grants program were to bear the brunt of this increase, it would translate approximately into a 37 percent increase in demand[5]. As the projects funded by the CFI actually come on stream, these estimates will become more precise in the next three years.

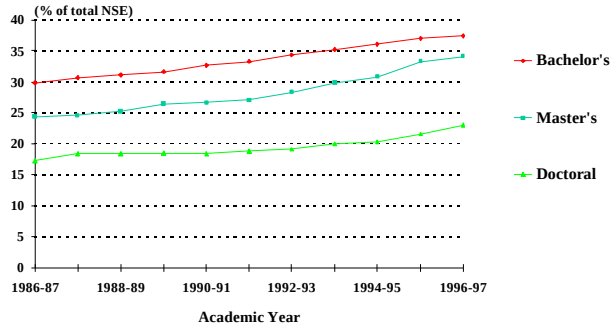
The demand for highly skilled people

Canada's long-term productivity depends on skilled people that can contribute to a knowledge-based economy. However, young talented people are often lured south of the border with higher salaries and research funding at leading-edge facilities. As a result, universities have difficulty attracting postdoctoral fellows and junior researchers. Moreover, many Canadian companies report that they cannot find highly skilled individuals in some fields, notably engineering and computer science. Companies often report unfilled vacancies and recruiting efforts outside Canada. If this trend continues, these companies and potential new firms, so important to Canada's long-term productivity, may set up in the United States and elsewhere to ensure a sufficient supply of highly qualified people.

[4] This includes the initial investment announced in the 1997 federal budget of $800 million to create the CFI plus an additional commitment of $200 million announced in the 1999 budget.
[5] In 1998–99, the total amount requested for Research Grants (Research Grants and Subatomic Physics research grants) was $135 million.

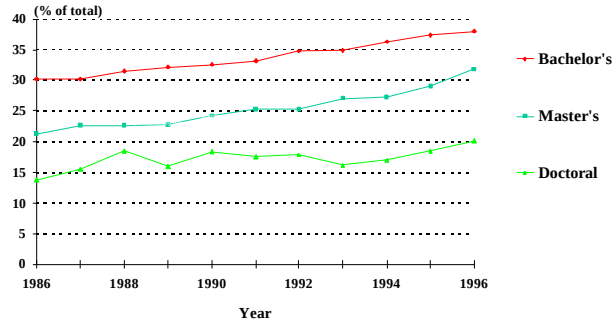
The low participation of women in science and engineering in Canada, particularly in the physical and applied sciences, and in engineering, also contributes to the problem. Over the past 15 years, the percentage of female university students or graduates in the natural sciences and engineering has not changed much. Figure 6 shows the trends in female enrolment in the NSE. Figure 7, the degrees granted to females in the NSE, shows similar trends. Clearly, the university system is not attracting enough women into natural sciences and engineering fields. As a result, Canada is missing out on a large segment of our population that can help fill the demand for highly qualified people. In 1997, NSERC, in partnership with industry, awarded five Chairs for Women in Science and Engineering to develop strategies and programs to increase the participation of women in these fields[6].

Figure 6: Female Enrolment[1] in the Natural Sciences & Engineering as a % of Total NSE Enrolment



1. Full-Time.
Source: Statistics Canada.

Figure 7: Degrees Granted to Females in the Natural Sciences & Engineering as a % of Total Granted in the NSE



Source: Statistics Canada.

As an important source of support in Canada for scholarships and fellowships in the natural sciences and engineering, NSERC must clearly encourage more young Canadians to pursue advanced studies in these fields[7]. An advanced education is essential for research, but it also contributes to problem solving in all sectors of the knowledge-based economy. More of Canada's young people need to be able to develop their talents fully to sustain and improve our ability to compete and innovate in a knowledge-based world.

The loss of leaders

Funding cuts to universities have had an impact on their staffing practices. While the debate over "brain drain" or "brain gain" may never be resolved, it is certain that Canadian universities are losing some highly qualified faculty and these tend to be the leaders. As highly paid senior professors retire or relocate, often outside Canada, universities have tended to replace them with junior faculty, or not at all.

---

[6] Also, thanks to the increased federal investment in the 1998 budget to NSERC, the New Faculty Award was created to help address the under-representation of women in faculty positions in the NSE.
See page 20.

[7] NSERC has been able to help more young people achieve their goals thanks to the new funding in the 1998 budget. See page 20 for details.

In 1997, the Association of Universities and Colleges of Canada (AUCC), in collaboration with NSERC, surveyed almost 100 deans in four major fields (computer sciences, engineering, mathematics, and the physical and biological sciences). The survey revealed that, in 1995–96 and 1996–97, only about half of departing faculty members were replaced. Of those replaced, over 80 percent were replaced with entry-level faculty, even though departures were mostly at the senior or mid-career levels. The net effect is a loss of research and training capability at our universities, at least in the short term.

Anecdotal evidence suggests that some universities expect to expand certain faculties in the next few years. However, it is not known whether they can attract qualified candidates. University, industry and government sectors compete for highly qualified individuals, most notably in the information technology fields. This intense competition may hinder the ability of universities to attract the necessary expertise.

