ESTIMATES

Natural Sciences and Engineering Research Council of Canada

Performance Report

For the period ending
March 31, 2001

Canada

Improved Reporting to Parliament
Pilot Document

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 of the Government of Canada are structured in several parts. Beginning with an overview of total government spending in Part I, the documents become increasingly more specific. Part II outlines spending according to departments, agencies and programs and contains the proposed wording of the conditions governing spending which Parliament will be asked to approve.

The *Report on Plans and Priorities* provides additional detail on each department and its programs primarily in terms of more strategically oriented planning and results information with a focus on outcomes.

The *Departmental Performance Report* provides a focus on results-based accountability by reporting on accomplishments achieved against the performance expectations and results commitments as set out in the spring *Report on Plans and Priorities*.

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 funds.

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Foreword

In the spring of 2000 the President of the Treasury Board tabled in Parliament the document "Results for Canadians: A Management Framework for the Government of Canada". This document sets a clear agenda for improving and modernising management practices in federal departments and agencies.

Four key management commitments form the basis for this vision of how the Government will deliver their services and benefits to Canadians in the new millennium. In this vision, departments and agencies recognise that they exist to serve Canadians and that a "citizen focus" shapes all activities, programs and services. This vision commits the government of Canada to manage its business by the highest public service values. Responsible spending means spending wisely on the things that matter to Canadians. And finally, this vision sets a clear focus on results – the impact and effects of programs.

Departmental performance reports play a key role in the cycle of planning, monitoring, evaluating, and reporting of results through ministers to Parliament and citizens. Earlier this year, departments and agencies were encouraged to prepare their reports following certain principles. Based on these principles, an effective report provides a coherent and balanced picture of performance that is brief and to the point. It focuses on results – benefits to Canadians – not on activities. It sets the department's performance in context and associates performance with earlier commitments, explaining any changes. Supporting the need for responsible spending, it clearly links resources to results. Finally the report is credible because it substantiates the performance information with appropriate methodologies and relevant data.

In performance reports, departments strive to respond to the ongoing and evolving information needs of parliamentarians and Canadians. The input of parliamentarians and other readers can do much to improve these reports over time. The reader is encouraged to assess the performance of the organization according to the principles outlined above, and provide comments to the department or agency that will help it in the next cycle of planning and reporting.

This report is accessible electronically from the Treasury Board of Canada Secretariat Internet site:
http://www.tbs-sct.gc.ca/rma/dpr/dpre.asp
Comments or questions can be directed to this Internet site or to:
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Investing in people, discovery and innovation

Departmental Performance Report

for the period ending March 31, 2001

Brian Tobin,
Minister of Industry

Executive Summary

The challenge

The next millennium will see a continued expansion of the global knowledge-based economy. Canada's prosperity depends upon people, knowledge and innovation, especially in science and technology, as we transform our economy from one based on commodities to one based on value-added products in all sectors. Science and technology will also continue to enhance our quality of life by helping us improve the management of our resources, environment, public education, and health system.

Who we are

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

What we do

Our mission is to invest in people, discovery, and innovation to build a strong Canadian economy and to improve the quality of life for all Canadians. NSERC advances government-wide priorities of building a stronger Canada, creating opportunities for young Canadians, and investing in knowledge and creativity.

NSERC supports world-class research and the training of Canada's brightest young people. As a result, Canada has access to leading-edge science and technology from around the world and highly qualified people expert in it. Students trained with the help of NSERC support acquire the skills needed to generate knowledge and pursue rewarding careers in all sectors of society. These investments in Canada's knowledge base lead to innovations in industry and advances in setting policy, standards and regulations, and in solving problems, thus strengthening our economy and improving the quality of life for all Canadians.

Some of our accomplishments

In recent years, NSERC has been successful in:

- maintaining a strong presence in world science and engineering research by supporting annually nearly 10,000 of the most creative and productive Canadian professors;
- supporting the training of more than 55,000 master's and doctoral students, and young research professionals since 1978, who have had little trouble finding well-paying, productive jobs and who are contributing to Canada's knowledge-based economic sectors;
- supporting the development of new processes and products, some leading to the formation of new companies, all of which contribute significantly to the national economy;
- encouraging Canadian industry to invest more than $700 million since 1978 in university research and training activities;
- introducing new concepts and programs to ensure the research community optimises its contributions to Canada's prosperity.

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List of Abbreviations

AUCC	Association of Universities and Colleges of Canada
CCAC	Canadian Council on Animal Care
CFI	Canada Foundation for Innovation
CIHR	Canadian Institutes of Health Research
CMC	Canadian Microelectronics Corporation
CRD	Collaborative Research and Development Grant
CRF	Consolidated Revenue Fund
DPR	Departmental Performance Report
IPM	Intellectual Property Management Program
IRF	Industrial Research Fellowship
MRC	Medical Research Council of Canada
NCE	Networks of Centres of Excellence
NSE	Natural Sciences and Engineering
NSERC	Natural Sciences and Engineering Research Council of Canada
OECD	Organisation for Economic Co-Operation and Development
P	Preliminary
PDF	Postdoctoral Fellowship
PI	Principal Investigator
R&D	Research and Development
S&T	Science and Technology
SSHRC	Social Sciences and Humanities Research Council of Canada
TPP	Technology Partnerships Program
USRA	Undergraduate Student Research Award

1. Messages

1.1 Minister's Portfolio Message

The Government of Canada is committed to making Canada a world leader in the global knowledge-based economy of the 21st century. To meet this goal, the government has set out a very bold vision: to have Canada recognized as one of the most innovative countries in the world.

The Industry Portfolio is …

Atlantic Canada Opportunities Agency
Business Development Bank of Canada*
Canada Economic Development for Quebec Regions
Canadian Space Agency
Canadian Tourism Commission*
Competition Tribunal
Copyright Board Canada
Enterprise Cape Breton Corporation*
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 Performance Reports*

Why this emphasis on innovation? Innovation is one of the most powerful sources of competitive advantage in modern economies. It fuels productivity and economic growth and that translates into greater prosperity and a better quality of life for all Canadians. Our ability to acquire, adapt, and advance knowledge will determine how well Canadian businesses and Canada as a nation innovate, and in turn, how well Canada competes in the global arena.

Promoting innovation, research and development is a cornerstone of our government's agenda, and we have made progress. Canadian businesses have boosted their research and development (R&D) spending at the second fastest rate among G-7 countries. We have the fastest rate of growth in R&D jobs. And the government is committed to doubling its R&D investments and catapulting Canada into the ranks of the top five countries in the world for research and development performance by 2010.

When it comes to embracing the Internet revolution, or what has come to be known as connectivity, Canada's record is the envy of the world. Our country is one of the most connected countries in the world. We connected all of our schools and libraries to the Internet over two years ago. We have the highest percentage of our population on-line of any country in the world. Furthermore, the National Broadband Task Force has advised the government on how Canadians together can achieve the critical goal of making broadband access widely available to citizens, businesses, public institutions and to all communities in Canada by 2004.

As Minister of Industry, I am responsible for the Industry Portfolio, which consists of fifteen departments and agencies that play a key role in delivering on the government's agenda. With over 40 percent of federal government spending on science and technology, and a wide range of complementary programs to help businesses both large and small

thrive and prosper, the Industry Portfolio has a national reach, regional depth and community presence across the country.

I am pleased to present this Performance Report for NSERC, which shows its contribution, during 2000-2001, to the government's agenda.

In 2000-2001, NSERC invested $539 million in university-based research and training in all the natural sciences and engineering. 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 strengthen our economy and improve the quality of life for all Canadians.

The government's strategy has been to strengthen Canada's capacity for innovation by investing in research and knowledge, and by fostering a nation of highly skilled people. We are assisting all Canadians with life-long access to the tools and skills they need for success. We are laying the foundation of a state-of-the-art research environment in which our best and brightest can make their ground-breaking discoveries right here at home. And we are working with our researchers and entrepreneurs to make sure that Canada is the place where new products and processes get to market first and fastest.

_____

The Honourable Brian Tobin

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

We have confidence in Canada's potential to foster a culture of discovery and innovation. The federal government is taking measures to reinforce Canada's competitiveness, improve the well-being of Canadians and build on Canada's image as a truly innovative society that values the contribution of its talented and skilled people.

New discoveries, knowledge infrastructure, business environment, human capital and marketing of knowledge are all things that we as a country need to strengthen to ensure Canadian leadership in the area of innovation. The National Research Council Canada, the Natural Sciences and Engineering Research Council of Canada and the Social Sciences and Humanities Research Council of Canada play essential parts in helping Canadians innovate and understand their world through science, research and development. We call upon experts from the social sciences, natural and physical sciences, humanities, medicine and engineering to inform us of what their disciplines can, and cannot, tell us about the increasingly complex issues that we face every day. This partnership allows us to better comprehend the full scope of the issues we face as a society, and helps us to frame the questions that remain to be answered.

