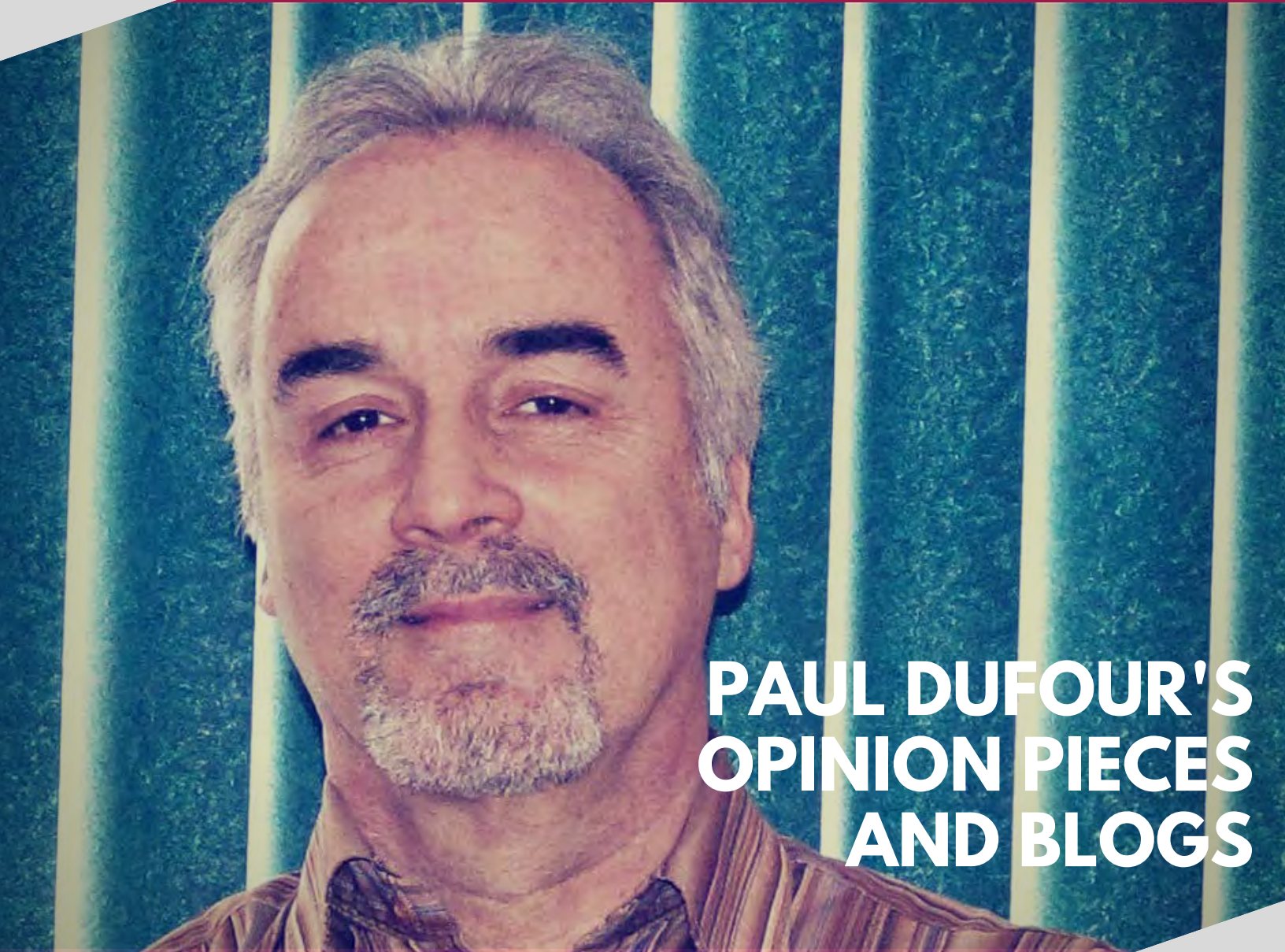


ISSP

INSTITUT DE RECHERCHE SUR LA SCIENCE,
LA SOCIÉTÉ ET LA POLITIQUE PUBLIQUE
INSTITUTE FOR SCIENCE, SOCIETY AND POLICY



PAUL DUFOUR'S OPINION PIECES AND BLOGS



uOttawa

PREFACE

Over the years I have been motivated to write various commentaries on current or emerging science policy issues-- often with an historical bent given my academic training and practical experience in science policy.

The following is a compilation of some of these for your interest. They have appeared in various outlets such as Research Money, Hill Times, iPolitics, Government Executive, AAAS, Research Fortnight, Canadian Chemical News, CSPC and ISSP websites to name a few.

The table of contents provides the reader a roadmap of policy riffs and rants (Rick Mercer says ranting is good for you:) on such issues as:

Naylor expert panel report

Gender equity in science

Science advice in its many forms

Role of national STI policies

Science advocacy

Innovation policy

International science and development

Science diplomacy

Parliament and science

Science culture and literacy

History of Canadian science policy--Lamontagne, NRC, Science Council, Mackenzie, Jenkins, etc..

A short list of other publications is also provided, including my weekly Fast Policy Facts for Research Money cobbled together with Rebecca Melville

The recent books with Jeff Kinder on the SCC and Agnes Herzberg on her father's speeches are cited, and, over the years, I have had the pleasure of co-authoring some pieces and other papers with Scott Findlay, Sally Otto, David Secord, David Strangway, James Mullin, John de la Mothe, Remi Quirion, Arthur Carty, Ramia Jabr, Kathryn O'Hara and Yves Gingras

I thank Rafael Dezordi at ISSP for his excellent travail in compiling this selection; views expressed of course are my own.



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The usefulness of relevant knowledge: the Naylor Expert Panel revisited

Originally published by The Hill Times

We suggest that government funding of basic research should emphasize quality rather than quantity—that the social sciences, multidisciplinary efforts, and projects relevant to Canadian needs should get higher priority (Senate Special Committee on Science Policy, 1977).

It's been just over a year since Canada's Fundamental Science Review report was published with much fanfare. It was inspired by the Lamontagne Senate Committee work of 40 years ago. Given the pedigree of the panel, expectations were high on how it would be received this time.

Fortunately, someone listened. The federal budget of 2018 responded to a number of its 35 recommendations, including, of course, key elements of the research ecosystem. Needless to say, the significant investments for the granting councils received the most attention by both media and the knowledge communities alike.

It's a generally happy story.

But the expert panel report also made some other key recommendations that will need further response if so-called 'ecosystem' benefits are to follow.

For starters, the report argues for a new National Advisory Council on Research and Innovation (NCRI) to replace the moribund, largely confidential body appointed by the previous administration. Clearly, when implemented, this new organization can be helpful not only to the science and innovation ministers, but to the chief science adviser in her work centred on ensuring that evidence is considered when government makes critical public policy decisions. As the Naylor report noted, the proposed NCRI could give ongoing advice on the effectiveness of both extramural research agencies and intramural research groups and facilitation of collaboration among them.

Further, the report flags increased federal-provincial-territorial collaboration as essential if Canada is to speak effectively on the international stage and take advantage of the key strengths in various areas. Many of these are identified in the Council of Canadian Academies' recent report on the state of science and industrial research and development. This shared agenda of pan-Canadian collaboration is critical if the country is to meet increasingly 'intermestic' challenges that require joined up efforts to address serious matters affecting society, economy and environment, both here and abroad. Canada had such an effort triggered in 1987 when all jurisdictions signed on to its first—and only—National S&T Strategy. As the then science minister said about the previous situation of developing S&T strategies, "A principal pitfall was that many well-intentioned efforts were unilateral, ignoring the political structure of Canada, and the complexities of our economy."

Today, there are indications that increasing cooperation is necessary with a well-articulated pan-northern science approach of the three territories and bilateral initiatives with a growing Ontario-Quebec research corridor, for example. And the recently released visionary, national Inuit strategy on research will go some ways to addressing one of the Naylor recommendations for long-term meaningful partnerships and support from the granting councils with Indigenous and community-based knowledge systems. But more needs to be done.

The usefulness of relevant knowledge: the Naylor Expert Panel revisited

Originally published by The Hill Times

Another related matter has been Canada's inability to structure decision-making guidelines for supporting engagement in so-called big science or major research facilities. These have been traditionally handled on an ad hoc basis, often with political rather than strategic motive, and with little regard for how these facilities fit into the overall research landscape, not to mention global linkages. An attempt was made to address this under the previous national science adviser to the prime minister, but was lost when that office was terminated. The Naylor panel picked this up and argued for a special standing committee on major research facilities to be convened by the CSA so as to better advise the government on coordination and guidance for the life cycle of these large infrastructures. Addressing this properly will also require a more activist role for science diplomacy in ensuring international partnerships.

To be sure, some effort is underway to pick up elements of these recommendations, and while the Naylor expert panel may have missed some opportunities to weigh in on other challenges affecting Canada's complex knowledge governance structures, we can at least look forward to further action by all concerned to address some of these other critical gaps underscored by the panel.

‘Reimagining’ National Academies: A Northern Minerva Reboots

Originally published by Research Money

‘Reimagination’ is very much in the news today (not to be confused with the imagineers at Walt Disney Imagineering). We saw the word trotted out in the 2018 federal Budget on how the 101-year-old National Research Council (NRC) was going to form a new conception of itself — not that it hasn’t been reimagined several times before.

We are also seeing it elsewhere. In the UK, preoccupied with an inward looking Brexit mindset, the seven existing research councils along with Innovate UK have been integrated into a new structure called UKRI or UK Research and Innovation. In China, where dictated governance is an oxymoron, new ways of shaping research are being put forward within the administrative apparatus of science. This occurs as that country moves rapidly to become a global science leader. And in the US, well, let’s just say that their own historic increases in science spending caught some observers by surprise.

Back here in Canada, something unusual (some would even say unprecedented) has been taking place within the knowledge community. For starters, the wizened ‘whine and wimp’ lobby is gradually being replaced by a more politically astute assemblage of organizations that represent various dimensions of a newly attuned ecosystem for ingenuity and creativity. They have learned to make a stronger public policy case for why investing in the long-term can reap benefits to society and future generations. And elected representatives serving Canadians seem to be listening. Witness the impact of student groups, researchers, NGOs and others in the latest federal budget.

One of these revitalized players is the 135-year-old Royal Society of Canada (RSC). Of course, when you are that well-anchored, it can be difficult to change attitudes and perceptions about you. But sound leadership makes a difference. An honorific society designed in part to mobilize Canadian intellectuals in all fields to work with Canadians and address pressing issues of our times has made strides in trying to rejuvenate itself. As one of its earliest members envisioned the unique multidisciplinary blending of the RSC in 1883:

“Let us not forget that science alone can enable us to discover, to explore all of the vast treasures which are concealed in the lands of our vast country. Let us not forget that science and literature united can do much to attract to our shores the vast flood of European immigration in search of homes, of bread and liberty.”

So when the RSC recently launched its strategic plan for 2018-2022, abetted by a broad consultation, optimism has emerged that a ‘re-imagined’ academy can play a pivotal role in reshaping a future Canada — along with other key partners. Indeed, one of the pillars of the three-pronged plan is centred on greater engagement respecting evidence-informed decision-making.

To punctuate this approach and to take advantage of Canada’s hosting of the 2018 G7 Summit in June, RSC has launched a series of G7 Research Summits to provide input to the government’s agenda and its global statecraft. Advancing gender equity in research – a priority of the Trudeau administration – was on the map two weeks ago at the Museum of Nature. This was during a meeting of the G7 science academies in Ottawa when the RSC worked with its partners to develop two statements about the global Arctic and our digital future. As has been done in past summits by other G7 academies, these succinct, readable reviews with science-informed recommendations will serve to give summit leaders reliable background knowledge when they come together in Charlevoix, Québec.

‘Reimagining’ National Academies: A Northern Minerva Reboots

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But before that, with a timely event given the Facebook firestorm, the RSC will explore ‘our digital future’ in more detail, partnering with the NRC in examining transparency and openness along with inclusion and accessibility. Unlike the technology, ethics does not scale. Hence, regulatory, privacy and policy issues will undoubtedly dominate.

Later in May, the theme of Arctic sustainability takes centre stage with discussions of climate change impacts on northern communities and the critical role of traditional knowledge within Inuit populations. This is a result of building upon a Montreal event on a related student-led Arctic science diplomacy, which is organized by the Science & Policy Exchange.

Hopefully, this will bring on board some of the key recommendations raised in the National Inuit Strategy on Research released on March 22. And in the fall, a conference on Data to Insights, with Statistics Canada – another 100- year- old organization – will underscore data literacy and the use of reliable information. Finally, to round off the research series, sustainable oceans will be on the agenda of the RSC with key experts from Canada and abroad.

The reimagination of the RSC is a healthy one because it responds to an underlying current that excellence, facts and evidence must come to the fore in a confusing, post-truth world. But for it to succeed, a joined-up approach will be needed. There must also be serious commitments from the various governments to implement and disseminate the input in a meaningful way for and with their citizens.

Gender Equity in Science Comes to Montreal — But Gaps Remain

Originally published by Research Money

This week, the North American Gender Summit sponsored by NSERC and Quebec's Fonds de Recherche took place amid a growing renaissance on the gender and science policy issue. l'Oreal Canada and UNESCO hosted the 15th ceremony honouring research efforts of women in science from Quebec and Ontario. Since they were launched, 65 women from Canada have been recipients of this prestigious award, which also has a large international component. Canada's science minister was there along with other guests including the new French Ambassador to Canada, the president of the Canadian Commission to UNESCO's Natural, Social and Human Sciences Sectoral Commission and the federal government's Chief Science Advisor — all women.

In her remarks, Minister Duncan underscored her activism when it comes to increasing the participation of girls and women in science and Indigenous knowledge. And she mentioned some encouraging signs on the equity front for Canada Research Chairs. Yet... the message has not translated fully within the country's education and knowledge leadership. While we celebrated a Canadian Nobel recipient for Physics in 2015, in the history of these awards since 1901, there have been no Canadian female Nobel Laureates in the sciences.

According to a 2014 CCA report, Canada is missing out on an important supply of skilled talent. Increasing the STEM participation of under-represented populations, including women and Aboriginal peoples, is an important strategy for diversifying the supply of STEM-skilled individuals. Just 29.6% of individuals with post-secondary STEM credentials and 26.9% of those employed in STEM-intensive occupations in Canada are women.

To be sure, there are a number of organizations promoting and empowering women in knowledge sectors. Today, media in all forms have a strong role to play in promoting a fairer science in Canada—science blogging and journalism about and by women are on the increase as are narratives detailing the power and passion of the sciences and research (in all disciplines) that are making a difference.

The private sector has a responsibility as well and needs to step up and do more in its hiring practices including support for women in the form of training, access to finance and backing for entrepreneurship—women hold only 8.5 per cent of the highest-paid CEO positions in Canada's top 100 listed companies. Signals to society from our science and innovation leaders matter: for example the PM's annual Awards for Teaching Excellence and Early Childhood Education underscore the gender issues.

As we discuss a more gender-neutral national anthem and advocate for more women on our currency, we should not forget the critical contributions of our pioneers along with the next generation of girls and women in shaping our knowledge-based society.

Daring to innovate: Quebec launches five-year strategy for research and innovation

Originally published by Research Money

Quebec has come a long way in strengthening its knowledge capacity since the early days of the Quiet Revolution. The notion of investing in S&T for its economic, social and cultural development has always been central to its policy platforms irrespective of political party. The May 11 release of the 126-page Quebec Research and Innovation Strategy (SQRI) by Quebec premier Philippe Couillard signals a major shift by the province to aim much higher and up the province's innovation game.

Quebec is already leading across the country in its GERD/GDP ratio at 2.30%. To up its game further, the new five-year strategy (2017-2022) focuses on three key elements — developing talent and inspiring the next generation; increasing the research and innovation capacity in all sectors; and amplifying the transfer of knowledge and its commercialization. The SQRI builds on the Quebec government's March 28 budget and supplements some of its STI initiatives (see chart).

Entitled Oser Innover (Daring to Innovate), SQRI invests \$585 million in new funding and spells out inspirational targets for the plan. The premier suggests that by 2022, the strategy will position Quebec as one of the top 10 leaders within the OECD in research and innovation. Quebec also aims by 2030 to have one of the world's most innovative societies when it comes to producing talent, ideas and creative solutions in the face of grand local and global challenges.

Another leitmotif of the strategy is its call to coordination and coherence. Much is made of the work done to integrate the various government agencies and ministries within the plan; an annex in the report outlines the many instances of these various strategies.

Within Quebec, the central plank is a strong science and innovation culture — one that encourages a capacity within citizens to base decisions on knowledge, evidence and science; instills a passion for science at all levels; and encourages the development of talent within society (just over 20% of Quebec students graduate in the sciences and engineering; among the lowest in Canada).

Other key components:

To boost the profile of science within schools, the Ambassadors for Science program will see CEGEP and university students conduct science experiments and assist teachers at primary and secondary schools. A prototype apprenticeship program will be launched to support new ideas developed by young people in key sectors.

Support for Quebec's well-developed science outreach organizations via NovaScience will continue to encourage interest in science and recognition of excellence will also be enhanced. Through the Quebec plan, efforts are also underway to provide guidance for high school students, particularly young women, seeking or wanting to learn more about careers in science and technology. Internships for science and engineering students in business innovation are outlined with \$50 million allocated through existing programs such as Mitacs and the first research employment program under QuebecInnove for college and university students to gain experience in business.

Daring to innovate: Quebec launches five-year strategy for research and innovation

Originally published by Research Money

Quebec's innovation ecosystem of research organizations and institutes will get a \$300-million boost over five years, including platforms that underpin these research entities. These investments follow other recent announcements, including \$117 million for a new provincial life sciences strategy and \$40 million for Genome Quebec's precision medicine competition. Another \$490 million over five years is directed at matching funds for Canada Foundation for Innovation-supported projects, as well as other federal programs that require co-funding. In addition, Quebec's research granting councils will receive a collective increase of \$180 million over five years.

The SQRI also lays out several measures to address perennial low business investment in R&D – over and above Quebec's generous R&D tax credits. Its new portal, QuebecInnove, brings together the key players in innovation (start-ups, risk capital, granting councils, financial, intellectual property, other tax incentives, SME support, etc.).

Superclusters are also targeted – one in artificial intelligence will receive \$100 million while another in Smart Manufacturing 2.0 (SM2) will net \$13 million. StartUp Quebec receives just over \$6 million to support its international linkages and develop university incubators and accelerators. Further support for StartUp Jeunesse (youth) will help groom budding entrepreneurs in secondary schools and in universities, including a science-based innovation contest.

Innovation hubs will benefit from new money to strengthen their development in selected regions of Quebec. The province's well-established small business and innovation research organization, CRIQ, will be reinforced with investments and intelligent (smart) transportation in various regions and cities.

The report also takes several steps to ensure its plan is implemented. An inter-ministerial committee for research and innovation will work with Quebec's chief scientist and research councils to ensure there is ongoing consultation on the strategy's actions. A call to use evidence in informing decision-making is emphasized. As well, the SQRI will establish a PublicLab to develop an innovation platform within the government – akin to the What Works centres in the UK that support bold ideas to improve innovation within the public service. Open government and open science are also underscored with the increased use of digital materials and investments to enhance the digital shift for businesses. The SQRI builds on extensive public input and the strong tradition of encouraging a science and innovation culture. In releasing this ambitious approach, Quebec dares others to follow.

Galvanizing a go-global education strategy

Originally published by The Hill Times

A report this month from the Study Group on Global Education, made up of Canadian businesspeople and academics, offers some revealing insights on preparedness and potential for Canadian students studying abroad. With only 11 per cent of undergraduate students having some form of international experience, it argues that we are stuck in neutral when it comes to competing with a limited selection of peer countries, and that the country needs a pan-Canadian approach to address this issue.

“The current generation of young Canadians will need to be comfortable working with people from different backgrounds. They will need self-awareness and self-confidence, a willingness to take smart risks, and knowledge of the world and other societies,” the report says.

“These are not luxuries in the 21st century; they are vital skills.

“Global education fosters these skills.”

Solutions are suggested, such as to “significantly increase the number of Canadian post-secondary students learning abroad.” This would be done by enhancing learning abroad by setting a “national target of one-quarter of all Canadian post-secondary students going abroad on credit and non-credit learning experiences within 10 years;” and establishing a “new national initiative—Go Global Canada—to support 15,000 Canadian post-secondary students per year going abroad within five years, rising to 30,000 per year within 10 years.”

The report also outlines how Canada’s post-secondary institutions should make international education an integral and leading component of their own internationalization strategies.

We’ve seen versions of these suggestions before. Five years ago, another expert panel led by Western University’s Amit Chakma, offered a series of proposed solutions to Canada’s international education approach; that was welcomed at the time by higher education and business alike. That 2012 report made 14 key recommendations, among them:

- double the number of international students choosing Canada by 2022;
- introduce an international mobility program for Canadian students to serve 50,000 students per year by 2022;
- make internationalizing education in Canada a strategic component of government of Canada official policies and plans;
- regroup grants and scholarships available to international graduate students and post-doctoral fellows under one label/brand; and
- develop comprehensive and multifaceted bilateral agreements with priority countries that focus on all aspects of graduate education and research, supported by appropriate levels of funding.

While it had commissioned the report, the then-Conservative government’s response was tepid at best. Like many expert panels, this one’s efforts largely disappeared, with few lessons learned.

Galvanizing a go-global education strategy

Originally published by The Hill Times

And now there's another effort. The 20 recommendations of the new report produced by the University of Ottawa's Centre for International Policy Studies and the University of Toronto's Munk School of Global Affairs target responsibilities towards various stakeholders. They are anchored by a notional overarching Go Global Canada strategy and budget orchestrated via a Global Education Leadership Council.

Though there were no students in this study-group membership, the next generation must also have a say. They are potential ambassadors: our future, well-rounded citizens. Ultimately, they are the projection of Canada abroad.

Fortunately, student groups are becoming much more engaged in these discussions that will affect their forward paths. Examples include the Science and Policy Exchange organization of graduate students making the case for support of the Naylor expert panel on fundamental science, and the student-represented group advising Quebec's chief scientist on issues of outreach and accessibility. The Mitacs programs for international exchanges are also active on this front, and the prime minister's Youth Council could also take some of these issues on board.

The student and youth voice—diverse and inclusive—is taking on a more activist role on social media, boards, and advisory panels as the country's higher education and research institutions rethink how to co-produce new policies and programs for a more effective representation.

Student organizations and groups need to be given every opportunity to have a real say in international learning and experience abroad. They will control their future.

Inclusive and responsible innovation coming full circle

Originally published by The Hill Times

To say that trendy titles for creative ideas are making a comeback in policy circles would be an understatement. The semiotics surrounding this embrace for knowledge, innovation, and technology are quite rich. Inclusive, sound, responsible, open, transparent, citizen-led, human-centric are just some of the monikers now appearing on the global stage.

Take, for example, the recent statement of G7 Industry and ICT ministers (all men incidentally) issued out of Torino, Italy, last week. The 15-page declaration, "Making The Next Production Revolution Inclusive, Open, and Secure," covers considerable policy ground, including digital futures, IPR, SMEs, start-ups, human-centric AI, cybersecurity, and related matters. The opening section opines that: "The pace of change is accelerating. The Next Production Revolution is now. The combination of a variety of digital and other technologies, new materials and new processes is already transforming production in our countries, with pervasive effects on our lives. This transformation has the potential for far-reaching effects to productivity, employment, skills, economic growth, trade, well-being and the environment. It brings opportunities, as well as challenges for our economies and societies."

The declaration was followed by another from G7 science and research ministers (not all men) on training and research infrastructures, including a central issue on the role of the education and research system in ensuring that the so-called new technological paradigm might bring social and economic growth, create social cohesion, and reduce inequalities. Considerable effort on this subject is ongoing in academic and policy environments, including work at the University of Ottawa's Institute for Science, Society and Policy.

But there is a history to all this. After Canada first joined the group in 1976 (making it formally the G7), these summit meetings have always addressed emerging and transformative global issues underpinned by the pace of knowledge and technology.

For instance, 35 years ago, the G7 heads of state and government commissioned a working group on technology, growth, and employment in June 1982 to explore the opportunities problems and challenges presented by emerging technologies. Their 80-page report in January 1983 outlined the role of science, technology, and innovation in revitalizing economic development and growth.

Future potential for new technologies such as robotics, remote sensing ICT, biotechnology, and renewable energy was underscored, with a reminder that fundamental scientific research is one source of technological progress in industry and should be given special support by governments, along with a tellingly cautionary note that: the fate of our scientific and technological innovations is largely a function of the willingness of the public to accept them.

The report went on to make a series of recommendations on regulatory, patent, and trade policies, capacity building in the developing world, greater international cooperation in science and technology, and impacts of new technologies in mature industries. It concluded by noting that G7 leaders take science, technology and innovation into account in their policy decisions and continue to include these on their agenda at future summit meetings. Hence, innovation, growth and employment have indeed benefited from CPA, continuous partial attention.

Inclusive and responsible innovation coming full circle

Originally published by The Hill Times

So as Canada prepares for the 2018 G7 Summit in Charlevoix, Que., it should build on this ongoing attention to inclusive innovation and knowledge creation. There is much to build on ranging from the federal government's Innovation and Skills Plan, to the recommendations issued by the Naylor review of fundamental science along with the strategies of provincial governments, along with work of science organizations and academic research now underway. But it should also be prepared to answer the key issue of responsible innovation for what purpose—paying special attention to the social, environmental and economic engagements and impacts.

The aggrieved and the beguiled: experts and evidence in troubled times

Originally published by The Hill Times

Is it not a curious fact that in a world steeped in irrational hatreds which threaten civilization itself, men and women—old and young—detach themselves wholly or partly from the angry current of daily life to devote themselves to the cultivation of beauty, to the extension of knowledge, to the cure of disease, to the amelioration of suffering, just as though fanatics were not simultaneously engaged in spreading pain, ugliness and suffering? The world has always been a sorry and confused sort of place—yet poets and artists and scientists have ignored the factors that would, if attended to, paralyse them. (Abraham Flexner, The Usefulness of Useless Knowledge, 1939)

Looking around the world these days, you would be forgiven if you felt that reason and evidence was collapsing as a sound tool of decision-making, let alone a hopeful light to shine through the darkening horizons around our planet. Brexit has stirred the populist emotions of citizens across the pond; south of the border, chaos reigns as Twitter trumps the traditional tools of public policy.

Fortunately, the knowledge and research communities have started to wake up to their civic responsibilities. The Marches for Science that took place in April in Canada, the U.S. and around the globe were designed to address this disturbing trend that experts and expertise are under attack. Many are hitting back by creating new vehicles for improving sound integrated science and social sciences literacy in our cultures.

In Canada, rhetoric about valuing the sciences and respect for scientists is a helpful sign that things can get better. As the science minister said in a recent speech: “it is our shared responsibility to explain how investments in research and scholarship through the granting councils and CFI (Canada Foundation for Innovation) serve science and the public good.” The expert review panel she commissioned on Canada’s Fundamental Science was a good first step and we now await action on its key recommendations alongside the appointment of a new chief science advisor.

We are fortunate that we can indeed recognize our scholars and their contributions to improving the human condition. A case in point is the annual event to award Killam Prizes offered by the Canada Council and presented by Canada’s indefatigable Governor General David Johnston. Last week at Rideau Hall, he reminded the audience that the variety and depth of work indicates the quality of research taking place in Canada, and most importantly, it is helping Canada build a smarter and more caring society. The GG Innovation Awards are another testament to his leadership in showing that expertise, creativity and knowledge matter. The CIHR Gold Leaf prizes and the NSERC Gerhard Herzberg Gold Medal Awards are yet other examples of why we need to salute our visionaries who have made a difference.

And it is intergenerational as well. The PM’s Awards for Teaching Excellence that will focus on STEM next year will no doubt help launch a new generation of inquisitive and ingenious talent. The youth ambassadors and other Canadians joining the remarkable Canada C3 (Coast to Coast to Coast) expedition that left on June 1 for its 150-day journey across the country will celebrate our diversity and will play a key role in shaping our knowledge heritage alongside the digital learning experiences made available for teachers, students, heritage sites and museums. Visiting the magnificent, newly operational Canadian High Arctic Research Station at Cambridge Bay will be a highlight to be sure.

The aggrieved and the beguiled: experts and evidence in troubled times

Originally published by The Hill Times

In fact, that research station along with other ventures offer a beacon for a stronger Canadian presence around the globe in lifting the veil of ignorance for better public policy. Deploying our knowledge assets for enhanced international partnerships in scholarship and research is our strong card to play in this troubling world. Thomas Huxley, the British biologist, said it well in 1887 when he reminded us that: "The known is finite; the unknown in infinite; we stand on an islet in the midst of and illimitable ocean of inexplicability. Our business in every generation is to reclaim a little more land."

From ‘InnovAction’ to innovation, it’s time to get serious

Originally published by The Hill Times

This year marks the 30th anniversary of the Mulroney government’s Canadian Strategy for Science and Technology (InnovAction), the 15th anniversary of the Chrétien government’s two-pronged innovation strategy, and the 10th anniversary of the Harper regime’s Mobilizing Science and Technology to Canada’s Advantage. And lo and behold, as if right on cue, comes another agenda—this one a summary of consultations on innovation for making a better Canada.

It is hard to innovate in policy documents; essentially they all say the same thing, with a dash of emphasis here, and sprinkle of investment there:

- Mulroney (1987-Waterloo): The private sector therefore has to do more research and development, and take up a greater share of the national effort in science and technology.
- Chrétien (2002-Toronto): I am saying to you that business must invest in learning for their workers if they want to compete. Canada is not doing enough here.
- Harper (2007-Waterloo): The private sector in Canada needs to do more of what it alone can do, which is to turn knowledge into the products, services, and production technologies that will improve our wealth, wellness, and well-being.
- Trudeau (via Bains, Ottawa, 2017): We also heard that if Canada wants to build world-leading and globally competitive innovation clusters, this country must do a better job of translating our science and technology strengths into commercial activities, including stronger, more coordinated partnerships among university-based researchers, industry and government.

One could go on citing a similar conversation on other issues: the essential point is that few are against progress, they differ mainly on priorities and values.

Does all of this continuous partial attention make a difference? Is it all just smoke and broken mirrors? Hard to say. We rarely go back to see what was learned; instead, documents are archived, and a new government ignores the previous administration’s policies.

Quite often the vocabulary is imprecise and muddled. As a recent Nature article argues, “moonshot,” “road map,” “initiative” and other science-planning buzzwords have meaning, yet even some of the people who choose these terms have trouble defining them precisely. A former Canadian industry minister, Alastair Gillespie: once said something similar: *“as politicians we have a major responsibility to articulate what innovation is, to other politicians and to our electors.”*

At the end of the day, our veritable innovation—however you define it—has really been about creating novel experiments, outside of strategy tracts or agendas, that respond to real demand or challenges, and hence make a difference to all Canadians.

From 'InnovAction' to innovation, it's time to get serious

Originally published by The Hill Times

Take for example the National Research Council, just celebrating its centennial last year and going through yet another re-tooling. Most forget that it was a critical centrepiece in Canada's war time efforts. It has been the breeding grounds for what is now the Canadian Space Agency, AECL, NSERC, and CIHR, not to mention the science and technology and aviation museums. Whole companies have spun out from the NRC's research, and Nobel Prize and Academy Award winners have worked there. In short, the NRC is responsible for a good deal of Canada's nation-building legacy around fundamental research, technology, and innovation; and it remains vital today.

Design of newer institutions such as the Canada Foundation for Innovation, Genome Canada, Grand Challenges Canada, Canada Research Chairs and Networks of Centres of Excellence (adopted from the Ontario model) and Canadian Institute for Advanced Research to name a few, can be interpreted as having responded to obvious gaps in our knowledge ecosystem, as well as to emerging threats and opportunities.

In 2017, we have truly troubling issues both here and abroad that will require a clear response from our knowledge leaders, and engagement with all of our research assets. We need to get serious in marshalling innovative responses to these challenges.

The Henderson Chronicles- Reflecting on Science, Innovation and Skills Agendas over the years

Originally published by Research Money

RESEARCH MONEY has always had impact. Since its founding three decades ago, the newsletter has covered a good deal of Canada's STI debates and discussions. When it debuted in 1987, Canada had its first and only national science, technology and skills plan—one that was adopted by all levels of government.

There was also a Science Council of Canada and a newly formed advisory board called NABST. The federal government of the day was pushing the Canada-US trade and economic development relationship. The Arctic was seen to be a key to national sovereignty and protecting the country's environmental heritage was a major touchstone. The PM gave a speech on March 4 in Waterloo (where all future PM's have since made a pilgrimage) stating, *"We can compete with the best, we can be world leaders, and in many areas we already are — In science and technology, Canada must itself become a byword for excellence."*

As 30 years have passed, so too have a raft of science, technology and innovation policies with similar messaging. Since taking over as editor in 1994 from Vince Wright, the commentary and interviews by Mark Henderson have tackled many of these policy subjects such as protecting intellectual property and changing rules for tax credits; creating a new high technology economy; covering how the natural resources sector will bail us out—after all, we are hewers of wood and drawers of water and a so-called energy power.

The success of our higher education sectors has been often highlighted where the university lobby has been remarkably adroit at re-shaping the rhetoric of respective governments when they come into power and procuring major new investments. Mark has also probed the pitfalls and challenges of the government sector and public good science considerably downgraded and eroded with few to champion its cause. And, of course, there was considerable editorializing on the industry and technology lobbies which remain the weak link of the ecosystem for innovation. As was so aptly put it in the 2013 CCA report Paradox Lost, *"Canadian firms have been as innovative as they have to be."*

Through all of this, Mark has been chronicling the ups and downs of the debate—it has been no easy task. Sound and reliable information from sources often reluctant to talk (especially over the past decade when the Harper regime shut down its own scientists and government communications shops) is no mean feat. As a source for inside information and helpful analysis about new trends and data, not to mention a platform for many to air their respective views, RESEARCH MONEY knows few peers.

Mark's editorials have been a valuable guidepost to the many issues that still plague the Canadian innovation landscape—they do not escape his notice. With the creation of CFI, Henderson warned in 1997 (March 12) that, *"The CFI board of directors must also be sensitive to the needs of the basic research community as a whole, and smaller schools in particular. Otherwise, the corporatization of the university system could lead to distortion and long-term damage."*

On Canada's bioscience capability, a November 26 1997 column noted that, *"The failure of Canada to maintain a presence in the global race to map the human genome is bewildering... that's about to change with the emergence of the Gene Sequence Centre in Vancouver and a high-powered, MRC -funded task force mandated to get genome research in Canada back on track."* (Genome Canada was yet to come into being).

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Regarding the constant tinkering with the NRC, in a Nov 24 1999 issue, he remarked that, *"Too much of Canada's S&T emanates from the NRC to risk starving it to death. Canada's fiscal surplus is large enough that there are simply no more excuses."*

With the global scene, he also argued. *"It's time government looked seriously at what constitutes Canada's international S&T effort, benchmark it against other nations, and act accordingly ... Being a small nation doesn't mean we also have to be small-minded."* (Dec 2 1998)

And the social sciences did not go unnoticed when fewer funds were to be had: *"This concern is not only coming from those engaged in, or supportive of, the social sciences and communities. It's also being raised by prominent members of the business community, who recognize that knowledge comes in many forms other than software code and chemical compounds—the new media sector demonstrates how interdisciplinary research can produce spectacular results."* (May 12 2000)

In a Jan 20 2003 column about the newly posited Innovation and Skills strategy of the Martin government, *"there certainly isn't a lack of good ideas — it's a matter of political will and making tough choices and thinking beyond the next election. Public ignorance on the centrality of S&T and innovation can be changed. The behaviour and motivation of politicians may prove far more difficult."*

And very recently this year, he was at it again noting that. *"The new Innovation and Skills Strategy, if properly resourced and implemented, could be the tool for ushering in a new era of innovation."*

Mark also weighed in on the proclivity of politicians to delay through continuous consultations. Here he is in 2001 (Nov 28): *"By all means, the government should consult with stakeholders and demonstrate flexibility in shaping the innovation strategy and new initiatives. But don't stall on the issues that need immediate attention. No more delays. It's time to get the innovation show on the road."*

In a Dec 18 2013 editorial he riffs on another Canadian condition that is well known to policy wonks: *"Canada's resource- and knowledge-based economies can be developed in tandem, cross-fertilizing one another and creating vast new sources of revenue generation—such a sea change from the status quo requires support for both basic research and innovation—not the either-or approach now being pursued in Ottawa. And it requires champions throughout the innovation ecosystem tied together by a holistic approach to identifying, building and exploiting Canada's research strengths."*

It's not easy being on top of these issues and writing about them week after week, year after year. But in 23 years, Mark's concise and expressive columns offer a positive tone in all of their concluding messages. Students of science policy will find a treasure trove of material that has marked the evolution of the STI issues in this country.

Readers of RE\$EARCH MONEY will miss Mark's guiding hand but will enjoy his continuing contributions to this important publication. Mark, we wish you an enjoyable musical interlude and future re-wiring.

The rise of the knowledge disruptors

Science learning is being retooled

Originally published by The Hill Times

“As we develop science policy we need to look beyond the short-term context, beyond the research that looks immediately promising. If we’re blinded by the urgency of our problems, we will go the wrong way. We’ll be investing in horses, carriages, and cleaning up the streets instead of fostering the research that can give rise to an idea or technology that is going to change the world.” —Mike Lazaridis, The Power of Ideas, 2012

There are emerging signs of a movement within Canada’s young talent pool and novel institutional experimentation to strengthen the knowledge and discovery base. It is increasingly inclusive, diverse, and transdisciplinary, and it is network-savvy. It does not always start with universities. Nor does it necessarily rely on more structured industry-higher education partnerships or slow-moving government policy. In fact, at the Canadian Science Policy Conference (CSPC) on Nov. 8 to 10 in Ottawa, the notion of disruption was a major cross-cutting theme.