Growing number of researchers to support

Despite a static or even declining number of permanent faculty positions at most Canadian universities, NSERC has to support a growing number of researchers. There are two reasons for this. First, all new faculty members are expected to conduct research; they must be supported at a critical time in their career even though those being replaced were not all active in research. Second, some early retirees who were active in research still remain as unpaid professors; they continue to win support in NSERC competitions. Both trends are good for Canada, but they create pressures on NSERC's budget.

The New Opportunities program of the Canada Foundation for Innovation recently awarded $36 million to help launch the research careers of more than 400 new faculty members in universities across Canada. This will help provide adequate research infrastructure for the best of the new faculty. However, since NSERC will likely be asked to fund much of these new faculty members' research, it will also increase demand on its budget.

Encouraging university-industry linkages

Enhancing Canada's productivity growth is key to improving Canada's standard of living. Over the past three decades, Canada's productivity performance has been less than satisfactory. In fact, Canada has had the lowest rate of growth in productivity among the G-7 countries for the past 25 years[8].

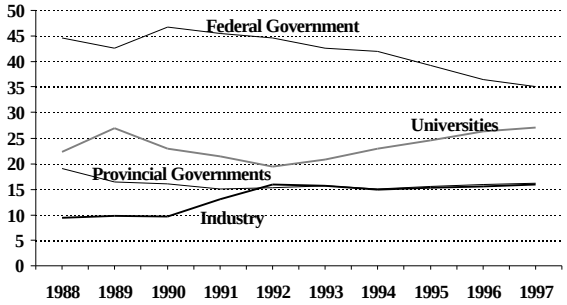
Two factors contributed to this slowdown in productivity growth. Canada does not spend as much on industrial R&D as other G-7 members and major trading partners. It also has

[8] OECD, *Economic Outlook*, June 1998.

gaps in its system of innovation caused by weak technology adoption by industry; a relatively small share of high-technology manufacturing; low R&D spending as a percentage of GDP; and low spending on R&D in medium-technology and low-technology industries compared to other G-7 countries.

The situation is improving as industry increases R&D funding[9]. Between 1987 and 1996, for example, business contributions for R&D at universities in the natural sciences and engineering (NSE) increased from $58 million to $178 million. In 1997, business funded about half of R&D expenditures in Canada[10]. Figure 8 shows the rising trend in industrial investment in university R&D in NSE.

Figure 8: Canadian University R&D Funding in the Natural Sciences and Engineering (%)



Source: Statistics Canada

Business recognizes that universities offer access both to new knowledge and to the highly qualified people who can use that knowledge. Thus, the private sector is forming partnerships with universities at an increasing rate. Figure 3 on page 9 clearly shows the strong growth in the number of companies that have contributed to NSERC's collaborative university-industry research programs.

Although the steps taken since 1994 to inject greater dynamism into our economy have begun to show signs of paying off, Canada must improve its poor productivity performance if we are to realize a higher standard of living for all Canadians. Thus, the federal government must continue to foster an environment where Canadian industry can develop new science and technology ideas and put them into commercial use. Only then can Canada sustain and improve its rate of growth in productivity.

NSERC is the principal source of public support for research partnerships between universities and the private sector. After nearly two decades of working to bring the university and industry cultures together, the effort is bearing fruit in spectacular fashion. The achievements of these successful partnerships are creating wealth and high-quality jobs. By continuing to promote university-industry partnerships across the entire R&D spectrum, NSERC will help meet the growing demand for new partnerships.

[9] Industry Canada. "*Science and Technology Data – 1997*", p. 2.
[10] Industry Canada. "*Science and Technology Data – 1997*", p. 2.

Improving collaboration

Information technology is partly responsible for the collapse of barriers between disciplines, institutions, sectors and nations. Groups of researchers with diverse disciplinary backgrounds and skills are now networking and sharing results. Often they work with industries, governments and international partners to solve small- and large-scale problems that benefit society. NSERC has participated in this evolution by developing programs and review mechanisms that support multi-disciplinary research. Still, NSERC's experience continues to show that much remains to be done to break down the isolation of disciplines.

Canada only produces about 4 percent of the world's pool of knowledge. Through international collaboration Canadians can gain access to the other 96 percent. The federal government believes that international science and technology collaboration is important and is making investments to give Canada access to international knowledge networks. For example, Canada reversed its decision to withdraw from the NATO Science Committee earlier this year. Also, as described on page 21, NSERC has been able to establish a new international program thanks to the new funds in the 1998 budget. NSERC will continue to give researchers the opportunity to gain an international presence and linkages that will help ensure our access to leading-edge research in many fields.

D. Financial Spending Plan

Table 1: NSERC Financial Spending Plan

($ millions)	Forecast Spending 1998–99*	**Planned Spending 1999–00**	Planned Spending 2000–01	Planned Spending 2001–02
Gross Program Spending:				
Natural Sciences and Engineering Research Council	499.0	**538.5**	545.9	545.4
	499.0	**538.5**	545.9	545.4
Less: Revenue Credited to the Vote	—	**—**	—	—
Net Program Spending	499.0	**538.5**	545.9	545.4
Less: Revenue Credited to the Consolidated Revenue Fund	(0.4)	**(0.4)**	(0.4)	(0.4)
Plus: Non-budgetary (LIAs)	—	**—**	—	—
Plus: Cost of services provided by other departments	1.8	**1.7**	1.7	1.7
Net Cost of the Agency	500.4	**539.8**	547.2	546.7

*Reflects best forecast of total planned spending to the end of the fiscal year.