The federal government has important roles as both a performer and a facilitator of science and technology. It fulfills these roles by performing research, using intramural capabilities and facilities, by funding extra-mural research, and by fostering partnerships between government, industry and universities. With the recognition that the sciences and technology are moving to the centre of decision-making in all walks of life, this is an opportune moment to pause and reflect on how we as a society keep abreast of the impacts and implications of science and technology.

_____

The Honourable Gilbert Normand

2. Departmental Overview

2.1 Mandate, Vision, Mission and Strategic Outcome

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. The country must seize these opportunities and build on our strengths.

To maximize the added value of investments Canadians make through NSERC, the Council must be flexible, dynamic, innovative, and forward-looking. NSERC is key to building a *Smart***Canada** that is prepared for the next new economy.

Created in 1978, NSERC's legal mandate, its vision and mission, and ultimately the desired strategic outcome are outlined in Figure 1.

The Council's ultimate objective is to advance Canada's prosperity and high quality of life by supporting the creation and transfer of knowledge in the natural sciences and engineering (NSE) in Canada, and by ensuring people are trained to use and create that knowledge. To achieve this, NSERC supports research in Canadian universities and colleges 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. Innovation contributes to wealth creation in the economy, which produces prosperity. New knowledge in NSE also enhances our quality of life through its impact on many policies, regulations, practices, and institutions.

Figure 1: NSERC's Mandate, Vision, Mission and Strategic Outcome

Mandate

NSERC was created in 1978. Its legal mandate and functions 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.)**

Vision

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**.

Mission

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.

Strategic Outcome

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 colleges to other sectors.

2.2 NSERC Operations

NSERC operates within a framework of:

(1) programs developed in consultation with the Canadian research community, in the context of the present and future challenges facing the Canadian university research system, and in light of Canada's needs and government priorities; and

(2) a rigorous process of peer review for awarding funding within the programs.

The peer review system ensures that funds go only to the best professors and students, and the best research programs and projects. NSERC's involvement guarantees objective and fair review of applications for support.

Applications for research funding are judged first and foremost on the merits of the proposed research and on the excellence of the research team; other criteria vary among the Council's programs, and include the level of commitment from industrial partners, the plans for interacting with the partners, and (especially for large projects) the design of the project and the proposed management structure.

Applications for direct student support, through NSERC's Scholarships and Fellowships programs, are judged on the student's academic qualifications, as well as his or her potential for research achievement, and an assessment of his or her leadership qualities. NSERC recognizes that success in graduate studies, and in a subsequent research career, is dependent on more than academic excellence; an enquiring mind, adaptability, and the ability to work well in a team are also essential. In addition, many other students receive NSERC support indirectly, through research grants awarded to their faculty supervisors.

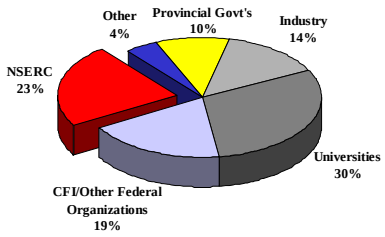
2.3 Clients and Partners

NSERC does not conduct any research in-house, nor does the organization have any training facilities. NSERC supports research in Canadian universities and colleges that meets the highest international standards of excellence and it supports the education of young people in that research. As a result, the universities, colleges, companies, government agencies, and other institutions with which NSERC collaborates are all key co-delivery partners. A brief summary of NSERC's clients and partners is presented below.

Universities

NSERC is the single most important funder of research and development (R&D) in the natural sciences and engineering in Canadian universities. In 2000, $1.9 billion in R&D was carried out by Canadian universities in the natural sciences and engineering. NSERC directly provided almost one-quarter of the total funding. Since much of the other funding from universities, industries and governments is contingent upon NSERC funding, a reasonable estimate makes the Council directly and indirectly responsible for slightly less than half of the funding. Figure 2 gives a breakdown of the total funding by direct source.

Figure 2: University R&D Funding in the Natural Sciences and Engineering, 2000



Total: $1.9 Billion

Source: Statistics Canada

More than 9,700 university professors and more than 15,700 university students and postdoctoral fellows are supported by NSERC. The Council also supports a considerable number of university technicians and research associates. Most Canadian universities benefit from NSERC programs, as do a growing number of industries and government departments. Figure 3 presents the details of NSERC's client support. Estimates of the share of the population funded or participating, for eligible individuals and organizations, and trends over the past ten years, are also included.

Figure 3: NSERC's Clients and Partners, 2000-01

	Number Supported or Participating	Share of the Population[1]	Trends in Share of the Population Over Past 10 Years
Clients:			
University Professors	9,735	65% – 70%	Small Increase
Undergraduate Students	6,568	6%	Small Increase
Master's/Doctoral Students	7,495	35% - 40%	Stable
Postdoctoral Fellows	1,639	40% - 50%	Stable
University Technicians and Research Professionals	3,111	30% - 40%	Stable
Partner Organizations:			
Universities and Colleges	65	75%	Stable
Companies Performing R&D[2]	691	10%	Nearly Doubling
Federal Science Departments/Agencies[2]	10	65%	Large Increase
Provincial Science Departments/Agencies[2]	13	25% - 40%	Large Increase

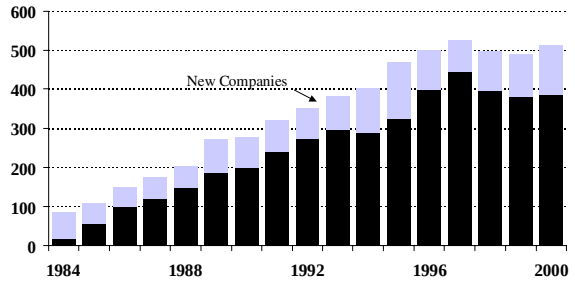
Source: NSERC

1. The percentage that NSERC supports of all individuals and organizations eligible for NSERC funding.
2. Organizations in partnership with NSERC (across all NSERC programs).

Companies

Strong growth has taken place in the number of companies that have contributed to NSERC's collaborative university-industry research programs (see Figure 4). Since the inception of the university-industry research programs, more than 1,400 firms have participated, rising from less than 50 companies in 1983 to more than 500 businesses in 2000. On average, 100 new firms are working with NSERC every year.

Figure 4: Number of Companies Contributing to NSERC's University-Industry Programs



Source: NSERC

NSERC is well known to companies heavily involved in R&D. Twenty-four of the top 50 Canadian R&D companies (as ranked by The Globe & Mail, 2000) have funded university research jointly with NSERC.

Government Departments/Agencies

NSERC is also well known to most federal and provincial science-based departments and agencies. A list of federal and provincial departments and agencies NSERC has collaborated with in 2000 is presented in Figure 5.

Figure 5: NSERC's Federal/Provincial Partners, 2000-01

Federal Departments/Agencies	Provincial Departments/Agencies
Agriculture and Agri-Food Canada	Alberta Advanced Education
Canadian Institutes of Health Research	Alberta Energy
Canadian Space Agency	Alberta Environmental Protection
Environment Canada	Alberta Oil Sands Technology and Research Authority
Fisheries and Oceans Canada	Alberta Science and Research Authority
National Defence	Forest Renewal BC
National Research Council Canada	Manitoba Energy and Mines
Natural Resources Canada	Fonds FCAR (Quebec)
Public Works and Government Services Canada	Ministry of Environment (Quebec)
Social Sciences and Humanities Research Council of Canada	Ministry of Natural Resources (Quebec)
	Ontario Ministry of Agriculture
	Saskatchewan Energy and Mines

2.4 Challenges

Flood of bright young professors into Canada's universities

NSERC is experiencing a rapid and sustained influx of new applicants. These new professors are critical to Canada's future capabilities in S&T, not only because they generate new knowledge and innovations, but also because they train highly skilled people able to succeed and add value in today's and tomorrow's economy. By far, the largest increase is in the areas where increased numbers of graduates are needed by the information and communication technology (ICT) sector. Based on a recent survey conducted by NSERC of faculty hiring plans, this growth trend is expected to continue.

NSERC Council is committed to providing the research funds needed by new applicants for Research Grants and will provide a portion of the additional funding needed from existing resources. This short-term fix will help ease the pressure in the upcoming competition, however, a longer-term solution is required to continue funding their work beyond the first year so that these new professors can realize their potential. These people are being attracted to our universities and if Canada is to prosper in the knowledge-based economy, we need them to succeed in research. And we expect the growth in new applicants to continue.

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: (1) the relative value of the Canadian dollar makes it expensive to import scientific instruments; (2) the prices for tools like scientific monographs and journals are going up much faster than the Consumer Price Index (CPI); (3) to conduct world-class research, Canadian researchers must adopt new and expensive research methods; and (4) many university research services that used to be free now carry user fees that must be paid out of NSERC grants.

