CSTA

Council of
Science and
Technology
Advisors

EDGE

Employees Driving Government Excellence:
Renewing S&T Human Resources in the Federal Public Service

A Report to the Government of Canada

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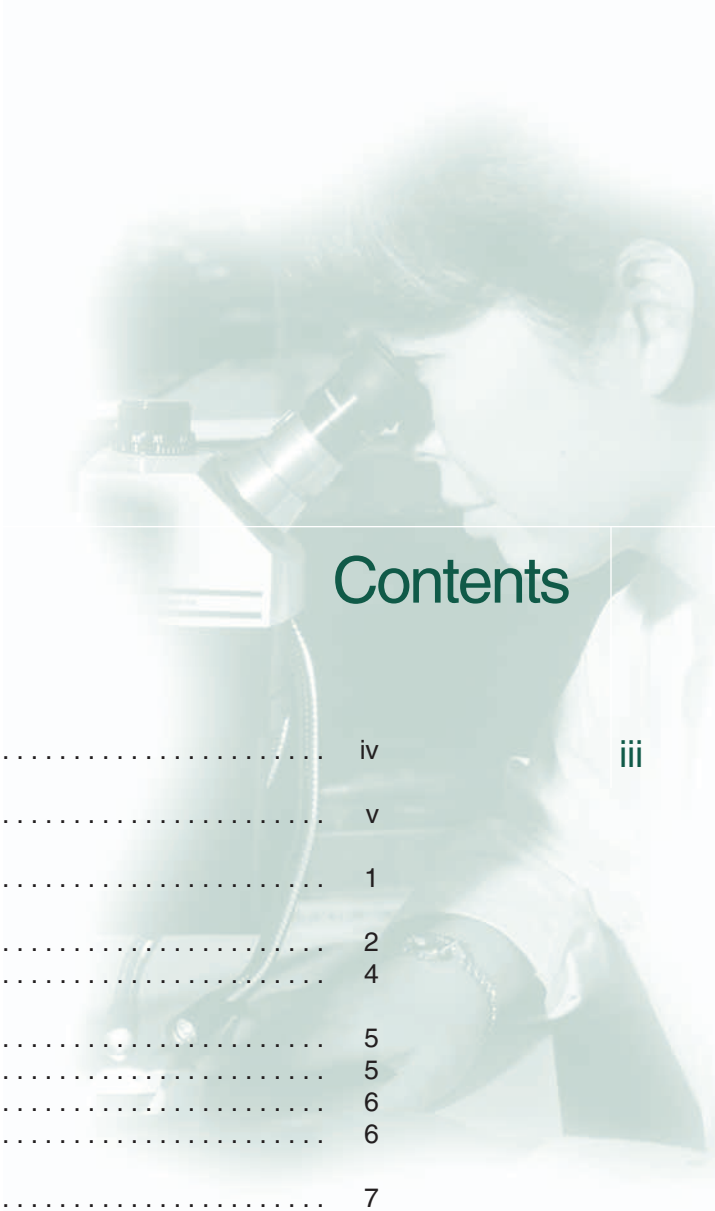

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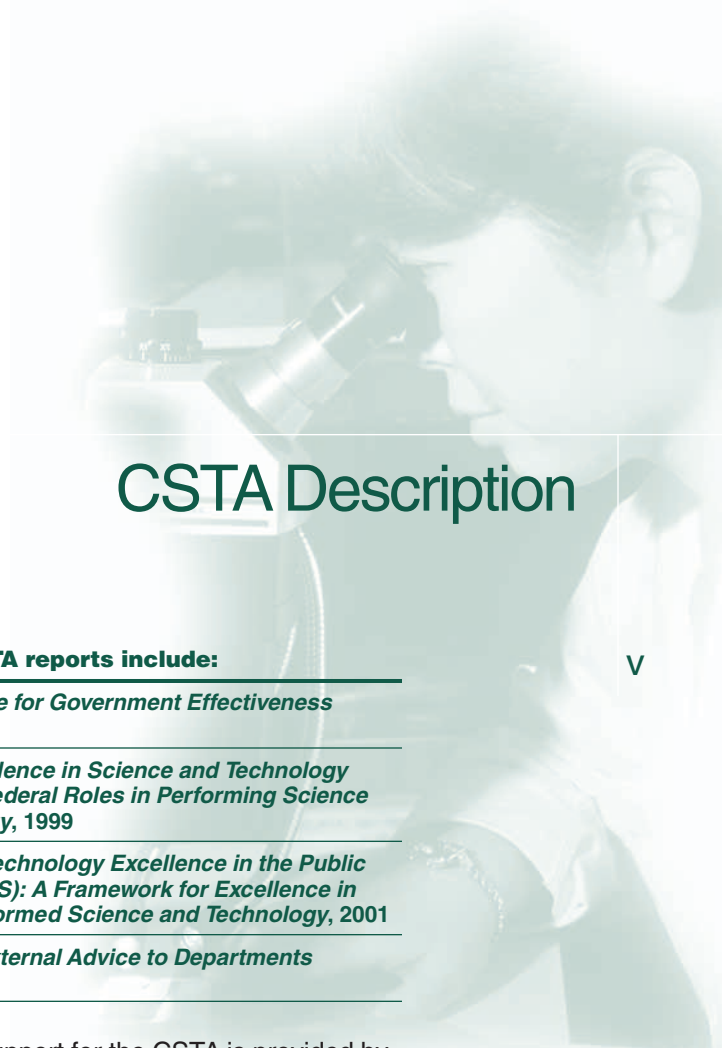

CSTA Description

The Council of Science and Technology Advisors (CSTA) is an external, expert advisory body that provides advice to the Federal Cabinet on the strategic management of the Government of Canada's internal science and technology enterprise. The CSTA was created in 1998, in response to the 1996 Federal Science and Technology Strategy, *Science and Technology for the New Century*, which called for greater government reliance on external advice.

CSTA membership is drawn from the academic, private and not-for-profit sectors, and reflects the diversity of science and technology-based disciplines. Council members are nominated by the federal science-based departments and agencies, and contribute their time and expertise to external science advisory bodies at the departmental level. Through its advice, the CSTA seeks to improve management of federal science and technology by examining issues that cut across science-based departments and agencies and highlighting opportunities for synergy and joint action.

After Cabinet review, the CSTA's advice is shared publicly through reports such as this. *Employees Driving Government Excellence (EDGE): Renewing S&T Human Resources in the Federal Public Service* is the Council's fifth publication.

Previous CSTA reports include:

- ***Science Advice for Government Effectiveness (SAGE)*, 1999**
- ***Building Excellence in Science and Technology (BEST): The Federal Roles in Performing Science and Technology*, 1999**
- ***Science and Technology Excellence in the Public Service (STEPS): A Framework for Excellence in Federally Performed Science and Technology*, 2001**
- ***Reinforcing External Advice to Departments (READ)*, 2001**

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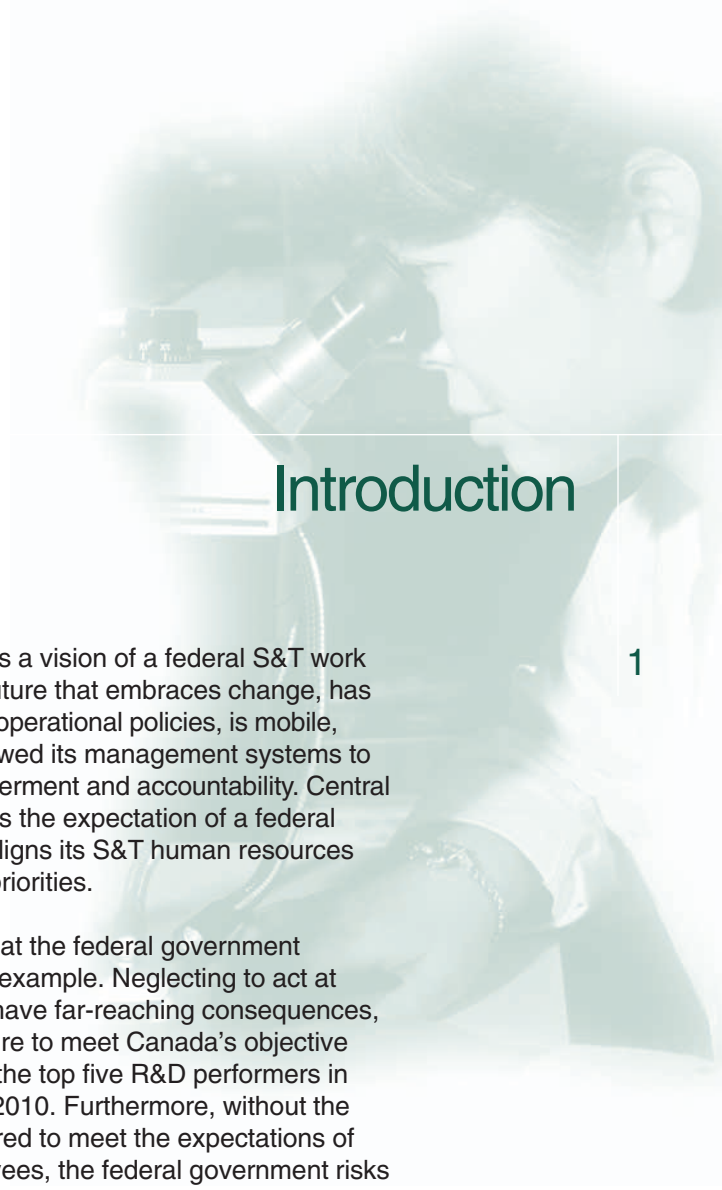


Introduction

Over the past seven years, human resource management has emerged as a central issue confronting the science and technology (S&T) work force of the federal public service.[1] The Council of Science and Technology Advisors (CSTA) agreed to conduct an examination of the challenges unique to the renewal of federal S&T personnel and to recommend possible practices and policies to address these challenges.

