



ICRI 20
24

International Conference on Research Infrastructures

3-5 December 2024

Conference Report

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Call: HORIZON-INFRA-2024-ICRI-IBA

(International Conference on Research Infrastructures – ICRI 2024)

Topic: HORIZON-INFRA-2024-IBA-ICRI

Type of Action: HORIZON-CSA (HORIZON Coordination and Support Actions)

Proposal number: 101177629

Proposal acronym: ICRI 2024

Type of Model Grant Agreement: HORIZON Action Grant Budget-Based

Acknowledgements

ICRI 2024 was delivered by Australia's national science agency, CSIRO, in cooperation with the European Commission and the Australian Department of Education.

We would like to acknowledge the invaluable contributions provided by ICRI 2024's speakers, panellists, moderators and rapporteurs.

Thank you to the International Program Committee for generously providing their time insights, and expertise. Co-chaired by Michael Arentoft and Dr Alex Cooke, with members Gonzalo Arenas, Inmaculada Figueroa, Andrew Gilbert, Hilary Hanahoe, Matt Hawkins, Ondřej Hradil, Bob Jones, Antje Keppler, Ohseok Kwon, José Luis Martínez Peña, Michael O'Neill, Imraan Patel, Roland Roberts, Uracha Ruktanonchai, Frederic Sgard, Carthage Smith, Ian Smith, Sronkanok Tangjajit, Graham Wright, and Lisa Yen, with support from Patricia Postigo-McLaughlin and Pierre Quertenmont.

Many thanks to CSIRO's Chris Krishna-Pillay for deftly acting as Master of Ceremonies.

ICRI 2024 was organised by CSIRO's Alex Stott, Carla McBride, Sally Way, Chris Still, Alana Fitzgerald, Kerisha Parkes, and Ofa Fitzgibbons, with assistance from the Australian Department of Education's Jessica Brosnan and Josephine Church.

We would also like to acknowledge the 34 friendly and enthusiastic CSIRO staff members who volunteered their time to assist with the running of ICRI 2024.

And finally, we'd like to acknowledge our generous partners who we couldn't have delivered the event without. Thank you to our Platinum Partners; Queensland Government Department of the Environment, Tourism, Science and Innovation, and Amazon Web Services (AWS). Gold Partner; Queensland University of Technology (QUT) and Silver Partners; University of Queensland (UQ), Canberra Data Centre (CDC), and the CSIRO ON Innovation Program.



Introduction

Hosted biennially, the International Conference on Research Infrastructures (ICRI) is the major professional forum for the global research infrastructure (RI) community. It plays an important international role building the capacity, capability, collaboration and performance of research infrastructures around the world.

ICRI 2024 was held in Brisbane, Australia, from 3 to 5 December 2024. It was the first time the conference has been held in the Asia Pacific.

As was pointed out during some ICRI sessions there has, historically, been a lack of conversation between Northern and Southern Hemisphere nations around research infrastructure. Bringing ICRI to Brisbane enabled more nations from the Asia Pacific to engage with the global research infrastructure community.

11 Southeast Asian and Pacific nations attended ICRI 2024. Representatives from some of those nations also took part in panels, introducing voices and viewpoints to ICRI previously absent.

ICRI 2024 also successfully introduced other new perspectives, through a focus on Indigenous knowledge and engagement.

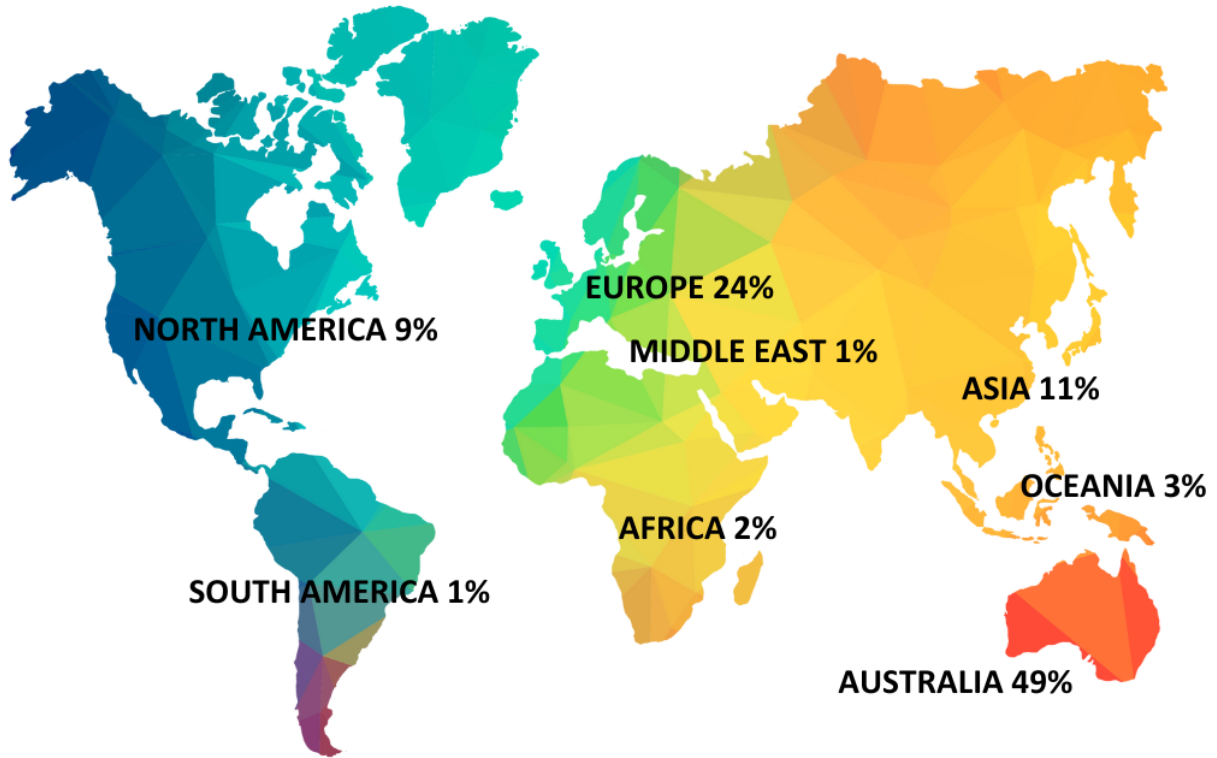
As a hybrid event, ICRI 2024 was livestreamed around the world. Doing so ensured the greatest possible level of global involvement and benefit from the sessions held, and allowed the expertise and experiences discussed to disseminate in many countries not otherwise represented at the conference.

ICRI 2024 was jointly hosted by the European Commission and the Australian Government Department of Education, and delivered by Australia's national science agency, CSIRO.



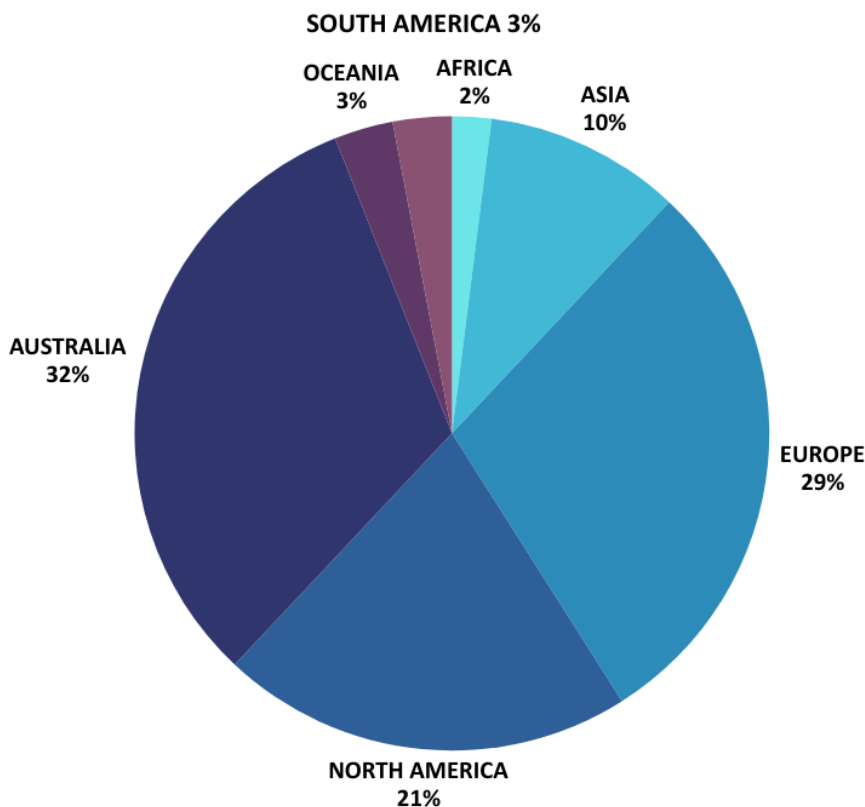
ICRI 2024 in numbers

In-person attendees



399 in person **423** online **6** continents **50** countries

Speakers



100 speakers

62 men

38 women

22 sessions

23 side events

ICRI 2024 official program

ICRI 2024 explored trends, challenges, and opportunities in research infrastructures globally. Key themes included:

Digital research infrastructure: Integrating Quantum, AI, High-Performance Computing (HPC) and other new technologies into RIs. Managing research data and building digital skills to support RIs.

Research infrastructure for translation: Ensuring RIs deliver societal impact, with a focus on international best practices and examples of RI-enabled translation into policy, community, and industry applications.

Global collaboration: Opportunities to expand global collaboration, partnership and access to RI.

Indigenous knowledge: Engaging with Indigenous communities and knowledge systems in developing and using RIs.

Hope and wonder (enabling future science): What are the future RI needs, how will they enable future science and technologies? Skilling the future workforce and imagining RIs beyond 2050.

Global challenges: climate change; feeding the planet; healthy communities: The role of RIs in addressing and collaborating on these challenges and showcasing best practice examples.



Opening Ceremony

Tuesday, 3rd December 9.00am, Great Room Plenary, W Hotel

Welcome to ICRI

- Dr Doug Hilton, Chief Executive Officer of CSIRO
- Tony Cook, Secretary of the Australian Department of Education

Welcome by the European Commission

- Marc Lemaître, Directorate-General for Research and Innovation from the European Commission (via video)

Baton pass

- Ondřej Hradil, Research Infrastructures Manager at Masaryk University
- Dr Alex Cooke, CSIRO

Summary:

Dr Doug Hilton AO, CEO of CSIRO, commenced the session by acknowledging the traditional custodians of the land and paying respects to First Nations Peoples as Australia's first scientists. He emphasised the significant role that First Nations Peoples played in unlocking knowledge from the universe and communicating it across tens of thousands of years, highlighting the importance of this legacy for modern science communication.

