



Natural Sciences and Engineering Research Council of Canada

**2000-2001
Estimates**

Part III – Report on Plans and Priorities

Canada

The Estimates Documents

Each year, the government prepares Estimates in support of its request to Parliament for authority to spend public monies. This request is formalized through the tabling of appropriation bills in Parliament. The Estimates, which are tabled in the House of Commons by the President of the Treasury Board, consist of three parts:

Part I – The Government Expenditure Plan provides an overview of federal spending and summarizes both the relationship of the key elements of the Main Estimates to the Expenditure Plan (as set out in the Budget).

Part II – The Main Estimates directly support the *Appropriation Act*. The Main Estimates identify the spending authorities (votes) and amounts to be included in subsequent appropriation bills. Parliament will be asked to approve these votes to enable the government to proceed with its spending plans. Parts I and II of the Estimates are tabled concurrently on or before 1 March.

Part III – Departmental Expenditure Plans which is divided into two components:

- (1) **Reports on Plans and Priorities (RPPs)** are individual expenditure plans for each department and agency (excluding Crown corporations). These reports provide increased levels of detail on a business line basis and contain information on objectives, initiatives and planned results, including links to related resource requirements over a three-year period. The RPPs also provide details on human resource requirements, major capital projects, grants and contributions, and net program costs. They are tabled in Parliament by the President of the Treasury Board on behalf of the ministers who preside over the departments and agencies identified in Schedules I, I.1 and II of the *Financial Administration Act*. These documents are to be tabled on or before 31 March and referred to committees, which then report back to the House of Commons pursuant to Standing Order 81(4).
- (2) **Departmental Performance Reports (DPRs)** are individual department and agency accounts of accomplishments achieved against planned performance expectations as set out in respective RPPs. These Performance Reports, which cover the most recently completed fiscal year, are tabled in Parliament in the fall by the President of the Treasury Board on behalf of the ministers who preside over the departments and agencies identified in Schedules I, I.1 and II of the *Financial Administration Act*.

The Estimates, along with the Minister of Finance's Budget, reflect the government's annual budget planning and resource allocation priorities. In combination with the subsequent reporting of financial results in the Public Accounts and of accomplishments achieved in Departmental Performance Reports, this material helps Parliament hold the government to account for the allocation and management of public funds.

© Her Majesty the Queen in Right of Canada, represented by the Minister of Public Works and Government Services, 2000

Available in Canada through your local bookseller or by mail from Canadian Government Publishing (PWGSC)
Ottawa, Canada K1A 0S9

Telephone: 1-800-635-7943
Internet site: <http://publications.pwgsc.gc.ca>

Catalogue No. BT31-2/2001-III-39

ISBN 0-660-61172-4



Natural Sciences and Engineering
Research Council of Canada

Conseil de recherches en sciences
naturelles et en génie du Canada



Investing in people, discovery and innovation

Report on Plans and Priorities

2000-2001
Estimates

John Manley
Minister of Industry

Canada

Table of Contents

Section I: Messages	1
Minister's Portfolio Message	1
Message from the Secretary of State	3
Management Representation Statement	4
Section II: Departmental Overview	5
A. Mandate, Vision and Mission	5
B. Roles and Responsibilities	6
C. Objective	7
D. Operating Environment	8
NSERC Clients.....	8
Challenges	10
E. Departmental Planned Spending	17
Section III: Plans, Results and Resources	18
A. Business Line Objective	18
B. Business Line Description	18
C. Key Results Commitments, Planned Results, Related Activities and Resources	18
NSERC's Strategy Review.....	18
Key Results Commitment	19
Planned Results, Related Activities and Resources	19
Section IV: Horizontal Initiatives.....	24
Section V: Financial Information	26
Section VI: Other Information	28
Index.....	31

Section I: Messages

Minister's Portfolio Message

In the global economy, innovation is an essential determinant of long-term economic growth, improved productivity and, ultimately, our quality of life. Preparing Canadians for the knowledge-based economy remains one of the government's top priorities in the years ahead. My portfolio of government organisations is promoting the growth of a strong, dynamic Canadian economy and helping Canadians take advantage of the opportunities offered by the global knowledge-based economy. We have laid a solid foundation through our continuing investments in knowledge and innovation.

An essential ingredient for our knowledge-based growth, both as an economy and as a society, is Connecting Canadians, an initiative designed to make Canada the most connected country in the world. Leading-edge applications will create jobs and growth, and strengthen productivity performance. Connecting Canadians also allows us to reach out to all citizens, and redefine and enhance how we provide services to, and interact with, Canadians.

I am pleased to present the Report on Plans and Priorities for NSERC (the Natural Sciences and Engineering Research Council of Canada), which sets out for Canadians the planned activities, priorities and resources over the course of the next three years. These plans illustrate how NSERC is contributing to building a strong and dynamic Canadian economy. 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.

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*

As we look ahead we must define excellence by global standards. Innovation, science, research and development, and connectedness will profoundly change the world we face in the next decade. To maintain and improve our quality of life, we must be more skilled, more productive, more entrepreneurial and more innovative than any other country in the world and we can be all of these things.

The Honourable John Manley

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

Canada's future success, and comparative advantage in the new Millennium, hinges on two virtually limitless resources, knowledge and skills. Investments in knowledge and skills will be critical to taking advantage of new opportunities in the increasingly connected global economy and in our creative and entrepreneurial communities. These investments will ensure a sound economy and healthy environment for all Canadians.

Science, research and development are all about the quest for knowledge - the discovery of new information and a new understanding of how our world works. The search for knowledge touches all facets of our lives - health and social sciences, education and the environment, business and the economy. The government continues to promote the creation, dissemination and commercialization of knowledge, and to create jobs and wealth. We are reinforcing Canada's competitiveness, improving the well-being of Canadians, and building on Canada's image as a truly innovative society that values the contribution of its knowledge workers. NSERC plays an essential part in helping Canadians and businesses innovate through science, research and development.

This Report on Plans and Priorities for 2000-2001 illustrates how the federal government is harnessing the benefits of science and technology for the future of all Canadians. NSERC is helping to create stronger partnerships that lead to better jobs for Canadians, to an improved quality of life, and to increases in the world's stock of knowledge. Our emphasis on research and innovation is guided by one vision: the future will belong to countries whose economies are sound, whose populations are healthy, whose children are prepared, and who invest in the knowledge, skills and innovation of their people.

The Honourable Gilbert Normand

Management Representation Statement

MANAGEMENT REPRESENTATION STATEMENT

Report on Plans and Priorities 2000-2001

I submit, for tabling in Parliament, the 2000-2001 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 planned results of the organization.
- 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, Vision and Mission

Mandate

NSERC was created in 1978. Its legal mandate, functions, and 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 such research as the Minister may refer to the Council for its consideration.” (Natural Sciences and Engineering Research Council Act, 1976-77, c.24.)

