

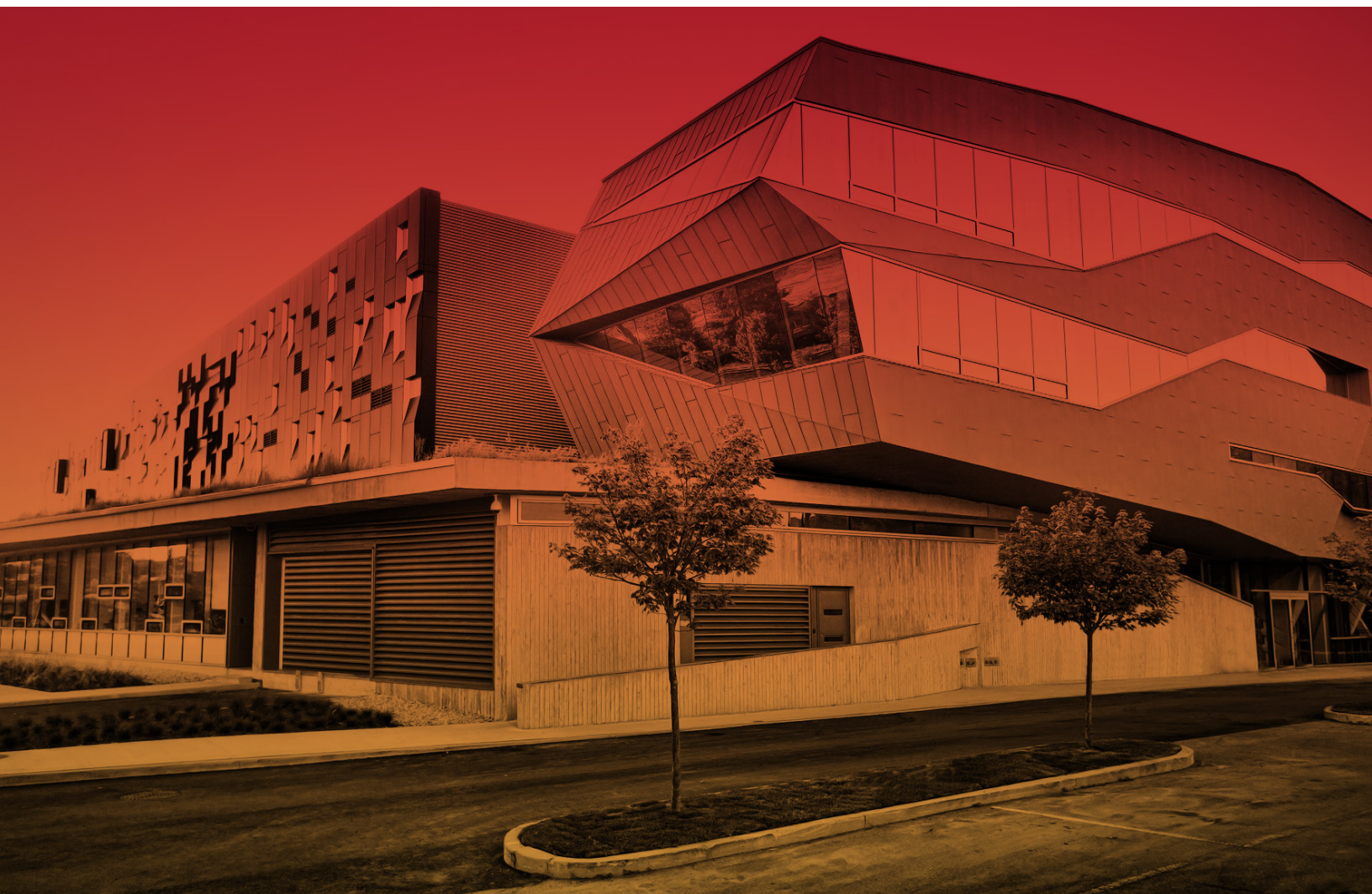


CONNECTING
GLOBAL
RESEARCH

International Conference on Research Infrastructures

Proceedings Report

June 1–3, 2021



FOREWORD

ICRI 2021: A conference in exceptional times

Looking back, linguists and historians may one day conclude that the word that best described 2020 was “pivot.” Organizationally, the Canada Foundation for Innovation (CFI) executed several pivots to be able to host the International Conference on Research Infrastructures (ICRI) in June 2021.

In 2019, when the CFI agreed to host ICRI 2020, we planned for a traditional academic meeting, a combination of plenaries and workshops, with many opportunities for friends and colleagues to renew old acquaintances, develop new friendships and discuss new professional collaborations. As the pandemic spread, it became clear to the CFI and its main partner, the European Commission, that our plans for a June 2020 ICRI had to be paused. But what next?

As the situation developed, an unprecedented level of global research collaboration emerged. A common concern in those early months of 2020 was ensuring that researchers had access to the state-of-the-art labs and facilities needed to face the pandemic.

The screenshot shows the ICRI 2021 website interface. At the top left is the ICRI 2021 logo. The main header reads "How we responded to the pandemic" with a dropdown arrow. Below the header is a navigation bar with categories: "Data & computing", "Environment", "Health & biosciences", "Research infrastructure funding", and "Social sciences & humanities". On the left is a vertical navigation menu with items: Home, Welcome, Program: Book your agenda, Watch "Theme A" case studies, Meet our speakers, Connect with delegates, Discover global infrastructures, How we responded to the pandemic (highlighted), Learn about our partners, Join the group conversation, About this platform, and Tech support. The main content area features four white cards on a red-tinted background of a laboratory. The cards are: 1. "EGI Federation Supporting COVID-19 Research" with a blue molecular structure image. 2. "e-Infrastructure Reflection Group (e-IRG)" with a photo of a meeting. 3. "ELIXIR vs COVID-19" with a poster titled "ELIXIR against COVID-19". 4. "EOSC-Life and the 13 European Life Science Research Infrastructures respond to the COVID-19 Pandemic" with a green and blue graphic.

Almost at once, a global community of scientists and research facilities pivoted to take up the challenge of finding treatments and cures for COVID-19. With this extraordinary international mobilization of science and research, the CFI and its partners determined that ICRI had an important role to play in convening global experts to discuss the unique role of research infrastructures in the COVID-19 response, as well as in meeting other global challenges, such as climate change and sustainable development. The CFI and its partners pivoted again.

While events prevented us from hosting the world's research community along the banks of Ottawa's Rideau Canal — a UNESCO World Heritage Site — and a short walk to Canada's majestic Parliament Buildings, the switch to a virtual conference offered us an opportunity to reach a wider global audience. The online platform allowed us to add more voices to these important discussions and to feature more research infrastructures, institutions and projects that would not have otherwise been part of the conference.

We also pivoted the focus on the conference program to enlarge the discussion to include topics not usually addressed at ICRI. The program encompassed not just the pandemic, but also climate change, food security and sustainable development. Now, researchers at the world's major infrastructure facilities are better able to tackle global challenges and, working together, find solutions that benefit everyone.