Share labs, big data, community social innovation, crowdsourcing, citizen science, grand challenges, or mission-oriented public ventures are the new mantra—but at the heart is the power of the bright idea married to an unconventional perspective with an ability to take risks. Luck and passion matter, but so do proper incentives. No one can predict where the next big idea will emerge, let alone impact society.

Not that this hasn’t been tried. For example, 30 years ago, the Science Council of Canada developed a national consultation on emerging technology, surveying more than 3,500 scientists and engineers about Canada’s responses to emerging or transformative technologies.

Quantum computing was barely a dream then, not to mention mobile telephony, virtual reality, and autonomous vehicles (unless you were a fan of science fiction or the Jetsons). But in 1986, genetic engineering, lasers, artificial intelligence, and robotics made the short list. Innovations in “legacy sectors” of the economy—fossil fuels, manufacturing, transport, agriculture, health-services delivery, and others—also received a nod, given the need to address major societal challenges of the day.

At the 8th CSPC conference, we learned a great deal of what is driving these unique experiments that will shape the next decades. Attention to public policy gaps was a major theme. How can existing educational institutions designed for another century actually keep up to the pace of the change? How do we signal and support these new opportunities with and by the next generation? What should be done to provide relevant support in keeping the lights on and in backing winners? And, of course, how does talent, skill, and creativity mobilize to address both the sunlight and shadows of these frontier innovations?

In many ways, as the Ontario minister of research, innovation, and science underscored at CSPC, Canadians are still grappling with the same questions, such as how to increase the speed of response to opportunities arising as disruptive technologies emerge, how to deal with the adverse effects of these, and how to improve co-ordination between key actors in this new space.

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Science learning is being retooled

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To be sure, the landscape has changed in the past decade or so. Organizations such as Grand Challenges Canada, Genome Canada, the Perimeter Institute for Theoretical Physics, Institute for Quantum Computing, Canadian Institute for Advanced Research, and others are morphing to capture this new wave. Newer ventures are under way, such as RBC's Machine Learning Lab, within the University of Toronto's Banting Institute, headed up by entrepreneur Foteini Agrafioti, or the pHacktory led by Andrew Pelling, designed to bring curiosity-driven research projects to the street and distribute them across Ottawa.

Science learning is being retooled through Actua, Let's Talk Science, Beakerhead, and NovaScience, to name a few. And then there is the experimentation centered on spurring our next generation of leaders, with the new Mitacs science policy fellows, the Science and Policy Exchange in Montreal, and Science Outside the Lab – North. Social innovation is not to be overlooked, with community-led and provincial-territorial initiatives using evidence and knowledge to shape sound public policy.

So when the federal government triggers an agenda for innovation or assesses the impact of fundamental science through a review panel, or when other levels of government engage in designing new pathways and platforms, it should be remembered that there is a great deal going on across this country and globally. The disruptors are hard at work as the very culture of the sciences is shifting; oh, and it has a human face.

Why Vision Matters; or How to Lead in Science

Originally published as a blogpost by CSPC

Coming up to its first anniversary in power, the Trudeau administration is coping with many consultations and challenges. This high expectations path forward is uncertain even for this majority government.

In the science, technology and innovation space, much is underway. After all, this is a government that promised to “value science and treat scientists with respect” following the antediluvian Harper era. The first few days in power of the Trudeau regime had two ministers declare that government scientists could now speak to the media without cumbersome filters; though whether this has been applied across the board with new guidelines remains unclear. The long-form census was re-established with a high return rate, though the Chief Statistician has since resigned arguing that Shared Services Canada ham-handed attempts to centralize all information technology services across government has compromised Statistics Canada's ability to fulfil its mandate.

Funding for research got a boost in the first budget and some of the Harper programs (CFREF for example) were followed through with announcements; but changes in the CIHR peer review process led to a major controversy within elements of the health research community requiring the Health Minister to weigh in (never a healthy thing). Canada's premier public research institution, the NRC, celebrating its Centennial, has had a controversial President replaced with a fixer from inside the bureaucracy, presumably to help tackle the troubles at the temple. And the announcement by the government of 11 new CERCs for a new competition to once more try to address the gender equity gap has been launched ---this time with feeling.

In short, things may have appeared sunnier, but some clouds have rolled over the knowledge landscape. Along the way, the science minister has had her own mandate issues to address. A chief science officer (make that scientist) is to be appointed with a still undefined role and a fundamental science review is underway with a high powered advisory group. A loosely- shaped innovation agenda is being promulgated by the senior Minister responsible for science and innovation (always helpful to remember what Canada's first science minister said in 1971: —“as politicians we have a major responsibility to articulate what innovation is, to other politicians and to our electors.”)

A data driven exercise to inform this agenda is well underway with work by the Council of Canadian Academies as well as within the holdover confidential advisory body from the previous government. Gender equity and greater participation with the next generation entrepreneurial talent is a key part of these policy platforms not to mention renewed attempts to embrace traditional knowledge and education within the country's STI ecosystem. And rebranding of Canada as a key player in global science and innovation remains paramount, especially concerning clean energy and research excellence in key areas. All of this has brought some good will from the research and entrepreneurial community, in part demonstrated by the enormous number of submissions provided through the consultations, both traditional and via social media.

But----will it last. Much depends on leadership of course. As Trudeau himself has said regarding his progressive mantra :

It's not hard to see how the connections between computing, information, robotics, and biotechnologies could deliver spectacular progress. It's also not hard to imagine how it could produce mass unemployment and greater inequality. Technology itself will not determine the future we get. Our choices will. Leadership will.

Why Vision Matters; or How to Lead in Science

Originally published as a blogpost by CSPC

Back in 1983, his father, Pierre, said much the same thing:

the government must be more than a patron of technological enterprise, more than a source of funding, for even more fundamental is the government's responsibility to help manage the impact of technological change, and to act as an honest broker between competing forces in the movement towards a technologically-sophisticated society. Government's preoccupation must be to ensure that the benefits of this revolution outweigh its costs.

So what can one expect in this hippish leadership centred on respect for science, using evidence to inform decision-making and support of reliable knowledge—one that has yet to define a compelling vision with Canadians?

For starters, Canada has a birthday coming up. Initiatives are underway to celebrate and signal achievements; and with good reason. Science has been a strong contributor to nation-building. Any effective pan-Canadian approach to a future vision for the country will require a careful re-engagement with all levels of government.

Almost thirty years ago, in 1987, the Council of Science and Technology Ministers (representing all of the provinces, territories, and the federal government) tabled a discussion paper to the First Ministers Conference on Canada's research and development effort. In it, they argued for a stronger industrial R&D effort; excellence in fundamental research (supporting the then proposed concept of national networks of centres of excellence); an orientation to science and technology in the Canadian culture (building on the Science Council of Canada's path-breaking report on science education in the schools); and ensuring a greater level of consultation between the levels of government, industry and the academic community on proposed new S&T initiatives. The Council also had a cross-country consortium of advisory groups to assist it-- the National Forum of Science and Technology Advisory Councils. That forum had a mandate to "examine issues affecting Canada's ability to develop and apply science and technology; and to formulate advice to influence Canadian's national and provincial science policies for the enhancement of the Canadian economy." All of this has since gone by the way-side.

Today, a new window of opportunity presents itself in exploring a national approach to the science and innovation agenda. Looking to 2017, there are a number of ventures underway designed to fill gaps in knowledge governance system as well as stimulate and engage with an increasingly knowledge-thirsty society. These, if properly channelled and supported, will help shape a more effective public dialogue and further action in science and innovation. A hopeful trend is emerging in Canada where neophobia is no longer the watchword, and heady institutional experimentation is underway; much of it from bright minds leveraging new partnerships and unique business models as governments struggle to meet the expectations of their citizens. Leadership and choices are indeed to be the watchwords. We look forward to the PM's forthcoming speech and action agenda as he seeks common ground with his counterparts across the country on the vision of why knowledge matters.

What's fundamental about a fundamental science review

Originally published by Reserach Money

"We suggest that government funding of basic research should emphasize quality rather than quantity, that the social sciences, multidisciplinary efforts, and projects relevant to Canadian needs should get higher priority, and that the peer system should be improved."

No, this is not the initial recommendation from the Naylor advisory panel now reviewing fundamental science, but it could be. Rather, the quote is from the concluding volume of the Senate Special Committee of the Senate on Science Policy in 1977 (otherwise known as the Lamontagne Committee).

The current Liberal government has made a point of stating they believe investments in scientific research, including an appropriate balance between fundamental research and the commercialization of ideas, will lead to good jobs and sustainable economic growth.

The mandate letter of the science minister states she is to examine options to strengthen the recognition of, and support for, fundamental research to support new discoveries. In response, she has recently appointed a high-powered advisory panel to review federal support for fundamental science. It has two basic questions:

- Are there any overall program gaps in Canada's fundamental research funding ecosystem that need to be addressed?
- Are there elements or programming features in other countries that could provide a useful example for the Government of Canada in addressing these gaps?

Consultations are underway and a report is expected by end-of-year.

As the Lamontagne quote suggests, this is not a new effort. One could also table the principles of the National S&T Policy of 1987, wherein a key action item was to examine the state of basic research in Canada; or the 1994 Federal Science and Technology Review which included an assessment of several key policy issues including the advancement of knowledge. It asked what is the current federal activity in advancing knowledge; does it form a coherent strategy and what changes need to be made to the federal S&T investment to achieve priorities and strategies? Then there is the 1997 report by the House of Commons Standing Committee on Industry – Review of Science and Technology and the Innovation Gap in Canada. One could go on.

The point is not that these are mere technocratic-governance questions that keep surfacing (which they are), all in different political and temporal eras. Rather, we need to constantly reappraise support of knowledge to ensure it is in tune with the times; meets global standards; keeps up with the changing nature of science; and has the necessary support and leadership it requires – public, political and otherwise.

Going even further back, a 1972 Science Council of Canada, Policy Objectives for Basic Research in Canada, enumerated a series of 13 answers to familiar questions about basic research, including:

What are the major impediments to improved effectiveness of basic research in Canada? Is it better to support individuals, teams or institutions? What should be done to improve communication between scientists and taxpayers? What criteria should be used for the distribution of basic research effort among the three social sectors – higher education, government and industry? How should one integrate the use of research to produce new knowledge to develop human expertise?

What's fundamental about a fundamental science review

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In this latter area they argued that special attention will have to be paid to developing a more flexible attitude toward future work among those higher-level graduates with intensive training in research. As more and more of them will have to look for a career outside the university, provisions are needed for developing their ability to generalize their experience in research, as a preparation for work other than basic research.

The report goes on to ask: Which mechanisms for the public funding of basic research are most effective? It noted that there was no explicit mechanism for supporting transdisciplinary research, particularly when it should involve natural, health and social sciences together. In fact, it was necessary to approach separately several agencies, which then would have to reach an agreement on simultaneous funding. The SCC did note a new Tri-Council Coordinating Committee being set up as a unit within the National Science Library of the NRC.

This 1972 report was written well before the creation of today's three existing granting councils. And the larger programmatic landscape that has built up around them has made it a challenge for anyone to describe what Canada's research system actually looks like and how effectively it works, let alone to our partners internationally.

But almost 45 years ago, it is worth noting that the SCC report, after looking at the global research arena, also indicated main opportunities where Canada could do better; for example:

- a) more concentrated effort in fewer areas of investigation to develop centres of strength with a greater degree of world leadership;
- b) more emphasis on quality everywhere;
- c) better coordination of effort and more cooperation among individuals and small groups;
- d) improved communication among researchers in different disciplines and among those in different sectors;
- e) increased emphasis on problem areas of national or regional priority; and,
- f) closer two-way interaction between basic and applied research or development.

These themes still resonate today — they continue to be fundamental — and there are others. For example, maintaining a basic capacity for research training; providing a base of advanced knowledge and encouraging excellence in research.

Ultimately, however, we should remember a much more fundamental question about the rationale for basic research. Gerhard Herzberg, Nobel Laureate in chemistry, made the point well in 1965 when he said: "The other reason for support of pure science by government funds is that scientific research of the purest kind is an intellectual activity which, just like art, music literature, archaeology, and many other fields, helps us to understand who we are, what is the nature of the world in which we live.

The newest assessment underway should also not forget this in underscoring why fundamental science remains a lifeline for this country's future.

Priority setting in the knowledge ecosystem

Australia, the U.K., and U.S. all have their science policy goals. What should Canada's be?

Originally published by The Hill Times

As the federal government contemplates a considered course on fundamental science and the Council of Canadian Academies reboots another assessment of the state of science, technology, and innovation in Canada, it is worth remembering why we do these exercises.

The reasons can be numerous: to improve global prestige, enhance culture, develop excellence, achieve breakthroughs, strengthen economic returns, manage security, deploy bright talent, deepen learning; or simply send signals that knowledge matters in a democratic society.

Of course, there are other temptations at the political level: can we leverage science for national objectives? We see this in the recent examples of various nations targeting priorities in which they wish to invest.

The United States president has announced a cancer “moonshot” that aims to cure cancer once and for all; the National Science Foundation director has singled out six “research big ideas” and three “process ideas” that she thinks will lead to transformative discoveries. The United Kingdom has its eight great technologies. Australia has stipulated its nine science and research priorities with corresponding practical challenges. And Canada enunciated its four priority areas for science, technology, and innovation with numerous sub-priorities in the previous government.

And so it goes. With a newly appointed advisory panel to review federal support for fundamental science, no doubt we will have revised priority lists in the coming year as the panel findings and innovation agenda are made public.

Inevitably, there will be calls for more opportunities than can be funded, more researchers competing than can be sustained, and more institutions and organizations seeking to expand than any one government can fund. Expectations are high—too high, given the limited fiscal capacity and constrained commitments of stakeholders. Investing in knowledge requires a strong sense of how it can contribute to overall societal goals. At the end of the day, for a nation like Canada, maintaining a portfolio of investments is needed where strength is apparent, excellence and ingenuity are rewarded, and a talent pool developed and well supported. In any ecosystem that is properly designed, “market forces” should ideally drive the research system, but there is always a tension inherent within a political system to set targets or priorities.

Let's not kid ourselves. Priorities are set every day at all levels and in all public policy arenas. Research councils establish longish-range plans, both for the respective institutions but also for the research fields they are mandated to support. Moving beyond institutions, a trickier issue is setting priorities that cut across councils or research fields.

Increasingly, the evolving nature of the sciences themselves is altering this approach as institutions originally created to address traditional disciplinary areas, for example, need to adjust and grapple with fast-moving knowledge—often an endless frontier. How does one support the growth of synthetic biology or nanotechnology while keeping an eye on the potentially dark shadows inherent in such knowledge? What is to be done with large-scale facilities that provide the tools to explore breakthrough science? What of global health challenges that traverse national borders, or impending climate change and its impacts?

Priority setting in the knowledge ecosystem

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At times, as was the case with genomics research in Canada or global health contributions, part of the solution is to establish a new organization with capacity to address the public policy gaps, such as Genome Canada or Grand Challenges Canada. Or when a perceived lack of analysis and evidence exists, flexible responses can be launched such as the Council of Canadian Academies or a proposed chief science adviser. Once created, how then does one track impact and measure progress? More critically, how does one assess if the policy innovation led to meaningful results for the country?

All of these are valid issues when exploring new public policy experiments. They are neither simple nor simply dealt with. They require measured inputs from the scientific and creative communities as well as the informed public to be interpreted by decision-makers who have competing interests for further or re-profiled funding. A half-century ago, a report on vital interests of the U.S. science and technology (S&T) system noted: "the federal government has displaced the university, industry, and the private foundation as chief patron and has fashioned a host of institutions to administer vastly increased commitments to scientific and technological excellence. Sustaining and managing this system is the challenge of the decade ahead."

Fast forward 50 years, and we are still dealing with this challenge, with ever-increasing players in the landscape. But if we are to truly launch so-called moonshots for Canada in 2017, the role of the government and public-interest science should not be forgotten. It is all well and good to examine and "optimize" governance mechanisms and granting councils along with universities, colleges, and private sector players, but the value and role of our national government assets in this should equally be considered.

A key recommendation from a report on federal science from a couple years ago is worth underscoring here: "Launch Federated Anticipatory, Adaptive, Advanced S&T Networks (FA3STnets) to rapidly mobilize national S&T capacity for urgent, horizontal, public policy priorities, and grand challenges."

There is no question Canadians will be faced with ever-more rapid transitions to society, the economy, and environment. As Stephen J. Toope noted in his July 4 Hill Times piece, "In order to address these important economic, social, and policy challenges, we need a more complete understanding of innovation that includes research and insight from all disciplines." We will certainly require the necessary innovative, responsive, and anticipatory ecosystem that can tackle these emerging and constantly shifting developments.

Taxing times at a temple of science, NRC at another crossroads

The NRC is in the crosshairs of a political battle over its mandate

Originally published by The Hill Times

There is probably no knowledge institution in this country that has received more policy attention during the course of its history than the NRC. Over its 100 years (it will be celebrating its formal centennial on June 6 of this year with special events across Canada), this national research organization has been prodded and poked by task forces, panels, and Senate hearings. Its had on and off cuts and changes to its priorities and has been criticized for not being commercial enough while being attacked for being too ivory tower.

Books have been devoted to its history and its public administration and academic texts have been written about its so-called “goal displacement”—established to achieve certain goals only to then shift to address other objectives because of the perennial weak link of Canada’s corporate innovation ecosystem. It has even overcome recent cyber-attacks, laying low its IT systems for an extended period of time.

And yet here it remains today—with facilities across the country contributing both to the pool of basic research as well as working in partnership with the private sector and other players to enhance the country’s innovative capacity. It was a critical centrepiece in Canada’s war time efforts. It has been the breeding grounds for what is now the Canadian Space Agency, AECL, NSERC, and CIHR. It has produced inventions too numerous to mention, a National Library, national industry standards, and an industrial research assistance program that is well seen by politicians and CEOs alike. Whole companies have spun out from the NRC’s research and Nobel Prize and Academy Award winners have worked there. In short, the NRC is responsible for a good deal of Canada’s nation-building legacy around the sciences, technology, and innovation.

And yet once more, the NRC is in the crosshairs of a political battle over its mandate.

The NRC is now having to readjust from six turbulent years of constant reorganization and repositioning into a so-called research and technology organization or RTO. Its president suddenly stepped down several weeks ago and went on personal leave, but the NRC website still lists him as president. And yet another framework for building a strategic agenda for growth to take effect on April 1 was postponed. Its brand has suffered. Many have been critical of the lack of open leadership in this once proud organization.

It is worth remembering that as one of NRC’s former archivists, Don Phillipson has said in a recent letter to the Ottawa Citizen: “The legal name of the NRC has been since 1917 the Honorary Advisory Council on Scientific and Industrial Research. This specifies both scientific and industrial research: it does not present them as interchangeable.”

And there is the nub of it. Should science merely power commerce as the previous Harper administration was fond of saying, or should it be a valued as a respected enterprise for the public good and in the national public interest; and what is a healthy balance between the two?

More than 50 years ago, an influential report was in the making by war-time science adviser and engineer, C.J. (Jack) Mackenzie. As the National Research Council’s president, he had been instrumental in advising government on its military and nuclear research efforts and collaborating with his allied counterparts. Under Mackenzie, the NRC was reorganized to provide a stronger foundation to support basic science and industry development. In 1963, he was appointed special advisor by prime minister Lester B. Pearson to provide counsel on the organization of government scientific activities. Mackenzie wrote an informal progress report on Jan. 28, 1964, to the PM, making several recommendations.

Taxing times at a temple of science, NRC at another crossroads

The NRC is in the crosshairs of a political battle over its mandate

Originally published by The Hill Times

They were: 1. A Central Scientific Bureau or Secretariat to be established in the PM's office to assemble, digest, and analyse all information concerning the government's S&T activities and their inter-relations with university, industry, and provincial scientific establishments. 2. A National Committee on Scientific Policy (NCSP) to assess the government scientific activities for the purpose of: (a) forming judgements on the adequacy of support for research and how well it's balanced within universities, industry and federal and provincial institutions; (b) prioritizing broad areas of research and determining which should be given the most support in the interest of the country and economic prosperity; and, (c) providing an annual report to the PM.

Mackenzie also suggested key studies that the proposed NCSP should undertake, including the reappraisal of the roles for university, private sector, and federal and provincial research establishments. Finally, he argued that consideration should be given to establishing a reinvigorated federal panel on S&T, comprised of DMs and heads of scientific agencies feeding into the NCSP.

These points resonate today within the intended mandate for a chief science adviser in the Trudeau government along with a review of the federally-supported basic research eco-system. Recent statements by the government make it clear that they see the NRC situation as a challenge—and part of a larger canvass that needs to be retouched on how the federal government supports the sciences and research. We have seen this picture before and one hopes that the leadership will be forthcoming from all participants engaged in the country's ever-expanding knowledge tapestry.

Ultimately, what the 1964 Mackenzie report serves to remind us is that getting the right people together with the right receptor at the right time with the right conviction can be more critical to any success than ideal org charts, vision-less policy, and weak leadership. Mackenzie said it well: *it seems to me the gut issue of broad national policy for science is political and economic, not scientific. Canada's future will depend on how well a few, at least, of our political leaders and senior public service officials realize the importance of science and develop a real understanding of what science is all about, what the essential conditions are for first-class scientific output, and how the authoritative voice of experience science can best be presented—and really listened to—in the deliberations of government.*

So as the federal and other levels of government scope out new forays in seeking the genuine contributions of the sciences, ingenuity, and innovation toward Canada's 2017 celebrations, including the new GG Innovation Awards and Innovation 150, we would do well to heed the Mackenzie philosophy in focusing the spotlight on expanding our own endless knowledge frontiers for—and with—Canadians.

The cause for fairer science, because it's 2016

We should not forget the critical contributions of our pioneers along with the next generation of girls and women in shaping our knowledge-based society

Originally published by The Hill Times

When Prime Minister Justin Trudeau made his famous remark—"because it's 2015"—about gender parity in his newly-appointed Cabinet last year, it attracted a lot of attention at home and abroad. He followed it up with a high-level panel on gender parity at Davos where he promoted women's rights across the spectrum of society, including science and sustainable development. Unfortunately, his signal has yet to be translated in the House of Commons where women make up only 26 per cent of the current sitting MPs, nor has it been received by the all-male House Industry, Science and Technology Committee.

Nonetheless, Trudeau's new Science Minister Kirsty Duncan (only the second female science minister since 1971) has embraced gender parity issues. At the 13th annual l'Oréal-UNESCO Foundation Awards for women in science and engineering on Jan. 19, the science minister offered a note of support for greater equality and participation of women in science and engineering. The ceremony had been preceded by a special panel on the subject hosted by the University of Ottawa along with l'Oréal and the French Embassy. The speakers were passionate and clear about barriers and opportunities. They spoke to the issue of mentoring, role models, the influence of family, and the need to be recognized financially on equal terms with men. At the French Embassy ceremony later that evening with UNESCO, seven women were awarded for their work in science and engineering, ranging from food safety and human computer interaction, to the concentration of contaminants and heavy metals in northern coastal sites, and how these may be influenced by climate change.

A few days later, Duncan spoke to the Actua national annual conference on the role of STEM education for girls. Actua's principal mission is to inspire young people, and particularly young women and members of the aboriginal population, to become innovators and take part in science, technology, engineering and math-related fields. In her remarks, the minister noted that: "I have been fighting for change so that young girls and women would not have to face the challenges I did. However, it saddens me to say that only 22 per cent of Canadians working in STEM fields are women. In 1987, it was 20 per cent; that's an increase of two per cent in nearly 30 years."

In short, things have moved slowly on the gender front for science and engineering.

According to a recent assessment by Sophia Hoyer from the UNESCO 2015 Science report, the Canadian situation is not unique. Female university students are a majority in North America (57 per cent), Central and South America (49 per cent to 67 per cent) and even more so across the Caribbean (57 per cent to 85 per cent). Women are pursuing bachelors and masters degrees and outnumber men at these levels with 53 per cent of graduates, but their numbers drop off abruptly at the PhD level. There, male graduates (57 per cent) overtake women students. The discrepancy widens at the researcher level, with men now representing 72 per cent of the global pool. It is clear that the high proportion of women in tertiary education is not necessarily translating into a greater presence in research nor in governance and decision-making roles.

Indeed, barriers persist and poorly-informed perceptions remain. The UNESCO essay argues for some key changes to address the underrepresentation and gender discrimination that continues. Among these are: commit to the equal representation of women in science, research, and innovation management and decision-making; support gender equality and diversity through funding, programming and the monitoring of progress; and introduce fellowships and grants to increase the scope of representation.

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Here in Canada, we have heard much of this before. After the 2010 political debacle following the total absence of female candidates in the first round of the Canada Excellence Research Chairs (CERC) program, the Council of Canadian Academies (CCA) was asked to assess the broader issues of underrepresentation of women in science. Its report on gender in university made clear that: the pathway to becoming a researcher is laid before university. The use of a life course perspective is critical to understand the career trajectories of women researchers. Socialization, schemas, and stereotypes define social roles and expectations, and contribute to the lack of encouragement for girls to forge non-traditional paths. We should also not overlook the role of community colleges and CEGEPS—encouraging women in science is not just about filling pipelines and academic careers; more needs to be done to foster attention of the issue in all sectors of our higher education sector.

To be sure, there are organizations promoting and empowering women in knowledge sectors. There are some helpful incentives, including the NSERC research chairs for women in science and engineering along with the work of outreach science groups such as Actua, l'ACFAS, Let's Talk Science and Youth Science Canada. Today, social media has a strong role to play in promoting a fairer science in Canada—science blogging and journalism of and by women is on the increase as are narratives detailing the power and passion of the sciences and research (in all disciplines) that is making a difference.

The private sector has a responsibility as well and needs to step up and do more in its hiring practices, including support for women in the form of training, access to finance, and backing for entrepreneurship. According to a 2014 CCA report, Canada is currently missing out on an important supply of skilled talent. Increasing the STEM participation of under-represented populations, including women and Aboriginal peoples, is an important strategy for diversifying the supply of STEM-skilled individuals. Just 29.6 per cent of individuals with a post-secondary STEM credential and 26.9 per cent of those employed in a STEM-intensive occupation in Canada are women.

Ultimately, there is the critical role of signals to society from our leaders such as the annual PM's Awards for Teaching Excellence and Early Childhood Education. The Governor General's Innovation Awards, a new program of national recognition announced last June, will celebrate outstanding Canadian individuals, teams, and organizations whose innovations have shaped Canadian society. The first six awards are to be announced in 2016 through a merit-based selection process managed by the Canada Foundation for Innovation—there is every reason to believe that women should be well represented in these annual awards.

So as we celebrate our upcoming 150th and contemplate making the national anthem more gender neutral as well as advocate for more women on our currency, we should not forget the critical contributions of our pioneers along with the next generation of girls and women in shaping our knowledge-based society.

So you want to be a chief sciences adviser?

Without nine-inch nails to anchor it, the position just becomes another advisory piece that is pulled out when a new government comes into power.

Originally published by The Hill Times

Kirsty Duncan, the new science minister, has been mandated by the PM to appoint a chief science officer—more commonly known as a chief scientist or science adviser. We've had them before: they didn't work.

Why you may ask?

There are a number of reasons—most of which have to do with the demand and receptor capacity within government. Leaving aside the chief scientist offices that exist within some line departments, a federal science adviser reporting to the minister likely means that the position would be embedded in the industry department or its latest reincarnation under the Liberals. Industry departments respond poorly to such positions because it means they are being second-guessed as to what they consider to be their own mandate. As a consequence, senior management often put up resistance to any newly-appointed science czar. Further, industry departments regularly view science as a marginal issue (they are an industry promotion department after all) and have little capacity or time to work effectively with well-meaning science advisers with spotty knowledge about how the Hill works.

On the other hand, if the science minister wishes to make such a new appointment and have it placed in the central machinery of government, such as the Privy Council Office (reporting to the PM), it might work, but only if there is some legislation to create the post. Without nine-inch nails to anchor it, the position just becomes another advisory piece that is pulled out when a new government comes into power. Of course, the other solution would be to place the science advisor in a Parliamentary function analogous to the PBO where it could be viewed as a non-partisan appointment and could serve to support relevant Parliamentary Committees with the assistance of the Library of Parliament. Again, one would need a demand for such a position (the previous NDP motion for a Parliamentary Science Officer notwithstanding).

In the early '80s, the Science Council of Canada tested the demand from Parliament for more structured science advice. A discussion paper (Karen Fish: *Parliamentarians and Science*, 1983) surveyed what members of Parliament had to say about the need and use of science advice for their work. The results were chastening—there is no reason to believe that things have changed in the 30 years since the survey was completed.

Here is one example from that survey:

The committee structure is terrible. MPs go into committee completely unprepared. Departmental experts are called in to feed the MPs information, but there is an absolute lack of information flowing in the other direction. The only place that scientific information could have any effect is in committee, but there the process is very partisan. In committee the point is to embarrass the minister and to score points for the folks at home.

And:

There is a fundamental inconsistency between parliamentary decision-making and planning for the long-range impacts of science and technology. Politics by definition is short term, and the nature of politics is to get re-elected. The political system doesn't allow issues to be dealt with in a scientific fashion. Decisions are made for emotional or political reasons.

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It goes without saying that such statements can also be viewed as constructive commentary on how the science and research communities can better prepare in advocating for more science advice within our Parliament. The UK has developed a sophisticated mechanism (Parliamentary Office for S&T and an annual MPs Pairing Scheme for example) to address both sides of the receptor and demand issue—i.e. how to make scientists less clueless about politics and how to make politicians less illiterate about the workings of science.

Knowing what's available as information sources is also critical for Parliamentarians. As two MPs reported in the 1983 survey:

At the moment there is no direct access for parliamentarians to the experts. The experts get pissed off because they say parliamentarians do not know anything, and they are right— we don't. Being aware of a problem is an entirely different thing than being alerted to a problem. This is an area where our resources are sorely lacking ... or more clearly stated by another; we do not have scientists on the Hill, but if we are being asked to make decisions based on scientific information, we have got to have the resources to back us up.

We do have some agencies designed to provide such information that such as the expert panel reports of the Council of Canadian Academies and the Royal Society of Canada. A periodic gathering of Parliamentarians with scientists and researchers takes place through the Bacon and Eggheads breakfast, but these are essentially one-way talks to the audience. There are other sources as well including the Science Media Centre, and the like—but they are not anchored within Parliament.

So what did the Science Council paper suggest to address the gaps? Here are some:

- Expand the research capabilities of the Library of Parliament
- Develop an ad hoc committee of parliamentarians, scientists and engineers with some resources
- Provide internships for scientists and graduate students in all disciplines (the new Mitacs announcement for science policy fellowships is one example today that could help address this gap)
- A science and technology advisory position be established within Cabinet for the purpose of alerting these MPs to problems on the horizon and provide expert advice on policy matters.
- Establish a standing committee for science and technology either in the house or jointly with the Senate
- Create a visible and influential scientific umbrella organization akin to the American Association for the Advancement of Science in the US (francophone Canada has one called ACFAS).

Today, some of these ideas have come to pass, but as we have learned, science advice requires a systems approach—one that will require a suite of inputs for the larger and more effective dissemination of knowledge within the Parliament and Cabinet—assuming they are prepared with necessary resources. Here's hoping the new sciences adviser can tackle some of this with colleagues in the community and in Parliament.

Bringing real change to Canada's knowledge culture

The new Trudeau government has signaled a course correction when it comes to the sciences

Originally published by The Hill Times

The new Trudeau government has signalled a course correction when it comes to the sciences—natural and social—by giving space to a new Minister of Science Kirsty Duncan who is only the second female to ever hold such a post. Interestingly, the first—Jeanne Sauvé—was appointed by Pierre Elliott Trudeau back in 1972. Then, Sauvé was the only woman in the senior Trudeau Cabinet. But times have indeed changed—it's now 2015, as Trudeau said at Rideau Hall last week.

Canada has had other ministers and secretaries of state for science since the early 1970s, but eventually science was buried within an Industry portfolio—it lost its political champions with weak advocacy from both the scientific and business leadership in this country.

Today, some may read the science appointment as a post second in importance to an economic and innovation ministry. Perhaps.

To be sure, the science minister will be working with her other colleague from Ontario, the Minister of Innovation, Science and Economic Development Navdeep Bains. And she can also be a champion to encourage larger participation of women in Canada's science culture.

But there is a more visible signal in the appointment, one that reflects what the Liberal platform clearly stated: “we will value science and treat scientists with respect.” On the surface, it is a remarkable statement, and unprecedented. But the sciences—especially developed in government—have had to deal with some tough challenges during the Harper era, including muzzling, indiscriminate cuts, and poor morale, which all may see a dark veil lifted. A good deal of this has to do with a highly-motivated, grassroots science advocacy movement from organizations that placed the sciences and evidence in decision-making squarely on the electoral agenda. As a result, the opposition parties climbed aboard expressing support for an unchained Prometheus in Canada. In particular, the Liberal platform argued that it would appoint a chief science officer to ensure that government science is fully available to the public, and that scientific analyses are considered when the government makes decisions.

This last statement would also suggest that the sciences will become imbedded within all the current Canadian ministry. Indeed, it is hard to imagine any policy issue that does not have a science underpinning, from health to international development, transport to public security and heritage to agriculture.

The new science minister along with her innovation confrere have an opportunity to ensure that their colleagues (and Parliamentarians) all get it—that the sciences matter in their portfolio as well. Science powers commerce, yes, but it also embraces creativity and enhances our culture. Instituting a set of principles designed to inform decision-making on the basis of the best available evidence from the sciences and indigenous knowledge as laid out, for example, by the Science Integrity Project, would be a good start as well. Already, it is heartening to see the quick reinstatement of the long form census.

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There are other opportunities with the real change being suggested under the new regime. One has to do with nation building. As we prepare to celebrate the country's 150th anniversary, it is worth remembering that science and technology were integral to shaping Canada. Indeed, the Trudeau government can leverage its newfound partnerships with other provincial and territorial governments and First Nations in engineering a pan-Canadian approach to science, technology and innovation. The 1987 National Science and Technology Policy, with its six key agreed actions signed by all governments in Vancouver, was the first such experiment, but it does not have to be the last. Here, there is the potential for finding a true common ground.

Ultimately, the clearest signal can only come from the PM himself. Like his counterparts in other countries, such as the U.S. and the U.K. who have given high-profile attention to why the sciences and knowledge matters, Prime Minister Justin Trudeau has the responsibility to articulate just how critical science is to the future of our country. He can start by providing a well-crafted statement to Canadians and engaging them with both traditional and social media. After all, his legacy and that of his government will be determined, in large part, by their ability to teach, help educate and pass on the increasing body of new knowledge to the next generation.

Federal science, technology, innovation strategy ‘mostly stale air’

Originally published by The Hill Times

When Oxford dictionaries came out with the 2014 word of the year ‘vape’—to inhale vapour from an e-cigarette—it struck me as an apt metaphor for the revised Science, Technology and Innovation (STI) strategy announced by the federal government in early December 2014 (innovation was now added to the older 2007 science and technology version; a signal of what matters).

The strategy is all about inhaling—we are not exactly sure what is being inhaled, and since there is no smoke, we know little about its side-effects. Indeed, the science and technology community is still sorting out what impact, if any, the strategy will have on the conduct of ongoing and future research. As for the business sector, they are encouraged to be more innovative.

Like most policy reports issued prior to a national election, the 68-page Seizing Canada’s Moment (let’s leave aside the physical difficulty of doing this) is a political creed extolling the virtues of the current Conservative brand in support of research and innovation. Since the last strategy emitted by the PM almost 7.5 years ago, the revised statement offers wisps of new directions, but mostly it is stale air.

The strategy—which took more than 14 months to produce with three different junior science ministers holding the pen—was a footnote to the PM outlining the details of a multi-year \$1.5-billion Canada First Research Excellence Fund (CFREF). This fund, which will be layered over the increasingly complex web of push-type, acronym-laden programs and incentives in the vain hopes of stimulating innovation in Canada, had already been announced in the February 2014 budget. CFREF is a partial response to a joint proposal by the U15 Group of Canadian Research Universities and the Association of Universities and Colleges of Canada. It commits to providing \$50-million in fiscal years 2015-16, rising in annual \$50-million increments to \$200-million in 2018-19 and remaining at that level for seven years. Needless to say, the universities (and even colleges) will be pleased; that is, if things don’t go even more south with the now delayed federal budget.

But like all new initiatives of the Conservative government, there are strings attached to this potential largesse. The CFREF proposals have to create long-term economic advantage for Canada. They must align with government STI priority areas; non-aligned initiatives will not be funded. They must leverage additional resources and promote knowledge mobilization through partnerships with industry, international research institutions or domestic and public sector, domestically and internationally; and, there must be potential for research results to foster innovation. Sounds familiar doesn’t it?

What are the STI priority areas (there are sub-priorities as well)? Through an opaque methodology, abetted by the government’s confidential advisory Science, Technology and Innovation Council, the government has enunciated the following:

- Environment and Agriculture
- Health and Life Sciences
- Natural Resources and Energy
- Information & Communications Technologies
- Advanced Manufacturing

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These are not quite Canada's five great technologies (to borrow from the U.K. label) but they signal what will get policy attention. The targeted areas are the same as those listed in the 2007 federal strategy, with the addition of advanced manufacturing. Creative as they are, higher education institutions will have no difficulty in fitting their respective applications into any of these categories. But the bigger issue is that they must also adhere to the other criteria laid down for CFREF eligibility. This will be difficult for at least two reasons.

