

The 1994 Federal Science and Technology Review

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Introduction

In 1994, the federal government of Canada conducted a Science and Technology Review, bringing together scientists, industrialists and the general public to debate the future direction of Canadian science and technology (S&T) policy. This dialogue was a “deliberate and coherent attempt” at promoting national and international collaboration among scientists (De la Mothe, 1996).

The roots of this review can be traced to the 1993 federal election, which saw the Liberal Party under Jean Chrétien defeat the Conservative Party. As part of their election campaign, the Liberals developed the “Red Book” and laid out their plans for Canada in writing (1993). It was in this book that the party announced its plans for reviewing S&T and for finding new ways of strengthening the economy.

Expectations for this review were high in the S&T community as the review involved not only an internal review of federal S&T and a third-party review by the National Advisory Board on Science and Technology (NABST), but a series of public consultations involving more than 2000 Canadians from coast to coast. In addition to these community workshops, the government received over 370 recommendation letters from stakeholders and interested citizens. Since little of this review had been analyzed since the mid-90s, this paper examines why the 1994 Federal S&T Review was conducted and what the final outcome was.

Using content analysis on transcripts and notes from the meetings, official reports from the government, interviews with stakeholders involved in the review and letters received by the

government, this study gleaned some quantitative data from largely qualitative sources. The result is a portrait of the review that traced sources of ideas from regional meetings in 1994 through the internal review to the final reports published in 1996.

It appears the review served two purposes. It allowed the government to make good on its election promise while shifting attention away from their larger Program Review, which resulted in severe cutbacks to many federal S&T programs. The final reports made no commitment to massive changes in S&T policy and reflect only some of the recommendations collected from stakeholders. At first glance, the culmination of this review appears to be a list of recommendations intended to steer S&T in this country. The impetus to develop a true S&T strategy would be left up to the ministers and bureaucrats in Ottawa.

The real value of the review lay in the process, not the product. Increased communication and collaboration between scientists in different sectors during the review served to increase ties between universities and industry, and in many ways bypassed the already floundering federal S&T stakeholders. Since Program Review cuts were implemented before the S&T Review reports were completed, it is likely that any commitment to change was a convenient afterthought to make the cuts seem like efforts to increase efficiency rather than a massive downsizing exercise.

With a diminished capacity to conduct S&T, the role of many federal S&T programs was reduced to that of policy making. The focus on policy has subsequently led to the transformation of the S&T agenda into an innovation agenda.

Canada has a long history of S&T policy reviews and a sporadic track record of implementing strategy. The federal government has experimented with a number of S&T policy structures and stakeholder consultations mechanisms. None have shown any permanence. This study seeks to find out why the 1994 federal S&T Review was conducted and what the actual outcome was.

In 2002, after a number of false starts, the Liberal government published a discussion paper titled "Canada's Innovation Strategy." The discussion process will include a series of cross-country consultations similar to those of the S&T Review, and is no doubt modeled on it. This paper has been prepared as a description of the 1994 S&T Review to provide a benchmark for measuring the new consultation process.

The Sequence of Events

Immediately following the 1993 election, the S&T Review was handed to the Office of the Chief Scientist of Industry Canada¹ for implementation. However, by mid-May 1994, responsibility for the review was transferred to Dr. Jon Gerrard, then Secretary of State, Research and Development.

The review was organized in three stages: an internal review of all S&T departments, an independent review of the government by NABST, and a series of public consultations.

Starting with a consultation paper called "Building a Federal Science and Technology Strategy," the government invited Canadians to give their advice on how federal investment in S&T could be applied to Canada as a whole.² As one component of this three-pronged review, the public

¹ This position no longer exists.

² With an official price tag of \$1 million, the process has been unofficially said to cost over \$2.5 million (De la Mothe, 1996).

consultations were by far the most controversial and difficult to quantify. This bold effort to bring federal S&T policy into the public forum met with mixed success.

The government had determined long before this review that science, technology and innovation were the critical ingredients for economic growth and job creation. The problem lay in determining the priorities for S&T in Canada and public consultation was held up as a solution. By consulting industry stakeholders, other levels of government, the academic sector and the general public, Dr. Gerrard hoped to find a focus for government S&T strategy that was best for society as a whole.

As stated in “An Overview of the Consultation Process for the Science and Technology Review” (1994), released prior to the review, the government’s goals for the public consultations were:

1. “To keep interested Canadians informed about the review exercise and the development of a new federal science and technology strategy.”
2. “To provide opportunities for focused debate among Canadians on federal policy options for science and technology.”
3. “To listen to the ideas and suggestions of interested Canadians which can be used to improve the new federal science and technology strategy.”
4. “To identify and describe the issues which are priorities to Canadians.”
5. “To facilitate open and transparent discussions with Canadians in order to identify areas of consensus, discuss and resolve disagreements, and describe differing views among stakeholders and the federal government.”
6. “To ensure that Ministers receive an accurate report of the views which interested Canadians expressed during the consultation.”