Impact of recent initiatives

The federal government has taken very positive steps in recent years to strengthen Canada's research base. While initiatives like the Canada Foundation for Innovation (CFI) and the Canada Research Chairs help address important needs in Canadian universities, they do create significant challenges for NSERC.

Funds are required to ensure that infrastructure provided by the CFI to date can actually be operated. Research grants, at internationally competitive levels, must also be provided to the Canada Research Chairs if we are to successfully attract and retain the best researchers and create a stimulating research environment in which they can work.

The demand for highly skilled people

Canada's success in the new economy is increasingly dependent on its human capital. 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 the best 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.

Making our universities a competitive advantage

We can enhance productivity performance in 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 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.

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. And Canadian universities are better positioned to play a more prominent role than in most other G-7 countries.

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.

Improving international linkages

In today's knowledge-based society there is an increasing interdependence across disciplines, institutions, sectors and nations. Questions are more complex and finding answers requires groups of researchers with diverse disciplinary backgrounds and skills, often working in collaboration with industry, government and international partners.

Canada produces about 4 percent of the world's pool of scientific knowledge, but we need to be able to use the other 96 percent. Canada is highly dependent on the rest of the world for much of the scientific knowledge that we need to maintain our enviable position. As a result, it is critical that our researchers be able to work on the most important problems, collaborate with the best people, and use the best and latest facilities and equipment. This requires both access to and understanding of the research done elsewhere. Therefore, Canadian researchers must collaborate and exchange scientific information with the world's best researchers, participate in international research networks and large-scale projects, and have access to the best equipment and facilities worldwide.

To address this challenge, NSERC is facilitating Canadian involvement in international S&T activities and has established new mechanisms to give our researchers access to international knowledge networks. Canadian researchers must be provided opportunities to gain an international presence and linkages that will help ensure our access to leading-edge research in many fields.

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 less experienced faculty resulting in a loss of research and training capability at our universities, at least in the short term.

Regional Capacity

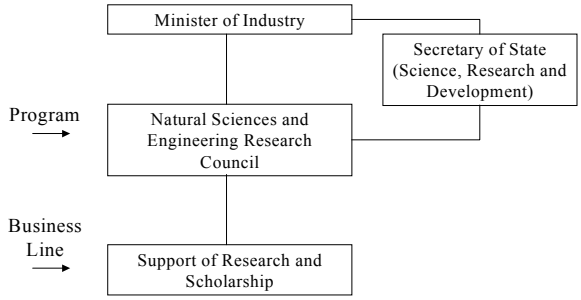
In today's economy, a healthy and diversified national innovation system is key and Canada's universities play a central role. Universities have become conscious of their potential to assist regional economic development, particularly by increasing the local capacity for innovation. They understand the connections between university teaching, research, innovation, and value-added economic activity. They are willing to work with industry and other partners to help them expand knowledge-based economic activity in all sectors.

However, the capacity for universities to seize these opportunities varies widely across the country. Some of the reasons for this situation include differences in provincial funding, low levels of value-added industrial activity, and limited access (or none at all) to graduate students. NSERC believes that there is a need for a flexible new capacity-building program, targeted at the individual needs of the universities. Thus, NSERC will work with its Industry Portfolio partners in all regions to help remove these barriers so that universities across Canada compete on a more equal basis in the national NSERC competitions.

2.5 Departmental Organization

NSERC's sole business line is: Support of Research and Scholarship in the Natural Sciences and in Engineering. Figure 6 presents NSERC's organization structure.

Figure 6: Organization Structure



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 7 presents NSERC's committee structure.

Figure 7: Council Committee Structure

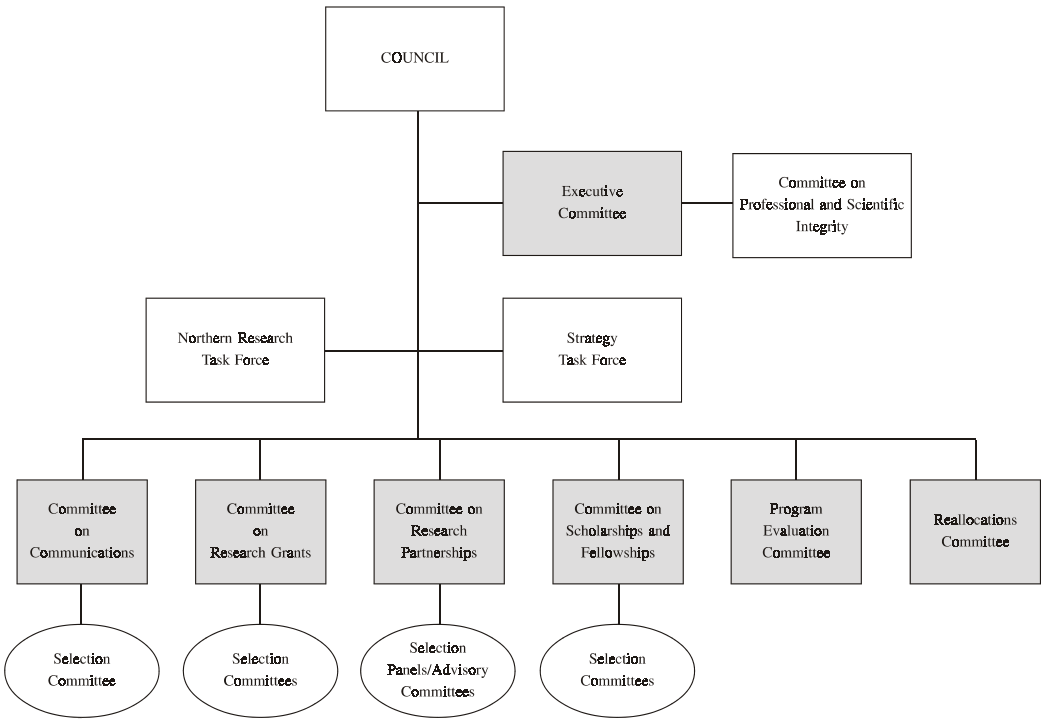
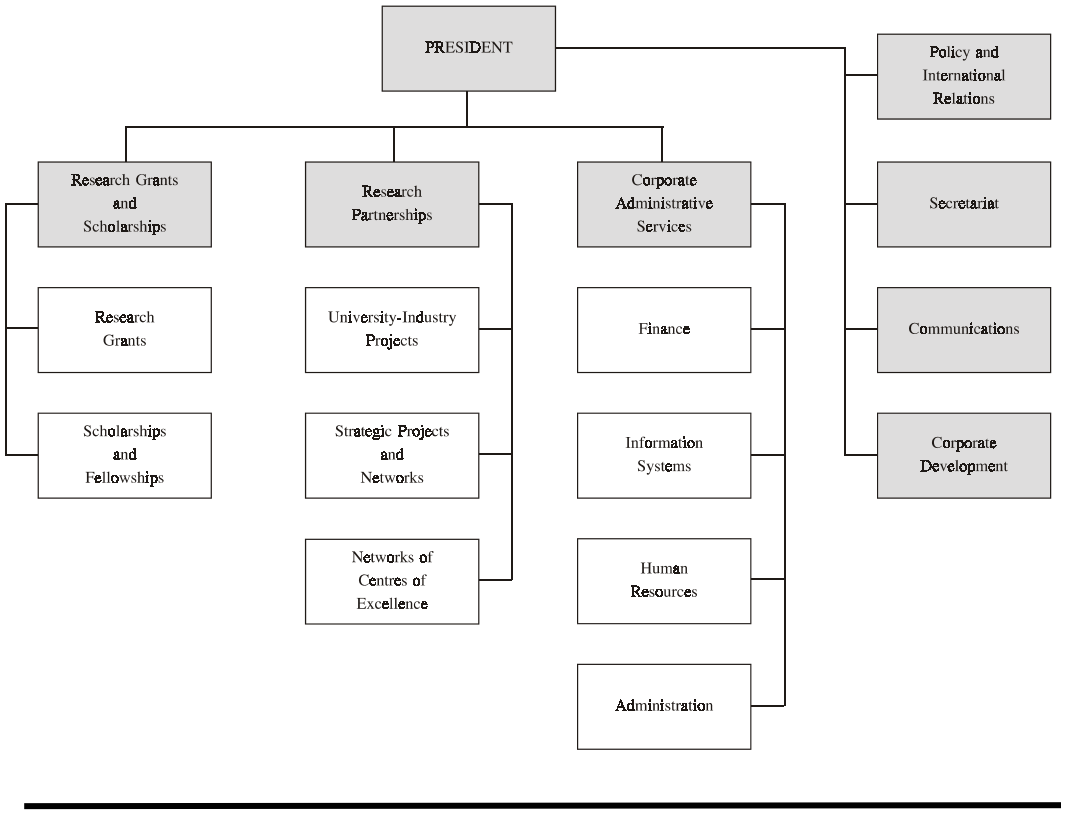


Figure 8 displays the corporate structure. NSERC is organized around two program directorates - Research Grants and Scholarships, and Research Partnerships. The Directors General of these directorates report directly to the President. There are also four corporate functions: Policy and International Relations, Corporate Development, Communications, and the Secretariat; the Directors of these units also report to the President. Finally, there is the Corporate Administrative Services Directorate. This directorate is shared with the Social Sciences and Humanities Research Council (SSHRC), and handles Human Resources, Information Systems, Finance, and Administration for both Councils. Its Director General reports to the Presidents of both SSHRC and NSERC.