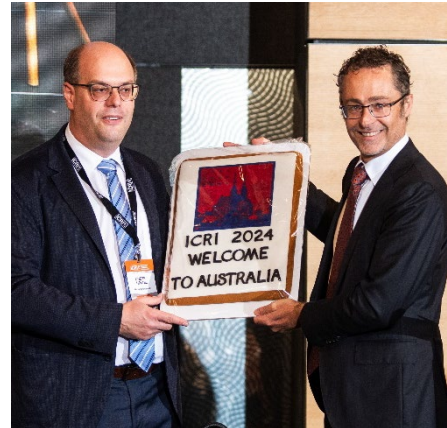
Tony Cook PSM, Secretary of the Australian Department of Education, expressed his gratitude to the conference organisers and volunteers. He emphasised the critical role research plays in Australia, noting that Australia would invest an estimated AUD\$16.5 billion in research in the coming years. Mr. Cook highlighted the importance of the National Collaborative Research Infrastructure Strategy (NCRIS), which supported over 100,000 researchers in 2023, as a key factor in advancing scientific progress and fostering collaboration.



Marc Lemaître, Director-General for Research and Innovation at the European Commission, spoke about the value of collaboration in science. He highlighted the significance of ICRI 2024, noting that it would build upon the momentum created by previous ICRI events. Mr. Lemaître underscored the importance of international partnerships in driving innovation and tackling global challenges through collaborative research infrastructure.

An online video call from the SKA Low (Square Kilometre Array) focused on First Nations engagement and the importance of sustainability in development. The SKA project, which aims to build one of the world's largest radio telescopes, has made strides in ensuring that the development process is inclusive and respects the cultural heritage and knowledge of First Nations communities.

The session concluded with a symbolic handover from **Ondřej Hradil** from Brno to **Dr Alex Cooke** from Australia, marking the transition of ICRI 2022 from Brno to ICRI 2024 in Brisbane.



Digital research infrastructure

Creating a trusted and secure research environment

Tuesday, 3rd December 2.00pm, Great Room 3, W Hotel

This session explored the challenges surrounding the creation of trusted and secure research environments, with a particular focus on data. It discussed different types of data pathways within research infrastructures and addressed key topics such as maintaining data sovereignty and developing effective digital environments that safeguard information while promoting transparency and accessibility. Through case studies and expert insights, attendees learned strategies for navigating these challenges and creating robust, open, and secure research infrastructures.

Moderator: Dr Ewa Deelman, Research Director at the University of Southern California's Information Sciences Institute (ISI)

Panel speakers:

- Dr Ashley VanderLey, Senior Advisor for Facilities in the Division for Astronomical Sciences at the National Science Foundation (NSF)
- Michael Arentoft, Head of Unit, Open Science, Directorate-General Research and Innovation at the European Commission
- Dr Mohamad Nasser Eddine, Vice President of Programs and Planning for the Canada Foundation for Innovation
- Professor Phil Quinlan, Professor of Digital Engineering and Health Informatics at the University of Nottingham

Summary:

Ewa Deelman categorised research data into three types: collective, community, and complex data. Emphasising the challenges of handling sensitive data, she also stressed the need for environments that protect privacy while enabling secure analysis.

Ashley VanderLey underscored the importance of integrating security from the design phase of research facilities, particularly within the NSF's large infrastructure projects.

Phil Quinlan addressed the difficulties of integrating diverse research infrastructures, focusing on secure data sharing across various systems.

Mohamad Nasser Eddine highlighted the evolving challenges at the Canada Foundation for Innovation, stressing the need for international collaboration and flexible infrastructures to meet the changing demands of the research community.

Michael Arentoft provided an overview of the European Commission's policymaking role, noting the significance of digitalisation and cybersecurity. He discussed the challenges of cybersecurity vulnerabilities, risks to technology transfer, and the potential threats to academic freedom and research integrity.

The discussion delved into the complexities of balancing open data sharing with security and governance. One key issue was the competition for limited funding, particularly when essential infrastructure needs, like telescope maintenance, were prioritised over cybersecurity. Panellists pointed out that basic cybersecurity measures, such as protecting against ransomware, could prevent significant disruptions. Creating a culture of security awareness within research environments was also emphasised, with humour and innovative training methods cited as effective ways to engage researchers in security practices.

Another challenge discussed was the reconciliation of frameworks like Five Safes and FAIR. The Five Safes framework restricts data access based on project safety, while FAIR advocates for openness. Panellists highlighted the need for a balanced approach that ensures security without hindering data accessibility or usability. They also discussed the rapid evolution of technology and the constant need to balance investments in new technologies with maintaining existing infrastructure.





The session also examined the funding of research infrastructures, stressing the importance of aligning investments with both current needs and future innovations. Panellists emphasised that funding solutions must be tailored to specific research domains, as different fields require distinct infrastructure solutions. Best practices must be shared across disciplines to create adaptable and sustainable research infrastructures.

Policymakers emphasised the principle of “as open as possible, as closed as necessary” and the need for clear legislative frameworks on data access, protection, and copyright. They stressed the importance of policies that clarify who can access data, under what conditions, and for which purposes, while ensuring that research institutions maintain trust and security through sound human resource policies.

The discussion also explored the challenges of domain-specific versus general research infrastructures. Domain-specific platforms facilitate specialised collaboration but may limit interdisciplinary work. General platforms offer scalability but require broader collaboration. Panellists suggested that a hybrid approach, where domain-specific platforms open up to other disciplines, might be the future of research infrastructure, promoting interoperability across fields.

The session concluded by addressing the importance of balanced governance structures that preserve the connection between researchers and the communities’ contributing data. Participants agreed that while data security and governance are critical, maintaining public trust and engagement is equally essential for creating sustainable and trustworthy research environments.

In conclusion, the panellists emphasised the need for a comprehensive, collaborative approach to research infrastructure that balances security, accessibility, and the preservation of public trust, ensuring that both current and future challenges in research data management are effectively addressed.

Building infrastructures and scaling up – data sharing on a global scale

Tuesday, 3rd December 3.00pm, Great Room 2, W Hotel

This session examined the value and challenges of scaling data infrastructures from national to global levels, focusing on three key areas: economies and challenges of scale, interoperability, and the impact of AI.

Moderator: Hilary Hanahoe, Secretary General of the Research Data Alliance (RDA)

Panel speakers:

- Dr Nigel Smith, Executive Director and CEO, TRIUMF
- Leo Chiloane, Manager, Data Infrastructure Node (uLwazi), South African Environmental Observation Network (NRF-SAEON)
- Dr Lesley Wyborn, Honorary Professor at the Australian National University (ANU)

Summary:

The session explored the complexities of global data sharing, emphasising the challenges posed by heterogeneity, differences in institutional data policies, and the infeasibility of a single universal solution. Interoperability was highlighted as a critical consideration, and achieving it requires a shared vision at the outset. A lack of consensus risks divergent solutions to identical problems. Institutions often operate at the intersection of government, industry, and academia, further complicating collaboration.

Europe's efforts, exemplified by the European Open Science Cloud and the EuroHPC Joint Undertaking, demonstrated a federated approach to data sharing, with nodes centralised around a European hub. Cross-border, interdisciplinary cooperation was acknowledged as essential to supporting research infrastructure investments. It was noted that accommodating diverse user cases through international collaboration aids standardisation efforts.

The session emphasised the importance of human resources in RI development. Academia prioritises career mobility, while governments and industries focus on retaining local talent. Ensuring adequate funding for the human component of data infrastructures was identified as a key challenge.

With respect to data interoperability, the uptake of the FAIR and CARE principles has improved globally but still requires substantial effort. It was stated that achieving CARE necessitates first adhering to FAIR standards.

Concerns were raised about global disparities in AI resources, which risk creating a two-tiered system where privileged groups dictate processes, standards, and protocols. To mitigate this,



inclusivity in training models and democratising data standards were emphasised. These efforts would ensure broader participation and equity. Lessons from the COVID-19 pandemic underscored the value of virtual and hybrid conferences, which allowed researchers without travel funds to engage internationally. Maintaining these formats was seen as vital for enriching the global research community.

Ethical considerations and the human aspect were highlighted as critical in AI development. The session concluded with a focus on the need for high-quality metadata and curation, essential for producing reliable data. Achieving global collaboration requires a concerted effort to build robust research infrastructure to address shared challenges effectively.

The session also promoted upcoming events like International Data Week 2025 in Brisbane, Australia, underscoring the importance of continued global engagement in the data-sharing community.

The role of RIs in training the digital workforce

Wednesday, 4th December 2.00pm, Great Room 1, W Hotel

Research infrastructures are essential in maximising research impact, but reliant on access to a skilled workforce. This session explored the pivotal role RIs play in providing crucial data and research software to train a digitally adept workforce, for their own needs and broader research communities.

The session highlighted strategies for developing expertise in advanced technologies and the foundational computational skills necessary for effective utilisation. By fostering these capabilities, RIs not only enhance their own operations but also empower researchers to harness cutting-edge tools for impactful discoveries.



Moderator: Manish Parashar, Director of the Scientific Computing and Imaging (SCI) Institute

Panel speakers:

- Dan Stanzione, Executive Director of the Texas Advanced Computing Center (TACC)
- Fotis Psomopoulos, Senior Researcher at the Institute of Applied Biosciences (INAB)
- Rosie Hicks, Chief Executive Officer of the Australian Research Data Commons (ARDC)

Summary:

The session emphasised the critical role of human capital in ensuring the success of research infrastructure projects. The importance of the digital workforce was highlighted, with discussions revolving around the different roles it plays within RI. These roles were categorised as: the digital workforce **at** the RI, the digital workforce **for** the RI, and the digital workforce **by**

the RI. It was emphasised that the workforce of the future must be adaptable and capable of working with both software and machinery to meet the evolving demands of digital RIs.



The Australian Research Data Commons (ARDC) presented a pyramid model for the digital workforce, which is structured from top to bottom as follows: NCRIS facilities, across-NCRIS initiatives, NCRIS staff, and institutions. This model underscored the need for improved communication between universities and RI operators to define roles and responsibilities, especially regarding training. Critical questions regarding the different roles, skill sets, and levels of competence required for effective functioning of the digital workforce were raised. There was also a focus on identifying the best-positioned stakeholders to provide training, as different organisations and sectors have varying expectations in the digital research infrastructure space.

The importance of programs that focus on "Training the Trainer" were discussed as a very effective way of upscaling teaching activities. These programs help ensure that a wider audience can be reached with necessary training and support. Moreover, RIs were encouraged to collaborate and uphold good practices by offering training, a role traditionally managed by educational institutions. Supercomputing facilities, for instance, identified graduate students as the largest volume of users, followed by post-doctoral researchers. A gap was observed where these students often lack adequate training before engaging with supercomputing resources, leading to frustration among staff who are tasked with assisting inadequately prepared users.