A Vision for NSERC

During the process of a year-long review of NSERC’s strategic directions, NSERC Council believed it was important to spell out a vision for NSERC.

NSERC is working to build a “Smart Canada” for the 21st century – a country that’s safe, clean and prosperous.

We see our people working at rewarding and meaningful jobs because they have the skills and knowledge to create value and meet needs in the global economy.

We see our scientists and engineers respected throughout the world because of their leading-edge discoveries and trailblazing projects.

We see our industries thriving because business is taking full advantage of the nation’s capacity for science-based innovation.

And we see NSERC playing, and seen to be playing, a leading role in making all this happen...by investing in people, discovery and innovation.

Restating NSERC's Mission

During the review, Council also restated its mission in terms that draw more clearly the connections between research and the well-being of Canadians in order to continue to build support for world-class university research and training.

NSERC invests in people, discovery, and innovation to build a strong Canadian economy and to improve the quality of life of all Canadians. It supports research in universities and colleges, research training of scientists and engineers, and research-based innovation.

The Council promotes excellence in intellectual creativity in both the generation and use of new knowledge, and it works to provide the largest possible number of Canadians with leading-edge knowledge and skills to help Canada flourish in the 21st century.

NSERC fulfils its mission by awarding scholarships and research grants through peer-reviewed competition, and by building partnerships among universities, colleges, governments and the private sector.

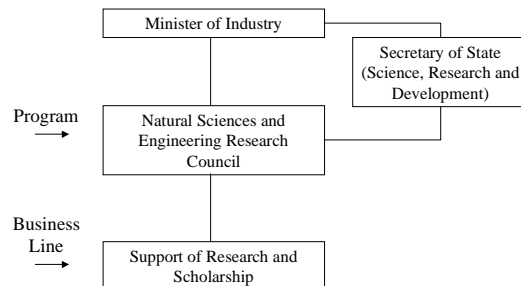
NSERC itself is committed to institutional innovation in achieving its mission.

B. Roles and Responsibilities

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. Its sole business line is: Support of Research and Scholarship. Figure 1 presents NSERC's organization structure.

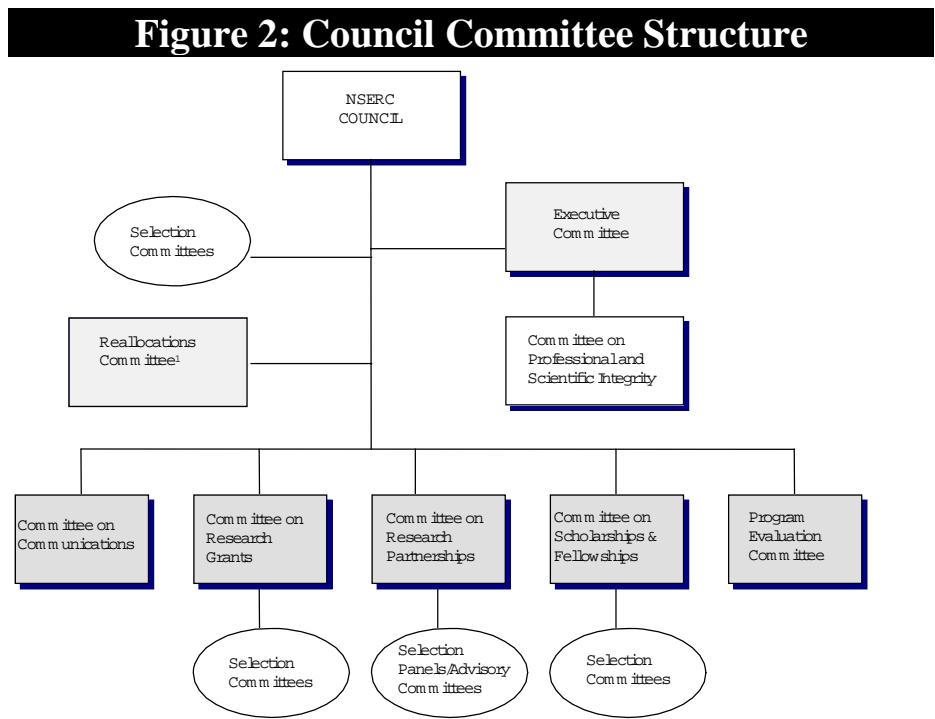
NSERC has always focused on the university sector. Universities play a vital role by helping to create new knowledge and by putting it to productive use. They also provide young people with the skills to contribute to these essential activities. However, following the year-long review of NSERC's strategy, Council concluded that it should begin to expand eligibility to include colleges. College professors, in partnership with their university colleagues, are now eligible as co-applicants and can receive funding for project research. For the purposes of this report the focus remains on NSERC's core sector, the universities. As we learn more about colleges and consider expanding their eligibility to other NSERC program funding, subsequent reports may be expanded to include colleges and related issues.

Figure 1: Organization Structure



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*.

NSERC is governed by a Council (a Board of Directors) whose members are drawn from industry and the universities, as well as from the private non-profit sector, and appointed by the Governor-in-Council. Members serve part-time, and receive no remuneration for their participation. The President serves full-time, and functions as the Chair of the Board and the Chief Executive Officer of the Council. Council is advised on policy and programming matters by several committees. Figure 2 presents NSERC's committee structure.



1. Committee is active during the Reallocations Exercise, which occurs every four years

C. Objective

The Council's ultimate objective is to strengthen Canada's economy and quality of life through the productive use of knowledge by the support of a broad base of high quality basic research in Canada's universities, and the encouragement and facilitation of links between the universities and the private sector.

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 the natural sciences and engineering (NSE) also enhances our quality of life through its impact on policies, regulations, practices and institutions.

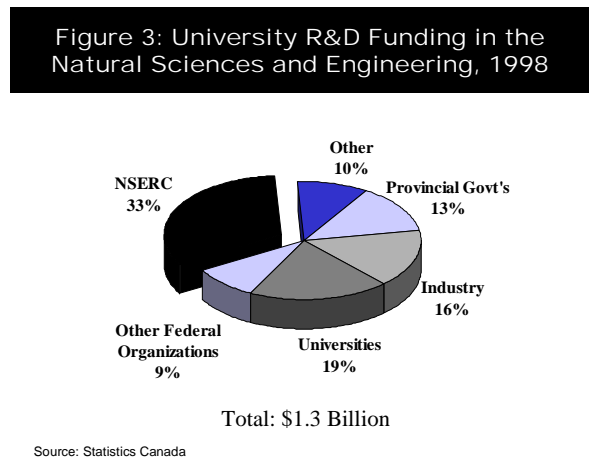
The impact of these investments is detailed in the 1998-99 Departmental Performance Report through a suite of indicators that range from bibliometrics, to patents and licenses, to spin-off companies, new products and processes.

