



In the Service of Canadians:
A **Framework** for
Federal Science and Technology

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Contents

1.	Introduction	2
1.1	Purpose of the Framework	2
1.2	The Need for a Framework	4
2.	The Unique Role of Federal Science and Technology	6
3.	Guiding Principles for Federal Science and Technology	8
3.1	Alignment	9
3.2	Linkages.....	10
3.3	Excellence	11
4.	An Enabling Environment for Federal Science and Technology	13
4.1	People.....	14
4.2	Leadership	15
4.3	Management	16
4.4	Engagement	17
4.5	Science and Technology Infrastructure	18
5.	Next Steps: Applying the Framework	19

Introduction

1.1 Purpose of the Framework

The framework provides guidance

for ensuring that federal S&T remains excellent, relevant and cost-effective.

This framework sets out the Government of Canada's continuing commitment to effectively conduct and manage science and technology (S&T) in support of action on issues of concern to Canadians. It has been prepared in response to the wide-ranging and rapidly evolving challenges and opportunities facing the federal government in carrying out, managing and communicating its S&T activities, many of which have been highlighted in a series of reports by the Council of Science and Technology Advisors (CSTA).¹

The framework consists of three related elements (see Figure 1 on page 3) that

- articulate the unique and essential role of federal S&T (*Section 2*);
- present a set of principles and corresponding commitments to guide the conduct and management of federal S&T activities (*Section 3*); and
- identify the necessary features of an environment that promotes and supports federal S&T (*Section 4*).

The framework applies to all federal departments and agencies and their employees involved in the direct planning, conduct, management, policy development, communication and use of federal S&T. It may also be applied, as appropriate, to the management of government funding of external S&T performed on behalf of the federal government.

The framework provides general direction to managers and staff responsible for federally performed and funded S&T. Other important audiences for the framework include parliamentarians, senior federal executives, other organizations and individuals involved in the national innovation system in Canada, and interested Canadians.²

1. *Building Excellence in Science and Technology (BEST)*, 1999; *Science and Technology Excellence in the Public Service (STEPS)*, 2001; *Employees Driving Government Excellence (EDGE)*, 2002. The framework also addresses issues raised in the CSTA's report, *Science Communications and Opportunities for Public Engagement (SCOPE)*, 2003.

2. Although there is no formal definition of a national system of innovation, the term is generally taken to describe "a system of interacting private and public firms, universities and government laboratories, aiming at the production and use of science and technology within national borders. Interaction among these units may be technical, commercial, legal, social and financial, inasmuch as the goal of the interaction is the development, protection, financing or regulation of new science and technology." [Jorge Niosi et al., "National Systems of Innovation: In Search of a Workable Concept," *Technology in Society*, Vol. 15, No. 2 (1993), pp. 207-227.]

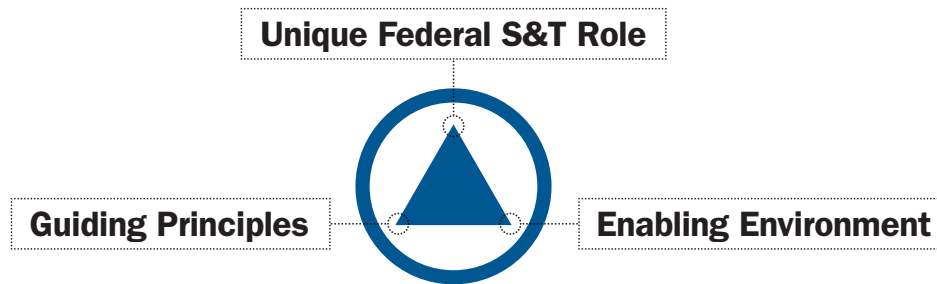
The framework is dynamic and will help guide evolving federal S&T efforts in the coming years.

The framework is not a single snapshot of current federal S&T activities and challenges. Rather, it will remain dynamic and relevant over the coming years, adapting as federal S&T evolves in response to new challenges and opportunities.

Together with *A Framework for Science and Technology Advice*, this framework provides an overarching conceptual structure for undertaking and funding federal S&T.³ The two frameworks serve as the umbrella for existing S&T policy documents, including the government’s policy on the precautionary approach.⁴

The framework will also link to forthcoming policy documents, including those pertaining to current S&T policy work on risk management, performance management, communications and linkages.

