Institute for Research on Public Policy
Institut de recherche en politiques publiques

The Canadian Academy of Engineering
L'Académie canadienne du génie

# Round Table Report: Making Better Use of Science and Technology in Policy-Making

Report

March 2016

# Round Table Report: Making Better Use of Science and Technology in Policy-Making

## Introduction

Amid rapid scientific and technological change and increasing complexity, there is growing concern about the ability of governments to absorb the findings of scientific research and technological advancements; incorporate this new knowledge in the development of legislation, policy and regulation; and conduct the scientific research in support of their missions.

Uncertainty surrounding the direction of science, technology and their intersection with public policy demands vigorous public exploration and debate of several questions, among them the following:

- How can governments better keep up with scientific and technological advancements in academic, R&D establishments and business environments, thereby ensuring that public policy initiatives reflect the latest scientific knowledge?
- How can governments best assure the internal capability to conduct necessary scientific and technological research on matters relevant to public policy?
- If the primary function of parliaments and legislatures is to "hold governments to account," how can sitting members get access to the scientific and technological knowledge necessary for an independent assessment of a proposal put to them for a vote by government?
- In light of recent debates on the concepts of "evidence-based" public policy versus "evidence-informed" public policy, how do we reconcile political conflicts with the findings of science and technology in making public policy? And how should governments be judged on the science and technology they use or do not use?
- In an era of 24/7 news and social media, to what extent and under what conditions should government scientists be allowed to publish or otherwise communicate the nature and results of their research? In what form or forum should this take place? How does one reconcile that with the parliamentary principle of ministerial accountability?

## About the Project

To spark debate on some of these questions, the Institute for Research on Public Policy (IRPP) and the Canadian Academy of Engineering (CAE) held a series of events in six cities across Canada between March and June 2015.[1] Held under the Chatham House Rule to ensure meaningful exchanges, these round tables brought together senior public servants, elected officials, business leaders, academic experts and stakeholders for an open exchange on the role that science and technology has played and should play in the development of public policy, a frank assessment of where we are today and recommendations on how the relationship between science and public policy might be better aligned.[2]

Prepared by the IRPP and the CAE, this report summarizes the issues that were raised over the course of the six round tables and draws out the main policy points that emerged from the discussion. Thus the report has been tremendously enriched by the expertise and insights of those who took part in the consultation exercise. That said, responsibility for the conclusions drawn and the recommendations made in the report remains that of the IRPP and the CAE.

## Round Table Findings

From the outset, it was important to draw a distinction between "science policy" and "science in public policy." The first term generally refers to public sector support for scientific research; the latter focuses instead on how science can better inform policy decisions. While we acknowledge the importance of public funding for scientific and technological research, it was made clear that the focus of this series was to be on the contribution of science to the formulation of public policy.

This almost inevitably led to the question: "What do we mean by *science*?" Is technology to be inferred in all contexts and circumstances? "Technology" is a commonly used term that required definition for the participants. It was defined as scientific knowledge that had been turned into useful products and services through design, usually performed by professional engineers.

And what about the social sciences? Is this analysis to be limited to the natural sciences, or are we considering the role of economics or political science as well in this analysis? These are obviously interconnected issues. It was agreed that the focus would be on the natural sciences and technologies, but that the observations made and the conclusions drawn could well be relevant for social sciences as well. In addition,

while we acknowledged that the relationship between science and public policy would be different depending on the specific field, considering the relationship in general terms would prove more useful in articulating recommendations to governments. And in keeping with that assessment, it was agreed that, for the purposes of the round table discussions, technological expertise would, unless otherwise indicated, be "read into" our definition of science.

### Understanding the role of science and technology in policy-making

At a basic level, the role of science is to provide an evidence base for decisions. At its core, science is neutral. It is neither good nor bad. It has no inherent propulsion to implementation, or value, until it is applied or interpreted by human beings. The same scientific knowledge, applied differently, can lead to untold progress or horrific ends. The "Atom for Peace" was given as an example of the former, while the 70th anniversary of Hiroshima and Nagasaki is a stark reminder of the latter. It is therefore the manner in which governments collect, assess and use science that is at issue. Some participants suggested that, in this postmodernist age, the idea that science is neutral is being challenged: depending on the hypotheses posited during the beginning of the experiment, different results could be obtained. This concern is particularly acute in the realm of economic and social sciences.

Early in the discussion, participants acknowledged that a great deal of knowledge transfer already occurs from the scientific and technological communities to government policy-making processes. And while the challenges that exist today are significant, there is a risk of falling into the "Golden Age Trap" — of imagining an earlier time in which governments of all political stripes and at all levels based their decisions on the evidence provided by science, with little regard for other considerations.

In the view of many participants, there was never a golden age of scientific knowledge and credibility that had a direct line to government. In fact, as one participant put it, "STEM thinking" is not aligned with "human thinking" and in some ways is antithetical to human psychology, which wants to grasp at a quick solution that has the "feeling of truth." This makes the case for the need to structure the way we incorporate science into policy-making, but also makes the point that, in the big picture, we are actually making remarkable progress integrating rigorous science into public decisions.