D. Operating Environment

NSERC 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 1998, NSERC provided direct funding for one-third of the \$1.3 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. Figure 3 gives a breakdown of the total funding by direct source.



NSERC has a substantial client base. The Council supports over 8,900 university researchers, nearly 13,000 university students and postdoctoral fellows, and over 2,800 university technicians and professional research staff. In addition, NSERC has entered into partnerships with a growing number of industries and government departments. Figure 4 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 4: NSERC Clients, 1998-99

Canadian Clients	Number Supported or Participating	Share of the Population ¹	Trends in Share of the Population Over Past 10 Years
Individuals:			
University Researchers	8,925	60% – 65%	Small Increase
Undergraduate Students	3,336	3%	Slight Decrease ²
Master's/Doctoral Students	7,873	35% – 40%	Stable
Postdoctoral Fellows	1,547	40% – 50%	Stable
University Technicians and Professional Research Staff	2,873	30% – 40%	Stable
Organizations:			
Universities	60	75%	Stable
Companies Performing R&D ³	678	9% – 11%	More than doubled
Federal Science Departments ³	11	65%	More than doubled
Provincial Science Departments ³	8	25% – 40%	More than doubled

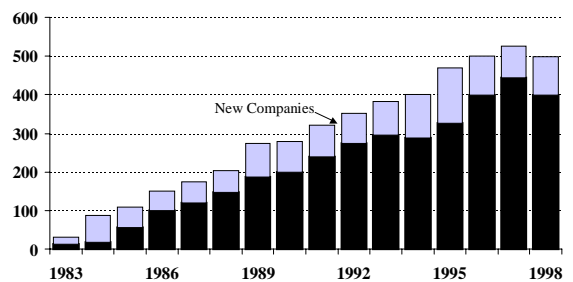
Source: NSERC

1. The percentage that NSERC supports of all individuals and organizations eligible for NSERC funding.
2. Reflects new measures and improved data collection for grant spending on undergraduate students. Recent increases to Undergraduate Student Research Awards will reverse this trend in the years to come.
3. Organizations in partnership with NSERC (across all NSERC programs).

Companies

The trend in the number of companies that have contributed to NSERC's collaborative university-industry research programs has continued to grow (see Figure 5). Since the inception of these programs, more than 1,200 firms have participated, rising from less than 50 companies in 1983 to nearly 500 businesses in 1998. On average, 100 new firms work with NSERC every year.

Figure 5: Number of Companies Contributing to NSERC's University-Industry Programs



Source: NSERC

NSERC is well known to companies heavily involved in R&D. Thirty-seven of the top 50 Canadian R&D companies (as ranked by the Globe and Mail, 1998) have funded university research jointly with NSERC.

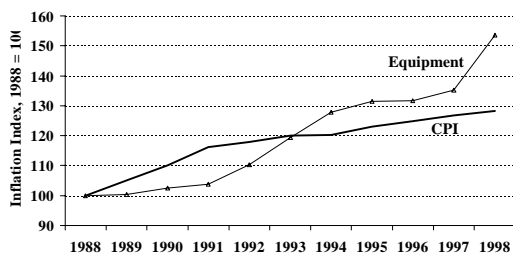
Challenges

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:

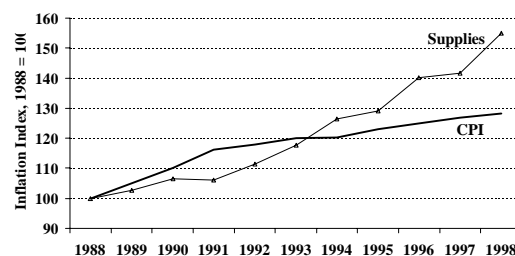
- *The dollar:* The weak Canadian dollar makes it expensive to import scientific instruments (much of the equipment is purchased from abroad) and to participate in international research activities.
- *Inflation:* The prices for tools like scientific monographs and journals are going up much faster than 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 6 shows the difference between the CPI and research equipment while Figure 7 compares the CPI with the price of supplies and materials.

Figure 6: Research Equipment Price Index²



Source: U.S. Bureau of Labor.

Figure 7: Supplies and Materials Price Index³



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, because of advances in information and telecommunication technology. 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 some 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 several years, the federal investment of \$1.9 billion for the Canada Foundation for Innovation (CFI)⁴ will translate into over \$5.5 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. Calculations estimate an increase in demand for NSERC funding by at least \$135 million per year. As the projects funded by the CFI actually come on stream in the next two years, these estimates will become more precise.

An example of this pressure is the CFI-funding of the Canadian Light Source (CLS). The CLS is expected to begin operations in 2003 and NSERC has agreed to provide \$4.6 million per annum towards the \$13.8 million annual operating costs. This commitment will be absorbed within NSERC's existing budget.

The demand for highly skilled people

Canada's success in the new economy is increasingly dependent on its human capital. "In our knowledge-based economy, productivity gains are a function of the development of human capital, which in turn is the engine for technological advance."⁵ 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. The Canadian Advanced Technology Alliance (CATA) estimates that the shortage of computer programmers in Canada is 30,000 with

⁴ This includes the initial investment announced in the 1997 federal budget of \$800 million to create the CFI plus additional commitments of \$200 million and \$900 million announced in the 1999 and 2000 budgets, respectively.

⁵ *Budget 2000, New Era... New Plan.* Report of the Standing Committee on Finance, December 1999, Chapter 5, p. 4.

similar shortages in engineering and science.⁶ If this trend continues, these companies and potential new firms, so important to Canada's prosperity, may set up in the United States and elsewhere to ensure a sufficient supply of highly qualified people.

NSERC is an important source of support in Canada for scholarships and fellowships in the NSE and, thanks to recent budget increases, is taking steps to encourage and support more young Canadians to pursue advanced studies in these fields. An advanced education is essential for research, but it is also an excellent education for 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 if we are to sustain and improve our ability to compete and innovate in a knowledge-based world.

The loss of leaders

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. "Loss of leaders" should perhaps replace "brain drain" as our greatest concern. As highly paid senior professors retire or relocate, often outside Canada, universities have tended to replace them with junior faculty resulting in a loss of research and training capability at our universities, at least in the short term.

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 most of the faculty who chose to leave were doing so at the height of their academic careers. Of those who were replaced, over 80 percent were replaced with entry-level faculty.

Dr. Monroe-Blum, in her 1999 report, *Growing Ontario's Innovation System: The Strategic Role of University Research*, echoes this concern: "Ontario and Canada have been losing some of their very best researchers and professionals. Ontario has lost top players in economics, physics, mathematics, Chinese culture, molecular biology, library and information science, computer and electrical engineering, religion, and literacy criticism, among others. Each of these faculty members ranks with the best in their fields worldwide."