Organizing a conference of this scale is a significant project for any host organization. Our success is a testament to the hard work and dedication of CFI staff as well as members of the program and organizing committees. As the host, we were able to count on the support of the European Union, and a strong Canadian contingent of partners in the Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, and Social Sciences and Humanities Research Council. We also received support from the National Research Council Canada and Laboratories Canada. I would like to offer a special word of gratitude to the conference patron and honorary chair, Canada's Chief Science Advisor, Mona Nemer.

Now that our role as an important participant and contributor to ICRI 2021 has concluded, we look forward to assisting our colleagues in the Czech Republic as they begin planning for ICRI 2022.



Roseann O'Reilly Runte
President and CEO
Canada Foundation for Innovation

ACKNOWLEDGEMENTS

The Canada Foundation for Innovation (CFI) acknowledges the financial support received from the European Union (EU) under the Horizon 2020 research and innovation program (Grant agreement No 874434). The conference was organized in collaboration with the EU and hosted by the CFI in partnership with the Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, and Social Sciences and Humanities Research Council. Additional support was received from Laboratories Canada and the National Research Council Canada.



Organizing and hosting ICRI 2021 was the result of the work and dedication of several CFI staff: Heidi Bandulet, Cynthia Beaudin, Michel Béchar, François Bergeron, Malorie Bertrand, Allison Bluett, Olivia Carey, Émilie Delattre, Jodi Di Menna, Sokhana Awa Sall Diop, Sami El Euch, Micheline Favreau, Mona Fidélia-Moise, Danielle Frenes, Ryan Gill, Pierre Normand, Eden Nzigiyiye, Michael A. O'Neill, Louise Paul, Greg Pilsworth, Claire Samson and Elizabeth Shilts.

The CFI also acknowledges the invaluable contributions to the conference's success from the panellists, moderators and rapporteurs who contributed their presence and participation. Similarly, the CFI wishes to recognize the contribution of the program committee members who gave freely of their time to the design and content of the conference program and the parallel sessions.

EXECUTIVE SUMMARY

From June 1 to 3, 2021, the international research community gathered for the fifth International Conference on Research Infrastructures (ICRI). Originally planned for June 2020, the 2021 conference was the first to be hosted in North America and the first to be held virtually, due to the COVID-19 pandemic.



The conference brought together nearly 700 panellists and participants spanning the five continents and a variety of disciplines and sectors of activity. As in the previous ICRI, the plenaries and parallel sessions led to wide-ranging conversations about the role of research infrastructures and the major challenges facing the global research enterprise. The issues discussed included:

- financing and organizing international research infrastructures;
- developing governance models required to operate and effectively use increasingly complex infrastructures;
- managing and regulating research data; and
- assessing the impact of research infrastructures on the advancement of knowledge, the sustainability of our environment and the well-being of our citizens.

Some of the conclusions to emerge from the four plenary and parallel sessions concerned the need to continue to invest in scientific research and research infrastructures and to ensure that this funding is stable and predictable over time. Participants agreed that the current and emerging global issues are collective and therefore require thinking through what the real meaning of solidarity is. Two of the challenges that are already affecting the world and its populations are climate change and environmental degradation. Science and research will be critical to charting a more sustainable future. Getting there will require support from governments and policymakers, measured not just in adequate resources but in commitments to scientific transparency and international collaboration.

Other discussions focused on the North–South dimension of science and research and the gaps between the developed and developing worlds. Many commented on the need to distribute global research capacity more equitably. This will require new thinking and insights about how to develop research infrastructures that are adapted to the local context of developing countries.

Finally, the participants and panellists discussed the next generation of researchers. They noted that accommodating the needs of future talent and integrating them into the network of research infrastructures should be a top priority. As several participants noted, training the new generations is an investment in our common future.



June 1-3, 2021

Virtual – online from Ottawa, Canada

Building bridges to a sustainable world

The International Conference on Research Infrastructures (ICRI) brings together policy experts, facility managers, leading researchers and a variety of other stakeholders to discuss challenges and emerging trends for research infrastructures around the world.

ICRI 2021 is supported with funding from the European Union and is hosted by the Canada Foundation for Innovation (CFI), in partnership with the Canadian Institutes of Health Research, the Natural Sciences and Engineering Research Council, and the Social Sciences and Humanities Research Council, and with additional support from Laboratories Canada and the National Research Council of Canada.

A message from your ICRI 2021 host

Thank you for attending ICRI 2021!

The global pandemic we have been living over the last year reminded us how important it is for us to

ICRI 2022

October 19-21, 2022
Brno, Czech Republic

INTRODUCTION

From June 1 to 3, 2021, the international research community gathered for the fifth International Conference on Research Infrastructures (ICRI). Originally planned for June 2020, the 2021 conference was the first to be hosted in North America and the first to be held virtually, due to the COVID-19 pandemic.

Marked by the pandemic, the conference theme evolved to include the globalization of research and technology development and the growing need for new knowledge, technologies and innovations to address global challenges and their associated social, economic and environmental factors. This focus was captured in the conference theme: *The role of research infrastructures in building bridges to a sustainable world.*

ICRI 2021 brought together nearly 700 panellists and participants from all continents from a broad spectrum of disciplines and sectors of activity. As in the past, the plenaries and parallel sessions led to wide-ranging conversations about the role of research infrastructures and the major challenges facing the global research enterprise. The issues discussed included:

- financing and organizing international research infrastructures;
- developing governance models required to operate and effectively use increasingly complex infrastructures;
- managing and regulating research data; and
- assessing the impact of research infrastructures on the advancement of knowledge, the sustainability of our environment and the well-being of our citizens.

The discussions underscored the common issues and concerns that confront researchers, research institutions, and the national and international funding organizations. The discussions also highlighted the value of international exchange to determine what works best, in what domestic context and through what means. Participants further shared their experience about the effectiveness of various approaches and the best practices that have positively affected how researchers share and use research infrastructures to generate new knowledge.

And, with the pandemic as backdrop, participants offered their perspectives on how global research infrastructures can join forces to quickly tackle global emergencies. Critically, participants noted the importance of researchers having access to the state-of-the-art labs and facilities to meet emerging global challenges and support sustainable development.

The screenshot displays the 'Discover global infrastructures' web application. The interface includes a top navigation bar with the ICRIC 2021 logo, the title 'Discover global infrastructures', and a search bar. A left sidebar provides navigation options such as 'Home', 'Welcome', 'Program: Book your agenda', 'Watch "Theme A" case studies', 'Meet our speakers', 'Connect with delegates', 'Discover global infrastructures' (highlighted), 'How we responded to the pandemic', 'Learn about our partners', 'Join the group conversation', 'About this platform', and 'Tech support'. The main content area is a grid of 21 infrastructure cards, each featuring a logo, the name of the infrastructure, and a heart icon for favoriting. The infrastructures listed are: Amundsen Science, André E. Lalonde Accelerator Mass Spectrometry Laboratory, ANFF - The Australian National Fabrication Facility, APPF - Australian Plant Phenomics Facility, Australian Research Data Commons, Canada's National Design Network, managed by CMC Microsystems, Canadian Cancer Trials Group, Canadian Centre for Electron Microscopy, Canadian Light Source, Canadian Research Data Centre Network, CGEn - Canada's Integrated Genomics Platform, Coalition Publica, DANUBIUS-RI - International Centre for Advanced Studies on River-Sea Systems, EMPHASIS - European Infrastructure for Plant Phenotyping, EMSO ERIC, ENVRI Community, ESRF, The European Synchrotron, and EST - European Solar Telescope.