The federal government has before it an exciting opportunity for change. The impetus for that change is the federal goal to make Canada one of the top five performers of research and development (R&D) in the world by 2010.[2] The national innovation system will not realize this goal without the government fulfilling its strategic and targeted roles as performer, catalyst and facilitator of S&T. If the government is to perform these roles in an environment where there is increasing competition for the best and brightest individuals, it must develop innovative human resource strategies to recruit, rejuvenate and retain its S&T work force.

The CSTA has a vision of a federal S&T work force of the future that embraces change, has more flexible operational policies, is mobile, and has renewed its management systems to foster empowerment and accountability. Central to this vision is the expectation of a federal system that aligns its S&T human resources with its S&T priorities.

We believe that the federal government must lead by example. Neglecting to act at this time will have far-reaching consequences, including failure to meet Canada's objective to be among the top five R&D performers in the world by 2010. Furthermore, without the change required to meet the expectations of future employees, the federal government risks failure to fulfil its fundamental mandates and its role in the national innovation system, and misses opportunities to contribute to improved national productivity.

1. The "federal public service" refers to the portions of the Public Service of Canada specified in Part 1 of Schedule 1 of the *Public Service Staff Relations Act* for whom Treasury Board is the employer.
2. Government of Canada, *Achieving Excellence: Investing in People, Knowledge and Opportunity* (Ottawa: Industry Canada, 2002), p. 51.

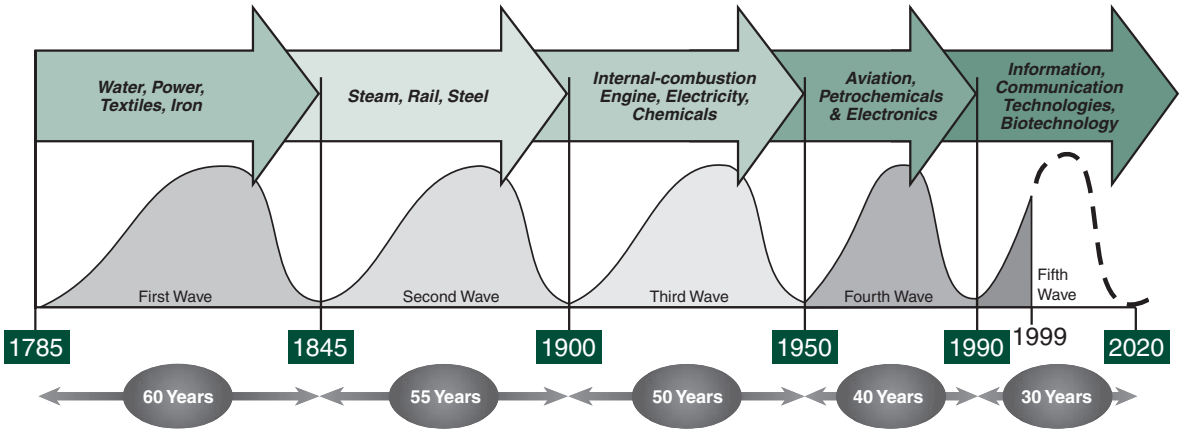
The Changing World[3]

To fully understand the current context for federal S&T human resources, it is necessary to view the issue in the more general context of the transition to a knowledge-based economy and society, and the way in which the deployment of human resources has reflected this shift. At the turn of the 20th century, the overwhelming majority of people worked in the agricultural sector. By mid-century, manufacturing was dominant. Today, the shift is increasingly to knowledge-based industries.

Rapid economic growth comes in waves linked directly to major technological change (*see the diagram below*). As we move into the knowledge-based economy, technological change is accelerating, with growth fuelled by leading-edge industries, many of which barely existed a decade ago.

One of the primary drivers and enablers of the knowledge-based economy has been the unprecedented advancement of S&T. Many believe the world is on the cusp of a scientific and technology-driven revolution. Advancements in science-intensive technologies such as information technology, biotechnology and nanotechnology will rival the impacts of the steam engine or electricity in previous centuries. S&T now underpins virtually every aspect of our lives — the economy, health care, safety and our leisure activities.

The federal government has not escaped the seismic shifts taking place. In the post-World War II period and throughout much of the 20th century, the federal government played a central role in the development of Canada's S&T and in the national innovation system, housing the majority of Canada's S&T facilities, infrastructure and expertise. The federal government was the "employer of choice" and was recognized for leading-edge S&T nationwide. Much has changed in recent decades. As we stated in *Building Excellence in Science and Technology (BEST): The Federal Roles in Performing Science and Technology*, the government's role as a performer of S&T is no less important to the national innovation system now than it was in the past, but it has become more focussed on areas essential to its mandate. This means that it is not necessary for the federal government to play a role in all areas of S&T.



Source: *The Economist*, February 20, 1999

3. This section draws from Peter Drucker, "The Next Society," *The Economist*, November 3-9, 2001 (special insert beginning after page 54).

Examples of Recent Federal Investments
Canada Research Chairs
Federal Granting Councils — new resources
Canadian Institutes for Health Research (CIHR)
Canada Foundation for Innovation (CFI)
Genome Canada
Biotechnology R&D
Connectedness Agenda
Scientific Research and Experimental Development (SR&ED) tax credits
National Research Council Canada (NRC) Technology Clusters
Sustainable Development Technology Fund
Networks of Centres of Excellence (NCE) Program
Trudeau Scholarships and Fellowships

The Canadian innovation system depends on the strengths of partnerships among governments, universities and the private sector. As universities and industry have become more research-intensive, the proportion of S&T performed by the federal government has decreased. Over this period, the federal government has made a number of new investments in R&D, in its role as catalyst and facilitator, that have leveraged investments in universities and the private sector, resulting in overall growth in R&D. This increased level of activity has a positive impact on the innovation environment that, in turn, has increased the demands on government, as both a manager of science and a participant in science.

In the knowledge-based society in which government is operating, knowledge is the primary resource and knowledge workers are a dominant group. With this evolution, we have already begun to see changes in work patterns and expectations. To a significant extent, knowledge workers require greater flexibility than that provided by the traditional full-time, nine-to-five employee model that continues to dominate much of the thinking in human resource management. Workers are increasingly participating in the labour force and managing their own careers in new and changing ways: gaining skills, focussing on specific projects, consulting or undertaking special assignments. Furthermore, knowledge workers are accustomed to working collaboratively in horizontal teams that cross a number of disciplines. They see themselves as professionals, and expect to be treated accordingly. They are highly mobile within their specialty. They are interested in high-quality, challenging work experiences within their specialized field of knowledge and will go wherever the best opportunity is available.

S&T workers, as a subset of knowledge workers, are typically very attached to their science and their research. Motivated by their ability to contribute to the big picture, as well as the acknowledgment by managers and peers of their contributions, they want their work to be meaningful beyond the borders of their current organization. They are driven by a desire to expand the boundaries of knowledge, and a desire that the knowledge be important and useful.[4]

In order for the government to be an effective, strong partner in this rapidly evolving, knowledge-based environment, it must do more than provide funds for externally performed S&T. To participate as a full partner in the national innovation system, carry out its mandates, and keep pace with the rapid rate of change, the government requires its own strong intellectual capacity. Thus federal S&T organizations must be able to compete for the best and the brightest, attract a strong S&T work force, and adjust how they relate to these workers.

4. Industry Canada, *Investing in Excellence, 1996-2001: A Report on Federal Science and Technology — 2001* (Ottawa: Industry Canada, 2002), p. 62.

