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Canadian science abroad

A case for coordinated, international science engagement

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The Public Policy Forum is an independent, not-for-profit organization dedicated to improving the quality of government in Canada through enhanced dialogue among the public, private and voluntary sectors. The Forum's members, drawn from business, federal, provincial and territorial governments, the voluntary sector and organized labour, share a belief that an efficient and effective public service is important in ensuring Canada's competitiveness abroad and quality of life at home.

Established in 1987, the Forum has earned a reputation as a trusted, nonpartisan facilitator, capable of bringing together a wide range of stakeholders in productive dialogue. Its research program provides a neutral base to inform collective decision making. By promoting information sharing and greater links between governments and other sectors, the Forum helps ensure public policy in our country is dynamic, coordinated and responsive to future challenges and opportunities.

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Introduction

The Canadian S&T landscape consists of a diverse community including academia, government, industry and the not-for-profit sector. Each entity within this system maintains a unique mandate, including national and international priorities, according to which it operates. While there is recognition of the importance and value of international engagement, as demonstrated by the emphasis placed on international by each of these organizations, collectively, there is limited coordination within Canada's S&T community. What opportunities are being missed through lack of coordination and national support to these individuals who are offering their time/expertise to the global endeavor? What opportunities for increased scientific reputation, international influence, and scientific diplomacy are we missing by failing to harness our internationally motivated scientific base?

The Public Policy Forum brought together senior thought leaders representing 19 federal departments, agencies and national associations in November 2015 to discuss opportunities for enhancing the coordination of Canada's international science engagement. The group traversed many topics and themes, addressing not only coordination of science, but the role and value of science, scientific infrastructure, science diplomacy, Canadian identity through and beyond science, global challenges and wicked problems, our common appetite for change, and Canada's future scientists. In the pages that follow, dominant themes of this discussion will be explored. Where there was consensus, recommendations have been put forward. More often, discussion has raised more questions that require further exploration. This conversation is the first step in what we plan will be a series of like-minded discussions to explore these and additional related topics.

Key themes

What are the advantages of coordinating Canada's scientific efforts internationally?

Each speaker shared their perspective on representing Canadian science at home and abroad, and offered suggestions for how greater coordination could provide benefits to individuals, communities, the national interest, and the greater global community.

- For the individual engaging abroad, greater coordination and engagement by and with national Canadian institutions enables them to become truly informed and respected Canadian national representatives who can speak with greater authority (backed by an engaged national peer community) on the international stage, furthering national interests.
- Well-connected Canadian nationals create virtual networks of knowledge around the world that promote the two-way flow of information across national and sectoral borders.
- Informed individuals in active networks can more effectively serve the global community, engaging with global challenges and wicked problems to make the world a better place.

According to findings in *Nature* (1993), Canadians are effective at creating, nurturing and stewarding networks; it is a talent for which Canada is known and well respected. Historically, Canadians have been broadly regarded as honest brokers (in science, development, and diplomacy). This perceived Canadian national strength, and the international willingness to engage with Canadian stakeholders in this way, provides opportunities for Canada and Canadian nationals to exercise influence in forums that would be much less accessible based on other measures of national size/strength (e.g., GDP and population).

There are many contemporary forums and networks, global in nature, which seek to build communities of scientists and researchers around the world for different purposes. They include but are not limited to ICSU, the Belmont Forum, the TransAtlantic Platform, the Galway statement, G7, and the OECD. How does each relate to the other? Where do they overlap and where do they complement? Do these networks encourage bottom-up and/or top-down collaborations? The objectives, outcomes, and national engagement/communication must be clear to ensure an effective use of Canadian resources.

Questions for further discussion: What is our objective and vision for a coordinated science mandate? What are Canada's national interests and how can Canadian science contribute to realizations of those interests? What are other potential benefits to coordinating Canada's scientific effort?

Science looks to the future

In 1942, the world was a grim place. Dieppe. The Battle of the North Atlantic. Many governments around the world were immersed in military efforts. In Ottawa, a group of scientists was already thinking ahead to the end of the war. How would Canada house the thousands of men and women who would eventually return from battle? These conversations led to the eventual creation of national building codes in Canada. Canada's building codes were in turn largely adopted in every province and territory. They have broadly influenced the construction industry, eventually acting as the framework for thousands of wartime homes built during the 1940s. This example illustrates how science can influence policy and regulation without direct authority, but address a demonstrated or anticipated need effectively. The adoption of these building codes, in whole or in part by every province is a successful example of domestic policy transfer and one that has stood the test of time.

Questions for further discussion: The notion of scientists informing policy and regulation as honest brokers may not be commonly understood. What gaps exist between the tasks a scientist performs and how this position is understood by and communicated to the public?