This situation will become more complex in the next decade as student enrolment expands and faculty members retire,⁷ and universities have to compete for highly

⁶ CATA Alliance. *CATA Alliance Advances Growth Agenda for a Knowledge-Based Economy*. Pre-Budget Submission to the House of Commons Standing Committee on Finance, September 1999.

⁷ The Association of Universities and Colleges of Canada (AUCC) estimates that over the next decade, population growth and rises in the participation rate will increase enrolments by about 20 percent. In combination with retirements and other departures, about 12,000 new faculty will be required in the next 10 years. (AUCC, *Research and Education: The underpinnings of innovation*. Brief to the House of Commons Standing Committee on Finance, September 17, 1999.)

qualified people across all sectors of the economy, and indeed, worldwide.

In the words of Prime Minister Jean Chrétien, “Today, our challenge as a country is to create a climate of opportunity for our graduate students and for our graduates. To provide exciting opportunities for Canadian researchers and to attract the best academic researchers in the world to Canadian universities. And to do so at a time when world-wide competition for them has never been so fierce. And particularly at a time when United States universities benefit from both permanent endowments and the generosity of private Foundations out of all proportion to those of our universities.”⁸

This challenge was brought out in the Advisory report of the Conseil de la science et de la technologie, *To Understand and To Innovate, Assuring Competitive Means for University Research*, released in November 1999. “Overall growth in university research funding and in each individual field must be of central concern to governments interested in continuing to support and stimulate the transition to a knowledge-based society and an innovation-based economy.”⁹

The 1998 and 1999 federal budget investments in the granting Councils, the Networks of Centres of Excellence, the Canada Foundation for Innovation, and the Canadian Institutes of Health Research provide a much-needed boost to help improve this situation.

And, the 2000 budget investment of \$900 million over the next five years to the federal granting councils to establish up to 2000 Canada Research Chairs is another important step forward. This will give Canadian universities the ability to create excellent research opportunities that are internationally competitive for Canada’s best and brightest. It will also help bring back some of Canada’s great minds, as well as attract those from other countries.

Growing number of researchers to support

While Statistics Canada reports a 7.1 percent decline in the number of full-time faculty at Canadian universities between 1992/93 and 1996/97, NSERC has to support a growing number of researchers. There are several 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.

⁸ Jean Chrétien, *Response to the Speech from the Throne*, October 13, 1999.

⁹ Conseil de la science et de la technologie. *To Understand and To Innovate. Assuring Competitive Means for University Research*. November 1999. Summary, pg. 2.

The New Opportunities Program of the Canada Foundation for Innovation (CFI) helps launch the research careers of new faculty members in universities across Canada by providing them with advanced equipment and facilities they need to undertake leading-edge research. Over the life of the CFI, this program will invest \$144 million giving research infrastructure to the best of the new faculty. This research infrastructure funding must be complemented with adequate research grants to operate these new facilities in order to maximize Canadian taxpayers' return on these investments.

As noted on page 12, the AUCC projects that over the next 10 years, population growth and rises in the participation rate will increase university enrolment by 20 percent. They estimate that between this growth and replacing retirees the universities will have to hire more than 12,000 new faculty members.¹⁰ This situation has already begun as a result of the information and communication technology (ICT) industry's call to increase the supply of university graduates specializing in the various fields such as computer science and electrical engineering. Four provinces (Ontario, Alberta, British Columbia, and Quebec) have taken steps to help universities increase the enrolments in these fields, and universities are attracting the new faculty needed to teach them. While this is good news for Canada, research funding is required so that these new professors might be active in leading-edge research and capable of training these students in the most advanced knowledge.

And finally, the Canada Research Chairs will provide much-needed salary and research support to the chairholders. To ensure that these stars and rising stars might continue their work at the leading-edge, an internationally competitive level of research support is necessary. Without such research support from NSERC and the other granting agencies, the Canada Research Chairs will not attract the people Canada needs.

Making our universities a competitive advantage

Productivity is a word frequently used in the media and in public policy debate. While we may never reach a consensus on how to measure productivity, Canadians can agree that increasing productivity growth is a primary method to enhance our quality of life.

“In simple terms, productivity is the value of what is produced divided by the cost of producing it. We can enhance productivity performance three ways; by cutting the costs of production, or by increasing the value of the goods and services we produce, or by doing both. But to become more productive and at the same time create new good jobs for Canadians, the emphasis must be on increasing the value of what we produce. This is

¹⁰ Association of Universities and Colleges of Canada (AUCC), *Research and Education: The underpinnings of innovation*. Brief to the House of Commons Standing Committee on Finance, September 17, 1999.

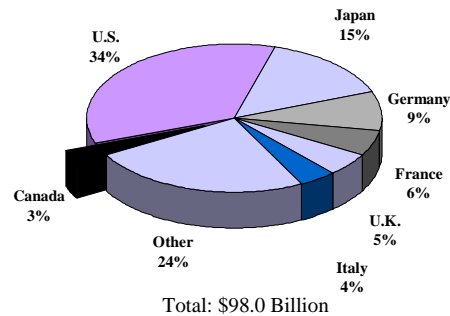
done by creating new goods and services that succeed in the world market, and that is the kind of innovation in which NSERC is involved.”¹¹

Canadian university researchers perform 3 percent of the nearly \$100 billion in university research in the OECD (see figure 8). When measured as a percentage of gross expenditure on R&D, Canadian universities perform a larger share of national R&D than in most other G-7 countries.¹²

Canada’s business enterprise has increasingly invested in R&D, funding about half of R&D expenditures in Canada in 1998.¹³ Industry has also increased its share of university R&D funding across all disciplines from about 6 percent in 1990 to almost 12 percent in 1997, the largest share in the OECD (see figure 9). This growth has significantly outpaced other G-7 countries and major trading partners.

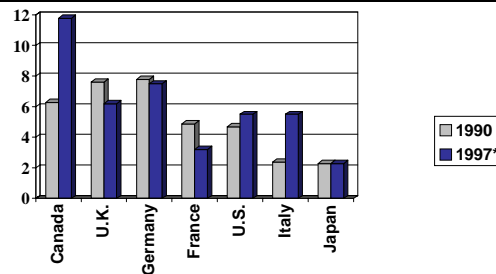
This trend is also true for the natural sciences and engineering (see figure 10). Between 1989 and 1998, for example, business contributions for R&D at universities in the natural sciences and engineering increased from \$87 million to \$200 million. At the same time, the share of private

Figure 8: University R&D Expenditures in the OECD, 1997



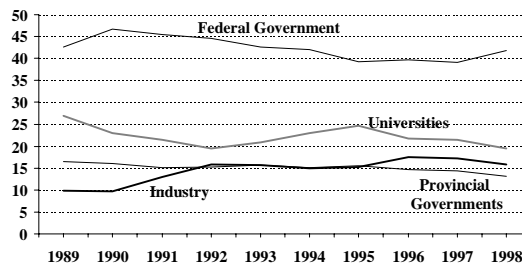
Source: OECD

Figure 9: Share of University R&D Funded by Industry (%), 1990 and 1997



* Data shown for most recent year available: 1997 for Canada; 1996 for Germany and Italy; 1995 for Japan, the U.K. and the U.S.; and 1994 for France
Source: Statistics Canada; National Science Board, Science & Engineering Indicators - 1998

Figure 10: Canadian University R&D Funding in the Natural Sciences and Engineering (%)



Source: Statistics Canada

¹¹ Thomas Brzustowski, *The New Economy, Productivity, NSERC and the University Sector*. NSERC Submission to the Standing Committee on Finance in preparation for Pre-Budget Consultations, September 10, 1999. Quoted in the 1999 report of the Standing Committee on Finance entitled, *Budget 2000 New Era... New Plan*, chapter 3, page 2.