PLENARY SESSIONS

The role of research and infrastructure in building a sustainable world

Plenary session 1 – June 1, 2021



Moderator

Elizabeth Cannon, President Emerita, University of Calgary

Panellists

Edith Heard, Director General, European Molecular Biological Laboratory (EMBL)

Jan Hrušák, Chair, European Strategy Forum on Research Infrastructures (ESFRI)

Youba Sokona, Vice Chair of the Intergovernmental Panel on Climate Change (IPCC) and former Executive Secretary of the Sahara and the Sahel Observatory

Panel presentations and discussions

The first plenary session focused on the contribution of research infrastructure to fostering a more sustainable future in the context of global challenges. It provided an opportunity for panellists and participants to discuss ways to advance the future of infrastructure research. The panel addressed a very broad spectrum of issues and contributions.

Jan Hrušák presented a brief overview of ESFRI's work and goals on research infrastructure-related issues in Europe and around the world. This included ESFRI's contributions to policy advice and dialogues in several areas, such as sustainability of research infrastructures, by advocating data interoperability as an important instrument to tackle societal challenges and to contribute to sustainable development goals. Jan Hrušák highlighted ESFRI's recent white paper, *Making Sense Happen*, which sets a new perspective and new ambition for research infrastructures in Europe. The white paper proposes reliance on an integrated research infrastructure ecosystem, including a proper governance and interoperability framework, to prevent any future crises.

EMBL's work, mission and collaborations relate to all aspects of molecular biology, from structural biology and bioinformatics right through to neurobiology and disease modelling. For Edith Heard, the ongoing pandemic underscored the fact that the best line of defence against the future global challenges is long-term sustainable support to fundamental research, open science and the research infrastructures hosting scientists across Europe and worldwide. According to Edith Heard, preventing future crises and addressing global challenges require both new solutions and long-term planning. As an example, Edith Heard pointed to EMBL's new five-year plan, *Molecules to Ecosystems*, which starts in 2022. Edith Heard used four examples of present and emerging challenges to illustrate the need for long-term planning: Climate change, biodiversity, disease and antimicrobial resistance. In addition, Edith Heard noted that international collaboration research organizations play a role in promoting and fostering open science and nurturing the next generation of scientists, who, of course, are the most critical seeds of future success.

Youba Sokona drew on the IPCC's experience as a model for how to address global challenges. From the outset, the IPCC was established to propose objective and transparent science on climate change. Drawing on the IPCC's experience, Youba Sokona proposed that one of the pandemic's main lessons is the importance of science that is transparent and highly policy-relevant and engages contributions from scientists worldwide. In his view, present and future challenges are collective. Youba Sokona also commented on the need to find a balance between scientific excellence and territorial cohesion, noting that the emerging global issues of the present and future require thinking about the real meaning of global solidarity. This implies taking stock of the relationship between countries, and between North and South, to take actions that collectively address our common challenges and to find best solutions for the future of humanity.

In conclusion, the panellists agreed on the importance of science and research as critical to charting a more sustainable future. Getting there will require support from governments and policymakers for the scientific enterprise. This support includes not only ensuring that research is adequately resourced, but also making commitments to scientific transparency and international collaboration.

Marshalling global research infrastructure to address emergencies: Incorporating resilience and agility in research infrastructure planning, financing and operations

Plenary session 2 – June 3, 2021



Moderator

Joy Johnson, President and Vice-Chancellor, Simon Fraser University

Panellists

Xavier Barcons, Director General, European Southern Observatory (ESO)

Werner Kutsch, Director General, Integrated Carbon Observation System (ICOS)

Beryl Morris, Director, Terrestrial Ecosystem Research Network (TERN)

Anna Panagopoulou, Director, European Research Area and Innovation

Panel presentations and discussions

The second plenary session focused on marshalling global research infrastructures to address emergencies by incorporating resilience and agility in research infrastructure planning, financing and operations in the context of the pandemic. It provided an opportunity to see different major infrastructure projects and challenges experienced worldwide. The panel addressed a broad spectrum of pandemic impacts on infrastructures and factors that enabled them to see their way through.

Xavier Barcons began his presentation with a brief overview of the ESO's work. In his view, the ESO is an excellent example of international cooperation, with benefits that extend across several facilities, institutions and organizations, including those currently building new facilities like the extremely large telescope. For Xavier Barcons, operating in this way enables sharing experiences and increasing capacity to plan and develop long-term projects. In addition, the ESO model provides for predictability in funding, which is critical for leading-edge research projects. Xavier Barcons further commented on the importance and benefits that derive from open access to research data, which is of critical importance for new generations of scientists who can have access to data no matter where they work.

Established to produce observations and research greenhouse gases, ICOS is a distributed research infrastructure spanning 13 European countries. For Werner Kutsch, however, ICOS is best described as a community of technicians and scientists who provide knowledge that benefits society. In the case of ICOS, the decision to build a distributed infrastructure was motivated by the science of climate change as greenhouse gases and other environmental problems do not stop at national borders or between continents. Werner Kutsch noted that there are important gaps in the worldwide distribution of the infrastructures needed to collect information about greenhouse gases and climate change, notably in Africa and Central Asia. To fill these gaps, Werner Kutsch offered new ways of engaging with developing countries, including listening to local actors and drawing lessons from them about approaches better tailored to their circumstances. These lessons also apply to developed countries, where listening to and working with local communities can enhance both the quality of science and citizen awareness to environmental issues such as climate change.

Beryl Morris addressed the pandemic's impact on the work of TERN, which is the Australian continent's ecosystem research infrastructure. Consequently, we learned that TERN's field crew responsible for maintaining equipment and gathering data was severely impacted by the working conditions made necessary by the pandemic. Another realization to emerge from the pandemic is the importance of a global ecosystem research infrastructure, which combines the efforts of Australia, South Africa, China, the United States and Europe. This global ecosystem makes accessible to decision makers data and information that takes a global perspective on the environment, which is particularly important given the climate crisis. Beryl Morris also highlighted an ecological education program that was started for people in underdeveloped countries. For instance, thanks to three of TERN's sites, both undergraduate and graduate students from Southeast Asia can learn and carry out some of their experiments using infrastructure that wouldn't be available to them locally. Expanding on these observations, Beryl Morris noted that common protocols and tools allow the marshalling of global research infrastructure.

The pandemic has been very challenging for various researchers, students and academics; however, it has created opportunities for many institutions. For example, the European Commission created the European COVID-19 data platform to collect data that are related to the pandemic. Anna Panagopoulou announced that there have been 140,000 users and 3.6 million web requests from 170 countries through the platform, which demonstrates collaboration

between different infrastructures at the international level and provides data that are very important for the public. Anna Panagopoulou pointed to two preconditions to Europe-wide research collaborations: clarity about research topics and areas to be pursued and alignment between national and European research priorities.