Figure 8: Corporate Structure



3. Departmental Performance

NSERC measures its performance by evaluating its programs of research and training support, their impact, cost effectiveness and continuing relevance. When reviewing performance of research support programs, it is important to remember that these investments take longer to bear fruit than most other government investments.

The strategic outcome that NSERC strives to achieve is **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 colleges to other sectors.** In more detailed terms, NSERC's performance expectations include:

- maintaining a high-quality research capability across all areas of the natural sciences and engineering;
- expediting access and use of new knowledge from around the world;
- creating a knowledge base for developing policies and regulations, and making decisions, for government and industry;
- creating and putting to productive use knowledge in support of new products, processes, services, policies, standards and regulations in private and public sectors;
- meeting the needs of industry and the public sector for highly qualified personnel;
- creating a stronger economy based more on knowledge, due to more technology transfer via highly trained employees in the public and private sectors, university-business partnerships and through the creation of new businesses by trained individuals.

The impact of NSERC's investment in research and training in the NSE can only be fully assessed over the long term. As well, no one indicator can be considered a defining accomplishment; rather the whole suite of indicators presented should be taken into consideration. The performance indicators are presented within two categories: (1) people, and (2) discovery and innovation.

NSERC is also addressing performance issues in its administration activity, including quality service initiatives. The goal of the administration activity is to support and underpin the Council's function; performance issues therefore revolve around efficiency and quality service to both Council's staff and the research community. Performance in administration will be discussed in future Performance Reports, after performance baselines have been established.

3.1 Investing in People

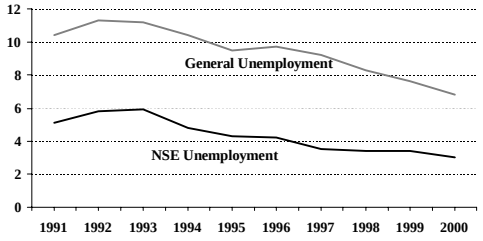
Context

NSERC must be able to support enough graduate students in the natural sciences and engineering to meet the needs of the country, and the support must be at a high enough level to attract the best people. Without these long-term investments in young people Canada will experience a decline in its ability to compete and innovate in a knowledge-based world.

Why does NSERC invest in training Canadians in the NSE? There are many reasons, but four will be highlighted with some independent data to support the conclusions:

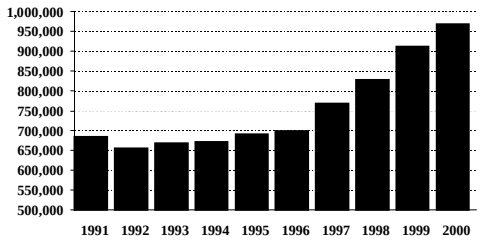
1. The demand for such people is high, as indicated by a very low unemployment rate for Canadians in the natural sciences and engineering, less than one-half the rate for the general population (see Figure 9).
2. Employment growth for natural scientists and engineers is strong (see Figure 10) and one of the highest of all occupation groups.
3. Unemployment levels fall and earnings increase as university graduates in the NSE earn higher degrees, NSERC's major training focus (see Figure 11).
4. Canada needs more research scientists and engineers to compete with the highly industrialized nations of the world (see Figure 12).

Figure 9: Unemployment Rate for Natural Scientists and Engineers (%)



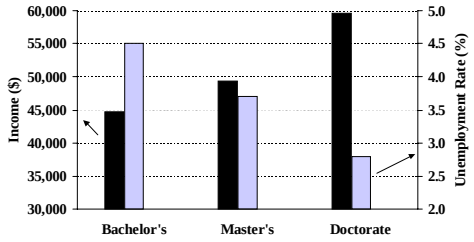
Source: Statistics Canada

Figure 10: Number of Natural Scientists and Engineers Working in Canada



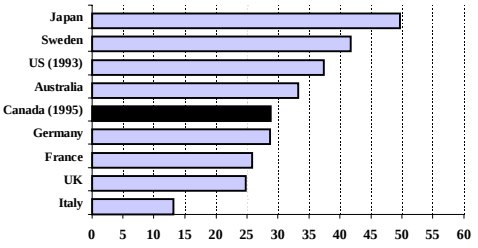
Source: Statistics Canada

Figure 11: Income and Unemployment Levels by Degree Level for Graduates in the NSE, 1995



Source: Statistics Canada

Figure 12: Scientists and Engineers Engaged in R&D per 10,000 Population, 1997



Source: OECD

Resources and Objectives

NSERC invested $215 million or 40% of total expenditures in 2000-01 to train the next generation of science and engineering graduates. This training support is provided in two ways: (1) directly through national competitions to selected individuals; and (2) through indirect support provided by an NSERC-funded researcher from his or her NSERC grant.

Undergraduate Students

NSERC provides four-month jobs for undergraduate students in the natural sciences and engineering through our Undergraduate Student Research Awards (USRA) program (Note: NSERC-funded researchers also support undergraduate students through their NSERC research grants). NSERC's current annual investment of $13 million brings this experience to nearly 3,000 students every year. Providing these students with valuable experience in a university or industrial laboratory, and encouraging them to undertake graduate studies are important indicators of the impact of the support.

Master's and Doctoral Students

NSERC provides scholarship support for Canadians to pursue a master's or doctoral degree in the natural sciences and engineering. This is done in two ways: (1) directly through national programs supporting more than 3,100 students annually at a cost of $53 million per year; and (2) indirectly through NSERC's research grants, which support more than 4,400 students (full-time equivalent), at roughly $81 million per year.

The career status of former NSERC-funded master's and doctoral students and the degree to which NSERC funding affects their ability to undertake or continue with their studies are important indicators of the impact of the scholarship support. Over the past five years NSERC has completed annual surveys of directly funded master's and doctoral students.

Postdoctoral Fellows

After a doctoral degree it has become customary in certain fields to go through additional postdoctoral research training. NSERC directly funds postdoctoral fellows (PDFs) for up to two years to continue their research training. NSERC now invests approximately $13 million per year to support roughly 470 Canadian PDF's per year. NSERC also provides this PDF support for more nearly 1,000 other individuals through NSERC research grants at an annual investment of over $33 million.

The career status of former NSERC-funded postdoctoral fellows and the degree to which NSERC funding affects their ability to pursue a research career are important indicators of the impact of the postdoctoral support. In 1999 NSERC completed a survey of directly funded postdoctoral fellows (See Figure 13).

Industrial Research Fellows

Another route for doctoral graduates to gain additional research experience is through NSERC's Industrial Research Fellowships (IRF) program. This relatively small program invests approximately $3 million per year to help place 175 Canadian Ph.D.s annually in industrial laboratories. This investment has contributed significantly to the number of doctoral graduates working in Canadian industrial labs. More than 15% of Canadian industrial researchers with a Ph.D. have been funded by NSERC through the IRF program.

To determine if the program is staying on track, NSERC routinely monitors the employment situation of former IRF winners (See Figure 13).

Outcomes Achieved

As mentioned, NSERC routinely surveys former holders of its various scholarship and fellowships. Survey results for the students and fellows are presented in Figure 13. Overall, the results are extremely positive and NSERC's funding has proven to be instrumental in career development and progression.

Figure 13: Student and Fellowship Survey Results (Detailed Report: www.nserc.ca/publicat.htm)		
	Survey Results	**Some Comments**
Under-graduate Students Surveyed after summer employment 1,672 respondents 61% response rate	❑ Long term career objectives are more important to students than short term financial returns ❑ Satisfaction is high with the USRA work experience ❑ Students report learning practical techniques and methods and gain critical management skills ❑ Students report that the supervision and instruction they received was excellent ❑ Students' interest in research increased at a critical period in their career-choice ❑ USRA work experiences had a significant impact on students' interest in careers in industry ❑ Students overwhelmingly believe their USRA job experience will improve their permanent job prospects ❑ A significant number of students plan to stay in university longer as a result of their USRA job experience	❑ "I enjoyed the hands-on laboratory work, that helped improve my skills and critical thinking." ❑ "This is a very good opportunity for students to get a taste of formal R&D." ❑ "I feel the program as it is gives important experience and education to the participant." ❑ "Increase the value of the USRA, not even enough to pay for tuition and books, much less living expenses." ❑ "Excellent program that helps students acquire knowledge and experience that is otherwise unavailable."
Master's & Doctoral Students Surveyed 9 years after award 1,195 respondents 49% response rate	❑ Graduates' experience far less unemployment (1.7%) than the norm (Canada = 8%) ❑ The vast majority (92%) have found full-time employment ❑ Nearly 2/3 of the graduates are engaged in R&D ❑ Incomes are much higher than the Canadian average, with more than half earning more than $50,000 a year ❑ 70% report their graduate training was "critical" to their current employment ❑ Over 80% of the graduates are living and working in Canada. Of the remaining 20%, half intend to return to Canada ❑ 46% report that NSERC funding was "essential" to their decision to continue to graduate studies	❑ "I now have tremendous research opportunities in my current job which I would not have had without my NSERC-funded training. The knowledge is beneficial to myself and employer certainly, but arguably for the country overall." ❑ "NSERC support was critical to my decision to pursue graduate studies instead of employment. I appreciate very much the opportunities now available to me as a result of your investment in me." ❑ "There are very few qualified Canadians available for hire in our industry. NSERC is a key enabler for generating suitable candidates, and thus plays a big role in our industry."