Note: Forecast and planned spending includes additional funding of $1 million per year to establish a Network of NSERC Industry Chairs in Design Engineering.

Planned spending includes additional funding announced in the 1999 federal budget of $32.5 million per year ($25 million to support advanced research plus $7.5 million targeted for health-related research). The figures do not include the additional $30 million per year provided to the Networks of Centres of Excellence.

Section III:
Plans, Priorities, Strategies and Expected Results

A. Summary of Priorities and Expected Results

Figure 9: Chart of Key Results Commitments[11]

NSERC (the Natural Sciences and Engineering Research Council) is in business

To provide Canadians with:	**To be demonstrated by:**
Economic and social benefits arising from the provision of a highly skilled workforce and knowledge transfer of Canadian discoveries in the natural sciences and engineering from universities to other sectors	A highly skilled workforce, with a base of expertise across the natural sciences and engineering fields ✓ Trends in employment and career status of former scholars and fellows An advanced knowledge base which is vital as a source of economic and societal benefits for Canada, in the short and long term ✓ High-quality research results, as assessed by internationally accepted standards Application of knowledge leading to new policies, standards and/or regulations ✓ Incidence and impact of contributions of researchers and/or their research results to the formation of public policies, regulations and standards Creative and productive use of knowledge for new products and services, leading to new jobs and businesses ✓ Trends in the numbers of collaborative partnerships supported by NSERC, between university and the private/public sector ✓ Economic impact of NSERC-supported research

[11] As published in the 1997–98 NSERC Departmental Performance Report and in Annex B of the Annual Report to Parliament: *Managing for Results 1998.*

B. Business Line Plans

Business Line

All NSERC activities relate to a single business line: **Support of Research and Scholarship in the Natural Sciences and Engineering**.

Business Line Objective

The objective for NSERC's business line is identical to the Council's overall objective described on page 8: to advance Canada's prosperity and high quality of life by supporting the creation of knowledge in the natural sciences and engineering (NSE) in Canada, and by ensuring people are trained to create and use that knowledge.

Planned Spending

See Table 1: NSERC Financial Spending Plan (page 16). Table 1 includes the 1999 federal budget announcement of an additional investment in NSERC of $32.5 million per year ($25 million to support advanced research plus $7.5 million targeted for health-related research). Since NSERC Council has not yet approved the allocation of the increased funding to NSERC programs, the following discussion does not reflect where the new funding will be invested.

Key Priorities, Strategies, Activities and Results

Context

In the years to come, the global knowledge-based economy will continue to expand. Canada's prosperity and high quality of life will depend on our ability to reverse the long-term decline in our productivity relative to the U.S. and other major trading partners. Success depends on investing in people and knowledge and the linkages between them.

Thanks to NSERC's investments on behalf of the Government of Canada, Canadian researchers gain access to leading-edge knowledge from around the world. Armed with this knowledge, and working increasingly in partnership with industry, they help fuel Canada's innovation system. The students, trained with the help of NSERC, acquire the skills needed to pursue rewarding careers in all sectors of the economy and become tomorrow's leaders. These investments in Canada's knowledge base lead to innovations in industry, and help set policy, standards and regulations. In so doing, they

One of the more tangible outcomes of NSERC-funded research is the creation of a company. In 1998–99, a survey found that, over the past 20 years, research partially funded by NSERC has led to the creation of at least 108 companies. These "spin-off" companies employ over 5,800 Canadians and generate more than $1.1 billion in annual sales.

strengthen our economy and improve the quality of life for all Canadians.

The federal government has enhanced its investments in people and knowledge. Recent investments on the knowledge side include: the Canada Foundation for Innovation (CFI), the Networks of Centres of Excellence, increased funding to the three granting councils, and the creation of The Canadian Institutes of Health Research (CIHR). The Millennium Scholarship fund, announced in the 1998 budget, is a key investment in people.

Still, as discussed in "Challenges" on pages 10–15, different aspects of the research environment continue to put pressure on NSERC's budget. Therefore, NSERC must be strategic in its investments. Actions must be in line with Canada's needs and government priorities, including the federal strategy, *Science and Technology for the New Century*, and the *Industry Portfolio's Action Plan.* To this end, NSERC has concentrated its resources on three core priorities: **people, discovery**, and **innovation**.

It is important to remember that NSERC's investments take longer to bear fruit than most other government investments. Therefore, it's often impossible to specify concrete expected results for the planning period.

Priority # 1: People

Young People

NSERC's investments in the training and development of highly qualified people in science and engineering are critical to Canada's long-term productivity. Canada's future capabilities in science and technology depend on today's graduate students, postdoctoral fellows and junior faculty.

NSERC invests in the advanced training of young people in two ways. Through national competitions, it provides scholarships and fellowships to selected individuals. It also provides indirect support; a researcher may hire a student or postdoctoral fellow using part of his or her NSERC grant, for example.