In conclusion, the panellists agreed that science holds the keys to the questions posed by the challenges faced by the global community, but this also brings with it challenges about how science and research is conducted on a worldwide scale. They noted that the concentration of major research infrastructures in the global North leaves countries of the global South without first-hand access to the science required to address environmental degradation and climate change. For this reason, prioritizing the integration of researchers in the developing world into global networks of research infrastructures is crucial. To this end, the research community needs to reconsider its approach to investments in research in the global South in order to develop research infrastructure plans that are aligned to local capacity and meet the needs and requirements of developing countries for scientific knowledge and expertise.

“...science holds the keys to the questions posed by the challenges faced by the global community, but this also brings with it challenges about how science and research is conducted on a worldwide scale.”

Possibilities and potential of global collaboration

Plenary session 3 – June 3, 2021



Moderator

Roseann O'Reilly Runte, President and CEO, Canada Foundation for Innovation

Panellists

Simon Kennedy, Deputy Minister, Innovation, Science and Economic Development Canada
Jean-Eric Paquet, Director General, Directorate for Research and Innovation, European Commission

Panel presentations and discussions

The third plenary session focused on the possibilities and potential of global collaboration. It provided an opportunity to share different ideas on how to foster engagement for collaboration as we look to the future. The panel addressed a broad spectrum of issues and prospects.

Science has always been, in one form or another, an international endeavour and, as Simon Kennedy argued, countries depend on scientific collaboration. For instance, Simon Kennedy observed that the pandemic and the search for a vaccine help us appreciate the importance of the international scientific community. Simon Kennedy also discussed the importance of supporting both applied and fundamental science. Simon Kennedy illustrated this by noting that the Canadian government is providing significant support to the development of artificial intelligence (AI) technologies and quantum science. Turning back to the pandemic, Simon Kennedy noted

that AI was of critical importance in the process of drug discovery and in the development of new therapies. Lastly, Simon Kennedy predicted that global challenges would accelerate the kind of policymaking that will facilitate international collaborations.

Jean-Eric Paquet observed that research infrastructures are rapidly evolving from facilities for science to actors in their own right in scientific research and innovation. In the context of the pandemic, Jean-Eric Paquet argued that more needed to be done to develop platforms for trials for therapeutics and vaccines. Certainly, these types of network infrastructures are going to be particularly powerful and important beyond what is done by industry. Beyond the pandemic, Jean-Eric Paquet proposed that sustainable and adequate resourcing of research will be essential to address present and future global challenges, starting with the development of technologies made necessary by climate change. At the same time, Jean-Eric Paquet noted that governments and scientists must work with non-science actors to ensure the social acceptability of their work.

In conclusion, the panellists agreed that COVID-19 illustrates the need for open data, the need for the scientific community to collaborate and the value of investments in research infrastructures. Undoubtedly, it is high time to enable international scientific collaboration, to enable the same kind of collaboration in many areas that require attention and physical resources.



PARALLEL SESSIONS

Theme A

International research infrastructures: The way forward



ICRI CANADA 2021

**PARALLEL THEME A: International Research Infrastructures:
The Way Forward**

Meeting stakeholders expectations for international RIs

European XFEL

Maria Faury - Chair of European XFEL Council

Theme abstract

Research infrastructures have been developed through international collaboration for many years. Still, earlier models for these ambitious scientific and technological projects are challenged by changes in the socio-economic and scientific context.

Research infrastructures are required in all fields of science, not just in traditional scientific disciplines. The scale of funding required for these facilities is increasing substantially. New international research infrastructures often require a large array of sites as well as mobile or virtual capacities. They are increasingly expected to produce socio-economic benefits alongside their main scientific objectives.

New international research infrastructures are of interest to, and require, a large number of participating countries, often beyond the usual countries leading in research.

Theme summary

A1 Lessons learned on Data management policies and practices ICRI CANADA 2021

Case studies

- Si-Woo Yoon**
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- Stephanie Carroll**
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Makina Yabashi
SPRING-8 RIKEN (light source)

Steven Vermeulen
EBRAINS

Carthage Smith
OECD GSF

Naveed Aziz
Cgen (Genomics)

Kathryn McWilliams
University of Saskatchewan
SuperDARN (space weather)

Victoria Tsoukala
EU Commission, DG Research

Heidi Bandulet
CFI

The slide also features two small video thumbnails on the right side, showing participants in a virtual meeting.

Summary of the four panel sessions

International research infrastructures — from the small, distributed platform to very large single-sited facilities — bring the world together in addressing the most pressing and challenging science questions of our modern times. For decades, such international research infrastructures have been successfully developed through international cooperation. However, ongoing changes in the global socio-economic and scientific landscapes, accentuated by the COVID pandemic, are challenging earlier models for international research infrastructures and have important implications for international research infrastructures going forward. Hence, the focus of this parallel theme was to explore ways of adapting and evolving governance, partnerships and financing models, as well as assessing the role of data policies, to better reflect this new reality.

The theme comprised 12 pre-recorded case studies, each illustrating one aspect of these challenges, which helped frame the discussions of four distinct panels. Overall, the presentations and discussions indicated that meeting tomorrow's needs is to recognize the interconnectivity of the world, the diversity of its players and the need for inclusiveness.

Data was said to play a key role in supporting this worldview, as it will allow for an unprecedented acceleration of knowledge as well as its democratization. However, panellists agreed that the true power of data has yet to be unleashed. Before data can serve as a common good for all to benefit, more groundwork is required from international research infrastructures and policymakers in, for example,

- harmonizing policies across borders;
- integrating heterogeneous data;
- ensuring data sharing (or else its access) while protecting data rights; and
- making data accessible to non-expert users.

For improving access, countries around the world must also be equipped with backbone infrastructure capability and the digital skills needed to make data meet their societal needs. The training of the next generation of researchers, in which current international research infrastructures play a critical role, was identified as another key requirement for this data revolution to occur.

The financing of international research infrastructures, especially in their initial phase, has always been particularly challenging in that they require a multitude of funders, which often have conflicting priorities and different abilities to contribute to international research infrastructures. Governments and funders are confronted with the challenge of supporting increasingly large and complex portfolios of infrastructures within and outside their borders. The panel agreed on the importance of integrating long-term strategies — which reflect the consensus on the scientific community's priorities — as well as the expected societal benefits early in the business and funding models. As international research infrastructure projects typically have a long lifespan, business cases need to evolve over time and funding partners need to be more risk-tolerant and to show more flexibility for adapting to evolving priorities. Also, although in-kind contributions play a critical role in most international research infrastructure projects, having a reserve fund in cash to adapt to contingencies was seen as valuable. Funders should consider adopting a portfolio approach to international research infrastructures to be able to manage national priorities and project leadership over a diversity of projects and be transparent about national constraints.

Although a lot of work still needs to be completed, the COVID crisis has proven that transformation of knowledge into practical uses by research infrastructures could be carried out faster than expected.