First, higher education institutions were not established to be surrogates for industrial innovation—they are there for other critical purposes like research, teaching, vocational training, community and civic outreach. Second, the CFREF falls into the long-standing trap of assuming that industry will be able and willing to take up the applications and partner with these public institutions. There is little evidence to demonstrate this.

In fact, data show that private sector research and development (R&D) in Canada is essentially flat-lining and well behind the overall OECD average. And according to the latest Statistics Canada data, industry is shedding R&D personnel with a 9.2 per cent decline between 2011-12. Over the period 2008-2012, the overall decline has been 23.5 per cent. Because of the well-documented structural weaknesses in the business sector, Canada's overall GERD-GDP ratio has been falling since 2006—it is now projected at 1.62 per cent for 2014, even lower than that in the U.K.

The 2014 federal strategy, with no new funding and little consultation with the other levels of government, lays out a feel good fog over the positive trends in science and innovation in Canada. To be sure, science in Canada remains fairly strong in selected areas, but its ability to participate actively in global fora is hampered by ideological trade and foreign policy imperatives that eschew science as a meaningful part of diplomacy and international collaboration.

Canada's image as a serious research player in the world has taken a hit, especially with the continued muzzling of government scientists and the Conservative government's dismissal (or ignorance) of scientific evidence in climate change discussions (Canada's governor general as the de facto science ambassador is doing his valiant best to change this image).

It is not just the current government that is solely to blame for the current situation—there is a marked absence of any activist scientific leadership in Canada to stand up for an integrated role of science in and for society. There are no significant national science societies or alliances that can make a difference in the political arena (in English Canada).

Further, unlike in the U.K. and elsewhere, the Canadian Parliament is missing a serious science capability, and has little elected representation from the research community. Some have been pushing for a Parliamentary science office operation on the Hill. A 2014 survey by the Council of Canadian Academies underscores that while Canadians have positive attitudes to science and technology, national and regional leadership in cultivating a stronger science culture is MIA with little appreciation of the need to support all of the sciences (social sciences and humanities especially).

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Some awakening has taken place in the research community with advocacy groups such as Evidence for Democracy, the Professional Institute of the Public Service and Get Science Right as well as French Canada science associations like ACFAS. Federal opposition parties are also taking up the cause and the science media are engaged. But Canada’s knowledge elites must move beyond their continued acquiescence and narrow, short-termism. As one Toronto Star editorial opined: Our S&T policy reveals a troubling selfie of sorts —short-sighted view of the world that includes only now and only us.

Is there hope for the health of Canada’s STI in 2015? I remain optimistic given a growing and more sophisticated understanding of science in policy and policy for science among the younger generation along with a more informed and knowledgeable society. But first we need to move past the addiction phase by resolving to quit vaping empty and potentially noxious strategies.

Driving innovation—are we there yet?

Originally published by The Hill Times

‘There has been no effective mobilization of advice and counsel from outside the public service and responsibility for the expansion of various activities has been borne by individual ministers without any evidence of their relation to national policy as a whole.’ (J. Grant Glassco, Commissioner, 1963)

This salient observation on the country’s national science activities by the Glassco Royal Commission on Government Organization could easily have been written today. Canadian governments and their public service have been experimenting on how to mobilize knowledge assets and advice ever since. A key dimension of all of these ventures over the five decades since that landmark report has been the innovation within the country’s science and innovation policies. From time to time, we have been quite creative, with significant impacts on productivity and social benefits. Unfettered creativity can indeed lead to novel action that makes a difference.

As the now dated 2007 federal S&T strategy put it,

“To achieve world excellence in science and technology, Canadians must promote and defend two complementary and indivisible freedoms; the freedom of scientists to investigate and the freedom of entrepreneurs to innovate and market their products to the world.”

History is always important here. Forty-three years ago, in October 1971, Alastair Gillespie, the freshly minted federal minister of state for science and technology was in Paris, meeting with his science counterparts at an OECD meeting. In his short speech on the subject where he outlined the responsibilities of the newly created ministry of state for science and technology, Gillespie argued for better assessments of technology and their environmental and societal risks that were then emerging, including large oil tankers in the North, new mind-altering drugs, entertainment and learning technology as well as other key developments. Gillespie also noted his concern for clearly articulating what the word innovation meant— *as politicians we have a major responsibility to articulate what innovation is, to other politicians and to our electors.*

Today, more than four decades later, “innovation” is still the word—can we therefore conclude that it is now truly central to, and at the heart of, the dealings of our elected governments?

Not quite. The average stint of ministers responsible for science in the Canadian government since the first appointment of Gillespie is just under two years, about the same for federal deputy ministers over the last few years. Continuity and stability in policy-making as a result has been difficult to maintain. We shed independent advisory organizations without considering their impact. There is no senior minister with a stand-alone department and overarching national vision; piecemeal decision-making with fragmentary evidence has often been the result. Proponents for new knowledge investments must make their case on a continuous and competitive basis with a constantly changing guard—all within a context of diminished expectations and rapidly-changing financial realities and uncertainty.

It is worth remembering, however, that, as the new millennium approached, a spate of policy innovation took hold of Canada’s knowledge ecosystem. The unique Networks of Centres of Excellence established in 1989 had already demonstrated considerable innovation as had the Canada Foundation for Innovation in 1997, but at the turn of the 21st century, the Canadian Institutes for Health Research (CIHR) emerged from the old Medical Research Council; the Canada Research Chairs were established; a retooled genomics organization was brought back on the table as Genome Canada. Other experiments have since followed.

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The Perimeter Institute and Institute for Quantum Computing saw the light of day with philanthropic and government support; a Science Media Centre emerged to assist journalists with getting the right science behind their stories as well as aiding scientists to better communicate their work; and the innovative Grand Challenges Canada venture has shown why strategic intent matters in designing new institutions that can fulfil both domestic and global needs.

Aggressive initiative from this country's research communities along with key champions in government circles helped create the Council of Canadian Academies and accomplished what Gillespie presciently suggested was badly needed—science assessments to inform decision-making.

There are a number of other innovations underway designed to fill gaps in our knowledge governance system; these, if properly channelled and supported, will help shape a more effective public dialogue and further action in science and innovation. Science culture—in all of its facets—is in need of more considered support at all levels of government. Government science is being reassessed via an expert panel. The current model for S&T in the federal government needs to evolve in relation to changing external realities such as fast-paced global scientific advancements and the convergence of disciplines. A health-care innovation advisory panel is underway consulting on key actions for more innovative and effective health care across Canada.

Ideas centred on a new Parliamentary office for S&T are circulating along with greater public recognition of research stars, students, teachers and entrepreneurs. Advocacy groups like Evidence for Democracy and PIPSC are holding the government's feet to the fire with respect to its own research community to ensure sound science for more effective public policy. There is also the new experience of a Quebec chief scientist who not only advises on science and innovation, but celebrates new and upcoming talent through media outreach and awards.

To be sure, experiments have also failed or succumbed to mission creep; sadly, we rarely seem to learn from our mistakes. Recently, the commissioner for the environment and sustainable development has suggested conducting a strategic science audit, asking for public input ... or more precisely, what is working well now; what are the areas that need improvement; what are the biggest risks facing the federal science and technology function and strategies, and what criteria would be used to assess how well the government is doing.

It is never easy to imagine a future that looks brighter at a time when the lights appear to be dimming. A hopeful trend may be emerging in Canada where institutional experimentation may well be underway once again, a lot of it from bright minds leveraging new partnerships and unique business models as governments struggle to meet the expectations of their citizens—all aimed at improving our culture, quality of life and economic prosperity through innovation and discovery.

Any sustainable architecture for novel science and innovation policy requires real resources, champions, transformative ideas, patience, passion and timing. Moving past the federal election and forward to celebrate our birthday in 2017, are we not due for some truly innovative science and innovation bold ideas from our entrepreneurs, creative youth, elected officials and knowledge communities? As the auditor general concluded in its 1994 report on the role of government in an innovative society, "if we could continue to establish and maintain among us the interconnection that is the basis for societal innovation, we might well become known as Canada, the innovative country."

Canada needs a senior science and innovation minister

Originally published by The Hill Times

When federal Finance Minister Jim Flaherty announced his 10th budget on Feb. 11, he once again demonstrated that science, technology, and innovation suffer from that Ottawa affliction known as CPA, continuous partial attention. Budgets with this government and others before it are usually careful to make some sort of statement about the need to invest in knowledge and innovation—only the emphasis and context changes (see, for example any, of the word clouds in Flaherty's previous budgets for 'research,' 'science,' and 'innovation').

It is worth reminding ourselves that the science and research budget is ultimately a matter for a finance minister, not a science minister. While Canada has had a federal science and research minister or secretary of state since 1971, final decisions about the actual budget for research and innovation remain with the treasury. To be sure, science and research ministers have had, and can have, their say about what should be supported by Cabinet and the PM, but like any science adviser their job is to propose, not dispose.

The notion of a science ministry has always been somewhat controversial, in part, because it does not hold sway on how science-based departments and agencies can spend their own money. From the outset, its power has always come from moral suasion, not in carrying a big stick. In short, science ministers operate on the periphery of power—hence, the reason for constant tinkering with new programs, structures, and S&T policy statements designed to influence investments in innovation and research.

We have had more than 30 science ministers since the position was created; some have been successful. Usually they are junior and often carry more than one unrelated portfolio; hence the science file is part-time warranting periodic attention. Of note, few actually had some science, health or engineering pedigree and there has only been one female science minister. Upon their appointment, they normally receive a so-called mandate letter from the PM or senior minister in charge (Industry these days) which frames their responsibilities. Typically, these will outline such duties as ensuring that a proper S&T perspective is fully taken into account in Cabinet decision-making, and monitoring the use of research and S&T budgets across the government as well as playing a policy-coordinating role. But, as a 1974 Science Council of Canada report astutely pointed out, science and technology ministers have limited capacity to make any real policy impact. (An exception can possibly be made here when a federal science minister, C.M. (Bud) Drury, was also the treasury minister).

A Department of Science was always a consideration for mixing knowledge with power. Indeed, Senator Maurice Lamontagne (who chaired a classic four-volume examination of Canada's science policy) broached the idea of a centralized ministry that would not only coordinate science policy, but would also provide granting functions for both university and industrial research. And an OECD study also suggested a similar position held by a senior Cabinet minister reporting to the Prime Minister.

But the notion of a ministry for science never really took hold since line departments that possess extensive research budgets were not willing to give up their authority to make decisions on funding priorities. Furthermore, the science community was quite skeptical of any political motives designed to control or direct what is essentially a 'free market-driven' enterprise. Hence, with little power or authority to back it, the Ministry of State for Science and Technology created in 1971 was doomed to fail (which it did decades later) when it was merged into another department and ultimately became part of today's Industry Canada. Science, technology and innovation were essentially buried in a large bureaucracy, and the minister's roles and functions became virtually invisible to most Canadians.

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Today, Industry Canada's responsibilities for federal science and technology are still viewed with suspicion not only within many of the science-based departments and agencies, but also by elements of the research community who hold that the genetic pre-disposition of any Industry Department inherently has little capacity to grasp the how and why of research and science.

Increasingly, however, innovation has crept into government policy and rhetoric. Science and technology are now seen to be touchstones for greater alignment with economic growth and job creation through innovation. Provincial governments as well as jurisdictions elsewhere are experimenting with how to capture the diverse policy dimensions of innovation within ministerial or departmental portfolios. There is a sound argument to be made that no single policy portfolio is diverse enough to undertake sole or primary responsibility for innovation. On the other hand, if research and innovation are to move from the periphery to the centre of policy-making and a government is to signal its importance within its own policy apparatus, then an equally valid case can be made for a separate Cabinet-level position dedicated to promoting innovation—in all of its facets. The Canadian policy landscape is increasingly populated with a large number of players all of whom could usefully consider more strategically their respective roles in helping shape a national effort that both reflects the fast-moving nature of innovation and knowledge production in Canada and abroad while resonating with the specific needs of the country. After all, effective public policy is essentially a course of action designed to help shape a positive and sustainable future for citizens.

As this and future governments move to engineer science, technology and innovation strategy over the longer term, an experiment might be in order to test the viability of a political champion for science and innovation—one that has a recognized gravitas by the very nature of the portfolio. Canada could use a stand-alone, senior science and innovation minister who has the trust and backing of the wider research and business community. In such a new post, she could also ensure support from across government for well-developed and resourced public interest science. Shaping and communicating sound open and consultative policy with counterparts in the provinces and territories, including those from abroad, would also be key. Branding this country as an innovative nation matters—so does signalling the criticality of innovation, ingenuity and knowledge to Canadian society and economy within our polity.

Time to readjust Canada's global compass on science, innovation

Originally published by The Hill Times

"Although its accomplishments may not be widely recognized at the present, the International Space Station (ISS) will go down in history as a first of its kind and a formidable example of an effective foreign policy tool. ISS brought (and somewhat forced) nations to work together, causing them to think not from a microcosm of nationality, but in terms of pushing the boundaries of the known world as partners, in a collaborative spirit and a peaceful manner," (Julie Payette, Science and Diplomacy, December 2012).

While we are being treated to Chris Hadfield in space strumming his guitar, tweeting and chatting with Captain Kirk, Julie Payette, former astronaut and scientific delegate to the Quebec government in Washington, D.C., makes a very good point in her recent essay about the multinational, orbiting ISS. Science and engineering as diplomatic tools can be truly effective global and collaborative ventures. But it takes leadership and sustained commitment for this to happen.

Other countries have understood the value of this linkage—the U.S. with its science envoys appointed by the president to troublesome political arenas around the globe; the U.K. with chief scientific advisers in both their international development and foreign affairs offices; and Australia with its well-honed Asia strategy using domestic science and innovation as lynchpins to global trade forays. It may well be time for Canada to step up and readjust its international commerce and foreign policy compass to integrate science more fully into the mix. With more than 400 international science and technology arrangements identified by federal departments and agencies, not to mention the considerable number of university and provincial bilateral arrangements with other countries, Canada should be better placed to use science and technology, as well as its well-trained talent as strategic tools in diplomacy. Why? For starters: To maintain and continually improve the quality of domestic science by applying global standards of excellence; to increase national security, democracy and economic prosperity by fostering improvement of conditions in other countries through enhanced technical capability; to address national interests of such a global nature that no country alone can satisfy; and to improve understanding by other nations of national values, scientific brand, and ways of doing business.

An International S&T Partnerships program introduced in 2005 has been designed to strengthen linkages with India, China, and Brazil, building on an earlier bilateral S&T agreement with Israel. A Global Partnership Program has also been in place in part to provide technical support and new alliances for scientists from the former Soviet bloc. And a Grand Challenges Canada venture to help shape a larger global health and research agenda has helped moved our goalposts as a major player in the health sciences.

To be sure, these are some steps to assist in opening trade, security, immigration and foreign policy doors with existing and emerging global partners. DFAIT is currently giving thought to this matter via an informal consultation about what the Canadian government could do to more effectively leverage science in its statecraft. While a good start, there needs to be an accompanying vision from our political and scientific leadership. With the right commitment, here are some low-cost measures that could be undertaken to help move towards this vision.

We should recognize that the so-called S&T counsellor network is facing challenges along with DFAIT itself. S&T officers are no longer selected by a cross-departmental competition; they are poorly resourced; have been downgraded at a number of posts, and their skill sets are rarely deployed or integrated when they return home for the knowledge they have gleaned abroad. As a result, there is a significant missed opportunity in science and technology intelligence gathering. Canada should consider mobilizing a focused network of experts for global science affairs that would bring together both the assets of DFAIT and other science departments and agencies with the higher education system to shape the emerging issues on science and education for diplomacy.

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Further, there has been little effort in developing a systematic training program in international S&T developed within DFAIT and elsewhere in government. A pilot program of some years ago entitled Science, Technology and Innovation was never fully implemented. DFAIT should be encouraged to review and improve this comprehensive course experiment together with briefings by key S&T stakeholders from the Canadian private sector, provincial governments, and academia. Something akin to the Jefferson Science Fellows at the U.S. State Department where tenured track academics are loaned for a short period to help negotiate and work on global issues or other skilled personnel exchanges might be considered. Close benchmarking of science diplomacy experiments in other jurisdictions would be relevant to more informed policy, including assessment of successes and failures.

It may well be opportune to name an adequately-resourced and strategically located chief scientist or science and innovation ambassador within DFAIT much like the U.S. and U.K. have in place. Such a position could undertake several tasks and liaise with the Canadian science community as well as the international community by raising the profile of Canada's image in knowledge circles and spotting new opportunities or threats. Indeed, this could help strengthen Canadian representation in the global clubs such as IPCC, NATO, or international S&T meetings of APEC, OAS, UNESCO and the G20 for example.

Finally, Canada can also strengthen its science and knowledge assets in support of the developing world by broadening and franchising its more successful programs such as the Canada Research Chairs and Networks of Centres of Excellence. The idea of a joint Canada-Africa research chairs program for example, has received some attention in global policy fora. IDRC, with a new incoming President, has an opportunity to re-examine its pioneering role in research and innovation capacity building, and to assess its fit with key geo-political partnerships across the globe.

Science diplomacy shouldn't be viewed as mere orbiting debris within our constellation of foreign affairs instruments. As long as international S&T issues remain lost in policy space and somewhat peripherally attached to the national innovation approach, one can expect that Canada's links to international S&T activities will remain disassociated from the explicit drive to a more coordinated 'intermestic' strategy for S&T to benefit Canadians. In order for this to change, a renewed effort will have to take place with demonstrable leadership in the attitude of the country's major sectors of innovation and research performers.

Canadians clearly deserve better from their science advisory apparatus

Originally published by The Hill Times

"It is not enough for scientists to have responsibility as citizens. They have a much greater one than that and different in kind. For scientists have a moral imperative to say what they know. It is going to make them unpopular. It may do worse than make them unpopular. That doesn't matter."—C.P. Snow.

By now, Canadian taxpayers are probably inured to the vecordious cloak of secrecy that has descended on Ottawa's decision-making processes. But the muzzling of federal government scientists, death of evidence, and assault on reason that has been played up in the press and elsewhere has glossed over yet another dimension of closed access to citizens; an area where Canada's efforts in the past have traditionally been in keeping with global good practice—that of open, well-informed national science policy advice.

Since its creation in 2007, the Science, Technology and Innovation Council (STIC) has provided confidential advice to the federal government. This advisory body of 17 eminent people from the public and private sectors was given a two-fold mandate: to provide the Government of Canada with evidence-based science and technology advice on issues critical to the country's economic development and Canadians' social well-being, and to produce regular reports benchmarking the performance of Canadian S&T and to international standards. According to Industry Canada media statements, its "streamlined advisory process strengthens the voice of external authorities while helping government decision-makers solve complex science, technology and innovation issues." Really?

If accountability and transparency are to matter, how can Canadians know that STIC is effective? On what basis do citizens know that STIC—five years on—has performed well when they have little way of knowing what the input was? Its website is of little help. Postings include a chart of a so-called innovation road map for Canada adapted from that of Connecticut's in 2006, as well as a 2010 state of S&T report.

Indeed, given the publication last month of the Council of Canadian Academies (CCA) more ambitious state of science and technology report, readers may understandably be perplexed as to why two separate benchmark studies are required from two different organizations commissioned by the same federal patron.

From the outset, STIC was purportedly modelled in part on the Australian Prime Minister's Science, Engineering and Innovation Council. But unlike STIC which reports to a junior minister with two portfolios, the Australian body is chaired by the prime minister with the chief scientist as executive director. It also publishes its advice and summary of its meetings.

The well-respected U.S. model, the President's Council of Advisers on Science and Technology (PCAST), responds to the president who has been present at several meetings. It releases its findings, and in keeping with U.S. requirements for open government, its meetings are accessible to the public with most presentations available on its website. The U.K. Chief Scientific Adviser has developed guidelines for scientific advice and policy-making in government that are updated periodically in an accessible manner. In fact, around the world, most science advisory bodies operate in a consultative and open fashion.

it bears noting that the 2011 Jenkins expert panel report reviewing federal support to R&D had issues with the current closed advisory system and recommended a more inclusive and open process. It argued

"to transform and broaden (the STIC) mandate to encompass whole-of-government advice on innovation goals related to business, science and social innovation, as well as all aspects of business innovation policy and programming. Unlike the STIC, whose policy advice is confidential, the new IAC's (Innovation Advisory Committee) advice should be made public."

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To date, the current federal government remains immorigerous to this rather sensible recommendation.

So is STIC stuck? Given the veil over the council, the answer is murky at best. Its modus operandi has seemingly been to respond directly to requests from government ministers. Sources indicate that some of the work by STIC has been solicited on such matters as public procurement to stimulate business innovation; attracting and retaining talent; supporting world leading research; enhancing Canada's international science and technology presence; addressing private sector commercialization challenges and; examining the role of science in government.

Clearly, while these issues are of import, they have largely been addressed previously by other organizations in some form, and these mostly through public consultative fora and rigorous analysis. In fact, the government procurement issue was the subject a separate report, undertaken by the Jenkins Panel on behalf of Public Works and Government Services Canada.

The STIC advice is no doubt offered on a well-intentioned, volunteer basis by those who—as the saying goes —“are on tap and not on top.” However, properly engaged and more widely communicated, it can offer a larger vista to encourage a healthy, democratic debate. But this can't take place when it is effectively silenced under a shroud of secrecy, and when the science and innovation leadership continues to assume an attitude of prudential acquiescence.

Canadians deserve better.

The ongoing and diverse public assessment work of the CCA aside, Canadians clearly deserve better from their science advisory apparatus. This is especially critical given the increasing integration and impact of S&T within policy debates, not to mention the vacuum for sound public advice and evidence created by the elimination of other specialized advisory bodies in recent years.

Governments come and go—not so with science. Science doesn't just power commerce, it is a mainstay of the country's social and cultural fabric. It is meaningless to argue for a strengthened science culture and knowledge-based economy if citizens are in the dark about what evidence is used and advice being given, how it affects them, and on what basis they can participate more actively. It's time to democratize science advice and give it a veritable voice.

And while we're at it, let's work with Parliament to help equip it with a well-resourced and publicly accessible science and innovation office to better empower Canadians with the needed evidence and critical knowledge for everyday decisions they face today and in the future.

Geeks on the Hill: The Big Bang Theory meets Yes, Minister

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If you missed it, there was a funeral on the Hill last week, but of an unusual variety. Chants of “no science, no evidence, no truth, no democracy,” filled the air as a large gathering of scientists and associates from across Canada descended on Parliament Hill on July 10 to mourn the “death of evidence.” It’s estimated that about 800 people took part in the protest.

Readers of HT will recognize some of the challenges that have beset and upset the research community since 2006. These have ranged from the muzzling of scientists in the federal apparatus to the closing of independent advisory agencies, to cuts to critical research experiments and programs. To be sure, slashing funds is always a cause for concern when the decisions are not transparent, but the bigger issue that happened last week was that it happened. Geeks in lab coats are certainly not your usual suspects to march on the Hill.

But stung by a government running roughshod over evidence and democratic rights, there they were—students, university and college professors, retired professionals, keen observers, real friends of science—all striving to make their voices heard with placards and pickets in hand.

Some MPs showed up from the opposition parties, and the government science establishment was somewhat understandably MIA, but the event received good press on a languid day. The eulogies by various scholars, activists, and others were wide-ranging with one arguing in Cold War language that an iron curtain is being drawn between science and society and another demanding that evidence be brought forward and be included in the public debate and decision-making.

With its eroding policy capacity, what was the government’s response to all this?—“the Harper Government has made historic investments in science, technology and research,” this in the face of the latest data from Statistics Canada showing that the nation’s gross expenditures on R&D as a percentage of GDP fell to 1.81 in 2011, down sharply from 1.92 in 2010 and the high mark of 2.09 in 2001.

Fundamentally, however, the two communities are talking past each other. While important, it’s not only about the money and funding crunches; the scientists are fed up with a federal government that espouses transparency but eschews public advice based on sound evidence. The research community is largely embarrassed by Canada’s declining knowledge image presented abroad and the youth cohort—which is undergoing a rapid demographic change—is seeking a better understanding of their real needs and aspirations—after all, it is this generation that will drive the country’s future prosperity and help tackle the inequities in our society.

On the other hand, the policy community is grappling with how knowledge and new ideas are translated for social and economic needs with a scientific community that traditionally has done little to respond collectively and strategically; indeed, it has often communicated poorly about its impact, and has constantly whined about more money for pet projects in the face of an austerity economy.

So what is to be done?

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For starters, the science community is showing signs that it is becoming more politically astute, not unlike movements in other economies such as in the U.S., U.K., and France where social activism for research and science is well-established and oft quite effective. Perhaps finally, in this country, science lobbying will no longer be viewed as an oxymoron. The students and their mentors who launched the death of evidence march deserve a major round of applause in waking up the community at large on the need to get organized, to be coherent in messaging, and to deliver key sound bites that the public at large can understand and appreciate. More of this is needed including training and primers on how Ottawa really works (or doesn't). Knowing the history and pathology of where divisive issues have emerged and why is also a sine qua non in becoming truly effective on this score.

Parliamentarians and other decision-makers, for their part, could pay greater heed to constituents and customers about why evidence of all forms matters in assessing next steps or action. Evidence first, yes, but acknowledging its input second is equally important.

The power of science comes from active debate and science, and, as we know it today, is grounded in democracy.

The federal government should consider taking a page from that of the Quebec government which has just asked two of its most prominent and experienced research advocacy groups to consult with the knowledge community and informed public in preparing that province's next strategic plan for research and innovation; all of it transparent and democratic.

The Canadian national government and its institutions clearly need to regain their confidence with an increasingly savvy geek community. More than 30 years ago, a Canadian Prime Minister said this about Canada's future through investment in knowledge and technology: "The government must be more than a patron of technological enterprise, more than a source of funding, for even more fundamental is the government's responsibility to help manage the impact of technological change, and to act as an honest broker between competing forces in the movement towards a (scientifically and) technologically sophisticated society."

Prescient then, it resonates today—scientists, students, informed publics, and decision-makers, alike, should respond to this challenge; take their respective responsibilities seriously; and should start talking more constructively with—and not at—each other.

On austerity, prosperity and posterity: an innovation nation?

Originally published by The Hill Times

"The key is to leverage private sector investment in research and development. In spite of our efforts so far, Canada is not keeping up with other advanced economies on this crucial front," (Minister of Finance Budget Jim Flaherty in his speech on March 20, 2012).

When Finance Minister Jim Flaherty spoke to the matter of Canada's innovation and R&D last week, he was following the path of many before him. Indeed, 25 years ago in March 1987, then Progressive Conservative Prime Minister Brian Mulroney said: "The private sector has to do more research and development, and take up a greater share of the national effort in science and technology. Private sector R&D spending in Canada is much lower than most of our major economic competitors."

That was when the Mulroney administration brought down arguably one of the most influential innovation and research strategies Canadians have seen, a multi-billion dollar plan called InnovAction, following a path-breaking national S&T strategy signed unto by all governments.

So, today if their efforts to change the anemic private sector R&D channel have failed six years into their mandate, what is the solution proposed by the current Conservative government to fixing the weak link to Canada's innovation ecosystem?—invest in universities and infrastructure, and re-tweak the National Research Council mandate. If you can't affect behaviour in the private sector, then turn to the public research sector as a surrogate for private sector deficiencies; oh, and pick some winners. Effectively that is what the 2012 federal budget espouses.

The budget argues this is a new approach to supporting innovation in Canada, but many programs and services are already in place designed to do just that.

Hence, the granting councils will be provided \$37-million annually to strengthen their existing industry-university research partnership programs and Genome Canada will receive another \$60-million for a new applied research competition. (Each of the three granting councils will have significant planned savings or cuts over the next three years as a result of the spending reviews so this is little major new funding).

The Industrial R&D Internship program that helps graduate students undertake research in Canadian firms will be doubled with \$14-million over two years, and the Business-led Networks of Centres of Excellence introduced in 2007 will see its budget made permanent (even if it is a bit early to call this program a success). And \$67-million will be set aside to help the NRC refocus on business-led, industry relevant research in addition to doubling the contribution budget of the NRC's highly-successful, cross-Canada Industrial Research Assistance Program (IRAP) in aid of SMEs.

Those who have tracked the NRC's 96-year old evolution will know that the NRC has always been engaged in industry relevant research, and responsive to new challenges—its 1916 mandate was focused "to undertaking, assisting or promoting scientific and industrial research in different fields of importance to Canada."

But where are the major transformations as the Government has repeatedly suggested? Are provincial governments engaged in this in any meaningful way as the federal government continues to broadcast its now five year old S&T strategy? Has the private sector actually bought into this agenda and is there a market demand for all of these initiatives? What happened to the idea of an Industrial Research and Innovation Council to help make sense of the suite of federal programs on R&D and commercialization?

On austerity, prosperity and posterity: an innovation nation?

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We can certainly speculate about why there is no new champion for innovation as envisioned in the Jenkins report, and why there is no rethinking of a new strategy with a longer-term focus on knowledge and innovation. Canada's ratio of gross expenditures of R&D to GDP remains well below two per cent. Many of our competitors are outstripping us in both vision and strategic investments for the future, and the richly-supported Canadian assets in research excellence can only go so far in helping shape our economic and social prosperity. Our industry and technology leaders need to step up, as does the research and entrepreneurship community across the country.

Ottawa needs to take seriously the social aspects and public good nature of investing in research, and the science and technology sectors must become more adept at signalling their value to both the economy and Canadian citizens. It would help if our research and innovation leaders could ask and answer succinctly the following question: what has science and innovation done for the taxpayer—and, more critically, what can it do for our prosperity and posterity?

On the 'rightful place' for innovation and science policy in our governments

Originally published by The Hill Times

When U.S. President Barack Obama came to power three years ago, one of his priorities was to re-establish the "rightful place" of science in his administration. This has meant restoring science as a tool for crafting smart policies to strengthen the nation; getting the best available evidence to decision-makers; hiring highly-qualified public servants to interpret that evidence; and strengthening and making full use of the science and technology advisory council that reports to the president. Over the intervening years, he has moved to implement these and other innovative measures as well as tackling scientific integrity in government departments via the Office of Science and Technology Policy in the White House.

Canadian leaders looking at the future governance of our knowledge ecosystem could learn a bit from our southern neighbour.

Last year, the Jenkins panel report on federal support for research and development also suggested much needed innovation in government. In its last recommendation, the panel noted: "the government needs to establish business innovation as a whole-of-government priority. This will require the designation of a minister as the voice for innovation, with a stated mandate to put innovation at the centre of the government's economic strategy and to engage the provinces in a dialogue on innovation to improve coordination and impact." The report also argued for a new advisory S&T council with a larger public remit to replace the current one.

We've seen a similar call for action before. Twenty-five years ago, in 1987, the Council of Science and Technology Ministers (representing all of the provinces, territories, and the federal government) tabled a discussion paper to the First Ministers Conference on Canada's research and development effort. In it, they argued for a stronger industrial R&D effort; excellence in fundamental research (supporting the proposed concept of national networks of centres of excellence); an orientation to science and technology in the Canadian culture (building on the Science Council of Canada's path-breaking report on science education in the schools); and ensuring a greater level of consultation between the levels of government, industry and the academic community on proposed new S&T initiatives.

Fast forward to today. Despite a more populated and variegated science and research apparatus, the policy landscape designed to facilitate leadership and champion generational change for science and innovation is decidedly more barren. The Council of Science and Technology Ministers no longer exists. Across the country, there are few full-time Cabinet level ministers solely responsible for science and innovation, and the public S&T advisory councils have all but disappeared.

Fortunately, inspired in part by the Jenkins report and other global initiatives, the Prime Minister has recently signalled some interest in revitalizing innovation and research in this country along with expanding S&T partnerships with key trading partners. But will the 2012 federal budget and its fall-out provide a meaningful response to the potential new governance initiatives as suggested by the Jenkins panel and other reports? Our competitors are certainly moving ahead.

On the 'rightful place' for innovation and science policy in our governments

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In the U.S., a debate is underway to restructure key technology and science elements of the Commerce Department following the release of its report on the competitiveness and innovative capacity of the U.S. There is even a wide-ranging discussion centered on the potential for a new Department for Competitiveness. In the U.K., a Committee of the House of Lords is examining the role of chief scientific advisers appointed in all of the U.K. government departments (as well as in Treasury), including their relationship with the chief scientific adviser to the Prime Minister. The U.K. House Committee for S&T also released a report on putting science and engineering at the heart of government decision-making. Australia has just revised its Prime Minister's Advisory Council for science, engineering and innovation that will commission reports from a new council of learned academies.

In India, in declaring 2010-2020 the Decade of Innovation, the Prime Minister has announced a major reform of that country's science and innovation strategy, including changing the policy paradigm for treating the entire R&D sector in the country as one and developing public-private sector partnerships for R&D to promote public and social good.

This global ferment underscores the willingness of governments to experiment with new ways of conducting decision-making and governing when it comes to innovation and research. Behind these explorations is the notion that science and innovation does not map neatly unto largely traditional structures of governance shaped mainly for a different time and different function. Fast, footloose, and flexible, both innovation and the growing interdisciplinary nature of knowledge are entering the very centre of public policy with the result that governments need to be alert to ensuring that these become well-anchored, fully integrated in decision-making and responsive to economic signals and societal needs.

In all of this, the research communities with their increasing civic outreach, along with our Parliamentarians and industry leaders can and should play a more activist role in helping to shape and actually deliver the next agenda for innovation in Canada. The key will be to ensure that the next generation of national innovation and research policies have their rightful place in the Canadian polity serving all Canadians. It is perhaps time to consider a new knowledge portal and national buy-in managed by strong and credible champions to respond to citizens' needs—an Innovate for Canada Agency (akin to our national tourism commission)—that can bring together our disparate organizations in the business of advising with the public, and providing meaningful services and programs to advance discovery and innovation.

Is innovation policy an oxymoron?

Originally published by The Hill Times

"Innovation has become a crucial survival issue. A society that pursues well-being and prosperity for its members can no longer treat it as an option... The lesson for Canada is clear: in addition to mining its mines, it will need to mine its minds."
(Auditor General of Canada, 1994)

The above quote from the 1994 auditor general report on an innovation society and the role of government flags what many of us already know—innovation matters and innovativeness resides fundamentally in people and their practices. By embracing innovation, the AG report also underscored that Canadian governments and their public service could easily become world leaders by exporting their knowledge of governance. I suggest that a key dimension of this is the innovation in the country's science and innovation policies. We have from time to time been quite creative in these avant-gardiste policies, with significant impacts on productivity and social benefits.

Forty years ago, in October 1971, Alastair Gillespie, the freshly-minted minister of state for science and technology was in Paris, meeting with his science counterparts at an OECD meeting. The subject of the gathering was trends and objectives of science policy for that decade. Gillespie signalled that economic growth and quality of life were not incompatible and that science and technology could play interdisciplinary and horizontal roles in helping shape a new public policy agenda.

But, he maintained, it would take better assessments of technology and their environmental and societal risks that were then emerging, including large oil tankers in the North, new mind-altering drugs, entertainment and learning technology as well as other key developments.

Gillespie also noted his concern for clearly articulating what the word innovation meant—"as politicians we have a major responsibility to articulate what innovation is, to other politicians and to our electors." Indeed, in 1971, along with new ministries of state, innovation of a special kind was taking place with the establishment of Canada's International Development Research Centre and the Department of the Environment, and NRC's Gerhard Herzberg received the Nobel Prize in Chemistry.

Today, four decades later, *"innovation"* is still the word—and while the federal government no longer has a ministry of science and technology, it has a four-year old science and technology strategy with an advisory council that provides private advice to the government. The only government that has the word *"technology"* in one of its departments is Alberta; most others have embraced, and to some extent, imbedded innovation as one component of a larger ministry. Can we therefore conclude that innovation is now truly central to, and at the heart of, the dealings of our elected governments?

Not quite. The average stint of ministers responsible for science in the Canadian government since the first appointment of minister Gillespie is just under two years, about the same for federal deputy ministers over the last few years. Continuity and stability in policy-making as a result has been difficult to maintain. S&T and innovation departments are not central agencies like Finance, or Treasury Board and have had little if any clout, not to mention staying power. Proponents for new knowledge investments must make their case on a continuous and competitive basis in the world of diminished expectations and fast-changing financial realities.

Is innovation policy an oxymoron?

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It is worth remembering however that, as the new millennium approached, a spate of policy innovation took hold of Canada's knowledge ecosystem, much like the start of the 1970s had. The unique Networks of Centres of Excellence, established in 1989, had already demonstrated considerable innovation as had the Canada Foundation for Innovation in 1997, but at the turn of the 21st Century, the Canadian Institutes for Health Research (CIHR) emerged from the old Medical Research Council; the Canada Research Chairs were established; a long-standing Canadian Biotechnology Strategy program was implemented; a new Genome Canada was brought back on the table. Their impacts are still with us today.

Other experiments have followed in the last decade. The Perimeter Institute and Institute for Quantum Computing saw the light of day with philanthropic and government support; MaRS was launched and expanded to address the health research and commercialization boom; a new partnership between NRC, the Alberta Government and the University of Alberta took hold via a national facility in nanotechnology; Quebec industry with various research institutions and government developed a word-beating consortium for aerospace research and innovation; a Science Media Centre emerged striving to assist journalists with getting the right science behind their stories; and more recently, the innovative Grand Challenges Canada venture has shown why persistence and strategic intent matters in designing new institutions that fill a need (see the new book, *The Grandest Challenge*).