Several key questions were addressed during the session:

- **What are the key skillsets required by the digital workforce in RI, and where are the gaps?** The session noted that RIs often work on the frontier of research, pushing the boundaries of innovation. Consequently, users are not always trained in the specific methods needed for their work on RI platforms. A significant gap identified was the knowledge disconnect between the services provided by RIs and the users who would benefit most from them.
- **How are gatekeeping processes handled, particularly in the context of unoptimized code that is too power-hungry?** Review committees play an essential role in determining which research projects gain access to compute resources. While allocation systems are effective in supporting access, supercomputing facilities often face high demand, leading to oversubscription. Transparent systems for allocating

access were suggested to ensure accountability and allow researchers to view others' ideas, fostering a collaborative environment. Such systems also ensure that users make effective use of the time and resources allocated to them.

- **How can the growing scope of users, including graduate students and industry professionals, be managed given the limited number of available trainers?** With the increasing number of users, particularly students and industry professionals, the challenge of scaling training became a prominent issue. It was suggested that funding agencies need to be convinced of the value of AI tools in supporting user training. This approach should be embraced enthusiastically by the research community, as these tools can enhance the effectiveness of training and help researchers get the most from available systems. Clear communication of the benefits of such advancements to funders was highlighted as critical in securing support.

In conclusion, the session underscored the need for a well-trained and adaptable digital workforce to support research infrastructure. It highlighted the importance of bridging skill gaps, fostering collaboration, and ensuring effective training programs to maximise the use of RI. There was a strong call for greater communication between stakeholders, as well as for embracing technological advancements like AI to scale training efforts and meet the growing demand for digital workforce support.

Research infrastructure for translation

Research infrastructure business models that enable translation

Tuesday, 3rd December 3.00pm, Great Room 1, W Hotel

This session explored how RI facility settings can significantly increase the potential for real-world impact from research. This includes both industry translation, such as turning research discoveries into new commercial products, and more social forms of translation (policy translation), like environmental research changing government policy or new medical techniques being used in hospitals.

Moderator: Jane Fitzpatrick, Chief Executive Officer at the Australian National Fabrication Facility (ANFF)

Panel speakers:

- Dr David Gottfried, Regents' Researcher and Associate Director in the Institute for Matter and Systems at the Georgia Institute of Technology
- Dr Eija Juurola, Director General of ACTRIS ERIC, the Aerosol, Clouds and Trace Gases Research Infrastructure
- Dr Hank Loescher, Director of Strategic Development, Environment and Infrastructure at the National Ecological Observatory Network (NEON)
- Professor Takata Masaki, President of the Photon Science Innovation Center, Japan

Summary:

The session focused on the barriers to translation in research and innovation, with a specific emphasis on the challenges faced when bridging academia and industry. One of the key barriers identified was the complexity of facilitating industry access to university-hosted facilities, which often involves navigating legal, insurance, and intellectual property (IP) concerns. Additionally, it was noted that academia typically operates on slower timescales compared to the fast-paced nature of industry, and the goals of academia often differ from those of industry.

To address these challenges, the panel discussed the importance of strategic development and governance tools that can foster collaboration and encourage innovation across these different research cultures. These tools are seen as essential for aligning the different operational speeds and priorities of both sectors, however measuring the impact of translational research has proven difficult. For instance, the National Nanotechnology Coordinated Infrastructure (NNCI) in the US conducted a pilot study evaluating job creation and the economic impact at the state level. However, the panel agreed that scaling this up to a national level would be a complex task.

It was also emphasised that research infrastructure should support translation research but not at the expense of fundamental research, which is foundational for long-term scientific advancements. Several panellists provided examples of initiatives where translation research was successfully integrated with fundamental research:

Professor Takata Masaki described an innovation ecosystem model that included both public and private sector participation. This coalition model involved a 1:1 co-investment between industry and academia, allowing industry partners to access beamlines without peer review while maintaining their intellectual property (IP).

Dr Hank Loescher shared insights into NEON's distributed network of 120 observation sites. Initially, NEON and the Global Ecosystems Research Infrastructure (GERI) did not prioritise translation outcomes but later integrated this focus, learning the importance of mentoring and managing a culture of integrated innovation.



Dr David Gottfried highlighted how NNCI's network of 71 facilities across 16 locations fostered innovation and entrepreneurship by providing flexible platforms for collaboration among academia, industry, and government.

Dr Eija Juurola discussed how ACTRIS served as a platform for innovation in atmospheric sciences, supporting high-quality datasets, instrument co-design, and improved measurement techniques.

In conclusion, the session underscored the need for integrated governance, mentorship, and a focus on balancing the demands of translation research with the pursuit of fundamental scientific advancements.

Research infrastructure success stories in supporting research translation

Thursday, 5th December 10.00am, Great Room, W Hotel

This session featured three successful best-practice cases of how research infrastructures can support translation. It covered diverse fields of science and application areas. The speakers shared their examples and reflected on the settings within their RI that made this translation possible, and how it has contributed to societal benefit.

Moderator: Ondřej Hradil, Research Infrastructures Manager at Masaryk University

Panel speakers:

- Claire Brown, Director of Advanced BioImaging Facility (ABIF) at McGill University
- Edward Mitchell, Head of Business Development at the European Synchrotron Radiation Facility (ESRF)
- Dr Michelle Heupel, Executive Director of Australia's Integrated Marine Observing system (IMOS)

Summary:

The session showcased panel members' insights into their respective Research Infrastructures and highlighted examples of successful knowledge translation.

Ed Mitchell discussed the European Synchrotron in Grenoble, emphasising its innovative work on imaging batteries. He described their use of cutting-edge imaging technologies to examine batteries in a "battery torture chamber," where batteries undergo rigorous industry-standard tests, such as the "nail test." This approach has advanced the understanding of battery performance and safety in extreme conditions, aligning scientific research with practical industry applications.

Michelle Heupel presented on Australia's Integrated Marine Observing Systems (IMOS) and their success in optimising ocean shipping routes. By leveraging observational data, IMOS contributed to significant reductions in fuel consumption and carbon emissions for the shipping industry, demonstrating the practical benefits of RI in addressing global environmental challenges.

Claire Brown highlighted the efforts of the Global BioImaging Network to enhance training and capacity building. The network established "train-the-trainer" programs, enabling experts to train others in their regions. This approach has fostered global upskilling and contributed to the dissemination of advanced imaging techniques, ensuring broader accessibility and application of RI expertise.



The subsequent discussion addressed the challenges and opportunities associated with global RIs. Panellists emphasised the importance of human resourcing in supporting global networks. Although the financial investment required may be relatively low, substantial effort is needed to build and sustain these networks.

A key point was the necessity of understanding the specific needs of end-users and international partners, particularly those in low-income countries. Panellists advocated for a user-centric approach, suggesting that asking partners "What do you need?" and aligning those needs with RI capabilities is more effective than imposing pre-defined solutions.

Training was recognised as a critical impact of RIs, with many skilled professionals transitioning into industry roles. Panellists also discussed data access models, noting that while open-access data can benefit the scientific community, commercial models allowing industry users to pay for equipment usage while maintaining RI sustainability are also valuable.

The session highlighted the importance of mobility funding for collaborations with low-income countries. Free training programs lose their impact if participants cannot afford travel. Collaboration between low-income countries was seen as especially beneficial, as researchers in these regions often share an understanding of working within resource-limited environments.

This discussion underscored the pivotal role of RIs in fostering innovation, building capacity, and addressing global challenges through collaboration and knowledge translation.

Global collaboration

Showcasing successful global research infrastructure collaborations

Thursday, 5th December 9.15am, Great Room, W Hotel

This session showcased successful large-scale international research infrastructure collaborations that have navigated scientific and policy challenges to build unique facilities and global networks. Each case study illustrated the varying levels of technological and institutional alignment required to achieve global integration and impact.

Moderator: Inmaculada Figueroa, Deputy Director General for International Consortia, Organisations and Research Infrastructures at the Ministry of Science, Innovation, and Universities of Spain

Panel speakers:

- Professor Rory Fitzgerald, Director of the European Social Survey, European Research Infrastructure Consortium (ESS ERIC)
- Satoshi Matsuoka, Director of RIKEN Center for Computational Science (R-CCS)
- Sylvain Charbonneau, President and CEO of the Canada Foundation for Innovation
- Dr Kate Thibault, Science Lead for the National Ecological Observatory Network (NEON) Program

Summary:

The panel explored global collaboration in research infrastructure, highlighting its role in addressing global challenges, effective frameworks for partnerships, and the tangible impacts of collaborative efforts across multiple disciplines. Panellists shared specific examples from their work, emphasising the importance of clear governance, adaptability, and alignment with shared values.



Panellists underscored the transformative impact of global collaboration in generating comprehensive solutions to complex global challenges. Integrating local, on-the-ground data with satellite observations was identified as a critical approach to improving data quality and developing truly global insights. For example, combining these data sources enables accurate modelling of environmental and societal phenomena. In social sciences, cross-national surveys have shed light on how differing healthcare systems influence public health outcomes, offering comparative perspectives that inform policy and practice worldwide.

Given the complexities of managing national and international collaborations, panellists emphasised the need for robust and flexible frameworks. The importance of establishing sound investments and clear relationships at the outset of any partnership was highlighted. Successful collaborations require openness where possible and confidentiality where necessary, patience in building trust, and shared values among partners. Governance structures, standardised protocols, and adaptability were also identified as essential elements that enable diverse stakeholders to contribute effectively.

Collaborative efforts in climate science, such as partnerships with the IPCC, have led to advanced climate models instrumental in disaster prevention and mitigation. In high-performance computing (HPC), industry collaborations have influenced the design of cutting-edge systems and facilities, exemplifying the synergy between academia and industry. Recent agreements between the US and Japan illustrate the growing recognition of top-down approaches to fostering international collaboration, while the G7's initiative to establish a global HPC network demonstrates the strategic prioritisation of shared resources.

Satoshi Matsuoka provided an overview of Japan's HPCI. This infrastructure comprises Tier-2 systems, a flagship system at RIKEN, and a shared data network that facilitates efficient data sharing. Operating at 98% capacity, the RIKEN machine exemplifies the demand for advanced computing resources. Global collaborations in HPC, such as the EU-Japan Alliance and HANAMI, have achieved milestones like the ACM Gordon Bell Prize for simulations conducted across multiple supercomputers. Future initiatives, including the deployment of FugakuNEXT by 2030, aim to expand international collaboration across scientific disciplines.



Rory Fitzgerald discussed the European Social Survey (ESS), a prominent RI initiative in social sciences. The ESS has conducted 11 survey rounds across 28 nations, completing over 500,000 interviews. As a bottom-up initiative, the ESS relies on the European Research Infrastructure Consortium (ERIC) framework, which has facilitated its maturation and global outreach. With over 235,000 registered users and more than 6,500 publications, the ESS demonstrates the value of free, non-commercial data for advancing academic and policy research. Future efforts aim to expand the ESS's scope through web-based panels and partnerships with institutions in the US, South Korea, and Australia.