Figure 1: A Framework for Federal S&T



3. *A Framework for Science and Technology Advice*, 2000. Government response to the CSTA report, *Science Advice for Government Effectiveness (SAGE)*, 1999.

4. *A Framework for the Application of Precaution in Science-based Decision Making about Risk*, 2003.

1.2 The Need for a **Framework**

Federal S&T has a strong record in protecting and improving the quality of life of Canadians.

The goal of federal S&T is to contribute to the Government of Canada's response to societal challenges and to identify and address emerging issues and opportunities for Canadians. This goal was set out in the vision for Canada's federal S&T community in 2002, which states, in part:

The Canadian federal Public Service will enhance its research, development and scientific services in order to secure Canada's place as a world leader in innovation, opportunity and quality of life.

The federal government's science and technology efforts will identify emerging issues that matter to Canadians, and refocus in response to changing needs in areas such as health and safety, public security, natural resources and the environment, and the growth of the knowledge economy.⁵

In working toward this vision, federal S&T contributes directly to a broad range of outcomes that Canadians expect from their government — that is, toward enhancing human health, assuring national security,⁶ improving economic strength, sustaining the environment and advancing the quality of life. It provides information affecting the daily lives of Canadians, such as weather warnings and food safety, and brings to life new ideas and technologies with global implications, such as the heart pacemaker and telecommunications satellites.

Currently, federal scientists provide national leadership in managing health crises, such as bovine spongiform encephalopathy (BSE) and severe acute respiratory syndrome (SARS), and in developing technologies in areas such as wireless communications, environmental remediation, alternative fuels and ocean monitoring.

Federal S&T covers a broad range of activities undertaken on behalf of Canadians.

S&T activities, as defined by Statistics Canada and the Organisation for Economic Co-operation and Development, consist of two related components: research and development (R&D); and non-research activities (i.e. related scientific activities, or RSAs), such as the scientific assessment of products and data analysis.

The federal government invests more than \$8 billion a year in S&T activities,⁷ including both R&D and RSAs.⁸ S&T activities to meet federal mandates and responsibilities are performed internally by science-based departments and agencies (SBDAs) or are performed externally with federal funding. Federal investment in S&T includes the funding provided by federal granting councils⁹ and foundations for university-based research. SBDAs employ scientific researchers and workers from a variety of disciplines in the natural and social sciences, engineering and technology; and maintain institutes, laboratories, field stations and offices across the country.

SBDAs undertake and deliver S&T along a common continuum involving the definition of scientific priorities and programs, the development of proposals and the selection of projects, scientific inquiry, the assessment of immediate results and longer-term impacts, and the communication of results.¹⁰ This common approach ensures that federal S&T continues to generate credible science advice and high quality scientific services on behalf of Canadians.

5. Vision for Federal Science and Technology, Federal Science and Technology Forum, October 2002.

6. National security is a broad term covering both conventional foreign policy and defence considerations, and the more recent focus on domestic safety and security from terrorism.

7. Approximately \$8 billion in the 2002-03 fiscal year.

8. For 2002-03, the split was approximately 64 percent R&D and 36 percent RSAs. For intramural S&T, the split is closer to 50/50.

9. Three granting councils are involved in funding S&T: Science and Engineering Research Canada, the Social Sciences and Humanities Research Council of Canada, and the Canadian Institutes of Health Research.

10. This S&T continuum is described in more detail in the CSTA STEPS report.

The federal government has worked to strengthen its S&T capacity.

This framework is the most recent step in an ongoing effort to strengthen federal S&T. It builds directly on the 1996 federal strategy *Science and Technology for the New Century*, which outlines the federal government's approach to the development of federal S&T policies and programs.¹¹

The 1996 strategy has served as an important catalyst for improving federal S&T performance. Its principles continue to be relevant as the demands placed on federal S&T change and evolve. As a result of the strategy, federal government scientists and researchers have forged stronger links with each other, as well as with the broader S&T community in Canada and around the world. The governance and advisory mechanisms established as a result of the strategy have helped shape new ways of doing business for federal S&T.

The establishment of the CSTA in 1998, in particular, has provided a valuable independent, external perspective on the government's approach to S&T. Its first report on science advice formed the basis of the federal *A Framework for Science and Technology Advice*. Subsequent advice from the CSTA has focused on other aspects related to promoting excellence in federally performed S&T.