These investments provide Canada with experts in the natural sciences and engineering. They also help satisfy Canada's demand for highly skilled people who will be able to pursue knowledge-intensive careers of many kinds within any sector

In 1997–98, over 9,000 university students and postdoctoral fellows were supported by NSERC. Another 2,700 university technicians' salaries were paid from NSERC grant funds awarded to university researchers. In total, NSERC created more than 12,000 high technology jobs this year in which people are learning the most advanced knowledge. Further, research spending from NSERC grants on goods and services (e.g. materials, scientific equipment and travel) indirectly created or sustained roughly another 1,500 jobs.

of the economy. Over NSERC's 21-year history, more than 50,000 master's and doctoral students and young research professionals have benefited from NSERC training programs.

NSERC will complement this approach with other activities. For instance, NSERC has been working with students and young researchers to address the needs of the next generation of Canadian researchers. The two workshops held to date have provided an excellent forum for discussion, resulting in recommendations, action plans and positive changes to program policy. A third workshop is planned and may be used to seek young people's input into NSERC's Strategy.

NSERC has also used much of the new funding announced in the 1998 budget to support graduate students and postdoctoral fellows. In addition, NSERC has added 2,000 awards for the Undergraduate Student Research Awards program, increased the stipend levels and number of awards for all core scholarship and fellowship programs, and increased the number of postgraduate students and postdoctoral fellows supported from grants and their maximum stipends.

Women

To help address the under-representation of women in faculty positions in the natural sciences and engineering, NSERC has created a new award. It encourages Canadian universities to appoint promising women researchers to tenure-track positions.

Resources

In 1997–98, NSERC invested $146 million, or 33 percent of its budget, to train the next generation of scientists and engineers. Direct support for students and postdoctoral fellows accounted for 14 percent of the total budget with the remainder attributable to indirect support. Since the 1998 budget provided new money to NSERC, this level of investment will rise in the years to come. This will help improve the future of Canada's young people and our future as a nation.

Priority # 2: Discovery

Basic university research continues to be the primary source of high quality new knowledge. This knowledge, when adopted in industry, leads to product and process innovations, and creates economic activity that benefits future generations of Canadians. In fact, the "spin-off" companies discussed earlier come from basic research. To build a strong national system of innovation with the capacity for radical innovations, we must continue to advance our knowledge of the world around us.

Investing in basic research

By investing in basic university research and the people who seek out new knowledge, NSERC ensures that Canada has a stock of new ideas for innovation. The Research Grants programs invest in the research activities of individuals and groups working in leading-edge science and engineering, as well as in the equipment and facilities necessary for this work. Combined, these two components provide a stimulating environment for research training. A peer review process ensures that only the most promising proposals are funded. These investments contribute to Canada's capabilities across all areas of natural sciences and engineering on a national and international scale, enhancing our ability to access and use new knowledge from around the world.

Reallocating resources

NSERC has used international benchmarking to develop a Reallocations Exercise that helps set research priorities. Every four years, national and international experts review submissions from natural sciences and engineering disciplines to identify priorities for funding. The exercise shifts resources to strategic directions that are the most important to Canada. This will ultimately lead to better basic research in science and engineering in Canadian universities. In the second exercise, NSERC redistributed $30 million ($20 million from the Research Grants envelope and $10 million in new funds from the 1998 budget) to invest in 38 major initiatives over the next four years. Some key initiatives focus on the growing importance of molecular biology and information technologies in modern research, and the need to support mathematical and statistical sciences on which much other science and engineering depend. By 2002-03, the combined budget for these areas will have increased by 20 percent. Planning for the third round begins next year.

International Expert Comments on Canadian University Sciences and Engineering Research

- "The quality of Canadian research contributions in process technology are absolutely outstanding on an international scale."
- "…in computing and information sciences – Canada has a long tradition of excellence by the highest international standards: excellence in education, excellence in research, and excellence in impact."
- "Canadian researchers are currently among the top scientists in the world in statistics and probability."
- "Let me say by way of summary that Canadian psychology does very well internationally. Canadian psychologists are prominent in virtually every field of psychology."

International collaboration

NSERC believes it is crucial to encourage international research collaborations that will significantly benefit Canadians. A new program, the International Opportunity Fund, will help Canadian researchers establish collaborative projects with research groups or

networks abroad, and enable them to access major international programs. While it is a small program ($1 million in 1999–00), it will still help put Canadian scientists and engineers in touch with researchers around the world. The federal government's increased investment in NSERC in the 1998 budget made this program possible.

Resources

NSERC expenditures on the Research Grants programs reached $244 million (56 percent of the total budget) in 1997–98. In absolute terms, the level of investment will rise as a result of increased funding to NSERC in the 1998 budget.

Priority # 3: Innovation

It is now widely understood that increasing Canada's productivity growth is key to our success in the global knowledge-based economy. Productivity is the ratio of the value of what is produced to the cost of producing it. Productivity can be increased either by reducing the costs of production, which results in increased societal costs if it depends on downsizing the workforce, or by increasing the value of what is being produced.

Prime Minister Jean Chrétien stressed the importance of Canada's productivity in his address on the occasion of the Confederation Dinner in October. He pointed out that "Improving our productivity also means investing in knowledge – in research and development."

NSERC fosters innovations in the natural sciences and engineering that add value to the goods and services we produce leading to productivity gains without losing jobs. As our economy becomes more knowledge-intensive, more innovations will be based on knowledge. That means the private sector will need to make better use of the excellent resource universities have to offer.