Sylvain Charbonneau highlighted the Canada Foundation for Innovation's (CFI) role in supporting Canadian RIs, such as the Canadian Synchrotron and the SNOLAB neutrino observatory. Established in 1987, CFI adopts a co-funding model, with 40% from CFI and 60% from provincial or sectoral partners. The foundation supports initiatives that have resulted in over 33,000 research outputs and 65,000 global users. Sylvain identified three pillars for successful partnerships:

- **Engagement:** Accurately estimate the resources required to support partnerships and maintain active involvement throughout the collaboration.
- **Selectivity:** Align partnerships with strategic priorities and carefully select partners with complementary goals and capabilities.
- **Patience:** Allow sufficient time for negotiation, trust-building, and the establishment of sustainable governance structures.

Kate Thibault presented on NEON, a distributed RI operated by Battelle within the National Science Foundation (NSF). NEON comprises 81 sites, over 180 data products, and 30 years of data collection, focusing on the effects of climate change on ecosystems. NEON prioritises open, FAIR, and free data, as well as long-term specimen archiving. Collaborations with global initiatives like AmeriFlux and FluxNEXT enhance data accessibility and interoperability. A partnership with the Korean National Institute of Ecology and multiyear projects with TERN further illustrate NEON's international impact.

The panel session underscored the critical importance of global collaboration. By integrating diverse data sources, fostering inclusive partnerships, and leveraging advanced infrastructure, collaborations drive innovation and deliver impactful solutions across disciplines. Clear governance, adaptability, and alignment with shared values emerged as foundational principles for success. These efforts exemplify the power of international cooperation in enhancing scientific understanding, improving societal outcomes, and addressing pressing global issues.

Institutional and policy frameworks for inclusive research infrastructure collaborations

Wednesday, 4th December 3.00pm, Great Room 2, W Hotel

This session examined policy challenges and opportunities related to open science, resource optimisation, technology sharing, and enhancing research excellence. It also discussed the benefits and challenges of robust governance, regulatory frameworks, and tools that support global RI collaborations. Attendees gained insights into developing policies that strengthen international research networks and foster global scientific progress.

Moderator: Frédéric Sgard, Project Administrator at the OECD Global Science Forum (GSF)

Panel speakers:

- Dileine Amaral da Cunha, Coordinator of Negotiation, Advice and International Studies at the National Council for Scientific and Technological Development (CNPq)
- Dr Roland Roberts, Deputy Chief Officer for Research Facilities at the U.S. National Science Foundation (NSF)
- Dr Uracha Ruktanonchai, Executive Director of the National Nanotechnology Center (NANOTEC) within Thailand's National Science and Technology Development Agency

Summary:

The session focused on the diverse challenges faced by researchers and networks across the globe, emphasising the shared goals that unite them. It highlighted the importance of utilising existing consortia to tackle global issues and the need for a clear value proposition for all stakeholders involved. Moreover, it stressed that collaboration should be integrated into funding models to support long-term research initiatives.

Dileine Amaral de Cunha presented a strategic vision for Latin American countries to collaborate on research infrastructure. Inspired by successful European models, a working group was established in 2017 to explore ways for Latin American nations to cooperate. The group focused on developing policies, best practices, roadmaps, and strategies for regional collaboration. This effort culminated in the creation of the Latin American Research Infrastructure Strategy, which identifies five key priorities: biodiversity and climate change, health, energy, technology, and food security. This strategy aimed to create a cohesive approach for Latin American countries to address common challenges through research infrastructure. The initiative was predominantly bottom-up, as the strategy lacked significant support from governments at the outset. The aim was to gather information to build a collective voice and advocate for the strategy's goals.



Uracha Ruktanonchai provided an overview of the Association of Southeast Asian Nations (ASEAN) and its efforts to promote regional collaboration in research. Despite the region's significant economic power, ASEAN countries have relatively low research output. To address this, ASEAN has focused on mapping gaps and opportunities within the region, completing this task in 2022/23. The organisation's strategy includes four components: an implementation group, technology transfer, regional research, and capacity building. ASEAN aims to integrate these efforts using its governance framework to leverage research, build a skilled workforce, and prepare the region for international collaborations. The goal is for ASEAN to work together regionally and become competitive on the global stage. It was noted that consortiums, such as the ASEAN-HPC taskforce, were already working together within the region. Some of these taskforces are also collaborating with the European Union, demonstrating early success in fostering international cooperation.

Roland Roberts introduced the concept of Global Innovative Research Infrastructure (GIRI), a model for international collaboration. Successful global research collaboration must overcome challenges such as differences in research culture, security concerns, governance, language, and diverse priorities. To strengthen collaboration, research infrastructure managers must be creative in allowing collaboration to form organically. GIRI was founded to address global-scale challenges, such as species loss and climate change, by promoting international cooperation in research. The collaboration includes notable organisations such as NEON, TERN, ELTER, and

CERN. In 2020, a MoU was signed to formalise the partnership, outlining its terms and conditions. The GIRI initiative aims to provide a framework for others to benefit from lessons learned, although securing sustainable funding remains a challenge. GIRI has been effective in consolidating efforts and sharing knowledge across international borders.

Regarding the challenge of global funding mechanisms, the panel discussed the importance of formalising collaborations like GIRI beyond just an MoU. While the MoU marked the beginning of the partnership, a more formal, singular entity is needed to ensure sustainability and coordination. Funding from government sources often comes with strings attached, while industry funding tends to be more flexible. The panel acknowledged that finding a solution to this challenge was still in progress.

Finally, the panel addressed the lack of research infrastructure in areas like artificial intelligence (AI) and critical minerals. They agreed on the need for a roadmap to guide the development of necessary infrastructure and secure investment from the top-down level. NAIR's investment in AI infrastructure in the United States was cited as a notable example. The panel also discussed the differences in funding models across countries, suggesting that incorporating an international collaboration aspect into funding models could help support critical infrastructure development.

In conclusion, the session highlighted the need for greater collaboration across regions to tackle global challenges. By aligning research priorities and funding mechanisms, the international research community can build more effective and sustainable infrastructures to address pressing issues such as climate change, health, and technology.



Indigenous knowledge

Where Indigenous knowledge and methodologies intersect with research infrastructures

Tuesday, 3rd December 10.00am, Great Room Plenary, W Hotel

How do Indigenous research methodologies, rooted in cultural contexts and Indigenous knowledge systems intersect with modern research infrastructures?

This session examined the practicalities and benefits of aligning research projects with the needs and priorities of local and Indigenous communities. It discussed impactful strategies for integrating Indigenous knowledge within modern frameworks that respect traditional and contemporary values and knowledge systems and ensure ethical and meaningful collaboration.



By highlighting successful case studies and best practices, this session aimed to provide actionable insights into creating research infrastructure that respects and enhances Indigenous perspectives while leveraging modern technological advancements.

Keynote speaker: Dr Maggie Walter, Professor Emerita at the University of Tasmania

Moderator: Louisa Warren, Executive Manager of the Indigenous Engagement Office at CSIRO

Panel speakers:

- Associate Professor Maui Hudson, Director of Te Kotahi Research Institute at the University of Waikato
- Dr Stephany RunningHawk Johnson (Oglala Lakota), Executive Director of Local Contexts

Summary:

Keynote: Maggie Walter highlighted Australia's updated National Science and Research Priorities, which now place Indigenous Knowledge at the centre. She emphasised that this development was critical and urged the audience to reconsider how their research would change if Indigenous people were considered as the primary audience. Furthermore, she addressed the concept of Indigenous Data Sovereignty, which consists of two components: Governance of Data and Data for Governance. She argued for a shift away from the traditional

view of "data as disregard," where data collected by non-Indigenous people often framed Indigenous people as a "problem." Instead, Indigenous Data Sovereignty is about enabling Indigenous leadership and decision-making in managing data, particularly to rebuild and preserve their knowledge systems.

Stephany RunningHawk Johnson introduced the work of Local Contexts, a toolset designed to digitally label information to maintain connections to Indigenous Communities and facilitate data sharing while ensuring control remains with the communities.

Maui Hudson underscored the necessity of ensuring that RI, particularly on a global scale, benefits local communities. He highlighted the importance of ensuring that the benefits of such infrastructure are shared equitably, especially with Indigenous and small nations, like Pacific Island nations, rather than concentrating in wealthier countries.

The panel also explored the intersection of AI and large language models with Indigenous Knowledge. The discussion recognised potential benefits, such as AI's ability to help Indigenous peoples access and compile Indigenous Data. However, concerns were raised about the risks AI poses, such as alienating Indigenous people from their own data. Once data is integrated into algorithms, it can become detached from Indigenous communities, making it difficult to trace back to its origins. Additionally, the panel discussed the potential for AI to reinforce cultural biases, which could further disenfranchise Indigenous peoples. The overall conversation underscored the importance of ensuring that Indigenous communities maintain agency and control over their data in the face of emerging technologies.

Developing research infrastructure partnerships with local and Indigenous communities

Tuesday, 3rd December 2.00pm, Great Room 2, W Hotel

What are the best ways to develop partnerships with local and Indigenous communities that secure community buy-in, building capacity, and uphold Indigenous rights in data management?

By highlighting best practices in creating inclusive research infrastructures, this session demonstrated how these projects can deliver tangible social, cultural, health, environmental, and economic benefits for Indigenous and local communities. It covered effective training approaches for academic and non-academic personnel to ensure staff are equipped to support and collaborate on these initiatives. Attendees gained practical insights into fostering equitable and impactful research infrastructure.

Moderator: Dr Cassandra Sedran-Price, Senior Research Manager, CSIRO

Panel speakers:

- Dr Daniel Wilson, Lecturer at Waipapa Taumata Rau, The University of Auckland
- Jennylyn Hamlett, Community Liaison Officer, Wajarri Yamaji Aboriginal Corporation
- Niklas Labba, Traditional Sami reindeer herder

Summary:

The session explored the significance of trust between Indigenous communities and researchers, emphasising its variability across communities and the extensive time required to cultivate it. The SKAO example, where negotiations between the local Indigenous community and CSIRO spanned over eight years, highlighted the long-term commitment necessary to establish trust. The eventual agreement benefitted both research projects and the Traditional Custodians of the land, illustrating the importance of continuity in personnel to avoid disruptions in trust-building. The principle that “community moves at the speed of trust” underscored the central role of respect in fostering trust.

Short-term research grants posed challenges to trust-building due to their limited timeframes. To address this, leveraging personal networks was recommended to accelerate the process. Researchers were encouraged to engage communities in their preferred language and to focus on community-driven priorities rather than imposing predefined research agendas. This approach fostered collaboration and mutual understanding.



The session emphasised the need for research infrastructure to move away from framing Indigenous communities from a "deficit" perspective. Indigenous communities were encouraged to proactively propose research questions that aligned with their priorities, while researchers were urged to embrace community engagement and

participate in power-sharing negotiations. Building cultural competence and ensuring cultural safety were highlighted as essential strategies to avoid overwhelming Indigenous communities while fostering their participation in research.

Reconciliation Action Plans were identified as critical tools for aligning research with the needs of Indigenous communities. These plans emphasised reflecting community priorities and enabling Indigenous-led research, such as the collection of census data. When working with multiple Indigenous communities within a research locality, researchers were advised to identify shared themes, such as environmental sustainability, as a basis for accommodating the unique preferences of each community.