Figure 13: Student and Fellowship Survey Results (Detailed Report: www.nserc.ca/publicat.htm)		
Postdoctoral Fellows (PDF) Surveyed 7 years after award completion 163 respondents 38% response rate	❑ Most PDFs (59%) study abroad, thereby gaining access to the best training in their field ❑ Only 2% of PDFs were unemployed, far below the national average ❑ PDFs tend to return to universities (73%) to train the next generation of scientists and engineers. ❑ The vast majority (88%) are still engaged in research, either as a university professor, research scientist, or engineer ❑ Almost 80% of PDFs report their postdoctoral training was critical to their careers ❑ For most PDFs, NSERC funding was either "essential" (50%) or very important (23%) ❑ Over 2/3 (67.3%) of PDFs are working in Canada.	❑ "Without my NSERC support I would simply not have conducted a research career – it changed my life." ❑ "NSERC Postdoctoral fellowships are essential to ensure the brightest young people remain in the University setting to become faculty in our Universities. This is most important." ❑ "NSERC PDF's are vital to insure that our best students get the opportunity to continue their studies in the world's best laboratories. Excellent programme-Keep it up!"
Industrial Research Fellows and Companies (IRF) Surveyed after award 369 respondents 100+ firms	❑ Seventy-seven per cent of former IRF winners are still working in Canadian industries. A small percentage have gone on to academic positions in Canadian universities, and a similar percentage have left the country. ❑ 98% of the firms said that the program was able to meet their requirements; ❑ 98% stated that the research project undertaken by the Fellow was "successful," and 94% believed it to be cost-effective.	❑ "The IRF program provides the added financial leverage to permit successful competition for talented Canadian Ph.D.'s. It helps to keep these individuals in Canada. It helps the high tech company to expand its R&D base with a reduced training burden or risk." ❑ "NSERC`s IRF program is a very successful program, providing a means for smaller companies to effectively build their internal R&D capability."

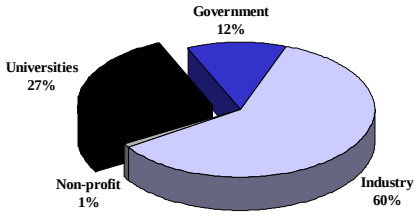
3.2 Investing in Discovery and Innovation

Context

The following statistics are presented to help the reader understand the position and relevance of Canadian university research.

1. University professors conducted 27% of all Canadian research, as measured by expenditures, in 2000 (see Figure 14).
2. Of the $3 billion of direct and indirect investment in Canadian university research in 2000, 42% was allocated to the natural sciences and engineering (see Figure 15).
3. Figure 16 shows trends in the funding of Canadian university research in the NSE. Over the past three years the Federal government's share has increased, due mainly to CFI funding.
4. Canadian university researchers perform 3% of the over $100 billion in university research in the OECD (see Figure 17). When measured as a percentage of gross domestic product, Canada conducts roughly the same amount of university research as most of its G7 competitors.

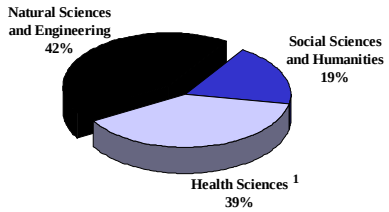
Figure 14: R&D Performance in Canada, 2000



Total: $16.6 Billion

Source: Statistics Canada

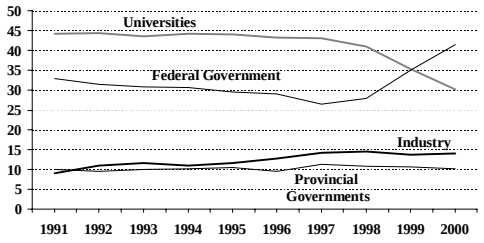
Figure 15: University R&D in Canada by Discipline, 2000



Total: $4.5 Billion

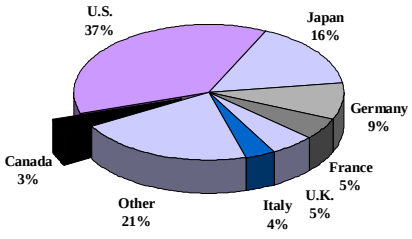
1. Includes hospitals.
Source: Statistics Canada, NSERC estimate.

Figure 16: Canadian University R&D Funding in the Natural Sciences and Engineering (%)



Source: Statistics Canada, NSERC estimate.

Figure 17: University R&D Expenditures in the OECD, 1998



Total: $103 Billion

Source: OECD

Resources

Across all its programs NSERC invested $324 million or 60% of total expenditures on discovery and innovation in 2000-01. (This total excludes all expenditures on undergraduate/master's/doctoral students and postdoctoral fellows, which was discussed in section 3.1.)

Outcomes Achieved

The results of the current and prior year's investments are described below under ten indicators:

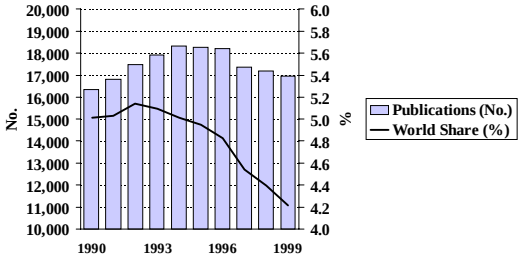
1. Publications
2. Collaboration/Partnerships
3. Patents
4. Awards and Prizes
5. Licences
6. Leveraging
7. Industrial Survey Results
8. Companies Linked to NSERC-Funded Research
9. New Products and Processes
10. Success Stories

1. Publications

One of the first tangible outcomes of an investment in university R&D is a publication in a scientific or engineering journal. The worldwide culture of university research places a great deal of importance on publishing new discoveries and advances in widely circulated journals. Investment in this very public forum gives the country's researchers access to the latest international research and the ability to build on this research. The graphs on the following pages highlight some performance trends.

- Canadian researchers (all sectors) in the NSE publish roughly 17,000 journal articles per year, ranking Canada 6th overall in the world. This has represented a declining share of worldwide production, from 5% at the beginning of the decade to 4.2% in 1999 (see Figure 18). Most of Canada's and the world's scientific and engineering publications are produced by university researchers.

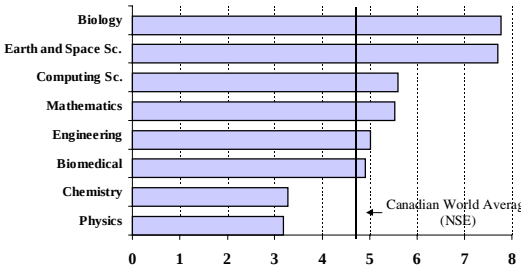
Figure 18: Number of Canadian Publications in the NSE and World Share



Source: Observatoire des Sciences et des Technologies

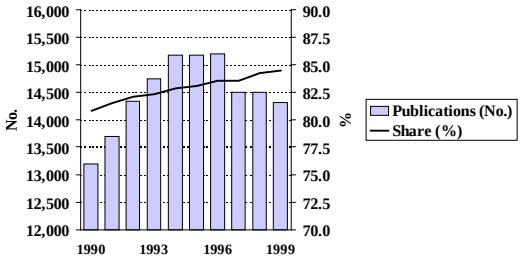
- One of the important objectives for NSERC is to maintain a significant world presence in all fields of the natural sciences and engineering. Figure 19 indicates that for the most part this is being accomplished.
- Most of Canada's NSE publications are produced by university researchers (see Figure 20). Of the average 14,500 university papers produced annually, over 80% can be attributed to NSERC-funded researchers.