In a sense, our challenge lies elsewhere and has more to do with the nature of the policy problems and the policy-making process that we are trying to address.

Indeed, scientific evidence plays a different role in situations in which the research is conclusive versus situations in which there is conflicting evidence and we are dealing in "transitory truths." In the first case, evidence can be used to confirm a course

of action and reassure the public that it is the "right thing to do." In the second case, evidence must be used to support government efforts to manage policy issues, taking into account the pitfalls of uncertainty.

At all round tables, a great deal of time was spent discussing uncertainty, complexity and truth — the consideration of which is only recently becoming more integrated and in-depth. Put bluntly, science is often unable to answer with certainty questions that pertain to real-life situations and issues that confront governments. Expert knowledge is rarely holistic and many controversies come out of credible but competing evidence. Moreover, individual scientists and policy-makers may draw very different conclusions from the same information. The input of science into policy should therefore be viewed, not as advice on what should be done, but rather in terms of what is known, what is unknown and how sure we are about it.

This uncertainty opens the possibility of governments cherry-picking the evidence to support the answer they want, which aligns with an already-established policy direction. It is therefore imperative to monitor the evidence that is highlighted, as well as the evidence that is ignored. Of course, this is as true of citizens as it is of governments and parliamentarians. Selective acceptance of facts often occurs, as people often use science to bolster their preconceived, non-scientific opinions. As one participant put it, knowing the anti-science is just as important as knowing the science. What, for instance, are people being told that makes them wary of genetically modified organisms (GMOs), or vaccines? Even the more educated may adopt the postmodern theory of knowledge to discount science and the scientific method as socially constructed, and to argue that objectivity doesn't exist.

In response, one way for governments to handle uncertainty is to adopt the concept of "flexible commitment." It is not about eliminating all risk or nailing down certainty, but rather defining decision points at which plans for achieving a set goal will be revised and changed if necessary, on the basis of the evidence gathered up to that point.

In addition, decision-makers and the public need to better understand the differences among problems that are simple, complicated and complex. In contrast to the simple problem and the complicated problem (understood to be a "bigger simple" problem), the complex problem has multiple causes and repercussions, thereby blurring lines between causes and effects.

Complex problems therefore pose fundamental challenges to the way we think about public policy and organize scientific research to inform it. Complex problems challenge the notion that we need to understand the causes before we explore solutions, and these problems require multidisciplinary inputs.

As we think about the role of science in policy-making, it is also important to make a distinction between long- and short-term policy: reactive policy-making under pressure, such as dealing with epidemics, looks different from strategizing or planning, the type needed to deal with climate change or accomplish energy transitions. We also need to acknowledge the different time horizons used by the scientific community on the one hand and governments on the other: evidence-based policy is good, but collecting the evidence takes a long time.

Finally, it is critically important to keep in mind the difference between "evidence-based" and "evidence-informed" policy-making: scientific findings may be a critically important factor in policy-making, but it is one of many. Decision-makers do use scientific evidence and information, but their perspective or concerns need to be much broader. They have to weigh the economic, social and political environment to decide what can be accomplished. These other factors, such as available resources, ethical considerations and public opinion, also shape decisions.

In sum, the role of science in policy development is to do the following:

> Provide an evidence base for decisions;
> Confirm the soundness of a policy in areas in which the evidence is conclusive;
> Define the contours of uncertainty and trade-offs when the likely outcomes cannot be known for sure; and
> Inform the decision-making process while allowing for other considerations.

### Linking the scientific and public policy communities

If there was agreement that science has an important role to play in the development of public policy, there was also agreement on the fact that connecting both worlds presents significant challenges. The scientific and public policy communities are animated by very different cultures and often behave as two solitudes.

Scientists and engineers bring to the organizations that employ them a distinctive culture based on strongly held values. This culture is characterized by a high degree of interaction among scientists and engineers based on knowledge and expertise, rather than position or rank; on external peer review and assessment, rather than deference to internal organizational authority. Recognition among them is based on intellectual performance as judged by their peers, rather than recognition from organizational superiors. These values distinguish the scientific and engineering culture from the bureaucratic culture that is usually the norm in government and other large organizations.

Derived primarily from the broader international scientific community, scientific values are remarkably consistent worldwide, despite the major cultural differences

that exist between populations. Results of a survey of scientists in government laboratories in Japan, for example, revealed the same strongly held values expressed by Canadian scientists and engineers in a similar survey.

In many ways, that distinctive scientific culture is incompatible with the structures and processes of the public sector, which makes the connection between those two worlds difficult to maintain. In the view of participants, both sides would do well to invest in better understanding the other. Much could be gained by examining and emulating best practices for the design and management of large science and technology (S&T) organizations. Well-managed S&T organizations respect and nurture these scientific and engineering values and build on them. They strive to protect the scientific values of their S&T teams, while engaging them in the fulfillment of the organization's scientific capabilities. To this end, they have developed a set of structural arrangements and management approaches that are remarkably consistent. The four major components are the following: (1) well-defined missions; (2) appropriate organizational structures and linkages; (3) effective human resources management; and (4) rigorous management systems.