Further, aggressive initiative from this country's research communities along with key champions in government circles to help create the Council of Canadian Academies accomplished what Gillespie presciently suggested was badly needed—science assessments to inform decision-making.

It is never easy to imagine a future that looks brighter at a time when the lights appear to be getting dimmer. But there are a number of other ventures underway designed to fill gaps in our knowledge governance system; these, if properly channelled and supported, will help shape a more effective public dialogue and further action in science and innovation. A hopeful trend is emerging in Canada where neophobia is no longer the watchword, and heady institutional experimentation is underway once again, a lot of it from bright minds leveraging new partnerships and unique business models as governments struggle to meet the expectations of their citizens—all aimed at improving our quality of life and economic prosperity through innovation and discovery.

The point is this—any sustainable architecture for novel science and innovation policy requires resources, champions, transformative ideas, patience, passion and great timing. Are we not due for some truly innovative science and innovation platforms from our entrepreneurs, creative youth, elected officials and knowledge communities as this decade unwinds? As the AG concluded in a 1994 report, *"if we could continue to establish and maintain among us the interconnection that is the basis for societal innovation, we might well become known as" Canada, the innovative country.*"

Time for action on neglected Naylor report advice

Originally published by The Hill Times

In the past few weeks, federal ministers have fanned out across the country announcing aspects of the 2018 budget relating to the report at various higher education institutions. It is no surprise that more money for discovery research is getting most of the attention. It was virtually the only part of the Naylor report that both the research community and the media covered.

But funding for the research and knowledge enterprise, while important, was only one aspect of the Naylor report's 35 recommendations. The report underscored the need to look at the integrated nature of the country's research ecosystem. Indeed, it noted the work of the Advisory Council on Economic Growth, chaired by Dominic Barton, in framing recommendations for a major review of innovation programming in Canada, as well as stressing the link between a healthy investment in basic research and potential downstream impacts with private sector players in commercialization and social innovation.

The Naylor report focused on improving the stewardship of the country's knowledge system, not simply the strategic investment in federal resources. Among the more significant of these governance issues was the consideration of the consolidation of the four largest federal funding entities for research: the Natural Sciences and Engineering Research Council (NSERC), Canadian Institutes of Health Research (CIHR), Social Sciences and Humanities Research Council (SSHRC), and Canadian Foundation for Innovation.

The report stepped away from this for several reasons, including large transition costs, and recommended instead the creation of a co-ordinating board that would expedite collaboration and harmonization, not to mention an economy of administration. The chief science adviser (CSA) would chair it. This recommendation has largely come to pass, with the creation of the Canada Research Coordinating Committee, but it is chaired by one of the funding agency heads, and not the CSA. Adopting the Quebec model where a chief scientist oversees the co-ordination of the province's granting councils would have gone some ways to ensuring a wider view of the changing nature of science and emerging opportunities for Canada's research assets.

Another critical area that the Naylor report examined centred on the advisory system for science, research, and technology. It recognized previous attempts to institutionalize various external research advisory experiments and concluded that all had failed in their impact, including the moribund Science, Technology, and Innovation Council (STIC) established by the former Harper government. The report argued for a new, high-level National Advisory Council on Research and Innovation designed to provide public advice to the federal government on spending and long-term strategy. It would report through the prime minister and cabinet and be chaired by an external member, with the CSA acting as vice chair.

Such a link would allow a strengthening of ties between federal science and the external research ecosystem while providing opportunities for greater collaboration within the overall knowledge network in the country. That recommendation is awaiting action and the existing STIC has yet to be fully wound down.

The Naylor panel also made suggestions for improving co-ordination among various levels of government, noting that a first ministers' conference on research excellence should be convened to address the pan-Canadian dimensions of our knowledge ecosystem. The last time such a conference took place was in 1987 in Toronto; but then, there was a National Science and Technology Policy signed by all levels of government; all jurisdictions had both a minister fully responsible for science and research and an advisory board to give direction and identify trends in science and technology.

Time for action on neglected Naylor report advice

Originally published by The Hill Times

Today, that is far from the case. Provinces and territories are key players in the science and innovation landscape, especially in education and skills where a new national science, technology, and innovation strategy could benefit from a more co-ordinated approach. This would include all partners of the higher education system.

Addressing the responsibility of the research and knowledge community, the report also reminded us that the status quo is no longer an option. Indeed, the report became a rallying point for many organizations including student groups, Indigenous communities, and various advocacy organizations that made the case collectively that science and knowledge matter for Canada's future.

The 2018 budget did come some ways towards redressing the imbalance in funding recognized by the expert panel and the wider community it consulted. Advocates have welcomed the new funding, but, of course, attention to how taxpayers' funds are spent is just as important as how much is spent. More needs to be done to keep the integrative policy issues raised in all of the Naylor expert panel recommendations front and centre.

A grand innovative challenge with Africa: Africa research chairs (co-written with David Strangway)

Originally published by The Hill Times

A grand challenge, according to the newly-launched Grand Challenges Canada, is a barrier that, if overcome, would help solve an urgent development-related problem in the developing world with the likelihood of global impact through widespread implementation.

There have been a number of examples of this over the past decade, including the Gates Foundation Grand Challenges for global health, various forms of X prizes to provide solutions to critical issues facing society, and of course, the Millennium Development Goals that were recently under discussion at the UN Summit as they reach their ten-year mark.

The MDGs made targets associated with health, child mortality, education, agriculture and some of the contributions to these goals have come as a direct result of science and innovation. Indeed, the Canadian leadership for maternal and child health flowing from the Muskoka G8 Summit is another case.

As Gebisa Ejeta, the 2009 World Food Prize laureate has argued in an interview with SciDev: “For the first time—in a very long time—African leaders have begun to invest in science and are using science as a vehicle for development. And so I really think that the MDGs have provided a mechanism by which leaders have begun to pay attention to the values of science as a solution for a number of problems on the continent.”

Africa needs more global science partnerships and a new generation of scientists trained to solve the continent’s pressing problem of sustainable development, according to Mohamed Hassan, executive director of the Academy of Sciences for the Developing World (TWAS).

Underpinning all of this will be the ability for the developing world to strengthen its capacity in knowledge so that development can be sustainable. It is increasingly understood that African universities need to be empowered to be competitive in attracting back and retaining those who will develop the programs of education and research.

These faculty members and experts will nurture the next generation of leaders. They will develop the coming generation of people who will be the health workers, the economists and political scientists, the scientists and engineers, the innovators and the teachers that are necessary for African indigenous development.

Indeed, the G8 science academies this year jointly released a statement on the role of science, technology and innovation in development suggesting that other countries should increase support, both direct, and via partnerships with their educational institutions, for education and training programs in Africa.

In July, the new director for science policy at UNESCO, Lidia Brito, told a session on advancing science in developing countries that scientists need to “research for Africa and with Africa, and not just about Africa.”

The African Union is expected to launch its long-awaited Research Grants Program within the next few months. The program will be financed by the European Union, but for the first time research proposals will be evaluated in Addis Ababa, rather than Western capitals.

Canada has been a pioneer in partnering with African countries to develop health, science and innovation capacity on that continent and recent developments ranging from health to social and natural sciences and engineering point to this.

The Next Einstein Initiative and Grand Challenges Canada are recent signals of such support.

A grand innovative challenge with Africa: Africa research chairs (co-written with David Strangway)

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Canada has had a remarkable degree of capacity building of its own in research over the past decade and one its marquee experiments has been the Canada Research Chairs program.

Designed in part to assist in reducing the brain drain, these 2000 chairs, along with other scholarship initiatives, have been successful in reinforcing Canada's competitiveness and establishing a network of excellence and expertise across the country. It is perhaps time to consider how to better "globalize" and scale up this program, by leveraging support from the G20 and other key organization such as the World Bank, African Development Bank and the Gates Foundation.

Canada's IDRC and the Canada Research Chairs Program have already experimented with a pilot program for such international partnerships and as Chad Gaffield, the President of SSHRC has argued, "The research collaborations supported through the international research chairs initiative will help Canada and developing countries connect and contribute to the global supply of talent and ideas."

In the past year, an international steering committee of eminent people with considerable consultation around the world, has helped shape an academic chairs with Africa (ACA) proposal to create and fund 1,000 research chairs managed by an international foundation with African partners in governments, in universities and in businesses. This proposal would have members of G20 (including G8) countries fund chairs at \$100,000 per year over five years.

The foundation would have senior representatives on it including funders, a significant amount from Africa and interested philanthropic organizations and other foundations. The proposal has a built in assessment mechanism and renewal would depend entirely on assessed results. The Association of African Universities and many other associations including francophone, anglophone and lusophone perceive the need for such an approach. Senior officials at many of the international agencies and G20 members, including Canada, have shown early interest.

From Morocco to Burkina Faso to Rwanda to Madagascar, much is being done to develop the science and technology capacity that is so desperately needed, but more can and should be done. It is widely understood that it is time to change the approach so that development in Africa will happen. It is recognized that Africa needs to set its own priorities. It is understood that research and development and higher education are an absolutely essential requirement in today's globalizing world. By building the capacity in these institutions in Africa, institutions in the developed world will find willing and capable partners as they move ahead. Partnerships are two-sided. This will be the platform for North-South partnerships, but will also be the platform for south-south partnerships.

All of these would be on the terms of the African partner.

The new global knowledge means that Africa is now ready to unleash the remarkable potential of many young Africans eager to learn by building the university and research capacity at home. This will help the countries reach the Millennium Development Goals. This new focus should be the top agenda for the G8 and the G20. Just as Canada has shown leadership, and continues to do, much can be done to reverse Africa's brain drain and to empower its people.

An African chairs program—a true global grand challenge—would provide a major surge to Africa's capacity.

A stronger knowledge union: renewing the Canada-U.S. science and technology partnership

Originally published by The Hill Times

As the federal government moves to integrate, and otherwise harmonize economic, security and environment approaches to those of the U.S., an opportunity is perhaps emerging to consider strengthening the Canada-U.S. innovation space.

After all, it is arguably the world's most extensive knowledge relationship where more than one-third of the world's R&D is conducted, and where over one-half of all Canadian scientists who co-author internationally do so with U.S. counterparts.

In his State of the Union Address on Jan. 28, building on his earlier elegant public statement at the U.S. National Academy of Sciences on the importance of science, U.S. President Barack Obama reiterated the case for long-term, continued leadership in science and innovation.

Indeed, the White House 2011 budget request of Feb. 1 outlined large increases in basic research and innovation—despite the President's plan to freeze domestic discretionary programs in the hopes of reducing a U.S.\$1.4-trillion deficit. Among the proposed investments are a U.S. \$1-billion increase for the National Institutes of Health; a \$13.3-billion total increase in the budgets of the National Science Foundation, the Department of Energy's science programs and the National Institute of Standards and Technology; a \$540-million boost to NASA for space science; and a \$1-billion planned hike in science, engineering and math education to prepare students and citizens for the future.

A few days later, a statement issued by a bipartisan group of well-respected politicians and research leaders made the case for stronger use of science in U.S. foreign policy—"Many of our most pressing foreign policy challenges—energy, climate change, disease, desperate poverty, and underdevelopment, and WMD proliferation—demand both technological and policy solutions. In these and other areas, U.S. national security depends on our willingness to share the costs and benefits of scientific progress with other nations."

If scientific leadership and global knowledge partnerships are to be the benchmarks of any U.S. economic revival, then clearly Canada should pay more attention to the signals from our largest trading and scientific partner. Certainly, others have, such as China, the EU, India, the U.K., and Australia. If it is to avoid increased concerns about a potential brain drain, Canada has no choice but to ramp up efforts for joint knowledge cooperation and help shape a revitalized North American research and innovation space as this country gradually climbs out of the global recession in better shape than most.

What will it take?

First, it requires recognition that investing in science and innovation with our southern partner (and others) is a long-term proposition and, as demonstrated by the U.S., involves significant and sustained funding of both the domestic science base and skilled people, not just infrastructure, starting with the granting councils and universities, but also including the federal government research labs and other institutions such as Genome Canada, and the NRC.

Second, any renewed continental focus, in addition to key leadership and sustained commitments from all sectors, will require a well-articulated road map for a successful partnership.

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For instance, the Science, Technology and Innovation Council could work with the U.S. President's Council of Advisers on S&T in shaping this new research agenda with a broad and open consultation (including with the provinces and states who already actively engage in joint technology ventures and skills cooperation).

It also means taking up the foreign policy challenge to enhance existing cooperation in key areas where both countries are already quite active. These include Arctic research, advanced manufacturing, space science, environment, metrology and standards in emerging fields such as nanotechnology, and synthetic biology; not to mention the ICT and life sciences arenas where Canada and the U.S. increasingly share common platforms for digital media and greater health breakthroughs. The Canada-U.S. Clean Energy Dialogue, and the just-announced Grand Challenges public request for information by the White House Office of S&T Policy and National Economic Council could also serve as models to explore strategic engagement via bilateral major programs. Of course, all of these and others must imbed and build on the extensive social sciences research cooperation that exists between each country.

Since the U.S. and Canada are both keen to ally with emerging powers in selected technology areas, why not piggyback on these ventures and foster tri-lateral or multi-party partnerships where appropriate. For instance, in energy R&D, the U.S. and China have established a joint \$150-million clean energy centre; why not consider how Canada can bring its own assets to this given its growing S&T linkages with China through the International S&T Partnerships Program managed by DFAIT; similarly one could envisage other such existing arrangements with the U.S. and India, or the U.S. and Japan, and U.S. and Mexico.

Finally, with the well-established reputation in supporting science and technology for capacity building in the developing world, Canadian institutions could link up with U.S. partners in strengthening knowledge capacity in Africa and other regions in need. The G8 and G20 meetings in Canada this June could certainly give impetus to this needed collaboration; further down the road, efforts to enhance research linkages can also be developed leading up to the 2012 annual meeting of the prestigious American Association for the Advancement of Science in Vancouver (the first such AAAS meeting in Canada since 1981).

As the Canadian foreign policy statement of 40 years ago stated, "Canada's most effective contribution to international affairs in the future will derive from the judicious application abroad of talents and skills, knowledge and experience, in fields where Canadians excel or wish to excel."

Let's put this to the test today in making Canadians healthy, wealthy and wise, and responding effectively to Canada's global responsibilities.

Canada needs a branding makeover in global, knowledge-based economy

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Many would agree that the beaver, a traditional national branding symbol, just doesn't quite cut it in a rapidly-changing, highly-mobile, knowledge-based economy. Don't get me wrong, beavers are cute, if you like water rodents. The mascot of our five-cent coin, the beaver symbolizes the amiable industriousness often associated with Canada.

Advertising professionals will tell you that branding is a critical aspect of marketing. Strong images shape the perception of clients and consumers. This holds true for nations as much as products and services.

An oft-ignored branding symbol for nations is its science diplomacy. The ability to use the "soft power" of science as a tool in the arsenal of foreign relations and international influence is becoming increasingly important. Certain countries have grown adept at using their knowledge assets to effect change and move policy and diplomacy.

The U.S.—the graceful, yet aggressive eagle brand—is good at this; China, with its powerful imagery of mythical dragons, is also accelerating their global knowledge presence. In Canada, *Castor canadensis*, the nocturnal builder of small dams, continues its travails.

Slapping one's tail in small lakes and pools is no longer sufficient when strategic knowledge through science and innovation is the new force driving turbulent, global currents. Indeed, perhaps the more wide-ranging and clever orca and raven, inscribed on the newly minted Vancouver Winter Olympic medals achieves a more spirited image.

The Canadian track record in using science and innovation assets to help brand its global image has at times been uneven. Science can be influential in shaping foreign aid, national security, emergency preparedness, global health, and enhancing bilateral and multilateral relations.

There are several opportunities in which Canada can be more strategic in this regard—including participating in the International S&T Partnerships Program with emerging countries; the development of initiatives in support of research and capacity building with developing countries including leveraging the diaspora of domestic talent, increasing the pool of more globally-attuned individuals in younger generations with incentives such as the Vanier scholarships or those from the Trudeau Foundation, and the enhanced use of science academies and expert advisers to influence and shape global challenges. More must be done if the impact is to be sustainable and have continued support. And it is a two-way street; foreign policy should also be able to help science's contributions to the larger questions of international public policy.

Taking advantage of these forthcoming global opportunities to strengthen the interaction of science and state will require a sound "intermestic" approach, involving the merging of international and domestic priorities. We need to determine how to organize a stronger, more strategic national contribution to these and other efforts. We must improve the science literacy in our foreign relations and enhance the knowledge and interest of our science community on the importance of statecraft. By better incorporating science diplomacy wisely into Canada's global image, our country will only be positively altered as a result.

Let Canadian science off the leash

Originally appeared in iPolitics

At a political level in Canada, discussions on science and innovation have always suffered from CPA — Continuous Partial Attention. Carrying on this tradition, the Oct. 16 throne speech will no doubt make overtures regarding research and innovation, likely including reference to a revised federal science and technology plan.

Now, imagine if a cabinet-level, full-time science minister were to stand up in Parliament and say something like this:

"I cannot begin to tell you how proud I am today to rise in this chamber and speak in support of a speech from the throne which, for the first time in our country's history, has placed science and technology (S&T) in such a prominent place of government operations and in the political agenda. The provincial and federal governments must work together to forge a coordinated national policy. S&T must move to the centre of government decision-making.

"The consensus which has emerged identified four critical issues which must be addressed immediately. The first has to do with creating a culture in Canada which appreciates and instills pride and celebrates Canada's scientists, engineers and innovators, which promotes a strong awareness of the importance of Canada today, and in the decades ahead, of astute application of S&T which utilizes the talents of Canadian women in science careers. We must expand the capacity of our universities to respond to new demands for basic research and the training of researchers for exploration of new disciplines and the development of new skills. There is a national consensus that we must urgently develop and use new strategic or ... 'enabling' technologies which underpin our industrial capabilities.

"For the first time, Canadians have a prime minister who is demonstrating appreciation of achievements of science, on a regular basis and in a formal way, with Canada's most eminent scientists, engineers and leaders from business, industry and labour. He will personally chair this new board or council. It will assess our national goals and policies regarding science and technology and their application to improve Canada's competitiveness and maintain prosperity ... Lastly, there is consensus that governments should use the full scope of their instruments to advance R&D. I believe all parties are in agreement that we must take long-range action. That is why we have made our plans for a federal S&T policy with an eye on the next generation, not with an eye on the next election."

Just imagine ... The words quoted here are excerpted from a speech given in the House of Commons by a former Progressive Conservative science minister on Oct. 8, 1986. Can we expect to hear something as far-reaching in scope this week?

Sadly, the signals are not positive. For some time now, federal science, technology and innovation policy has been festering in a kind of primordial soup carbon-dated to 2007, when the prime minister announced a so-called 'mobilizing framework' in Waterloo.

Six years on, it needs a new spark. Despite continued statements suggesting that the climate for Canadian science is being supported and is improving — in part by an anxious scientific leadership pre-occupied with funding cuts — the country's overall R&D spending is dropping and our global standing on innovation measures remains stagnant.

Let Canadian science off the leash

Originally appeared in iPolitics

Government scientists remain on a leash. Formal science advice provided by the Science, Technology and Innovation Council operates in stealth mode, with no public accountability. The scientific image of Canada as an open, knowledge nation has taken a hit. Science is apparently only useful if it powers commerce. These and other manifestations of a worn-out science and innovation policy show little direction, vision or commitment.

So here's some advice to the newish team trying to shape a revised research-innovation agenda. Demonstrate meaningful leadership. Talk to Canadians — for real. Listen to your own scientists. Take lessons from abroad. Support all of the research community and respect their inputs as allies — not as enemies.

Consider joined-up policy engaging other parts of the pan-Canadian policy community as well as provincial and territorial partners. Take a leaf from the PC-led national S&T strategy of 1987 and build a new science and innovation strategy by making it national in scope. Take on good speechwriters who know how to talk about science and its value to relevant audiences.

And get real — with more than ambient rhetoric — about creating a culture that values skills, excellence, entrepreneurship and talent, both with our society and within Parliament.

To be sure, knowledge communities in this country also bear some responsibilities. Articulating more powerful arguments about the role of science and research in Canadian society is one of them. They must keep in mind the need to know the limits of policy-making and take on a renewed approach to the role of science in nation-building. Advocating the usefulness of supposedly useless science will be a continuous challenge.

As Mike Lazaradis, in his 2012 Power of Ideas speech to the American Association for the Advancement of Science, argued:

"As we develop science policy we need to look beyond the short-term context, beyond the research that looks immediately promising. If we're blinded by the urgency of our problems, we will go the wrong way. We'll be investing in horses, carriages and cleaning up the streets instead of fostering the research that can give rise to an idea or technology that is going to change the world."

It is heartening to see that the Canadian research lobby is waking up from its lethargic stupor and starting to engage in the political debates with a more activist and constructive agenda: the successful ELA campaign overturning a small-minded federal decision; the Death of Evidence march last year and its successor Stand Up for Science by Evidence for Democracy (evidencefordemocracy.ca); the Get Science Right experiment of CAUT (getscienceright.ca); the Concerned Science efforts of PIPSC (pipsc.ca); not to mention growing movements in various professional groups for more open science.

We may have witnessed a tipping point with a new generation of tech-savvy and politically conscious scientists and their allies who understand social media and know how to mobilize it for political effect. But it will take more to sustain the message. Here are some modest suggestions for maintaining the momentum as the Harper government launches its next S&T strategy:

Let Canadian science off the leash

Originally appeared in iPolitics

- Develop a clear public statement outlining why science matters (see President Obama's 2013 speech to the National Academy of Sciences) with examples that have public resonance. And resist the temptation to oversell the impacts.
- Invite local parliamentarians from all stripes to events where science and innovation are on the agenda. Consider an annual science day-fair on Parliament Hill or provincial legislatures, in addition to orchestrating balanced, public science debates with all the political parties in the lead-up to federal or provincial elections.
- Recognize that science is ultimately aimed at helping shape the human condition in all its respects. Yes, it needs to be framed within a contemporary context — but since science also provides the polity with sound evidence based on facts, it should not be arbitrarily muzzled or leashed. As Thomas Jefferson once said, whenever the people are well-informed they can be trusted with their own government.
- Ensure a major science presence in the celebration plans for the forthcoming 150th anniversary of Canada. Science helped build this country and it continues to add to its social and economic foundations.
- Challenge senior government officials and private sector leaders at all levels on future directions of science for Canada. Get their attention about the need to renovate dated science and innovation strategies by making them more open and relevant to today's climate and public needs.
- Target key messages to senior ministers with science and research portfolios, as well as the board members of granting councils and other funding bodies, including members of the federal government's Science, Technology and Innovation Council. While their counsel is secret, the STIC's stated mandate is to provide evidence-based S&T advice on issues critical to Canada's economic development and Canadians' social well-being. Demand public accountability and transparency in their operation. And ask why Canada, unlike other jurisdictions, has no chief science adviser or ambassador for science.
- Examine, enlist and learn from similar campaigns that have been effective in other countries, especially those in the UK, France, Australia and the United States and especially on how to engage private sector associations and lobby groups more constructively.
- Design and coordinate a collective research community brief or vision statement for next year's budget and beyond. Make it clear that researchers understand how to operate in a climate of austerity and priority-setting without jeopardizing first principles of excellence, integrity and transparency.

Ultimately, Canadians require a more directed and visionary approach in moving beyond just the rhetoric. It's time to initiate a meaningful spark that can bring life and passion back to this country's science and innovation policy.

Why Canada needs a science watchdog (Co-written with Scott Findlay)

Originally appeared in iPolitics

The recent series of pieces at iPolitics on Canadian science and science policy bears witness to a growing concern about the health of public interest science.

One such source of concern is the increasing imposition of constraints on the ability of government scientists to communicate their science to the public. Concerns about muzzling have been voiced by academic institutions like the Canadian Association of University Teachers, media associations like the Canadian Science Writers Association, professional organizations like the Royal Society of Canada and even the prestigious international science journal *Nature*.

The Professional Institute of the Public Service of Canada recently released the first results of a survey of over 4,000 government scientists, 90 per cent of whom reported that they were prevented from speaking publicly about their scientific work.

The evidence of muzzling is sufficiently persuasive to have prompted an investigation by the federal Information Commissioner into the legality of government communication policies, following a petition by the University of Victoria's Environmental Law Clinic.

A second source of concern is Canada's reduced capacity for science in the public interest. Recent data from Statistics Canada indicate that in 2012-2013, for the fourth year in a row, federal science and technology funding has declined, with most science-based departments and agencies experiencing cuts. One might argue that in these trying times of fiscal restraint, even science must do its bit. But despite a more difficult economic situation south of the border, President Obama's 2014 budget plan still included a 9.2 per cent increase (\$143 billion) in federal non-defense R&D spending.

Reduced capacity for science in the public interest reflects both a shrinking budget and a shift in priorities away from basic scientific research. The 2013 budget provided \$37 million to the three research councils for industry-dedicated programs, effectively replacing funds lost to deficit reduction measures. The Natural Sciences and Engineering Council's (NSERC) Major Resources Support Program, which traditionally provided much of the infrastructure and equipment for basic research, has been suspended. And earlier this year, the National Research Council (NRC) was restructured to serve as a "concierge" facility for industry.

A third concern is what appears to be the selective elimination or reduction of institutions and programs engaged in the collection of scientific information on the environmental and health impacts of economic development. Shuttered or defunded programs and institutions include the Experimental Lakes Area, the Canadian Foundation for Climate and Atmospheric Sciences and the National Round Table on the Environment and Economy, among dozens of others.

A fourth concern is the apparent indifference to evidence-based decision making. In August 2012, responding to questions about the Northern Gateway pipeline, Prime Minister Stephen Harper asserted that "the only way that governments can handle controversial projects of this manner is to ensure that things are evaluated on an independent basis scientifically, and not simply on political criteria." In March 2013, Minister of Natural Resources Joe Oliver advanced the view that President Obama was — on the Keystone XL issue, at least — "driven by facts", adding "*that's what drives us as well.*"

Why Canada needs a science watchdog (Co-written with Scott Findlay)

Originally appeared in iPolitics

The evidence suggests otherwise. The mandatory long-form census that provided critical information to governments and businesses alike was replaced with the voluntary National Household Survey (NHS), which, it was argued, would deliver similar quality data — even though all the experts said otherwise. Recently, Statistics Canada slapped a disclaimer on the first results of the survey and data from many municipalities across Canada were withheld due to concerns about data quality.

We now have a Safe Streets and Communities Act, which imposes minimum mandatory sentencing on a number of offences. Results of similar programs in other jurisdictions are highly variable; within Canada, there is little available evidence of the effectiveness of mandatory minimums, and better evidence of substantial financial and public health costs. The recently amended Fisheries Act also includes a number of provisions that fly in the face of current scientific understanding of what it takes to sustain Canada's fisheries.

Will these issues resonate on the election trail in 2015? We hope so. But whether they do or not, Canadians should expect our next government to take concrete action to restore the health of public interest science, and implement preventative measures to ensure it stays healthy.

To inform future action, let's revisit the past.

In 1999, the federal Council of Science and Technology Advisors (CSTA), in its Science Advice for Government Effectiveness (SAGE), noted that *"democratic governments are expected to employ decision-making processes that are transparent and open to stakeholders. Openness implies a clear articulation of how decisions are reached, policies are represented in open fora, and the public has access to the findings and advice of scientists as early as possible."* It goes on to say that *"departments need to publish and disseminate widely all scientific evidence and analysis (other than proprietary information) underlying policy decisions, and show how the science was taken into account in policy formulation."*

Precisely. In keeping with the SAGE report, we need a federal science communication policy that explicitly lays out the conditions under which government scientists can communicate their science to the public and media. A case can be made that government scientists ought not to comment publicly on government policy, and there are undoubtedly circumstances where the public interest is better served by preventing disclosure.

Nonetheless, such a policy should allow — indeed, encourage — scientists to communicate their science freely, openly and directly unless there are overwhelmingly compelling reasons for doing otherwise.

In 2006, the Federal Accountability Act amended the Parliament of Canada Act to create the Parliamentary Budget Officer (PBO). The PBO's job is to keep parliamentarians abreast of Canada's finances and ensure that Canadians hear the real deal on the state of Canada's finances, not simply what the government of the day thinks Canadians ought to hear.

The state of Canada's finances are important — but so is the state of Canada's public interest science. Perhaps the time has come to create a well-resourced Parliamentary Science Officer (PSO), charged with providing independent analysis to Parliament on the state of Canada's public interest science. Such an office would also provide an objective analysis of the current state of scientific understanding on a range of policy and legislative issues and, perhaps most importantly, synthesize and evaluate the scientific evidence relevant to policy or management alternatives.

Why Canada needs a science watchdog (Co-written with Scott Findlay)

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This oversight function would serve to expose instances where scientific evidence has been misrepresented or ignored, and highlight where there is simply little scientific evidence on which to draw.

Does Canada need such an institution? Yes, desperately. The position of the National Science Advisor was eliminated by Prime Minister Harper in 2008, a decision hotly debated during a House of Commons committee hearing. While the Science, Technology and Innovation Council (STIC) provides advice directly to the government, this advice is completely confidential. Moreover, unlike the PBO, STIC has no legislated right of access to the data required to fulfill its mandate. The Council of Canadian Academies (CCA) does undertake science assessments, but principally in response to government-defined terms of reference.

Most importantly, neither STIC nor the CCA serve parliamentarians directly. As a service operation, a PSO would help upgrade science literacy among — and provide response briefs to — the rank-and-file of both the House and Senate, assisting them in fulfilling increasing public expectations of science-informed decision-making.

The idea of a PSO is not original. The UK has had an office of this sort since 1989, which has served both Labour and Conservative governments well. Why not Canada?

In 1994, Canada's auditor general, in his report to Parliament, noted that "our audit has shown that an effective, highly-focused, national science and technology strategy is critical to survival and growth in today's high-technology economic environment." Canada has no national science policy — though we had one in 1987 that reflected a vision of a national science agenda shared and endorsed by all levels of government. It has since been superseded by a federal S&T strategy that focuses exclusively on federal support for university and private sector scientific research and innovation.

In 1987 we recognized that provincial and territorial governments are major players in the S&T sandbox. A properly formulated national science policy could, among other things, provide the framework for federal-provincial and federal-territorial agreements on: (a) investment in public interest science; (b) the principles and practices of science communication; and (c) the role of scientific evidence in decision-making, in areas of shared authority or interest. More generally, it would help ensure that all sectors — and Canadians — benefit from the most effective use of our knowledge resources in addressing global, national and regional challenges.

A federal policy on science communication, a Parliamentary Science Officer, and a national science policy are potential ingredients of an action plan to restore the health of public interest science in Canada. Others might be suggested. But Canada's next government must intervene quickly, lest the patient slip away.

Do science ministers really matter?

Originally appeared in iPolitics

With the recent appointment of yet another junior science and technology minister during Prime Minister Stephen Harper's recent mini-cabinet shuffle, the people appointed to the post since 1971 now number more than two dozen.

Some held the post for as little as three months, others for as long as five years. With one exception, they've all been men. Little clout goes along with the job, usually, since they tend to be ministers of state reporting to more senior politicians. On rare occasions we have seen ministers of science; unfortunately, they tend to have other portfolios that can distract from research and science policy.

So why do governments keep appointing them? When it was first proposed in 1971 under Pierre Trudeau, the minister and ministry of state concept was novel — an advisory ministry. Robert Uffen, who served as chief scientific advisor to cabinet, said in 1972 that *"the ministry at present appears to have power by virtue of influence but lacks the powers that usually accompany ministers of operating departments — tradition, statutory responsibilities, financial authority, political prestige, large staffs and expensive facilities ..."*

Despite this, a ministry of state for science and technology managed to survive for over two decades until it was dissolved and both 'science', and 'technology' disappeared into what was to become Industry Canada. Today, the policy functions of science and technology, along with its junior minister, are embedded in that department. How, then, does one make any headway in an environment bereft of any real financial heft or political authority?

There have been some fairly effective science and technology ministers. But they've been few and, without the support of the Industry and Finance ministers, science ministers can do little other than engage actively within the government machinery, the media and the communities that support the role.

Prime Minister Harper promised a renewed federal science, technology and innovation strategy via the October 2013 throne speech. The previous minister of state initiated a short consultation to obtain views from selected groups to breathe some life into a moribund, seven year-old federal strategy. The new junior science and technology minister, Ed Holder, will now have a role to ensure its follow-through (oddly, he does not have 'innovation' in his title). Clearly he will need to engage with the research funding players in government within the more powerful science-based departments.

He also will have a steep learning curve coming to grips with the portfolio agencies — including two of the three the granting councils and the National Research Council itself — undergoing a controversial 'transformation' into a Research and Technology Organization.

And he will have to obtain buy-in from provinces and territories which view unilateral research program incursions by the federal government with suspicion.

All of this is to be conducted in a climate of budget cuts, of low morale in government science circles as a result of eroding infrastructure and the muzzling debacle — not to mention Canada's declining reputation as a reliable international knowledge partner.

Do science ministers really matter?

Originally appeared in iPolitics

So can a junior science minister really make a difference in the face of this? Not likely. It would happen only if Canadians demand, and a prime minister appoints, a designated senior cabinet minister responsible for science, research and innovation, supported by a chief science advisor who has the full support of the research community at large.

Such a minister could, for example: act as a responsible conduit to Parliament for all three of the federal research granting councils; re-assert the value of public interest science; and engage in an open debate with stakeholders while negotiating a national science, technology and innovation strategy that underscores a long-term vision for Canada's society and economy.

A new ministry for science, technology and innovation could provide a much-needed signal that science matters in Canada.

A future for science and innovation? It's time for Canada's tomorrow

Originally published in Research Money

Some years ago in these R\$ pages, (December 21/09), I opined that we have yet to see a business card that says Minister for the Future. A recent speech (May 25) by the Australian Chief Scientist refers to himself as an Ambassador for the Future. That's close. CP Snow in his classic 1960 essay on Science and Government made the comment that *"scientists have it within them to know what a future-directed society feels like, for science itself, in its human aspect, is just that."*

Indeed, in the late 1960s, a great deal of foment and open public debate was underway in capitals around the globe to re-assess where governments stood on planning and investing for the future. More specifically, what role could research and the sciences contribute to mid- and long-term national economic and social goals? As one example, the Organisation for Economic Cooperation and Development (OECD) — then a 22 member think tank based in Paris — was examining the research systems of different countries. Canada was its 10th target, and in late 1969, the OECD published its results in both official languages.

The 400-page plus volume on Canada followed the usual procedure for such reviews. An international expert panel (from the OECD, France and Japan) was appointed to visit Canada and develop information and data based on specific questions about the national research system. A so-called "confrontation" took place in Paris with selected senior Canadian officials responding to the key findings of the report before its release.

Given current consultations underway by the Trudeau government, it bears remembering some key points in that report. The OECD recommendations included:

- A minster for science without departmental responsibility be established deriving authority from the prime minister;
- A Science Policy Council (of independent experts) to advise the government on scientific matters through a science minister;
- A Government Research Board of various science-based departments represented by their most senior officials to assist in interdepartmental coordination;
- A strengthened, more focussed role for Canadian universities to serve national goals through multi-disciplinary groups; and,
- A single comprehensive granting agency combining the functions of the then Medical Research Council, the Canada Council and NRC (which was then supporting university research as well).

So who says you can't go back to the future? Today, the Minister for Science (imbedded within the Industry portfolio) is contemplating a science advisory structure that will at least include a Chief Science Adviser and is mulling over what to do with a moribund Science, Technology and Innovation Council — perhaps with a new advisory apparatus that will be open and transparent to support the new science adviser.

As Kirsty Duncan meets with the senior levels of science-based departments and agencies, no doubt one topic will be trying to figure out how to better integrate government science within a new ecosystem being built up around science advice, research support and the forthcoming Innovation Agenda.

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Additionally, the federal review of funding for research now underway — with help from an Advisory Panel on the Review of Federal Support for Fundamental Science now seeking applicants as members — will be exploring the scale and scope of the granting councils and other agencies and colleges that support the public research ecosystem across this country. Ultimately, however, much of this will have to somehow find its way into the proposed Innovation agenda.

Lessons from the past

Almost 15 years ago, the 2002 two-part policy thrust of the Chrétien Liberal administration tried, but failed, to effectively integrate the skills and learning foundation needed to stimulate innovation. Here's what then PM Chrétien said at the launch of the Toronto National Summit on Innovation and Learning in November 2002.

"First, we must make Canada a learning society; where learning and upgrading are continuous." An early childhood development agreement had been signed with the provinces and the Canada Millennium Scholarships were in full swing.

"Second, we must become a knowledge society that invests in ideas." The Canada Foundation for Innovation, Canadian Institutes for Health Research, Genome Canada and the 2000 Canada Research Chairs had been created and an agreement with AUCC — (now Universities Canada) — signalled a commitment that universities would double the amount of research they performed and triple their commercialization performance.

The PM also announced a revitalized Advisory Council on S&T (ACST) chaired by then minister of Industry Allan Rock who in turn had asked the advisory body to provide guidance on how to simplify and consolidate the research landscape. His predecessor, Brian Tobin, had met in September 2001 with provincial and territorial counterparts in Quebec outlining principles of action to speed up Canada's transition to an innovation and knowledge-based economy.

"Third, we have to improve how we bring ideas to market, creating clusters that link those who produce to those who apply knowledge". The national nanotechnology centre in Alberta had been announced.