The public consultations were the most publicized aspect of the review. After initial government news releases, stakeholders were invited to participate in a series of 25 community workshops held across Canada, from St. John’s, Newfoundland to Victoria, British Columbia. Written recommendations were also solicited and 397 submissions were received, many following community workshops. Five regional conferences rounded out the process, which was wrapped-up at a national conference in Ottawa on October 12, 1994.

Dr. Gerrard spearheaded the public consultations, assisted by a secretariat under Elizabeth Dickson, a career civil servant appointed as Executive Director of the S&T Review. Although the workshop transcripts were analyzed, broken down into a series of recommendations and reviewed leading up to the national conference (see below), the written submissions received no such treatment.

The internal review was not public because Program Review – an operations review that cut some department’s budgets by 25 per cent – heavily influenced the decisions made behind closed doors. Despite the secrecy, it is known the internal review was headed by:

- Health Canada, reviewing quality of life issues,
- The Natural Sciences and Engineering Research Council of Canada (NSERC), reviewing the advancement of knowledge in government departments,
- Statistics Canada, reviewing S&T information systems, and
- The National Research Council (NRC), looking at sustainable job creation and economic growth.

These four subject areas were later carried over to NABST’s public policy review activities. To facilitate a third-party review of government, the Liberals renewed NABST with 19 non-

government representatives from a wide spectrum of sectors. Tasked with advising the Prime Minister's Office on potential S&T policy changes, this group was also to report to the public.

During the 1997 federal election, the Liberal Party restated its position, claiming that S&T had been reviewed and more reviews would take place if the Liberals were re-elected. However, shortly after the completion of the public consultations in late 1994, NABST published a series of reports around the four working groups and set out a series of strong recommendations for government. These documents were publicly available as proof of the government's commitment to non-partisan, third party review of its S&T policies. A series of "action plans" from the reviewed ministries and departments preceded the 1997 election campaign and appeared to support principles laid out in an S&T Review Secretariat document entitled *Science and Technology for the New Century*. These reports embodied the federal government's commitment to the principles identified during the review and closed off the review process.

Methodology

At the time, the 1994 S&T Review was well documented, mainly in the "gray" literature of government files and reports. However, over the intervening years much of this ephemeral material has disappeared. Centre for Policy Research on Science and Technology (CPROST) is fortunate in having an archive containing much of this material, which provides the basis for this analysis. A detailed content analysis was carried out on more than 500 documents, including government reports, transcripts, and letters sent to the government by members of the public. To ensure inter-coder reliability, a shallow review of the documentation established a list of the most common recommendations made by stakeholders. The resulting list of pre-coding issues was used for coding those found within the full inventory of stakeholder transcripts and letters.

Quantitative data measuring support for an issue was obtained by counting the number of documents within a forum calling for a recommendation. For example, a letter from a stakeholder suggesting that government spend more money on core research represented one vote for that recommendation.

Once support for each issue was determined, a comparison of the issues and the parties supporting them revealed the patterns that form the core of this study. Examples of each recommendation are cited where possible in the analysis section. Some issues overlapped with others, requiring a further distillation of the ideas into seven core issues. These core issues were constructed after coding and each encompasses several of the pre-coding issues.

The Community Workshops

The first stage of the public consultations was a series of workshops designed to talk to "local innovators" in a wide range of communities. Dates and times for the workshops – which began in Peterborough on July 12, 1994 and ended in Ottawa on August 29, 1994 – were posted in the relevant communities and advertised in government correspondence. Attendance by all community members was welcome, but the representation at these workshops broke down into the following groups:

- Academics – 690 (41% of the total participants)
- Business – 549 (33%)
- Government – 359 (21%)
- Other – 91 private citizens, elected officials and other non-categorized individuals (5%)

Overall, a strong consensus emerged from the community workshops (see Table 1). The recommendations, with few exceptions, fit into the pre-coding issues identified during the

literature review. The percentage indicating support from the community workshops is the number of times it was recommended divided by the number of workshops, indicating average support.

The Regional Workshops

The second stage of the public consultations was the regional workshops, which were held between September 1 and 30, 1994, beginning in Vancouver and ending in Toronto. The government invited 584 delegates from the community workshops and the representation broke down into the following groups:

- Academics – 165 (28% of the total participants)
- Business – 243 (42%)
- Government – 112 (19%)
- Other – 64 private citizens, elected officials and other non-categorized individuals (11%)

Unlike at the community workshops, where local socio-economic issues often emerged, the regional differences between the five conferences were minimal. The only noticeable differences were on the topic of government initiatives. Toronto and Montreal focused on this topic more than the other three cities and put responsibility for initiating changes in the government's hands.