These reports also provided thoughtful analysis of the evolving context for federal S&T. It is a context characterized by the following:

- rapid changes in S&T knowledge and capacity worldwide;
- an aging workforce;
- competing demands for government resources to attract a new generation of scientists and researchers, and to maintain and upgrade facilities and equipment; and
- increasing public expectations for S&T to provide the answers to complex challenges that reach across jurisdictions and disciplines, such as climate change, stem cell research, food safety, national security and the threat of epidemic diseases.

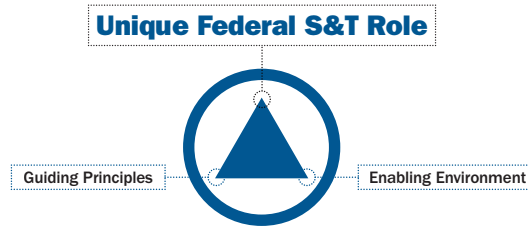
A framework is needed to bring an integrated government-wide approach to S&T.

The advice of the CSTA has resonated across government. Several SBDAs have been active in implementing specific recommendations, though generally on an individual basis.

The challenge now is to facilitate a more consistent and integrated approach to S&T across the government. In this way, federal investment in S&T will continue to provide world-class knowledge, credible scientific advice, critical science-based services and innovative technology for Canadians in an increasingly competitive global marketplace. A more integrated approach can build on the many examples of good practices already being implemented by SBDAs. It can demonstrate the federal government's commitment to S&T based on excellence and continuous learning and improvement. It can promote more effective horizontal management of crosscutting issues that touch on both departmental mandates and government-wide priorities. It can create greater economic benefits from activities such as licensing its intellectual property and commercializing government-discovered S&T applications. It can promote greater accountability in the use of federal S&T resources, consistent with Treasury Board of Canada Secretariat's (TBS) *Management Accountability Framework* (2003) and with the Strengthening Public Service Management initiative.

11. The strategy can be found at strategis.gc.ca/pics/te/e-strat96.pdf

The Unique Role of Federal Science and Technology



The first element of the framework is the federal government's unique role in the national innovation system.

The CSTA has identified four core roles of federally performed S&T, distinct from that conducted by the other participants in the national innovation system, industry, academia and not-for-profit organizations. The CSTA concludes that the unique and essential role of the federal government is in performing public good S&T, that is, undertaking activities that focus on protecting and advancing the public interest on behalf of Canadians.

The four core *public good S&T roles* identified by the CSTA form the foundation of this framework.

Support for decision making, policy development and regulation

The issues that matter most to Canadians are increasingly informed by S&T — from the safety of food and drinking water, to the sustainability of major industries, to dangers posed by new diseases and security threats.

Federal decision makers need access to timely, high quality and objective S&T advice from domestic and international sources to respond effectively to current and emerging policy challenges. They also must retain the in-house capacity to assess science-based issues and input, to ensure that issues continue to be addressed from the perspective of the Canadian public interest.

Many federal departments and agencies also rely on a strong S&T capacity to effectively deliver on their regulatory responsibilities in such areas as health and safety, security, consumer protection, and environmental protection.

Development and management of federal and international standards

Standards have a far-reaching effect on the lives of Canadians. Whether in the area of drinking water quality, consumer product safety or industry practices, Canadians rely on the federal government to set standards that protect their health, safety and security, and well-being. Canada also must be an active participant in the cooperative effort to develop international standards on S&T related to health, economic trade and environmental quality.

Achieving these objectives requires a capacity to impartially assess the impact of products, processes and actions, and to translate the results into standards that protect the public interest. It also requires a capacity to manage those standards — to monitor compliance and effectiveness, and to propose and implement adjustments when necessary.

Federal S&T is not carried out in isolation.

The federal government is continually engaged with other participants in the national innovation system and with members of the international S&T community. Such linkages are key to the effective functioning of the national, regional and local systems of innovation.

In addition to the direct role it plays in these systems as a performer of S&T, the federal government also has several indirect yet critical roles as a leader, funder and facilitator. For example, the federal government provides grants for academic research, research chairs and research infrastructure, as well as tax credits for industrial R&D. It also supports innovation systems through several other critical activities, such as infrastructure, information systems, industrial and trade policy, regulatory systems, training, and intellectual property rules.