The role of scientists informing policy and regulation has been grossly underutilized in recent years. Given this, are there particular policy areas – domestic or global – where science could act as the honest broker to unite diverse perspectives? Where are Canada's strengths? In which areas should Canada invest resources, strategically, to assume a leadership role? Identifying strategic priority areas upon which to focus will ensure effective use of Canada's scientific resources.

Quiet giants need to speak up

Canadian researchers are well-connected, representing 0.5 percent of the world's population, producing 4.1 percent of the world's papers with an average collaboration rate of 43.0 percent (Council of Canadian Academies, *State of Science and Technology in Canada*, 2012). As Heino Nau, DG Research and Innovation, European Commission said, "Canada is a world of big thinkers,"¹ but we are not big talkers.

Participants raised many examples that demonstrate Canada's ability to think proactively to address big global problems, including the recent production of a vaccine for Ebola which was produced at the National Microbiology Laboratory in Winnipeg, Manitoba. Canada was active in designing the Phase III clinical trials in Guinea. Upon successful completion of trials and testing, the vaccine was promptly sold to Newlink, a small company in Iowa. Newlink in turn sold the vaccine to Merck who developed mass quantities of the vaccine for distribution to affected areas around the world. Media coverage of this story almost exclusively points to Merck as the 'good guy' who saves the day, without reference to the Canadian research that developed the vaccine.

The Ebola vaccine case study prompted mixed reactions. Participants agreed that Canadian research did not get enough credit for the initial development of this lifesaving vaccine. For some participants, the outcome – saving lives in West Africa and elsewhere – alone determined the success of the research. For others, production of the vaccine in Canada and commercialization of the vaccine by Newlink and Merck pointed to many gaps in Canada's innovation system, notably the ability of Canadian scientists to (quickly) commercialize their findings at home, to scale production, and to incur monetary benefits and the associated reputational accolades.

Questions for further discussion: Setting aside the time-sensitive nature of the Ebola outbreaks, what other factors made Canadian scientists sell the vaccine to an American company in order to commercialize and distribute the Ebola vaccine? How might Canada address gaps in our national policy framework, innovation system, and supply chain to encourage the development of national capacity in the future? How can Canadians leverage these successes at home or abroad to reinforce the value and strength of our scientific community? Is it enough that Canada's science community knows of its depth and expertise if the general (Canadian) public and wider world does not?

¹ Nau, H. 2015. *Welcome to the ERA-Can+ Innovation Symposium*. June 25, 2015, Toronto, Canada.

Focus on accomplishments

In 1955, anesthesiologist Henry K. Beecher published “The Powerful Placebo” in which he concluded that if a patient believes he or she is receiving medication, the patient’s condition will improve because they believe it to be so. Beecher’s findings demonstrated that the human mind is a powerful thing: powerful enough to create something where little or nothing exists.

Public funding for research – including grants, infrastructure, staff, technicians, and students – has changed a lot or a little depending on who you speak with, the period analyzed, and whether funds are in real or constant dollars. But the messages in support of research funding have changed dramatically in recent decades. In the 1990s, Canadians were convinced of “brain drain,” the idea that our best and brightest were fleeing for greener pastures. This was followed by a “period of plenty” in the early 2000s, when programs like the Canada Research Chairs were created. In the last 10 years, common messages have promoted international research collaboration or “brain circulation,” which suggests the brightest minds do not share a single postal code and that (international) collaboration should be encouraged. This occurred at the same time as, and has been followed by the “politics of grievance,” a narrative that has served to communicate how and where Canada is falling behind, lacking, and generally failing.

Messages that seem like motherhood statements – such as some of those quoted above – have a significant impact on how Canadians engage each other, and with foreign governments and dignitaries. Thus, with a freshly minted Nobel laureate, political promise on the horizon and untold successes like our Ebola vaccine, Canadians should consider ‘reframing the narrative’ to promote our world-class science.

Questions for further discussion: Canada is a world leader in many areas of research, and an active participant in many global research initiatives. How can we create and promote an era of celebrating our successes? What stories can we tell, and how best can we tell them to: promote science; engage children in the pursuit of science; and increase the profile of Canadian science domestically and internationally? What does Canada do well that the world should know? Does increasing promotion of ourselves threaten our ability to act as a connector and facilitator of networks (see *Quiet Giants need to speak up?*).

Share(d) infrastructure

For many research disciplines, scientific infrastructure is expensive. Demand for research necessitates creative approaches to cost sharing and can create unlikely partners. For example, in 2002, a group of Canadian universities submitted a bid for funding to the Canada Foundation for Innovation. Their vision was to have the CCGS Sir John Franklin outfitted as a floating research vessel that could access the High Arctic all year, enabling researchers to gain greater understanding of the area. Their proposal was successful. In 2003, the Franklin was relaunched as the CCGS Amundsen (a T1200 Class Medium Arctic icebreaker and research vessel operated by the Canadian Coast Guard), a veritable floating laboratory. The Amundsen has simultaneously housed lawyers, geologists, nurses and many marine-related disciplines, and has provided researchers from around the world with unprecedented access to the high arctic, often in extreme weather conditions.