Partnerships

NSERC has successfully leveraged its investments by forging partnerships with the private sector, as well as in other sectors, including government departments and agencies, to help strengthen Canada's capacity in science and technology. In the past 10 years, partner contributions[12] have rocketed from $23 million to $83 million – a growth of 260 percent. These investments lead to university licensing agreements, patents, and new products and processes, as well as new policies, standards and regulations. Taking this one step further, this activity can expect to improve the productivity of existing companies and create new jobs and businesses, as well as to improve how government manages the advancement of knowledge. Ultimately, these partnerships create prosperity, improving quality of life for Canadians.

[12] This includes contributions from all partners; industry, universities, government departments and agencies, and other sources such as private non-profit organizations, institutes, hospitals, and other organizations.

Productive use of knowledge

Thanks to the 1998 budget increase to the Research Partnerships Program, NSERC will continue to play a major role in helping industry turn research into commercial opportunities. As a result of the increase, NSERC raised the stipends paid to students from grants (as done in the Research Grants program above), and satisfied more of the demand for university-industry projects and research networks. At the same time, it reinstated two important programs. The Technology Partnerships Program supports partnerships between universities and Canadian small- and medium-sized companies, enabling them to turn research into commercial applications. The Intellectual Property Management Program strengthens Canadian universities' ability to manage their intellectual property and to transfer the technology to industrial partners.

Canadian universities are increasingly commercializing the results of their research. For example, between 1991 and 1996, revenue to Canadian universities from licensing jumped from just under $10 million to just below $30 million. In addition, many companies have been created that are linked to NSERC-funded research.

Communications strategy

A communications strategy specifically aimed at industrial clients will enhance the private sector's awareness of NSERC programs that foster university-industry research collaboration and training. NSERC will begin to implement this strategy in 1999.

Resources

In 1997–98, NSERC's Research Partnerships Program invested $95 million (apart from the $22 million for the Networks of Centres of Excellence program), or 22 percent of the total budget, in project research. NSERC will continue to invest the same proportion of its budget in these important programs[13].

Other Strategies and Activities

Policy Leadership

NSERC will use lessons learned through the program evaluation process to help set policy and refine its programs. Ultimately, this will ensure that NSERC's investments have the greatest possible impact on Canada's capabilities in science and technology.

For example, it has become evident that Canada lacks capacity in design engineering. Consequently, companies are often forced to look outside the country to fill positions. To address this gap, NSERC plans to establish a Network of NSERC Industry Chairs in

[13] This does not include the increased investment in the Networks of Centres of Excellence (NCE) of $30 million per year starting in 1999-2000, announced in the 1999 federal budget.

Design Engineering. NSERC's extensive experience and success with Industry Chairs and Networks of Chairs coupled with Canada's need to develop its design engineering capacity make this a natural fit. Also, since Canada must improve the environmental aspects of product and process design to help meet its Kyoto commitments, the first four Industry Chairs will emphasize the environmental aspects of design. Initially, NSERC will invest $1 million per year for five years.

Also, in light of many changes in the research environment, NSERC has begun to review its Strategy and strategic planning process. NSERC's last strategy, *Partnerships in Knowledge*, was published in 1994.

Creating public awareness

NSERC continues to increase public awareness of the natural sciences and engineering research sector. As part of its new communications policy, NSERC is reaching out to the public, government and Parliament, as well as maintaining its traditional contacts with the research community. NSERC has already had some success. In 1997, the press published 450 articles that mentioned NSERC and NSERC-supported research. In 1998, the number jumped to 675 articles. The Financial Post Magazine and Les Affaires also published an insert on NSERC. Both issues reached about 270,000 business readers.

Key activities to further this strategy include:

- NSERC/PAGSE[14] series of *Bacon & Egghead Breakfast* seminars for Members of Parliament, senior policy-makers, and the media to help improve their understanding of the important research and training taking place in Canadian universities;
- advertising campaign in major Canadian magazines to highlight research that affects everyday life;
- *NSERC/Conference Board of Canada Synergy Awards*;
- *Great Canadian Ideas*: a page of NSERC stories sent every month through News Canada;
- *Spark*: a pilot program, in co-operation with the University of Guelph, in which students from three universities write and market stories about NSERC-sponsored research; and
- *NSERC Web Site:* a redesigned Web site to make it more user-friendly and appealing to business people, children and the general public, as well as the university community.

Improving service

NSERC has provided high quality service to internal and external clients while keeping administration costs less than 4 percent of total funding. It will maintain this ratio while developing service standards, as well as new and improved services.

[14] PAGSE – Partnership Group for Science and Engineering

Some key activities to improve service quality include:

- implementing the *Global Payments System Project* to streamline payment of scholarships and fellowships;
- progressing to Phase II and III of the *Electronic Forms Project* so that submissions, peer review and management of applications are all performed electronically;
- creating an Intranet to provide employees with easy access to Council information;
- broadening the number of areas to develop service standards and ultimately creating a service contract for each; and
- continuing to collaborate with other granting councils to harmonize policies and procedures.