¹² Advisory Council on Science and Technology. *Public Investments in University Research: Reaping the Benefits*. Report of the Expert Panel on the Commercialization of University Research. May, 1999, pp. 7-8.

¹³ Industry Canada. *Science and Technology Data, 1998*, p. 4.

sector-funded R&D performed in universities is also greatest in Canada.¹⁴

The private sector is forming partnerships with universities at an increasing rate as universities offer access both to new knowledge and to the highly qualified people who can use that knowledge. Figure 5 on page 9 clearly shows the strong growth in the number of companies that have contributed to NSERC's collaborative university-industry research programs.

It has been well documented that Canadian universities play a strategic role in strengthening our innovative capacity and productivity performance. Universities train highly qualified people critical to creating and building knowledge-based firms, and they create an advanced knowledge base that can lead to spin-off companies and new products and processes that add value in the global market.¹⁵ And Canadian universities are well positioned to play a more prominent role than in most other G-7 countries.

NSERC is the principal source of public support for research partnerships in the NSE between universities and the private sector. As a result of recent increases to NSERC's budget, it is better equipped to keep pace with the demand for university-industry partnerships.

This increased importance of the role of Canadian universities on our economic and social development has complicated the research environment. The relationships between universities and industry are increasingly complex, governments are seeking maximum value for their investments in research, universities are struggling to find adequate resources and capabilities to support technology transfer and commercialization activities, and industry is pushing for more highly skilled people trained in certain fields.

Some of these challenges are addressed in the Expert Panel on the Commercialization of University Research report to the Advisory Council on Science and Technology (ACST) entitled, *Public Investments in University Research: Reaping the Benefits*. Final recommendations are expected in spring 2000 with a strategy to be developed in the subsequent months. NSERC looks forward to playing a key role in implementing this strategy.

Improving international linkages

In today's knowledge-based society there is an increasing interdependence across disciplines, institutions, sectors and nations. The questions are more complex and finding the answers requires groups of researchers with diverse disciplinary backgrounds and

¹⁴ Advisory Council on Science and Technology. *Public Investments in University Research: Reaping the Benefits*. Report of the Expert Panel on the Commercialization of University Research. May 4, 1999, p. 8.

¹⁵ Specific examples are available in NSERC's 1998-99 Departmental Performance Report and the second edition of *Research Means Business*, a directory of companies built on NSERC-supported university research, published in November 1999.

skills, often working in collaboration with industry, government, and international partners.

Canada is a diverse nation. And while Canada only produces about 4 percent of the world's pool of scientific knowledge, Canadians can take advantage of their intercultural and international skills and knowledge to access the other 96 percent of knowledge produced abroad.

The federal government continues to recognize the importance of international science and technology and has established an Expert Panel on Canada's Role in International Science and Technology. This panel will advise the ACST on how Canada can most benefit from its involvement in international science and technology.

In the meantime, NSERC is facilitating Canadian involvement in international S&T activities and has established two new programs to give our researchers access to international knowledge networks. 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.

E. Departmental Planned Spending

Table 1: NSERC Planned Spending

(\$ millions)	Forecast Spending 1999-2000 ¹	Planned Spending 2000-2001	Planned Spending 2001-2002	Planned Spending 2002-2003 ²
Budgetary Main Estimates	505.0	549.4	549.5	489.4
Non-Budgetary Main Estimates	—	—	—	—
<i>Less: Respendable revenue</i>	—	—	—	—
Total Main Estimates	505.0	549.4	549.5	489.4
Adjustments ³	44.7	30.9	57.9	113.5
Net Planned Spending	549.7	580.3	607.4	602.9
<i>Less: Non-respendable revenue</i>	0.4	0.4	0.4	0.4
<i>Plus: Cost of services received without charge</i>	1.9	1.9	1.9	1.9
Net cost of Program	551.2	581.8	608.9	604.4
Full Time Equivalents	230	240	240	240

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

2. Does not include the portion of funding for the Networks of Centres of Excellence flowing through NSERC.

3. Adjustments are to accommodate approvals obtained since the Annual Reference Level Update (ARLU) exercise and to include Budget initiatives. Includes additional funding to establish the Canada Research Chairs.

Section III: Plans, Results and Resources

A. Business Line Objective

The objective for NSERC's business line is identical to the Council's overall objective described on page 7: *strengthen Canada's economy and quality of life through the productive use of knowledge by the support of a broad base of high quality basic research in Canada's universities, and the encouragement and facilitation of links between the universities and the private sector.*

B. Business Line Description

All NSERC activities relate to a single business line: **Support of Research and Scholarship**. NSERC provides research grants to university professors at Canadian universities and partnerships to support the basic and project research in the natural sciences and engineering, scholarships and fellowships to students and postdoctoral fellowships and the related administrative support.

C. Key Results Commitments, Planned Results, Related Activities and Resources

NSERC's Strategy Review

This next century will see the global, knowledge-based economy create tremendous opportunities for greater prosperity and improved high quality of life for all Canadians. We must seize these opportunities and build on our strengths. "In the global, knowledge-based economy, the advantage goes to countries that are innovative, have high levels of productivity, quickly adopt the latest technology, invest in skills development for their citizens, and seek out new opportunities around the world."¹⁶

It is with this in mind that NSERC undertook a year-long review of its strategy. NSERC's previous strategy document was published in 1994 and since then the research environment has changed dramatically.

Canadians increasingly recognize the importance of research and development and the role it plays in our economy and quality of life. The federal government is significantly investing in university research (e.g. the Canada Foundation for Innovation, the Networks of Centres of Excellence, the granting council budgets, the Canadian Institutes of Health Research, and the Canada Research Chairs).

NSERC concluded that the environment within which the Council operates is changing so rapidly that publishing a strategy document every few years will no longer do. Rather, NSERC's strategy must become an ongoing planning process. NSERC must be flexible,

¹⁶ Speech from the Throne, *Building a Higher Quality of Life for All Canadian*, October 12, 1999, p. 6.

innovative, strategic and responsive to meet the changing needs of the Canadian natural sciences and engineering research community. At the same time, NSERC will preserve its core priorities of investing in **discovery** and **innovation** and the **people** who make it happen.