The Amundsen’s Platform Outcome Measurement Study was conducted by an independent panel and chaired by Dr. Martin Taylor at the University of Victoria. The Study found the ship’s scientific and technical capabilities to be *“impressive and internationally competitive when compared with the Arctic research vessels operating in the United States, United Kingdom, and European Union.”* Since 2003, the Amundsen has spent more than 1,400 days at sea. It has housed more than 1,300 scientists, researchers, technicians, students, and professionals from many disciplines – such as health, engineering, law, chemistry, geoscience, geobiophysics, marine science – and more than 20 countries. During this time, the ship has simultaneously contributed to many diverse research programs. Teams aboard the Amundsen have conducted health surveys and provided health care in Inuit communities; delivered programs as part of the International Polar Year; collected evidence which has led to advanced policy development in the North in various areas including health care; and, collected data on marine and northern terrestrial ecosystems to improve knowledge and understanding of changes in the northern environment and provide baseline information to inform future development and resource extraction projects.

None of these research programs would have been realized without funding from many partners. Since 2002, funding for the Amundsen has been provided by the Canada Foundation for Innovation, Fisheries and Oceans

Canada, the Government of Quebec, and the Government of Manitoba. Additionally, in-kind or support for individual projects has come from more than 75 other federal and provincial departments, private companies, and international partners.

The Sudbury Neutrino Observatory (or SNOLAB) is another example of a Canadian research infrastructure success story. The (professional) home of the 2015 Nobel Laureate in physics (Arthur McDonald/Takaaki Kajita), SNOLAB was created by matching funds from municipal, provincial, private and federal funding partners. These included: Greater Sudbury, the Ontario Ministry of Research and Innovation, the Ontario Northern Heritage Fund, the Ontario Innovation Trust, Vale, the Natural Sciences and Engineering Research Council, the Canada Foundation for Innovation, FedNor, and the National Research Council.

The broader field of astronomy and astrophysics, in itself, constitutes a unique Canadian success story. Canada has repeatedly led the world both in the impact of its research (reference to the CCA report on the state of Science & technology in Canada 2012) and in deriving economic benefit from its engagement in international astronomy projects. Canadian engineers have built leading facilities for the U.S., Japan, France, and multinational consortia; and have and will play a big role in the development/construction of the Thirty Meter Telescope, Canada's largest investment in science facilities in history. Canada's success in this arena has been attributed to effective long range planning processes, which engage government, university and industrial players to set strategic goals and focus scientific and economic resources.

Questions for further discussion: Are successful partnerships built to realize and maintain big science an untold story of Canadian collaboration? Or are they simply a symptom of ever-increasing costs and under-funded science, which highlight an underlying gap in Canada's funding models that do not provide for ongoing maintenance and upkeep? How should big science in Canada be supported and funded? What mechanisms can be put in place to ensure that investments in big science do not fall short because of failure to account for/provide long-term costs of staffing, maintenance and upkeep of world-class facilities?

Unite scientific communities, break down barriers & simplify processes

In 2013, there were 226,620 full-time equivalent personnel working in research and development (R&D) in Canada. The private sector employed 58.4 percent of R&D personnel, followed by the higher education sector with 33.0 percent and the federal government with 6.8 percent.² The wealth of ideas, knowledge and wisdom these three sectors represent is great. While many modest programs aim to create long-term ongoing partnerships across sectors, they are uncoordinated, and their capacities do not necessarily reflect the need within the community. Additionally, of those individuals who pursue PhDs, fewer than 20 percent are employed as full-time university professors. The majority of PhDs are employed in a wide range of careers outside of academia, and face significant challenges in that transition.³ While attempts are being made to increase collaboration and education across these sectors, universities, colleges and polytechniques are primarily responsible for stewarding the next generation of talent: researchers, scientists, and professionals. Creating effective cross-sector partnerships holds the potential for great return on investment.⁴

In promoting our strengths and identifying areas where Canadians can influence change through research, programs, and policy, there is also merit to recognizing that great ideas come from the bottom-up as well as the top-down. In recent years, a growing body of research has identified stark contrasts between the modus operandi of Baby Boomers (post WWII), Generation X (1970-1980) and Generation Y or Millennials (post-1980). These groups vary in the ways they approach work, appreciate and recognize reward, as well as in how they organize themselves, create and engage with their respective communities/peer groups. This needs to be taken into account when looking to develop or modify systems that are expected to engage both with cross-sector integration as well as intergenerational dynamics.