C. Consolidated Reporting

Chart on Year 2000 Initiatives

Year 2000 Initiatives	*Expected Results*
Ensuring that NSERC internal systems function correctly during and after the Year 2000.	• NAMIS (*NSERC Award Management Information System*), NSERC's major mission-critical internal business software, is Y2K-compliant. • NSERC's Treasury Board-approved Human Resources Information System (HRIS) is Y2K-compliant. • NSERC will implement a new Treasury Board-approved financial system by April 1, 1999. This Freebalance system is already installed and testing has begun. • In keeping with a hardware/software inventory and compliance assessment, a few commercial software packages and hardware components will be replaced in the first half of 1999. • In keeping with NSERC's Audit Plan, an audit of Y2K Readiness and disaster recovery will be undertaken in the spring of 1999.
External client awareness of the Y2K issue	• The NSERC/SSHRC/MRC Y2K Working Group has joined forces with The Canada Foundation for Innovation (CFI) and the Association of Universities and Colleges of Canada (AUCC) to help bring the Y2K message to the university community. An article appeared in the winter volume of NSERC's newsletter, *Contact*, alerting universities to the Y2K problem. • NSERC has informed researchers that upgrades to scientific equipment are an eligible grant expense. • An addendum to the *NSERC Researcher's Guide* stresses the need to be ready for Year 2000.

Section IV: Supplementary Information

A. Spending Authorities

Table 2: Spending Authorities – Ministry Summary Part II of the Estimates

B. Personnel Information

Figure 10: Council Organization Structure
Figure 11: Council Committee Structure
Table 3: Planned Full Time Equivalents (FTEs) by Program and Business Line

C. Additional Financial Information

Table 4: Summary of Standard Objects by Expenditure
Table 5: Program Resources by Program and Business Line for 1999–00
Table 6: Transfer Payments by Program and Business Line
Table 7: Revenue by Program
Table 8: Net Cost of Program for 1999–00

D. Other Information

Table 9: Listing of Statutes and Regulations
Table 10: Contacts for Further Information and Web Site
Table 11: References

A. Spending Authorities

Industry
Table 2: Spending Authorities – Ministry Summary Part II of the Estimates

Vote	($ millions)	**1999–00 Main Estimates**	1998–99 Main Estimates
	Natural Sciences and Engineering Research Council		
85	Operating expenditures	**18.2**	16.0
90	Grants	**484.8**	404.8
(S)	Contributions to employee benefit plans	**1.9**	1.9
	Total Agency	**505.0**	422.7

B. Personnel Information

Figure 10: Council Organization Structure

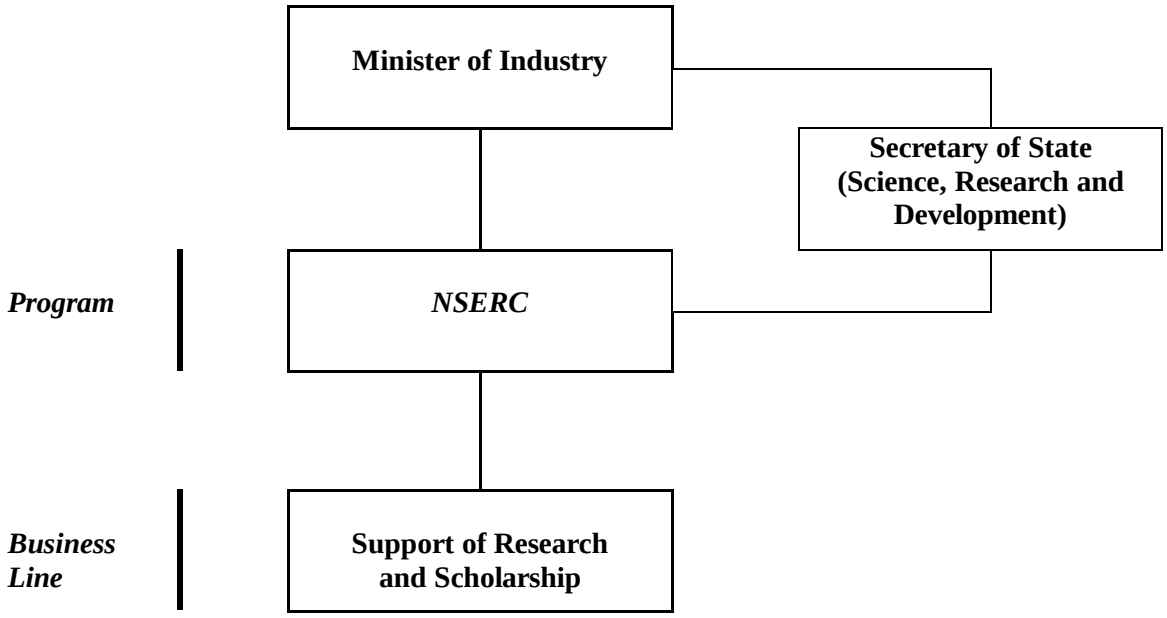
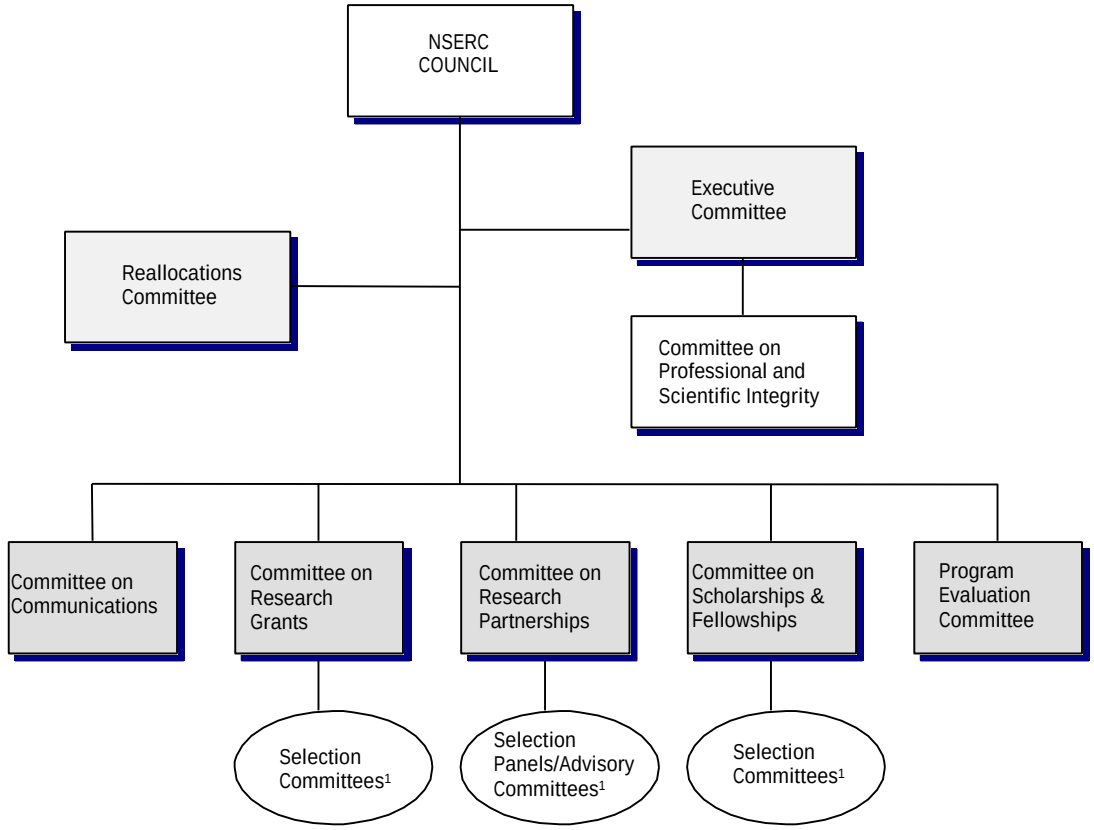