"Fourth, we must work together on Smart Regulations that spur innovation." The government established an expert advisory committee on the subject along with a Smart Border Declaration).

"Finally, we need to draw on our Diversity of talent... that will create a quality of life in our communities that is second to none." An urban strategy was designed; there was increased support for Aboriginal Business Canada and a PM's Caucus Task Force on Women Entrepreneurs was launched.

Some argue that history rarely repeats, but it does rhyme at times. The closing section of Senator Lamontagne's final report on science policy in 1977 made the case for a Canadian Centre for Future Studies that could help identify aspects of Canadian society, knowledge, technology and economy that were changing most rapidly and how these would impact on Canadians.

This country might well introduce such assets in its policy planning, building on existing think tanks, government networks and academic centres, as we move to an innovative future, and hopefully with a strong and bold vision, for the country in 2017.

Finding common ground — A revitalized agenda for scientists and politicians

Originally published in Research Money

There's a sunnier disposition among Canada's science community these days. Maybe it's because they have read the Liberal Party platform which states: *"We will value science and treat scientists with respect"*. This is an extraordinary statement for a political party taking power. In the annals of science policy history, it is unprecedented. Hopefully, the Trudeau administration will make good on its various pledges to base its policies on facts, and eventually appoint a Chief Science Officer (note the wording) whose remit will be to ensure that government science is fully available to the public.

For good measure, the platform also states that scientists will be able to speak freely, and scientific analyses will be considered when the government makes decisions. In short, scientists will be back on tap — but not on top. That is for the good. After all, Canadians elected our political representatives, not the science community, to help frame policy and adroitly steer the country.

Some will claim that most of these pledges on science are easy to deliver; and they are virtually costless. As Trudeau said in a Financial Times interview: *"I'm on the side of both economists and people who say why put off investing when we have an opportunity now"*. Fair enough. But funny things can happen to people, principles and pledges once in power. Slogans can collide with hard choices. And science is a marginal policy issue at best, with little political clout or constituency; the new grassroots science advocacy groups notwithstanding.

Those that have been arguing for a more fulsome chief scientist should cast their eyes across the Pond where the UK — with its own national chief scientific adviser, chief scientists in almost every department, Innovate UK, and a Parliamentary Office for S&T — is performing abysmally in R&D, sliding even further than Canada in global rankings. Different and more do not always equal better. That said, low hanging fruit are there for the picking for an avant-gardiste Canadian STI agenda.

Let's start with the Science, Technology and Innovation Council (STIC) whose mandated 2014 state of the nation science and technology report was held back and whose advice remains confidential, despite calls for increasing the nation's public science culture. It could be dissolved with another more open and representative advisory body created. On the other hand, the history of such bodies in Canada is far from salutary — they come and go with little learning of what actually works. Perhaps using existing bodies to provide punctual commentary or analysis on critical public policy issues requiring external scientific input could be explored along with on-going evaluations of their success, rather than the facile option of establishing yet another council for a new government.

Then there is the matter of government research beset by unnecessary barriers, cuts and declining morale. As a 2014 expert panel on government science has recognized, the current model of internal S&T within the federal government should evolve in relation to changing external realities. Not that this is a new subject. We have witnessed several such reviews in the past.

The expert panel focussed largely on those S&T activities carried out by or on behalf of federal government to fulfil its mandates. The panel completed its task, handing over its confidential recommendations to the senior bureaucracy. Ensuring its follow-up would be a logical mandate for a new, legislated Chief Science Officer, while at the same time adopting science integrity principles for use of evidence in government research and decision-making (see R\$, October 10/15 on the Science Integrity Project).

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While the Liberal Party has remained silent on the NDP idea for a Parliamentary Science Officer, it would make sense for the Trudeau administration to consider a resource centre or specialized STI office for all Parliamentarians. Clearly, the great number of new MPs will require assistance and analysis in dealing effectively with science-based issues coming forward from their Parliamentary committees and constituencies.

Consideration should also be given to ensuring that Canada's international image in science (which has suffered greatly from the muzzling saga and ideological stands on global climate change) is restored with careful assessment for using diplomacy more aggressively in promoting partnerships while advancing our aid, trade and statecraft. Science — international by nature — can be a perfect instrument for this if used wisely.

With the Harper 2014 federal STI strategy likely to be set aside, it remains to be seen if the Trudeau government can leverage its new found partnerships with other provincial and territorial governments and First Nations in helping shape a pan-Canadian approach to STI. The 1987 National S&T Policy signed by all governments was the first such experiment — it does not have to be the last.

Elements of the business community are proposing a more muscular approach from the federal government, blending innovation, science and technology through a new super ministry. Canada has experimented in the past with such machinery changes, including a ministry of Industry, Science and Technology. It is simply not enough to continually advocate for a linear approach to innovation — there is no one policy intervention or portfolio that will address the innovation gap in this country. Indeed, it is often forgotten that most of the value of innovation is associated with its diffusion, adoption and adaptation by users and consumers.

It behooves the private sector whose R&D performance has been declining year over year to better integrate knowledge investments as part of their overall business planning and management. Some private sector alliances for technology are emerging but business associations should weigh carefully the advantages of having competitiveness enhanced through more sophisticated strategic innovation thrusts.

Finally, the university, college and granting council leadership in this country should actively support the needs of their clientele, in addition to working with grassroots science, environment and research organizations, by coming forward with creative, joined-up approaches in partnering with federal and provincial decision-makers.

This is not an overly ambitious agenda. It just needs recognition from the new PM with a strong signal (perhaps via a high-profile speech) that these steps are necessary to establish a common ground for greater prosperity in Canada's next 150 years.

Legacy of Lamontagne and lessons for today

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The recent announcement of the Governor General's Innovation Awards by David Johnston (Canada's de facto science ambassador and de jure science cheerleader) has brought to mind an earlier proposal put forward by another statesman of science and public policy — Maurice Lamontagne. The Laval-Harvard-educated senator chaired a 10-year special Senate committee study of science policy between 1968 and 1977.

The committee suggested that the government institute a series of awards for "*meritorious technological innovation and to Canadians contributing significant inventions, to be called The Innovation Canada Award and the Invention Canada Award*".

For good measure, he also put forward the need for a Canada Innovation Bank to support the launch of technological innovations in new or existing small- and medium-sized enterprises and that grants designed to encourage R&D activities in industry be integrated into one multi-disciplinary program (mirroring one of the Jenkins panel recommendations). That was in 1972. Like good coffee, policy ideas can percolate for a while.

The Lamontagne Committee's four-volume report remains one of the most comprehensive examinations ever undertaken of Canada's science and innovation system. The committee held extensive consultations and hearings, assessed international good practices, and laid out a roadmap for science policy. While it had both its supporters and its detractors, ultimately it fostered a national dialogue on a critical issue impacting Canada's economy and society. We have not seen the like since.

The final volume of the report, issued in 1977, was a reflective piece labelled "progress and unfinished business". It is instructive to re-assess some of its recommendations as they resonate with a debate today on why, where and how Canada should improve its ecosystem for innovation.

Weak business innovation

At its heart, the report restated the persistently weak link in Canada's innovation system — that of the business sector. In testimony to the Senate Committee, the then minister of state for S&T in 1977 argued that "*the proposed (federal) budget reflects the government's intention to give greater emphasis to the research effort in industry and to design measures and policies that will encourage industry itself to take on greater responsibilities in this area.*" We heard almost identical prodding 38 years later in the 2015 federal Science, Technology and Innovation Strategy. Despite the continuous moral suasion, business innovation remains the weakest link in Canada's innovation approach.

Government science

Recognizing that government science was a critical component, the report suggested that science-based departments and agencies should have a science adviser acting as liaison between top management and research services. The senator also added that there were intramural scientific activities indispensable to the success of government missions, and that government labs also had a role of supplementing and complementing the university and industry sectors.

Also singled out was a program in cooperation with the Public Service Commission and the Treasury Board to facilitate mobility of research personnel within the government and between universities, industry and public agencies. The recently completed Knox expert panel on government science has examined these and related issues yet again — maybe action will follow.

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Arguing that the National Research Council mission had become ambivalent (on the one-hand it was devoted to long-term research, and on the other, it was a complex of industrial labs), the Senate Committee made strong, yet controversial recommendations to transform the NRC into a national academy concentrating on long-term investigations, fundamental and applied.

It made a case for a multi-purpose institution — a Canadian Industrial Labs Corporation — to be established where government intramural R&D activities serving the manufacturing sector would be consolidated. As it prepares for its 100th anniversary next year and has just launched its new Factory of the Future program in Winnipeg and London, readers will recognize that the transformation of the NRC took the path of an RTO (Research Technology Organization) designed to assist industry.

The university sector also received considerable attention during the Lamontagne hearings. The senator noted the vacuum in Canadian university research funding, governance and financial stress in their budgets (this was before the current granting councils were created). He suggested a Canadian Research Board (CRB) be set up, together with three foundations (covering physical sciences, life sciences, social sciences and humanities) with responsibility for the development of a capacity in curiosity-oriented basic research within universities and similar institutions. Lamontagne recommended that the board also cover the full costs (direct and indirect) of the projects and programs they selected in this area. The report even opined that social sciences and humanities should be the order of priority for government support of curiosity research, followed by the life sciences. The "*Research Quebec*" model that exists today with a chief scientist overseeing its three provincial granting councils suggests some inspiration from the CRB concept.

Stronger governance advocated

Governance was also a key focus of the Lamontagne remit. A ministry of S&T had existed since 1971, but the senators were displeased with its direction and lack of gravitas in the public policy sphere. It was argued that the minister of state should be ex-officio member of the Treasury Board and of the Cabinet Committee on Priorities and Planning, and that an Inter-Ministerial Committee for Science and Technology be established to examine and approve general and specific science policies of departments and agencies.

Additionally, an Inter-Ministerial, Federal-Provincial Committee on S&T was to meet at least once a year. Parliament did not escape attention. A group of parliamentarians from the Senate and House of Commons was to be organized to study science policy matters raised by S&T, leading ultimately to the establishment of a Canadian Association of Parliamentarians, Scientists and Engineers in collaboration with representatives of scientific and engineering bodies.

We've since lost the stand-alone science ministry — it is a mere vestigial organ within the Industry ministry voiced by a junior minister of state with little independent authority to influence budgets.

Parliamentarians have few tools at their disposal to help shape science-based public policy. The NDP motion for a Parliamentary Science Officer has been posited as one element to filling this gap.

Lamontagne also examined the public advisory functions of the Science Council of Canada as it was asked to ensure its mandate cover the social sciences and humanities in addition to maintaining closer relationships with the Canadian scientific and engineering communities in developing policy ideas.

Legacy of Lamontagne and lessons for today

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Careful reading of all of the Lamontagne recommendations can lead one to conclude that little has changed today. In one sense, the issues of science policy raised by the Senate Committee over 40 years ago may seem intractable, but occasionally a window can open to help frame bold new directions.

As Lamontagne concluded in his report: "Canadians are now facing the collective challenge of inventing the future". The coming federal election, celebrations of Canada's 150th along with Lamontagne's legacy, offer a potential window for vision, inspiration and change.

Calling for a 21st Century STI strategy (Co-written with Scott Findlay)

Originally published in Research Money

"We cannot be so blinded by the urgency of our problems that we take for granted how important, how powerful the combination of curiosity and reason really is. That is the tradition of science." — Mike Lazaridis, *The Power of Ideas*, 2010

In January, the federal government published its consultation document *Seizing Canada's Moment (SCM)* on the next federal science, technology and innovation (STI) strategy. In February, it released *Economic Action Plan 2014*, which includes several commitments to research and development. Curiously, none of these are referred to in SCM, leading one to wonder which is the cart, and which is the horse.

Concern with business innovation is palpable in both documents, but there is little reference to innovation in the larger public interest. In a recent Environics poll, 73% of respondents considered the top priority of government science to be science in the public interest, including protecting public health, safety and the environment.

Yet federal public interest science has been steadily eroded through the shuttering or termination of federal S&T institutions and programs, and restrictive communication policies that hamper the dissemination of scientific information among scientists and to the public. Federal intramural R&D spending continues to fall, and in EAP 2014 federal budgets have been frozen.

The existence of STI capacity within Canada's knowledge ecosystem was explicitly recognized in 1987, when federal, provincial and territorial ministers signed the National Science and Technology Policy, which outlined six national STI goals. Federal-provincial-territorial cooperation is crucial for business and public interest innovation, but both EAP 2014 and SCM are silent on how the government proposes to do so.

Both documents claim to recognize the importance of discovery research. EAP 2014 includes an apparently untargeted \$46 million for the three granting councils— an increase of 1.7%. What proportion of EAP 2014's proposed \$1.36 billion (over 10 years) Canada First Research Excellence Fund will go to discovery research is unknown.

By comparison, US Budget 2014 increased funding to the basic research agencies by an average of 4%, reflecting president Obama's understanding that *"the nation that goes all-in on innovation today will own the global economy tomorrow. ... That's why Congress should undo the damage done by last year's cuts to basic research so we can unleash the next great American discovery."*

Finally, both documents say little about the need to realign federal funding and decision-making structures to better address the burgeoning importance of interdisciplinary science and enhance the role of science in government decision-making.

What should a new STI strategy include?

First, it should explicitly underscore that public interest innovation is as important as business innovation.

Calling for a 21st Century STI strategy **(Co-written with Scott Findlay)**

Originally published in Research Money

That recognition should, in the short term, be reflected in restored funding to the major research councils, a review of government science to assess where public science capacity is eroding, and the development and Cabinet approval of a set of principles for guiding decisions about the allocation of federal research support to different points of the knowledge cycle, from research to technological innovation. We further suggest that government research agencies and departments adopt a public outreach mandate to better communicate the value of public science with Canadians.

Second, it should develop a plan to engage governments at all levels in an updated national policy that identifies national STI priorities and mechanisms by which these might be collaboratively pursued. Some provinces have already developed their own STI strategies—a more seamless pan-Canadian approach would enhance decision-making in the allocation of increasingly scarce strategic resources.

Third, the strategy should consider ways to enhance the role of science in government decision-making. We suggest that a Parliamentary Office for S&T (POST) be established to assist parliamentarians in understanding the scientific information relevant to decision-making as well as provide oversight on the use of scientific evidence in public policy. Elected officials can only make informed decisions if they know and understand the current state of research and what is likely on the horizon. Parliamentary fellowships and pairing schemes — such as currently available in the US and UK for science and engineering students and researchers — should be made available to provide youth with opportunities to contribute to public policy as well as to learn how complex decision-making takes place.

Fourth, an independent assessment should be undertaken with a view to improve the adequacy and effectiveness of the interaction among the three granting councils in responding to the emerging global knowledge revolution. As a World Economic Forum panel recently noted, scientific research is increasingly more diverse, more networked, more impactful, more popular and requires more money from more sources, both public and private.

Not only do individual researchers increasingly cooperate on projects across countries, research agencies are also collaborating worldwide on issues such as research integrity, big data, emerging pandemics and the brain. These trends are all impacting institutional, project-based, research excellence and cost-shared research ventures.

Given the importance of STI to the well-being of Canadians, we suggest that this — indeed the entire STI innovation file — be overseen by a full-time, senior, Cabinet-level minister for Science and Innovation supported by a well-resourced national science advisor to help bring about a fuller integration of the government's S&T activity.

Finally, we suggest that the strategy consider establishing an independent science audit or report card that would provide regular updates and data through social media to Canadians on the impact of federal investments in STI with respect to both business and public interest innovation. We believe that seizing the (STI) moment requires a federal strategy that includes elements such as those proposed here if, collectively, we are to maximize the benefits to Canadians of federal investment in science and innovation.

Engineering science policy for the nation

Originally published in Research Money

RESEARCH MONEY readers may be familiar with the 1945 Science-The Endless Frontier report written at the end of WWII by Vannevar Bush —US president Harry Truman's science advisor and engineer. It set the stage for a re-tooling of support and re-organization of science in the reconstruction era, and led to the creation of the National Science Foundation. As a classic touchstone for the influence of science in policy-making, it has a considerable following not only in the US but across the world.

A Blueprint for Canada's Emerging Science Landscape

Fifty years ago, a similarly influential report (but not as well known) was in the making by another former war-time science adviser and engineer, C.J. (Jack) Mackenzie. As the National Research Council's president, he had been instrumental during WWII in advising government on its military and nuclear research efforts and collaborating with his allied counterparts. Under Mackenzie, the NRC staff reached 2000 and was reorganized to provide a stronger foundation to support basic science and industry development. In 1963, he was appointed special advisor by prime minister LB Pearson to provide counsel on the organization of government scientific activities. Mackenzie wrote an informal progress report on January 28, 1964 to the PM, making several recommendations. They were:

- 1) A Central Scientific Bureau or Secretariat to be established in the PM's office to assemble, digest, and analyse all information concerning the government's S&T activities and their inter-relations with university, industry and provincial scientific establishments. It would have no executive authority but would be staffed by a small group with sound credentials.
- 2) A National Committee on Scientific Policy (NCSP) to assess the government scientific activities for the purpose of: **a)** forming judgements on the adequacy of support for research and how well it's balanced within universities, industry and federal and provincial institutions; **b)** prioritizing broad areas of research and determining which should be given the most support in the interest of the country and economic prosperity; and, **c)** providing an annual report to the PM.

Mackenzie also suggested key studies that the proposed NCSP should undertake, including the training, supply and demand for scientific personnel; support for civilian R&D; and the reappraisal of the roles for university, private sector and federal and provincial research establishments. Finally, he argued that consideration should be given to establishing a re-invigorated Federal Panel on S&T, comprised of DMs and heads of scientific agencies feeding into the NCSP.

It is worth remembering that the government of the day was itself undergoing considerable re-engineering. A three-person Royal Commission on Government Organization had been established in 1963 (the Glassco Commission) tasked with examining scientific R&D activities.

Federal government R&D spending more than doubled from \$107 million in 1951-52 to \$258 million in 1961-62 and performance of R&D by the federal sector had almost tripled in the same period. With this growth, coordination of government scientific activities had become an obvious target of public policy (the GERD-GDP ratio for Canada was 0.72% in 1959-60 compared to 2.58% in the US and 2.11% in the UK).

Engineering science policy for the nation

Originally published in Research Money

The Glassco Commission examined the machinery for scientific policy, reviewing the respective roles of the NRC, PCO and a moribund federal advisory panel for scientific policy. Eschewing the need for either a science department or science minister, it argued for a 'Cabinet spark plug' — a Central Scientific Bureau operating under the president of the Treasury Board along with a National Scientific Advisory Council to submit independent scientific advice for policy making. In several respects, the Mackenzie report had picked up from the Glassco recommendations and fine-tuned them.

In a speech several months later to the Royal Society of Canada, Canada's first Industry minister, C M Drury (who later become the new S&T Minister), took up the Mackenzie report and challenged his audience for *"assistance and advice in the urgent need to formulate a Canadian Science Policy which is truly national in character and domain"*.

Based on the Mackenzie and Glassco reports, a Science Secretariat was created along with a Science Council of Canada (1966). And, in partial response to minister Drury's challenge, a decade long series of public debates emerged with the Special Committee of the Senate on Science Policy (Maurice Lamontagne) ultimately leading to Canada's first-ever science ministry and forward-looking research policies.

And Five Decades On?

Today, a half century later, we can be forgiven in thinking that Canada's science policy has much evolved. A revision of the seven-year old federal S&T strategy is finally underway, though it is clearly late as many of Canada's competitors have moved on including China whose GERD-GDP ratio is now well above that of Canada's.

To be sure, the Jenkins expert panel and various other studies have pointed to key steps, but policy actions will need to take on more urgency. Some provinces have gone forward with their own plans, and a pan-Canadian approach to mobilize the country's knowledge assets for social and economic development will be difficult at best. The science (and innovation) policy landscape is mutating rapidly and the scientific and business leadership must be more proactive in making the case for S&T.

In the mid 60s and 70s, science—especially government research capacity — was seen as a prime player in the overall future direction of the nation and public dialogue was real and intense. Science was at the frontier of Canada's economic and social revival. Then, the government was seizing the moment. Today, it threatens to become a mere appendage to policy rhetoric.

What the 1964 Mackenzie report serves to remind us is that getting the right people together with the right receptor at the right time with the right conviction can be more critical to any success than ideal org charts, vision-less policy, and risk-averse leadership. As the federal and other levels of government scope out new forays in seeking the genuine contributions of science and innovation towards Canada's 2017 celebrations, we would do well to heed the Mackenzie philosophy in focusing the spotlight on expanding our own endless knowledge frontiers for — and with — Canadians.

Boutique science diplomacy

Originally published in Research Money

"One of the things that I've tried to do over these last four years and will continue to do over the next four years is to make sure that we are promoting the integrity of our scientific process; that not just in the physical and life sciences, but also in fields like psychology and anthropology and economics and political science — all of which are sciences because scholars develop and test hypotheses and subject them to peer review — but in all the sciences. We've got to make sure that we are supporting the idea that they're not subject to politics, that they're not skewed by an agenda, that, as I said before, we make sure that we go where the evidence leads us. And that's why we've got to keep investing in these sciences." — President Barack Obama, National Academies of Science speech, April 29, 2013.

"The fact is long-term economic growth will be driven in large measure by science. Prime Minister Harper said it best: Science powers commerce. A successful innovation system requires a mix of complementary elements. R&D spending is only one of them. In our view, the role of government is to establish policies that strengthen the science, technology and innovation enterprise from discovery research all the way through to commercialization." — minister of state for science and technology Gary Goodyear, AAAS Forum on Science and Technology Policy, May 2, 2013.

There you have it. Two speeches on science in Washington in the same week (see above) — one by the US President (his second to the National Academy of Sciences celebrating their 150 anniversary) and the other by Canada's junior minister for science and technology (his second to the AAAS forum on S&T policy). Both given in a period of austerity enveloped within a context of politicized attacks on science and the increased globalization of knowledge.

Readers of RE\$EARCH MONEY who follow the Canada-US science and technology partnership will know it is an extensive one. It is also critical given the global reach and leadership of the US in science and research. So when a junior science minister heads to Washington to deliver a keynote address to a sophisticated audience, it helps if you have something new and relevant to offer. Otherwise, the US audience — given its oft-obsessive pre-occupation with global leadership — quickly moves on to the next suitor.

The May 2 speech by the Minister was essentially a checklist of programs and policies of the current Harper administration with a smattering of existing bilateral initiatives. To say it was nepheligenous would be an understatement, laced as it was with the usual doses of jactation.

To be fair, when the major baseline is an outmoded six-year-old federal science and technology strategy unhinged from other policies with a tired mantra, one should not be surprised at the yawn that follows. That same day in DC, interestingly, president Obama and Mexican president Pena Nieto announced the formation of a Bilateral Forum on Higher Education, Innovation, and Research to expand opportunities for citizens of both countries and to help develop a 21st century workforce.

There was a time not long ago, when governments would prepare a serious agenda going to Washington. Knowledge diplomacy mattered. For instance, when the Canadian minister for science spoke to the same AAAS S&T conference in April 1993, he outlined the need for a focused joint approach on science culture by engaging more youth in knowledge and discovery. He even offered that Canada would participate with the US in its National Science and Technology Week (to be reciprocated by the US in Canada's own S&T week).

Boutique science diplomacy

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When the US president and the Canadian prime minister met in DC in April 1997, they announced joint participation in the GLOBE program for environment science and education; outlined next generation internet links via CANARIE and the National Science Foundation; initiated a project on new production technologies to help industries become more competitive, sketched plans for a new Polar Cap observatory, and triggered a dialogue between their respective science advisory committees.

In May 1997, during a joint Canada-US innovation roundtable in DC, an exchange program between the two industry departments was launched along with projects centred on skills shortages and skills development; climate change technologies; e-commerce and SME technology extension. A brochure outlining the scale and scope of the Canada-US STI relationship was published when another Canadian industry minister visited the US in 1998.

In Obama's April 2013 speech to the NAS, he detailed an agenda that included a large-scale \$100-million brain research initiative; more focus on maths and science education and outreach, and grand challenges in clean energy research and manufacturing to name a few.

Given their complementarities to the Harper government, it is surprising that these were not underscored as areas that Canada could collaboratively address in a renewed partnership with specific actions. One needs shiny new things to attract the attention of the US policy-making machinery.

As the next version of the federal S&T strategy is re-tooled with hopefully a more global focus, the Canadian minister responsible for research needs to re-consider an engaged and principled strategy in S&T and innovation with the US, Canada's largest science relation by far. There are key areas where Canada can benefit from a leveraged partnership not to mention learning about the conduct of effective public science advice and research integrity in government.

It is a reality, not mere rhetoric, that science and innovation operate in an open and global environment. Well-designed science diplomacy can be a key platform for new research and outcomes for mutual benefit.

Listing a menu of disconnected national initiatives to a savvy and connected audience in DC without grasping the larger opportunity in constructively moving the science and innovation agenda forward with a science superpower is not merely policy manqué, but a missed window for effective science diplomacy.

A new future for the research councils?

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Ever wonder why Canada has three separate federal granting councils when integration and interdisciplinarity are the new research paradigms? Curious as to why Canadians do not have a single portal or concierge service for understanding how and why research grants are awarded across the country? Have some questions about whether granting councils are strategically addressing the issues of competition and collaboration in science and innovation? Read on...

Readers may not realize that NSERC and SSHRC are celebrating their 35th anniversary this year and that the CIHR's origins can be traced back 75 years. NSERC emerged from the granting functions of the National Research Council (NRC); SSHRC from the loins of the Canada Council; and CIHR's forerunner was an Associate Committee for Medical Research established at the NRC in 1938. Over the years, they have all undergone various strategic planning exercises and other transformations, with the CIHR being the most recent to morph into a more comprehensive health research funding agency from its Medical Research Council origins. And while their mandates clearly state they are funded by Parliament, the councils de facto report through two separate ministers — one responsible for Industry, the other for Health.

Yet, as critical actors in Canada's so called innovation eco-system, there is rarely any public debate about their collective future. Are they doing the job they are supposed to be doing, do they have their eyes on the horizon, and are these agencies asking whether Canada has the right governance in place for our next generation of scholars, trained personnel and researchers?

To be sure, the landscape has changed dramatically over the years to fill perceived gaps that the granting councils could not address adequately. In some cases, the provinces have created their own equivalent agencies to be both responsive to local and regional needs and to tackle new — oft unilateral — program decisions from the federal level. With the addition of Genome Canada, Canada Foundation for Innovation, multiple versions of Networks of Centres of Excellence (NCEs), Canada Research Chairs and others, it is a challenge for anyone to describe what Canada's research system actually looks like, let alone to our partners internationally.

Colleges, polytechnics, CEGEPs and their contributions to the eco-system are receiving more attention and rightfully so given their contributions to innovation. And if universities are now viewed by politicians largely as surrogates for industrial research, then the granting councils have fast become the chosen instruments in delivering new partnership models to accommodate the trend for short-term returns on investment, job creation and economic growth. Indeed, the prime minister has spoken about the fact that "science powers commerce". And his part-time, junior science minister likes to remind Canadians and global partners alike that the Harper government will weigh the "benefits of investments against return".

Much of this is not new. In the '80s and throughout the '90s, there was a vigorous national debate — open and engaged — to examine what might be the best way to assure the continued support for research excellence and to review the direction for the Canadian model in being responsive to its users. Somehow we've lost that momentum.

Meanwhile, others are moving ahead with experimentation. The seven Research Councils of the UK are now coordinated via the Research Councils UK which also maintains offices in China, India and the US to present a unified voice for the UK. A triennial review of the councils' governance is underway to assess its overall impact.

A new future for the research councils?

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The Australian Research Committee, chaired by the chief scientist, was established to provide integrated and strategic advice on future research investments, including in the areas of human capital, infrastructure and collaborative activities.

The US President's Council of Science and Technology Advisors argued in a recent report that the US should review mechanisms for increasing the stability and predictability of federal research funding, including research infrastructure and facilities, via a cross-agency, multiyear program.

Quebec has a chief scientist who oversees that province's three granting councils while providing incentives that regularly recognize young scientists for their work.

There's no question that the federal research funding councils have been tweaking a more collaborative approach amongst themselves and with the CFI. Common CVs, research integrity, management of the NCES and scholarships are all areas where collaboration has become more active. But this is largely 'tweeting' at the edges. Science and research are moving far more rapidly with a modality that is global and team-oriented in nature. Our research funding institutions need to catch up.

The Jenkins expert panel report suggested that perhaps it was time for NSERC and CIHR to help manage selected basic research institutes and major science initiatives of the NRC by having these transferred to universities (oddly, they left out SSHRC). While this recommendation has seen little take up to date, at least the panel raised the question for debate.

It may well be time to have a national dialogue (let's NOT call it a summit or conclave) around some of the emerging issues on the changing nature of science, its governance and funding in Canada, with an objective of developing coordinated public services made available to Canadians via the granting councils. The agenda for such a discussion could examine the following public policy questions:

- Are the federal granting agencies well integrated into Canada's funding eco-system for science, training and innovation? What new architecture, including a joined-up national and international presence, could provide a more responsive public service with Canadians?
- Should Canada be looking at other models abroad that are perceived to have a more integrated approach in funding of research and what can we learn from these?
- On what basis should this dialogue engage other research funding and performing agencies within the federal and provincial government ambits?
- What new measures could be introduced to assess progress in achieving new directions?

It may well be time to address the rapidly changing global research paradigm by refreshing our funding apparatus with a more responsive service for our citizens and researchers.

The trouble with voiceless science advice

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"It is not enough for scientists to have responsibility as citizens. They have a much greater one than that and different in kind. For scientists have a moral imperative to say what they know. It is going to make them unpopular. It may do worse than make them unpopular. That doesn't matter." — CP Snow.

By now, Canadian taxpayers are probably inured to the vecordious cloak of secrecy that has descended on Ottawa's decision-making processes. But the muzzling of federal government scientists, death of evidence, and assault on reason that has been played up in the press and elsewhere has glossed over yet another dimension of closed access to citizens; an area where Canada's efforts in the past have traditionally been in keeping with global good practice — that of open, well-informed national science policy advice.

Since its creation in 2007, the Science, Technology and Innovation Council (STIC) has provided confidential advice to the federal government. This advisory body of 17 eminent people from the public and private sectors was given a two-fold mandate: to provide the Government of Canada with evidence-based science and technology advice on issues critical to the country's economic development and Canadians' social well-being, and to produce regular reports benchmarking the performance of Canadian S&T and to international standards.

According to Industry Canada media statements, its *"streamlined advisory process strengthens the voice of external authorities while helping government decision makers solve complex science, technology and innovation issues"*. Really?

If accountability and transparency are to matter, how can Canadians know that STIC is effective? On what basis do citizens know that STIC — five years on — has performed well when they have little way of knowing what the input was? Its website is of little help. Postings include a chart of a so-called innovation road map for Canada adapted from that of Connecticut's in 2006, as well as a 2010 state of S&T report.

Indeed, given the publication last month of the Council of Canadian Academies' (CCA) more ambitious state of science and technology report, readers may understandably be perplexed as to why two separate benchmark studies are required from two different organizations commissioned by the same federal patron.

From the outset, STIC was purportedly modelled in part on the Australian Prime Minister's Science, Engineering and Innovation Council. But unlike STIC which reports to a junior minister with two portfolios, the Australian body is chaired by the prime minister with the chief scientist as executive director. It also publishes its advice and summary of its meetings.

The well-respected US model, the President's Council of Advisors on Science and Technology (PCAST), responds to the president who has been present at several meetings. It releases its findings, and in keeping with US requirements for open government, its meetings are accessible to the public with most presentations available on its website.

The UK Chief Scientific Adviser has developed guidelines for scientific advice and policy-making in government that are updated periodically in an accessible manner. In fact, around the world, most science advisory bodies operate in a consultative and open fashion.

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Clearly, while these issues are of import, they have largely been addressed previously by other organizations in some form, and these mostly through public consultative fora and rigorous analysis. In fact, the government procurement issue was the subject a separate report, undertaken by the Jenkins Panel on behalf of Public Works and Government Services Canada.

The STIC advice is no doubt offered on a well-intentioned, volunteer basis by those who — as the saying goes — 'are on tap and not on top'. However, properly engaged and more widely communicated, it can offer a larger vista to encourage a healthy, democratic debate. But this can't take place when it is effectively silenced under a shroud of secrecy, and when the science and innovation leadership continues to assume an attitude of prudential acquiescence.

Canadians deserve better

The ongoing and diverse public assessment work of the CCA aside, Canadians clearly deserve better from their science advisory apparatus.

This is especially critical given the increasing integration and impact of S&T within policy debates, not to mention the vacuum for sound public advice and evidence created by the elimination of other specialized advisory bodies in recent years.

Governments come and go — not so with science. Science doesn't just power commerce, it is a mainstay of the country's social and cultural fabric. It is meaningless to argue for a strengthened science culture and knowledge-based economy if citizens are in the dark about what evidence is used and advice being given, how it affects them, and on what basis they can participate more actively. It's time to democratize science advice and give it a veritable voice.

And while we're at it, let's work with Parliament to help equip it with a well-resourced and publicly accessible science and innovation office to better empower Canadians with the needed evidence and critical knowledge for everyday decisions they face today and in the future.

Science for the lambs, or how a research community got its scream back

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Until recently, media headlines about cuts to national research and selective stifling of sound evidence in public decision-making have underscored an unsettling fact — the scientific community has been largely silent in speaking for itself. To be sure, public service unions are tracking issues on muzzling scientists and cuts to government science, former federal ministers are issuing letters about the threats to ongoing fisheries and marine research, and the Canadian Committee for World Press Freedom is handing out awards to science journalists for boldly tackling restrictions imposed on public scientists to speak about their work.

But largely missing in action has been any orchestrated lobby group that can strategically and aggressively represent the various dimensions of research and innovation in this country.

The chill in the research air brought about by a federal administration predisposed to silencing science has served to curtail the normal reflex that would accompany more effective lobby efforts from professional science societies. Because Canada has had no national association with any gravitas to send out a *cri d'alarme*, we are left with organizations that often have difficulty seeing past the horizon to assess the larger vista of our ecosystem for knowledge and innovation.

Make no mistake, what affects one aspect of this organic enterprise will ultimately impact other sectors. For some reason, this feedback loop has been lost on professional organizations and others as they focus on protecting their own backyards from the invasive state species of *homo obscurus*.

Looking around other countries where science and its practitioners have been attacked, one can witness a rich spectrum of responses and tactics, ranging from effective use of social media to orchestration of campaigns, petitions and marches (all of it with well-honed analyses to back them). In the US, various groups such as the Union of Concerned Scientists and the AAAS are rarely shy about publicly speaking out on cuts, and their potentially negative impacts to the integrity of science.

Indeed, several of these groups with some US Congress support have banded together to award a new Golden Goose Award to research projects that might sound odd, but have produced significant health or economic benefits. As part of its National Science and Engineering Week, the UK House of Commons with the Society for Biology has organized a Voices of the Future event where young scientists and engineers formed a select committee to put questions to the minister of science and the opposition critics for science in the chamber.

In Canada, research advocacy groups have finally begun to stir - it took some committed students and their mentors to speak out. The Death of Evidence (www.deathofevidence.ca) funeral march that took place on July 10 on Parliament Hill and related protests across the country was a start (see related story). That this was an unusual event was underscored by the buzz in the media; both here and abroad.

Historically, protests of this type are not new. One can point to the shuttering of the Avro Arrow CF-150 project in the late 50s; the "Scientific Scream" manifesto of Environment Canada scientists in the late 70s; the elimination of the Science Council of Canada in the early 90s; and more recently, the termination of the government's National Science Advisor and other advisory bodies.

Science for the lambs, or how a research community got its scream back

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All of these led to various letter-writing campaigns, media blitzes, and petitions. But none has triggered the scale and scope of frustration witnessed at the death march. Public good science, of course, could not speak at the rally and remains mute for fear of its short leash being shortened even more. But at least now government science has some keen allies — scientists, students and others who recognize that issues of evidence and democracy in decision-making go beyond their sandbox views of the world.

We may therefore have witnessed a tipping point with a new generation of tech-savvy and politically conscious scientists and their allies who understand social media and know how to mobilize it for effect. But it will take more to sustain the message.

Here are some modest suggestions for continuing the momentum:

Develop a clear public statement outlining why science matters (see the Tony Blair 2001 speech on this) with specific examples that have public meaning.

Invite local parliamentarians from all stripes to events where the sciences and innovation are on the agenda. Consider an annual science day on Parliament Hill, in addition to orchestrating a public science debate with all the political parties in the lead-up to the next federal election.

Recognize that science is ultimately aimed at shaping the human condition in all its respects. Yes it needs to be framed within a contemporary context, but because science provides the polity with sound evidence based on facts, it should not be muzzled or leashed. As Thomas Jefferson once argued, whenever the people are well-informed they can be trusted with their own government.

Ensure a major science presence in the celebration plans for the forthcoming 150th anniversary of Canada.

Challenge senior government officials at all levels on future directions of science for Canada. Get their attention about the need to renovate dated science and innovation strategies and make them more open and relevant to today's climate and public needs (see the recent Quebec approach on this).

Target key messages to members of the federal government's Science, Technology and Innovation Council. While their advice is secret, their mandate is to provide evidence-based S&T advice on issues critical to Canada's economic development and Canadians' social well-being.

Examine, enlist and learn from good practices of similar campaigns that have been effective in other countries, including how to engage private sector associations and lobby groups more constructively.

Design and coordinate a collective research community brief or vision statement for next year's budgets and beyond. Make it clear that scientists understand how to operate in a climate of austerity and priority-setting without jeopardizing first principles of integrity and transparency.