Our complex world commands that decision-making processes be informed by scientific evidence and knowledge. International and interdisciplinary scientific collaboration that brings together the collective capacity of a broad range of scientific fields, including those focused on human, health, social and ethical dimensions, is a prerequisite to sound policy-making.

If there was a strong consensus on the basic point, there was also great diversity in the ways to address it. By and large, the suggestions can be grouped under the following headings:

> Education and recruitment;
> Communications and relationship building; and
> Structures of engagement.

Regarding education and recruitment, it was often remarked that students aiming for a career in government or in science learn precious little about the other field. More than one participant recommended that academic curricula be reviewed to bridge the divide by providing students with more opportunities to increase their knowledge of the other world and learn to "speak its language." It was noted that students are in fact interested in bridging disciplines and the science/policy gaps, but also very worried about getting jobs. Providing such opportunities would therefore align with their learning preferences and enhance their preparedness for their eventual careers.

Participants also noted that the situation does not improve much once those students have launched their careers. Incentives in academia don't reward public engagement and public communication but rather push toward specialization, whereas sound policy-making requires broader and integrative competencies. How can value be created for scientists and engineers to spend time collaborating with government, and how can bureaucracies be restructured to allow for a freer flow of outside experts in and out of the machinery of government? As a starting point, it was suggested that we look at the practices in the United States, where universities have addressed the silos or noncommunication problem by giving much more recognition to public sector work. Canadian universities, on the other hand, continue to focus exclusively on publications in peer-reviewed journals in making decisions about tenure and promotion. The example of the Clifford Clark Visiting Economist, whereby a senior economist from business or academia is embedded within the Department of Finance policy apparatus for a two-year period, provides a template to emulate.

There was some discussion about the role of government departments in providing dual science/policy career paths for their employee scientists. It was noted that this had been offered within the federal government but that there was very little take-up among scientists.

Similarly, intermediaries with strong understanding of both sides are crucial and should be found at all levels within government departments and agencies. While it is crucial that senior public servants and elected officials understand the importance of science in policy-making, oftentimes, policy-making doesn't happen at the most senior levels and emerges from clusters of officials across departments. The availability of individuals who are familiar with science must therefore be distributed across the bureaucracy. Internal capability is needed to allow continual engagement with scientists and have the capability to distinguish "good" science from fads and disguised advocacy. This could take the form of "embedding" more scientists at all stages in the policy process, but should also mean including more policy-makers in the processes of scientific research.

Perhaps not surprisingly, there was a great deal of discussion and debate on the role of scientists in providing advice. Although the discussions on evidence-based policy are generally framed in terms of scientific contributions to the design of policies, we were also given examples of scientific advice assisting government in avoiding very costly mistakes.

First, an important statement was made by scientists themselves at a number of round tables that scientists had to give advice proactively if they wanted a voice in policy-making. It was not sufficient to provide answers to questions that had been put to them by deci-

sion-makers. They also had a responsibility to anticipate future needs and volunteer their advice on issues that were likely to surface. As one participant put it, the "pull" created by policy demand is important, but so, too, is the "push" created by scientific inquiry: to build a strong relationship between science and government, both sides need to be prepared to give and receive advice, and should be prepared to do so unsolicited. We were told that some government labs had already done this by having groups identify and research areas that they felt would be important at some point in the future.

In ensuring that these linkages are effective, we should distinguish among the many functions of scientific evidence, such as regulation and oversight; knowledge creation; and knowledge translation, aggregation and interpretation. In some cases, it may be appropriate for those functions to be handled internally; in others, the function might well be properly filled by outside expertise. By and large, participants felt that governments should focus on maintaining an internal capability to provide an independent assessment of the quality and relevance of the research done externally. This internal capability should be able to "manage" conflicting evidence and make determinations about the relative reliability of different sources. And it should focus its research on those areas and disciplines that cannot adequately be covered by universities or the private sector. The ideal network of science includes public, private and academic sector expertise; but for reasons related to the public good or national security, certain functions might best be centred within government. It was also suggested that the function of defining what constitute scientific "facts"— for example, Is climate change primarily anthropogenic? Do vaccines cause autism? — could be assigned to the purview of professional scientific organizations such as the three Canadian academies (the Canadian Academy of Health Sciences, the Royal Society of Canada, and the CAE) or the Engineering Institute of Canada.

With regard to the structures of engagement, participants agreed that the most successful structures linking scientific expertise to the policy process involve many disciplines. It is also important that the research function not be compartmentalized: "de-siloing" the research function is a critical determinant of success. Moreover, given the growing complexity of policy problems, the command-and-control structure must give way to the network. Interdisciplinary cooperation and dialogue are crucial to counteract the tendency to work in silos.