Figure 11: Council Committee Structure



1. In 1998-99, over 55 committees were active.

Table 3: Planned Full Time Equivalents (FTEs) by Program and Business Line

	Forecast 1998–99	**Planned 1999–00**	Planned 2000–01	Planned 2001–02
Natural Sciences and Engineering Research Council Program				
Support of Research and Scholarship	204	**215**	215	215
Total Agency	204	**215**	215	215

C. Additional Financial Information

Table 4: Summary of Standard Objects by Expenditure

($ millions)	Forecast Spending 1998–99	**Planned Spending 1999–00**	Planned Spending 2000–01	Planned Spending 2001–02
Personnel				
Salaries and wages	10.0	**9.7**	9.7	9.7
Contributions to employee benefit plans	1.9	**1.9**	1.9	1.9
	12.0	**11.6**	11.6	11.6
Goods and services				
Transportation and communications*	2.6	**2.7**	2.7	2.7
Information	1.3	**1.2**	1.2	1.2
Professional and special services	3.8	**3.1**	3.1	3.1
Rentals	0.2	**0.3**	0.3	0.3
Purchased repair and maintenance	0.3	**0.5**	0.5	0.5
Utilities, materials and supplies	0.4	**0.4**	0.4	0.4
Minor capital	0.4	**0.3**	0.3	0.3
	9.0	**8.5**	8.5	8.5
Capital				
Controlled capital	—	**—**	—	—
Revolving Fund	—	**—**	—	—
	—	**—**	—	—
Transfer payments				
Voted	478.0	**518.3**	525.8	525.2
Statutory	—	**—**	—	—
	478.0	**518.3**	525.8	525.2
Gross budgetary expenditures	499.0	**538.5**	545.9	545.4
Less: Revenues Credited to the Vote	—	**—**	—	—
Net budgetary expenditures	499.0	**538.5**	545.9	545.4
Non-budgetary (LIAs)	—	**—**	—	—
Total	499.0	**538.5**	545.9	545.4

*Includes the transportation costs of the volunteer members of Council committees (approximately 450 volunteers).

Note: Forecast and planned spending includes additional funding of $1 million per year to establish a Network of NSERC Industry Chairs in Design Engineering.

Planned spending includes additional funding announced in the 1999 federal budget of $32.5 million per year ($25 million to support advanced research plus $7.5 million targeted for health-related research). The figures do not include the additional $30 million per year provided to the Networks of Centres of Excellence.

Table 5: Program Resources by Program and Business Line for 1999–00

($ millions)		Budgetary				Non-Budgetary			
	FTE	**Operating**	**Capital**	**Transfer Payments**	**Planned Spending**	**Plus: LIAs**	**Gross Planned Spending**	**Less: Revenue Credited to the Vote**	**Net Planned Spending**
Natural Sciences and Engineering Research Council Program									
Support of Research and Scholarship	215	20.2	—	518.3	538.5	—	538.5	—	538.5
Total Agency	**215**	**20.2**	**—**	**518.3**	**538.5**	**—**	**538.5**	**—**	**538.5**

Note: Planned spending includes additional funding of $1 million to establish a Network of NSERC Industry Chairs in Design Engineer ing.