Figure 19: Canada's Share of World Publications by Discipline in the NSE, 1990-99 (%)



Source: Observatoire des Sciences et des Technologies

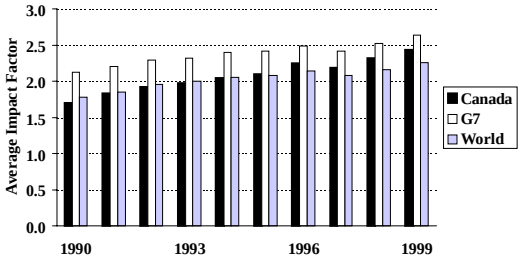
Figure 20: Number of Canadian Publications in the NSE by the University Sector, and Share of Canadian Papers



Source: Observatoire des Sciences et des Technologies

- Figure 21 provides an indication of the "impact" of Canadians papers in the NSE. Similar to common rating systems, in which a higher score indicates more viewers, listeners, or readers, the impact factor is a measure of the potential use of a researcher's work by fellow researchers. If a researcher's work is being referenced or cited more often by his/her peers, then there may be more intrinsic value to the work. Canada's impact factor in the NSE is slightly better than the world average and slightly below the G7 (although the latter gap is narrowing).

Figure 21: Average Impact Factor of Publications in the NSE



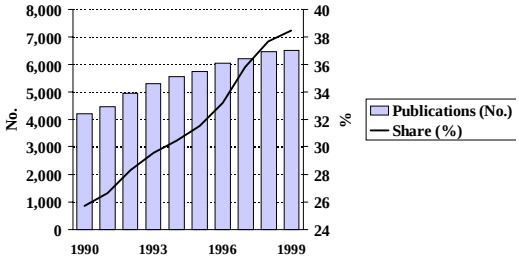
Source: Observatoire des Sciences et des Technologies

NSERC will be releasing a detailed report on scientific publications and the relationship to NSERC funding in the spring of 2002.

2. Collaboration/Partnerships

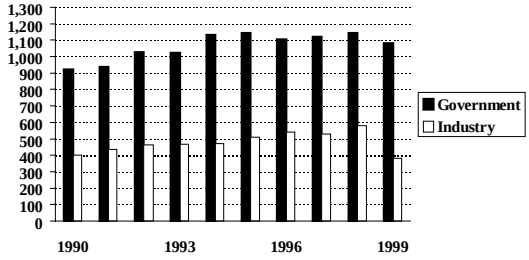
- Increasingly Canadian researchers in the NSE are collaborating with international partners and benefiting from the globalization of R&D. Figure 22 shows the trend over the past decade, culminating in more than one-third of Canadian papers in the NSE being written with international partners.
- Canadian university researchers are also working closely with researchers in Canadian government laboratories and industry. Figure 23 indicates that over 1,000 university-government publications and on average 500 university-industry publications are produced annually. This trend has been fairly steady over the past decade.

Figure 22: Number of Canadian Publications in the NSE Co-Authored with International Partners, and Share of Canadian Papers



Source: Observatoire des Sciences et des Technologies

Figure 23: Number of University-Industry and University-Government Publications in the NSE

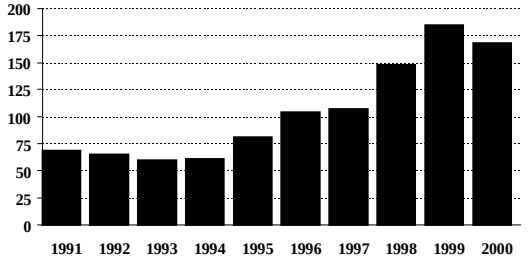


Source: Observatoire des Sciences et des Technologies

3. Patents

A patent is issued when an invention is deemed to be new, useful, and nonobvious. Universities are paying closer attention to the potential value of R&D carried out on their campuses, and are seeking patent protection. A good measure of this activity is the number of U.S. patents being issued to Canadian universities. These have increased over the decade (see Figure 24), but the 2000 level still falls behind the number of patents issued to U.S. universities by approximately 50% (after factoring in the different sizes of the countries).

Figure 24: Number of U.S. Patents Issued to Canadian Universities

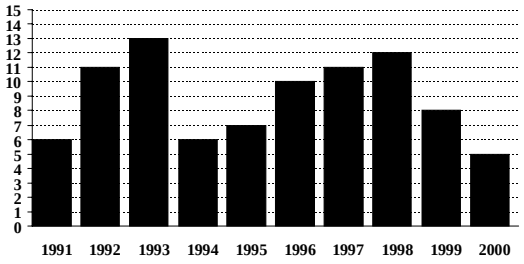


Source: U.S. Patent Office database (www.uspto.gov/patft/index.html).

4. Awards and Prizes

Awards and prizes are a tribute to excellence in the research community. NSERC collected data on 191 international awards and prizes over the past ten years. NSERC-funded researchers have received roughly 3% of the awards and prizes included in the analysis. (See Figure 25.)

Figure 25: Number of International Awards and Prizes Won by NSERC-Funded Researchers

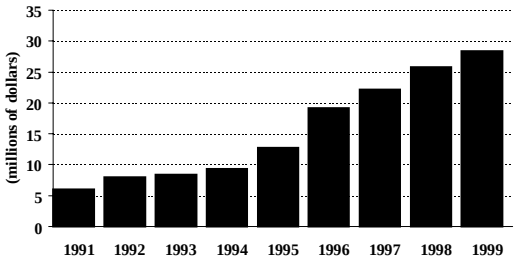


Source: NSERC

5. Licences

One way university research is transferred to industry is through a licence, giving the industrial buyer the right to commercialize the research. Commercial use of the licensed technology results in royalty income to the university and typically the researcher. The amount of licensing royalty revenues is another measure of the value of university research. Figure 26 presents an estimate of licensing revenues for Canadian universities. Most of these revenues can at least be partially attributed to funding from NSERC and the Canadian Institutes of Health Research (CIHR). The trend in revenue growth is certainly a positive one and as universities strive to secure additional revenues it should continue to grow. But for now, Canadian university licensing revenues are far below U.S. university levels by a factor of at least two, even after taking into account the relative expenditures on university research in each country.

Figure 26: Canadian University Licensing Revenue (millions of dollars)



Source: NSERC estimate, Association of University Technology Managers..

Examples of licences based on NSERC-funded research include:

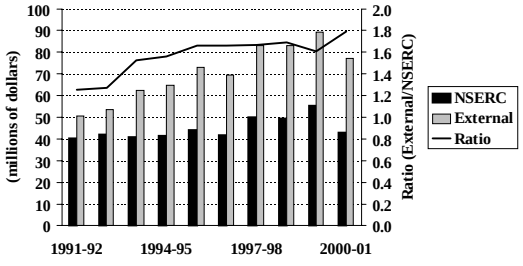
- NSERC-funded researchers in the department of microbiology and infectious diseases at the **University of Calgary** have developed a vaccine against giardia, otherwise known as beaver fever. The vaccine has been licensed to American Home Products and is now commercially available for dogs. A cat vaccine is expected soon.

- Dwayne Hegedus and Thomas Grigliatti at the **University of British Columbia** developed a new gene expression system that simplifies production of high-value recombinant proteins in insect cells. The system uses insect cells to make a variety of valuable recombinant proteins, such as cytokines and growth factors, peptide hormones and protein drugs for infectious diseases. This system, InsectSelect, was licensed to Vancouver's InCell Technologies in 1999. Drs. Hegedus and Grigliatti receive NSERC grants.
- Researchers from **Queen's University's** departments of biology and biochemistry have licensed their novel insect antifreeze protein to A/F Protein Inc., a firm based in the U.S. and Canada. The technology has potential applications in the preservation of donor organs, the development of cold-tolerant crops, and as a frozen food preservative.

6. Leveraging

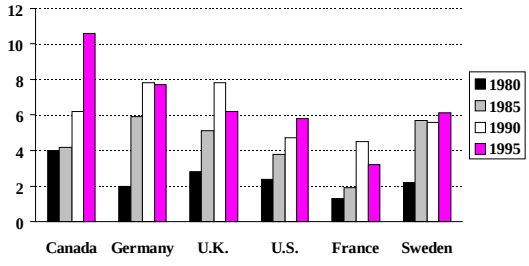
Many of NSERC's programs, and especially the university-industry programs, require a contribution from industry, universities, government departments and agencies. Over the past ten years, contributions from NSERC's partners have grown tremendously. (See Figure 27.) The total contribution from NSERC partners over the decade is an impressive $706 million. A comparison of NSERC funding to partner contributions is also presented in Figure 27. The ratio of partner contributions to NSERC funding has increased over the 10 years. From a low of 1.3 in 1991-92, this ratio now stands at 1.7. Put another way, for every dollar NSERC puts on the table for a University-Industry research grant, our partners contribute $1.70, demonstrating the value they place on the R&D. The impact of NSERC's and CIHR's partnership programs has been to increase the share of university research funding from industry to levels well beyond other industrialized nations. (See Figure 28.)

Figure 27: Contributions to NSERC's University-Industry R&D Programs



Source: NSERC

Figure 28: Share of University Research Funded by the Private Sector (%)



Source: OECD

7. Industrial Survey Results

NSERC tracks the outcomes of the Collaborative Research and Development (CRD) program, a program that brings university researchers and industrial partners together. A summary of the industrial participants' perceptions of their CRD experience and some short-term outcomes are described below:

- Of the 64 projects studied to date, 92% of the industrial partners felt that the research objectives of the project were met.