To be effective, the networks must also be engaged at multiple stages in the policy process and, ideally, at a time when decision-makers are genuinely uncertain about the direction they want to take and open-minded about the various options. It must also be acknowledged that each component in the network speaks a different language

and operates on different time horizons. These issues bring challenges that need to be recognized. For instance, it was noted that engineers have provided examples of times when this did not occur, such as engineers providing unsolicited comments on well-advanced infrastructure projects, giving advice on decisions that had been made long before. Furthermore, we noted that scientists and engineers sometimes make public comments on areas of science outside their professional expertise, thus lessening the credibility of the profession. Some participants also observed that policy-makers had sometimes been "burnt" by scientific advice, making wrong decisions because the advice had been too definitive and the options and risk levels had not been adequately communicated.

In terms of access to knowledge, it was noted that more needs to be done to link experts to governments, but also to parliaments and legislatures. In this regard, the United Kingdom and the United States were referred to as possible examples that Canada could follow.

Finally, it was noted that communication must be two-way, that is to say, that the experts must be able to provide advice to policy-makers, but policy-makers must also encourage experts to contribute their knowledge and expertise to the policy-making process. Thus the policy process can benefit from both the "research supply" and the "policy demand" sides of the equation.

### Governance and political considerations

Without question, the most sensitive issues raised during the round tables concerned the relationship between evidence and politics. How should decision-makers manage the inherent conflicts between them and, when those conflicts occur, which of evidence or politics should prevail?

Most round table participants agreed there was no set formula to answer that question and that it depended a great deal on the expectations of those involved. As one participant put the question, *What does government want from science?* For instance, innovation is often the desired outcome of science but, for several participants, innovation is mostly industry-driven. Governments are generally supportive of scientists and their research, but these governments often assess scientists' value in terms of commercialization and economic gains. This tension becomes all the more real when investments in science do not pay off right away or when money is put into basic research.

Consistent with the "there-was-no-golden-age" thesis mentioned above, most participants also agreed that the challenges we face are not in themselves new. What is new are the opportunities provided by the Internet for individuals to access conflicting scientific

evidence and the inability of the media to distinguish areas in which the scientific evidence is genuinely contestable from those in which one view has clearly and overwhelmingly been debunked. As noted above, it was suggested that the professional scientific organizations may have a role in being a clearing house for journalists and citizens looking for "truth." The tendency of journalists to provide "balanced coverage" by giving both sides equal time regardless of the weight of the scientific evidence supporting one side has reinforced a false sense of relativity in policy debates about science. It was noted that the respected journalistic outlet, the BBC, recently announced that scientific views that had been proven wrong, such as climate change naysayers, would no longer be included in BBC news coverage.

The tightrope that modern governments must walk requires balancing two seemingly irreconcilable goals. On the one hand, governments must promote science as a moving window of knowledge and a process of evaluating and assessing information and evidence. To further this goal, we need to support voices that can help the public navigate uncertainty and accept the risks inherent in it. On the other hand, governments must make clear that not all research results are created equal and that some evidence is more compelling and valuable than the rest. On this front, we need more courage and outspokenness from true experts who can act as credible referees for these public debates. Moreover, with the information overload of the Internet age, presentation and credibility become all the more important: building the communications capability of the scientific community is therefore critical to supporting thoughtful debate.

The relationship between evidence and politics is delicate and complex. The science community must be ready to accept that policy-makers weigh many factors before making decisions. It must also accept that, in most cases, the confidential nature of the advice given by departmental scientists as part of the process that leads to a decision is a key feature of our system of government. On the other hand, the system must better acknowledge the public benefits of providing more information to citizens on the options being considered and better distinguish between sharing information in a technical briefing and advice to the minister.

At all events, participants agreed that the "information-providing" and advisory roles of government scientists are often conflicting and put the government scientist in a difficult position. As an example, it was noted that the primary duty of professional engineers — the safety of the public — could create a conflict for government-employed engineers when the advice on delicate matters (such as the state of disrepair of infrastructure) must remain confidential. But it was also acknowledged that it should be possible to distinguish between providing information to the public and revealing confidential advice — and the system should allow for both. Clearer "rules of engagement" must be developed to maximize the

contribution of the scientist to public debate while not creating conflicts of interest. But the clear consensus is that this can, and indeed should, be done.

Building an environment for public debate that accepts uncertainty as a necessary feature of policy-making is also essential. Scientists need to be open about gaps in knowledge. As one participant observed, the peer review process applied to Galileo's findings centuries ago would have validated the idea that the world is flat. Accepted assumptions we work from today on the frontiers of science may similarly be wrong. Scientists need to provide policy-makers with advice that clearly describes (as a former US defence secretary famously put it) "the known knowns, the known unknowns and the unknown unknowns."

Ultimately, the relationship between evidence and politics must rest on the fact that elected officials must be the ones making the decisions. All policy decisions are based on subjective value judgments, but the role of science and evidence is to aid that by giving accurate assessments of the available evidence, the known facts and the risks involved. The public rightly expects researchers to provide government leaders with their best advice, but also expects the buck to stop with those who were elected to make those decisions.