Like the community workshops, a relatively strong consensus on issues was found throughout the five regional workshops (see Table 1). The recommendations from the regional workshops, with few exceptions, fit into the pre-coding issues identified during the literature review. The percentage indicating support from the regional workshops is the number of times it was recommended divided by the number of workshops, indicating average support.

Dr. Gerrard's Report

Interestingly, Dr. Gerrard, in his summary report of these workshops (October 1994), painted a different picture of the consensus. He correctly identified the gap between research and development (R&D) and commercialized S&T as an issue of concern and pointed out Canada's lack of a science culture. However, he went on to talk about Canada's relatively poor R&D performance compared to other G-7 nations as measure by the Gross Expenditure on Research and Development to Gross Domestic Product ratio (GERD:GDP) – an issue only two of the 25 community groups and one of the regional groups mentioned, even in passing.

Later in the report, he emphasized the fact that one-third of the workshops recommended a cut to federal laboratories and reducing their role to market-directed core research. He also went into great detail about the importance of universities, despite the fact many groups called for a complete overhaul of S&T education systems.

Industry needs, although addressed only briefly in his report, were adequately handled. The need for sector-specific policy and different levels of assistance for different sized businesses were mentioned, as was the importance of small business support of S&T in non-traditional sectors such as tourism, construction and fisheries.

The rest of the report was broken up into sections labeled "Strengths on Which Canada Can Build," "Major Needs in Canada Which Must Be Addressed" and "Areas Where New Spending Is Needed." These sections cite examples, some of which were pulled randomly from the workshop transcripts, to illustrate the recommendations. In some cases, the source of a recommendation is unknown. For example, Dr. Gerrard cites "a just society/a peaceful world"

under “Major Needs.” None of the workshops identified this as a recommendation for federal S&T policy and its relationship to S&T policy is abstract at best. Some inconsistencies could be explained by the questions asked of participants, since the content analysis revealed the government asked different questions at each of the community and regional workshops.

The Written Submissions

The first of the written submissions were received around mid-July 1994, shortly after the first community workshop was held, with the bulk arriving in August and September 1994. In their submissions, organizations and individuals often cited a workshop they attended and were often critical of the government policy agenda framing these workshops. Others simply saw it as an opportunity to push their personal agendas and did so without addressing the issues at hand.

Despite the plethora of suggestions for supporting pet projects, a series of solid recommendations emerged, with slightly lower levels of support than (but corresponding with) recommendations from other forums (see Table 1). The same standards used on the workshop transcripts were applied to all 397 submissions. The issues identified in the written submissions fit within the list of issues identified prior to coding. Percentages indicating support from the written submissions is the number of times an issue was coded divided by the number of letters received, indicating average support. Issues with less than four per cent of the individuals’ support were not listed because the list is intended to be an overview of the most popular issues.

The numbers in favor of each recommendation may appear low, but since these are completely independent recommendations the numbers are more significant. There was no structure to the call for submissions other than a general request for recommendations, whereas in conferences and workshops there would have been pressure from the discussion leaders and other participants to recommend a certain course of action.

Synergies between the recommendations given at the community workshops and in the written submissions can be interpreted one of two ways. First, since many of the written recommendations followed community workshops, there is a possibility the submissions come from the more vocal elements in attendance. If this is the case, the quality of information gleaned from the public consultations is minimal. On the other hand, since there is less peer pressure to conform in written submissions, it is possible a true cross-section of the S&T community was obtained.

The most prominent synergies between the community workshops and the written submissions are between recommendations on partnerships and funding arrangements. Increased collaboration between government, private sector and academia was recommended in 22 per cent of the written submissions, 88 per cent of the community workshops, and 60 per cent of the regional workshops. This is a strong indication that increased co-operation between all stakeholders was viewed as a positive step towards a solid S&T foundation. Similarly, more funding for core research in universities and federal labs was recommended, as was increased funding to industrial research support programs such as the NRC Industrial Research Assistance Program (IRAP).

The National Conference

Held in Ottawa on October 12, 1994, the national conference was set up so key stakeholders could revise and approve issues identified by government from the community and regional workshops. The Review Secretariat boiled down the feedback from all of the sources and came up with a list of 15 recommendations for debate by the 200 delegates attending. Event

organizers claim they made every effort to include all stakeholders: there was a smattering of non-scientists, First Nations' and women's rights groups.