To safeguard Indigenous data governance and sovereignty, the session recommended the use of traditional knowledge labels, federated learning systems, and community-driven discussions on data representation. These measures aimed to ensure data sharing occurred within trusted frameworks. Increasing the presence of Indigenous researchers was viewed as a vital step in

addressing these challenges effectively. The session underscored that trust, cultural respect, and meaningful engagement were foundational to successful collaborations with Indigenous communities.

Hope and wonder (enabling future science)

Looking to space for answers on Earth

Tuesday, 3rd December 4.30pm, Great Room Plenary, W Hotel

What's new in space observations, and how it is pushing the frontier of knowledge?

This session presented the latest advances in space and ground telescopes, discussed the challenges ahead and their potential impact on scientific and industrial development. It delved into the latest innovations in space observations, highlighting how cutting-edge developments in space and ground telescopes are expanding our understanding of the Universe.

Moderator: Dr Izabela Rottmann, RadioNet - European Radio Astronomy Consortium Manager

Panel speakers:

- Professor Elisabetta Barberio, Professor of Physics, University of Melbourne
- Fabio Biancat Marchet, Deputy Programme Manager and Programme Engineer, European - Extremely Large Telescope (E-ELT)
- Professor Philip Diamond, Director General of the SKA Observatory in the UK
- Dr Zhiming Cai, Director of the Scientific Satellite Institute at the Innovation Academy for Microsatellites, Chinese Academy of Sciences

Summary:

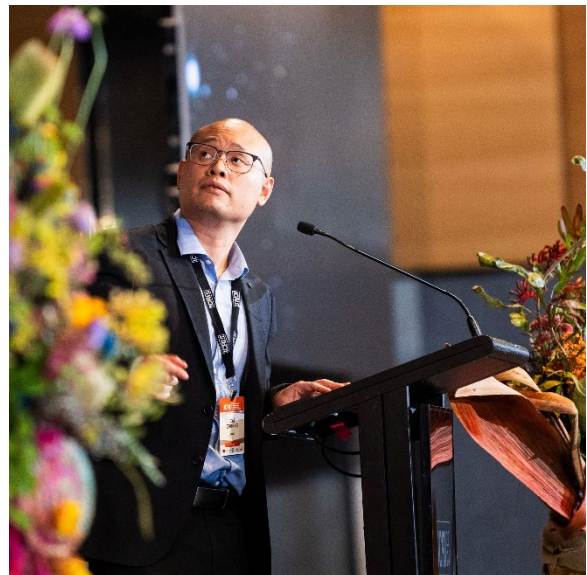
The session discussed the latest advancements in astronomical research, the challenges posed by these advancements, and their societal impacts. A central theme was the increasing complexity of astronomical instruments and the growing presence of satellites, particularly low Earth orbit (LEO) satellites, which pose significant disruption to the quiet sky necessary for astronomical observations. These satellites, while essential for global communication and other purposes, have made it increasingly difficult for astronomers to conduct research without interference. The panel emphasised that the demand for satellite use cannot be reduced, but mitigation strategies such as using non-disruptive materials for satellites, adjusting backlighting, and engaging in dialogue with satellite operators may help minimise their impact on astronomical observations.

Another major challenge highlighted was the complexity of RI and the difficulties in engaging diverse communities in this work. Effective communication through town halls and public lectures was identified as a key strategy for engaging local communities. These efforts have led to increased interest in STEM fields, with many communities expressing excitement and enthusiasm for involvement in research. It was emphasised that continued engagement and treating communities as active participants in the research process, rather than just political stakeholders, were crucial to fostering long-term involvement.

The panel also addressed the challenge of securing long-term investments for large-scale projects, such as the Square Kilometre Array (SKA). Initially a small company in the UK, the SKA project evolved from a corporate to a research-focused initiative. After years of negotiation, the SKA settled on a treaty model, providing stability in funding and international cooperation. The treaty allowed the organisation to participate in international discussions, including those concerning the mitigation of satellite disruptions to astronomy, and also positioned SKA as an intergovernmental organisation (IGO) that could influence space law and policy.

The potential societal benefits of space exploration and astronomy were also discussed, particularly through intergovernmental collaborations like CERN, which promotes research and the sharing of information. International collaborations in space exploration allow for the combination of multiple scientific capabilities, such as gravitational wave detection and x-ray astronomy, enhancing the impact of these endeavours. The panel emphasised the importance of making discoveries and innovations accessible to the public, as taxpayers fund much of the research.

Zhiming Cai highlighted the unique contributions of X-ray astronomy. The Einstein Probe, which launched on January 9th, focuses on observing black holes and stellar flares using two instruments: a wide-field X-ray telescope and a follow-up X-ray telescope. The use of lobster-eye optics significantly enhances the probe's performance, enabling it to detect a greater number of stellar flares. Rapid communication of data is crucial for such observations, with delays reduced to less than 30 seconds.



Fabio Biancat Marchet discussed advancements in southern hemisphere astronomy, particularly the Extremely Large Telescope (ELT) program. The ELT, currently under construction in Chile, will provide a telescope five times more powerful than current facilities, allowing astronomers to see further and with greater resolution. The ELT's mosaic of 800 segments will shift with nanometer precision. The telescope's construction includes significant technological innovations, such as anti-seismic facilities, high-accuracy positioning systems, and high-energy lasers. It is expected to be completed by 2026, with observations beginning in 2028.

Elisabetta Barberio described the unique capabilities of the first underground lab in the southern hemisphere, situated 1 km beneath the ground in a gold mine. This lab, which aims to detect dark matter and neutrinos, is part of a global effort to study fundamental physics. The lab's first stage was completed in August 2022, and it will continue expanding, with additional facilities set to come online by 2025.

Philip Diamond provided an update on the SKA project, which is an intergovernmental organisation that has been operational since January 2021. SKA operates two telescopes across three sites: SKA-mid in South Africa and SKA-low in Western Australia. The project, with a construction cost of approximately 1.3 billion euros, is expected to begin early science

operations in 2026, with full operations starting in 2028. The data generated by the SKA will be transmitted to data centres around the world, and its data volumes are projected to surpass those of any similar projects to date.

In conclusion, the session highlighted the significant advancements and challenges in astronomical research, the importance of international cooperation, and the role of innovative technologies in addressing complex scientific and societal issues. Despite the disruptions posed by satellites and the complexity of engaging diverse communities, the future of astronomical research looks promising, with initiatives like SKA and the Einstein Probe paving the way for new discoveries.

Atomic-scale insight with global-scale research infrastructure for exploration and discovery

Wednesday, 4th December 10.00am, Great Room Plenary, W Hotel

The panel session heard from major global RIs that are at the forefront of scientific exploration and discovery, from probing the origins of the universe to addressing critical challenges on Earth. Focusing on synchrotrons, lasers, neutron sources, and electron microscopy, it explored how these large-scale facilities are collaborating internationally to push scientific boundaries and knowledge frontiers.

It also discussed the enabling policies and emerging technologies that will take us to the next level in driving innovative research emerging from these collaborations. It addressed the challenges of sustaining funding, retaining and attracting talent, and maintaining relevance in a rapidly evolving scientific landscape.

Moderator: Dr Ceri Brenner, Director of Australian Nuclear Science and Technology Organisation's (ANSTO) Centre for Accelerator Science

Panel speakers:

- Dr Nicole Elleuche, Managing Director of European X-Ray Free-Electron Laser Facility GmbH (European XFEL)
- Professor Rafal Dunin-Borkowski, co-Director of the Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons in Forschungszentrum Jülich
- Dr Jamie Schulz is the Director of the Australian Centre for Neutron Scattering (ACNS) at the Australian Nuclear Science and Technology Organisation (ANSTO)



Summary:

Ceri Brenner illustrated the convergence of science and art by recounting an anecdote about incorporating an artist into an experimental setting. This approach revealed that both fields share a commitment to exploring profound questions, interpreting the world, and presenting findings to others. She emphasised hope and wonder as central themes of the session, showcasing how RI can foster creativity and resilience in addressing scientific challenges. The panel's discussions focused on utilising particles and light to tackle the world's most pressing questions, embracing the potential for success and failure as intrinsic to the pursuit of discovery.

Rafal Dunin-Borkowski presented an overview of advanced electron microscopy (EM) developments in Germany and Europe, alongside his vision for the field's future. He noted that Australia's EM capabilities, recognised for their robust funding and support, are envied by the global EM community. Rafal highlighted the continuous technological advancements in EM, such as the ability to study chemical reactions in real-time, which offer significant new capabilities. He stressed the need for EM to transition from laboratory-scale operations to RI-scale



infrastructures, enabling greater collaborative potential and scientific breakthroughs. Achieving this expansion will require long-term stability and funding, particularly across Europe, to propel the field to "the next level."

Nicole Elleuche outlined the contributions of the European XFEL, emphasising its pivotal role across various domains, including environmental sustainability, basic research, climate and energy, health, and digitisation. The facility's contributions have been recognised at the highest levels, with its work associated with recent Nobel Prize-winning research in Chemistry and Physics. She highlighted the European XFEL's commitment to societal responsibility as an RI. This includes prioritising the well-being of its staff, engaging with the local community, supporting younger generations, and effectively communicating its value to the public.

Jamie Schulz discussed ANSTO and its critical role in addressing humanity's complex challenges. He highlighted ANSTO's collaborations with global neutron-scattering facilities. These partnerships ensure that vital research continues uninterrupted, even in the face of planned or unforeseen disruptions. Jamie underscored the centrality of the people behind ANSTO's work, emphasising the facility's focus on safety and providing an environment that encourages asking big scientific questions. He said ANSTO also strives to deliver exceptional service to its users, fostering a culture of collaboration and innovation.

Panellists shared examples of recent successes achieved through their facilities:

- **ANSTO's Innovations:** International collaborations led to the development of materials with potential applications in future refrigeration technologies, offering environmentally sustainable alternatives to existing methods.
- **Remote Research during COVID:** The pandemic accelerated the adoption of remote research, enabling laboratories to continue operations without requiring researchers to travel extensively. This shift aligns with sustainability goals while ensuring uninterrupted research progress.
- **EM in Health and Medicine:** Electron microscopy continues to contribute significantly to medical advancements, including the study of biomedical implants.

The panel also addressed the integration of emerging technologies such as AI, automation, and remote working into RI:

- **AI Applications:** AI is increasingly being used to control instruments remotely and streamline workflows. It also plays a critical role in managing and analysing vast volumes of data, a need expected to grow as data generation increases.
- **Data Sharing and Trust:** Establishing AI-trusted communities was suggested as a means to build confidence among researchers in sharing their data, ensuring its effective and ethical use.

The session illuminated the transformative potential of research infrastructure in addressing global challenges and advancing scientific knowledge. From advanced electron microscopy and the European XFEL to ANSTO's neutron research, each panellist highlighted the innovative strides being made in their respective fields. The discussions reinforced the importance of collaboration, adaptability, and the integration of emerging technologies in driving future advancements.