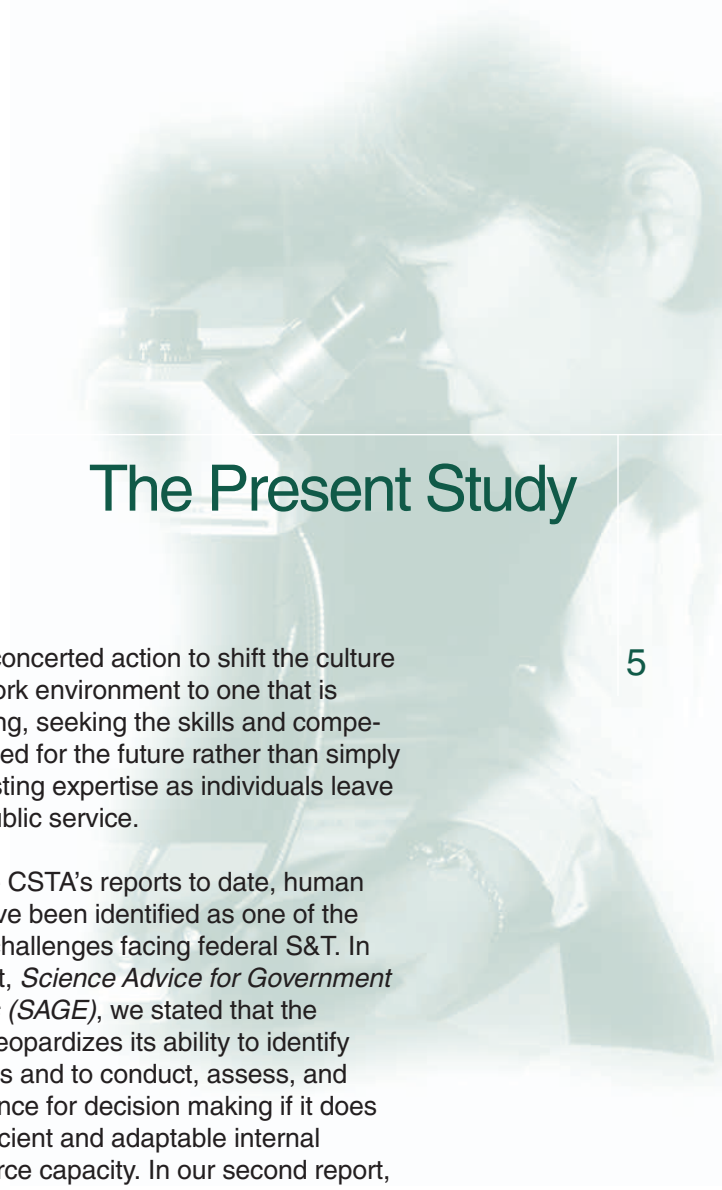
A Public Service for the 21st Century

Bringing the human resource management structure of the public service in line with the realities of the new economy is a critical task. The existing federal human resource system is outdated and inflexible. Moreover, the public service is facing the same looming demographic bulge that will affect all sectors of the economy. Recently, the federal Advisory Council on Science and Technology (ACST) reported that some industries are experiencing difficulties recruiting and retaining skilled workers. It is anticipated that these challenges will continue to grow in the future.[5] Aging populations and declining birth rates will result, over time, in fewer workers available in the labour market. As the large cohort of baby boomers retires, the demand for highly qualified persons will grow significantly, resulting in fierce competition for highly skilled workers among sectors of the national innovation system.[6] Higher salaries, challenging work, opportunities for promotion and other rewards are offered to new graduates and experienced government personnel as incentives to entice them to these other sectors. The competition for highly skilled workers nationally is compounded by increasing competition on a global level. Since all Western countries are facing these same demographic challenges, Canada will increasingly find itself competing in a global marketplace for S&T workers. The world is changing quickly and the federal government needs to keep pace.

In the January 2001 Speech from the Throne and the Prime Minister's response, the government committed to take the steps necessary to ensure continued excellence and to modernize the public service for the requirements of the 21st century. In response to the commitments, in April 2001, the Prime Minister announced the formation of the Task Force on Modernizing Human Resources Management in the Public Service. In the period following the Prime Minister's announcement, the President of the Treasury Board reinforced the importance of modernizing the federal human resource management framework, calling for the creation of "a streamlined, decentralized system that empowers managers, and is based on trust, respect and accountability."[7]

We recognize the efforts of the federal government and the Task Force to address the modernization of the public service, but believe that much remains to be done to meet current and future challenges for the renewal of the federal S&T work force. In an increasingly tight labour market, failure to fully address these issues will only serve to further disadvantage the federal government.

5. Expert Panel on Skills of the Advisory Council on Science and Technology, *Stepping Up — Skills and Opportunities in the Knowledge Economy* (Ottawa: Industry Canada, 2000), p. 25.
6. Sectors of the national innovation system include government, academe, industry and individuals.
7. President of the Treasury Board, *2002 Government Conference: The Public Service of Tomorrow — Attracting, Managing and Keeping Talent* (speech), February 14, 2002.



The Present Study

Background

In the January 2001 Speech from the Throne,[8] the federal government set a goal to become one of the top five countries for R&D performance by 2010. The speech emphasized that achieving this goal will require a comprehensive approach and the participation of all sectors of the economy, including the private sector, academe, government and individuals. The federal innovation strategy, *Achieving Excellence*, re-committed to this goal and estimated that, to perform R&D at this level, more than double the current number of S&T workers will be needed in the Canadian labour force.[9] Ensuring that the government remains a credible contributor to the national innovation system is essential in this new climate.

The 1994 Auditor General's report included a chapter entitled *Science and Technology: The Management of Scientific Personnel in Federal Research Establishments*. The report found that the problems in the management of scientific personnel identified during the preceding three decades had not been corrected. More specifically, it noted deficiencies in the hiring of new graduates, career deployment activities, and the management of training and development activities. The report concluded that, unless significant changes were made in the management of scientific personnel, there would be a serious risk that research establishments would not be able to cope with the rapidly evolving context in which government research activities take place.[10]

Human resource challenges of the federal S&T community are not new, but have grown in importance in recent years. In response, a considerable amount of work has been undertaken. An extensive body of literature has been prepared that analyses the human resource challenges and opportunities within the federal S&T community. We support this analysis and recommend concerted action to shift the culture of the S&T work environment to one that is forward-looking, seeking the skills and competencies required for the future rather than simply replacing existing expertise as individuals leave the federal public service.

In each of the CSTA's reports to date, human resources have been identified as one of the most critical challenges facing federal S&T. In our first report, *Science Advice for Government Effectiveness (SAGE)*, we stated that the government jeopardizes its ability to identify science issues and to conduct, assess, and translate science for decision making if it does not have sufficient and adaptable internal human resource capacity. In our second report, *Building Excellence in Science and Technology (BEST)*, we identified a number of priority issues related to the government's capacity to fulfil its role in the national innovation system. In particular, human resources are critical if the government is to fulfil the following key S&T roles:

- supporting decision making, policy development and regulations;
- developing and managing standards;
- supporting public health, safety, environmental and defence needs; and
- enabling economic and social development.

8. *Speech from the Throne: To Open the First Session of the Thirty-Seventh Parliament of Canada*, delivered by the Governor General of Canada, January 30, 2001.
9. Industry Canada estimate.
10. Office of the Auditor General of Canada, *1994 Report of the Auditor General of Canada,* "Chapter 11 — Science and Technology: The Management of Scientific Personnel in Federal Research Establishments" (Ottawa: Office of the Auditor General of Canada, 1994).

In *BEST*, we emphasized that it is "no longer necessary for the federal government to be a central player in all areas of S&T but, where it was deemed that a federal presence was necessary, federal S&T organizations need to be able to compete with the best to attract a strong research work force."[11] The report called for greater flexibility to hire workers on shorter terms, competitive compensation packages, modern facilities and a stimulating research environment. It recommended that federally performed S&T be

- **aligned** with departmental mandates and overall government priorities;
- **linked** across departments, and with other sectors in the national innovation system, to focus federal S&T on the tasks it is uniquely equipped to deliver; and
- **demonstrated** to be of the highest quality, to meet or exceed international standards of scientific and technological excellence.

Building on these reports, *Science and Technology Excellence in the Public Service (STEPS)* further emphasized the importance and urgency of attracting and retaining S&T workers. Highly skilled human resources are identified as a key precondition of scientific excellence, and are necessary to support the policy research and analysis that underpin the science advisory process. *STEPS* noted that success will be contingent upon the government's ability to offer an environment conducive to the conduct of S&T, including stimulating work, high-calibre managers and colleagues, opportunities for learning and career advancement, competitive salaries, appropriate financial resources, and modern equipment and facilities.

Approach

In recognition of the importance of S&T human resources to the federal government's roles and responsibilities, the Cabinet Committee for the Economic Union (CCEU) asked the CSTA to build on its work to date by conducting an examination of the challenges unique to the renewal of federal S&T personnel and recommending policies and practices that address these challenges.