It was emphasized at the beginning of the conference that the 15 recommendations were only rough working models and that changes could be made to them until they were satisfactory. It was at this point that the government introduced the concept of a "national system of innovation."³ Understanding the operation of its national system of innovation would allow a country with limited resources to lever its R&D funding to achieve greater results (De la Mothe, 1994).

In the end, the 15 recommendations were explored and voted on. Delegates were asked to show their support for an issue by voting on a five-choice scale that included "support," "support with minor changes," "support with major changes," "no opinion," and "do not support." The following list is in the order the recommendations were presented by the government and indicate the percentage of delegates who voted "support" or "support with minor changes":

1. Industrial Sector Competitiveness (82%)
2. Capitalizing on Strategic Opportunities in the Canadian Economy (79%)
3. Technology Transfer (75%)
4. Workforce Skills and Education (70%)
5. Quality of Life (77%)
6. Integration of Economic, Social and Environmental Goals (89%)
7. Streamlining Federal Regulatory and Program Delivery Systems (79%)
8. Human Implications of Technology (49%)
9. Excellence in Science and Engineering (90%)
10. Aligning Science and Technology to Societal Needs (63%)
11. Canada's Science Culture (71%)
12. National System of Innovation (79%)
13. Infrastructure (96%)
14. Measuring Return on Investment (95%)
15. Independent Advice (63%)

These voting results were obtained, already tabulated into percentages, from the final conference report. Fitting these pre-determined recommendations into the pre-coding issues (for the sake of analysis) was more challenging than anticipated. Recommendation #1 was broad and could be broken up into several of the pre-coding issues. However, since not all of the 50 per cent of delegates that voted in favor of #1 "with minor changes" identified what changes they'd like to see, their votes cannot be counted as strong support for a particular issue within recommendation #1.

A report by Holbrook⁴ on the voting patterns from the conference also highlights the main focus of the participants. According to this report, the voting results put the heaviest emphasis on infrastructure, industrial sector competitiveness, measuring return on investment (ROI), workplace skill development, and excellence in science. While "Infrastructure" seems like a huge commitment for government, Industry Canada made it clear in their backgrounders leading up to the review that infrastructure development is the private sector's responsibility.

³ The Organization for Economic Cooperation and Development (OECD) developed this concept in the early 1990s as part of their studies on S&T policy. See OECD "National Systems of Innovation," document DSTI/STP/TIP(97)2, DST, OECD, Paris, 1997.

⁴ CPROST report 96-04, available on www.sfu.ca/cprost/publications as an Acrobat document

Two issues previously unidentified by other groups – “Excellence in Science and Engineering” and “Integration of Economic, Social and Environmental Goals” – were not added to our list of pre-coding issues. The first recommendation is problematic because until this conference no one had complained about the quality of the science in Canada, only the gap between basic research and commercialization. Despite the recommendation’s questionable origin, the conference delegates voted heavily in favor of it. There is no reason for them not to vote in favor of increased quality in science, but it failed to address the question at hand – how can the government improve science policy to benefit Canadians? The environmental recommendation also did not make it onto the final list of pre-coding issues because it touched on many points already covered by sustainable development and quality of life. In short, this recommendation seemed repetitive and did not add to the dialogue.

Support for multi-disciplinary research policy was strong with nearly half of the delegates voting in favor of the “Human Implications of Technology” recommendation. Taking into consideration the weak support for multi-disciplinary research, we may be seeing a skew in favor of this recommendation because of the accessible wording used in the briefing document. When this recommendation explicitly stated it would see increased involvement of “the often under-represented” in the S&T dialogue, peer pressure may have skewed the data. Logically, not many delegates would want to vote against a recommendation of this nature because by doing so they might appear elitist or racist. The issue of equal representation was raised in the Saskatchewan regional workshop alone and may not have gained the exposure it needed.

No single recommendation addressed the need for increased co-operation between government, the private sector and academia, but nearly all of the 15 conference recommendations mentioned increased partnership. Unfortunately, there is no way to measure this support because the issue was buried in other issues.

Some of the crucial ideas from the written recommendations and workshops were not on the national conference list. For example, almost one-third of community workshop participants and 80 per cent of regional workshops saw increased co-operation between government departments as a positive recommendation, yet it was not on the agenda at the national conference. Maintaining the R&D tax incentive program was also missing.