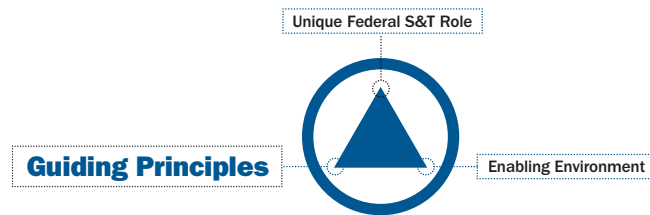
Support for health, safety and security, and environmental needs

A third key role of federal S&T is to protect and advance the public interest in the areas of health, safety and security, and environment in the face of current and emerging threats. A significant proportion of the federal government's S&T is devoted to supporting this role. The full range of S&T activities are needed — from research, monitoring and data collection, to forecasting and communications. In many cases, the federal government is the only body that can perform S&T to serve these needs.

Enabling economic and social development

The fourth key role for federal S&T is to contribute to the advancement of Canada's related goals of social well-being and economic growth. Advancements in federal S&T knowledge contribute directly to economic growth through the creation of new economic opportunities and improved competitiveness for Canadian companies. Federal S&T also contributes to improvements in Canada's quality of life in such areas as education, health and environmental protection. For example, humanities and social sciences research helps to enhance understanding and inform decisions about issues such as immigration, education, monetary policy, justice and culture. Federal science, technology and engineering efforts contribute to helping Canadian businesses and industries become more productive, innovative and competitive. In addition, the granting councils play an essential role in the development of the highly qualified personnel who will create new knowledge and advance Canada's social and economic goals.

Guiding Principles for Federal Science and Technology



The second element of the framework is a set of principles to guide all federal S&T.

This section presents three guiding principles (alignment, linkages and excellence) that serve as the foundation of the federal S&T framework. The principles should be applied by all SBDAs in planning, managing, performing and funding S&T. The principles build on the 1996 federal S&T strategy and incorporate the advice provided by the CSTA in its recent reports. They also provide sufficient flexibility to allow for the evolution of federal S&T in response to new challenges and opportunities.

Actions that will be taken by the Government of Canada, in support of the principles, are highlighted under each principle.

3.1 Alignment

➔ **Principle 1:** Federal S&T must reflect and be supportive of the priorities of Canadians.

Federal S&T exists to serve the needs and interests of Canadians.

Alignment of S&T ensures that federal S&T activities target priority issues that matter to Canadians, present and future. Federal S&T, therefore, must be aligned with both the mandates of departments and with the broader priorities of the government.

At a departmental level, alignment ensures that departments will receive the S&T advice and services they need to deliver on their mandated responsibilities. Alignment of S&T first requires the identification of desired outcomes in support of departmental mandates. Second, the outputs needed to deliver those outcomes must be identified. Finally, a decision must be made on what S&T activities are needed to produce the desired outputs.

However, the complexity of challenges in areas such as health, safety and security, and global environmental change demands a collaborative, horizontal approach to S&T across departments; this includes regional-level integration for federal activities. No single department can successfully address such challenges in isolation. Alignment within and among departments, therefore, enables a more effective integration of S&T activities across federal departments as duplication can be minimized.

Alignment is an ongoing process.

Alignment is not a one-time activity. Rather, just as priorities themselves evolve, alignment is a dynamic, ongoing commitment to monitoring how S&T activities are linked to departmental mandates and government-wide priorities, and then making the necessary adjustments, through analysis and consultation.

In support of the principle of **alignment**, the Government of Canada is committed to:

- continually monitoring S&T activities and programs, and realigning them as required to departmental mandates and government priorities;
- reallocating resources based on the realignment; and
- determining whether the performance of S&T activities is best achieved within the department, in collaboration with others, or by other performers of science.

3.2 Linkages

➔ **Principle 2:** Federal S&T must be built on effective, collaborative relationships.

Strong linkages expand the value and reach of federal S&T.

Addressing the complex and multi-faceted challenges facing Canadians requires drawing together S&T knowledge and expertise found internationally, domestically and internally within the federal government. Strong linkages through partnerships, collaboration and integration expand the value and reach of federal S&T, and enable the government to draw on a broad range of knowledge and experience. Linkages open avenues for more efficient and innovative use of S&T resources and facilitate quick mobilization in response to emerging issues. Strong linkages require a two-way relationship, meaning that we must be strong contributors if we wish to remain strong recipients.