Two other conclusions of the strategy review are worth noting. First, as mentioned in Section II, NSERC has expanded its eligibility to include colleges. Shifting from the current practice, colleges in partnership with universities are now eligible for project research funding. NSERC will review this change in two to three years and consider expanding college eligibility to other NSERC program funding.

The second conclusion relates to NSERC's influence. While NSERC is already influential in areas beyond its program reach, there are several ways in which NSERC plans to become more influential. One example is by entering into partnerships with agencies responsible for elementary and secondary education to help improve early education in math and sciences. In addition, NSERC is becoming actively engaged in science promotion by assuming the responsibility for the Michael Smith Awards for Science Promotion and creating a new Science for Youth program. Through these programs NSERC hopes to influence young Canadians' interest in science and engineering and encourage them to pursue studies in those areas and consider related career goals.

NSERC has also launched a network of NSERC-Industry Chairs in Design Engineering. In addition to the direct benefit of Canada having more design engineers, NSERC expects this program to help change attitudes so that design engineering is more widely recognized as a valuable, credible, prestigious intellectual activity that belongs in universities. Through the activities of the Chairs, NSERC may influence the curriculum of engineering schools to enhance the teaching of design.

Figure 14 on page 28 provides a graphical representation of what NSERC does, how it invests and why. A colour version is available on NSERC's Web site at www.nserc.ca.

NSERC's Strategy is available at the following Web address:
www.nserc.ca/publicat.htm.

Key Results Commitment

NSERC is in business to provide Canadians with: *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 and other sectors.*

Planned Results, Related Activities and Resources

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 all the expected results for the planning period. Concrete data can be provided on advanced

degrees granted, theses published, patents applied for and granted, papers published, etc., but the long-term socio-economic benefits of research emerge much more slowly.

With NSERC support, 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 strengthen our economy and improve the quality of life for all Canadians.

The 1998-99 Departmental Performance Report details the impact of NSERC's investments through a suite of indicators such as bibliometrics, licences, patents, spin-off companies, and the career progression of NSERC-funded students and fellows. For example, NSERC recently published *Research Means Business*, a directory of companies built on NSERC-supported university research. This report profiles one hundred and eleven companies that have created more than 7,500 jobs and nearly \$1.3 billion in revenue annually. However, this activity is the result of research support sustained over many years, decades in some cases.

Figure 11 (pages 21-23) describes NSERC's major planned results, related activities, and resources for the next three years. Information is grouped to report on NSERC's three core priorities: people, discovery and innovation. The figure also reports on NSERC's efforts to create public awareness of the natural sciences and engineering research sector and to improve service to clients.

Figure 11 – Planned Results, Related Activities and Resources

Planned Results	Related Activities	Resources
<p>PEOPLE:</p> <p>Highly qualified people (HQP), expert in research in the natural sciences and engineering, able to pursue knowledge-intensive careers of many kinds within any sector of the economy.</p> <p>Help satisfy the demand for HQP by industry, government and other sectors of the economy.</p> <p>Help Canadian universities create the outstanding research opportunities needed to retain and attract the “research stars of today” and the “research stars of tomorrow”.</p>	<p>Provide research training support to undergraduate, master’s, and doctoral students, and postdoctoral fellows. This is done by:</p> <ul style="list-style-type: none"> • Providing direct support: awarding scholarships and fellowships, some in partnership with industry, to selected individuals through national competitions; • Providing indirect support: a researcher may hire a student or postdoctoral fellow using part of his or her NSERC grant. <p>Become actively engaged in science promotion by assuming the responsibility for the <i>Michael Smith Awards for Science Promotion</i> and creating a new program of <i>Science for Youth</i>.</p> <p>Work with the other granting councils to establish the Canada Research Chairs.</p>	<p>Over the planning period, NSERC will invest on average \$87.5 million per annum in direct support (approximately 16 percent of its total budget).</p> <p>Indirect support falls within the sections that follow.</p> <p>Once fully operational, science promotion activities will invest more than \$2 million per year.</p> <p>A total investment of \$900 million over five years to the three granting councils.</p>

Figure 11 – Planned Results, Related Activities and Resources (cont'd)

Planned Results	Related Activities	Resources
<p>DISCOVERY:</p> <p>High quality research capability maintained across all areas in the natural sciences and engineering.</p> <p>High quality new knowledge that is the source of new ideas for innovation.</p> <p>Enhanced ability to access leading-edge knowledge from around the world.</p>	<p>Investments in 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.</p> <p>Planning the third round of the Reallocations Exercise that helps set research priorities within the <i>Research Grants Program</i>.</p> <p>Programs that enhance Canadian researchers' access to international knowledge networks.</p> <p>Honour research excellence with a \$1 million research prize, <i>The Gerhard Herzberg Canada Gold Medal for Science and Engineering</i>.</p>	<p>Over the planning period, NSERC will invest on average \$296 million per annum (approximately 54 percent of its total budget).</p> <p>Of the \$296 million, about 29 percent is used to pay salaries for students and research fellows.</p>
<p>INNOVATION:</p> <p>Productive use of knowledge in support of new products, processes, and services, leading to new jobs and businesses.</p> <p>Knowledge base for developing policies, standards, and regulations, and making decisions, for government and industry.</p>	<p>Leverage investments by forging partnerships with the private sector, as well as with other sectors, including government departments and agencies.</p> <p>Implement a communications strategy specifically aimed at industrial clients to enhance the private sector's awareness of NSERC programs that foster university-industry research collaboration and training.</p>	<p>Over the planning period, NSERC plans to invest on average \$117 million per year¹ (approximately 26 percent of its total budget).</p> <p>Of the \$117 million, about 29 percent is used to pay salaries for students and research fellows.</p>

1. Figures exclude the Networks of Centres of Excellence Program.

Figure 11 – Planned Results, Related Activities and Resources (cont'd)

Planned Results	Related Activities	Resources
<p>OTHER:</p> <p>Increase public awareness of the natural sciences and engineering research sector.</p> <p>High quality services to internal and external clients while keeping administration costs to approximately 4 percent of total funding.</p>	<p>Create a <i>NewsBureau</i> that is a web-based method of putting journalists in touch with NSERC-funded researchers;</p> <p>Use media to draw public attention to NSERC-supported research;</p> <p>SPARK (Students Promoting Awareness of Research Knowledge), a program where students write stories based on NSERC-supported research;</p> <p>NSERC/PAGSE¹⁷ series of <i>Bacon and Egghead</i> Breakfast seminars on the Hill;</p> <p><i>NSERC/Conference Board of Canada Synergy Awards.</i></p> <p>“Getting government online” by building on existing online services, an <i>E-Business Project</i> to facilitate the electronic submission, peer review, and management of applications;</p> <p>Harmonize policies and procedures with other granting councils;</p> <p>Develop service standards and service-level agreements;</p> <p>In partnership with other granting councils, promote research integrity and ethics;</p> <p>Create a tri-council working group to identify best practices in establishing and maintaining collections;</p> <p>Create an Intranet to provide employees with easy access to Council information.</p>	<p>Resources for the activities described are included in the general administration of NSERC (about 4% of the total budget or \$21.8 million per year).</p>

¹⁷ PAGSE – Partnership Group for Science and Engineering

Section IV: Horizontal Initiatives

Figures 12 and 13 describe two horizontal initiatives, the results NSERC plans to achieve, and major activities. Planned resources are included within figure 11.