## Recommendations

One of the very first acts of the new government was to restore the long-form census in time for the 2016 census. The decision fulfilled a major campaign commitment to ensure governments had the evidence required to make informed policy decisions and was welcomed with enthusiasm by the policy and scientific communities. It also echoed a significant concern that was expressed throughout the round table process. Indeed, one of the strongest recommendations made at each of the six round tables in the series (all held prior to the start of the federal election campaign) was to reinstate the long-form census immediately.

This campaign theme carried over into the mandate letter issued by the Prime Minister to the Minister of Science following the swearing-in of the new ministry. The letter states, "We are a government…that believes that good scientific knowledge should inform decision-making"[3] and outlines specific actions the minister must take over the course of the government's mandate, including the following:

- Supporting the integration of scientific knowledge in the government's policy decisions;
- Creating 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 are considered when the government makes decisions";[4] and

> Supporting ministerial colleagues as they, too, integrate scientific evidence into their own policy-making processes.[5]

Taken together, these commitments clearly signal the importance of science to the government and its intent to incorporate the best available evidence in its policy processes. Thus the statements will have been overwhelmingly supported by round table participants, who were asking for nothing less. The challenge, of course, will be the transition from intent to implementation.

While it would be impossible to list all of the specific recommendations made over the course of the six round tables, six key themes emerged that could serve as a guide to the new government and structure its approach.

### Recommendation 1: Create the conditions for informed debate

Improving the quality of public debate on the policy choices facing government requires that the results of scientific research be more accessible to those engaged in the debate; that government be more transparent about the evidence it is considering and its assessment of it; and that the criteria to reach a decision also be communicated more openly.

To achieve the first condition, many participants argued in favour of creating an "ecosystem of debate" — that is, support the proliferation of credible and highly qualified sources of scientific knowledge. Many made the specific suggestion that these can be modelled on the US national academies, but the important point is that publicly funded organizations be charged with providing expert advice *that is available to the public* on the challenges facing government.

The latter two conditions require more a change in government behaviour than new structures or processes. Put simply, decision-makers should inform the public about the sources of evidence it is using to come to a decision and should be forthcoming about whether there are particular studies or schools of thought that they find more or less credible than the rest. Moreover, decision-makers should disclose — preferably at the start of a process — what criteria will be used to make the decision.

### Recommendation 2: Strengthen internal policy-making processes and decision-making infrastructure

On a very basic level, it is important for government to take stock of the science and technology expertise available within the public service. In the view of a great many participants, there is a lack of scientists within the decision-making structure, whether as elected officials or bureaucrats.

It was recommended by many that government should review the internal structure within which scientific advice is provided and the moments in the process of decision-making at which that advice can be incorporated. Points of scientific input into the decision-making process should be identified more explicitly and should occur as early on in the evolution of a specific policy file as possible.

As part of this discussion, many participants alluded to the notion of recreating the position of chief science officer for the Government of Canada. Given the complexity of issues that modern governments face and the diffuse nature of decision-making, some reservations were expressed about the "mechanics" of this proposal — should it be one person/one office for the entire government or a network of science officers stationed in key ministries answerable to their deputy minister? While most round table groups were agnostic about the specifics, all agreed that embedding such expertise at senior levels of the public service was a critical element of any reform. The word of caution on the specifics of creating one office, however, is worth considering.

Finally, government must improve its systematic review capacity. While some participants acknowledged that the Council of Canadian Academies fulfills part of this mandate, most agreed that it was insufficient to meet the demand. If we are serious about systematic reviews, we need additional infrastructure.

### Recommendation 3: Establish a national advisory board on science and technology chaired by the Prime Minister

The creation of a National Advisory Board on Science and Technology (NABST) is worthy of consideration. Important for both the substance of the NABST's mandate and the symbol is that it is led directly and personally by the Prime Minister.

The primary mandate of the NABST would be to provide advice to the Prime Minister on (1) national science and technology goals and policies; (2) how Canada could expand and strengthen its S&T enterprise; and (3) their application to benefit Canadian society from both sustainable economic growth and quality of life perspectives. The NABST should include about 20 members drawn from industry, government, labour, academia and research. NABST reports and formal advice should be made public.

A priority for the NABST should be to examine the performance of the federal government in the conduct of its core S&T activities — the funding, quality and relevance of the in-house scientific research performed to support the mandates of departments and agencies — and the efficiency of the governance and management mechanisms in place to help establish priorities and measure outcomes.

### Recommendation 4: Bridge the divide between scientists and public servants

To address the challenges in the relationship between scientists and public servants, many argued that communications had to be a top priority. Put simply, the two sides of the divide don't speak the same language. To remedy the situation for the long-term, participants agreed that the government should increase its direct engagement of science undergraduates who are interested in policy issues. While respecting provincial jurisdiction, and perhaps through its Canada research chairs, the federal government might encourage the expansion of academic programs in science policy.