Planned spending includes additional funding announced in the 1999 federal budget of $32.5 million ($25 million to support advanced research plus $7.5 million targeted for health-related research). The figures do not include the additional $30 million provided to the Networks of Centres of Excellence.

Table 6: Transfer Payments by Program and Business Line

($ millions)	Forecast Spending 1998–99	**Planned Spending 1999–00**	Planned Spending 2000–01	Planned Spending 2001–02
Grants				
Natural Sciences and Engineering Research Council Program				
Support of Research and Scholarship	478.0	**518.3**	525.8	525.2
Total grants	478.0	**518.3**	525.8	525.2
Contributions	—	**—**	—	—
Total grants and contributions	478.0	**518.3**	525.8	525.2

Note: Forecast and planned spending includes additional funding of $1 million per year to establish a Network of NSERC Industry Chairs in Design Engineering .

Planned spending includes additional funding announced in the 1999 federal budget of $32.5 million per year ($25 million to support advanced research plus $7.5 million targeted for health-related research). The figures do not include the additional $30 million per year provided to the Networks of Centres of Excellence.

Table 7: Revenue by Program

Revenue Credited to the Consolidated Revenue Fund (CRF) ($ millions)	Forecast Spending 1998–99	**Planned Spending 1999–00**	Planned Spending 2000–01	Planned Spending 2001–02
Natural Sciences and Engineering Research Council Program				
Support of Research and Scholarship	0.4	**0.4**	0.4	0.4
Total Credited to the CRF	0.4	**0.4**	0.4	0.4
Total Revenue	0.4	**0.4**	0.4	0.4

Table 8: Net Cost of Program for 1999–00

($ millions)	Natural Sciences And Engineering Research Council Program	**Total**
Gross Planned Spending	538.5	**538.5**
Plus:		
Services Received without Charge		
Accommodation provided by Public Works and Government Services Canada (PWGSC)	1.2	**1.2**
Contributions covering employees' share of insurance premiums and costs paid by TBS ($9,743,000 * 5.5%)	0.5	**0.5**
Workers' compensation coverage provided by Human Resources Development Canada	—	—
Salary and associated costs of legal services provided by Justice Canada	—	**—**
	1.7	**1.7**
Total Cost of Program	**540.2**	**540.2**
Less:		
Revenue Credited to the Vote	—	—
Revenue Credited to the CRF	0.4	0.4
Total Revenue	**0.4**	**0.4**
1999–2000 Estimated Net Program Cost	**539.8**	**539.8**

Note: Planned spending includes additional funding of $1 million to establish a Network of NSERC Industry Chairs in Design Engineering .

Planned spending includes additional funding announced in the 1999 federal budget of $32.5 million ($25 million to support advanced research plus $7.5 million targeted for health-related research). The figures do not include the additional $30 million provided to the Networks of Centres of Excellence.

D. Other Information

Table 9: Listing of Statutes and Regulations

NSERC does not administer any statutes.

NSERC was created by the *Natural Sciences and Engineering Research Council Act* 1976-77, c. 24, s. 24.

Table 10: Contacts for Further Information and Web Site

Our Web site is located at: www.nserc.ca

For further information about this report you can contact:

Mr. Steve Shugar
Director, Policy and International Relations
Tel. (613) 995-6449
Fax. (613) 947-5645
E-mail: sbs@nserc.ca or steve.shugar@nserc.ca

Or

Ms. Robbyn Plumb
Policy Analyst, Policy and International Relations
Tel. (613) 996-1417
Fax. (613) 947-5645
E-mail: rmp@nserc.ca or robbyn.plumb@nserc.ca

Table 11: References

AUCC Faculty Survey Findings. November 1997.

Brain Drain or Brain Gain? AUCC, 1997.

Brzustowski, Tom. "A Start has been made". Presentation to the Standing Committee on Finance. NSERC, November 1998.

Department of Finance. *The Economic and Fiscal Update – Strong economy and secure society*, October 14, 1998.

"DFAIT Refines Approach to International S&T Activities", *Research Money*, 12, no. 19, December 2, 1998.

Industry Canada. *Science and Technology Data – 1997.*

"Libraries at the mercy of a falling dollar", *University Affairs*, December 1998, p. 19.

Notes for an Address by Prime Minister Jean Chrétien. On the occasion of the Confederation Dinner, Toronto, October 26, 1998.

NSERC, *Departmental Performance Report*, 1997-98.

NSERC, *Facts and Figures*, 1997-98.

NSERC, *HQP Pipeline Analysis by Gender*, September 1997.

NSERC, *Partnerships in Knowledge – Maximizing the investment in university research*. Winter 1994.

NSERC, *Performance, Reporting and Accountability Structure*, 1997.

OECD, *Economic Outlook*, June 1998.

"Pressure Growing to Expand Interaction with International Science and Technology Community". *Research Money*, 12, no. 19, December 2, 1998.

Science and Technology for the New Century – A Federal Strategy, March 1996.

Science and Technology for the New Century – Industry Portfolio's Action Plan, March 1996.