- More than 20% of the industrial collaborators interviewed stated that "new products, processes, standards or services" were created as a result of the projects, 37% mentioned "improvement of existing processes or products," 86% "updating knowledge" and 25% experienced "improvement to product quality" through the CRD projects.

- A total of 15 patents and 12 licences have so far been issued with respect to the 64 projects examined. According to the industrial partners, commercializable results were achieved for two-thirds of the projects.

- 50% of university researchers indicated that their participation on the CRD project allowed them to bring real world examples into the classroom and the practical experience and industrial exposure their students received was a tremendous benefit.

8. Companies Linked to NSERC-Funded Research

The creation of a company remains one of NSERC's more tangible outcomes of university-funded research. The "spin-off" companies highlighted in this report have all been founded on results of research partially funded by NSERC. The 111 "spin-off" companies featured (see Figure 29 on the next page) are currently in business producing goods and services for Canadian and international markets. Combined, these companies employ 7,542 Canadians and generate nearly $1.3 billion in annual sales/revenue. Creating innovative goods and services using the latest technologies, these firms make an important contribution to Canada's economy. The potential for future growth of many of these advanced technology companies, which may be tomorrow's multi-nationals, is high. They range in size from new start-ups with only a few employees to well-established firms with hundreds of workers.

Figure 29: Companies Linked to NSERC-Funded Research, 1969 to 1999
(Number of employees in Canada in 1999)

Alberta
Raylo Chemicals (175)
BIOMIRA (160)
Wi-LAN (65)
D.B. Robinson and Associates (56)
Harding Instrument Company (41)
Hycal Energy Research Laboratories (40)
Itres Research (35)
SemBioSys (22)
Cell-Loc (20)
Boreal Laser (5)

Saskatchewan
SED Systems (250)
Wavecom Electronics (155)
DEL-AIR Systems (100)
Sci-Tec (93)
Venmar CES (60)
Biostar (32)
Droycon Bioconcepts (8)

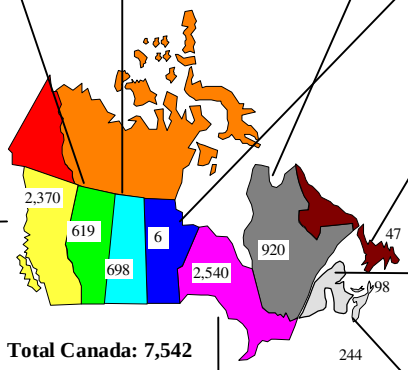
Quebec
BioChem Pharma (438)
Les entreprises GIRO (120)
AD OPT Technologies (60)
Pyrovac International (45)
Nexia Biotechnologies (38)
Hexavision (35)
Advitech Solutions (25)
Infolytica (24)
INRO Consultants (23)
Comlab (22)
Kemestrie (18)
NeoKimia (18)
Tekna Plasma Systèmes (18)
DephyTech (10)
Bios Inc. (10)
Mycota (10)
Real Numerix (6)
Cosem Neurostim (Confidential)

British Columbia
MacDonald Dettwiler and Associates (1400)
NEC Moli Energy (350)
QLT PhotoTherapeutics (175)
Brooks Automation (Techware) (100)
CTF Systems (60)
Westport Innovations (55)
Forbes Medi-Tech (34)
Terragen Diversity (34)
TIR Systems (25)
Vortek Industries (25)
Phero Tech (22)
Credo (Kinetic Effects Research) (13)
IGT Pharma (13)
Barrodale Computing Services (11)
Wavemakers Research (9)
Kinetic Sciences (8)
Intertech Systems (8)
Assistive Listening Device Systems (7)
Mycologic (7)
Quantum Technology (6)
Albacore Research (6)
Dewey McMillin & Associates (5)
Process Stimulations (5)
Aurora Instruments (Confidential)

Manitoba
Sysmon (6)
Quantic Laboratories (Confidential)

Newfoundland
Guigné International (30)
A/F Protein (10)
Northern Radar (7)

New Brunswick
Unisys (70)
EMR Technologies (28)



Total Canada: 7,542

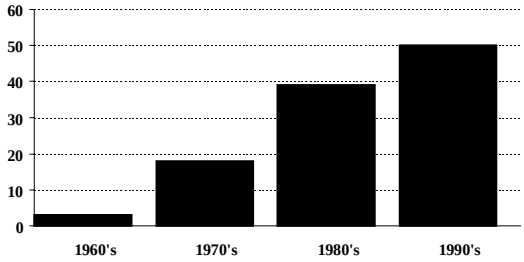
Nova Scotia
Focal Technologies (80)
Applied Microelectronics (50)
Satlantic (40)
Pictorius (30)
Ocean Nutrition Canada (29)
MathResources (8)
Thermo Dynamics (7)

Ontario
ZENON Environmental (400)
MDS SCIEX (320)
Sybase Waterloo (230)
DALSA (195)
Inverpower Controls (175)
Open Text (140)
Honeywell Hi-Spec Solutions (130)
Waterloo Maple (100)
Certicom (95)
Optech (90)
Stantec Consulting Ltd. (80)
Platform Computing (60)
Virtek Vision (52)
E-TEK Electrophotonics Solutions (51)
COSMAX Powerlasers (40)
Imaging Research (38)
Diffracto (33)
Philips Analytical (31)
Ensyn Technologies (30)
Innova Technologies (30)
Performance Plants Biotechnology (28)
TurboSonic (22)
Legasys (21)
Dynacon Enterprises (20)
Engineering Seismology Group (18)
Polyphalt (15)
Hydromantis (14)
Millennium Biologix (12)
Right Track CAD (10)
SMT Hydrasil (10)
Estco Energy (9)
Biorem Technologies (7)
Apollo Environmental Systems (6)
Qubit (6)
Elstat (5)
EnviroMetal Technologies (5)
Gensel (5)
Ask Science Products (4)
New Orbit Technologies (3)

8. Companies Linked to NSERC-Funded Research (Cont'd)

The pace of "spin-off" company formation seems to be accelerating (see Figure 30). As more researchers embrace the entrepreneurial spirit to launch a company, NSERC expects more and better things to come in the future.

Figure 30: Number of NSERC-Related Spin-off Companies by Decade of Incorporation



Source: NSERC

As of August 2001, 21 of the 111 spin-off companies examined are now publicly traded firms. Although the gyrations of the markets have been significant in recent months, the market capitalization of these 21 publicly traded firms on August 15, 2001 was an impressive $9.1 billion (see Figure 31). The downturn in the markets in 2001 has reduced the market capitalization of these firms by roughly 40%.

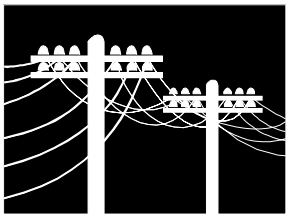
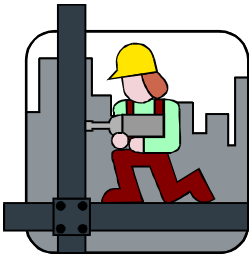
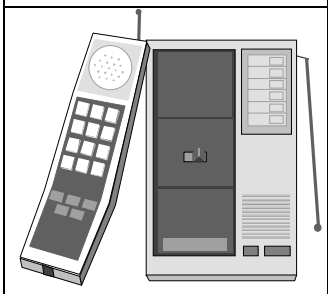
Figure 31: Market Capitalization of Spin-Off Companies

Company	Market Capitalization August 15, 2001	June 12, 2000
BioChem Pharma (Shire)	$3,406 M	$3,607 M
QLT PhotoTherapeutics	$2,249 M	$6,152 M
MacDonald Dettwiler	$836 M	$- M
Open Text	$638 M	$845 M
BIOMIRA	$460 M	$674 M
ZENON Environmental	$319 M	$153 M
Westport Innovations	$303 M	$359 M
Stantec Consulting	$208 M	$95 M
Nexia Biotechnologies	$158 M	$- M
Certicom	$125 M	$896 M
Wi-LAN	$85 M	$852 M
Forbes Medi-Tech	$73 M	$155 M
DALSA	$71 M	$49 M
Virtek Vision International	$60 M	$53 M
AD OPT Technologies	$36 M	$62 M
Cell-Loc	$27 M	$491 M
Innova Technologies	$18 M	$21 M
Polyphalt	$13 M	$- M
TIR Systems	$6 M	$6 M
Gensel	$4 M	$22 M
Inverpower Controls	$- M	$2 M
Total	$9,095 M	$14,494 M

9. New Products and Processes

NSERC-funded researchers have created or developed many new products and processes, the value of which is easily in the billions (although it is very difficult to determine the exact amount). A sample of these new products and processes by economic sector is presented in Figure 32.