Early Career Scientists: Pitch Session

Wednesday, 4th December 4.30pm, Great Room Plenary, W Hotel

Early Career Scientists from around the globe pitched their visionary ideas for the research infrastructures the world will need by 2050. These researchers, deeply connected to current RIs in their countries, presented ambitious, future-focused concepts across a diverse range of disciplines. A unique opportunity to hear from the next generation of leaders, who will one day guide us toward groundbreaking RIs that address emerging challenges and unlock new frontiers in research.

Moderator: Dr Graham Wright, Director of the Research Support Centre within Singapore's Agency for Science, Technology & Research (A*STAR)

Panel speakers:

- Dr Ash Dyer, Senior Process Engineer Deputy Facility Manager at the Melbourne Centre for Nanofabrication (MCN)

- Dr Ben Norton, Senior Technical Manager for Griffith Sciences at Griffith University
- Inês Pinho, Coordination Manager at EMPHASIS
- Joel Bautista, Chief of the Knowledge Innovation Division (KID) of the Philippine Department of Science and Technology (DOST) – Philippine Science High School System
- Laurence Lejeune, PhD candidate in Science, Technology, and Science (STS) at The Université du Québec à Montréal (UQAM)
- Dr Pakpoom Buabthong, Deputy Director of the Office of Lifelong Learning at Nakhon Ratchasima Rajabhat University, Thailand

Summary:

The session centred on the perspectives of early career researchers (ECRs) regarding the future of RI towards 2050. It was emphasised that ECRs represent the future of RI and the International Conference on Research Infrastructures (ICRI), making it essential to understand their motivations and aspirations. Key drivers for ECRs included their passion for science, the desire to address global challenges, and the opportunity to engage in intellectually stimulating and collaborative research.

ECRs envisioned a democratised scientific landscape by 2050, characterised by open science, transdisciplinary collaboration, and the absence of borders or disciplinary limitations. They anticipated the establishment of virtual research labs, globally connected and powered by artificial intelligence (AI), which would facilitate collective efforts to solve complex global problems. They also highlighted the significant role quantum computing would play, with Australia leading advancements in this domain.

Sustainability was identified as a core principle for the future of RI. Presenters emphasised the need for mandatory sustainable practices in RI operations to ensure efficiency and innovation without duplication of efforts. They stressed the importance of open science to maintain collaboration and maximise the impact of research processes.



The RI workforce was recognised as pivotal to achieving these goals. Sustainable career pathways, recognition, and incentives were deemed crucial for fostering long-term commitments and supporting world-class research. It was suggested that primary and secondary education should teach AI literacy, critical thinking, and ethical sensibility to prepare future generations for navigating new challenges and opportunities.

Human-centricity in RI was emphasised, with advancements in AI seen as complementary rather than replacements for human input. Regional access to RI was highlighted as a priority, advocating for equitable access across regions, enabling researchers from less developed countries to conduct their work on equal terms with those in more developed areas.

The rapid pace of technological advancement in RI was acknowledged, with a call for proactive anticipation of training needs to support ECRs in adapting to emerging tools and techniques. Overall, the session presented a vision of RI in 2050 as a beacon of innovation, sustainability, and collaboration, driven by the passion and commitment of ECRs and underpinned by cutting-edge technology and inclusive practices.

The skillsets needed today and for the future: Developing the next generation of research infrastructure leaders

Wednesday, 4th December 12.00pm, Great Room Plenary, W Hotel

How do you prepare a skilled workforce to meet the evolving needs of future research infrastructures? This session highlighted effective recruitment strategies and career pathways that promote innovation and excellence, whilst ensuring a sustainable and vibrant future for the global research infrastructure ecosystem.

Through a Global Café format, the session featured speakers presenting various international training initiatives and programs, fostering a shared understanding and potential for collaboration. Attendees had the opportunity to discuss this with colleagues and gain further insights into how research infrastructures worldwide are cultivating the next generation of leaders.

Moderator: Lisa Yen, Chief Executive Officer of Microscopy Australia

Panel speakers:

- Antje Keppler, Director of the Bio-Hub, Euro-BioImaging ERIC
- Dr Graham Wright, Director of the Research Support Centre within Singapore's Agency for Science, Technology & Research (A*STAR)
- Joe Shapter, Emeritus Professor at University of Queensland and Flinders University
- Tim Rawling, Chief Executive Officer of AuScope Limited

Summary:

Joe Shapter discussed his involvement with the Australian National Research Infrastructure (NRI) Advisory Group, particularly focusing on the development of career paths within RI. He provided an overview of Australia's NRI Roadmaps, which are released every five years. The most recent roadmap, released in 2021, highlighted the ongoing challenges surrounding RI staffing and identified the need for long-term solutions. The next roadmap is set to be developed in 2025 and will be released in 2026. Each of the past three roadmaps—those of 2011, 2016, and 2021—emphasised the importance of addressing staffing issues within RI, underscoring the need for more comprehensive support for these professionals.

In response to these challenges, the National Research Infrastructure Advisory Group (NRIAG), established in 2023, has committed to tackling the RI staffing issues at multiple levels. At the institutional level, the group has committed to introducing the UK Technicians Commitment in Australia. This initiative encourages institutions to join and take part in efforts to improve the visibility, recognition, career development, and sustainability of their technical staff, including RI personnel. At the individual level, the Academy for Collaborative Research Infrastructure (ACRI) has been established to provide professional development opportunities for RI staff. Furthermore, at the career mobility level, NRIAG is exploring the potential of establishing RI Fellowships to support staff in advancing their careers.

Tim Rawling highlighted the efforts to develop career paths within GeoScience, an interdisciplinary field that includes geology, biology, chemistry, and other sciences. Rawling emphasised the importance of attracting a diverse range of individuals into GeoScience, particularly women and people from underrepresented backgrounds. To support this, AuScope is implementing initiatives aimed at introducing geoscience concepts to young students, such as bringing seismometers into primary and secondary schools to engage children and spark their interest in the field.

Antje Keppler presented on the career development initiatives established by GlobalBioImaging, a global consortium of 800 staff across 237 facilities. She outlined several key programs aimed at fostering the growth of RI staff. These included a Job Shadowing Program designed to help staff develop both technical and soft skills across different countries. In addition, the consortium offers international training courses that are held both online and in host countries. The Global BioImaging Exchange of Ideas Conference facilitates the sharing of lessons learned and solutions and has begun attracting interest from industry players.

Graham Wright discussed the work of the Global BioImaging Career Path Working Group, which is developing a set of recommendations to better support RI staff. The group is currently working on a report that addresses four key themes based on user feedback: defining what an imaging



scientist is and where this role fits in both academic and industry settings, highlighting the value and impact of imaging scientists in core facilities, tackling the recruitment and retention of personnel, and focusing on the training and professional development of imaging scientists. He suggested that an MBA could be beneficial for RI managers, providing them with valuable skills for overseeing complex projects and teams.

Overall, the session underscored the importance of developing career pathways for RI staff across multiple scientific disciplines and highlighted ongoing initiatives aimed at improving training, development, and mobility for these essential professionals.

Research infrastructures beyond 2050

Thursday, 5th December 11.15am, Great Room Plenary, W Hotel

We closed out ICRI 2024 with a bold glimpse far into the future. What are the key themes for research infrastructures as we contemplate the challenges we face and the pathways to overcoming them? Professor Alan Duffy discussed RI's crucial role in shaping and navigating our planet's future, and the transformative role RIs will play in addressing global issues, from environmental sustainability to technological innovation.

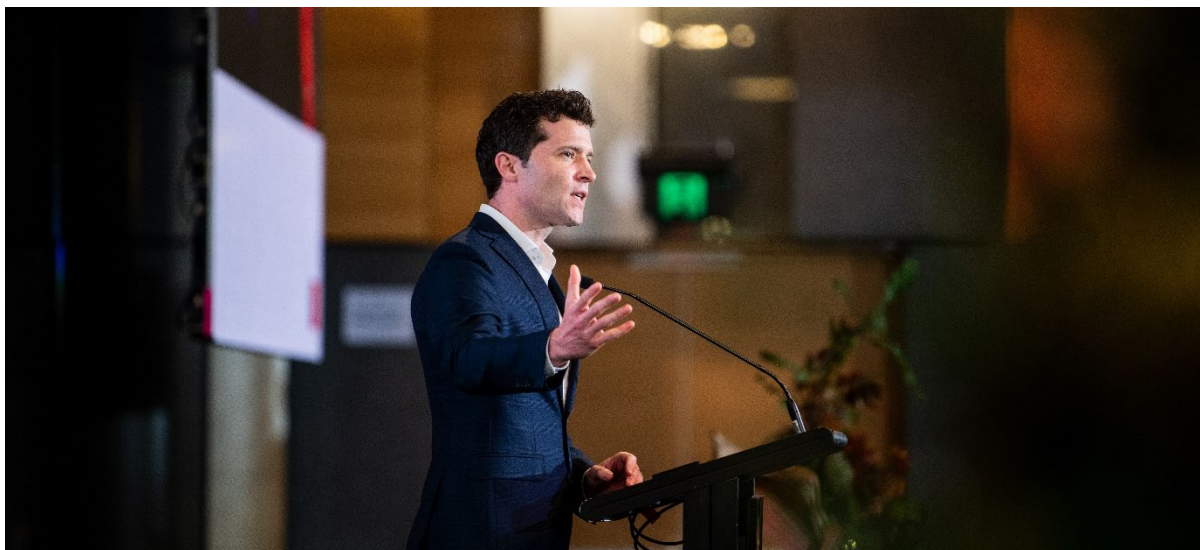
Keynote speaker: Professor Alan Duffy, Pro-Vice Chancellor of Flagship Initiatives at Swinburne University of Technology

Summary:

The session on the future of research infrastructure beyond 2050 presented a visionary outlook, exploring its potential trajectory and transformative impact on science and society. Using an example from astronomy, the discussion highlighted how sustained investment and upgrades to existing RIs, such as a telescope facility from the 1960s, have enabled groundbreaking discoveries decades later. This underscores the importance of preserving and modernising RI to ensure it remains relevant for future research.

Astronomy was a central focus, with the global scope of the Square Kilometre Array (SKA) project exemplifying how international collaboration drives innovation. Between now and 2050, six generations of PhD students will emerge, raising questions about how research methodologies and focus areas will evolve. Advancements in rocket and satellite technologies were noted as pivotal developments in the field, while the integration of data from space with land and sea-based observations offers immense potential to benefit humanity universally, regardless of geographic or national boundaries.

The session explored the transformative role of emerging technologies, including quantum and AI capabilities. Beyond quantum computing, potential advancements were anticipated in quantum sensing, quantum internet, and quantum diamonds. These technologies promise to redefine the landscape of RI, enabling novel ways of conducting and interpreting research.



AI was acknowledged as a powerful tool for enhancing research capabilities, but Alan emphasised the need to address the growing energy demands associated with its applications. Managing these energy requirements while harnessing AI's potential will be a critical challenge in the coming decades.