This is a long-term agenda ... make sure the scream is well-**DIRECTED** and heard.

Requiem for a science council

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Spare a thought for public and transparent science advisory councils in Canada. They have all gone the way of the dodo. This summer, readers of RE\$EARCH MONEY were alerted to the elimination of one of our original science advisory councils — Quebec's Conseil de la science et de la technologie (CST) (R\$, July 22/11). For over three decades, the Conseil was a major force enlivening and informing the dialogue for science and technology in society. It produced a wide array of thoughtful and practical reports for numerous Quebec administrations over its life-span.

Many of its recommendations had impact on policy-making and on science culture. The Conseil's reports are now archived and can be accessed for historians and others to remind us of debates past; policy portends of the future, and sad to say, opportunities lost (the Conseil also produced a useful 30-year history in 2002 that provides an excellent perspective of its scope).

Arguments for the Conseil's closure, a small organization — ostensibly for cost-savings — are risible. Increasingly, governments (in Canada) fail to grasp that knowledge is a highly public good. In this era of democratic social media and open source information, the notion that one can per force shorten the length of the arm of science advisory organizations to the government apparatus is one sure way to stifle healthy debate, not to mention curtail viable policy options. As we have learned in numerous instances when sound outside advice is ignored, this practice can often be detrimental to desired outcomes. This is especially the case in science, where knowledge and expertise are public currencies that have de facto repercussions, both domestic and international.

In closing the Conseil, the Quebec government argued that it will have an internal mechanism for advice with a more efficient structure in place, including a new umbrella for its three granting councils, overseen in part by the appointment of a first-ever chief scientist. We wish him *bonne chance*.

Current practice outside Canada shows a growing trend to increase the modes of science advice and ensure scientific integrity. Pluralism has its benefits. Indeed, the Conseil had produced a report assessing global good practice in the various models of science governance and advice (just as had the former federal Council of Science and Technology Advisers in some of its reports to Canadians).

The CST also published reports on such broad topics as R&D tax incentives, intellectual property issues, science culture, industrial innovation and regional development, in addition to critical commentary on the effects of both provincial and federal S&T initiatives or strategies.

The Conseil was also requested to produce a regular "rapport de conjoncture" (state of S&T report, the last being on the emerging trends in open innovation), something the federal Science, Technology and Innovation Council (STIC) has tried to emulate. The Quebec Conseil provided all of its advice in an open space allowing for debate around central questions of how and, with what impact, knowledge and society intersect.

The CST had other unique features, several of which were homologous to its former sister organization — the Science Council of Canada. The CST:

- could concentrate on long-range, often intractable problems, and conduct in-depth studies (improving science culture and education in schools);
- could work on detection of future problems, providing an early warning function to help influence government policies and priorities (emerging technologies, neurosciences, nanotechnology and biotech);

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- was able to take expert positions without implicating the government directly. Because of its credibility, it could stimulate and actively participate in parliamentary and other societal discussions (future of the social sciences, foresight for technology);
- was not limited by politically sensitive considerations (the impact of federal R&D programs and investments in Quebec);
- could undertake studies at the request of government and engage in international assessments ("state of science" report on globalization);
- brought to bear public input and expertise of a wide cross section of eminent people through an institutional structure designed to express their objectivity and autonomy (long- term perspectives or grand challenges affecting Quebec society); and,
- had sound institutional memory that provided important checks and balances in policy making.

Above all, the CST provided valuable reflection on how Quebec society viewed the importance of the growing interface of science, culture and innovation with society. It also served as a training ground for future decision-makers and scholars.

Others will provide a proper judgment on the Conseil's overall success but, as we have seen, policy context very much matters these days. There are some lessons to be learned for what remains of Canada's weakened independent science advisory capacity.

First, no occupational group or sector has a monopoly on wisdom in a knowledge- based society. While it's fair to expect that advice can be sought from many sources, it is nonetheless critical to have a sort of "crap detector" with sound expertise, public integrity and a corporate memory to help wade through difficult options and conflicting advice in an independent fashion. Decision-makers should expect to receive advice they want, as well as that which they have not requested since "stuff happens" (providing the latter is properly contextualized). Otherwise, these boards can quickly lose the public trust, repeat failed advice, and ultimately become a burden on taxpayers.

Above all, before performing a topectomy on a vital organ of the knowledge society, decision-makers would be well advised to assess the whole body consequences. One never knows what functions you may be impairing or destroying. As Dr John de la Mothe and I argued in a Nature editorial: *"The ability to respond to new demands from knowledge-thirsty societies and truly global issues will strain the bond between politician and scientist. Good science policy is needed as never before."*

And, as decision-making becomes imbedded with critical issues anchored in scientific advance and rapid technological development, we are ripe for more experiments in the science policy domain. Our public, research communities, parliamentarians and policy-makers should be demanding and welcoming well-grounded, independent science advice engaging Canadian society in a meaningful way; at least those who embrace the fruits of speciation.

A place for science in the Speech from the Throne

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Twenty-five years ago, a Minister of State for Science and Technology under the federal Progressive Conservative government gave an address to the House in response to the October 1, 1986 Speech from the Throne. I can't recall another such wide-ranging statement on science in response to a Speech from the Throne (which itself was laden with references to the importance of science and technology for the economy and society).

But it resonates well with many issues before us today. The speech presaged a new Canadian Space Agency, a micro-electronics strategy, the Networks of Centres of Excellence Program, a Parliamentary Committee for Research, Science and Technology, and other key programs including a national Public Awareness of S&T Program.

Regional consultations took place, buttressed by the policy analysis work of the Science Council of Canada. These were followed in 1988 by a major national conference on technology and innovation presided over by the prime minister, which laid out the platform of the government's "InnovAction". The 1986 Throne Speech announced that the PM would chair a new National Advisory Board on Science and Technology — a group of eminent Canadians asked to assess national S&T goals. This board published all of its advice, allowing for an open national debate.

The science minister's address also underscored cost-cutting that was taking place (e.g. the National Research Council was to absorb cuts to make way for funding of the Canadian Space Program). But it also laid out a renewed focus on science culture and pan-Canadian cooperation along with substantively funded joint federal-provincial S&T agreements.

A National S&T Policy was signed by science ministers of federal, provincial and territorial governments on March 24/87 in Vancouver. The policy was designed to "bring science and technology fully to bear on the economic, social, cultural and regional development of our country by encouraging cooperation among governments, and between the public, quasi-public and private sectors." It remains the last time the country had a truly pan-Canadian approach to S&T with leadership from a national Council of Science and Technology Ministers established to implement its objectives.

Excerpts from Minister Oberle's October 8/86 speech to the House follow. Some may argue it is a bit hyperbolic, but at least it is not azoic like many of the statements we have today:

"Mr Speaker, we are living in very exciting times, times of critical significance to the future of Canada. These are times of unprecedented change pressed relentlessly upon us by the advancement of science and the application of technology. These are also times of unprecedented opportunity for our country, and for all Canadians. But like most opportunities, these times are accompanied by risk and challenge.

I cannot begin to tell you how proud I am today to rise in this chamber and speak in support of a Speech from the Throne which, for the first time in our country's history, has placed science and technology(S&T) in such a prominent place of government operations and in the political agenda.

Let us be under no illusions. Canada has no place guaranteed in this new order, no seat reserved. We will improve employment prospects in Canada. We will improve our standard of living and the prestige we have earned throughout the world only if we work hard, make the right choices at each crossroad, adopt new attitudes and work together.

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Canadians are coming to understand that our ability to use research and development (R&D) effectively, without delay, has a determining impact on the number of jobs open to us, on Canada's access to international markets, and on the competitiveness of Canadian industries and Canadian products. We can see new possibilities open to us in realizing national goals with the use of S&T to protect and conserve our environment, to develop a new workplace in which men and women can play equal and important roles, to bridge distances ... to unite our vast and diverse land.

The provincial and federal governments must work together to forge a coordinated national policy. S&T must move to the centre of government decision-making. The consensus which has emerged identified four critical issues which must be addressed immediately. The first has to do with creating a culture in Canada which appreciates and instills pride and celebrates Canada's scientists, engineers and innovators; which promotes a strong awareness of the importance of Canada today; and in the decades ahead, of astute application of S&T which utilizes the talents of Canadian women in science careers.

We must expand the capacity of our universities to respond to new demands for basic research and the training of researchers for exploration of new disciplines and the development of new skills. There is a national consensus that we must urgently develop and use new strategic or ... 'enabling' technologies which underpin our industrial capabilities. Lastly, there is consensus that governments should use the full scope of their instruments to advance R&D.

An extensive internal review is reaching completion on the entire federal S&T framework so that all federal resources dedicated to science can be focused on new national priorities in a consistent manner.

I anticipate that the Standing Committee on Research, Science and Technology, which was established during the last session of Parliament, will play an important part in evaluating the results of that review and of how the federal government can spend much smarter and more effectively the \$4.2 billion that we presently spend on science and technology and related activity.

For the first time, Canadians have a prime minister who is demonstrating appreciation of achievements of science, on a regular basis and in a formal way, with Canada's most eminent scientists, engineers and leaders from business, industry and labour. He will personally chair this new board or council. It will assess our national goals and policies regarding science and technology and their application to improve Canada's competitiveness and maintain prosperity.

I believe all parties are in agreement that we must take long-range action. That is why we have made our plans for a federal S&T policy with an eye on the next generation, not with an eye on the next election." — Frank Oberle, Minister of State for Science and Technology, House of Commons, 8 Oct 1986.

On improving dialogues between the scientific illiterate and politically clueless

Originally published by Research Money

The interactions between politicians and scientists are undergoing more scrutiny these days. And well they should as science underpins much of what constitutes public policy. It is also a two-way street. Science needs to better grasp the oft-complex context behind policy and the polity needs to better understand the growing knowledge agenda.

Thirty years ago, a former science minister for Canada, issued this cri d'alarme:

"In essence, I believe that it is the scientific community that must convince the public that science — and the issues of science — are both germane and comprehensible; that science, or knowledge, can respond to the values and needs of our society; and that it is not necessarily inhumane, or threatening, nor beyond the control of society's purposes; but that it will respond to the direction an intelligent society gives to it. Scientists have an obligation not as scientists, but as citizens, to explore and explain the social consequences of what it is they do." — John Roberts, 1981.

Virtually every review or report in this country (and we have had a ton) that has touched on science and technology (S&T) has made hay with the issue of improving our so-called science culture and links with public policy. As the American Association for the Advancement of Science quaintly put it, we are often faced with the scientifically illiterate vs. the politically clueless. Both communities could use more help to get an improved grasp of their respective cultures and modus operandi resulting in better grounded decisions that will affect us all.

It's not that we haven't tried. The past experiments are many, diverse and mostly moribund like the parrot in a famous Monty Python sketch. We are probably no different in tinkering with these issues than most other countries, but we have at least three unique assets — we are bilingual, we have geography (lots of it) and we have the world's most powerful S&T player south of us. These traits have figured prominently in the design of our policies and programs when it comes to S&T.

It is refreshing to see that, despite previous weak attempts at making science policy a high salience issue, public experiments still go on with progressive ventures like:

- the Canadian Science Policy Centre via its Science Policy conferences in Toronto and Montreal;
- the SciencePages initiative of the Partnership Group for Science and Engineering;
- the Public Science web-site of the Professional Institute of the Public Service ;
- the Science and Technology Awareness Network for outreach ;
- the newly launched Science Media Centre.

While Canadian activism rarely extends to the science policy arena as it has in the UK (Science is Vital Campaign or Sense About Sense, etc) or France (Sauvons la recherche) or the US (Union of Concerned Scientists, Science Cheerleader, etc), we do our best to ensure that the public debate on science policy continues at all levels. The first Science and Policy Exchange created by students at McGill in October this year is a good example of next-generation activism.

On improving dialogues between the scientific illiterate and politically clueless

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One lesson learned in all of this: you need patience to see things through (witness the fits and starts of the origins of the Council of Canadian Academies). Timing and champions matter and you have to deploy multiple tactics as well as learn from good practice. Strong demand helps too. Another lesson is that pluralism is usually a good thing. As Jesse Ausubel notes in his marvellous piece on the organizational ecology of science advice in America, one prescription to the control and muzzling fetishes within governments is to strengthen the role of critical, pesky, independent groups.

By his count, the US S&T cohort of NGOs ranging from the American Institute of Physics to Computer Professionals for Social Responsibility is in the order of 4,000-5,000. We may not have that scale here, but we do have a good number and it would be useful to explore these growing grassroots initiatives to get a sense of their scope and influence. These NGOs — an emerging form of public science advocacy (including the renewed outgrowth of citizens' science movements via social media)— can provide a useful glue to help design the next generation of science and policy ecology and hopefully go beyond mere criticism and banal speeches to real solutions.

But all of this will require some understanding of how polity and science interact (or don't) at any given time. The woeful lack of expertise and resources within Parliament to handle matters of public policy impacted by science is one major gap. A 1983 Science Council of Canada report made this telling point: *"The lack of historical precedents for the incorporation of scientific evidence in decision making is evident at every level of the federal parliamentary system."*

Frank Maine, a former federal MP, underscored this weak link as early as 1976 at a science association meeting, arguing that: *"Members of Parliament will be called upon to make some very important decisions in the years to come. It is therefore essential that they have ready access to scientific and technological information and an opportunity to discuss and explore the wide ranging opinions within the Canadian community".*

The new SciencePages idea is an initial attempt to help bridge this gap with briefing notes on topical issues alongside the more conventional Bacon and Eggheads breakfasts or Genomics on the Hill with scientists telling MPs about the latest developments.

Another gap has been identified with the recent establishment of the Science Media Centre of Canada (based in part on the UK model), an independent, not-for-profit organization that helps journalists access the experts and evidence-based research they need to cover science in the news (see their excellent posting on medical isotopes).

Finally, lest we forget, the scientific and technological community needs to develop a greater level of sophistication whereby science lobbying is not seen as an oxymoron, where some focused training and leadership development on policy-making within governments would be enormously helpful as is done often successfully in the US and the UK. (The Howard Burton book on First Principles: The Crazy Business of Doing Serious Science should be required reading here).

In short, there is a bit of a renaissance in current efforts to fill some holes in the know-ledge galaxy where from time to time science collides with polity. As long as these remain open for public debate and rely on sound evidence, they should be supported.

The provinces, the feds & national S&T building

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With the announcement in March that the Quebec government was shutting down its long-time science advisory body, the Conseil de la science et de la technologie (CST), a productive and decidedly public chapter in Canadian science policy efforts has come to an end (R\$, April 9/10). The last of the original science advisory councils, the CST has been an important contributor to the debate on innovation in that province for almost 30 years, as well as playing a critical role with its other Canadian counterparts to help shape a larger policy agenda for S&T across the country.

Indeed, along with 11 other advisory councils, including the federal National Advisory Board on S&T (NABST) and the Science Council of Canada, the CST was a key player in the National Forum of Science and Technology Advisory Councils founded in 1989. That forum had a mandate to *"examine issues affecting Canada's ability to develop and apply science and technology; and to formulate advice to influence Canadian's national and provincial science policies for the enhancement of the Canadian economy."*

There were many attempts at strengthening pan-Canadian science, technology and innovation since the early 60s, but with the arrival of the Progressive Conservative Mulroney administration in 1984, a concerted effort began in national consultation on S&T, involving all key sectors, especially the private sector. How did this come about?

The nation-building exercise was kicked off by the release in February 1985 of a working paper by the federal minister of state for Science and Technology (MOSST) — in part the result of a federal-provincial meeting of ministers responsible for S&T held in Calgary. In addition to a series of statistical profiles of Canada's S&T performance, the report brought forward a discussion of four key themes (by now perennial): increasing private sector investment in innovation; accelerating the rate of diffusion of technology; redefining the role of government R&D; and recognizing the importance of academic R&D.

A major national forum sponsored by the federal government and hosted by the Science Council of Canada took place in Winnipeg in June 1986.

During his opening speech, the MOSST minister indicated that he was looking for views on how the \$4.2-billion federal S&T envelope could be more effectively spent to forge better linkages between universities, research institutes, colleges, private sector firms, government labs and schools.

The minister had earlier requested the Science Council of Canada to undertake an evaluation of the effectiveness of government funding of private sector R&D in Canada. That report noted that government was underfunding private sector R&D when compared to other countries, but more importantly warned that R&D was just one element of the overall innovation process. It also noted that governments were not relating Canada's overall R&D policy within the context of a coherent set of sectoral strategies (this may resonate given the current review exercise of R&D spending underway at the federal level).

On March 4, 1987, Prime Minister Mulroney delivered a major address on R&D at the University of Waterloo. The speech was an open challenge to the private sector to increase its R&D efforts, and to redouble efforts to transfer technology out of university and government labs into industry. Mulroney closed with an appeal to all stakeholders to understand how Canada's technology can strengthen national sovereignty and territorial integrity in such areas as the Arctic and protecting the country's environmental heritage. NABST —chaired by the PM —had also been announced earlier to give him guidance on key S&T policy issues.

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On March 12, the National Science and Technology Policy was signed in Vancouver by the federal, provincial and territorial ministers responsible for science and technology. The policy (the first-and last- of its kind in Canadian history) outlined six objectives:

- improving industrial innovation and technology diffusion
- developing strategic technologies
- ensuring the necessary pool of highly qualified people
- supporting basic and applied research and development
- dealing with the impact of technological change in society
- promoting a more science-oriented culture

To implement these objectives, a Council of Science and Technology Ministers (CSTM) was established and an action plan was developed to push forward each of the areas identified in the national policy. The federal response to this policy was InnovAction. Subtitled "a Canadian Strategy for Science and Technology", the five-track strategy put forward \$100 million in support of a federal microelectronics strategy; a new technology centres policy for the management of key federal labs and external technology centres aimed at promoting technology diffusion; funding for the Networks of Centres of Excellence (NCE); a Canada Scholarship Program for undergraduate students; new funding for unsolicited proposals program for government procurement; increased funds for the Industrial Research Assistance Program (IRAP); and, an increment to the matching policy funding for university research.

Further, a decision framework for S&T in the government's management of S&T activities was announced. Prepared by MOSST at the request of the PM, the framework was designed to assist science-based departments and agencies to manage their S&T activities. It was intended for use as the basis for an annual overview of federal S&T strategic directions for cabinet and NABST.

In November 1987, the CSTM presented a discussion paper on Canada's R&D efforts to the First Ministers' Conference in Toronto. The paper suggested a number of steps that ministers could take to improve the situation. Among these was that the concept of a national NCE should be given careful consideration and R&D priorities within industry be developed on a sector-by-sector basis. The last meeting of the CSTM took place in 1992 in Ottawa. The discussions included matters such as improving access to Environment Canada's Green Plan, the Canadian Space Agency's future directions; and whether to form a national network on software engineering.

While other major policy exercises were also conducted during that period, the political momentum generated by the pan-Canadian efforts to strengthen national S&T continued. Federal, provincial and territorial ministers responsible for research, science and technology met from time to time. At the penultimate Quebec City meeting of this group in 2001, the co-chair Brian Tobin, federal minister of Industry, and Pauline Marois, Québec's minister for Research, Science and Technology, led the debate on how Canada could move its R&D expenditures to GDP ratio from 15th to 5th by 2010.

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Other issues were also addressed including the impact of the new Canada Foundation for Innovation on the provinces, a report from the Québec CST on the status of nanotechnology, implementation of a national broadband strategy, provincial funding for Genome Canada's regional centres, and a major discussion on the issue of indirect costs of federally funded university research and commercialization of university research. Ministers were also briefed on the proposal for a Canadian Academies of Science.

Several principles for future interaction recognizing the differing jurisdictions, responsibilities and priorities within the federation were also debated. Finally, a commitment was made to develop a federal-provincial-territorial network for communication and information exchange on research, S&T and innovation.

The federal-provincial-territorial exercises of the 80s and early 90s were instructive on how S&T can contribute prominently to economic and social development. They also helped shape an international image of a concerted Canada.

As minister of state for science and technology Frank Oberle said in 1986: *"If European nations have found it necessary to join their efforts in order to use S&T to maintain prosperity, it seems that our ten provinces, (two) territories, and a federal government must also see the need to join efforts. Why should Canada not be able to match the efforts of the best?"*

If Canada is to compete with the best and become a truly global knowledge power, leadership in federal-provincial-territorial cooperation at the highest levels in science and technology surely matters.

How to Recognize a Minister for the Future

Originally published by Research Money

I have yet to meet someone with a business card that says Minister for the Future — at least not yet. Some would say it is almost an oxymoron. But in the late 1960s, a great deal of foment and open public debate was underway in capitals around the globe to re-assess where governments stood on planning and investing for the future and more specifically, what role research and the sciences could contribute to mid- and long-term national economic and social goals.

For its part, the Organisation for Economic Cooperation and Development (OECD) — then a 22 member think tank organization based in Paris, now expanded to 38 members — was examining the research systems of different countries. Canada was its 10th target, and in late 1969, in the afterglow of the Apollo 11 Moon landing, the OECD published the results of its efforts in both official languages.

Some of the OECD work had been triggered by the International Statistical Year of 1964 through reports and studies to develop better comparator statistics for science and research spending and outputs. These were the origins of the so-called Frascati Manual which today is the methodological standard for looking at S&T expenditures globally.

The 400-page plus volume on Canada undertook the usual procedure for such reviews. An international expert panel (from the OECD, France and Japan) was appointed to visit Canada and develop information and data based on specific questions about the national research system. A so-called "confrontation" meeting took place in Paris with selected senior Canadian officials to respond to the key findings of the report before its release. Among these officials were the honourable CM (Bud) Drury, then chair of the Privy Council Committee on scientific and industrial research and slated to become Canada's third minister of state for science and technology; the chief science adviser to the Cabinet, Robert Uffen, and the presidents of the National Research Council and Science Council of Canada, William Schneider and Omand Solandt respectively.

It's useful to flag some key points in the report and from the consultation meeting. The OECD recommendations included:

- A minister for science without departmental responsibility be established deriving authority from the prime minister;
- A Science Policy Council (of independent experts) to advise the government on scientific matters through a science minister;
- A Government Research Board of various science-based departments represented by their most senior officials to assist in interdepartmental coordination;
- A strengthened, more focussed role for Canadian universities to serve national goals through multi-disciplinary groups; and,
- A single comprehensive granting agency combining the functions of the then Medical Research Council, the Canada Council and NRC (which was then supporting university research as well).

It should surprise no one that the OECD report focused on the need to increase the emphasis on industrial R&D related to national objectives, as well as addressing the weak exploitation of new technologies and lack of entrepreneurship. This will resonate today with analyses of the country's overall innovation approach. Indeed, more recently, the OECD has commented on Canada's relatively weak business R&D intensity when examining overall economic development.

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In 1969, along with commenting on matters of decentralization of research excellence and regional economic development, a major issue was the rather thin university-industry interaction in research, especially when considering the American experience in this area. The OECD had just reviewed the US science system and noted that the Canadian domestic market was perhaps too small to justify large-scale production or substantial expenditure on industrial R&D.

Within a North American market context, Canadian industry could certainly orient itself towards selective specialization. Canadian officials responded by noting the existing specialization in such areas as bush aircraft, and communications and air navigation equipment. (For the purists, in 1988, the OECD also reviewed the regional innovation policies of the four Western provinces and laid out a need for those provinces to enhance industry-university interactions as well as a supporting environment for innovation in selected technology areas).

With respect to the perception of poor entrepreneurship, Canadian officials noted that the deficiency was widely recognized, while signalling that the government of the day had introduced a program designed to share half of the risks involved in launching new products or processes (Program for the Advancement of Industrial Technology - PAIT). Much was also made of the foreign ownership issue with Canada home to a large number of branch plants conducting little domestic R&D. But here again, it was noted that a form of "world product mandate" was being awarded to some Canadian-based subsidiaries for global markets.

External reports from organizations like the OECD can serve as useful lenses for issues that remain long-term, complex and challenging at a domestic level. Forty years ago, the OECD Canada report did just that. A flurry of debates, reports and policy decisions were under review and others followed. Some were influenced by the OECD thinking, others by national economic and social considerations.

Above all, however, the focus of this activity remained on science policy as a means to other ends. As the OECD report put it, *"The Canadian government expects national scientific activities to contribute to the quantitative and qualitative progress of the economy"* (and the society, it should be added). Indeed, minister of state for science and technology Mr Drury was to articulate these objectives in 1975 as:

- a) policy for the support of science;
- b) policy for the application of scientific and technological resources; and
- c) science in public policy.

Today, the Canadian science policy landscape is populated with a large number of players all of whom could usefully consider more strategically their respective roles in helping shape a national effort that both reflects the fast-moving nature of knowledge production in Canada and abroad and resonates with the specific needs of the country. After all, effective public policy is essentially a course of action designed to help shape a positive and sustainable future for citizens.

A science forum takes shape and engages the Canadian public

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Readers may have seen recent commentary on ideas such as the proposed Science Media Centre, or the Science Day organized by the Public Policy Forum, as well as RE\$EARCH MONEY's own annual and regional conferences — all laudable efforts to strengthen the science and innovation culture. While these are forward-looking, we might also keep in mind the importance of learning from our past. For instance, a novel experiment that engaged Canadians from 1968 to the mid-70s — the journal Science Forum — covered many key debates and issues, including the need for a science policy institute in Canada.

Let us take the way-back machine to that era:

Dateline: February 1968

Place: Ottawa

Event: Launch of the journal Science Forum

Issues: Priority setting, big science and new research funding

A new science and technology policy journal launches its first issue. Science Forum is designed to close the social and cultural gap emerging on the relationship between public policy and advancing S&T. The first issue, edited by the science writer for the Globe and Mail, David Spurgeon, covers a major debate on a proposed big science facility for AECL— the Intense Neutron Generator, a new hydro research facility for Quebec (IREQ), and the outlook for a new approach to medical research in Canadian schools.

Science Forum, published initially by University of Toronto Press, is destined to engage the public in a dialogue for almost a decade and serves as a bilingual sounding board for the science and policy-making communities to vent their issues in an informed way and discuss options openly with Canadians. A fascinating debate in its early issues emerges on the need for a new S&T policy institute in Canada — still germane today.

In the August 1968 edition, E.L. Holmes, Waterloo's associate dean of engineering, argues for a new unit on a Canadian campus to study science policy. His thesis is couched within the context of the two-year old Science Council of Canada preparing its first-ever report on the status of Canadian S&T; the opening salvo of a major Senate committee study on science policy (Lamontagne); and an OECD study examining Canada's national research policies.

Holmes is concerned that, with the emergence of a workable and dynamic science policy in Canada, there will be a need to train new talent and understand the factors that shape and influence science and technology down the road. A science policy institute will be required (based perhaps on the newly created unit at the University of Sussex in the UK).

Holmes suggests that few governments are in a position to make detailed decisions on science policy on a sound basis, and quotes a Canadian report on tax policy: *"So little is known about the kinds of research that are required, and who should do it that it is dangerous to take a firm stand. Canada desperately needs some research on research."* Holmes asks for feedback to his suggestion and is re-joined in the same issue by JW Grove at Queen's University who cites the work underway at his university to develop graduate seminars on science and government. Grove argues that university is *"well placed to conduct a coordinated program of research on science policy because of its traditionally close and friendly links with Ottawa.... and the fact that many of our natural science colleagues at Queen's are already engaged in important policy studies for the Science Council."*

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Fortunately, the experimentation over those 40 years did not rest there. As readers will know, Canadian universities and other groups undertook the challenge by establishing various experiments in the form of centres, institutes, think tanks, and networks of research on research, ranging from the Université de Montréal's former Institut d'histoire et de sociopolitique des sciences (the author is an alumnus) and UQAM's CIRST, to Simon Fraser's CPROST (celebrating its 20th year), to the planned new science policy and society institute at the University of Ottawa. SSHRC, NRC and NSERC have been supporters over the years of some of this focus with other university partners via the Innovation Systems Research Network-(ISRN), for example. The public policy agenda has been enriched as a result.

Continued, independent science and innovation analysis and studies will be even more critical for public policy as Canadians discuss and act on the growing impacts, both domestic and global, of knowledge on society and the economy. Indeed, institutionalizing training and research in science and innovation policy will be further explored in the context of the Canadian Conference on Science Policy to take place in Toronto in October (<http://sciencepolicy.ca>).

The ability to form the next generation of talent able to come to grips with a fast-changing knowledge society as well as address the impact on innovation from the economic crisis and other major public policy issues, will be a key hallmark of success for any such experiments.

Alberta's Foresight and the Need for Over-the-Horizon Thinking

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Precisely 25 years ago, I co-wrote a report with Don LeRoy for Canada's leading research think tank — the Science Council of Canada — on the evolving role of the provincial research organizations and their mandates in support of technology and innovation for Canadian business and society. Among the group of players we examined was the oldest of these, the Alberta Research Council (est. 1921), generously supported then, as it is now, by the provincial government along with other partners.

We also explored the growing linkages among these research organizations in developing joint projects as well as acting as key national brokers for technology policy. Today, that network has grown to over 2,000 experts conducting over \$250 million of R&D and commercialization and is known as Inno-ventures Canada (I-CAN).

So it was back to the future when the ARC invited me to their June 11-14 Jasper Innovation Forum to help shape new directions for its research agenda and future interactions.

The by-invitation, Chatham House rules only initiative brought together about 60 of the leading players engaged in the emerging national and global policy issues centred on food, energy, water (appropriately, FEW). FEW is emerging as a critical nexus bringing together a loosely-knit coalition of governments, industry, research organizations, communities and cultural and civil society organizations. All are seeking new ways to improve the human condition through a combination of social action, technological research and sound public policy options.

The Forum — while understandably somewhat Alberta-centric — had a good cross-section of these groups, including experts from the developing world, and importantly, youth who will inherit the knowledge of today and hopefully respond affirmatively to the question, (borrowed from a famous Robert Heilbroner essay); "*What has posterity ever done for me?*"

The timing of this Forum was propitious. The Alberta government had announced its multi-million dollar technology action plan focused on applying science and research for innovations in key sectors; the OECD had just released its 2008 Economic Survey of Canada arguing, among other things, for possible prizes offered for technological breakthroughs in addressing energy challenges (www.oecd.org); the G8 Energy Ministers had met in Japan to outline an action plan on climate and energy futures, including carbon capture and storage technologies and biofuels (www.international.gc.ca); and the G8+5 science academies produced a statement on the transition to a low-carbon society calling for greater attention to the research and technology issues associated with this in both the developed and developing worlds (www.nas.edu).

At the Forum, the president of ARC along with its chair of foresight, ably set out the agenda and the challenges faced by society: how can we collectively develop an effective research and technology agenda that enhances and develops innovative approaches to FEW issues we are facing today and in the near future?

There was no expectation that the forum would solve all of these issues, but that at a minimum, several markers and trends with potential research agendas could be outlined along with the identification of an expert network to creatively work at this in the coming months and years. The Forum was indeed creative with excellent lead-off speakers on each topic; facilitators prodding and teasing out the energy and thought processes from the participants; and a stand-up comic qua newscaster highlighting the need for some levity to get important messages across.

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The interaction was excellent with a great deal of time devoted to networking —probably the single most important method of stimulating ideas and ensuring contacts and friendships. And, of course, with the cross-section of many disciplines in all fields ranging from energy, environment, media, the arts, social sciences to finance and management, the setting was ideal for stimulating dialogue.

An evening with the premier of Alberta who outlined his vision of the importance of technology and social engagement for the future of Albertans in the world was certainly a highlight. It demonstrated the keen interest that province possesses in championing these key areas of Canadian and global import. Indeed, the sub-text for the Forum was equally to help trigger stronger innovative thinking within a traditionally commodity-based industry community in that province and to make bridges to other partnerships for a new agenda.

It was recognized that Alberta has a growing leadership and responsibility role, one that was underscored by the premier. How can it work more closely with the rest of Canada and actively engage on emerging knowledge-based issues and public policy? (In fact, this was subsequently highlighted by the significant \$4-billion climate change announcement by the premier on July 8).

In short, the forum was long on ideas. Such independent and active support from Alberta's research council is clearly healthy. It is something our think tanks and science advisory mechanisms could perhaps learn from as they examine the ecology of their new spaces for novel thinking about Canadians' collective future and place in the world.

If there is one message that emerges from this exercise it is that ultimately, technology is a rather simple issue. It is the social and policy-political arenas that complicate our challenges, and with good reason. Any solutions to the FEW nexus will come through a real interaction of social and natural sciences knowledge. ARC with I-CAN should certainly play a key role in making this happen by continuing to draw on the natural interdisciplinarity of these issues. The challenge to our knowledge organizations in this country is there.

It is useful perhaps to recall some wisdom from EF Schumacher's last talk in 1977, called, *"Caring, For Real"*: *"If you want to be a shoemaker, it is not good enough to make good shoes, and to know all about making shoes. You also have to know a lot about feet. Because the aim of the shoe is to fit the foot. But most of us never thought about this."*

Of Dinosaurs, Slime Moulds and YouTube

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You would be mistaken in thinking that this is a commentary on current political discourse, or a screed about technophiles afflicted with CPA (Continuous Partial Attention). Rather, as we turn the corner on the new year, a reflection about our next generation and their keen interest in science and fast emerging technical knowledge is perhaps more germane. This new cool culture of knowledge is what my kids, grand- daughters and their peers are now experiencing — but in a very different environment from that which we faced several decades ago.

To be sure, these days we see a litany of data that would indicate a decline of interest in some fields of science and engineering by students and school children, especially among Western developed nations. At a recent conference I attended in Washington, DC the event was devoted to assessing data on the Science, Technology, Engineering and Math (STEM) education system with associated concerns about whether America can still compete with the rise of growing competition from the East. Respected global rankings of students show that Canadian kids do very well in math and science education. In the latest OECD survey of science ability among 15-year olds, Canadian students rank third (one should note that girls do as well as boys). And we certainly are producing a lot of skilled talent with all of the recent research funding that has gone into our universities.

We also have a population that is interested in science and finds it important to invest in. But rather counter-intuitively, a recent comparative study from Norway suggests that there is an inverse correlation between interest in science and overall support for science and technology. In short, the greater S&T-driven is the economy, the more there is an apparent lack of interest in S&T studies and careers among youth.

Before we start scratching our heads or wringing our hands over this, it is worth considering that there are positive and practical things happening out there led by dynamic and passionate champions. Science outreach organizations such as Let's Talk Science, Actua, Youth Science Foundation, Shad Valley and Science Pour Tous demonstrate tremendous initiative in designing new, flexible incentives for our young people keen on science and civic duty. The annual Canada-Wide Science Fair bringing in school students from all across the country will be taking place next May in Ottawa to celebrate its 46th anniversary.

Our granting councils and other federal and provincial organizations are also active in this arena, with such experiments as the women in science and engineering chairs (with NSERC and private sector partners), the Synapse youth connection program of CIHR and the Gee! in Genome exhibits of Genome Canada with the Museum of Nature and other partners.

The science centres and museums across this country are mobilizing themselves to ensure they can keep up with the new ways of stimulating the science and entrepreneurial cultures and will host a major international gathering this June in Toronto. In celebrating the current International Polar Year, experiments and expeditions such as Students on Board with ArcticNet and Students on Ice are showing how we can energize young people about the culture, environment and health dimensions of our indigenous populations, as well as becoming polar research ambassadors of the future.

We have an annual National Science & Technology Week, National Biotechnology Week and the Prime Minister's Awards for Teaching Excellence have been re-launched. More talent in science and entrepreneurship is a key element of the federal S&T Strategy which calls for encouraging young people to become interested in studying science and help stimulate a culture of science, technology and, not to mention better coordination of efforts to lever greater impact.

Of Dinosaurs, Slime Moulds and YouTube

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Ontario, Quebec, Alberta and BC are examples of just some provinces that have turned their attention to the need to engage our young people in the new currency of ingenuity and S&T. And Nobel Prize winner Carl Weiman, attracted from the US to the University of British Columbia, is working to improve the teaching of science in schools.

Private sector initiatives — such as the recent \$12-million donation by the Gates Foundation to University of Waterloo for enhanced youth outreach efforts in math and computer science, the Manning Innovation Awards supported by EnCana and other players, and the L'Oréal- UNESCO fellowships for women in science — are all positive signals of growing interest in the next generation and the application and use of science and technology for everyday life.

At the end of the day, however, the critical issue will be to focus on ensuring that our citizens are well prepared for the *"post-scientific world"*. As Chris Hill argues in his paper, *The Post-Scientific Society* (Issues in Science and Technology, Fall 2007) more attention must be paid to science and engineering graduates. science council advice still relevant

But there must also be a focus on having our citizens prepared for global workforce opportunities and skill sets that will have them engage in key areas, including business acumen, international languages, networking skills and team work. Indeed, the Science Council of Canada, in its landmark 1984 study, *Science for Every Student*, offered five key areas for why any society should care about dinosaurs and slime moulds. The Council argued that studying science (in its widest definition) is important to:

- develop citizens able to participate fully in the political and social choices facing a technological society;
- train those with a special interest in science and technology fields for further study;
- provide an appropriate preparation for the modern work world; and
- stimulate intellectual and moral growth to help students develop into rational autonomous individuals.

These remain with us today as guideposts for the future. We can certainly build on the synergies offered by this wealth of activity to mobilize science and entrepreneurial assets for the demands of our next generation.

Perhaps then we can unselfishly and collectively answer that decades-old query about what has posterity ever done for me?

On the Shape of Science Advice to Come?

Originally published by Research Money

NRC President Arthur Carty has lots of new friends and critical new challenges. It was gratifying to see his appointment by the prime minister as national science adviser, as well as the challenging mandate for Dr Carty in the Speech From the Throne and its subsequent response. The establishment of the position in Prime Minister's Office (PMO) follows from calls for such a position from various parliamentary committees and other groups over the past several years.