Figure 12 – Sustainable Development Strategies	
Planned Results	Related Activities
<p>1. CLIMATE CHANGE:</p> <p>Advanced knowledge base in the area of climate change and related issues.</p> <p>Highly qualified people expert in climate change research.</p> <p>Application of climate change research in support of new products, processes, policies, standards, and regulations.</p>	<p>Support for university research and training in the area of climate change. In addition to a suite of untargeted research funding programs, targeted investments are made through the Strategic Project Grants Program and through five regional Chairs in Environmental Design Engineering;</p> <p>Networks of Centres of Excellence target area, <i>Meeting the Environmental Challenges for Clean Water</i>, in the 2000 competition for new networks;</p> <p>NSERC representation at the Climate Change Action Fund and National Climate Change “Issues Table” Process. NSERC also represents Canada on the International Group of Funding Agencies for Global Change Research (IGFA).</p> <p>Collaboration with other federal departments and agencies to address issues related to research on climate change.</p>

Figure 12 – Sustainable Development Strategies (cont'd)

Planned Results	Related Activities
<p>2. NORTHERN RESEARCH:</p> <p>Enhanced research and training opportunities in the North that are essential to monitor, manage and safeguard Canada's northern communities and environment.</p> <p>Improved co-operation between researchers and northern communities to ensure research needs are defined and knowledge transfer takes place.</p> <p>Enhanced ability to meet international science and research obligations, and contribute to issues of global importance.</p> <p>Enhanced capacity for people in the North to plan and perform research.</p>	<p>NSERC/SSHRC* Task Force on Northern Research established in October 1998.</p> <ul style="list-style-type: none"> ● Phase 1 – data collection and analysis completed in June 1999; ● Phase 2 – recommendations for actions to address problems and issues identified in Phase 1. Consultations with northern partners to be completed early in 2000 with final report and recommendations in May 2000; ● Recommendations to feed into federal Northern S&T Strategy. <p>NSERC representation on Interdepartmental Committee on Northern S&T.</p>

*SSHRC – Social Sciences and Humanities Research Council

Figure 13 – International Science and Technology

Planned Results	Related Activities
<p>Enhanced ability to access leading-edge knowledge and research facilities from around the world.</p> <p>Highly qualified people with international knowledge and intercultural skills.</p>	<p>Investments in programs that enhance Canadian university researchers' access to international knowledge networks;</p> <p>Flexible terms and conditions of NSERC grants that permit their use for international collaboration purposes;</p> <p>Co-operation with the Advisory Council on S&T (ACST) Expert Panel on Canada's Role in International Science and Technology;</p> <p>Collaboration with Human Resources Development Canada and the Department of Foreign Affairs and International Trade on the International Knowledge Strategy initiative.</p>

Section V: Financial Information

Table 2: Summary of Transfer Payments

(\$ millions)	Forecast Spending 1999-2000	Planned Spending 2000-2001	Planned Spending 2001-2002	Planned Spending 2002-2003 ¹
Grants				
<i>Support of Research and Scholarship</i>	526.9	558.5	585.6	582.9
Total grants	526.9	558.5	585.6	582.9
Contributions	—	—	—	—
Other Transfer Payments	—	—	—	—
Total Grants, Contributions and Other Transfer Payments	526.9	558.5	585.6	582.9

1. Does not include the portion of funding for the Networks of Centres of Excellence flowing through NSERC.

Note: Planned spending includes additional funding to establish the Canada Research Chairs.

Table 3: Source of Non-Respendable Revenue

(\$ millions)	Forecast Revenue 1999-2000	Planned Revenue 2000-2001	Planned Revenue 2001-2002	Planned Revenue 2002-2003
<i>Support of Research and Scholarship</i>	0.4	0.4	0.4	0.4
Total Non-Respendable Revenue	0.4	0.4	0.4	0.4

Table 4: Net Cost of Program for 2000–2001

(\$ millions)	Total
Net Planned Spending	580.3
<i>Plus: Services Received Without Charge</i>	
Accommodation provided by Public Works and Government Services Canada (PWGSC)	1.3
Contributions covering employers' share of insurance premiums and expenditures paid by TBS	0.6
Workman's compensation coverage provided by Human Resources Canada	—
Salary and associated expenditures of legal services provided by Justice Canada	—
	1.9
<i>Less: Non-Respendable Revenue</i>	0.4
2000-2001 Net cost of Program	581.8

Note: Planned spending includes additional funding to establish the Canada Research Chairs.