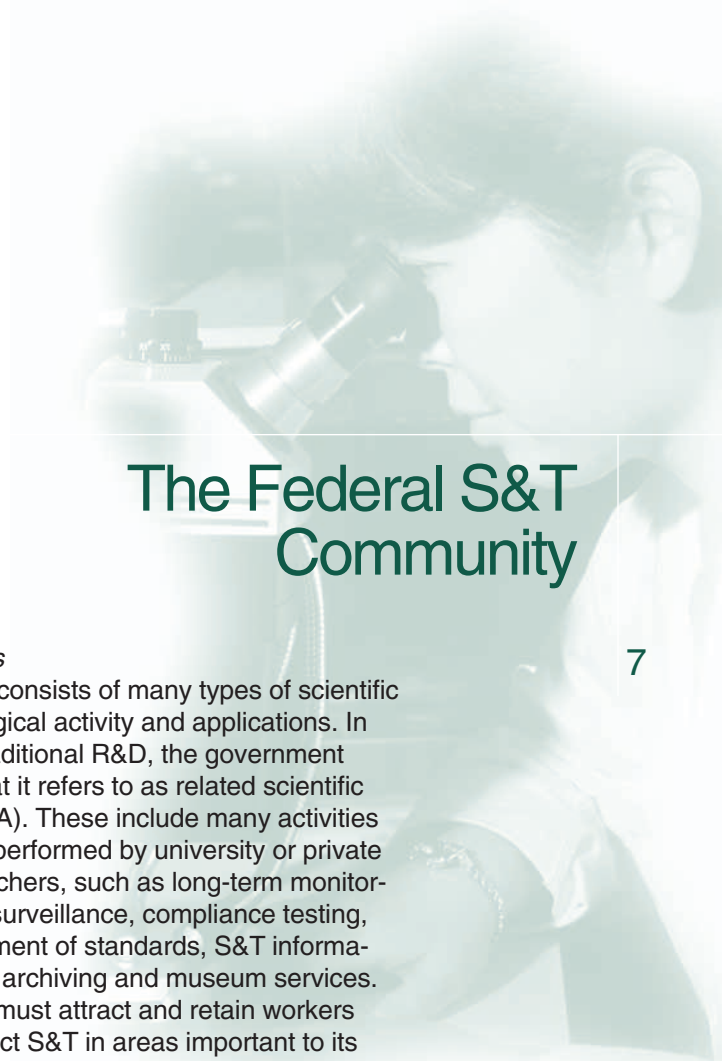
To inform our deliberations, we commissioned several studies and heard presentations by a number of experts in the field. A review of recent federal S&T human resource initiatives provided a summary of the common themes and barriers to reform that exist in the federal S&T human resource system. A demographic study provided the facts facing the government in the near term. We also commissioned studies of best practices related to S&T human resources found in federal departments and agencies in various Organisation for Economic Co-operation and Development (OECD) country governments (United States, United Kingdom, New Zealand, Australia, Germany and Japan), and in a sampling of academic, non-governmental and industry organizations.

Community of Study

For the purposes of this examination, the community of study included the 65 departments and agencies that form the "core" federal public service.[12] Within these departments and agencies, S&T workers included in the data sample are full-time or part-time; indeterminate, term or casual workers (see *Glossary of Terms, Appendix I*); and in the Research, Health, Applied Science and Engineering, and Technical occupational categories. The specific occupational groups of study within each category are identified in Appendix II.

Although the National Research Council Canada (NRC) is not part of the core public service, data were gathered to gain an understanding of its work force engaged in S&T. These data are presented separately. NRC occupational groups of study are also included in Appendix II.

11. Council of Science and Technology Advisors, *Building Excellence in Science and Technology (BEST): The Federal Roles in Performing Science and Technology* (Ottawa: Industry Canada, 1999), p. 22.
12. Treasury Board is granted authority under the *Public Service Staff Relations Act* as the federal public service employer — or the "core" federal public service.



The Federal S&T Community

Facing the pressures of globalization, the need to cut budget deficits, the rapid pace of advancements in information and communications technologies, the push for alternative systems of delivering services, and the emergence of the knowledge economy, the federal public service has been undergoing unprecedented change in recent years.

Characteristics of the Federal S&T Community

In conducting the study, we looked at distinguishing characteristics of the federal S&T community, examining the ways in which it is different from, firstly, S&T workers in the broader labour market and, secondly, federal public servants as a whole.

S&T Workers in the Federal System Compared with the Broader S&T Labour Market

There are a number of ways in which the human resource issues surrounding S&T workers in the federal government may differ from those in industry or academe. A few examples are discussed here.

Public Service

The federal government attracts employees interested in serving Canada as public servants. Some base their career decisions on their ability to contribute to national priorities, and to serve the "public good". Others are keen to participate in government's stewardship activities, or to contribute to and influence public policy decision making.

S&T Activities

Federal S&T consists of many types of scientific and technological activity and applications. In addition to traditional R&D, the government conducts what it refers to as related scientific activities (RSA). These include many activities not normally performed by university or private sector researchers, such as long-term monitoring, disease surveillance, compliance testing, the establishment of standards, S&T information services, archiving and museum services. Government must attract and retain workers able to conduct S&T in areas important to its mandates, including R&D and RSA in strategically selected areas.

Public Accountability

S&T workers in the federal government are expected to contribute to government decision making that is occurring in an increasingly dynamic environment. There are increasing concerns in the public mind regarding the accountability of scientists and decision makers. There is greater public interest in science-based issues and greater emphasis on active public involvement in the government decision-making process. A more knowledgeable public is demanding greater accountability, openness and transparency. Although expectations of scientific excellence do not differ from one sector to another, the public's expectation of scientific information from each sector differs considerably. Since such demands are growing with respect to S&T performed by government in particular, this is likely to have implications for the government's ability to attract and retain scientists.

An Evolving Public Workplace
The work environment of the federal public service is important to the recruitment and retention of employees. Federal S&T workers are unionized (with salaries and dispute resolution negotiated through collective bargaining), while some in competing sectors are not. Once in the public service, S&T workers tend to be less mobile than their academic or industrial counterparts. Furthermore, staffing actions in the federal public service are ponderously slow. The 1996 Consultative Review on Staffing conducted by the Public Service Commission of Canada, and referenced in a recent study by the Auditor General, reported that it takes 119 calendar days on average to complete a competition in the core public service, and an average of 230 calendar days to staff a new position that first requires the position to be established. This compares with an average of 60 days to staff a position in a quasi-public organization.[13] In the private sector, where more than half of Canada's research and development takes place, staffing times are even shorter. As a result, academe and industry have a distinct hiring advantage. These and other aspects of the federal public service impact on the government's ability to attract and retain high-calibre scientists and technologists.

S&T Workers in the Federal System Compared with the Broader Public Service
Demographic changes in the federal public service present important opportunities for change. There are a number of considerations that are particular to federal S&T workers that distinguish their human resource needs from those of the broader public service.

A Changing Environment
The operating environment of the federal government reinforces the importance of conducting excellent S&T to support government policy and decision making. In view of ministers' accountability for the decisions they make, and the public's expectation that those decisions are based on the best available information and analysis, the government must have the capacity to access and deliver excellent S&T to contribute to the decision-making process. This requires the best of S&T human resources.

A Community of Communities
With the evolution of human resource management by "functional community",[14] responsibility for the management of the S&T work force has transferred to the S&T community. The S&T community is a relatively large, heterogeneous community that is really a collectivity of many communities (as compared with communities based on disciplines such as finance or information technology). Although the issues and challenges within the community overall may be the same, the solutions to these challenges may vary greatly, both across and within functional areas.

Role of Peers Versus Managers
Unlike most groups in the public service, the work of federal scientists is judged not only by their managers, but also by a professional community of peers who work both inside and outside of government. The work of research scientists, in particular, is compared with that of scientists in the private sector and especially the academic sector. The credibility of government science is also judged by this standard. As a result, the federal S&T community differs from other public service communities to the extent that its members' reputations, and hence the reputation of science in government, are determined by "peers" in the broader scientific community. It is critical that management recognize that the credibility of federally performed S&T rests on the external credibility of its S&T workers.

13. Office of the Auditor General of Canada, *2000 Report of the Auditor General of Canada,* "Chapter 9 — Streamlining the Human Resource Management Regime: A Study of Changing Roles and Responsibilities" (Ottawa: Office of the Auditor General of Canada, April 2000), p. 21.
14. A functional community is a group of federal workers employed in jobs with common characteristics and interests. The federal S&T functional community is comprised of federal employees and managers working in science- and technology-related positions in science-based departments and agencies.

Level of Expertise
The federal S&T work force embodies a high level of technical expertise. This expertise comes after many years of formal education and on-the-job experience. Thus rejuvenation and renewal of the S&T work force require a long lead-time investment, for acquisition of new skills both through training of the existing complement and through recruitment of new employees. Due to their typically above-average ability to learn, S&T workers, when provided the necessary re-skilling opportunities, can be encouraged to contribute to new areas of interest reflecting the government's S&T goals and needs.

