CSPC shares ideas for governing and funding big science facilities

Plenary Session: International Perspectives on Big Science in Canada: Where Should Canada Go?
Organized by: Canada Foundation for Innovation

CSPC 2015 - November 26, 2015

Panelists: **Gilles Patry**, President and CEO, Canada Foundation for Innovation; *Panelists*: **Catherine Ewart**, Head of Stakeholder and International Relations, Science and Technology Facilities Council, U.K.; **Rolf Heuer**, Director General, CERN; **Nigel Lockyer**, Director, Fermi National Accelerator Laboratory

Takeaways and recommendations

- ✓ Canada needs a vision and roadmap for big science
- ✓ Funding for big science is the responsibility of countries and the public sector
- ✓ A big science model should be fair and flexible
- ✓ Governance and accountability are key
- ✓ A user facility should be both host and participant to ensure excellence
- ✓ For CERN, all funding agencies agree on a plan and oversee its execution
- ✓ Canada should become a member of CERN

The policy issue: Canada is home to several "big science" research facilities that cost upwards of $100 million, take years to build and operate on decade-long time scales. While these facilities have a powerful impact on the quality and competitiveness of Canadian science, there is no national policy framework considering, evaluating and overseeing large-scale research infrastructures.

Funding is another issue, noted Patry: "How can we make sure that the limited resources available for big science investments, both here and abroad produce the maximum benefits for Canada and the rest of the world?"

The panelists provided their perspectives on what other countries are doing on this front, and how Canada might learn from their experiences.

The options: The European Union Council of Research Ministers responded to these challenges with the creation in 2002 of the European Strategy Forum on Research Infrastructures. The ESFRI does not fund research infrastructures; rather, it provides a forum for coordination, information sharing, help and best practices.

Ewart describes ESFRI as a "top-down process that complements the bottom-up processes within the member states".

One of its jobs is to prioritize research infrastructures and develop roadmaps, based on best practices, transparency, strict evaluation and excellent science. The roadmaps identify new pan-European research infrastructures or major upgrades to existing ones to meet the European research community's needs over the next 10 to 20 years. The current roadmap contains 48 projects and work is underway to launch a new roadmap in March 2016, which Ewart said will be more of a strategy document and contain fewer and more mature projects (about 25).

"The proposals not only have to present a science case, but a technical case, a business case, and they have to say something about the maturity of the infrastructure and external peer review is extremely important," said Ewart, adding that projects will be audited every two-to-three years.

Overall, she said ESFRI resulted in better coordination between member states, less duplication and reduced fragmentation.

Increasingly, countries also share costs that are too large for any country to manage on its own. For example, the U.K. is one of 21 member states that contribute to the governance and costs of the CERN particle physics laboratory, which accommodates the research of over 12,000 visiting scientists from over 70 countries. (Oddly, though Canada is involved in several experiments at CERN, in particular the largest one, it has yet to join the four associate members.)

The CERN council, with support from a scientific policy committee and a finance committee, decides on infrastructure development and research directions proposed by CERN management. Fairness, flexibility and mutual understanding are central to CERN's model: each country gets one vote, and each contributes according to their means.

Besides having long -term plans, CERN has a rolling five-year plan which helps the facility to avoid "fiscal cliffs and aid seamless financial management", said Heuer, who is responsible for the day-to-day operations of CERN.

CERN brings all the funding agencies to the table to agree on a plan and oversee its execution. He described CERN as "the most successful model for international scientific collaboration the world has yet seen". The key to its success, he added, is how it accommodates the needs of diverse communities with different levels of resources, different needs and different priorities.

"The CERN model is based on consensus, collaboration and competition. If you can bring those together you have a recipe for multi-stakeholder success … Canada can learn from this model," said Heuer.

Lockyer brought both a Canadian and American perspective on research infrastructure, as the former director of the TRIUMF particle physics lab in British Columbia and current director of the Fermi National Accelerator Laboratory near Chicago. The big funder of big science in the U.S. is the Department of Energy's (DOE) Office of Science. The US$5-billion organization funds basic research and 10 national labs, including FERMI.

"The funding agencies are like parents and are committed to your success and that's different from how it's done in Canada," said Lockyer. "When I go to CERN and talk to Rolf (Heuer), my funding agency goes with me."

Unlike the National Science Foundation in the U.S. which is proposal-driven, DOE is mission-driven and top-down, but driven by the grassroots scientific community. "DOE won't go out on a limb unless everyone is behind the idea."

Governance is also key. DOE conducts upfront reviews of management and their experience as part of a "layman review" process.

To ensure stable and ongoing funding, DOE uses a Total Project Cost (TPC) system, which takes into account things like inflation, labour and contingency costs—the latter can cost 30-35% for large projects. But the money isn't given without accountability. Each lab's Performance Evaluation and Measurement Plan (PEMP), based on such criteria as operations, safety and efficiency, is appraised and graded, with annual "report cards" made publicly available.

Labs are also operated as Government Owned/Contractor Operated (GOCO). "They get a fee for running the lab, like Chalk River (nuclear) Labs (north of Ottawa). If you score lower on the report card, you get less money so there's motivation for doing a good job," said Lockyer.

When asked what advice he would give Canada, Lockyer said it's important for a country to develop a vision and a roadmap for big science that sees big science facilities "working together as a unit and be more mission-driven".

Ewart said it's important for funding organizations to agree on a coordinated approach. Heuer urged individual disciplines to develop their own roadmaps first before bringing all the different roadmaps together. "Then you can look internationally to see the best way to proceed. Is Canada leading in this area, or is another country or continent overtaking you. It might make sense to join them and do it there and not here."

Despite the challenges, Lockyer is optimistic. He met Trudeau at TRIUMF years ago and unlike many politicians, he said Canada's newest prime minister understands the importance of big science. "He knew what CERN was and knew what particle physics are. He said 'I love that stuff'. It's an opportunity and a special moment for Canada."