It was clear from the feedback received during the round tables that work needed to be done at the parliamentary end of the policy-making process as well. At a minimum, continued engagement between parliamentarians and scientists, such as the Bacon and Eggheads events run by the Partnership Group for Science and Engineering, was deemed vital. But considerable thought was also given to the idea of creating a parliamentary science officer, along the lines of the parliamentary budget officer (PBO) created a few years ago. As with the chief science officer, and especially given the significant problems that have arisen in the implementation of the PBO model, there is a great deal of openness to the way more and better scientific research might be made available to parliamentarians. Whether it is through a single office or through additional funding for the Library of Parliament to better support committees remains an open question. But the notion that parliamentarians should have access to first-rate capability to assess scientific evidence *that is independent from the advice the House of Commons or Senate might get from the government* was a critically important feature of this discussion.

### Recommendation 5: Increase and improve the connections between government and the wider scientific community

In addition to the internal structures, more work needs to be put into ensuring that government-based capability connects to the outside world. To this end, the government must enable and encourage government scientists to engage in the broader scientific community, thus improving their ability to perform better science. In particular, and bluntly, remove obstacles to conference attendance.

In addition, it was felt that government should not completely shut out advocacy-based engagement in its research effort. It should at all times be mindful of research biases and lobby efforts, but that should not preclude the engagement of not-for-profit or industry groups. Properly framed, these associations might well prove beneficial.

### Recommendation 6: Embed an S&T culture throughout Global Affairs Canada

Science knows no boundaries. The breadth of technological advancement throughout the world is increasing at an accelerating pace. The S&T advances are driving foreign policy agendas throughout the world. Canada needs to incorporate a considerably stronger S&T dimension into its foreign policy objectives and upgrade Global Affairs Canada's (GAC's) S&T capabilities and related policies and programs accordingly. In this 21st century, S&T will increasingly become a critical aspect of diplomacy. A cultural change within GAC is required to align competencies, resources and programs with this new reality.

Canada's foreign policy needs to adopt a whole-of-society approach to diplomacy, which includes the capabilities and contributions of not only many government agencies but also non-governmental entities that are deeply vested in S&T. Widespread involvement of public and private sector organizations throughout the country should be encouraged to play important diplomatic roles in many areas involving S&T considerations such as Internet governance, the Arctic, climate change, fisheries, clean energy, health issues, global scientific research programs and humanitarian assistance.

To this effect, GAC, in close collaboration with other departments and agencies, should do the following: (1) Carry out S&T-oriented foresight assessments. The foresight program should be mandated to synthesize actionable conclusions of over-the-horizon assessments of S&T capabilities and strategies in different countries and bring them to the attention of appropriate department officials and other stakeholders. (2) Expand diplomatic efforts that capitalize on Canada's S&T strengths. (3) Assign scientists or engineers from interested departments, agencies, industry or academia to carry-out short-term assignments.

## Conclusion

Making better use of scientific knowledge and technological expertise in the development of public policy is a complex and nuanced endeavour. While scientific research is an essential input into the formulation of sound policy, it is one of several sources of information that must be considered by decision-makers. Thus the distinction between evidence-based and evidence-informed policy-making is a critical one. One hopes that evidence will weigh heavily in the balance, but it will not replace or always trump budget considerations, public opinion, campaign commitments and other considerations. Governments are at their core political entities; the challenge is therefore not to remove politics from decision-making, but rather to create an environment in which it is appropriately informed by science.

## Appendix A: Round Table Itinerary

**Edmonton**
Wednesday, March 18, 2015
8:30 a.m. – 2:00 p.m.

**Vancouver**
Thursday, March 19, 2015
8:30 a.m. – 2:00 p.m.

**Halifax**
Tuesday, March 24, 2015
8:30 a.m. – 2:00 p.m.

**Toronto**
Tuesday, June 2, 2015
8:30 a.m. – 2:00 p.m.

**Montreal**
Le vendredi 12 juin 2015
De 8 h 30 à 14 h

**Ottawa**
Tuesday, June 16, 2015
8:30 a.m. – 2:00 p.m.

## Appendix B: Round Table Participants

### Edmonton

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|---|---|
| Daphne Cheel | Science and Research Branch, Economic Development and Innovation Division, Alberta Innovation and Advanced Education |
| Graham Fox | Institute for Research on Public Policy |
| Kevin Goheen | Canadian Academy of Engineering |
| Denise Hemmings | Women in Scholarship, Engineering, Science and Technology |
| Robert Lamb | Canadian Light Source |
| Pierre Lortie | Dentons Canada LLP |
| Chris Lumb | TEC Edmonton |
| Steve MacDonald | Energy and Climate Change, Government of Alberta |
| Axel Meisen | Canadian Commission for UNESCO |
| Norbert Morgenstern | Geotechnical Engineering, University of Alberta |
| John Morin | Western Economic Diversification, Government of Canada |
| Marcia Nelson | Innovation and Advanced Education, Government of Alberta |
| Ubaka Ogbogu | Health Law Institute, University of Alberta |
| Nils Petersen | Faculty of Science, University of Alberta |
| Andrew Read | Pembina Institute |
| Indira V. Samarasekera | University of Alberta |
| Bob Sandford | EPCOR |
| Jim Saunderson | Western Economic Diversification, Government of Canada |
| Lori Schmidt | GO Productivity |
| Warren Singh | Edmonton Chamber of Commerce |
| Lawrence Staples | Construction Owners Association of Alberta |
| John Stewart | Canadian Nuclear Association |
| Adam Sweet | Edmonton Economic Development Corporation |
| David Verveda | Enbridge Pipelines Inc. |