Demographics

Overall Community
The federal S&T work force (i.e. S&T employees in departments and agencies identified in Part I of Schedule I of the *Public Service Staff Relations Act*) consists of almost 21,600 employees, which represents 17 percent of the overall federal public service (126,000).[15] The total dropped from about 28,000 in 1993 to a low of about 19,500 in 1999, before rising to its current level. While S&T workers are employed in 42 departments and agencies, 75 percent of the federal S&T work force is employed in just six departments: Fisheries and Oceans, Environment Canada, Health Canada, National Defence, Natural Resources Canada, and Agriculture and Agri-Food Canada.

Federal S&T occupations can be grouped into the following four broad categories:

- **Technical** — The largest category (46 percent) includes employees in four occupational groups: engineering and scientific support, general technical, electronics, and drafting and illustration. Of these, the engineering and scientific support occupational group is the single largest group of S&T employees in the public service with more than 6,500 employees, representing 30 percent of the total S&T work force.
- **Applied Science and Engineering** — The next largest category (34 percent) includes scientists and engineers in the agriculture, biological sciences, chemistry, engineering, land survey, forestry, meteorology, physical sciences, patenting and scientific regulation occupational groups.
- **Research** — This category (11 percent) consists of research scientists and research managers, and members of the defence scientific service.
- **Health** — The smallest category (9 percent) consists of those in medicine, nursing, pharmacy and veterinary medicine.

The relative balance among these categories has been stable over the past five years. It is important to note that, although these occupational categories are grouped together to make up the "federal S&T community", the solutions to their human resource challenges may differ.

Employment Type
The federal S&T community consists of indeterminate, term, casual and seasonal employees working full-time or part-time (see *Glossary of Terms, Appendix I*). Over time, the proportion of term, casual and seasonal employees has increased, from only 10 percent of the S&T work force in 1992 to 20 percent in 2001.

Diversity
In general, designated groups (women, visible minorities, Aboriginal people and persons with disabilities) are under-represented in the federal S&T work force, compared with current labour market availability.

Distribution by Age and Years of Service
The average age of federal (and NRC) S&T workers is 44 years, although there is a 10-year difference in the average age of indeterminate employees (46) and term employees (36). Almost a third of the population is aged 50 years or more. Occupational groups with significantly higher than average ages are

15. NRC has an additional 2,226 S&T workers, up from 2,062 in 1999.

agriculture (53), medicine (52), research management (50), research science (49) and veterinary medicine (48).

Because retirement decisions are based on a combination of age and years of service, it is also important to look at the distribution of years of pensionable service. Almost all (94 percent) term employees have fewer than six years of pensionable service, suggesting that the use of term appointments is primarily for those who are early in their public service careers. Indeterminate employees are fairly evenly distributed across years of service.

Recruitment Statistics
During the mid-1990s period of public service downsizing, S&T departures exceeded new hires, resulting in a net loss of S&T workers. Since 1999, S&T hiring has exceeded departures overall, and in almost every occupational group, resulting in net gains. The average age of hires is 34.

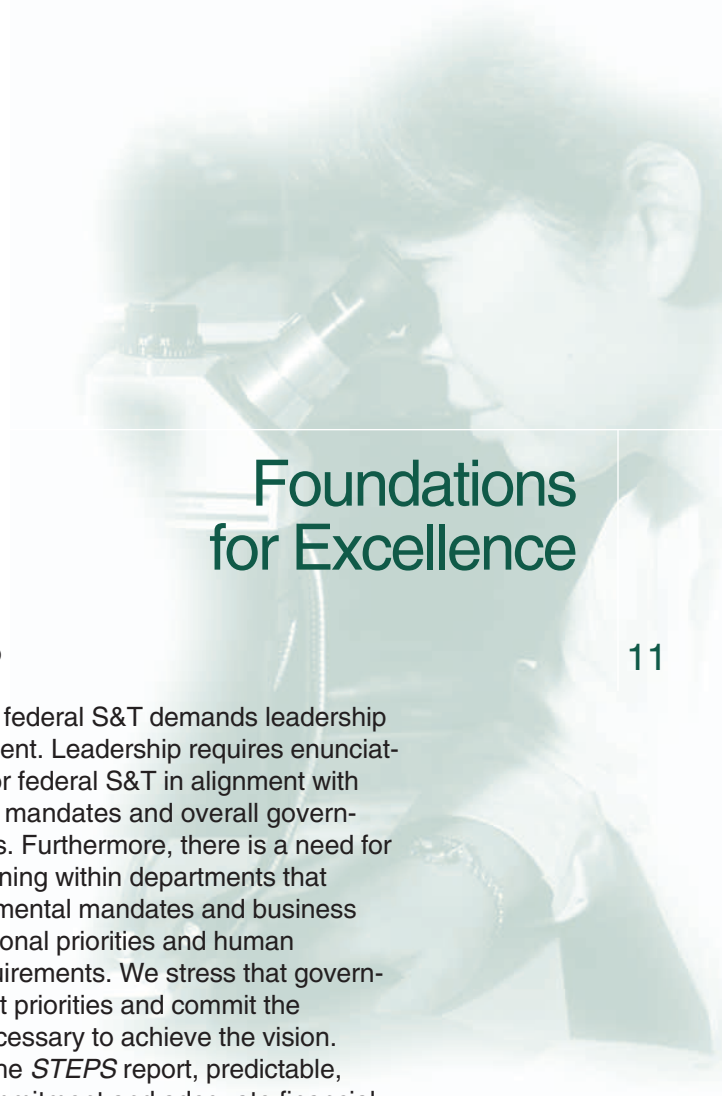
Consistent with the overall public service, S&T workers have been hired predominately as term employees. Indeed, over the past decade, 90 percent of external recruitment has been for term positions. Only in the medicine, meteorology, scientific regulation and veterinary medicine occupational groups have indeterminate hires exceeded term hires.

Departure Statistics
The trend in the S&T population is consistent with the trend in the overall public service. In the years 1995 to 1999, annual S&T departures ranged from about 5,000 to 5,400. Since then, departures have returned to their pre-Program Review pattern of about 3,000 annually.

On a consolidated basis, the statistics would indicate that the S&T population has a healthy renewal capability given the annual S&T departures. However, it is worth exploring the reasons for departures. Over the past five years, 80 percent of departures were due either to the expiration of term or to downsizing initiatives. Voluntary departures, such as leaving for "personal reasons" or "outside employment", accounted for only 12 percent of departures over the five years. The average age of people departing the S&T work force is 38 years, the same as that of the public service overall. The average age of full-time indeterminate employees departing is 49, while that of full-time, long-term, term employees departing is 34. In summary, the vast majority of departures from the S&T community are due to the completion of terms by term employees, while the indeterminate S&T population experiences negligible voluntary departures presently. This is not dramatically different from the current situation in academe; however, it is very different from that in industry.

Retirement Eligibility Statistics
Looking forward, it is important to gauge the number of retirements that will occur over the next five years. Because public servants do not face a mandatory retirement age, the analysis considers those who are "eligible to retire", defined as those 60 years or older or those at least 55 years old with at least 30 years of pensionable service (i.e. they are eligible to retire without penalty to pension).

The number of S&T workers eligible to retire within the next five years is estimated at more than 4,300 or 20 percent of the current S&T work force. However, of the 4,300, almost 1,500 people, or 7 percent of the current S&T population, are eligible to retire penalty-free now, which indicates a tendency among S&T workers to continue working beyond retirement eligibility. The concern about pending retirements affects the research category more than the other categories, given that 12 percent of the research population (a total of almost 300 people) is eligible to retire at this time.



Foundations for Excellence

In a knowledge-based economy and society, S&T is increasingly central to our lives. Advancements in S&T proceed at a rapid pace and change is continuous. The demographic data send a clear message about the challenges of maintaining, let alone expanding, the national level of S&T effort in the coming years. Given Canada's target to rank among the top five countries in the world in R&D performance, the volume of S&T activity in the national innovation system must increase. As a result, these pressures will only continue to intensify. The need to act now is great; delay means a significantly greater burden to overcome these challenges in the future. The government must continue to invest in its S&T; failure to do so will become a limiting factor in the country's objective to meet its national target of becoming one of the top five research performers by 2010.

If the federal government is to conduct excellent S&T in an environment where there is increasing competition for the best and brightest individuals, it must improve its image as a performer of S&T, improve the quality of its working environments, and develop innovative strategies to recruit, rejuvenate and retain its work force. In order to achieve this, it is necessary first to ensure the foundations for excellence in the federal S&T human resource system.

As we described in the *STEPS* report, excellence in federal S&T rests on a foundation of essential conditions that foster scientific and technological excellence. A dynamic and highly skilled human resource capacity was identified as but one necessary condition. In addition, the following elements must be in place if the federal government is to achieve excellence in its S&T human resource system, and become an "employer of choice".