Section VI: Other Information

Figure 14: NSERC on a Page

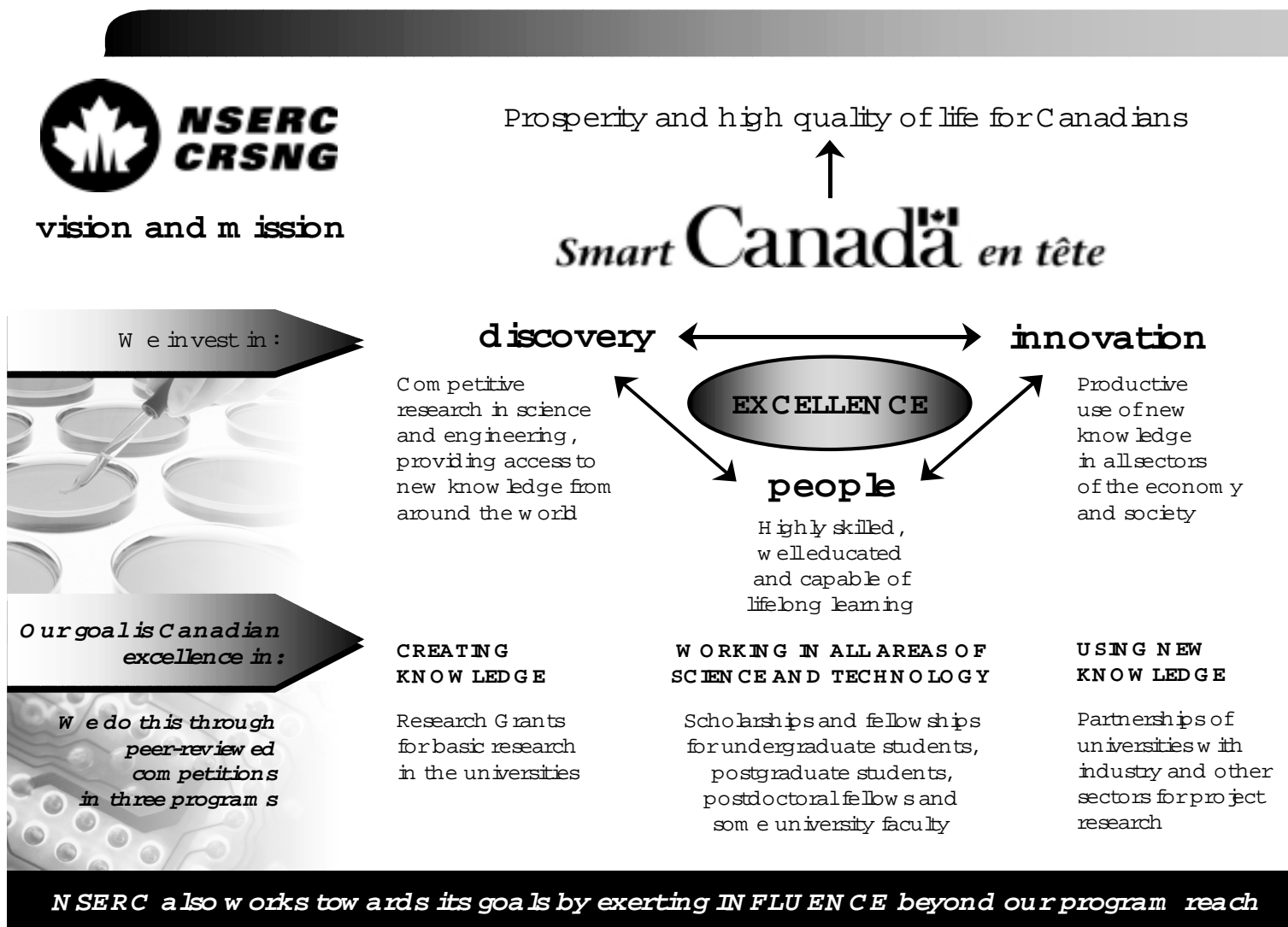


Table 5: Contacts for Further Information and Web Site

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

A searchable Web database of grants and scholarships awarded by NSERC since 1991 is located at <http://www.nserc.ca/programs/result/database.htm>.

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
Senior Policy Analyst, Policy and International Relations
Tel.: (613) 996-0923 Fax.: (613) 947-5645
E-mail: rmp@nserc.ca or robbyn.plumb@nserc.ca

Table 6: References

Advisory Council on Science and Technology. *Public Investments in University Research: Reaping the Benefits*. Report of the Expert Panel on the Commercialization of University Research. May 4, 1999.

Association of Universities and Colleges of Canada (AUCC). *AUCC Faculty Survey Findings*. November 1997.

AUCC. *Brain Drain or Brain Gain?* 1997.

AUCC. *Presentation to the House of Commons Standing Committee on Finance*. Robert Giroux and Robert Best. November 25, 1999.

AUCC. *Research and Education: The underpinnings of innovation*. Brief to the House of Commons Standing Committee on Finance, September 17, 1999.

Brzustowski, Tom. *The New Economy, Productivity, NSERC and the University Sector*. NSERC Submission to the Standing Committee on Finance in preparation for Pre-Budget Consultations, September 10, 1999.

Budget 2000, New Era... New Plan. Report of the Standing Committee on Finance, December 1999.

Table 6: References (cont'd)

Building a Higher Quality of Life for All Canadians. Speech from the Throne 1999.

Canada Foundation for Innovation. *\$11 million to boost innovative research at Canadian universities*. October 15, 1999.

Canada Foundation for Innovation. *51 Canadian universities and research institutions receive \$226 million to strengthen their innovation capacity*. June 23, 1999.

CATA Alliance. *CATA Alliance Advances Growth Agenda for a Knowledge-Based Economy*. Pre-Budget Submission to the House of Commons Standing Committee on Finance, September 1999.

Chrétien, Jean. *Response to the Speech from the Throne*. October 13, 1999.

Conseil de la science et de la technologie. *To Understand and To Innovate. Assuring Competitive Means for University Research*. November 1999.

Department of Finance. *The Economic and Fiscal Update – Translating better finances into better lives*. November 2, 1999.

Industry Canada. *Science and Technology Data, 1998*.

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

Monroe-Blum, Heather. *Growing Ontario's Innovation System: The Strategic Role of University Research*. December 1999.

NSERC. *Departmental Performance Report, 1998-99*.

NSERC. *Facts and Figures, 1998-99*.

NSERC. *NSERC Strategy 1999-2000*, December 1999.

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

NSERC. *Research Means Business; A Directory of Companies Built on NSERC-supported university research*. November 1999.

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.

Statistics Canada. *The Daily*. December 15, 1998.

Index

B

Budget 11, 12, 13, 15-18, 21, 22, 23, 29, 30

C

Climate Change 24

Collaboration 12, 17, 22, 24, 25

Commercialization 3, 16, 29, 15, 16

D

Direct costs 11

Discovery 3, 5, 6, 19, 20, 22

E

Education 3, 8, 12, 14, 19, 29

Environment 3, 8, 16, 18, 24, 25

Excellence 2, 6, 8, 13, 14, 17, 18, 22, 24,
....26

H

Highly qualified people 1, 8, 12, 13, 16,
....21, 24, 25

Highly skilled people 11, 16

I

Indirect costs 11

Influence 19

Infrastructure 11, 14

Innovation 1, 2, 3, 5-8, 11-15, 18, 19, 20,
....22, 29, 30

International 8, 10, 13, 14, 16, 17, 22, 24,
....25, 29

L

Leaders 12, 20

N

Northern research 11, 25

O

Objective 7, 18

P

Partner 15, 17, 25

Partnership 1, 3, 6, 8, 9, 16, 18-23

Plans 1, 3, 4, 18, 19, 22, 24

Priorities 1, 3, 4, 19, 20, 22

Productivity 1, 11, 14, 15, 16, 18, 29

R

Research and development 2, 3, 8, 9, 10,
....15, 16, 18

Resources 1, 3, 4, 16, 18, 19-24

Results 4, 11, 18-25

S

Skills 3, 5, 6, 17, 18, 20, 25

Strategy 6, 7, 16, 18, 19, 22, 25, 30

T

Technology transfer 16

Training 1, 6, 12, 14, 21, 22, 24, 25

Y

Young people 6, 8, 12

Youth 19, 21