The success of any partnership relies upon the ability of its members to clearly identify and communicate their expectations and adopt a model of governance that will suit these demands. In doing so, a partnership should aim to integrate the perspectives of as many stakeholders as possible. Before it opts for a given model — acknowledging there are pros and cons to each type — it should first establish a clear vision of how the partnership should operate. Regardless of the chosen model, it is essential to build in different modes of participation, with flexibility to evolve from one mode to the next, for allowing partners of all kinds to contribute. The panel noted that partnerships can also evolve to agreements broader than for a single research infrastructure. This

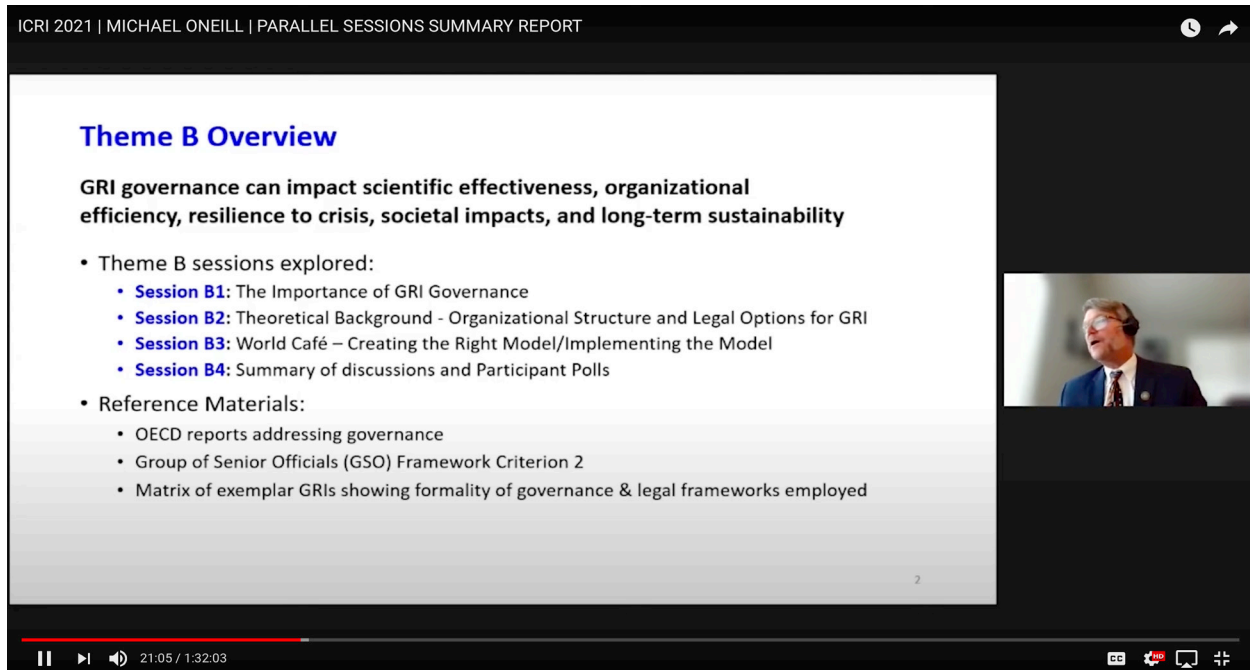
would offer the possibility to share human and scientific resources, and ideally, would lead to an entire research infrastructure ecosystem functioning as a reactive complex with synergies for greater impact.

Finally, panellists recognized that future international research infrastructures will become more and more integrated into society. Thus, measuring and demonstrating the impact and benefits beyond excellent science is central to their long-term sustainability and relevance. New international research infrastructures will have to grapple with an increasing number and diversity of stakeholders with wide-ranging and sometimes contradicting expectations that must be reconciled with their science goals. Today, there is clearly a need for inclusiveness in the governance, business, and financing structures and processes of international research infrastructures. Emerging countries, civil society and private citizens must have a seat at the table. Stakeholder diversity also requires redesigning the data access models so they can be available for non-experts, including civil society members and private citizens. To respond to the increasing complexity and diversity of demands, the panels saw that the future of international research infrastructures probably lies in the development of networks across a balanced portfolio of facilities and services. This will require a more strategic approach to international research infrastructure investments toward creating a globally balanced ecosystem.

“New international research infrastructures will have to grapple with an increasing number and diversity of stakeholders with wide-ranging and sometimes contradicting expectations...”

Theme B

Practical steps toward effective global research infrastructure governance



ICRI 2021 | MICHAEL ONEILL | PARALLEL SESSIONS SUMMARY REPORT

Theme B Overview

GRI governance can impact scientific effectiveness, organizational efficiency, resilience to crisis, societal impacts, and long-term sustainability

- Theme B sessions explored:
 - **Session B1:** The Importance of GRI Governance
 - **Session B2:** Theoretical Background - Organizational Structure and Legal Options for GRI
 - **Session B3:** World Café – Creating the Right Model/Implementing the Model
 - **Session B4:** Summary of discussions and Participant Polls
- Reference Materials:
 - OECD reports addressing governance
 - Group of Senior Officials (GSO) Framework Criterion 2
 - Matrix of exemplar GRIs showing formality of governance & legal frameworks employed

21:05 / 1:32:03

Theme abstract

Governance can be described as the processes, structures, policies and organizational traditions that determine how people direct, administer or control an organization; how stakeholders have their say; how decisions are made; and how decision makers are held to account.

The governance of international research infrastructure faces specific challenges because their funding partners and user communities are multinational. The governance model can have a significant impact on scientific effectiveness, societal impacts and organizational efficiency. These can, in turn, have an impact on long-term sustainability, including the ability to improve both services for science communities and support from funders.

In order to maximize effectiveness, governance models should be tailored to global research infrastructures based on:

- the expectations and needs of the science community;
- a broad set of stakeholders;
- the infrastructure's historical and anticipated development; and
- the needs and capabilities of the global research infrastructure as it matures.

The organizational structures that support governance can range from highly structured and centralized, like CERN, to very decentralized and loose, like the LIGO Collaborative.

The Group of Senior Officials (GSO) Framework Criterion 2 – Partnership Management speaks to the importance of defining roles and responsibilities early on, having the ability to evolve with time and using independent scientific advisory bodies.

Theme summary

The aim of the session was to equip participants with a sound understanding of organizational structures and legal options for international research infrastructure through presentations from research infrastructure managers as well as legal and governance experts. As a practical application of the acquired knowledge, the panel experts joined in a World Café where they formulated guidelines for creating, implementing, and managing international research infrastructures during a global crisis. They shared their own experiences and discussed the learnings from the previous presentations. The global pandemic crisis showed that agile, responsive and flexible governance mechanisms are extremely important for international research infrastructure's effectiveness and long-term sustainability.

Panel B1 agreed that dealing with members from different countries and a high degree of heterogeneity in terms of financial and scientific contributions is a challenge that cannot be taken up without consensus and understanding. The resilience of international research infrastructures depends on the legal structure, proactivity, transparency of the management teams and level of trust among the different stakeholders.

Complex issues in complex environments require not only defining roles and responsibilities as early as possible but also having trust and mutual understanding, which are highly dependent on the quality of human relations. Synergies and mutual benefits can be exploited with federations of infrastructures like the Global Ecosystem Research Infrastructure (GERI), using very informal governance models.

The presentations in panel B2 showed that organizational structures that support governance can range from highly structured and centralized (like the Long-Baseline Neutrino Facility/ Deep Underground Neutrino Experiment) to very decentralized and loose (like the GERI) and still be highly effective. The governance model used should adhere to the principle of “form follows function.” Also, multiple legal tools are often used in a single GRI. Managing the financial consequence of project technical changes in the context of binding vs. non-binding agreements requires attention. Legal frameworks may also restrict important operational elements like staff mobility. Basic challenges and successes of governance are closely linked to funding mechanisms, business innovation, access provision and performance monitoring.