Within the federal government, SBDAs are taking collective action to develop mechanisms to encourage interdepartmental S&T integration, including ways to collectively set and fund priority areas.¹²

A well-integrated national innovation system helps ensure S&T resources provide economic and social benefits to Canadians.

Strategic partnerships among governments, industry, universities and non-profit organizations enhance the strengths of each sector through the sharing of information and the application of the S&T expertise available in other sectors and regions. The federal government is a key player in the national innovation system, participating as a leader, facilitator, collaborator and regulator.

Partnerships also extend to the international S&T community. In addition to the significant opportunities for S&T collaboration and partnering on the international level, the federal government must remain engaged internationally to so contribute to the development of standards and ensure that the Canadian innovation system is benefiting from international S&T.

In support of the principle of **linkages**, the Government of Canada is committed to:

- fostering interdepartmental, horizontal linkages among SBDAs on crosscutting S&T challenges; and
- developing and enhancing effective, collaborative relationships with other members of the national innovation system, as well as with the international S&T community.

12. A CSTA report on linkages is forthcoming, and future recommendations will be addressed accordingly.

3.3 Excellence

➡ **Principle 3:** Federal S&T must incorporate the highest standards of excellence.

Excellence in S&T contributes

to a progressive society and a competitive economy.

Federal S&T needs to be of the highest standard, not only to protect and serve Canadians, but also to assure them that the best possible efforts are being made on their behalf. Excellence in federal S&T provides an essential contribution to the knowledge and innovation needed for a progressive society and a competitive economy.

Five factors contribute toward S&T excellence: **quality, relevance, ethics, transparency and openness, and innovation.**

The quality of S&T should be readily demonstrable to all stakeholders, including the scientific community and the public.

Ensuring that federal S&T is of the highest quality enhances the performance and credibility of the government's science-based actions, and increases public confidence in its ability to deliver on its unique roles.

There is no single measure that can be broadly applied to S&T to ascertain quality. Quality of S&T is based on the collective view of experts with respect to the veracity and merit of the methodology applied and results achieved. Quality also depends on having adequate resources to carry out the S&T required.

Relevant S&T must target both current concerns and emerging challenges.

For S&T to be considered excellent, it must be relevant from both an immediate and a longer-term perspective. In the first case, relevant S&T must be directed at issues that are important to Canadians today. As noted under the guiding principle of alignment (*see Section 3.1*), federal S&T must be supportive of departmental mandates and government priorities in order for S&T to continue to address immediate concerns.

More generally, however, relevant S&T must extend beyond the immediate concerns of today. It must be able to identify and begin to shape the public policy response to issues that are just beginning to emerge and that have yet to become public priorities. Foresight and long-range forecasting can help the government anticipate and prepare for these issues.

All members of the federal S&T community share a responsibility for adhering to the highest ethical standards.

New capabilities in science and advancements in genetics, biotechnology and other sciences have brought important benefits to society. At the same time, scientific progress itself is raising ethical concerns that require study and public debate. Integrity in federal S&T is essential in order to maintain the respect and confidence of Canadians and members of Parliament, and to enhance the reputation of federal research organizations, S&T professionals, and research and scholarship in general.

As employees of the federal government, members of the federal S&T community are expected at all times to uphold the public trust, as laid out in the 2003 *Values and Ethics Code for the Public Service*. They are expected to observe the ethical standards established by their own department or organization, as well as those set by the professional bodies with which they are affiliated.

Federal S&T employees are also members of the broader scientific community, and therefore have a special responsibility to uphold scientific integrity. Their actions must be guided by honesty and propriety, and adhere to the rigorous norms and standards required of scientific investigation. In particular, Canadians expect that federal S&T reflects core ethical principles governing the treatment of human research participants and animal welfare.¹³

13. Examples of these principles are found in the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans*, 2003, a policy of the Canadian Institutes of Health Research, the Natural Sciences and Engineering Research Council of Canada, and the Social Sciences and Humanities Research Council of Canada; and the Canadian Council on Animal Care (CCAC), *Guide to the Care and Use of Experimental Animals* (Volume 1, 2nd Edition, 1993, and Volume 2, 1984); *CCAC guidelines on: transgenic animals* (1997); *CCAC guidelines on: animal use protocol review* (1997).