Work by the Tri-Council to address cross-sector partnerships, while simplifying application procedures to meet quicker turnaround times for funding, are moves aimed at addressing the concerns above. More recent examples of this, including as Engage, Connect, and CREATE are oversubscribed and delivering results, suggesting the demand is both present and strong

² Statistics Canada, 2015, Research and development personnel. Available online <http://www.statcan.gc.ca/daily-quotidien/160112/dq160112a-eng.htm?cmp=mstatcan>.

³ Edge, Jessica, and Daniel Munro. *Inside and Outside the Academy: Valuing and Preparing PhDs for Careers*. Ottawa: The Conference Board of Canada, 2015.

⁴ Bloom, Michael, Cameron MacLaine, Daniel F. Muzyka, and James Stuckey. *Partnering for Performance: Enhancing Partnerships Between Post-Secondary Education and Business*. Ottawa: The Conference Board of Canada, 2016.

within the stakeholder community. Industry-academic partnerships are on the rise, and more students are getting the experiential learning opportunities they demand. But the need for coordination and communication amongst the programs remains.

International collaboration and how we work with international partners to address common challenges adds yet another dimension to the mix. Finding ways to simplify working with trusted partners toward shared goals, and incentivizing international, interdisciplinary and cross-sector engagement would also provide broader experiential opportunities for Canadian students and researchers. The ‘Digging into Data’ Challenge offers an example of an international collaboration with multiple partners that featured a simpler, single application process with positive results.

Internationally, Canada has several programs that have attracted attention. While Tri-Council programs listed above have had great success (including accolades from international partners for engaging with industry), some longer-standing industry engagement programs have also been used as models for the development of similar programs abroad. These include the Networks of Centers of Excellence, particularly the Centres of Excellence for Commercialization and Research and the Business-Led Networks of Centres of Excellence. Mitacs is another example of an expanding Canadian program that aims to bridge the cross-sector divide, successfully fostering innovation in Canada through engagement of post-secondary researchers, research institutions, industry and not-for-profit partners, both domestically and abroad. While there are many examples of success, it is clear that many challenges around communication and coordination remain to be addressed.

Questions for further discussion: What mechanisms can be introduced to curate, advertise, and broaden informal and formal partnership opportunities across sectors, across generations, and internationally? How can researchers and scientists in the private and public sectors play a greater role in the development and training of post-secondary and graduate students? Where can processes to release public funds be simplified, and how can those funds be leveraged to increase international research collaboration? Recognizing that the problems of the world are not classified by discipline, how can policy mechanisms incent, recognize and reward multidisciplinary approaches to research? How can Canada leverage some

of the excellent cross-sector experience and programs that exist to increase its visibility, access valuable international partners, and gain some of the benefits of engaging in the broader global marketplace?

End the basic and applied dichotomy. Just fund research.

Scientific research – in the broadest sense – contributes to advance our knowledge and understanding of our bodies, our interactions and the world around us. The pursuit of knowledge has both the potential to solve challenges facing us now and future challenges we have not yet encountered. The longstanding debate between pure and applied research divides the research and scientific community and detracts from the opportunities that should be promoted regarding the role that research plays in innovation, policy development, and addressing local and global challenges. All research – whether basic, applied, or emerging from social sciences, humanities or other disciplines – has great promise and can contribute to address local and global challenges.

Recommendation: Develop and employ messages that promote the benefits of all research equally.

Conclusions

The participants raised some important issues in this animated discussion. They posed more questions than they answered, demonstrating a keen interest in the range of challenges discussed. The Public Policy Forum will continue to engage stakeholders on topics identified here, to achieve clarity, consensus and recommendations.



Appendix 1: Agenda

Canadian science abroad

A case for coordinated, international science engagement

November 26, 2015
8:00 a.m. - 10:00 a.m.
Public Policy Forum Offices
130 Albert Street, Ottawa, ON

AGENDA

- | | |
|------------------------|--|
| 8:00 a.m. - 8:15 a.m. | Introduction and tour de table <ul style="list-style-type: none">• Words of welcome, Julie Cafley, Vice-President, Public Policy Forum |
| 8:15 a.m. - 8:40 a.m. | Remarks <ul style="list-style-type: none">• Gordon McBean, President of the International Council for Science;• Chad Gaffield, University of Ottawa Research Chair in Digital Scholarship, former President of the Social Sciences and Humanities Research Council, member of the ICSU Committee on Scientific Planning and Review; and,• Dick Bourgeois Doyle, Secretary General, National Research Council of Canada, and member of the ICSU Committee on Freedom and Responsibility in the conduct of Science. |
| 8:40 a.m. - 9:50 a.m. | Facilitated discussion <ul style="list-style-type: none">• Julie Cafley, Vice-President, Public Policy Forum |
| 9:50 a.m. - 10:00 a.m. | Concluding remarks <ul style="list-style-type: none">• Summary comments and next steps, Janet Bax, Interim President, Council of Canadian Academies |

Appendix 2: Participant list

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