From a macro perspective, it appears the government set the national conference agenda without attempting to accurately represent the recommendations from the other forums. As a result, recommendations that focus on federal government restructuring, re-allocation or more spending were not included. The following issues did not make it onto the final agenda:

1. Funding agencies should focus on helping small and medium-sized enterprises (SMEs) – 48% support from community workshops, 40% from regional workshops, 6% of written submissions
2. More funding to government/industry programs like IRAP – 28% community, 40% regional, 12% written (Note: There is a brief mention of strengthening IRAP under item #2 – “Capitalizing on Strategic Opportunities in the Canadian Economy”)
3. S&T policy should be harmonized at the federal and provincial levels – 36% community, 80% regional, 4% written
4. Government continues to fund core research – 20% community, 60% regional, 17% written

Analysis: Core Issues

Seven core issues, identified by various stakeholders, were used as separate recommendations for narrowing down the coded submissions and transcripts into manageable data.

At the outset, the Review Secretariat indicated there would be some kind of policy developed after pooling together the internal review results, the NABST review and the recommendations from the public consultations. Government did not directly address this in the resulting reports from the departments in 1996. Paul Dufour, a former Industry Canada policy analyst attached to the 1994 review, feels the ultimate outcome of the review was a set of principles that government could use in developing future S&T policy.

1. Third party steering of S&T policy

One recommendation that surfaced several times was that Canadian S&T policy be steered by a body that is “independent of government” and connected to fields of S&T at the highest levels. NABST was held up as a possible model for establishing such a body.

The reasoning behind this suggestion stemmed from opinions that government R&D should not be unduly influenced by political or bureaucratic decisions. Specifically, a “National Academy of Sciences” or other central body of excellence was recommended for conducting independent peer review with findings used to steer government S&T decision-making. One duty of this third party would be making it easier for scientists to find money and recognize their efforts. Most of the written submissions indicated a need for university researchers to work with industry, but reluctance on the part of the researchers to do so. One potential solution suggested was rewarding scientists for working with industry; setting up a formal reward system would be the first step in such a plan.

2. Focus public funding and policy to maximize return on investment

Many delegates and stakeholders believed the bridge between federal R&D and commercially viable products to be an important element of the national system of innovation. Grants from government have the potential to push labs toward the “critical mass” necessary for innovation, which might come in the form of a new manufacturing process or something as simple as a marketing ploy. Funding R&D showing some initial potential for commercialization was identified as the key to successful innovation programs.

The caveat in this case is that groups voted for “innovation” as though it was a simple, cure all solution. Some of the groups noted the federal government produces more than enough R&D and that stronger utilization is needed. The biggest successes in S&T have come not with huge budgets but with creativity. Supporting innovation (not research) and providing proper development facilities were seen as crucial. Canadians need to start building successful technology-based businesses. Canada must ensure a steady supply of trained people to spur innovation in the high-tech sector and the sector needs to invest in flexible mini-fabrication facilities geared towards specialized manufacturing. Industry must lead the innovation process to turn R&D into commercially viable products.

In addition, intellectual property laws should be brought in line with the laws of our closest international competitors. The delegates calling for this recommendation say Canadian S&T investments are literally going into the pockets of trade competitors due to legal loopholes. Logically, publicly funded R&D should go towards Canadian societal good.

Under the heading “Infrastructure,” the national conference delegates voted overwhelmingly in favor of investing in national S&T infrastructure. The suggestions varied, but at their core they all called for a chain of centres of excellence where federal, industrial and academic research could be focused on specific areas and linked with a strong Internet backbone.

There was also support for long-term funding to core-research programs and short-term funding to applied research. The idea is that funding needs to be flexible and project-based. Applied research was cited as best conducted by small labs, so the notion that funding agencies should focus on helping SMEs is not new, but it is a contentious point because some parties question whether or not SMEs are capable of carrying out R&D on their own. According to a few companies that submitted letters, the infrastructure required for carrying out R&D is too large for a small corporation and a strain for a large one. However, there is a demand for this support and it would most likely come in the form of business development grants from IRAP to pay for advanced R&D. Some groups said SMEs are the most capable of marrying S&T to the natural resource extraction sector, while others simply indicated SMEs need more risk capital if they are to engage in R&D.

Further, it was recommended that Canadian S&T focus on sectors where Canada already has a market advantage such as telecommunications, transportation and natural resource extraction. Delegates identified the following Canadian S&T sectors as successful: health care, sustainable resource manufacturing and process, information technology, tourism, communications, transportation and aerospace, advanced electronics, and biotechnology.

Under the heading “Aligning Science and Technology to Societal Needs,” two-thirds of national conference delegates gave their support for market-driven R&D. Market research would be built into the evaluation of any new R&D projects and funding would be contingent on the project meeting some societal goals such as job creation or commercialization potential. Targeted research would eliminate waste in government spending and maximize ROI.

3. Increasing partnerships among stakeholders

At a surface level, many delegates and stakeholders recommended that government, the private sector and academia work together to maximize funding leverage. Oftentimes, these recommendations talked about cooperative projects between universities and industry, but left government out of the loop.