### Vancouver

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|---|---|
| Samuel Abraham | BC Cancer Agency |
| Kevin Butterworth | Ministry of Technology, Innovation and Citizens' Services, Government of British Columbia |
| John Clague | Professional Engineers and Geoscientists of BC |
| Karl H. Doetsch | Doetsch International Space Consultants |
| Hadi Dowlatabadi | Applied Mathematics and Global Change, University of British Columbia |
| Diane Finegood | Michael Smith Foundation for Health Research |
| Graham Fox | Institute for Research on Public Policy |
| Kevin Goheen | Canadian Academy of Engineering |
| James Gorman | BC Council of Forest Industries |
| Jim Hanlon | Advanced Applied Physics Solutions |
| George Heyman | Member of the Legislative Assembly of British Columbia for Vancouver-Fairview |
| J. Adam Holbrook | Centre for Policy Research on Science and Technology, Simon Fraser University |
| Pierre Lortie | Dentons Canada LLP |
| James R. McFarlane | International Submarine Engineering Ltd. |
| Gerard McLean | BIC Inc. |
| Dinesh K. Pai | Department of Computer Science, University of British Columbia |
| Ken Putt | Canadian Academy of Engineering |
| Peter Robinson | David Suzuki Foundation |
| Stephen M. Rowins | Ministry of Energy and Mines, Government of British Columbia |
| Martha E. Salcudean | Department of Mechanical Engineering, University of British Columbia |
| Gerry Salembier | Western Economic Diversification, Government of Canada |
| Kevin Sauvé | Pembina Institute |
| David Sanborn Scott | International Association for Hydrogen Energy |
| Colin Smith | Kitsault Consulting Associates |
| John Stewart | Canadian Nuclear Association |
| Kennedy Stewart | NDP Critic for Science and Technology; MP, Burnaby-Douglas |
| Trevor Stuthridge | FPInnovations |
| Thomas Tiedje | Electrical and Computer Engineering, University of Victoria |
| Valerie Walker | Mitacs |
| Joseph D. Wright | Paprican |

### Halifax

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|---|---|
| Paul Amyotte | Faculty of Engineering, Dalhousie University |
| Steven Armstrong | Genome Atlantic |
| Ulrike Bahr-Gedalia | Digital Nova Scotia |
| Nikki Beauchamp | Ocean Tracking Network, Dalhousie University |
| Tim Brownlow | Industry Relations, Atlantic Towing |
| Tony Charles | School of the Environment, Saint Mary's University |
| Patricia A. Charlton | Nova Scotia Environment, Nova Scotia Government |
| Thomas Duck | Department of Physics and Atmospheric Science, Dalhousie University |
| Kevin Dunn | Industry Liaison and Innovation, Dalhousie University |
| Allan Eddy | Natural Resources, Government of Nova Scotia |
| Brian Flemming | Former board member, Institute for Research on Public Policy |
| Graham Fox | Institute for Research on Public Policy |
| Peter Geddes | Nova Scotia Environment, Nova Scotia Government |
| Brennan Gillis | Business Development (NS), Mitacs |
| Kevin Goheen | Canadian Academy of Engineering |
| Richard Isnor | Research and Graduate Studies, St. Francis Xavier University |
| Stephen Locke | Bedford Institute of Oceanography |
| Pierre Lortie | Dentons Canada LLP |
| Cora MacLean | Entrepreneurs' Forum |
| Patricia McNeil | Natural Resources, Government of Nova Scotia |
| Melanie Nadeau | Science and Technology, Emera |
| Carole Lee Reinhardt | Canadian Manufacturers & Exporters (CME) |
| Amy Ryan | Ocean Tracking Network, Dalhousie University |
| Steven Smith | Faculty of Science, Saint Mary's University |
| Doug Wallace | Department of Oceanography, Dalhousie University |