Leadership

Excellence in federal S&T demands leadership and commitment. Leadership requires enunciating a vision for federal S&T in alignment with departmental mandates and overall government priorities. Furthermore, there is a need for strategic planning within departments that aligns departmental mandates and business lines with national priorities and human resource requirements. We stress that government must set priorities and commit the resources necessary to achieve the vision. As stated in the *STEPS* report, predictable, long-term commitment and adequate financial resources are required to conduct S&T in support of the roles of government, and to address emerging science-based issues. At the same time, it is important that government cease to fund those functions that are no longer required and redeploy resources toward new strategic priorities.

Management

Many of the basic human resource challenges facing the federal government are common to managers across the innovation system. In seeking solutions to these problems, federal S&T managers are expected to be knowledgeable about and skilled in applying the best practices in S&T human resource management, whether

drawn from government, industry or academe. Managers need not necessarily be practising scientists; however, they require an understanding of science processes in order to effectively manage S&T employees and maximize their productivity. Government needs to identify those S&T workers who have demonstrated a potential for management and help them develop their managerial and "people" skills. Where necessary, federal S&T managers must be supported through training that specifically aids them in managing S&T and addressing the human resource issues facing federal S&T. Finally, managers must be provided with the flexibility to manage and be held accountable for their decisions.

Opportunity

For decades, Canada's best and brightest S&T workers were attracted to the federal government by, among other factors, the high-calibre research infrastructure and unique S&T facilities, as well as the leading-edge research conducted in government laboratories and research establishments. As noted in *STEPS*, government must provide a stimulating work environment that offers challenging assignments and appropriate rewards. Government is facing increasingly strong competition from sectors that are able to offer higher salaries, better facilities and modern equipment. Maintaining a priority-driven S&T infrastructure capable of attracting and retaining excellent S&T workers requires ongoing strategic investment. The challenge is not necessarily rebuilding or restoring capacity along historical requirements, but identifying the capacity needed to enable the government to meet current needs and enhance its ability to meet future challenges.

Legislative/Policy Structure

The federal human resource system is governed by a body of public service legislation and policy that originated with the civil service reforms early in the last century. Any attempt to reform the current human resource structure must respect core values for staffing a public service that is representative, non-partisan and merit-based. At the same time, however, the government must recognize the changing context for human resources, particularly in the S&T areas, and ensure that the current legislative/policy structure is sufficiently flexible and appropriate for a competitive, fast-paced, knowledge-based labour market. In addition to official policies, the government must also identify and change standard practices that are counter-productive to improving its image as an employer of choice.

The Way Forward

The national innovation system cannot realize its full potential without government fulfilling its role as performer, catalyst and facilitator of S&T. In the context of the government's commitment to be among the top five R&D performers in the world, this role has never been more critical. The resolution of current and future S&T human resource challenges is central to the government's ability to effectively fulfil its role. As was observed in *BEST*, to be a "stronger contributor to the national innovation system, the federal S&T establishment needs a culture change, more flexibility in its operational policies and a renewal of its management systems".[16]

We have considered the barriers in the current federal human resource system in terms of four major dimensions: evaluation of supply and demand conditions; attraction and recruitment; maintenance and retention; and retirement. These dimensions are not unique to the S&T community, but have been considered with the special characteristics of the S&T community in mind. Success in solving the S&T human resource challenges facing government will not be achieved unless efforts are directed along all dimensions. In each of these areas, the government must eliminate practices and procedures that are not consistent with a healthy work environment and not conducive to modern science. The challenges are pressing and the need for action is urgent. The following provides a review of each dimension, along with our recommendations for each.

Evaluation of Supply and Demand Conditions

It is important that the federal government better understand, monitor and forecast S&T labour market conditions on an ongoing basis in support of improved human resource management. The S&T labour market is "hot". To be competitive, government must acknowledge that it is competing with both industry and academe in the national innovation system, as well as with other countries in a global labour market for skilled S&T workers. Currently, demographic information either is not available or is gathered on an ad hoc basis. For example, comparative data regarding pay, benefits and rewards are not available, yet such information is of particular importance to human resource planning activities. Timely S&T labour data from a centralized source can aid departments in planning their human resource strategies to meet future needs, and in ensuring that they are competitive in the S&T labour market.

We therefore recommend that the government ***support and properly fund an S&T community organization*** that includes in its mandate maintaining a centralized, accessible, data-based information system that supports strategic human resource planning and decision making, and

16. Council of Science and Technology Advisors, *Building Excellence in Science and Technology (BEST): The Federal Roles in Performing Science and Technology* (Ottawa: Industry Canada, 1999), p. 21.

facilitates the sharing of information among government departments, and between government and the other sectors of the national innovation system. This organization can undertake research to benchmark the federal government against other sectors and other countries in areas such as work conditions and compensation (including salaries, rewards and incentives), so that government can understand where it is competitive and where it is not, and consider action to address any gaps identified. The organization can identify "best practice" approaches to S&T human resource management across sectors to ensure that government maintains practices and procedures that are conducive to modern science.

Attraction and Recruitment

In an increasingly competitive, knowledge-economy labour market, it is necessary to identify the conditions that must exist to make federal S&T recruitment competitive with the other sectors of the national innovation system, and thereby effectively attract S&T workers to the federal public service, whether at the start or at the mid-point of their careers. It is important to consider recruitment in the context of the public service system overall, while recognizing that new strategies may be required with respect to attracting and recruiting S&T workers.

Canada — Improving Research Infrastructure at the University of Regina

As part of creating the right atmosphere to attract people, the University of Regina has made a significant overhaul of research equipment and infrastructure. As the university's President Barnard puts it, "you can't attract first-rate people to third-rate equipment".

Government's current recruitment practices are not conducive to first-rate science. A broadly held perception exists within the scientific community that the government lacks a vision for, and commitment to, its in-house S&T capacity, which makes it difficult for government to attract the human resources it needs. Current central and departmental processes are in many cases inconsistent with strategic planning for future needs, and have been observed to inhibit both continuity and flexibility. An important practical barrier to competitive recruitment into the federal S&T work force is the lack of a timely hiring process, which inhibits the government's ability to attract the best and the brightest.

To address these problems, we recommend that government departments have ***clear mandates with respect to their performance of S&T*** that are communicated to departmental staff and potential new recruits. This includes ensuring that government science is funded appropriately, to demonstrate the commitment to its ongoing importance. If the government is to play its strategic role in the national innovation system, and maintain modern facilities and equipment as well as a stimulating work environment that is appealing to potential recruits, funding must include both new resources and the re-allocation of existing resources to new S&T priorities.

We further recommend that the government ***dramatically shorten the time it takes to hire new employees***. Given the intense competition for S&T workers, government must explore mechanisms to decentralize the hiring process and facilitate the expeditious recruitment and hiring of S&T workers. **Two hundred and thirty days to complete the process of hiring a new employee is not competitive in the current S&T labour environment.**

In addition, government should ***target the recruitment of young S&T workers while they are still students and research trainees, and encourage and fund the staffing of post-doctoral scientists***. This can be achieved through the widespread, systematic use of programs such as student internships and co-ops. Mechanisms must be implemented to ensure that students can be hired over a series of summers or periods of time. The research indicates that once a student works for the federal government in any capacity, he or she is very likely to consider the federal public service as a future employer.[17]

Canada — Collaborations with Universities

Several of the science-based departments have proactive initiatives to develop a supply of highly qualified personnel in collaboration with universities. These initiatives include meeting periodically with deans and department heads to discuss research priorities and skill requirements, working with the granting councils to supplement fellowship support in key areas where supply gaps exist, and bringing researchers into contact with students through adjunct professorships. Many departments begin the recruiting process by hiring co-op or summer students to work in federal labs. This provides students with excellent work experience, and means that they are more likely to develop an interest in working in government after graduation, as well as to convey a positive message about government science to their fellow students.

The heavy use of term appointments in the government is another issue that requires attention. The data show that 90 percent of new hires are terms. Term employees tend to be younger, and experience rapid turnover. This high turnover allows for little development of institutional memory and creates a revolving door that suggests to potential recruits that a career in government is highly unstable. At the other end of the spectrum, there is a large population of indeterminate employees in place, who tend to be older and experience relatively little turnover. This suggests to potential hires that there is a rigidity in the system and a potential lack of advancement opportunities. We recommend that government ***create a better balance in the system overall*** through flexibility, ensuring that term employment is used only in situations where appropriate, and not simply as an alternative to an otherwise lengthy indeterminate hiring process. Options are needed that provide the opportunity for new hires to join a mobile public service that provides a broad spectrum of opportunities and career possibilities. On the other side, mechanisms and incentives are needed to change the workplace culture to foster a healthier, ongoing turnover of indeterminate employees.