Government must demonstrate that transparency and openness are practised at each step of the S&T process.

As the component of the national innovation system responsible for *public good S&T*, the federal government makes its S&T visible to Canadians at each step of the process — from planning and conducting S&T, through to peer review of results and access to data.

Transparency and openness require early and ongoing dialogue with stakeholders to ensure that public concerns are considered in decision making on science issues. In a knowledge-based society, empowering citizens with information contributes to their understanding of science and its accompanying uncertainty and risk. It allows individuals to make informed decisions about issues that affect their well-being. It also offers the interested public the opportunity to engage in discussion, not only about the specifics of a particular science-based issue, but more broadly about the directions that government science should take, the appropriate application of scientific discoveries and the ethical issues surrounding them.

Federal S&T must embrace innovation by encouraging creativity and continuous learning.

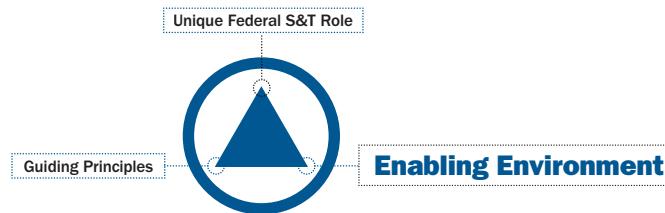
Assessment, adaptation and creativity are fundamental to maintaining excellence. To effectively serve and provide value to Canadians, federal S&T must embrace the notion of continuous learning, create a climate that supports innovative thinking, and continue to look for creative partnerships and resource applications. Government also has a key role to play as a builder, holder and facilitator of a research infrastructure that supports Canada's innovation system.

Government can generate significant benefits from its investments in S&T. Improved awareness within government of the commercial potential of its S&T, matched with an enhanced understanding within the private sector of the potential for commercialization increase Canada's ability to turn its S&T investments into wealth, jobs and improved quality of life. *Public good S&T*, however, cannot focus only on ideas and technologies with commercial potential; its top priority must remain the public interest of present and future generations of Canadians.

In support of the principle of **excellence**, the Government of Canada is committed to:

- employing expert review processes and internationally accepted standards to assess the quality of federal S&T;
- ensuring relevance in federal S&T by consulting regularly with advisory bodies, clients, partners and interested Canadians;
- keeping current on advancements in domestic and international S&T;
- using a variety of tools to ensure that Canadian federal S&T is compared with S&T performed internationally, to ensure excellence;
- rigorously applying specific ethical guidelines to all sponsored and internally performed S&T involving human and animal subjects;
- providing timely reporting on S&T findings and the processes used to reach these findings;
- promoting a culture of creativity and innovation within SBDA's; and
- providing support to federal S&T activities with commercial potential.

An Enabling Environment for Federal Science and Technology



The third element of the framework is an environment in which federal S&T can thrive.

An enabling environment of people, policies and infrastructure is needed to ensure that the guiding principles for federal S&T can be applied within individual SBDA's and across the government. Attention to the enabling environment will help ensure that the federal government has a dynamic, high-calibre, internal S&T work force; strong relations with Canadians on S&T issues, based on engagement; and the necessary facilities and equipment to address its S&T roles.

The framework identifies five components of an enabling environment for federal S&T: **people, leadership, management, engagement** and **infrastructure**.

4.1 People

People are fundamental to the Government of Canada's ability to deliver on its S&T responsibilities.

The government values its outstanding scientists, engineers, technicians, technologists and support personnel, and will invest in the resources needed to attract, develop and support them in the performance of consistently excellent work.

The ability of the public service to effectively recruit, develop and provide support to talented S&T personnel will determine its level of success in fulfilling the unique federal role in Canada's innovation system. As working environments become increasingly multi-faceted and fast-paced, the importance of horizontal S&T linkages grows. For federal S&T employees, the trend toward horizontal linkages will have an important impact on the mobility and training of the S&T workforce, and will influence career development and learning plans.

SBDA's have, for several years, managed crosscutting human resource issues that face federal S&T employees through a common, scientific community approach. The resulting benefits include the recognition of a common vision, sharing of best practices, creation of multidisciplinary teams to work on horizontal S&T issues and co-location of S&T workers.