Figure 32: Examples of New Products and Processes Developed by NSERC-Funded Researchers, by Sector

 **Energy**	➢ HPDI, High Pressure Direct Injection for converting diesel engines to natural gas ➢ PetroTag, a system for monitoring the mass, density and volume of fuel in storage tanks ➢ Molicel rechargeable lithium-ion battery ➢ Solar Boiler domestic solar water heating system ➢ Battery Health Manager battery management system ➢ RPT, Rapid Thermal Processing for fuel recovery from wood residues and biomass
 **Construction**	➢ High-performance asphalt ➢ Stantec pavement analysis system ➢ Instrumented bridges ➢ High-performance concrete ➢ Acoustic emissions monitoring systems ➢ Light Pipes, a lighting system for inaccessible areas ➢ Heat exchangers for homes, offices, and livestock barns ➢ Corrosion-resistant (composite) materials for bridges and buildings ➢ Pavement engineering technologies for roads ➢ Waste plastics-based binder for asphalt and roofing products
 **Telecommunications**	➢ Fibre optic filters, components ➢ Hopper and Hopper Plus wireless modems ➢ Speech compression software ➢ SQL Anywhere Studio: mobile database technology ➢ CELLOCATE™ System pinpoints exact location of cell phone for safety reasons ➢ Digital Video Modulator for video-on-demand applications ➢ Self-healing and self-organizing networks
 **Earth Observation Systems**	➢ CARIS spatial information and GIS solutions for marine and land applications ➢ Shoals-Hawkeye airborne lidar bathymeter ➢ *casi* digital imaging spectrograph for airborne remote sensing ➢ SWR, Surface Wave Radar ➢ DRUMS™, Dynamically Responding Underwater Matrix Sonar ➢ Civilian multi-satellite capable Earth observation centres

10. Success Stories

The following are examples of NSERC-funded research projects that have improved the quality of life, health, or prosperity of Canadians or that have brought international prestige to Canada by significantly contributing to the advancement of knowledge. NSERC has collected hundreds of similar success stories and will present a selection of them in every performance report.

Salt tolerance puzzle – huge agricultural benefits in sight

A Canadian research team led by University of Toronto plant biologist Eduardo Blumwald has reported a major advance in the engineering of salt tolerant plants. Professor Blumwald reported that his research with graduate students Maris Apse, Gilad Aharon, and NSERC postdoctoral fellow Wayne Snedden on the process of salt removal in salt-tolerant plants had led to the discovery of a key protein involved. The group identified the gene that produced the protein. Inserting it into a test plant that had no salt resistance, they produced the world's first bioengineered salt-tolerant plant-one that thrived in soils 10 times saltier than normal. Loss of crop productivity to salinity is aworldwide problem on dryland soils, making this a discovery of major agricultural importance.

Lessons about earthquakes

In the aftermath of devastating earthquakes in California in 1994 and in Japan a year later, it was discovered that most of the bridge collapses were due to failures in columns holding the structures up.

That's sparked renewed scientific attention onto the design of earthquake-resistant columns. One of the investigators, University of Ottawa civil engineer Mural Saatcioglu, receives annual funding of $39,375 from NSERC to carry on his work in this field. "Current design provisions for earthquake-resistant columns are not adequate to protect structural damage and loss of lives in the event of a strong earthquake, " says Dr. Saatcioglu.

He'll be exploring not only how to design better structures but also how to retrofit existing ones so they're better able to withstand earthquakes. To do so, he'll be designing, building and testing 40 large-scale concrete columns reinforced with welded steel grids and external fibre wrapping.

How safe is our drinking water?

Environmental engineer Steve Hrudey wants to shed new light on the health risks associated with disinfected water. NSERC has earmarked $63,500 for the University of Alberta research. It's an area surrounded by considerable controversy.

Some epidemiological studies have implicated chlorinated drinking water in up to 10 per cent of bladder cancers and in a near doubling of the risk of spontaneous abortion. On the other hand, toxicological evidence doesn't support that level of elevated risk for the exposure levels which have been measured.

Dr. Hrudey believes that although some by-products of disinfection have been suspected of causing cancer or interfering with the body's reproductive system, the amounts of the known by-product exposures are far too low to cause these health effects. His research aims to evaluate whether previously unaccounted for by-products formed during household uses of water and in swimming pools could explain any of the missing exposure.

4. Reader's Survey

NSERC would like to hear from Canadians who have read this report. Your comments will help ensure that NSERC provides information that is easy to understand and relevant. NSERC would appreciate it if you would take the time to answer the questions below and send in your completed questionnaire as soon as possible. Please use the scale provided and select the number that best represents your point of view.

	Not at All			Somewhat			To a Great Extent
1. Did the report explain clearly what NSERC does?	1	2	3	4	5	6	7
2. Did the report provide you with sufficient information to assess whether Canadians are receiving value for the money invested in NSERC?	1	2	3	4	5	6	7
3. Has the report presented accomplishments and performance information in a balanced manner (e.g., presented both positive and negative aspects)?	1	2	3	4	5	6	7
4. Overall, was the information presented in this report easy to understand?	1	2	3	4	5	6	7

Are there any additional comments you would like to make regarding this report?

Send your completed questionnaire:

By mail to
Policy and International Relations
NSERC
350 Albert Street
Ottawa, Ontario
K1A 1H5

Or by fax to
(613) 947-5645

Or by e-mail to
bjl@nserc.ca

Annex A - Financial Tables

Tables 1, 2, 3, 5, and 7 present the required financial information for NSERC, while the other Financial Tables were not applicable to NSERC. There were no major differences between planned and actual spending levels for 2000-2001.

Table 1: Summary of Voted Appropriations

Financial Requirements by Authority (millions of dollars)

		2000-2001		
Vote		**Planned Spending**	**Total Authorities**	**Actual**
	Natural Sciences and Engineering Research Council Program			
85	Operating expenditures	19.8	24.7	**23.8**
90	Grants	558.4	555.4	**538.8**
(S)	Contributions to employee benefit plans	2.1	2.3	**2.3**
	Total Program	*580.3*	*582.4*	***564.9***
	Total Agency	**580.3**	**582.4**	**564.9**

Note: Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.
Due to rounding, figures may not add to totals shown.
Actual results are lower mainly due to lapsed funding within the Canada Research Chairs program.

Table 2: Comparison of Total Planned Spending to Actual Spending

NSERC Planned versus Actual Spending (millions of dollars)

	2000-2001		
Support of Research and Scholarship	**Planned Spending**	**Total Authorities**	**Actual**
FTEs	240	240	243
Operating[1]	21.9	27.0	26.1
Capital	—	—	—
Voted Grants & Contributions	558.4	555.4	538.8
Subtotal: Gross Voted Expenditures	580.3	582.4	564.9
Statutory Grants and Contributions	—	—	—
Total Gross Expenditures	**580.3**	**582.4**	**564.9**
Less:			
Respendable Revenues[2]	—	—	—
Total Net Expenditures	**580.3**	**582.4**	**564.9**
Other Revenues and Expenditures			
Non-Respendable Revenues[3]	(0.4)	(0.6)	(0.6)
Cost of Services Provided by Other Departments	1.9	2.5	2.5
Total Transfer Payments	**581.8**	**584.3**	**566.8**

1. Operating includes contributions to employee benefit plans.
2. These revenues were formerly called "Revenues Credited to the Vote."
3. These revenues were formerly called "Revenues Credited to the (CRF)."

Note: Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.

Table 3: Historical Comparison of Total Planned to Actual Spending

Historical Comparison of NSERC Planned versus Actual Spending (millions of dollars)

	Actual 1998-99	Actual 1999-00	2000-2001 Planned Spending	2000-2001 Total Authorities	2000-2001 Actual
Natural Sciences and Engineering Research Council	498.5	549.8	580.3	582.4	**564.9**
Total	**498.5**	**549.8**	**580.3**	**582.4**	**564.9**

Note: Total Authorities are Main Estimates plus Supplementary Estimates plus other authorities.

Table 5: Revenue

Non-Respendable Revenues (thousands of dollars)

	Actual 1998-99	Actual 1999-00	2000-2001 Planned Revenues	2000-2001 Total Authorities	2000-2001 Actual
Natural Sciences and Engineering Research Council	115	313	400	602	**602**
Total Non-Respendable Revenues	**115**	**313**	**400**	**602**	**602**

Table 7: Transfer Payments

Transfer Payments (millions of dollars)

Support of Research and Scholarship	Actual 1998-99	Actual 1999-00	2000-2001 Planned Spending	2000-2001 Total Authorities	2000-2001 Actual
Grants	478.0	526.9	558.5	555.4	**538.8**
Contributions	—	—	—	—	**—**
Total Transfer Payments	**478.0**	**526.9**	**558.5**	**555.4**	**538.8**

Note: Total Authorities are Main Estimates plus Supplementary Estimates.

Annex B - Contacts for Further Information and Web Sites

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

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