To build a sense of common purpose among the international research infrastructure organizations, leadership, good governance and quality human relations are all necessary.

The participants of the World Café in panel B3 agreed that to create the right governance model, practitioners should define specific goals, be flexible and consider the entire international research infrastructure life cycle. Then, to implement the governance model, they should work with political actors and rely on a tandem of managerial and scientific leadership. Practitioners should also address the skills gaps by communicating about governance matters and providing education and training opportunities.

The global pandemic showed that crises can create new opportunities and threats. Indeed, crises may require international research infrastructures to quickly expand research to new areas, to look for alternative sources of funding and to overcome administrative burdens. To respond to these challenges, governance should be flexible enough to allow for rapid reactions as it did during the pandemic.

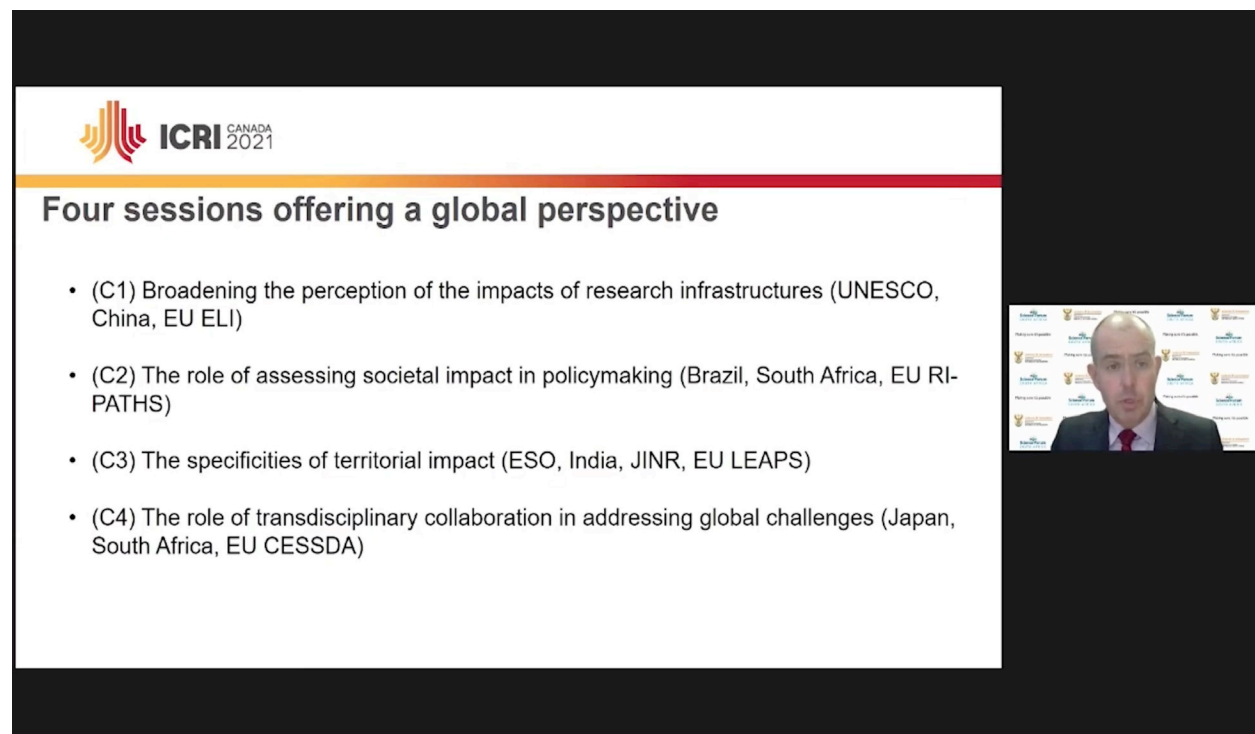
In summary, the Theme B panellists and participants concluded that the international research infrastructure community should:

- continue to promote and inform good governance practices at global forums such as ICRI and the OECD Global Science Forum;
- foster international discussions to modify legal frameworks where possible to reduce impediments to international research infrastructure operability; and
- initiate future discussion topics specifically around financial frameworks, including good practices and overcoming challenges.



Theme C

Assessing and communicating societal impact: The impact of research infrastructures and their contribution to societal welfare



The screenshot shows a presentation slide with the ICRI CANADA 2021 logo at the top left. The slide title is "Four sessions offering a global perspective". Below the title is a bulleted list of four sessions: (C1) Broadening the perception of the impacts of research infrastructures (UNESCO, China, EU ELI), (C2) The role of assessing societal impact in policymaking (Brazil, South Africa, EU RI-PATHS), (C3) The specificities of territorial impact (ESO, India, JINR, EU LEAPS), and (C4) The role of transdisciplinary collaboration in addressing global challenges (Japan, South Africa, EU CESSDA). On the right side of the slide, there is a video inset showing a man in a suit and tie speaking, with a background of logos.

Theme abstract

This parallel theme went beyond the traditional studies on how to measure the potential and socio-economic impact of research infrastructures. It told a story that was theoretically founded on socio-economic grounds but based on experiences and concrete examples from different research infrastructures. The four sessions offered a sequence of case studies of research infrastructures' societal impact, using examples from all continents, different scientific domains and different research infrastructure types (single-sited and distributed).

Theme summary

There is a high degree of consensus that research infrastructures need to show their broader direct and indirect impacts, both to politicians and to the public. Research infrastructure managers need to demonstrate how their projects lead to economic benefits, inspire youth and promote diplomacy. Consequently, they need to start collecting data early, define impacts broadly, use success stories and develop alliances to support investment cases based on project impacts.

In the discussions, the panellists recognized that each research infrastructure is unique. It has its own geographic, political, societal and scientific context. As indicators need to lead to a meaningful and feasible impact assessment, the indicator system should be agreed upon with the research infrastructure stakeholders. The OECD Reference Framework of Indicators can be a valuable tool to assess the quality, effectiveness or trends of a particular aspect of the research infrastructure, such as promotion of education or social responsibility.

Regarding the territorial impact of research infrastructure, panellists indicated that there should be a balance between the requirement of global scientific excellence and local, regional and national priorities. Consultation and coordination between local, regional and national policymakers is essential to have an optimized research infrastructure distribution that considers the local context and promotes regional development. In addition, social acceptance and a good understanding of the local engagement rules are critical for all research infrastructures.

To assess the impact of research infrastructures and their effectiveness, data collection and sharing is crucial. It is the transdisciplinary collaboration between researchers and stakeholders that enable research to move forward and solve community problems.

The panellists concluded that a broadened perspective of impacts of research infrastructures, including their territorial impact, are important to inform policymaking for research infrastructures and to harness their potential to enable transdisciplinary collaboration to support local communities and address global challenges.

“As indicators need to lead to a meaningful and feasible impact assessment, the indicator system should be agreed upon with the research infrastructure stakeholders.”