The proposal for harmonizing S&T at the federal and provincial levels may be a symptom of the frustration felt by the private sector when dealing these two levels of the government in Canada. There are many overlapping responsibilities, especially when it comes to R&D funding. A unified policy on S&T would be ideal but not likely as there are constant struggles over jurisdiction. Post-secondary science was also criticized for not falling in line with industry needs. The following are some of the individual recommendations made by delegates: work with industry on developing science curriculum (a provincial responsibility) that meets employers’ needs, create a national standard for education that includes foundations in math and science, enhance the learning environment using the best available S&T, and encourage continual retraining by developing tax incentives.

A large number of groups also recommended that government departments responsible for S&T work together to maximize efficiency and avoid duplication of effort. The “vertical stovepipe” of government departments leads to a lack of horizontal coordination and is hindering S&T policy at the government level.

As a subset of the recommendations in “Industrial Sector Competitiveness,” one-third of the delegates showed very strong support for opening up federal labs to key stakeholders in all sectors. Specifically, federal labs would be the central location for cross-sector collaborative work.

It is telling that one-third of the groups recommended government reduce funding to federal R&D labs and farm out research to the private sector and universities. One-third of delegates strongly supported the recommendations for re-defining the role of federal labs. This involves enhancing government programs leading to commercialized S&T and eliminating programs that do not.

4. Fostering linkages between science and social issues

In Dr. Gerrard's report, the multi-disciplinary aspects to S&T policy are addressed under a heading called "Human Implications of Technology." Broadly, is the holistic impact of commercialized S&T on society, good or bad?

Promotion of a science culture is a subtle tactic, but one that gained the support of more than half of the workshops. Some of the suggestions included promoting science and technology through Canada's many media outlets. The recommendation laid out a public relations campaign that included: demonstrating the contribution of S&T to quality of life, profiling the diversity of Canadian contributions to the sciences in general, enhancing programs that reward and recognize excellence in R&D, and promoting a science culture within government.

More than three-quarters of delegates agreed quality of life was a big factor in any S&T strategy and made the following recommendations: support environmentally sustainable S&T, focus on R&D that leads to sustainable practices for natural resource extraction or addresses global challenges, increase research into preventative medicine and early detection of illness, and support from the federal government for national medical research infrastructure.

5. Funding federal core research as the backbone of Canadian R&D

At the time of the review, it was clear the role of federal laboratories needed to change and the government could no longer produce competitive S&T affordably. The obvious solution was for the laboratories to regroup and focus on what they do best – core research. Some delegates wanted to see government focusing on "core research" and farming out everything possible to the private sector.

Funding core research would not only increase the level of science research done in this country, but would most likely create more opportunities for taking R&D and bringing it to market. Universities, as some put it, would be more than welcome to continue conducting core research, but would do so under the aegis of an industry consortium. Research would be targeted at marketable projects and the university doing the research would benefit in terms of more grants.

6. Using IT to improve delivery of services

Many delegates and stakeholders stressed that without a strong Internet backbone improved services and e-Government will not be possible. Government online was seen as a way of improving service while cutting costs since an electronic information clearinghouse is much more economical than staff at a call centre or public resource library.

Some saw the Internet as the ultimate communication tool, enabling them to coordinate R&D with their contemporaries around the globe and gain access to valuable government resources. The private sector also saw it as infrastructure their businesses will need to operate in the future. At one of these conferences, Dr. Gerrard pointed out that government is not responsible for building this infrastructure, only providing direction and expertise. "The information highway in Canada should be at least as good as our industrialized competitors" (Gerrard, 1994).

7. Increasing the profile of Canadian S&T abroad

Around one-quarter of those involved were also calling for government enhancement of Canada's ability to compete internationally in the S&T market. Some of the proposed changes involved export laws and trade relations, and promotion of Canadian goods through existing international channels. The private sector would like to see Canada renowned for its transportation technology, telecommunications expertise, and natural resource extraction technology. Under the heading "Streamlining Federal Regulatory and Program Delivery Systems," the national conference delegates voted nearly 80 per cent in favor of adopting the following action steps:

1. Encourage the transformation of innovative ideas into commercially viable products by removing some regulations.
2. Communicate comparative risks of various standards and regulations to the public in a public-awareness campaign.
3. Stimulate commercialization of products and services in Canada by designing and implementing regulatory systems for each sector.
4. Establish a regulatory framework for new S&T products.
5. Create new processes by which intellectual property is treated like an asset in the commercialization process.
6. Avoid duplication and speed up decision making by streamlining government.