Four key takeaways framed the discussion on what RI may look like beyond 2050:

- **Seamless Integration of Data**
The future of research will likely see the fusion of datasets from diverse trials and experiments, particularly those publicly funded. Coupled with next-generation AI, this integration will redefine laboratory environments and create innovative opportunities for discovery.
- **Valuing Technical Expertise**
Sustaining careers for professionals with deep technical expertise was identified as an urgent priority. As AI enables researchers to operate further from the physical research environment, preserving the knowledge and contributions of technical experts will become increasingly important.
- **Advancement, Cost, and Public Engagement**
As RIs become more advanced and expensive, they will also become more concentrated. This will require greater effort to maintain connections with the public and industry to justify investments and sustain motivation for continued development.
- **Collaboration and Metrics**
Addressing large-scale challenges necessitates collaborative, sector-wide responses. However, current systems often prioritise individual achievements over team efforts. A shift in key performance indicators (KPIs) toward rewarding collective contributions was proposed as a potential solution.

The session emphasised that RI extends beyond physical equipment—it is fundamentally about people. Networks of individuals and entities bring RIs to life, operating and optimising them for

the benefit of the communities they serve. Moreover, RIs embody a rich history and cultural significance, providing a bridge between scientific innovation and human connection.

RI was envisioned as a tool for connecting with the earliest scientists and astronomers of human history, particularly in Indigenous communities. This connection represents a profound opportunity to integrate traditional knowledge with cutting-edge technologies, enriching the scope and impact of future research.

In conclusion, the session painted a compelling picture of RIs evolving into highly advanced, globally connected systems. These infrastructures will not only enable groundbreaking scientific discoveries but also foster collaboration across disciplines and cultures. By prioritising sustained investment, valuing human expertise, and embracing emerging technologies, RI will continue to address humanity's greatest challenges and inspire future generations of researchers. Looking beyond 2050, RI will remain a testament to the ingenuity, resilience, and collective ambition of the global scientific community.

Global challenges: climate change; healthy communities; feeding the planet

Exploring global strategies: How RI will address climate challenges over the next 30 years

Wednesday, 4th December 9.15am, Great Room Plenary, W Hotel

This panel discussed how global research infrastructures address climate challenges through monitoring, mitigation, support for decision-makers, and the implementation of global environmental accounting and auditing. A critical issue explored was the delineation between research and operational monitoring and the respective roles of research agencies and meteorological services, focusing on best practices for inter-agency cooperation to bridge existing gaps.

Moderator: Dr Michael SanClements, Research Initiatives Lead for Battelle

Panel speakers:

- Matías Troncoso-Villar, Coordinator of the Cape Horn Long Term Ecological Research Network (LTER) Network
- Patricia Nying'uro, Climate scientist and researcher at the Kenya Meteorological Department, Climate Change branch
- Professor Sushil Kumar, Director of Research at the University of the South Pacific
- Dr Werner L. Kutsch, Director General of the Integrated Carbon Observation System (ICOS ERIC)

Summary:

The session focused on the role of research infrastructure in supporting climate change adaptation and mitigation over the next 30 years. Various perspectives were shared, highlighting the challenges and opportunities faced by different regions and sectors in addressing the impacts of climate change.

Sushil Kumar shared the Oceania perspective, focusing on the University of South Pacific, which operates 14 campuses across the Pacific region. The region faces significant climate threats, including sea level rise and tropical cyclones, with nearly 100% of the population living in coastal areas, compared to 40% globally. The frequency of cyclones has not increased, but their intensity has.



Patricia Nying'uro discussed the distinction between adaptation and mitigation in climate change efforts. While developing countries prioritise adaptation, the global focus has been more on mitigation strategies. She emphasised the importance of utilising RI to support adaptation efforts, particularly in regions like Africa, where the need for climate data is critical. Africa, with initiatives such as KADI, ARA, and IPCC, has been making strides, but significant gaps remain, especially in heat research. For instance, while heat poses a major issue in Africa, specific studies on heat effects in Kenya are scarce. A pilot project in Kenya was launched to study the impact of heat on health and farming, working closely with community settlements to understand how small farmers experience and adapt to climate change. This pilot raised concerns about the lack of sufficient data in large areas, which the IPCC acknowledged as a major challenge. Ethical considerations were also brought up, particularly regarding the disparity in climate observation stations between the EU and Africa. Patricia also highlighted the increasing energy needs for AI and machine learning technologies in climate research, raising questions about how to balance these needs with the energy access challenges in energy-poor regions.

Matías Troncoso-Villar presented the situation in Cape Horn, a region known for its unique oceanic environment. Located at a latitude where 98% of the area is ocean, Cape Horn experiences minimal temperature fluctuation, making it a distinct location for research. However, there are very few research sites at this latitude—only three, compared to 539 in Europe. Matias stressed the importance of expanding research infrastructure in the Southern Hemisphere, as it plays a crucial role in understanding climate change and supporting conservation efforts, including through tourism. A new headquarters with teaching and research labs had been established, and various monitoring systems were being set up to aid further research.

Werner L. Kutsch shared three key thoughts on climate challenges for the next 30 years. He highlighted the importance of moving away from fossil fuel emissions and using the lobster-eye design in satellites as an example of science mimicking nature. Werner emphasised the need for multilateral cooperation to address climate change, focusing on standardised operations, common open access data, and scientific exchange. ICOS, as a multilateral research initiative, exemplifies the benefits of such cooperation. He also stressed the importance of supporting regions with low-density observations, such as Africa, and the necessity of timely, long-term data to measure the success of climate actions. He proposed rethinking the distribution of resources between RI domains, citing solar energy as a potentially more sustainable approach than fusion reactors.

During the panel discussion, the importance of addressing regional climate change needs was emphasised. For example, Fiji focuses on sea level rise, while other regions prioritise food security. When asked about balancing research and operations, panellists agreed that there is no one-size-fits-all solution, as maintaining both research and operational centres is key to achieving greater impact. They also discussed the challenges of multilateral operations, with ICOS recognising its late start in working with both the Northern and Southern Hemispheres, and the need for standardised operations. Finally, the panel acknowledged similarities in the study of tropical diseases in both hemispheres, suggesting that lessons learned in one region could inform climate research in the other.

In conclusion, the session underscored the need for collaboration across regions and sectors to address climate change effectively. It highlighted the importance of expanding research infrastructure, improving data availability, and embracing multilateral cooperation to ensure that climate research is both comprehensive and sustainable.





Global trends and environmental considerations for research infrastructures

Tuesday, 3rd December 11:15am, Great Room Plenary, W Hotel

This panel discussed major emerging trends and considerations around research infrastructures and energy production, storage, and efficiency from US, EU, Australian and Chilean perspectives using the Brisbane Statement as a framing document.

Keynote speaker: Dr Kartik Sheth, Program Scientist in the Astrophysics division of NASA

Moderator: Dr Roland Roberts, Deputy Chief Officer for Research Facilities at the U.S. National Science Foundation (NSF)

Panel speakers:

- Gonzalo Arenas, Head of International Affairs in Chile's Ministry of Science, Technology, Knowledge and Innovation
- José Luis Martínez, ESFRI Chair
- Professor Kerrie Wilson, Queensland Chief Scientist, Australia

Summary:

The session focused on the role of fundamental research infrastructure in addressing global energy demands and the challenges associated with energy transition and storage. The panel explored the intersection of RI, sustainable energy practices, and the importance of international collaboration to address these pressing issues.

Keynote: Kartik Sheth drew on his experience in the White House and his work with the U.S. energy policy team, emphasising that RI is vital for addressing global challenges. He highlighted ICRI 2024 as a platform to foster networks aimed at solving humanity's shared energy challenges. Kartik underscored the increasing need for energy to reach all people globally, emphasising equitable distribution alongside sustainable practices. He noted that energy production, transmission, and distribution must be tackled collectively to meet the rising demand. Future technologies, including space-based solar power, nuclear fusion, renewable energy, and advanced energy storage, were identified as pivotal. Kartik highlighted RI's critical role in enabling these technologies and stressed the importance of human capital in operating and managing RI effectively.



Kerrie Wilson highlighted RI's potential to drive new knowledge, solutions, and innovative approaches, particularly in advancing energy science and low-carbon technologies. She referenced Australia's commitment to RI, with the Prime Minister's National Science and Technology Council and the National Research Infrastructure Advisory Group (NRIAG) reviewing the national RI ecosystem. She emphasised the need for career mobility and job security within the RI workforce to ensure competitiveness and sustainability.

José Luis Martínez presented Europe's perspective, outlining the dual energy challenges for RI: contributing to energy transition research and reducing the energy consumption footprint of research facilities. He shared insights into ESFRI's 2026 Roadmap, which emphasises incorporating energy considerations from the early planning stages of RI projects. The Roadmap advocates for energy-efficient methods with minimal environmental impact to address the broader competitiveness and sustainability goals in Europe.

Gonzalo Arenas discussed Chile's unique position at the intersection of RI and energy transition. Chile hosts major astronomical observatories that observe 60% of the universe, presenting distinct challenges due to the country's vast and remote geography. These logistical challenges impact energy transmission and distribution. Gonzalo highlighted Chile's focus on leveraging its natural resources, such as green hydrogen and extensive lithium reserves, to support a sustainable energy transition.

The panel acknowledged the significant energy demands of AI and its impact on RI. They concluded that meeting these demands requires sustainable energy production and robust international collaboration. The balance between energy efficiency and AI's needs was seen as a critical issue, requiring coordinated global efforts to develop innovative and sustainable solutions.

In conclusion, the session reinforced the role of RI as a cornerstone for addressing global energy challenges, fostering international cooperation, and driving sustainable innovation.



Improving critical ocean and Earth observations

Tuesday, 3rd December 2.00pm, Great Room 1, W Hotel

This panel highlighted best practices in ocean and Earth observation research infrastructures, focusing on strategies to enhance cross-border coordination. Key topics included improving the integration of ocean and terrestrial observation systems, advancing sea level rise forecasting, and exploring the future of ocean and Earth monitoring technologies.

Moderator: Dr Paula Mabee, the National Ecological Observatory Network's (NEON) Chief Scientist and Observatory Director at Batelle

Panel Speakers:

- Dr Emmanuel Salmon, Head of Strategy & International Cooperation at Integrated Carbon Observation System (ICOS)
- Dr Shelby Walker, Senior Advisor for Facilities, Directorate for Geosciences at the National Science Foundation (NSF)
- Dr Yann-Hervé De Roeck, Director of the Euro-Argo European Research Infrastructure Consortium
- Benoît Pirene, Ocean Networks Canada's Corporate Innovation and Technology Officer (CITO)

Summary:

The session addressed the challenges and opportunities in improving data collection for coastal observation, emphasising gaps in current data and potential solutions. One of the key issues discussed was the use of Distributed Acoustic Sensors (DAS), which are already deployed off the coast but face several challenges. A primary concern is that these sensors are integrated into networks used for telecommunications by various countries, raising security concerns related to the sharing and use of the data. This issue underscores the difficulty of balancing data collection needs with national security considerations.