Government faces another challenge in that the Canadian labour market is expected to move from a surplus to a deficit position within the next decade. This is the result of a combination of factors, including an ageing population, decreasing birth rates and increased ability of skilled individuals to emigrate to new opportunities. As the labour market moves toward a deficit position, Canada will become increasingly reliant on immigration to meet labour requirements. This will present an additional challenge for government, as the vast majority of competitions require that individuals be residents of Canada and, by law, preference for appointment is given to Canadians. We recommend that, in the near term, as a minimum step, the government ***allow Canadian citizens residing outside Canada easier access to federal S&T job competitions***. The current competition residency requirements fly in the face of objectives to recruit skilled Canadians back to Canada from abroad. Over the longer term, when shortages occur, government will find it necessary to more actively recruit foreign nationals on the basis of merit without regard to their country of origin.

17. Ruth Matte, *A Review of Federal Science & Technology Human Resource Studies 1994-2001* (work commissioned by the CSTA, March 2002).

Maintenance and Retention

In a knowledge economy, many career opportunities exist for S&T workers, and these individuals may be more willing to change workplaces in search of new challenges and opportunities. In order to meet current and emerging priorities, the government must address the key success factors to retain flexible, agile, high-calibre S&T employees.

Canada's Innovation Strategy notes that "without increased and ongoing investments in skills upgrading, Canada's labour force will perform below its potential in dealing with the new demands of the knowledge-based economy".[18] Government can lead by example by committing to lifelong learning and career development. Although they are a key asset for government, some S&T workers in highly specialized capacities can be resistant to undertaking new skills training, especially if it is in areas unrelated to their specialization. As departments review their S&T activities with a view to re-aligning with changing mandates and evolving government priorities, the accompanying adjustment of human resources is an opportunity for individuals to gain experience and skills in new priority areas. The government must foster a cultural shift that encourages S&T workers to view these new opportunities positively, while committing to career planning that fosters growth. We recommend that the government ***provide significant opportunities for training*** to support lifelong learning and career development. Re-skilling and re-tooling can help to ensure that the government has the flexibility and expertise it needs to respond to the ever-changing demands of the knowledge-based economy.

Australia — The Costs of "Job Churn"

Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO) recently completed a study on attracting and retaining S&T personnel. Entitled *CSIRO: Employer of Choice*, the study found that it cost roughly four times as much to continually hunt for and train replacement staff than it did to provide optimal conditions for job satisfaction and motivation of existing personnel. Researchers ranked the following factors as most important when personnel are considering remaining with their organization:

1. **interesting work**
2. **a degree of autonomy on the job**
3. **pay**
4. **flexibility in working hours**
5. **promotional opportunities**
6. **good relationships with colleagues**
7. **learning opportunities.**

Issues related to work-life balance, such as flexible work schedules and the provision of day care centres, are especially important for retaining women.

The S&T human resource system currently lacks mobility — both within government (especially between the core public service and non-core departments and agencies), and among government, academe and industry. We recommend that the government ***foster greater mobility both within government and with industry and academe***. The flow of individuals among the various sectors must be eased, by enhancing programs and mechanisms such as interchanges, and by removing structural barriers that inhibit mobility (e.g. lack of pension portability).

18. Government of Canada, *Achieving Excellence: Investing in People, Knowledge and Opportunity* (Ottawa: Industry Canada, 2002), p. 59.

Japan — Increasing Retention Through Mobility

Japan is keenly aware of the looming demographic trends as its low birth rate makes it very vulnerable to shortages of skilled personnel. Based on a Cabinet decision in 2001, Japan has adopted a new plan for S&T. The government plans to implement broad exchanges of S&T personnel among industry, universities and public sector facilities "so that researchers can obtain jobs commensurate with their natural endowment and capabilities." In addition, Japan will relax regulations restricting the participation of Japanese researchers in overseas conferences. The government intends to provide more opportunities for researchers to gain experience in international S&T practices.

The system also lacks the flexibility necessary to allow managers greater discretion and accountability. We recommend that the government ***empower science managers*** to manage science and their human resources in a manner that nurtures a healthy, dynamic, challenging work environment for S&T employees. Managers should not be unduly restricted by practices and procedures that constrain the exercise of modern science — for example, limiting the number of employees from a unit who can attend international conferences. Managers should have the discretion to implement flexible work arrangements for staff (e.g. dual appointments with other bodies) and to acknowledge superior performance through rewards and incentives, and through a more responsive, flexible promotion process that allows advancement without sacrificing hands-on science.

Retirement

As a result of the "demographic bulge", a significant number of senior S&T workers will be eligible to retire over the next few years without penalty. However, current career planning focusses on recruitment and retention. Federal science managers rarely discuss departure plans and approaches to restaffing with their pending retirees. Current human resource rules make it very difficult to hire new workers until a position is vacated.

The pending retirement of a large group of senior S&T workers presents an opportunity to effect the re-orientation of the government's S&T skill base toward addressing newly emerging challenges, and to encourage change while concurrently ensuring the smooth transfer of knowledge. It also provides the opportunity to address the under-representation of designated groups.

The government should foster an open environment where employees and managers can share information about retirement and restaffing plans without either party feeling threatened, so that managers can adopt a strategic approach to restaffing. With a large cohort currently eligible to retire without penalty, we recommend that the government ***implement bridging plans across the S&T community***, where required, sooner rather than later. These bridging plans should provide opportunities for knowledge transfer, where necessary, through mentoring, emeritus scientist or understudy programs. It is important to reiterate that restaffing after retiring workers is not necessarily a matter of simply refilling existing positions. Recruiting must be strategically aligned with S&T directions, to enhance the government's ability to meet future challenges.

Summary of Recommendations

The federal government is an important player in the national innovation system. The government must commit to its role in the system at a level commensurate with its mandated responsibilities and emerging S&T priorities. Failure to do so will have a negative impact on the national innovation system and limit productivity. To effectively fulfil its role, government requires a dynamic, high-calibre internal S&T work force. It must act decisively to address its human resource challenges and become an employer of choice.

The federal government must ensure a competitive working environment, supported by human resource policies and procedures that are responsive to the needs of the S&T work force. Its human resource system must reflect the understanding that S&T workers are stimulated by interesting and challenging work, competitive salaries, progressive and well-trained management, high-calibre colleagues, a creative rewards framework, opportunities for learning, career advancement potential, and excellent equipment and facilities.

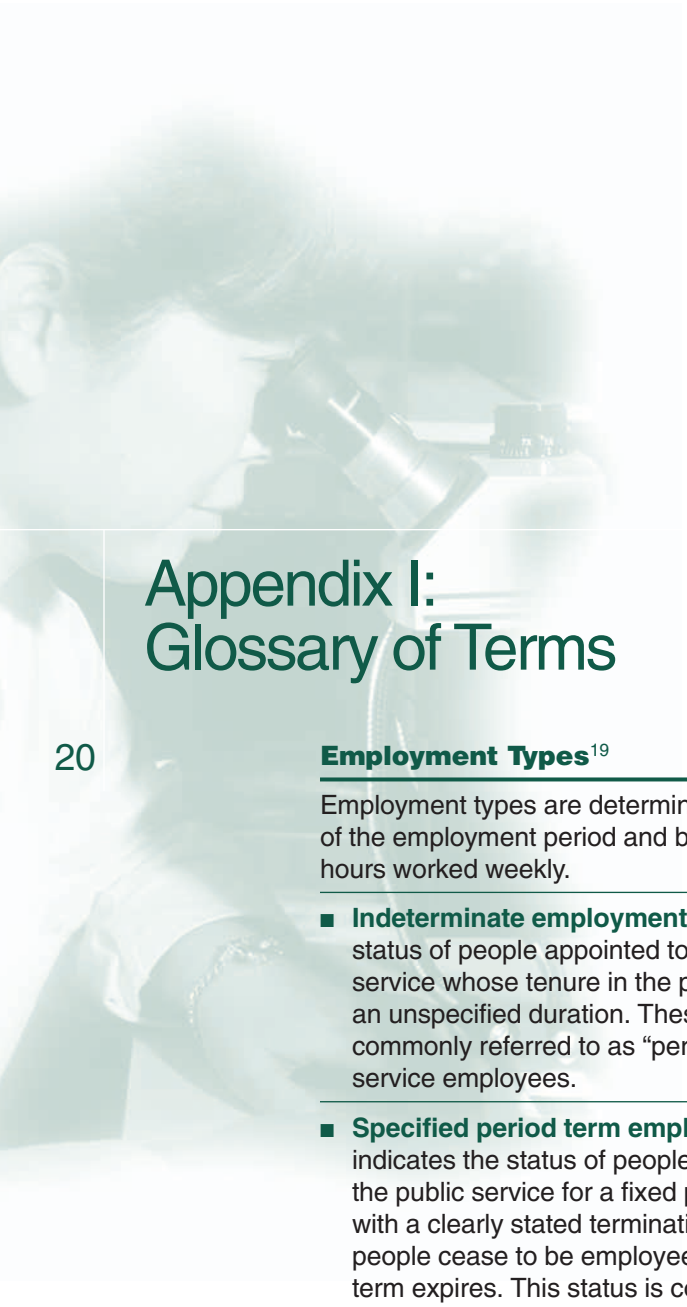
Federal S&T human resource issues have been the focus of much analysis in recent years. It is now time for concerted action, by Treasury Board, the Public Service Commission, and science-based departments and agencies, working together to address policies and practices that are not conducive to modern science. Building upon our previous reports, we recommend that the Government of Canada adopt the following actionable measures to address its S&T human resource challenges:

- **Ensure clear departmental mandates with respect to the performance of S&T that are communicated to departmental employees and potential new recruits.** Fund these mandates appropriately, to demonstrate government's commitment to its role in the national innovation system.