Theme D

Enabling collaboration between academic and public sector research



Theme abstract

Research infrastructures that enable collaboration between curiosity-driven academic research and the mission-driven research undertaken by government departments and agencies can amplify scientific outcomes. They can also lead to new solutions to complex challenges such as climate change, emerging diseases and cybersecurity. As a topic of growing interest in many countries, this theme explored:

- how these collaborations have managed the COVID-19 crisis;
- how they may contribute to future crises;
- how data sharing practices help or hinder collaboration; and
- how to attract the next generation of research talent.

Theme summary

The fourth parallel session focused on collaboration between the academic and public sectors. The session opened with the motto “Be as open as possible and as closed as necessary.” However, Martha Crago explained that there are counter currents that need to be considered very carefully, including cyber hacking and theft of intellectual property, data and information. Openness requires security and trust. Furthermore, data should be considered as infrastructure, and tools to ease data sharing should be improved. However, we must respect data sovereignty, too, including among Indigenous people.

To face the global challenges, funders must work together to set priorities and reduce inequalities between the global North and South and within each region. To achieve this, everyone must contribute, whether by funding, expertise or other support. “Glue money” to facilitate collaborations is essential but often hard to find. Also, networks need to be coordinated and institutions need to constantly innovate as systems change quickly.

Recently, the pandemic has taught us that open science is not spontaneous: it relies on the trust built up over many years. During the last months, the actual challenge was not so much the shift in priorities as the speed and pressure for fast solutions. Moving to a remote operations model made us reflect upon what labs will look like in the future. In Australia, this reflection gave rise to the Labs of the Future initiative, to envision and plan for a future that will be quite different. So, foresighting needs to be an enormously important part of the planning process.

The pandemic has also changed how we build the talent pipeline. It showed us that diversity and inclusion should be further promoted, and that to face the new challenges, talent with social science and other disciplinary backgrounds are essential.

SPECIAL PANELS ON CANADIAN SCIENCE AND RESEARCH

Sharing data and balancing priorities: A view from Canada’s research funders

Moderator

Roseann O’Reilly Runte, President and CEO, Canada Foundation for Innovation

Panellists

Alejandro Adem, President, Natural Sciences and Engineering Research Council of Canada (NSERC)

Ted Hewitt, President, Social Sciences and Humanities Research Council (SSHRC)

Michael Strong, President, Canadian Institutes of Health Research (CIHR)

Panel presentations and discussions

The fourth plenary session focused on Canada’s research funding ecosystem with sharing data and balancing priorities. It provided an opportunity to learn about open science and to see different ideas about open science’s dynamic concept. The panel addressed a broad spectrum of issues and priorities.

Ted Hewitt briefly described the Social Sciences and Humanities Research Council (SSHRC) and its collaborations with the Canadian Institutes of Health Research (CIHR) and the Natural Sciences and Engineering Research Council of Canada (NSERC) to promote open science in Canada. To this end, SSHRC and the other councils now require funded researchers to publish their work in open-access journals and publications within 12 months after publication. As a next

step, the councils plan to apply a similar requirement for research data that derives from the councils' funded projects. In time, this will make research data broadly available for research in Canada and worldwide.

Alejandro Adem sought to clarify both the nature and scope of open science, noting that it involves not only university-based research or science but also the science being done within the government. Alejandro Adem pointed to the open science roadmap produced by Canada's Chief Science Advisor as an important step in setting out the principles for open science in Canada and the world. Lastly, Alejandro Adem argued that while it is important to have policies and principles in place for open science, it is equally important to ensure that researchers and others apply these to foster the transparency and accessibility of publicly funded science.

Michael Strong observed that a major impediment to open science is the opposition of incentives between scientific publishing and publicly funded research. The former seeks to maximize the economic value of research findings. The latter, taxpayer-funded institutions, seek to ensure that research and research findings are available to the broadest segment of users. This has resulted in a research dissemination model where publishers charge researchers many thousands of dollars to publish open access articles, based on research that was publicly funded — creating a further obstacle to open science. However, Michael Strong also noted that though the scientific response to the pandemic may have contributed to the open science movement, it also provides a cautionary tale. As Michael Strong noted, the past months have seen many examples of the shortcuts taken by scientists who published findings in news articles and commentaries, long before their scientific data had been validated. Thus, open science should only be encouraged where it supports sound scientific practice, including in the dissemination of data.

In conclusion, the panellists agreed that we must emphasize that science is not monolithic. It is based on gathering evidence and on applying analytical tools. This means following the way that science is done, a requirement that is not always entirely well understood by the public. Nevertheless, the principle remains the same: there is a need to disseminate freely accessible data that can be interpreted and looked at by scientists worldwide and that is open for their interpretation.

Canada and the world: Research collaboration is more important than ever

Moderator

Roseann O'Reilly Runte, President and CEO, Canada Foundation for Innovation

Panellists

Mitch Davies, President, National Research Council Canada

Mona Nemer, Chief Science Advisor (Canada)

Fred Wrona, Special Science Advisor, Laboratories Canada

Panel presentations and discussions

The fifth plenary session focused on research collaboration's importance in Canada and the world in the context of global challenges with the pandemic. It provided an opportunity to see different points of pride regarding Canada's research and research infrastructure. The panel addressed a very broad spectrum of global challenges and possibilities.

Mona Nemer began by stating the importance and richness of Canada's ecosystem of research facilities, as shown by the response of government research facilities in facing the pandemic. This level of cooperation in the national interest contributed greatly to our understanding of the pandemic, which was critical to government's public policy response to the crisis. For example, inter-agency collaborations assisted governments to estimate the need for diagnostic testing and how to supply Canadian facilities with reagents. About open science, Mona Nemer observed that access to data is fundamental to scientific discovery. However, Mona Nemer argued that enhancing access to research data will not be without challenges, noting that issues such as interoperability of systems is an impediment to the open data movement. Given this, ensuring that systems are in place for data to be shared may represent the next frontier in terms of research infrastructure.

Mitch Davies began his presentation with an overview of the National Research Council Canada's 14 research centres and 126 facilities, which represent approximately \$2 billion of Canadian research infrastructure. Mitch Davies noted that NRC facilities are engaged in leading-edge research projects, such as compound semiconductors for photonics and microelectronics, which are critical to growth in several sectors, including telecommunications, health care, defence and security, environment and the automotive industries. Mitch Davies also pointed to other projects in the areas of pulsars and dark energy where NRC researchers are poised to make important breakthroughs. In addition, the research infrastructure under NRC's stewardship also contributes to the design and fabrication of scientific instruments that derive from the NRC's expertise. These instruments are part of the significant contribution made by the NRC to Canadian science. Finally, Mitch Davies noted that the NRC embraces the principles of open science. In practice, this means a commitment to data accessibility and its treatment as an institutional resource.

Describing Laboratories Canada, Fred Wrona noted that federal science facilities encompass approximately 2,400 buildings and a total floor area of 2.5 million square metres, representing about 11 percent of the government's overall portfolio of science infrastructure. Having these facilities puts Canada at the forefront of countries for their capacity in science and technology. Fred Wrona pointed to Canada's investments in research infrastructure in the North and said that support for northern science is enabling research of global importance in areas such as climate change.