The federal S&T community is poised for change.

A significant portion of the federal S&T community will soon be eligible for retirement. This trend poses a challenge in maintaining institutional knowledge. It also presents an opportunity for renewal. Either way, it illustrates the need to focus on people in the S&T environment.

The advice provided by the CSTA has prompted the identification of human resource priorities for the federal S&T community. The government has recognized the need for a renewed human resource strategy for federal S&T. This strategy must be one that provides direction to the community on the management of its human resources, defines guiding principles for SBDA's, and emphasizes initiatives and programs that span the S&T community.

In support of enabling **people**, the Government of Canada is committed to:

- implementing a renewed human resource management strategy for the federal S&T workforce;
- monitoring implementation of the strategy, and undertaking adjustments as required; and
- fostering an open environment in which employees and managers can share concerns and information about S&T human resource management.

4.2 Leadership

Federal S&T demands leadership and commitment at all levels.

The three principles of alignment, linkages and excellence in S&T demand leadership at all levels of the federal government, from national concerns to the work of individual SBDA's.

At the national level, the federal government can draw together other governments, universities and the private sector to address issues of national priority. This national leadership function is supported by leading-edge expertise and facilities. It is shaped by national mandates that help identify and define opportunities for federal leadership.

Government-wide, leadership is needed to identify, launch and maintain the horizontal, collaborative S&T initiatives that are vital in responding to many emerging challenges. Leadership is needed to build bridges between mandates, to develop and apply consistent administrative processes, and to provide the appropriate incentives and recognition, in order for collaborative S&T efforts within the federal government to realize their potential.

Finally, at the level of individual SBDA's and specific S&T initiatives, leadership is an essential ingredient to success. Leaders can articulate federal S&T goals, establish ethical standards, motivate others, engage partners and promote S&T success stories. In this way, leaders can help develop a culture that supports and encourages S&T.

In support of enabling **leadership**, the Government of Canada is committed to:

- recognizing and rewarding leadership in federal S&T; and
- developing leadership skills in its S&T workforce.

4.3 Management

Federal S&T must function within a clear management accountability framework.

Federal S&T operates under the accountability regime established by the TBS *Management Accountability Framework* (2003). Under this accountability framework, the effective management of any activity requires information about strategic priorities, objectives, inputs, flow of resources, outputs and outcomes. Monitoring of these factors provides the basis for the ongoing evaluation of progress, as well as input into subsequent decision making.

Performance management is an essential component of the accountability framework.

Performance management is a particularly difficult challenge for S&T because of, for example, the long lead times for R&D results, the uncertainty of outcomes and the potentially diverse areas of S&T applications. The CSTA has concluded that, in many SBDAs, and on a government-wide basis, the information available on federal S&T activities has been inadequate for understanding the federal contribution to Canada's innovation system and for effectively managing S&T resources.

However, a number of SBDAs are actively developing more consistent approaches to performance management related to S&T across the federal government. This framework for federal S&T also notes the government's commitment to the collection and reporting of management information in support of its ongoing performance measurement initiatives.

S&T is a powerful tool for managing risk and reducing uncertainty.

S&T involves risk on many levels. The outcomes of research are uncertain at the onset, meaning that the investment in research carries a degree of risk. New technologies and science-based products can create unanticipated risks to individuals or to the environment.

However, S&T can also be an important tool for managing risks and reducing uncertainty in decision making. *A Framework for Science and Technology Advice* identifies a number of principles and guidelines that promote sound decision making and that reduce the level of risk. The federal government's *A Framework for the Application of Precaution in Science-based Decision Making about Risk* provides further guidelines about science-based decisions in the presence of uncertainty. As with performance management, several SBDAs are working to develop more consistent approaches to risk management related to S&T across the federal government.

In support of enabling **management**, the Government of Canada is committed to:

- ensuring that federal S&T operates under a sound management accountability framework, including the collection of comprehensive and consistent information about S&T activities to support performance measurement initiatives.

4.4 Engagement

Federal S&T must be based on open and meaningful engagement with Canadians.

Providing timely and meaningful opportunities for citizen and stakeholder engagement enhances the relevance and effectiveness of federal S&T and is key to maintaining public confidence in federal decision making and stewardship. In addition, the CSTA has drawn attention to the need to incorporate communications planning early in the S&T cycle, and to plan for stakeholder engagement throughout the process.