Analysis of the Review

While preparing this report, the lead researcher had the opportunity to talk to one of the government officials involved in the 1994 review and to Dr. Geoffrey Ballard, founder of Ballard Power Systems, who was one of the S&T stakeholders that submitted written recommendations to the government in 1994. By both accounts, the following are pertinent pre-existing conditions:

1. The government has no corporate memory and is always re-inventing the review process for political reasons.
2. Contrary to popular belief, the government did take into account the views presented at the national conference in Ottawa, but those views do not necessarily reflect the views collected in the rest of the public consultations. Key officials in the government set the agenda for the national conference and handpicked the participants to ensure the mix of views that they wanted.
3. Any changes in policy that appeared to emerge from the S&T Review were actually justification for cuts forced by Program Review.

Most analysts see the series of reports and news releases sent to the press by the government as the "culmination" of the 1994 S&T Review (De la Mothe, 1996). Paul Martin, finance minister at the time, outlined the government's commitment to innovation in the 1994 budget, marking the beginning of the process. In the end, the government provided direction to Canadian scientists in the form of recommendations. In order of support, they were:

1. Increasing the effectiveness of federally funded R&D.
2. Capturing the benefits of partnership.
3. Taking a preventative approach to S&T and supporting sustainable development.
4. Building information networks.
5. Extending science and technology links internationally.
6. Promoting a strong science culture.
7. Positioning Canada competitively within emerging international regulatory, standards and intellectual property regimes.

S&T policy statements dating as far back as 1963 previously established many of these principles. The apparent lack of concrete commitments stemmed from government's existing

unwritten science policy – infrastructure for public science, law-making to support all science in Canada, and direction to ensure S&T in Canada improves citizens' quality of life.

Increasing the effectiveness of federally funded R&D is a vague commitment, grouping together the measurement of the value of R&D, market driven research, cutbacks to federal labs, and the review of intellectual property laws. In demonstrating their commitment to these issues, government cited many programs that measure performance and redefine the roles of government R&D, but made no mention of Program Review. Simply by cutting R&D budgets, departments increased their on-paper effectiveness or ROI on R&D spending. The suggestion that government labs run in a more business-like way was first raised by the Task Force on Federal Policies and Programs for Technology Development in 1984, and since then the neo-classical economic argument that government has no business competing with private sector R&D has been a common theme. Program Review cuts seem only to have forced the issue.

Capturing the benefits of partnership was another area for government policy initiatives. With the changing economy and increased commercialization of university research, government is now only one player in a much larger S&T field. By building partnerships with universities and industry, governments could leverage their smaller S&T budgets to maximize ROI. The Science Council of Canada first recommended working with industry in 1968 in an effort to leverage resources for tackling “large, important issues,” but this forward thinking was only put into action when budget cuts slashed the operating capabilities of most S&T departments.

Support for infrastructure tended to focus on building broadband electronic information networks, the construction of which is left to the private sector while government provides direction and ensures equitable distribution. In 1992, the Steering Group on Prosperity identified the “Information Highway” as a key tool for securing the economic future of Canada. Since the review, the federal government ensured effective delivery of their services by extensively employing IT; the Internet has become the backbone of government communication with the public. The government has also supported the creation of a high speed Internet network across the country for public sector institutions – CA*net 3, soon to be CA*net 4 – run by a consortium of public and private institutions, CANARIE.

Extending S&T links internationally is primarily a government thrust with no support from other stakeholders. The only synergy between this recommendation and what the stakeholders were asking for was the call for enhanced international competitiveness. Stakeholders felt changes to export regulations and tariffs would enhance the international competitiveness of Canadian businesses. International R&D collaborations appear more politically than economically motivated, as collaborating with other countries is a way of garnering support for Canadian goods abroad.

While not explicitly supported, creating a strong science culture is seen in the government's promotion of S&T as the career of choice for young Canadians. Logically, those who work in S&T become stakeholders and have a vested interest in seeing the sector do well. Positioning Canada competitively within emerging international regulatory standards and intellectual property regimes is another area that is largely supported only by government. If issues of quality could stop foreign markets from purchasing Canadian goods, compliance with established international standards would likely alleviate that concern.

Conclusions

Although the S&T Review started with the best of intentions, it developed into a public relations exercise for making good on election promises and minimizing the impact of cutbacks made

during Program Review. Evidence supporting this statement stems from a simple juxtaposition of dates. Most of the cuts made by Program Review came before the S&T Review reports were completed (De la Mothe, 1996). Ultimately, the end result of the review was a series of principles that departments were loosely committed to, but which required no major restructuring or increased expenditures.