### Toronto

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|---|---|
| Paul Acchione | Ontario Society of Professional Engineers (past chair) |
| William Bawden | University of Toronto |
| Joseph Berkovitz | Institute for the History and Philosophy of Science and Technology, University of Toronto |
| John Bianchini | Hatch Ltd. |
| Mel Cappe | School of Public Policy and Governance,University of Toronto |
| Michael Carter | Centre for Healthcare Engineering, Mechanical and Industrial Engineering, University of Toronto |
| Arthur J. Carty | Waterloo Institute for Nanotechnology, University of Waterloo |
| Graham Fox | Institute for Research on Public Policy |
| Kevin Goheen | Canadian Academy of Engineering |
| Robert Haché | York University |
| Mehrdad Hariri | Canadian Science Policy Centre |
| Gerald R. Heffernan | G.R. Heffernan & Associates Ltd. |
| Vaikuntam Iyer Lakshmanan | Process Research ORTECH Inc. |
| Pierre Lortie | Denton Canada LLP |
| Hadi Mahabadi | Xerox Research Centre of Canada |
| Andreas Mandelis | University of Toronto |
| Peter Mascher | McMaster University |
| Michael Owen | University of Ontario Institute of Technology |
| John Preece | British Consulate-General, Toronto |
| Peggy Sattler | New Democratic Party |
| John Stewart | Canadian Nuclear Association |
| David S. Wilkinson | Materials Science and Engineering, McMaster University |
| Jean Zu | Mechanical and Industrial Engineering, University of Toronto |

### Montreal

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|---|---|
| Jean Bélanger | OPAL-RT Technologies Inc. |
| Jean Belzile | Department of Electrical Engineering, École de technologie supérieure |
| Richard Boudreault | Technologies Aérospatiales Boudreault Inc. |
| Philippe Bourke | Regroupement national des conseils régionaux de l'environnement |
| Sylvain G. Cloutier | Canada Research Chair in Hybrid Optoelectronic Materials and Devices, École de technologie supérieure |
| Danielle Fleury | Direction de la recherche et de l'environnement, Transports Québec |
| Graham Fox | Institute for Research on Public Policy |
| Édouard Gervais | The Canadian Academy of Engineering |
| Jacques Lamarre | Jacques Lamarre Management Inc. |
| Pierre Lortie | Dentons Canada LLP |
| Karel Mayrand | David Suzuki Foundation |
| Éric Montpetit | Department of Political Science, Université de Montréal |
| Hany Moustapha | AÉROÉTS; Pratt & Whitney Canada |
| Roger Nicolet | Nicolet, Chartrand, Knoll Ltée |
| Mario Rivero-Huguet | Consulate General of the United Kingdom in Montreal |
| Jean Simard | Aluminium Association of Canada |
| John Stewart | Canadian Nuclear Association |
| Ashok Vijh | Institut de recherche d'Hydro-Québec |

### Ottawa

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|---|---|
| Richard Barnabé | Statistics Canada (retired) |
| Peter Bleyer | Professional Institute of the Public Service of Canada |
| Neil Bouwer | Science and Policy Integration, Natural Resources Canada |
| John Buschek | Technology, Society, Environment Studies, Carleton University |
| Frank Des Rosiers | Innovation and Energy Technology Sector, Natural Resources Canada |
| Graham Fox | Institute for Research on Public Policy |
| Dan Gardner | *Policy Options*, Institute for Research on Public Policy |
| Katie Gibbs | Evidence for Democracy |
| Kevin Goheen | Canadian Academy of Engineering |
| Ted Hewitt | Social Sciences and Humanities Research Council of Canada |
| Jeffrey Kinder | Federal Science and Technology Secretariat |
| Deirdre Laframboise | Canadian Climate Forum |
| John Leggat | Jayden Defence & Security Inc. |
| Pierre Lortie | Dentons Canada LLP |
| Alexandra Mallett | School of Public Policy and Administration, Carleton University |
| Prakash Patnaik | NRC Aerospace, Government of Canada |
| Marc Saner | Institute for Science, Society and Policy |
| John Stewart | Canadian Nuclear Association |
| Stephen Tapp | Institute for Research on Public Policy |
| Sean Webster | Enbridge Pipelines Inc. |

## Appendix C: Agenda

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| 8:00 – 8:30 a.m. | Continental breakfast buffet |
| 8:30 – 8:45 a.m. | Welcome and opening remarks |
| 8:45 – 9:30 a.m. | Session 1 — Understanding the role of scientific evidence and technology in policy-making |
| 9:30 – 10:15 a.m. | Session 2 — Using scientific and technological expertise |
| 10:15 – 10:30 a.m. | Break |
| 10:30 – 11:15 a.m. | Session 3 — Governance and political challenges |
| 11:15 – 11:30 a.m. | Session 4 — Advice to governments |
| 12:00 – 1:50 p.m. | Luncheon |

## Notes

1. The IRPP and the CAE would like to thank Industry Canada, the Canadian Nuclear Association and the Canadian Energy Pipeline Association, whose financial support helped cover some of the costs of this project.
2. Please see the appendices for the dates and locations of the six round tables (appendix A), the list of participants (appendix B) and the meeting agenda (appendix C).
3. http://pm.gc.ca/eng/minister-science-mandate-letter#sthash.GP01uoU0.dpuf
4. *Ibid*.
5. *Ibid*.

*Institute for Research on Public Policy*

*Institut de recherche en politiques publiques*

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