The government also recognizes the importance of engaging citizens in setting priorities. Engagement means moving beyond communicating S&T results and taking steps toward participatory communications, in which audiences are engaged in dialogue, deliberation and decision making; scientific risk and uncertainty are clearly articulated; and debates are inclusive of the diverse perspectives and local expertise of different sectors, cultures and geographic areas.

In support of enabling **engagement**, the Government of Canada is committed to:

- fostering mutual trust and confidence with stakeholders and citizens by bringing S&T information, planning and debate into the public realm, and offering opportunities for input in priority setting; and
- clearly communicating the risk and uncertainty of scientific knowledge.

4.5 Science and Technology **Infrastructure**

Public good S&T requires modern facilities, equipment and networks.

In accepting and committing to its overall role in performing *public good S&T*, the Government of Canada recognizes that state-of-the-art facilities, equipment and networks are required to carry out its responsibilities. A modern S&T infrastructure forms the basis of the government's ability to uphold the integrity of current S&T programs and to study emerging challenges. In the competitive global market for S&T talent, modern facilities also are critical to attracting and retaining the best and brightest S&T workforce; and they enable the government to be a credible and effective partner in the many areas where partnerships are needed to fulfill its mandates.

Collaborative S&T may require a shift to new models of using and sharing infrastructure.

As the CSTA has concluded, the goal of more effective and efficient S&T requires a shift away from a traditional vertical model to more horizontal approaches that cut across federal government departments and across the full spectrum of the national innovation system. The increased use of horizontal approaches would encourage greater sharing of physical infrastructure for S&T, including development of multi-party R&D network clusters around critical public policy and scientific issues, and the co-location of multi-use laboratories.

In support of enabling S&T infrastructure, the Government of Canada is committed to:

- ensuring that its base of scientific facilities and equipment is appropriate, responsive, sustainable and aligned to support the efficient delivery of government programs and services; and
- exploring innovative ways of managing government S&T facilities, and enhancing efficiency and effectiveness through asset sharing, co-location and facilities integration.

Next Steps: Applying the Framework

Applying the framework will help strengthen the calibre and accountability of federal S&T.

This final section briefly outlines the general steps to be undertaken by SBDAs and the federal government in applying the framework in the planning, performance and reporting of federal S&T activities. Applying the framework will help build public confidence in government decision making and in the calibre and accountability of the federal S&T process. Canadians will know that federal S&T is aligned with the country's priorities, that it is more effective and efficient through collaborative approaches, and that it embraces the highest standards.

Application of the framework is set out under **three broad categories: promoting awareness and application of the framework, ensuring accountability, and evaluating effectiveness.**

Promoting awareness and application of the framework

The first task is to promote awareness of the federal S&T framework among all SBDAs, and encourage its application in all federal S&T activities. The federal government will also ensure that other members of the national innovation system, the interested Canadian public and Canada's international S&T partners are aware of the framework.

SBDAs will use appropriate opportunities to promote awareness of the framework internally and to ensure that their S&T managers and staff, policy analysts, and decision makers apply the principles and guidelines of the framework in their S&T activities.

Ensuring accountability

The framework is a key tool for promoting greater accountability for federal S&T, and is consistent with and supportive of the accountability provisions required by TBS for all federal government activity.

In applying the framework, SBDAs and the federal government will use appropriate reporting mechanisms to regularly inform interested Canadians, parliamentarians and other participants in the national innovation system about how they are applying S&T resources to priority

issues. The federal government will also designate a federal S&T champion to promote accountability within the federal S&T community. This champion will guide the application of the principles and guidelines of the framework across the federal government, and work to share best practices in S&T management among all SBDAs.

Evaluating effectiveness

The federal government will undertake a coordinated, government-wide effort to monitor the effectiveness of the framework's principles and guidelines in strengthening federal S&T. The effort will include the following:

- common government-wide criteria to evaluate the extent to which SBDAs are applying the framework;
- performance indicators to monitor and measure the effectiveness of the framework's principles and guidelines; and
- government-wide reporting on progress.

The government will also adjust the framework in response to the results of its performance monitoring, to ensure that the framework remains relevant and useful as federal S&T evolves.