Canada will now have a formal, high-level designated channel that can assist in priority-setting, engage with Cabinet colleagues and the research communities in domestic matters affecting future directions of science and research, and of course, look at how to bring the benefits of our R&D to bear on the challenges of the developing world.

Carty's appointment comes almost 40 years to the month after another National Research Council president, CJ (Jack) Mackenzie was asked to respond to a request by then Prime Minister Lester Pearson on how best to organize government science. That request was made following the publication of the Glassco Royal Commission on Government Organization. It suggested the need for a central scientific bureau (managed by Treasury Board) and a national advisory council, much like today's Advisory Council on S&T (ACST) that Carty has been asked to breathe life back into.

Mackenzie had no small experience in this matter. As defacto national science adviser to the Canadian government during WWII and the post-war period, he had direct access to the Cabinet as well as to his counterpart science advisers in the UK and US.

Those were heady days when science was "mainstreamed" into the war and reconstruction efforts and bureaucratic turf issues were fairly easy to resolve.

Mackenzie, in his January 1964 report to Pearson, made some key points that hold water today (even if they were not all implemented). Among these: getting the right people is more important than drafting an ideal organization; the new scientific bureau should be established in the PMO, not Treasury Board as had been suggested; and, a more effective federal panel on S&T (borrowed from the US model of the time) should bring together heads of federal agencies involved in major scientific programs. This was a precursor perhaps to the current CSTA.

We've been around the block several times with all manner of experiment on science advice to and for government — some good, some bad, some just plain ugly. Today, readers will be right to ask: if S&T funding in the past seven years has been on the upswing without a national science adviser all these years, why create such a position today? Let's ponder some considerations, besides the obvious that the PM has a strong inbred understanding of the need for R&D and science, in addition to the view that the responsibility and legacy of any generation is to pass on an enhanced level of knowledge.

First, somewhere in the growing cacophony of advice and expert counsel that surrounds public policy is a comfortable medium that places scientific advice in its appropriate station with other forms of public policy input. The PM will not limit his counsel to advice from his science adviser, his parliamentary secretary for science and small business and Industry minister. The complexity of decision-making requires many sources of advice. But how this advice is interconnected to the decision-making process is a key element to ensuring that science advice matters.

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After all, the general public is becoming leery of the dissonance between the rapid advance of knowledge and the inability of our social structures to address emerging challenges effectively. Just think SARS, water quality and safety, mad cows, avian flu, farmed salmon, climate change, bioterrorism, AIDS, missile shields and manned space missions and you get the picture. Linking and exchanging information among the various S&T advisory bodies and expertise both at the federal and provincial levels is, and will continue to be, paramount.

Second, anticipating change is a growing challenge. How does one keep track of issues of a scientific and technical nature that are just now appearing on the horizon, while preparing the way for appropriate action or policy response? Some foresight is required if a science adviser is to be effective here. One mechanism has been the Carnegie Group of Science Ministers and Science Advisers from the G-8. The group meets twice annually to exchange knowledge on issues such as bioterrorism, big science, intellectual property rights, and international cooperation with the developing world. A parallel group of G-8 research council heads also meets annually, but there is little linkage between the two.

It may be time to reconsider this format to broaden the connections, as well as ensuring a greater input to the G-8 Summit meetings by adding a stronger linkage to the developing world's emerging economies, such as India, Brazil, China and South Africa. These, and other developing economies, have significant S&T assets and are key partners for us. The PM's statement that Canada should devote no less than 5% of its R&D investment to knowledge-based approaches to development assistance is a significant signal of leadership in this area, both at home and globally. His charge to the national science adviser to help bring the benefits of Canadian research and technology to bear on challenges in the developing world will require a mobilization of the Canadian knowledge community that is probably no less important than a similar "*projet de société*" experienced by Jack Mackenzie in the post WWII environment.

Increasingly, we are in a risk environment. Communicating science and its impacts effectively is an art form. As Tony Blair argued in his elegant Science Matters speech, "This isn't about Government and science. It's crucially about society. We need stronger, clearer ways of science and people communicating. The dangers are in ignorance of each other's point of view: the solution is understanding them".

Some of this communication needs to take place in more structured fora that can provide technical and social impact assessments of S&T issues. A Canadian Academies concept has been proposed to do this, but it remains on the shelf. Dusting it off might be a useful response to assist our citizens and policy makers who are looking at how to better understand the complex dynamics of the society-science interface.

These, and other considerations that science advice in this country will face, all require strong leadership, commitment, partnerships and patience. Are the knowledge and policy-making communities up to the task?

The Maple Leaf, the Blackberry & Shawinigan Science Policy

Originally published by Research Money

In this era of rapid technological change and media saturation, psychologists and other social scientists have been busy analysing a unique, modern-day hubris. It's known as ASN (Acquired Situational Narcissism) that develops among some pop stars, high-priced athletes, politicians and CEOs. Experts have also identified another condition that politicians in particular are prone to developing: CPA, or Continuous Partial Attention. This phenomenon must always be borne in mind when citizens and stakeholders make their case for research support. Innovation is only one of many complex, conflicting and often contradictory issues that leaders must factor in, always with an eye to the polls and what's in it for their respective constituencies.

In his more recent speeches, the Canadian prime minister has been big on "*branding*" Canadian excellence, and using the imagery of the maple leaf to do this. Witness his remarks to the Microsoft Summit on Canadian Innovation in August: "*the bold strategy of our government (is) to make the Maple Leaf a global trademark for innovation excellence*".

The PM has also taken to singling out the true leaders of corporate innovation, such as the Research in Motion (think Blackberry) founder's philanthropic gesture in the creation of a unique centre for theoretical physics. The PM and his team— along with various "ginger groups" of elites from the academic and public sectors — have been behind novel, world class policy experiments. These include the Canada Foundation for Innovation (CFI), Canada Research Chairs, Genome Canada, Atlantic Innovation Fund and Canadian Institutes of Health Research. Now the PM's promoting the current innovation and skills strategy that, if we are to believe the recent Speech from the Throne, will spruce up the next Budget.

Lest it goes straight to — or is that from? — his heart, Canada's PM knows it's not all been peaches and cream. It's been more like guns and roses. The research community took a hit under the mid-1990s Program Review exercise from which it's still recovering. Some evidence? Government labs in Canada — recent creative defence R&D initiatives aside — are figuring out how to re-invigorate the public face of research after years of cuts and erosion of infrastructure. Skills demands continue to remain high in many sectors, with questions lingering over the scale of the so-called brain drain. The federal-provincial dynamics on innovation policies haven't seen their best years, but they are gradually showing signs of a turn around as S&T ministers gather again after a decade-long hiatus. Industrial R&D has suffered its first significant fall in almost four decades. Canada's neighbour south of the border is continuing to invest massive new amounts into research, in part triggered by security and terrorist threats.

THE LIBERAL RECORD

While some of these gaps have been raised in the latest in a long list of innovation consultations, it might be instructive to match today's Liberal record to the original set of promises outlined by the PM when he began issuing ideas on innovation.

The WayBack Machine now takes us to that period.

Date: October 13, 1993.

Place: Kitchener ON.

The Maple Leaf, the Blackberry & Shawinigan Science Policy

Originally published by Research Money

Then Liberal leader Jean Chrétien is outlining how his party will develop a more innovative economy by investing in science and technology (S&T). He notes that investing in R&D is a key element to Canada's economic development and productivity. An innovative business "culture" is required, as is sound investment in human resources and the application of knowledge.

The Liberal Party platform said in 1993 that it supported doubling the country's overall investment in R&D while understanding that this can only take place as Canada is able to absorb and manage such an increase. The 1993 manifesto also called for establishment of a Canadian Technology Network to disseminate information on technology across Canada.

- It argued for a technology partnership program to help commercialize technology between Canadian universities, government facilities and the private sector.
- It suggested support for university research through stable, long-term funding.
- The Liberals underscored their support the Networks of Centres of Excellence.
- They would invest in environmental technologies.
- They would develop and expand the mandate of the Defence Industry Productivity Program (DIPP).
- They would review government S&T policies on a regular basis.
- They would establish a Canadian Engineers Program.

Today, the record is not bad overall. But in at least one critical area of "branding" excellence, the engagement is still lacking. The Kitchener tract contended that there would be efforts to forge strategic alliances between Canadian and international partners. It also called for an enhanced role for the Trade Commissioner Service, linked to a strongly qualified technology and science attaché network that would gather overseas information for diffusion on emerging technologies, potential alliances and opportunities for Canadian exports abroad.

To some extent, the Team Canada missions have tried to address this, but Canada is still too often seen as an unreliable partner in S&T. Admittedly, some efforts have been undertaken by the granting councils and the CFI. But the fact remains that the essence of the 2000 Simard report to the PM's Advisory Council on Science and Technology on Canada's role in international S&T has not been fully acted upon. And if one is to assess the current innovation and skills agenda, the lacunae persists. This area needs to be addressed — with adequate funding and strategic partnerships in both the developed and developing world — if the objective is to broadcast the Maple Leaf as the global standard for innovation and research excellence.

One final point. In his remarkable speech to the Royal Society of London earlier this year, Britain's PM Tony Blair was right in saying that science is a central part, not a separate part, of common culture.

A strong campaign to communicate this with society through the active participation of research communities (and a new Canadian Academies?) is a sage path to ensuring that science is seen as ONE key ingredient to Canada's economic, trade, environmental, health and other social goals. Messages such as these always have more impact when they are delivered (in both senses of the word) by political leaders, not just the converted.

Mapping science's post-election future in Canada

Originally published by Canadian Chemical News

Well, it's finally over — for now. The 2015 federal election results are in with a new majority Liberal government. What does it all mean for the future of science in this country? First, a word about what happened. Science received more than its usual due for an electoral campaign. Readers will have noticed an unusual amount of attention given to federal science, more specifically the muzzling of government scientists and the use of evidence in decision making. This was different from past campaigns. Grass roots science movements have sprung up to shine a beacon on the silencing issue — unprecedented in Canadian science policy history. Evidence for Democracy, the Canadian Association of University Teachers' Get Science Right and the Science Integrity Project, for example, have provided platforms to publicize the issue and to offer solutions. Aided by surveys from the Professional Institute for the Public Service (PIPSC), the chilling of public-interest science has received considerable media attention, both here and abroad.

The federal parties running against the Conservatives all made room in their platforms for improved science governance, ranging from a new Parliamentary Science Officer to the re instatement of a national science adviser to the return of the long-form census. Pledges to increase funding to the Industrial Research Assistance Program (IRAP), the granting councils and health research, were also made. On the innovation front, the parties have made promises to improve incentives, including tax credits for venture capital and R&D to selected funding to strategic sectors or clusters of the economy.

Science and innovation always receive some attention in these campaigns. Continuous partial attention is to be expected. With no natural constituency, science and innovation remain marginal as headline topics. Even the announcement of the latest Nobel Prize to a Canadian in physics was a mere ripple in the media's and general public's eyes.

But to the extent that science and innovation impact on the everyday lives of Canadians, that is when knowledge does and should matter. A powerful narrative from all sectors that makes clear why research and knowledge contributes to our health, our education and training, our culture, our environment and our economic well-being is ultimately what can make a difference to the voting public. It has been missing.

We now have a new majority government in Ottawa. The Liberal party has made promises to fund a \$200 million innovation agenda with a focus on technology incubators and national network for business innovation and cluster support, research facilities and small-business assistance. In valuing and respecting scientists, it also commits to a chief science officer, restoring the long-form census and pledging to the use of accurate data in decision-making. A centrepiece is \$300 million annually over the next four years for clean technologies and clean-tech manufacturing in the natural resources (forestry, mining, fisheries, energy and agriculture).

The Liberals have also committed to restore funding for freshwater research as well as make new investments in the Experimental Lakes Area. The party promised to devote \$200 million over the next four years to ocean science and monitoring. Also pledged was an annual increase in the popular IRAP budget to the tune of \$100 million.

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There is a longer game, however. We will need a national vision that is collaborative with other governments in moving forward on a new agenda for a Canada that will be 150 years old in 2017. We should expect the scientific leadership in this country to come to the plate and deliver alongside the grass roots groups that have emerged. And we need an entrepreneurial and private sector that starts taking its responsibilities seriously about investing in the next frontier. Only then will Canada's knowledge future be a true nation-building "*projet de société*".

Assessing the Usefulness of Useless Research

Originally appeared in the CSPC website

My great uncle, Paul Larose, was a distinguished chemist at the NRC during the WWII era. His expertise was in textiles (especially wool materials). With part of the research he conducted, the NRC was able to demonstrate the superiority of nylon in the making of parachutes (substituting the then used silk). It was a world first. Like most researchers exploring their curiosity itch, he had no clear sense that his work would lead to such a development. As the scientist turned polymath Michael Polanyi was to say later in a classic paper, *"The Republic of Science: You can kill or mutilate the advance of science, you cannot shape it. For it can advance only by essentially unpredictable steps, pursuing problems of its own, and the practical benefits of these advances will be incidental and hence doubly unpredictable."*

So it is with fundamental science—it is a veritable free market of ideas and indeed unpredictable, with consequences virtually unknowable. Its prime motivation is about understanding nature and ourselves. And the sciences, along with music, and the arts are cultural assets not to be overlooked for their profound impacts on people and society. So it makes sense to leave science to creative scientists, and leave them alone – to a certain point.

But when politicians and bureaucrats are too much engaged in this process, things can get muddy. In the US, a political-policy debate has emerged within elements of Congress and the *avant-garde* science community with *arrière-garde* officials wanting to ensure that publicly funded research is relevant and not wasteful—especially within that easiest of all targets- the social sciences. In partial response, the Golden Goose Award has been instituted to illustrate the benefits of federally-funded basic scientific research, by highlighting examples of studies that seemed unusual at the time but ultimately led to major breakthroughs that have had a significant impact on society.

Back here in Canada, scientists of all persuasions are recovering from an antediluvian period under the Harper administration when much of what constituted support for basic research had strings attached to it or was scaled back—and scientists, at least within the federal government ambit, were muzzled. Science powered commerce and that was the end of the discussion. Then along came 2015 and the promise of progress.

Building on the Liberal Party platform of valuing and respecting science and scientists, the 2016 federal budget has signalled the need to better understand the role and importance of so-called discovery research or fundamental science. It is even presaged by a 1986 quote from one of Canada's Nobel Prize awardees, John Polanyi, who, picking up from the earlier remarks of his father Michael, underscored that: *"I had no thought of any application of this new knowledge—if it could be obtained—nor did anyone ask me to justify my work in this fashion. The assumption at that date was that if the breakthrough in understanding of nature, that is to say in fundamental or basic science, could be achieved, applications would undoubtedly follow. The assumption turned out to be correct."*

To be sure, Canada's support for fundamental science is non-trivial ranging from investments in polar and oceans research along with large scale (big science) facilities such as TRIUMF-celebrating its 40th anniversary; to the SNO lab which led to a co-shared Nobel this past year for Art McDonald and his team; to partnership arrangements with private patrons such as the Perimeter Institute for Theoretical Physics and the Institute for Quantum Computing, and to large-scale research stations such as the Experimental Lakes Area. Discovery research is now being supported with a fresh, larger injection of money.

Assessing the Usefulness of Useless Research

Originally appeared in the CSPC website

But with the budget, the Minister for Science has been given the unenviable task of undertaking a comprehensive review of all elements of federal support for fundamental science over the coming year. Among other things, the review aims to:

- Examine the rationale for current targeting of granting councils' funding and bring greater coherence to the diverse range of federal research and development priorities and funding instruments;
- Ensure there is sufficient flexibility to respond to emerging research opportunities for Canada, including big science projects and other international collaborations.

This may sound a bit like the Sir Paul Nurse review of the UK granting councils last year and even smacks with the rhetoric behind the 2011 Jenkins Expert Panel of federal support to research and development. And it isn't the first time that the granting councils' discovery research mandates have been scrutinized. Organizations as diverse as PAGSE, the CCA, and the defunct Science Council of Canada have all grappled with how to better assess the critical role of basic research—be it hard, soft or just plain mushy.

It will be a challenge to tackle this latest venture effectively along with adept diplomacy while not unduly interfering with unfettered creation of ideas. Trickier still will be to take account of the links to other aspects of the knowledge ecosystem including traditional knowledge, public interest research and private sector innovation. No doubt the Minister will have the support of her new Chief Sciences Officer along with other willing partners within Cabinet and the knowledge communities. That said, the exercise should bear in mind what that staid magazine, *The Economist*, has noted: *"As long as the money available gives scientists enough opportunities to keep new ideas flowing---and keeps the laboratories that produce trained people reasonably happy---the number of missed opportunities does not matter. If research scientists are variedly busy, their work can benefit the society that pays for them."*

My great uncle fully understood this and that it required a certain continued freedom to enable the power of ideas. He became the President of the Canadian Association of Scientific Workers after the war. In that role, he pushed hard for an understanding of the role of science in society making efforts to launch better working conditions for male and female researchers so that they could stay in Canada. Hopefully, the latest review of science by the federal government will recognize the importance of signalling the usefulness of all forms of fundamental knowledge.

*(with apologies to Abraham Flexner-*The Usefulness of Useless Knowledge*, Harper's 1939)

Of Harpman, Hadfield and Herzberg - Free Radicals in Science and Society

Originally appeared in the CSPC website

Absorbing the latest news surrounding the federal election, one might be surprised to see the occasional reference to the role of science and technology in society. But this is as it should be—after all, science and technology have always played a major part in Canada's history, culture and socio-economic development.

Often understated in this has been the engagement of 'free radicals' who take up the cause and use their star power to make Canadians sit up and pay attention. David Suzuki would qualify here as a long-standing rebel on why science matters to everyday Canadians... and it is more than his long-running *Nature of Things*. He recently gave a stirring keynote address to the iVote group at University of Ottawa organized by Kevin Page, the former Parliamentary Budget Officer---himself a key player in warning about the abuses of accountability.

Harpman, a federal environmental researcher who has composed a song about the muzzling treatment of its own scientists by the Harper administration, has recently stolen the spotlight criss-crossing the country to alert citizens about why voting in this election is important. He has not been alone. In an unprecedented awakening by the grass roots scientific community, the general public is witnessing the emergence of various groups designed to tackle issues such as the muzzling of the federal scientists, arbitrary cuts to public research; shelving, destruction and archiving of information, data and scientific collections that have provided key inputs to public policy over the years; and elimination of governance bodies that have served to provide valuable advice to the polity. These organizations are interviewing candidates; holding debates, using social media, and asking the federal political parties to answer questions about trends in science and what they will do to commit to its future support.

The media and bloggers are doing their bit as well by shining a spotlight on some of these electoral questions, including ACFAS, Je vote pour la science, Science Borealis and the Quebec, and Canadian science writers' associations.

The advocacy work of Diane Orihel in campaigning to reverse the Experimental Lakes Area cuts (The 'Lady of the Lakes' as Nature has labelled her); the development of Evidence for Democracy, the Scientific Integrity Project, CAUT's Get Science Right campaign, and the PIPSC embrace of science as a major election issue, all speak to this *cri d'alarme*.

Students clubs are also engaged such as the Science and Policy Exchange in Montreal and UOttawa's Science Policy Society. Not to be forgotten, our Governor General has been an outspoken ambassador for science and innovation (with the recently announced GG Innovation Awards in collaboration with CFI and the Canada Science and Technology Museums Corporation).

National recognition also matters for other reasons. When Statistics Canada (itself a target of the Harper cuts) released its survey on pride in being Canadian and pride in Canadian achievements, science and technology ranked sixth, above economic achievements and Canada's political influence in the world; and was virtually tied with Canadian pride in sports.

Here, our astronauts and space achievements are often cited as contributing to this positive perception. Roberta Bondar, Marc Garneau and Julie Payette come to mind for their accomplishments and their continuing work in promoting science culture throughout the country. Chris Hadfield, using social media and his guitar, has probably done more to cement his own mark.

Of Harpman, Hadfield and Herzberg - Free Radicals in Science and Society

Originally appeared in the CSPC website

Other perceptions of our achievements are shaped by major prizes to Canadians in the sciences. Given the annual announcements this past week; Nobels are usually seen as the highest watermark. Canada has had a number of Nobel science recipients over the years apart from this year's physics co-awardee Art McDonald. They include John Polanyi, Bertram Brockhouse, William Boyle and Michael Smith, but probably none more fitting of the 'free radical' label than Gerhard Herzberg who was awarded the Nobel for chemistry in 1971. Indeed, the country's most prestigious award in the sciences (bestowed by NSERC) is called the Gerhard Herzberg Canada Gold Medal.

Along with his excellence in science, Herzberg was a prolific commentator on the role of basic research and science in society. During his professional lifetime spent almost exclusively at the NRC, he gave talks, speeches and commentary on the need to ensure the vitality and integrity of science, discovery and its cultural role. He railed against the increasing bureaucratization of science (when he received his Nobel Prize in 1971, the government had just launched its new Ministry of State for Science and Technology and the Senate Special Committee on Science Policy led by the Harvard-trained economist Maurice Lamontagne had been holding hearings on the future of science, targeting the NRC). Herzberg took them on arguing for less intrusive meddling in the workings of creative scientists.

From his argument for why astronomy and astrophysics is critical to advances in the human intellect, to the problematic notions of economic justification in funding science—('science powers commerce' as the current PM is fond of saying), to the need for scientists to pursue ideas in a 'free market', to the long-standing arguments about basic vs applied research, Herzberg is actually quite contemporary. He was the epitome of a scientist taking his role as concerned citizen seriously.

Every society needs advocates such as the ones we have outlined above. They provide fresh insights into the root of things we often take for granted. They are key to helping shape new dialogues, and demonstrating the need to question fundamental assumptions about how our knowledge and science impacts on everyday life and society—even if we don't always agree. That is the basis of a well-functioning democracy. As Mike Lazaridis, another outspoken and articulate player on this scene once said, *"We cannot be so blinded by the urgency of our problems that we take for granted how important, how powerful the combination of curiosity and reason really is. That is the tradition of science."*

Do you want to build a(nother) snowman?

Originally appeared in the ISSP website

I think we are all familiar with our Nordic clime and the Canadian habit of building snowmen. What's nice about them is that you can use your creativity and imagination to build them to any specification under the right conditions. No two are alike—just like snowflakes. But snowmen have a structural –if not temporal, flaw—while some may last through a winter, they will all eventually melt—leaving the water to dissipate---until we build them again in another winter if the conditions are propitious.

The history of Canada's science advisory experiments are just like these snowmen—we build them (at times with interesting features) but in the end, they are doomed to disappear leaving little visible trace. We simply have not learned how to keep them from melting.

We are now yet again exploring another science advisory mechanism. We know that it is a mandate by the PM to the new science minister who is now consulting broadly seeking input on this Chief Science Officer concept. But we don't know its form or function. We don't even know if we need one—but it does seem to be a good idea.

And it is trendy. There have been conferences or summits to discuss best practices in this area, including 2014 events in Auckland hosted by the International Council for Science and the New Zealand Chief Scientist, Sir Peter Gluckman, as well as a preceding meeting of Chief Scientists and Opinion Leaders convened by Québec's Chief Scientist, Dr. Rémi Quirion. A new International Network for Government Science Advice has been established. It provides a forum for policy makers, practitioners, academies, and academics to share experience, build capacity and develop theoretical and practical approaches to the use of scientific evidence in informing policy at all levels of government.

Going back to the CSO issue here, it does strike me as passing strange that we are only exploring one small part of the organizational ecology of our advisory apparatus. The South African science minister has just appointed a special **institutional landscape review** to establish whether the institutional landscape is able to optimally assist in achieving the objectives of South Africa's National Development Plan (NDP) and socio-economic needs. This includes identifying any gaps in the current institutional landscape. This is but one example but other countries are doing same. Advisory structures are one element of that, but no means the only dimension. I raise this case because ultimately it is a dangerous thing to assume that with a science advisor in place, one can effectively address expectations about the use, direction, scale and scope of knowledge in your country. Science advice is not science—it is an art. And it operates in a complex policy and political environment. As Gluckman said at the CSPC meeting in Ottawa last November:

"We... need to recognise that the systems developed to deliver science advice are complex and evolve according to local history, culture and approach to public reason. A complete system needs to consider the diversity on the demand side both in need and in type; the executive branch, the legislative branch (if distinct) and the policy community all have different needs."

Let me also be clear about one other expectation. If science, technology and innovation advisory functions are to be effective, they must be clearly linked to, and perceived to have an impact on, government decision making, priority setting and policy development, coordination and implementation. Linkages need to be made at the political level – Ministers, Cabinet and Parliament, and within the federal bureaucracy. In order to assist decision-making, there is a requirement for accountability to Parliament and a need to provide Parliamentarians with regular information and objective analysis of science and technology relevant to the policy issues of the day.

Do you want to build a(nother) snowman?

Originally appeared in the ISSP website

Most recently in the House, the NDP has yet again suggested a type of Parliamentary Science Office akin to the Parliamentary Budget Office structure that now exists as a watchdog for government finances. Such a structure might well be helpful for a new CSO to have—providing of course, that a PSO remains non-partisan and that there is a demand for this service. In **Research Money**, Jean-Marc Mangin of the Canadian Federation of the Social Sciences and Humanities said: *"To be effective, the new Chief Science Officer must be part of the central machinery of government, positioned to understand the policy context, able to integrate insights from all disciplines, and be a superb communicator. However, creating a Chief Science Officer is not on its own sufficient to democratize science advice. Parliamentary committees should be able to make full use of Canada's abundant research insights in their deliberations, calling on postsecondary institutions, scholarly associations and non-profit organizations in all scientific disciplines."*

And this includes traditional knowledge as well. The Indian PM said as much at the 103rd Indian Science Congress in January when he noted: *"Like traditional knowledge, science has also evolved through human experiences and exploration of Nature. So, we must recognize that science, as we see it, does not constitute the only form of empirical knowledge about the world. And, we must bridge the distance between traditional knowledge and modern science, so that we can craft local and more sustainable solutions for our challenges)."*

Here then are my ten observations on making things work for any structure implicating a chief science advisor:

1. There is no ideal structure-- historical experience and culture matter
2. CSAs need to undertake a systems approach; at the end of the day, their effectiveness is measured in their ability to understand context, crisis, the policy world and political-social interactions--not to mention how to communicate well to both the public and media
3. There is no training or proving ground for CSAs--perhaps there should be
4. A key to successful CSAs appears to be their ability to frame complex issues in such a way as to have their political masters-- and the informed public-- grasp the essence of the issues
5. CSAs should always be on tap--not on top (sometimes they forget)
6. There is no such thing as an independent or objective CSA-- all come with baggage and values; but they must be non-partisan to be effective
7. Chemistry matters- personal relationships are key to making such arrangements work--sometimes organizational--- design ---however well intentioned, can get in the way.
8. The most qualified person in terms of credentials or research is not necessarily the most effective CSA
9. While the UK and other Commonwealth models are often go-to structures, they should be assessed critically before borrowing some of that experience; What Works Centres, POST and MP Pairing Scheme nonetheless are worth a more intensive look
10. CSAs best operate with a suite of other advisory structures to both complement their work, but also to provide needed outreach for effective advice and implementation.

So if we want to build something a bit more permanent that will not disappear at the first signs of spring, we might wish to consider some of these principles. After all, we can build a durable snowman or as the song from Frozen says: maybe something else.

A Chief Science Officer for Canada? Looking for Models

Originally appeared in the Canadian Government Executive website

Following the various mandate letters from the Trudeau Administration, the Minister for Science has been asked by the prime minister to establish a Chief Science Officer (CSO) position to guide and inform government decision-making. The Minister, Kirsty Duncan, has launched a consultation exercise and is asking for input on what the role and responsibilities of this CSO will be; what priorities should be tackled; and how these will be communicated to the research community and wider publics.

It's an ambitious charge for anyone—and has raised expectations that are unlikely to be met. Canada's previous attempts at any sustainable structure for science advice have all failed. The most recent experiment, the National Science Advisor (NSA) to the Prime Minister (2003-2008), cratered for several reasons. The role and mandate of the NSA were not sufficiently well defined. Its relationships with the Minister of Industry, Cabinet, the PMO, Parliament and the other advisory functions within the federal system were particularly vague.

In her discussions, the new science Minister is also tapping into experience and experiments abroad, particularly within Commonwealth countries where Parliamentary systems resemble those of Canada. The UK, Australia and New Zealand are countries of choice given their experience in tapping advice and knowledge for more effective decision-making.

Canada has also looked south of the border for inspiration—the new Minister has already consulted with the Assistant to the President for Science & Technology and the Director of the Office of Science & Technology Policy (OSTP) in the White House. The mission of the Office of Science and Technology Policy is threefold: first, to provide the President and senior staff with accurate, relevant, and timely scientific and technical advice on all matters of consequence; second, to ensure that the policies of the Executive Branch are informed by sound science; and third, to ensure that the scientific and technical work of the Executive Branch is properly coordinated so as to provide the greatest benefit to society.

But the US has a highly pluralistic system for science advice—one that is well established with a culture that values the application of this advice to decision-making; something Canada is sorely lacking. The advisory landscape is populated with such organizations as the American Association for the Advancement of Science and the National Academies of Science, not to mention numerous advocacy groups. As a result, there is almost no shortage of advisory capability. Rather, the issue is one of wading through the various sources of knowledge and applying a critical eye on the reliable data and information. That said, the advisory ecosystem is an open one—much of the advice is available to the public for further input and consultation.

Of all of the various national science advice experiments, the UK model is the one that Canada pays the most attention to because the UK is constantly tinkering with the advisory structures. The BSE (Mad Cow) and foot and mouth outbreaks gave considerable impetus to the current structure that is now in play within the UK.

The UK has a long-established chief science advisor apparatus. It adopted guidelines on scientific analysis in policy making in 1997 and continuously refined them. (Canada adapted much of the structure for its Council of Science and Technology Advisors. Created in 1996, it was meant to examine scientific controversies requiring more effective use of reliable knowledge. It was closed down by the Harper government in 2006.)

A Chief Science Officer for Canada? Looking for Models

Originally appeared in the Canadian Government Executive website

The current UK Government Chief Scientific Adviser and the Government Office for Science work closely with Departmental Chief Scientific Advisers to deliver the science advice, evidence and implementation that the UK government needs to govern the country. It does this mainly by working as a “transmission mechanism” between expert scientific communities working in academia, industry and government, and government policy makers.

The UK Parliament also benefits from its own advisory-analytical support platform. The UK Parliamentary Office for Science and Technology (POST) provides advice on research evidence relating to public policy issues. For example, POST advisers provide oral briefings to select committees on research evidence relevant to inquiries, or assessments of evidence received by a committee; and ad hoc peer reviewed briefings prepared at the request of a select committee or library research service. POST covers a wide range of areas including health, biological sciences, physical sciences, engineering, ICT, energy, environment and the social sciences. It holds briefings, convenes workshops and publishes regular POSTnotes to assist parliamentarians in grappling with key public policy issues. The federal NDP Party has introduced several motions in the Canadian Parliament to consider this type of information service for the Canadian Parliamentarians—it awaits a sustained demand from elected MPs.

It would be a mistake to assume that the UK’s sophisticated science advisory system will automatically deliver a well-functioning knowledge-based society. By most measures, the UK has been dropping in its overall spending and performance for R&D and innovation and is now on par with Canada. There are other concerns about the UK advisory system. First, it is complex and difficult to manage. In addition, with the exception of the Chief Scientific Adviser, most of the departmental advisors are part-time, limiting their ability to be effectively embedded within the policy apparatus. In slight contrast to the UK model, the New Zealand Prime Minister’s Chief Science Advisor (PMCSA) is an independent individual who reports directly to the PM. This mechanism allows the role to be filled by the secondment of a practicing academic. The PMCSA has a separate Office, which is physically within the appointee’s home institution, but has direct liaison into the Department of Prime Minister and Cabinet. The PMCSA, established in 2009, has the following responsibilities:

- To enhance the use of science in policy making;

- To promote public understanding of science;
- To promote STEM education;
- To promote NZ’s interests through science diplomacy;
- To provide scientific advice to the PM
- To act as sounding board on policy for science;
- To commission deliberative advice on selected topics,
- To serve on specific governmental boards;
- To chair the network of Science Advisors.

Much like the UK model, NZ Departmental Science Advisors have been appointed in major ministries and report to their Chief Executive with an indirect reporting structure to the PMCSA. The current New Zealand Chief Scientist is Sir Peter David Gluckman, a paediatrician who does not shy from presenting the pluses and minuses of the role of a chief scientist wherever he goes. He is also careful to argue that science advice comes with baggage and its own value-laden predilections. He believes strongly in the honest-broker role of a science adviser and has launched an international network of science advisers designed to collect good practices in this area.

A Chief Science Officer for Canada? Looking for Models

Originally appeared in the Canadian Government Executive website

His May 2015 speech on the need to pay attention to traditional Western science and indigenous knowledge is worthy of careful perusal in the Canadian context. “Science, over the centuries has been refined to recognize and mitigate the influence of values in producing knowledge,” he said. “Other ways of knowing may position values and tradition at their very heart. Our challenge is to come to a meeting place on the reliability and acceptability of variously derived knowledge and what elements from each knowledge pathway will inform the whole and create a better society.” He has recently launched the third in a series of extensive consultations for further recommendations to the Prime Minister on the principles and practices for the production and treatment of science-based evidence for public policy decision-making and on the interface with academia.

The position of Chief Scientist for Australia was created by the Labour Government in 1989. Dr. Alan Finkel, an engineer, is Australia’s current Chief Scientist (the eighth). His task is to provide high-level independent advice to the Prime Minister and other Ministers on matters relating to science, technology and innovation. The CS also holds the position of Executive Officer of the Commonwealth Science Council to identify challenges and opportunities for Australia that can be addressed, in part, through science. The Chief Scientist reports to the Minister for Industry and Science, and also works closely with the Prime Minister both in his role as Executive Officer of the Commonwealth Science Council and in order to provide detailed scientific advice. The Chief Scientist also holds a number of ex-officio roles at the discretion of the government including Chair of Australian Climate Change Science Framework Coordination Group, and membership of the Defence Science and Technology Organisation (DSTO) Advisory Board.

The incumbent is also an advocate for Australian science internationally and focuses national thinking on science across the states and territories through the Forum of Australian Chief Scientists. An equally important part of the role of Chief Scientist for Australia is to be a champion of science, research and the role of evidence in the community and in government. Finally, the Chief Scientist is a communicator of science to the general public, with the aim to promote understanding of, contribution to and enjoyment of science and evidence-based thinking. The new Chief Scientist is currently tackling two key areas: to help lead the development of a 15-year plan for investment in science, research and innovation and to map Australia’s long-term research infrastructure needs.

It should perhaps come as no surprise that science advice has come into its own around the globe. A new International Network for Government Science Advice has been established. INGSA provides a forum for policy makers, practitioners, academics, and academics to share experience, build capacity and develop theoretical and practical approaches to the use of scientific evidence in informing policy at all levels of government. Quebec’s Chief Scientist—the only Canadian jurisdiction to have such a position—is a member and serves on the network development group to this newly formed group.

In due course, Canada will have a federal Chief Science Advisor of sorts. That position will be yet another attempt by a Canadian government to arm itself with expertise to tap on emerging public policy issues that have a significant science (including social sciences) input—presumably there will be a demand for this advice. It is always useful in this context to explore other models and try to learn from our past failures. Of course, adapting models from other places should be done with great care given Canada’s history, culture, Nordic and bilingual confederation.

A Chief Science Officer for Canada? Looking for Models

Originally appeared in the Canadian Government Executive website

Nonetheless, as Sir Peter Gluckman noted in his remarks at the American Association for the Advancement of Science meeting on February 14, “The key issue for science and scientific advice is that of maintaining trust with the policy makers, rather than being seen as a well-placed lobby for science. This is generally done through maintaining the integrity of both the form and the function of advice.”

This is sage advice. Canada’s new Science Officer should be exclusively an advisory role—an adviser that is “on tap” and not “on top.” This key criterion has already proven to be a successful mandate.

Carnegie Group at Twenty-Five

Originally appeared in the Science & Diplomacy website

There is a seeming renaissance underway on how science can be used to inform statecraft more effectively. From Science & Diplomacy to the science diplomacy training events sponsored by the American Association for the Advancement of Science (publisher of Science & Diplomacy) and The World Academy of Sciences to the annual Japanese Science & Technology in Society forum, from the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Science Forum to the Organisation for Economic Co-operation and Development's Science and Technology Ministerial conferences, considerable attention is being paid to the intersection of knowledge with international relations.