- **Support and properly fund an S&T community organization** that maintains a centralized, accessible, data-based information system to monitor and forecast S&T labour market conditions and benchmark the federal government against other sectors and other countries in areas such as work conditions and compensation. Use this information to support departments in strategically planning their human resource strategies, and in ensuring that they are competitive in the S&T labour market.

- **Dramatically shorten the time it takes to hire new employees.**
- **Target the recruitment of young S&T workers while they are still students and research trainees, and encourage and fund the staffing of post-doctoral scientists.**
- **Create a better balance in the system between term and indeterminate employees.** Provide the opportunity for new recruits to join a mobile public service that provides a broad spectrum of opportunities and career possibilities, while fostering mechanisms and incentives to change the workplace culture to foster a healthier, ongoing turnover of indeterminate employees.
- **Allow Canadian citizens residing outside Canada easier access to federal S&T job competitions.** Over the longer term, when S&T labour shortages occur, recruit foreign nationals more actively on the basis of merit without regard to their country of origin.
- **Provide significant opportunities for training** to support lifelong learning and career development.
- **Foster greater mobility both within government and with industry and academe**, by enhancing programs such as interchanges and removing structural barriers that inhibit the flow of individuals.
- Decentralize functions to **empower science managers to manage science and human resources effectively**, in a manner that enhances flexibility and productivity, and nurtures a healthy, dynamic, challenging work environment for S&T employees.
- Foster an open environment where employees and managers can share information about retirement and restaffing plans, so that managers can approach recruitment strategically, **and ensure that bridging plans are put in place across the S&T community where required**, to provide opportunities for knowledge transfer.

The government's S&T human resource challenges are pressing and the need for action is urgent. We acknowledge the considerable amount of work that has been undertaken in recent years in this area, but urge decisive action to address internal S&T human resource challenges. We encourage the government to develop a clearly articulated plan to implement the recommendations contained in this report, monitor progress to achieve them, and ensure accountability by the appropriate senior managers in central agencies and science-based departments.



Appendix I: Glossary of Terms

Employment Types[19]

Employment types are determined by the length of the employment period and by the number of hours worked weekly.

- **Indeterminate employment** indicates the status of people appointed to the public service whose tenure in the position is of an unspecified duration. These people are commonly referred to as "permanent" public service employees.
- **Specified period term employment** indicates the status of people appointed to the public service for a fixed period of time, with a clearly stated termination date. These people cease to be employees when that term expires. This status is commonly referred to as "term employment" and the employees as "terms."

  Term employees fall into two categories:
  - short-term — appointed for less than three months; and
  - long-term — appointed for three months or more.
- **Casual employment** indicates the status of people appointed under section 21.02 of the *Public Service Employment Act* for a specified period of no more than 90 days by any one department. That department may extend the employment period up to a maximum of 125 days within a 12-month period. This extension cap does not apply if another department rehires the person.
- **Full-time employees** are those who work the full number of scheduled hours of work for their occupational group, normally as defined in their collective agreement. These employees may be either indeterminate or term.
- **Part-time employees** are those who work anything less than the full number of scheduled hours of work for their occupational group, normally as defined in their collective agreement. These employees may be either indeterminate or term.
- **Seasonal employees** are those appointed to work for a portion of the year (i.e. a season) each year.

Classification is the occupational group, sub-group (where applicable) and level assigned to a position.

Collective Agreement is an agreement, in writing, entered into under the *Public Service Staff Relations Act*, between the employer and a bargaining agent and containing provisions covering terms and conditions of employment and related matters.

Occupational Group is a series of classifications within a category performing similar kinds of work requiring similar skills. Each group has its own classification standard and its own pay plan to ensure that rates of pay can be adjusted independently. Some groups are further divided into sub-groups, either to relate more closely to specific outside markets or to provide a different approach to job evaluation, if required.

Retirement is a voluntary separation where the employee's entitlement is an immediate annuity.

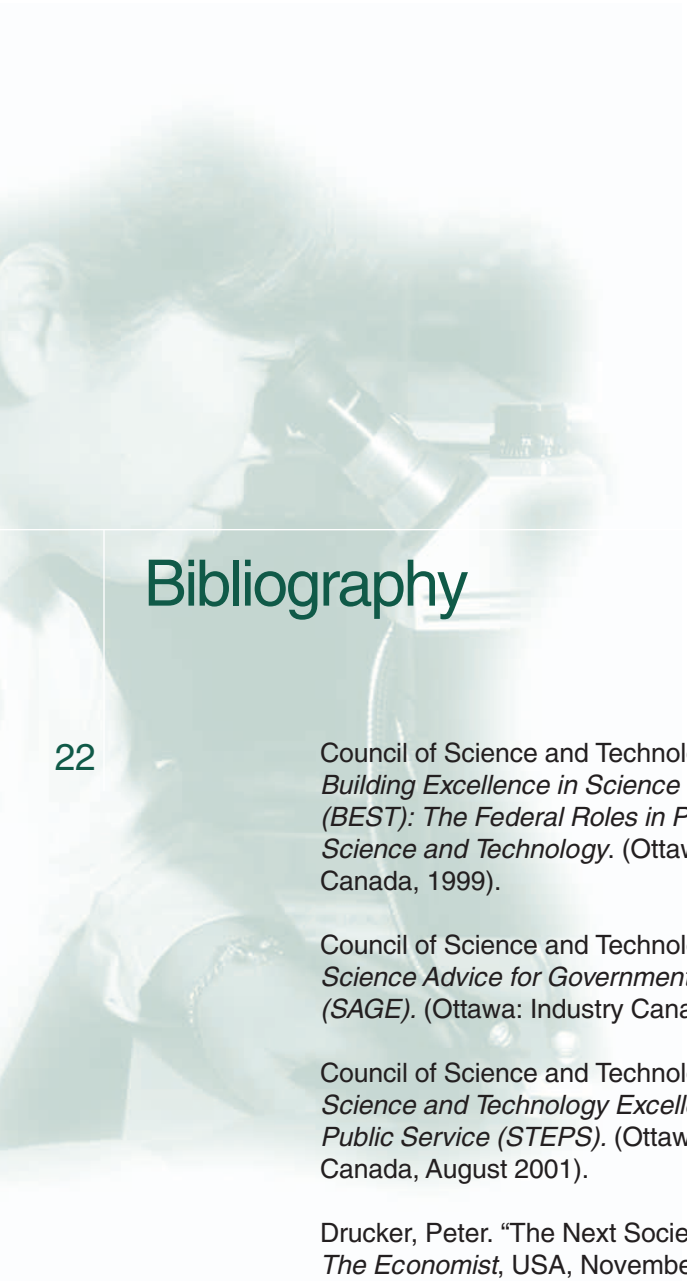
19. This section is sourced directly from Treasury Board of Canada Secretariat, *Employment Statistics for the Federal Public Service: April 1, 1999 to March 31, 2000* (Ottawa: Treasury Board Secretariat, 2000), p. 20.

Appendix II: Federal S&T Occupational Categories

Occupational Category	Occupational Group
Applied Science and Engineering	Agriculture (AG) Biological Sciences (BI) Chemistry (CH) Engineering (EN-ENG) Land Survey (EN-SUR) Forestry (FO) Meteorology (MT) Physical Sciences (PC) Scientific Regulation (SG-SRE) Patent (SG-PAT)
Health	Medicine (MD) Nursing (NU) Pharmacy (PH) Veterinary Medicine (VM)
Technical	Engineering and Scientific Support (EG) Electronics (EL) General Technical (GT) Drafting and Illustration (DD)
Research	Scientific Research (SE) – Research Manager (REM) – Research Scientist (RES) Defence Scientific Service (DS)

National Research Council S&T Occupational Categories

Occupational Category	Occupational Group
Research	Research Officer (RO) Research Council Officer (RCO)
Technical	Technical Officer (TO)



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20. All studies commissioned by the CSTA are available on the CSTA Web site at **www.csta-cest.ca**