



Big science redefining the boundaries of collaboration

Panel: Science Without boundaries

CSPC 2015: Organized by TRIUMF

November 26, 2015

Panelists: **Andrew Potter**, Editor, The Ottawa Citizen; **Jonathan Bagger**, Director, TRIUMF; **Bob Crow**, Executive in Residence, Institute for Quantum Computing, University of Waterloo; **Mark Dietrich**, President and CEO, Compute Canada; **Heather Douglas**, Waterloo Chair in Science and Society, University of Waterloo

Takeaways and recommendations

- ✓ Science can be an incredible platform to drive national and international collaboration. It is important to consider how we can better enable this
- ✓ Consider academic structures that allow more cross-disciplinary opportunities
- ✓ Create more partnerships between industry, government and academia
- ✓ Look to address boundaries existing within Canada and how we might overcome these
- ✓ Build capacity in Canada to retain talent and resources
- ✓ Look carefully at the policy culture of international partners
- ✓ Partner equally with science capacity in developing countries
- ✓ Consider local issues when partnering to ensure inequalities are not exacerbated

The policy issue: Big science is addressing questions that inherently cross boundaries, enabling collaborations that go beyond the science. The projects are sufficiently large and complex to require the expertise of scientists from around the world and from multiple disciplines. Yet these endeavours are challenged by systemic limitations. As delegates heard, challenges include administrative boundaries, budgetary limitations, and policy and economic factors that restrict risk-taking and create obstacles for cooperation, both at home and abroad.

Successes such as the Human Genome Project, CERN's Large Hadron Collider in Switzerland, SNOLAB in Sudbury, ON, and SESAME in Jordan have transcended competitive divides and political differences between international governments, and have united academic institutions and private industries. But such success has required extraordinary administrative efforts.

For Canada, some considerations include determining clear national priorities and overcoming provincial barriers.

The options: The first hurdle any major science project has to overcome is capital, said Crow. He noted that "the international boundary basically vaporizes" when sufficient funding is available, not only for capital and operating costs but also for travel and student exchanges.

The large, private donations that helped launch Canadian science ventures like the Institute of Quantum Computing (IQC) and the Perimeter Institute in Waterloo ON, have lessened the financial burden and allowed for experimentation in terms of structures and approaches to doing science.

For example, the IQC takes a multidisciplinary approach to the field of quantum information processing. It draws on researchers based in six departments across three faculties at the University of Waterloo. "Faculty and students can be simultaneously appointed at IQC and in a traditional discipline, meaning some disciplinary boundaries are starting to disappear," said Crow.

That collaborative approach extends to IQC's funders as well: "We worked very hard to ensure that both federal and provincial governments, and University of Waterloo became equal partners in this venture," added Crow. Public and private funders have come together with a shared vision as well.

"The end goal is to ultimately build capacity and an industry for Canada. We're building something in which Canadians can be proud to have a leadership position in the world," said Crow.

Facilities like the Vancouver-based TRIUMF—Canada's national laboratory for particle and nuclear physics and accelerator-based science—represent huge opportunities for Canada, said Bagger. "They bring together talented people to address compelling questions. And to address those questions, they have to invent technologies—they don't just buy them off the shelf."

Of TRIUMF's 500 annual users, 75% come from outside Canada. "Big science, I would say, is almost designed to cross boundaries. We cross boundaries of nationality. We cross boundaries of discipline," said Bagger.

While these facilities require significant investments to build, Dietrich said what makes them successful is the people and the commitment to collaboration. "That collaboration occurs without boundaries and that's what we see in all our international achievements, at SNOLAB, and ATLAS (experiment at CERN). These are multinational, multidisciplinary, multi-personal interactions."

The international organizational structures help balance the funding demands and spread both the burden and the wealth, added Dietrich.

But the developed world has to find ways to partner equally with growing science capacities in the developing world. "Different science policy cultures exist in each nation, because of the different and distinct political cultures and histories," said Douglas.

Douglas explained how each nation and each locality have a different policy culture. "You ignore these differences at your peril. Even if we set aside the local policy cultures, there's still issues of how we tend to tie science and innovation to national economies, that we expect our investments in science in our particular nations to pay off for the economy in that particular nation."

The panel agreed that it's important to recognize each partner's priorities and to ask how science can address them. As Douglas noted, "It is breaking down boundaries (and) thinking outside of the science."