In conclusion, the panellists agreed that there are many reasons to be extremely proud and enthusiastic about research and science in Canada. They also acknowledged the important contribution made by the Canada Foundation for Innovation (CFI) to increasing awareness of Canadian research infrastructures. All panellists pointed to the CFI's Navigator as a tool that has made it easier to find the Canadian specialized science infrastructure. The panellists also noted their view that large infrastructures are the perfect platform for collaboration across countries but also across sectors and between the private, the public and the university sector, to make sure that our research goes from discovery to communities. Therefore, this will involve increased collaboration among regulators, researchers and the supply chains.



ANNEX A

Session panellists and contributors

ICRI 2021 Meet our speakers

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- Watch "Theme A" case studies
- Meet our speakers**
- Connect with delegates
- Discover global infrastructures
- How we responded to the pandemic
- Learn about our partners
- Join the group conversation
- About this platform
- Tech support

 Sekazi Mtingwa TRISEED Consultants, LLC	 Gail Murphy The University of British Columbia	 Maribeth Murray Arctic Institute of North America	 Isayvani Naicker	 Shamila Nair-Bedouelle	 Mylène Shiroko Ndisi Université Clermont Auvergne
 Mona Nemer Office of the Chief Science Advisor of Canada	 Clifford Nxomani National Research Foundation (NRF) of South Africa	 Michael O'Neill Canada Foundation for Innovation	 Roseann O'Reilly Runte Canada Foundation for Innovation	 Anna Panagopoulou European Commission, Directorate General for Research and Innovation	 Gelsomina Pappalardo

PARALLEL SESSION THEME A

International research infrastructures: The way forward

Moderators and rapporteurs

Heidi Bandulet, Canada Foundation for Innovation
Frédéric Sgard, OECD – Global Science Forum
Carthage Smith, OECD – Global Science Forum

Panel A1: International data management policies and practices

Panellists

Naveed Aziz, CGEn
Kathryn McWilliams, University of Saskatchewan
Andrew Smith, ELIXIR
Victoria Tsoukala, European Commission
Steven Vermeulen, EBRAINS
Makina Yabashi, RIKEN SPring-8 Center

Case studies

Stephanie Russo Carroll, University of Arizona
Si Woo Yoon, Korea Institute of Fusion Energy

Panel A2: Financing international research infrastructures

Panellists

Alain Becoulet, ITER
Apostolia Karamali, European Commission
Eric Smith, NASA
Nigel Smith, SNOLAB/TRIUMF

Case studies

Matthew Hawkins, United States National Science Foundation
Ivan Logashenko, Budker Institute of Nuclear Physics
John Wormersley, University of Oxford

Panel A3: Meeting stakeholder expectations for international research infrastructures

Panellists

Catherine Cesarsky, Commissariat à l'Énergie Atomique et aux Énergies Alternatives (CEA)
Susan Daenke, Instruct – ERIC
Maribeth Murray, Arctic Institute of North America
Ulrich Schurr, Forschungszentrum Jülich

Case studies

Maria Faury, Commissariat à l'Énergie Atomique et aux Énergies Alternatives (CEA)
Tetsuya Ishikawa, RIKEN SPring-8 Center
Sekazi K. Mtingwa, TriSEED Consultants, LLC

Panel A4: Toward new partnerships in international research infrastructures

Panellists

Philip Diamond, Square Kilometre Array Observatory (SKA)
Sergey Nedelko, Joint Institute for Nuclear Research (JINR)
Mylène Shiroko Ndisi, Université Clermont
Sandy Starkweather, Sustaining Arctic Observation Networks

Case studies

Sean Dougherty, Atacama Large Millimeter Array
Matthew Hawkins, United States National Science Foundation
Joe Miller, Global Diversity Information Facility
Clifford Nxomani, South African National Research Foundation
Mark Thomson, United Kingdom Science and Technology Facilities Council

PARALLEL SESSION THEME B

Practical steps toward effective global research infrastructure governance

Moderator and rapporteur

Matthew Hawkins, United States National Science Foundation

Panel B1: Practical examples

Panellists

John Amuasi, African Research Network for Neglected Tropical Diseases

Robert Feidenhansl, European XFEL

Eija Juurola, Finnish Meteorological Institute

Henry (Hank) Loescher, Battelle Memorial Institute

Panel B2: Theoretical background

Panellists

Marialuisa Lavitrano, University of Milano-Bicocca

Stephen Markus, United States Department of Energy

Carlo Rizzuto, CERIC-ERIC

Andrew Smith, ELIXIR

Panel B3: World Café of participants

Panellists

Altaf Carim, United States Department of Energy

Ewa Deelman, University of Southern California

Wolfgang Eberhardt, SESAME Council

PARALLEL SESSION THEME C

Assessing and communicating societal impact: The impact of research infrastructures and their contribution to societal welfare

Moderator and rapporteurs

Xavier Barcons, European Southern Observatory (ESO)

Daan du Toit, South African Department of Science and Innovation

Allen Weeks, ELI ERIC (moderator)

John Womersley, University of Oxford

Panel C1: Broadening the perception of the impacts of research infrastructures

Panellists

Linhao Chen, Chinese Ministry of Science and Technology

Shamila Nair-Bedouelle, UNESCO

Allen Weeks, ELI ERIC

Panel C2: The role of assessing societal impact in policymaking

Panellists

Elina Griniece, EFIS Centre
Andrei Polejack, World Maritime University
Rakeshnie Ramoutar-Prieschl, University of Pretoria

Panel C3: The specificities of territorial impact

Panellists

Caterina Biscari, League of European Accelerator-based Photon Sources (LEAPS)
Yashwant Gupta, Tata Institute of Fundamental Research
Dmitry Kamanin, Joint Institute for Nuclear Research (JINR)

Panel C4: The role of transdisciplinary collaboration in addressing global challenges

Panellists

Ron Dekker, CESSDA ERIC
Yuko Harayama, RIKEN
Clifford Nxomani, South African National Research Foundation

PARALLEL SESSION THEME D

Enabling collaboration between academic and public sector research

Moderator and rapporteurs

Martha Crago, McGill University
Jeff Kinder, Institute on Governance
Ezra Miller, Ibex Consulting

Panel D1: Optimizing data sharing in academic–public sector collaborations

Panellists

Ron Dekker, Consortium of Social Science Data Archives
Hilary Hanahoe, Research Data Alliance
Gail Murphy, University of British Columbia

Panel D2: Solving future crises through collaborations

Panellists

Fleming Crim, United States National Science Foundation
Peter Gluckman, International Science Council
Meng-Fan Luo, Taiwan Ministry of Science and Technology
Mark Thomson, United Kingdom Science and Technologies Facilities Council
Vaughan Turekian, United States National Academies of Sciences, Engineering, and Medicine

Panel D3: Lessons learned from COVID-19's impact on academic–public sector collaborations

Panellists

Muriel Attané, EARTO

Pei-Zen Chang, Taiwan Industrial Technology Research Institute

Arthur B. McDonald, SNOLAB

Gelsomina Pappalardo, Consiglio Nazionale delle Ricerche - Istituto di Metodologie per l'Analisi Ambientale

Sarah Pearce, Commonwealth Scientific and Industrial Research Organisation

Panel D4: Attracting talent and building connections to foster new collaborations

Panellists

Eckhard Elsen, CERN

Sarah Gallagher, Canadian Space Agency

Monika Stachura, TRIUMF