It is difficult to separate the S&T Review from Program Review and for that reason some critics claim the reports released by the various departments only justified budget cuts. Transport Canada's report clearly illustrated this as the introduction talked about the department's massive lay-offs and budget cutbacks and then continued by stating that changes in policy are increasing the department's efficiency.

Many government labs were severely cut and/or reorganized because they could not produce any evidence of partnerships or ROI (with the probable exception of the NRC). Efficiency became the new motto of the surviving labs because it became apparent that a portion of an S&T budget spent analyzing efficiency could come back tenfold in operating cost savings.

Despite the scale of this review, it was a minor exercise that excluded other levels of government and had little impact on the economy. The real impact was within the federal S&T community as it forced dialogue among stakeholders and created some cross-departmental cooperation. The "early thinking" that emerged from this review is still being used today as the foundation for policy planning.

One of the biggest changes to the S&T community was the elevated importance of universities and the transformation of government departments into policy makers – not operators of S&T. In other words, industry can expect to see fewer grants and more partnerships with government.

In the end, it was noted by one source that the review was worthwhile, but it may have been a disappointment to public servants who had "their hopes set too high." The scientific community was expecting a revolution, but it was one that became mired in the bureaucracy and politics of the review (De la Mothe, 1996).

It has been said that Canadian S&T policy died with the completion of the 1994 review and has since become "innovation policy" in Ottawa (Dufour, 1994). S&T moved away from "big science" and focused on the "federation of firms" – small labs and companies that work towards a common goal (Ahluwalia, 1994).

A Postscript

In 1997 the federal government announced initiatives for new funding for basic research, such as the Canada Foundation for Innovation (and later the Canada Research Chairs). In addition, the granting councils were given new funding, which erased the previous cuts under Program Review. With a growing economy, falling national debt and a renewed focus on the knowledge-based economy, these increases were a rational move, but no reference was made to the 1994 S&T Review.

In 2001, Industry Canada prepared a draft of a new innovation strategy. Even before the strategy became public, it was widely criticized by stakeholders. Following a series of ministerial changes, the government published *Canada's Innovation Strategy* in 2002, which will feed into a national consultation process. It is hoped that this consultation process will result in a more definitive outcome than the 1994 S&T Review, leading to a more explicit S&T and innovation policy for Canada.

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Table 1

ISSUE/TOPIC	% SUPPORT		
	COMMUNITY WORKSHOPS n = 25	REGIONAL WORKSHOPS n = 5	WRITTEN SUBMISSIONS n = 397
Increase partnership between government, private sector and academia	88%	60%	22%
Focus on R&D/S&T where Canada is already a market leader	56%		9%
Promote a science literacy and science culture	56%	80%	9%
Support sustainable S&T to maintain a high quality of life in Canada	56%	80%	11%
Improve/maintain R&D tax credit system	48%	40%	7%
Funding agencies should focus on helping small or medium-sized enterprises	48%	40%	6%
Government support for innovation to turn R&D into commercially viable S&T	44%	60%	11%
Create a strong/cohesive federal S&T policy	40%		13%
R&D needs to reflect market forces/be market-driven	40%	40%	8%
Transfer public R&D and S&T to entrepreneurs for exploitation	40%		
Harmonize S&T policy at the federal and provincial levels	36%	80%	4%
Create a system for measuring the value of R&D; create a system of measuring return on investment	36%	60%	
Increase profile of S&T among youth as a potential career; hire more youth	36%		14%
Cut back federal R&D labs and transfer responsibility to private sector and academia	32%		8%
Government departments work more closely on S&T projects and avoid duplication	32%		
Enhance Canada's international competitiveness (with government S&T policy)	32%	40%	8%
Balance short-term and long-term investment in R&D	28%		
Increase funding to (or maintain) government/industry assistance programs such as NSERC and IRAP	28%	40%	12%
Revamp the education system	28%	100%	6%
Develop the Information Highway	24%		4%
Continue government funding for core research	20%		17%
Government will use IT to improve delivery of programs and services	20%		
Government will remove some S&T restrictions	20%		
Make public R&D publicly accessible	20%		
Make social sciences an integral part of R&D		100%	
Maintain basic research capabilities in Canada		60%	
Government to review internal S&T policies		60%	
Rework the health care system and make it innovative		60%	
A non-partisan third party should steer S&T initiatives/policy		40%	5%
Increase the GERD:GDP spending ratio (to 2%)		20%	4%
Focus all government S&T spending on wealth creation		20%	
Government R&D should not compete with private sector research		40%	
Create an S&T performance measurement system			8%
Investment in R&D should focus on long-term ROI			7%
Integrate multi-disciplinary research			4%
Promote and support lifelong learning			4%
Increase funding for S&T infrastructure (such as buildings and staff)			4%
Develop an R&D recognition and reward system			4%

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