It is an old discussion with much rhetoric. As the U.S. House Committee on International Relations stated in 1977, *"Science and technology have affected changes in the substantive tasks of foreign policy, in the methodology of diplomacy, in the management of information on which diplomacy is based, in the intellectual training of diplomats, in the range of present options of negotiations, and in the prospects of future evolution of diplomatic, foreign policy objectives and the international political system."* [1]

Science has traditionally been engaged with the international arena in five ways: [2]

1. As linkages between and among scientists—largely informal in nature, this *"invisible college"* as some have called it, is still a highly networked global enterprise, now expanded to many regions within the developing world. [3]
2. As an organized activity via the discussions between specialized agencies such as the United Nations, the North Atlantic Treaty Organization, the World Health Organization, the Intergovernmental Panel on Climate Change, and others . . . where science is truly on tap to help address policy at a larger scale. Indeed, UNESCO's program of fostering mutual understanding through science, education, and culture was launched on the premise that *"war begins in the minds of men."*
3. As a strategy for diplomatic-trade contacts among countries—building political bridges when it is difficult to do so through the usual channels. A classic example is the creation of the International Institute for Applied Systems Analysis during the Cold War. Of course, research exchanges can also be channeled more negatively, such as the scientific espionage that took place around the atomic bomb project during World War II. [4]
4. As an input to solving global problems—be it humanitarian aid or capacity building or both. The establishment of Canada's International Development Research Centre in 1970 was a unique experiment in this vein. Its board was then composed of members from both the developing and developed world, and regional offices were located in selected developing locales to ensure attention to local needs and culture. [5]
5. As a way to link national pride with growing international economic prowess. Countries such as China, Brazil, and India have used a major buildup of their knowledge assets to increase their global standing. For example, in his 1960 report to the Organisation for European Economic Co-operation, the Canadian diplomat L. Dana Wilgress made the following prediction about China: *"China also is on the threshold of great achievements in science. They are putting into force a beautifully phased programme which commences with those now attending the secondary schools. These will be followed through by an expansion of the institutions for teaching science and technology until China is producing more scientists and engineers than Russia. In twenty-five years from now such a programme is bound to show results. They are likely to make China a first-class economic power."* [6]

Carnegie Group at Twenty-Five

Originally appeared in the Science & Diplomacy website

Time has moved on—and so have global issues. New players have emerged attempting to make the link between science and diplomacy more immediate as well as more effective. Civil society and advocacy groups using social media have become more prevalent. Terrorism, climate change, and global health matters all require more integrated responses.

Much of this newer experimentation today suffers from a certain wistfulness—if only one can integrate science advice and experience into foreign affairs, better outcomes should follow.

The trouble is that most of these efforts often lack a sound understanding of how policy is made or how diplomacy works today. Just as science itself is rapidly being transformed by external and internal forces, diplomacy is coping with cyberspace and global security, and policy makers have to make increasingly complex decisions based on rapidly shifting information.

Monitoring several of these global trends and emerging dynamics was a group created in 1988 called the Carnegie Commission on Science, Technology and Government. Its stated goal was to help government institutions respond to unprecedented advances in science and technology that were transforming the world—including how science advice was provided to the U.S. president. One of its commissioners, the co-chair with Joshua Lederberg of Rockefeller University, was William T. Golden, then chair of the board of the American Museum of Natural History and a former advisor to Harry Truman. Golden suggested that the commission convene a meeting of science advisors and ministers of science of the G7 countries, the European Union (EU), and Russia. Golden had consulted D. Allan Bromley, the Canadian-born assistant for science and technology to George W. Bush, for his views as well. Bromley had agreed with the concept, and in 1991 the Carnegie Group of Science Advisors to Presidents and Prime Ministers was born. [7]

The Carnegie Group Experiment

In many respects, the Carnegie Group—celebrating its twenty-fifth anniversary this year—is a flexible forum that reflects several of the key characteristics of the science and diplomacy trends outlined above. It is particularly adept at responding to the new challenges that have emerged around the use and diffusion of reliable knowledge for more effective statecraft—in fact, it has become a high-level “invisible college” for addressing knowledge-based global issues. Over the years, the Carnegie Group has expanded its membership from the G7, the EU, and Russia to include some emerging economies as well. [8]

Its mission, though, remains steadfast: to provide space for an international dialogue designed to raise serious science issues of common concern and to serve as an informal vehicle for science to shape diplomacy (and vice versa) at the highest levels of decision making.

The Carnegie Group came into being with some key principles that remain in force today. In order to allow for more open, candid, and informal discussions, only members can attend, with rare exceptions. No staff members are present, [9] and no minutes are kept. The media are not involved, and there is no subsidy for travel. Meetings were originally held semiannually and now are held annually. They move from country to country, with the members as guests of the host country. Members are asked to provide key issues that are of relevance to their specific national or global concern, and the host country provides the space for their discussion over a weekend. At times, in order to focus the dialogue, themes are selected, such as energy and technology, science for development, big science, or emerging health issues.

Carnegie Group at Twenty-Five

Originally appeared in the Science & Diplomacy website

At first blush, some may view the Carnegie Group as another in a series of sector-specific G8 groupings (now G7) such as those of the finance or foreign policy ministers. This is a common assumption since the membership is essentially the same. (The EU research commissioner, for instance, is also a member of the Carnegie Group.)

However, the Carnegie Group is quite different from any such formal mechanism, never having been incorporated directly into the G8 summitry process per se. This is not to say that the Carnegie Group has not had any influence or impact with respect to the G8 process.

Indeed, Carnegie Group members have briefed their respective leaders on specific issues that have emerged from Carnegie Group dialogues, and on occasion their meetings have been tied to issues or themes of the G8 summits, such as the June 2006 Carnegie meeting in St. Petersburg where education, infectious diseases, and energy security—all themes of the G-8 summit that Russia was hosting in St. Petersburg the following month—were discussed.

More often than not, the Carnegie Group discussions serve as a stimulus to key actions emerging from the G8 leadership where science has an important role to play, such as capacity building in Africa, bioterrorism, bioethics, or international cooperation in large-scale science projects. It was a discussion from the Carnegie Group meeting in 1999 in Japan on the ethical and legal limits in biotechnology that would trigger a larger debate and consensus on the banning of reproductive cloning (the Raelian cult notwithstanding). [10] The Carnegie Group also encouraged international harmonization of policies on patenting inventions. A special 2004 Carnegie Group expert meeting in Washington, DC, helped formulate specific further initiatives emanating from the Science and Technology for Sustainable Development Action Plan adopted at the G8 Summit in Evian, France. And the opportunity to launch a new international network centered on the emergence of green chemistry was put forward by Italy at the 2005 Carnegie Group meeting hosted in Canada. Other meetings on selection of sites for large international science facilities such as ITER [11] or astronomical facilities led to greater collaboration among interested nations and helped avoid the long-standing national unilateralism that had characterized decisions to move ahead prematurely with such experiments. As a result, global road maps for research infrastructures such as that developed by the EU have become more common.

On other occasions, domestic policy needs serve as the backdrop for Carnegie Group meetings (for example, the United Kingdom in dealing with the outbreak of mad cow disease and its impact on global trade), or national priorities can be brought to the attention of an international audience for potential partnerships or adopting best practices (for example, the United Kingdom on low carbon energy futures, Russia on improving its science education, the United States on nanotechnology, or Canada on enhancing competitiveness and innovation).

The December 2005 Carnegie Group meeting in New York featured a presentation from the United Kingdom's chief scientific advisor on its foresight project addressing emerging infectious diseases, with a special focus on Africa. This was a remarkable effort looking over the horizon in predicting outbreaks, detection, and monitoring in human, plant, and animal diseases; it presaged epidemics that would later emerge such as Ebola. [12]

Carnegie Group at Twenty-Five

Originally appeared in the Science & Diplomacy website

Case Study: Science and Technology Partnerships with the Developing World

One area that has received considerable attention centers on how to build capacity for science and technology in partnership with, for, and by the developing world. Canada's national science advisor brought the issue forward to the Carnegie Group in 2005. (The Canadian prime minister had charged his science advisor with developing a plan to target 5 percent of Canada's research and development assets to the needs of the developing world.) It quickly went global with the Carnegie Group taking on the challenge. The Canadian national science advisor worked with his UK counterpart and later with representatives of Germany and the EU on this issue, leading to a major dialogue with African counterparts on the required knowledge base of science and technology needed to meet the needs of the developing world.

The Leipzig Carnegie meeting of December 2006 was especially helpful in this regard. It brought together ministers and advisors from selected African nations who assisted in moving this dialogue forward, especially through the G8 summit process. A joint paper prepared by representatives of Canada and the United Kingdom served to reflect on the overall progress made by the Carnegie Group on this subject, moving from an emphasis on aid to working in partnership with the African leadership.

The African members outlined progress under their Science and Technology Consolidated Plan of Action, and it was agreed to make proposals based on what African countries themselves had identified as priorities. The minister of science and research of Senegal made a presentation on behalf of the African Ministerial Committee on Science and Technology, which emphasized the following:

- Africa needs to be conscious of the need to take development and regional development into its own hands.
- Africa can develop its economies only through science and technology.
- Africa needs to put resources in place to allow universities and institutes to develop. The New Partnership for Africa's Development (NEPAD) was set up to foster this development.
- A principal problem is engagement of African countries and ensuring their commitment to invest the equivalent of at least 1 percent of GDP in science and technology.
- A process must be put in place and indicators and measures adopted to check on progress, and there must be common platforms across Africa.
- Coordination is an issue because of the vast distances between countries and the diversity of peoples and governments.
- Countries have decided to proceed on a regional level. The system of innovation should include opportunities to build capacity, promote technology transfer, and develop and improve products for agriculture, health, and manufacturing.
- Each region needs to develop its innovation system.

Suggested follow-up actions from the several subsequent Carnegie meetings included:

- Engaging G8 outreach countries to encourage South-South capacity building in African science and technology.
- Supporting NEPAD efforts to develop a science advisory apparatus that could deliver evidence-based policy making, good governance, and industrial development.
- Lending G8 expertise and support to the African Union-NEPAD working groups on science and technology and innovation indicators and on centers of excellence.

Carnegie Group at Twenty-Five

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- Identifying ways to influence (1) pan-African, regional, and national decision making in Africa and (2) the development community in an effort to increase domestic and international investment in science and technology.
- Creating a special meeting of science and development ministers to discuss the African science and technology action plan and G8 outreach.

Later, as holder of the EU presidency in 2007, Germany pushed to integrate African countries and scientists into the Seventh Framework Programme on EU research. The German minister also agreed to host a workshop for a G8-Africa science and technology partnership in 2007 (it was held in October 2007 in Berlin and a report was prepared for follow up). [13]

The development agenda has evolved considerably since then, especially with Africa, and the Okinawa meeting of the Carnegie Group in June 2008 helped place the science-for-development program squarely on the agenda of the G8 summit in Japan that year.

More recently, in May 2014, the South African science and technology minister attended the Carnegie Group meeting in the United Kingdom, hosted by the then minister of state for universities and science. The agenda included items on antibiotic resistance, large-scale opportunities for infrastructure collaboration, and research and innovation for energy security. During that meeting, the UK and South African ministers discussed plans for Newton Fund cooperation with South Africa. [14] Subsequently, the South African minister visited the United Kingdom to sign a memorandum of understanding related to human capital development and capacity building along with industry partnerships. The Newton Fund's focus on the participation of other African countries permits South Africa to assist in supporting science, technology, and innovation capacity building elsewhere in Africa, especially within the frameworks of the African Union and the Southern African Development Community.

The Carnegie Group at Twenty-Five

The Carnegie Group still meets today on an annual basis and has expanded with members from emerging regions, including Brazil, China, India, Mexico, and South Africa. Its core principles continue to be followed, albeit with more bureaucracy surrounding its meetings and agenda. It will likely need to be more attentive to the evolving science diplomacy landscape around it—especially in the context of various summits and regional foreign policy gatherings. For example, the G8 (now G7) science ministers have also been meeting annually, [15] as have groups bringing together global research councils and young scientists such as the Global Research Council and Global Young Academy. Another recent creation in 2013 is the UN Secretary-General's Scientific Advisory Body, which has identified eight top grand challenges it sees as scientific concerns for people and the planet. [16]

That said, the concept as designed twenty-five years ago by Golden and Bromley with initial support of the Carnegie Commission remains a creative and informal vehicle for science to shape diplomacy (and vice versa) more effectively at the highest levels of decision making. But it bears remembering that while science advisors and ministers can assist in diplomacy while at the same time recognizing the boundaries of their influence, diplomats also need to appreciate and learn more about the important role of science in influencing and building healthier international relations. Future Carnegie Group meetings will no doubt have to ensure that these notions remain front and center as they establish meaningful networks for effective science diplomacy.

Carnegie Group at Twenty-Five

Originally appeared in the Science & Diplomacy website

Endnotes

1. U.S. House of Representatives, Committee on International Relations, Science, Technology and American Diplomacy, volume 1 (Washington, DC: Congressional Research Service, 1977).
2. Adapted from Canada, Science and International Affairs, report no. 20 (Ottawa: Science Council of Canada, April 1973).
3. Caroline Wagner, The New Invisible College: Science for Development (Washington, DC: Brookings Institution Press, 2008).
4. Paul Dufour, "Eggheads and Espionage: The Gouzenko Affair in Canada," Journal of Canadian Studies 16, nos. 3-4 (1981):188-98.
5. IDRC at 40: A Brief History (Ottawa: International Development Research Centre, 2010).
6. Dana Wilgress, Co-operation in Scientific and Technical Research (Organisation for European Economic Co-Operation, 1960).
7. The Carnegie Commission had already begun an exploration of international science and foreign affairs in 1990 that was to be eventually published in January 1992 under the title "Science and Technology in U.S. International Affairs."
8. The first meeting, held in Mount, Kisco, NY, was co-chaired by D. Allan Bromley, science advisor to President Bush, and Yuri Osipyan, the science advisor to Soviet President Mikhail Gorbachev. For the first time in its history, a Carnegie meeting was held in South Africa in 2011. Five short volumes have been written on the outcomes of the Carnegie Group meetings, the most recent in December 2010, co-authored by Arthur J. Carty and Paul Dufour.
9. Carnegie members can invite one staff member to accompany them, but the staff members are not present in the formal meetings. The author accompanied his Carnegie representative at sixteen of their meetings.
10. The Raelian movement, a religious cult that believes that various mythologies are based on an alien race and believes in immortality through cloning, presented a manifesto to the Carnegie Group at its meeting in Quebec City in 2001.
11. ITER ("The Way" in Latin) is a collaboration of thirty-five nations building a magnetic fusion device for possible eventual use as a large-scale and carbon-free source of energy. The idea uses the same principle that powers the sun and the stars.
12. Foresight. Infectious Diseases: preparing for the future (London: Office of Science and Innovation, 2006).
13. Science and Technology for Africa's Future: Towards a Sustainable Partnership (Berlin: G8-AMCOST, October 18-19, 2007).
14. The Newton Fund is designed to address science and technology capacity building in the developing world and through strategic partnerships help alleviate poverty.
15. See https://www.bmbf.de/files/English_version.pdf for a summary of their 2015 meeting in Berlin.
16. Results of a Delphi Study on the Top Challenges for the Future of Humanity and the Planet to be brought to the attention of the Secretary-General (Saint Petersburg, Russia: UN Secretary-General's Science Advisory Board, December 14-15, 2015).

Dedicated to the legacy of William T. Golden, global science and diplomacy visionary and creative spirit behind the Carnegie Group.

A World Cup for science diplomacy

Originally appeared in the Research Fortnight and the INGSA website

In his speeches when he travels abroad, Canada's governor-general David Johnston is fond of referring to "*the diplomacy of knowledge*", defined as the ability and willingness to share learning across borders. This is nothing new: science is the most international of languages, and has long been well placed to assist in discourse and partnership building between nations.

But, perhaps driven by the increasingly international and collaborative nature of science, the rise in multinational endeavours such as Cern, the Square Kilometre Array and the Iter fusion reactor, and global issues such as climate change, the ideas of science for diplomacy and diplomacy for science are becoming increasingly prominent on the geopolitical agenda. Now is a good time to think about how countries use and disseminate knowledge to engage in discourse and partnerships.

Any nation's science is stronger for looking beyond national borders. Exposure to global standards of excellence helps maintain and improve the quality of domestic science. Individual researchers are better for access to the frontiers of science, and international collaborations with the world's leading scientists strengthen research impact. Visits, exchanges and immigration by overseas scientists also strengthen domestic science.

It's difficult to say precisely where scientific collaboration shades into science diplomacy, but it's easy to point to products of international science that go beyond the scientific. A nation can enhance its national security and economic prosperity by fostering improved conditions in other countries through increased technical capability, and some issues are of such a global nature that no country can address them alone. Science diplomacy can also achieve many of the same things as regular diplomacy. It can lead to a better understanding of other cultures, values and ways of doing business. It discharges obligations negotiated in connection with treaties. And it can play a part in solving geopolitical conflicts and opening up avenues for cooperation.

This summer, the World Academy of Sciences and the American Association for the Advancement of Science held a special workshop and training course in Trieste, Italy. Participants came from 32 nations: from countries with well-established science systems, from emerging and developing nations, and from states where conventional diplomatic relations with the rest of the world range from the strained to the virtually non-existent.

The workshop, which ran from 8 to 13 June, was designed to improve participants' ability to develop science diplomacy projects by introducing them to various case studies at national, regional and multinational scales. Through breakout groups guided by specialists, areas such as governance structures, the role of scientists, the responsibility of the diplomatic community and implications at levels from the regional to the global were investigated and analysed.

Each group's results were presented in a session on the final day of the workshop, following presentations that provided examples of science diplomacy. These included: the unique aspects of Iter; the role of science academies, non-governmental organisations and science education, including the Global Young Academy; and cooperation in east Africa and east Asia.

Science for and in diplomacy is a nebulous concept. To give an obvious example, governance of the international spaces that constitute roughly 70 per cent of the Earth outside national borders, such as the oceans, requires a strong element of science advice. But science diplomacy can also help to provide guidance in conflict resolution, address global security concerns and build engagement in multinational projects.

A World Cup for science diplomacy

Originally appeared in the Research Fortnight and the INSGA website

One conclusion at the Trieste meeting was that more also needs to be done to ensure that science is on tap to effect good foreign, trade and aid policy. And perhaps the main goal was summed up by Romain Murenzi, executive director of the World Academy of Sciences: *"In the long run, by training people from many countries, we believe that this course can help make contributions to the sustainability of the planet."*

Take water as a critical issue. Two-thirds of the world's population will face a lack of water in the next 20 years if today's trends in climate change, population growth, rural-to-urban migration and consumption continue.

More than one-third of people worldwide live in areas where the water supply is scarce or insufficient. Moreover, available fresh water is threatened by pollution, poor management and increasing commodification.

Problematic access policies limit many communities' supply of clean and potable water. Without urgent action, the conflict between water supply and demand is set to get worse. Resolving the issue will require a collaborative approach that promotes the exchange of knowledge and development of local capacity in underresourced regions.

Participants at the workshop illustrated this with a case study on the Nile basin that highlighted the need for greater exchange of sound evidence, scientific collaboration and research. The case also revealed the need for increased scientific literacy within the diplomatic apparatus, to enable the foreign policy structures of the surrounding countries to attain a more refined capacity to interpret science.

The ability to use the 'soft power' of science as a strategic tool in matters of foreign relations, aid and international commerce is often overlooked. Scientists and diplomats can also work together to make a country forward-looking and improve its public outreach. An experiment in this area is the SKA radio telescope, led jointly by South Africa and Australia. Construction of the SKA, which has a budget of about \$2 billion (£1.2bn), is scheduled to begin in 2018 for initial observations by 2020 and full operation by 2025.

Another is Sesame, the Synchrotron-light for Experimental Science and Applications in the Middle East, which is under construction in Jordan. Modelled on Cern, Sesame is a partnership between Bahrain, Cyprus, Egypt, Israel, Iran, Jordan, Pakistan, the Palestinian Authority and Turkey. Synchrotrons are large and expensive facilities, usually only found in wealthy countries. By pooling resources, Sesame has the potential to build scientific capacity in the region. It can also serve to build scientific and cultural bridges between diverse societies, and contribute to a culture of peace through transboundary cooperation in science.

This is particularly important as countries around the world compete to attract top talent and innovative minds, in the hope of fuelling economic growth and addressing social inequalities. Brazil's Science without Borders programme is a great example of how a country can benefit from international connections and build for the future. The aim is to send 101,000 Brazilian students abroad to study science, technology, engineering and mathematics subjects by 2015. The Brazilian government is funding 75,000 scholarships, and industry the other 26,000.

The movement of people can also play a huge role. Expatriate skills and expertise can be leveraged to build stronger knowledge capacity back home. Another case study at Trieste examined what needs to be done to shape a 21st-century PhD that is easier to operate in the fast-moving international spheres of science and politics.

A World Cup for science diplomacy

Originally appeared in the Research Fortnight and the INGSA website

Scientists should recognise the opportunities in the burgeoning global policy arena. As participants in Trieste learned from how the International Centre for Theoretical Physics, Cern and the IAP global network of science academies were established, the skills of scientists are well suited for influencing public policy—“naturally they have the future in their bones”, as the novelist CP Snow once remarked. Science academies are playing a growing role, through activities such as issuing statements on policy issues and assisting in the development of grand challenges including pandemics, maternal and child health, and food security. Working groups at the meeting in Trieste explored what it would take to establish an institute for science diplomacy, as well as better science education for more informed civic dialogue and enhanced career options.

But there are cautionary notes to be struck. Science can prepare the ground for diplomatic initiatives, and benefit from diplomatic agreements, but it cannot provide the solutions to either. As a tool of foreign policy, science is limited in its ability to affect domestic and global outcomes. The diplomatic community has its own set of responsibilities.

In Trieste, participants noted that more should be done in the world’s state departments to enhance their appreciation of science in diplomacy. Whether they come through the Global Development Lab at the United States Agency for International Development, via existing networks of science envoys and advisers or through long-standing institutions such as the International Development Research Centre in Ottawa, efforts to communicate the impacts of science diplomacy must be encouraged.

A US House of Representatives committee report on foreign affairs said it well as early as 1971: *“Science and technology have effected changes in the substantive tasks of foreign policy, in the methodology of diplomacy, in the management of information on which diplomacy is based, in the intellectual training of diplomats, in the range of present options of negotiations, and in the prospects of future evolution of diplomatic foreign policy objectives and the international political system.”*

Scientists can assist in diplomacy at the same time as recognising the boundaries of their influence, but diplomats also need to appreciate and learn about the emerging global currency for healthier international relations. That means using sound evidence and judiciously applied knowledge to help create a better world. Trieste provided a superb venue for a fresh look at this continuing dialogue.

Building Science Integrity Principles (co-written with Dave Secord and Sarah Otto)

Originally appeared in the AAAS website

The muzzling of federal scientists in Canada hit the mainstream media following the AAAS Annual Meeting in Vancouver BC in February 2012. At the conference, a panel of experts described some disturbing trends in the federal government's approach to its own scientists and their communication of research to journalists and the Canadian public. Concerns had been circulating in various communities – academic and public sector researchers, non-governmental organizations, and philanthropic foundations – about government control over communications, which limited access to federal scientists by the media, and hence by the public. As a result, various parties initiated studies to obtain more evidence about the scale and scope of the muzzling issue.

According to a 2013 survey by the Professional Institute of the Public Service of Canada, nearly three out of four federal scientists (71%) believed political interference had compromised Canada's ability to develop policy, law and programs based on scientific evidence. Nearly half (48%) were aware of actual cases in which their department or agency suppressed information, leading to incomplete, inaccurate, or misleading impressions by the public, industry and/or other government officials. [1]

Following the AAAS meeting and the publication of several critical media reports, a few individuals – particularly those with an interest either in funding science or practicing evidence-based philanthropy – began to discuss how we might collectively address the issue. [2] It quickly became clear that even defining the problem would not be straightforward; the experience in Canada to date and parallel experiences earlier in the United States suggested muzzling was a symptom of deeper systemic issues.

Our objectives were not to critique one particular government's real or perceived misdeeds. Rather, we sought to define the scope of a problem comprehensively and accurately, including all parties whose expertise and experience were relevant. We developed the goal of offering up consensus-based principles and "gold standard" practices for evidence-based decision-making by all levels of government in Canada (not just federal) and across diverse areas of public policy. The Science Integrity Project (SIP) was born.

The Building Blocks for Evidence-based Policy Making in Canada

Before describing how SIP developed, it is instructive to consider the deeper historical roots from which it grew. It is clear that use of sound evidence in decision-making has profound effects on Canadian society, from increasing the efficacy of criminal justice practices to protecting our cities from climate change, from incorporating the best data in public health and education policies to sustainably managing our forests, fisheries, and farms. Indeed, there is little on the policy front that does not benefit from effective, timely use of relevant knowledge.

Across many levels of government and political parties over many decades, Canada has experimented with a variety of organizational and institutional mechanisms to improve evidence-based decision-making.

As early as 1966, the establishment of the Science Council of Canada attested to the importance of guiding public policy, and Canadians in general, through scientific advice and evidence. The Science Council of Canada operated at arm's length from the government and reported to Parliament through a Minister responsible for science. Its mandate was to assess Canada's scientific and technological resources, requirements and potentialities, and to increase public awareness of scientific and technological problems and opportunities. It produced numerous studies in its 25 year life-span, before eliminated in 1992.

Building Science Integrity Principles (co-written with Dave Secord and Sarah Otto)

Originally appeared in the AAAS website

In later years, various advisory councils appointed by federal governments came to populate the science advice landscape. [3] Particularly interesting was the Council of Science and Technology Advisors (CSTA). Established in 1998, CSTA was designed to provide the Cabinet with external expert advice on internal federal government science and technology issues. It was chaired by the Secretary of State for Science, Research and Development, and its 22 members were nominated from their Advisory Boards/Councils by Ministers of science-based departments and agencies.

Following public controversies surrounding key issues such as dwindling fish stocks, the contamination of Canada's blood supply, genetically modified organisms, and growth hormone use in dairy cows, the government looked to the CSTA for help. The resulting Science and Government Effectiveness (SAGE[4]) report of 1999 was adopted by the Cabinet in 2000 as a series of principles and guidelines for the effective use of science and technology advice in government decision-making. The framework borrowed heavily from a similar set of principles in the UK. [5]

The advice from SAGE is as salient today as it was then:

- Government needs to anticipate, as early as possible, those issues for which science advice will be required.
- Advice should be drawn from a variety of scientific sources and from experts in relevant disciplines.
- Government should employ measures to ensure the quality, integrity and objectivity of the science and science advice it uses, and ensure that science advice is considered in decision-making.
- Government should develop a risk management framework that includes guidance on how and when precautionary approaches should be applied.
- Government is expected to employ decision-making processes that are open, as well as transparent, to stakeholders and the public.
- Subsequent review of science-based decisions is required to determine whether recent advances in scientific knowledge have an impact on the science advice used to reach the decision.

In 2007, three existing advisory structures – CSTA, an Advisory Council on Science and Technology and the National Science Advisor – were replaced with the Science and Technology Innovation Council (STIC). The mandate of STIC is “to provide confidential advice on science, technology and innovation policy issues” to the Government of Canada. The mandated confidentiality has made it difficult to assess the extent and kind of evidence that has been considered and how this evidence is used to guide policy.

With the election of a federal Liberal government in 2015, a new Minister for Science has been appointed. The remit of this new Minister includes creating the position of a Chief Science Officer to ensure that government science is fully available to the public, that scientists are able to speak freely about their work, and that scientific analyses and evidence are considered when the government makes decisions.

Beyond the federal level, various general or issue-specific science advisory mechanisms have been independently pioneered at other levels of government in Canada, especially in provinces and territories, but also in municipal and indigenous governments. In addition, non-governmental civil society efforts have been designed to help improve the ability of governments to use evidence more effectively in decision-making. The non-profit advocacy organization Evidence for Democracy and the multi-party Science Integrity Project are two such examples.

Building Science Integrity Principles (co-written with Dave Secord and Sarah Otto)

Originally appeared in the AAAS website

The Science Integrity Project

Given this historical context and with guidance from a steering committee, the Science Integrity Project set out to better define the problem we were trying to solve and to deepen our nuanced understanding of it.

SIP was built through several distinct activities that reinforced one another:

- A research phase consisting of interviews with about 30 Canadian leaders who collectively had centuries of professional experience in generating and applying knowledge to policy. Individuals interviewed represented diverse sectors of Canadian society – universities, public and Indigenous governments, NGOs and foundations, consultants and think tanks. They also represented professional experience with non-federal policy issues in nearly all of the country's provinces and territories. Each of these interviews was conducted by one or more members of the Steering Committee, along with post-doctoral researchers on the SIP team. A synthesis of the findings and themes of these interviews – to be summarized in a forthcoming publication – was a major design input for the next phase. [6]
- A discussion phase involving about 60 participants at a national forum in Toronto in February 2015. Held over 2.5 days, the professionally facilitated forum stimulated high-level discussion among leaders and practitioners of evidence-based policy, ranging from education and health to climate change and fisheries management. About 20% of the forum participants brought particular expertise in the generation and application of Indigenous knowledge. Guided by background material on the history of evidence-based decision making and a summary of the interviews, the forum achieved: 1) cross-cutting dialogue among those in diverse evidence-based research and policy fields; 2) agreement that the issue went deeper historically than the then-current government, beyond the federal jurisdictional scale, and across many disciplines and sectors; 3) consensus that the nature of policy-relevant evidence includes complementary insights from science and traditional knowledge; and 4) exploration of the key principles that would guide scientists and policy makers towards improved science-based decision making across issues and jurisdictions.
- A consensus phase involving multiple rounds of drafting, consultation, and revision of the forum outputs. The result included a set of principles [7] for well-informed decision-making in Canada, contextual and background information for those principles, and examples of real-world stories illustrating the value of science and traditional knowledge as inputs to better decisions at all levels of government.
- An implementation phase calling upon a variety of actors to apply the principles in widest possible range of contexts across the country.

SIP resulted in four consensus principles for how evidence can improve important decisions on a wide range of Canadian issues (**Figure 1**).

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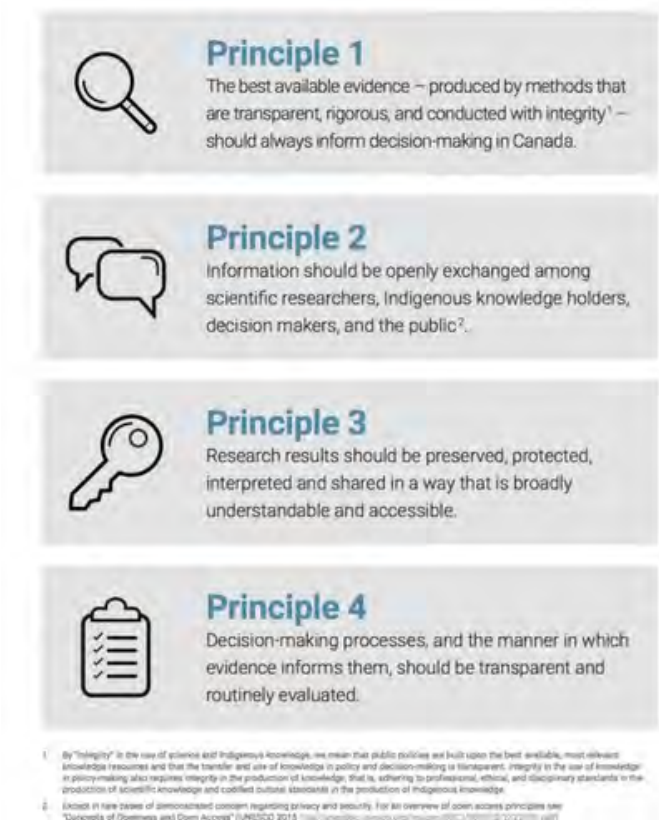


Figure 1

The goal of SIP is lofty: to make Canada an international leader in openly-discussed, evidence-based policy and decision-making. It is worth pointing out a few specific issues with which the SIP process and participants grappled.

When using the term “science,” all knowledge and evidence sources must be included. Particularly crucial in Canada is indigenous knowledge, the body of knowledge resulting from intellectual activity and insight gained in a traditional context and adapted over time to modern situations. [8] How best to incorporate indigenous knowledge in decision-making, in a mutually respectful and beneficial manner, created robust discussion at the forum and in the drafting process afterwards, and remains a pressing question that warrants sustained and focused follow-up efforts. This is a deeply complex issue, given the colonial history of usurping indigenous culture and knowledge and the mistrust of science generated by non-consensual and dehumanizing experiments in Canadian history. [9] Participants throughout the SIP process pointed out examples of constructive application of indigenous knowledge to critical policy decisions, especially in the context of wildlife, watersheds, and land use planning in western and northern Canada.

It became clear during the discussions that action is required both on the part of decision makers and on the part of knowledge generators and holders to improve evidence-based decision-making. As a result, the first three of the principles require actions on the part of scientists: to conduct research with integrity, to communicate information openly, and to share and preserve knowledge for others to use. We sought to offer a set of principles that would have enough precision to encourage accountable application, but at the same time be general enough to generate practices tailored to diverse issues and jurisdictions.

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Who do we hope our audience will be? All Canadians – indeed people and institutions around the world – who, acting individually and collectively, can embrace and apply the principles. We hope that our rigorous and inclusive process has produced principles that can be brought alive by those involved in knowledge generation and transmission over generations, people involved in making and improving policies, and all of us who make decisions in our everyday lives and who deserve to have those decisions informed by accessible and interpretable evidence.

[1] Professional Institute of the Public Service of Canada, The Big Chill: Silencing Public Interest Science: A Survey, 2013; see <http://www.pipsc.ca/portal/page/portal/website/issues/science/bigchill>

[2] For a list of participants throughout the process, see <http://scienceintegrity.ca/SIP2015/background.html>

[3] http://scienceintegrity.ca/SIP2015/documents/SIP_background.pdf

[4] <http://publications.gc.ca/site/eng/84765/publication.html>

[5] www.gov.uk/government/publications/scientific-and-engineering-advice-guidelines-for-policy-makers

[6] http://scienceintegrity.ca/SIP2015/documents/SIP_Interviews_Synthesis_FINAL.pdf

[7] <http://scienceintegrity.ca/SIP2015/principles.html>

[8] Definition adapted from the World Intellectual Property Organization

[9] E.g., Mosby, I. (2013). Administering colonial science: Nutrition research and human biomedical experimentation in Aboriginal communities and residential schools, 1942–1952. *Histoire sociale/Social history*, 46(1), 145–172.

Science in the Service of Statecraft—oh, and Improving the Human Condition

Originally appeared in the AAAS Science Diplomacy magazine Medium

"There will be an increasing need to recognize the global nature of the science-policy decisions, and the need to establish a new relationship between science and power that acknowledges that international dimension. Knowledge is power – power to produce, to foresee, to prevent. To apply that knowledge for the benefit of mankind is wisdom. Knowledge and wisdom are the two main pillars of a better, common future." (Federico Mayor, *Science and Power*, edited by Nigel Hawkes, UNESCO Publishing, Paris, 1995)

As Federico Mayor foretold over two decades ago, we live in an age where the sciences demonstrate “soft power” on a daily basis. A large part of this success is based on shared knowledge – knowledge that has national or regional rooting, while grounded in global cooperation and culture.

Global knowledge connections increasingly matter. Lately, the very nature of how the sciences intersect with diplomacy has been transformed. In part, this is a function of the growing digitalization of knowledge and its spread beyond states. International organizations are having a say, and youth and other groups are now engaging as the role of the sciences is becoming more embedded within statecraft. Indeed, the organizational ecology of global summitry has become increasingly complex as a result.

Several science academies’ recent statements to the **G7 Summit leaders** on specific topics – for example, the Global Arctic statement and our Digital Future – demonstrate a growing recognition that building knowledge capacity to address these rapidly evolving challenges will require a new mindset – one that is inclusive and brings in the voice of all (not just the usual suspects) stakeholders in an interconnected world.[1]

One path these global knowledge connections are expressed is by mobilizing expertise and evidence in handling wicked crises affecting our planet. For example, science advisers from across the Commonwealth have recently agreed to establish a knowledge exchange network to look at some of the planetary challenges we face such as climate change, pandemics, and the state of the oceans. Another pathway is finding effective solutions via research and knowledge to address the Sustainable Development Goals (SDGs), including gender equity, food security, and poverty reduction.

Witness the forthcoming Science 20 (S20) Summit in Argentina in July or the latest round of G7 events being hosted by Canada, including a Carnegie Group meeting of science ministers and advisors later in September. For example, as part of the consultations underway in Canada, a Y7 (Youth) group has enunciated a generational vision for 2030 calling upon the G7 to:

- Establish a G7 working group that generates innovative ways to protect bodies of water, such as legal rights, expansion of protected areas, & the creation of a list of endangered waters;
- Clearly articulate that the human right to privacy includes full ownership of personal data, even when data are used and modified by non-human entities for profit.

Within the context of engaging students as major stakeholders in science diplomacy, the **Science & Policy Exchange (SPE)** organization run by graduate students and early career researchers – supported by the governments of Quebec and Canada, along with the AAAS – convened a major event in Montreal in mid-May 2018 exploring the role of student diaspora in science diplomacy and future training of students. The exchanges were dynamic, leading to a productive dialogue.

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Indeed, language is knowledge, as we were reminded by participants at the Science and Policy Exchange's event. Increasingly, understanding, interpreting and integrating the context and nuance of community-based knowledge and wisdom is critically important in any discussion on diplomacy and science.

Statecraft and science are intertwined and to be sure, leadership and dialogue must come together in a meaningful way—and not just through the usual formal diplomatic avenues.

But more and more, this is an inter-generational issue mobilizing regional efforts, local communities, youth, women, and non-state actors. They are filling the space. Canada's former Governor General pointedly argued: *"Practicing the diplomacy of knowledge means recognizing that we are stronger when we work and learn together. Competition is vital and necessary, and diversity is essential to maintaining our resilience, but we must always keep in mind...the basic principle of the Enlightenment: knowledge is meant to be shared."*

UNESCO's former Director-General, Federico Mayor, reminds us of this. Everyone is affected and has a stake in the common future of this planet. The sciences and knowledge contribute to statecraft almost seamlessly—but the ultimate objective is about improving the human condition.

[1] For more on Canada's emerging role in science advice and global partnerships, see the recent editorial by Mona Nemer—"Canada's Call," *Science*, May 25, 2018, VOL 360, Issue 6391.

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