The panel also explored the importance of data sharing and the role of FAIR (Findable, Accessible, Interoperable, and Reusable) data principles in enabling collaboration among research infrastructures. These principles are essential for ensuring that data can be shared seamlessly across borders and institutions, facilitating greater collaboration in ocean and Earth observation efforts. However, achieving this requires coordinated efforts to align policies and practices across different regions and stakeholders.

The societal benefits of ocean and Earth observation were also discussed. The panel emphasised that social benefits are at the heart of these efforts, particularly when it comes to the monitoring and protection of communities. Ocean observation, especially through deep-sea cables, plays a critical role in monitoring natural disasters such as earthquakes and tsunamis in earthquake-prone regions. These observations can provide valuable early warnings, enabling better preparedness and response.



Moreover, the data gathered through these observations can be utilised operationally in various ways. For example, it can assist in calibrating satellite measurements, improving the accuracy of remote sensing data. The data can also be used to develop digital twins, which are virtual

models that simulate real-world systems, offering insights into ocean and Earth processes and supporting decision-making in areas such as environmental management and disaster response.

In conclusion, the session highlighted both the challenges and significant opportunities in enhancing coastal observation through improved data collection and sharing. By addressing security concerns, ensuring collaboration, and leveraging the societal benefits of ocean and Earth observation, significant strides can be made toward improving our understanding and management of coastal and marine environments.

Greening research infrastructure

Wednesday, 4th December 2.00pm, Great Room 3, W Hotel

What is best practice for transitioning research infrastructure projects towards higher environmental standards and carbon neutrality? This session offered strategies to overcome obstacles such as financial barriers and skill shortages. The discussion covered the sustainability of digital RIs, including high-performance computing (HPC), artificial intelligence (AI), and quantum technologies. Key topics included methods for measuring sustainability, securing international support for environmentally friendly RIs, and exploring exemplary regulatory frameworks. It offered practical solutions and innovative approaches to making RIs more sustainable and eco-friendlier for a greener future.

Moderator: José Luis Martínez, ESFRI Chair

Panel speakers:

- Dr Carina Kemp, Global Lead for Academic Research at Amazon Web Services (AWS)
- Mark Stickells, Chief Executive Officer of the Pawsey Supercomputing Research Centre
- Yuri Demchenko, Senior Researcher and Lecturer at the University of Amsterdam
- Dr Vyacheslav (Slava) Lukin, Program Director in the Division of Physics at the U.S. National Science Foundation (NSF)

Summary:

The session focused on the sustainability of RI, addressing the challenges of reducing environmental footprints, increasing efficiency, and ensuring financial sustainability. A central theme was balancing the speed of research with sustainable practices, emphasising the role of collaboration and innovative strategies to integrate sustainability into RI development and operation.

A key issue raised was the difficulty in coordinating various funding opportunities from different levels of government, councils, and communities. Streamlining funding cycles to complement one another was identified as a crucial step in supporting sustainable practices within RIs. ESFRI (European Strategy Forum on Research Infrastructures) was cited as an example, having made sustainability assessments a criterion for funding decisions. While some financial constraints are necessary to incentivise efficiency, the panel also warned against making everything "too free," as this can lead to inefficiency and lack of accountability.

The session also addressed the concept of shared responsibility in research sustainability. It was questioned whether it is truly in everyone's best interest to produce research when sustainability comes at a cost. This raised concerns about the balance between advancing research and minimising environmental impact. Furthermore, the role of software development was discussed, particularly the challenge of researchers writing code as a side skill, which may not result in efficient solutions. To address this, initiatives like Pawsey/Amazon's investment in computational skills and expert training for researchers were highlighted. This approach aims to optimise research code, ensuring both efficiency and sustainability.

A shift in perspective regarding sustainability within RIs was also noted. While sustainability was not prioritised in the past, today there are key performance indicators (KPIs) in place for all NCRIS nodes, with a growing emphasis on viewing resources such as energy and water as valuable assets. Researchers' responsiveness to sustainability initiatives was emphasised, with the community's receptiveness playing a significant role in driving change.

When asked whether the size of an RI impacts its sustainability, the panel concluded that while larger RIs may have more resources to focus on sustainability efforts, smaller RIs could still collaborate with larger systems or benefit from their learnings. Additionally, incentivising researchers to take ownership of their sustainability practices was seen as essential, and the panel expressed interest in exploring new ways to encourage such ownership.

Mark Stickells discussed the energy efficiency strategies employed at the Pawsey Supercomputing Research Centre. The facility, part of the NCRIS network, is designed with sustainability in mind, incorporating solar energy and geothermal water cooling. Pawsey emphasises the need to change consumer behaviour, promoting the idea that energy usage, rather than time on a supercomputer, should be the limiting factor. By simplifying code to reduce energy consumption, researchers can achieve both efficiency and sustainability.

Yuri Demchenko highlighted the importance of integrating sustainability into digital infrastructures. GreenDIGIT brings together four major distributed digital infrastructures at various lifecycle stages, aiming to assess the status and trends of sustainability efforts in RI, develop new technologies, and provide tools for researchers. The project focuses on improving energy efficiency, decarbonising digital infrastructure, and reducing environmental impacts associated with digital technologies.

Carina Kemp discussed AWS's sustainability efforts, particularly their goal of achieving carbon-free energy. In 2023, Amazon reached its goal of matching 100% of global electricity use with renewable energy, and their focus has since shifted to water conservation. Amazon also provides publicly available information through its Sustainability Exchange, offering data-driven insights on sustainability in cloud computing.

Slava Lukin addressed the diverse environmental challenges faced by RIs supported by the U.S. National Science



Foundation (NSF). Some RIs, such as CERN, are highly energy-intensive, while others are located in fragile or remote environments like the Arctic. NSF, however, does not set environmental policies but responds to the scientific community through a merit-based process. The foundation strives to provide low-cost operational solutions while encouraging the evolution of sustainable practices within scientific communities, often driven by mandates and incentives.

In conclusion, the session highlighted the growing emphasis on sustainability within research infrastructures, emphasising collaboration, efficient use of resources, and the integration of sustainability into both digital and physical infrastructure. As RI projects grow in scale and complexity, addressing environmental considerations will continue to be crucial for ensuring their long-term viability and minimising their ecological impact.

AI & Imaging: Innovative insights into next generation therapeutics and diagnostics

Tuesday, 3rd December 12.15pm, Great Room Plenary, W Hotel

This session focused on the transformative potential for research infrastructure of generative, advanced imaging, and other AI-driven imaging techniques. The keynote explored how these innovations are revolutionising precision health, enhancing the accuracy and efficiency of medical diagnostics, and facilitating personalised treatment plans.

Keynote speaker: Professor James Whisstock, Director of the ARC Centre of Excellence in Advanced Molecular Imaging

Moderator: Lisa Yen, Chief Executive Officer of Microscopy Australia

Summary:

The session highlighted Australia's challenges in adopting AI, underscored its lagging position in AI funding, and provided insights into opportunities and ethical considerations for the future.

The session emphasised the need for societal acceptance, focusing on ethical considerations, data protection, and regulatory frameworks.

The session stressed the importance of:

- **Data Standardisation:** Addressing the variability in data quality and equipment to enable effective collaboration and data sharing across health systems.
- **National Security:** Ensuring AI development is conducted with care and precision to safeguard against risks.



- **Cultural and Ethical AI Training:** Developing AI systems that are culturally appropriate and free from inherent biases in training data.

Data privacy and protection are paramount. Ensuring access, use, and control of patient data with robust safeguards against privacy breaches is critical. Patient consent was highlighted as non-negotiable, alongside maintaining high data quality and integrity. The adoption of AI in healthcare must address ethical concerns, including:

- **Autonomy:** Supporting the independence of patients and clinicians.
- **Transparency and Trust:** Ensuring the decision-making processes of AI systems are clear.
- **Fairness:** Mitigating biases in data and AI applications.
- **Accountability:** Establishing mechanisms to hold AI systems and developers responsible.

The session explored six challenges and opportunities in medical imaging analysis: registration, synthesis, reconstruction, multi-modal prediction, segmentation, and classification. These advancements are already yielding tangible benefits, including:

- **Cancer Diagnosis:** AI-driven imaging enhances detection accuracy.
- **Aged Care:** AI tools support companionship and monitoring.
- **GP Visits:** Reducing the burden on healthcare systems.
- **Clinical Decisions:** Providing diagnostic suggestions and disease pathway insights.
- **Surgical Tools:** Assisting in precision surgeries.
- **Skin Checks:** Improving early detection of conditions like melanoma. AI alleviates the strain on healthcare systems by analysing images and building databases, addressing overdiagnosis concerns.
- **Medical Records and Datasets:** Streamlining data collection and analysis.
- **Enhanced MRI Resolution:** AI improves MRI imaging by synthesising higher-resolution images from lower-resolution data.
- **STI Risk Tools:** AI-driven apps provide provisional diagnoses and guide patients to appropriate healthcare services.
- **Fracture Detection:** AI enhances the detection of hairline fractures.
- **Bushfire Smoke Analysis:** AI tools measure the global health burden of bushfire smoke, which contributes to millions of deaths annually.

Additionally, researchers are transitioning to petabyte-scale datasets, with applications such as in silico antibody and protein modelling.

A skilled workforce is needed to integrate AI into healthcare effectively. Training programs such as BioCommons Australia were noted as progress, but significant gaps remain in building expertise in computer science and coding within healthcare research.

Key audience questions revolved around data standardisation, funding, and collaboration challenges:

- **Data Quality:** The lack of standardised data formats and privacy concerns were identified as significant hurdles. Collaborative efforts to establish uniform standards were deemed essential.
- **Funding and Expertise:** Participants discussed the limited funding for AI in Australia and the importance of developing foundational models. Training AI with culturally sensitive and unbiased data was highlighted as critical.
- **Data Curation:** Curated datasets require human oversight, emphasising the need for trained experts to guide the process.

The session concluded that while AI holds immense potential to transform healthcare research and delivery, Australia must address its lagging adoption through increased funding, workforce training, ethical frameworks, and robust data governance. Collaborative efforts, combined with advancements in AI-driven technologies, will be essential to unlocking the full potential of AI in healthcare.

Global collaboration in biosecurity and pandemic preparedness

Wednesday, 4th December 3.00pm, Great Room 3, W Hotel

What role can research infrastructures play in enhancing preparedness for future pandemics? This session covered the entire spectrum from vaccine discovery to the global RI networks, emphasising the importance of collaboration in shaping global health policies and the critical need to address biosecurity concerns in a changing climate. It explored the One Health approach, which integrates the health of humans, animals, and the environment into RI planning, and offered strategies for building resilient and adaptable health RIs capable of responding to emerging global health threats.

Moderator: Debbie Eagles, Director of CSIRO's Australian Centre for Disease Preparedness (ACDP)

Panel speakers:

- Professor Brett Sutton, Director of Health & Biosecurity at CSIRO
- Professor David Lye, Director of the Infectious Disease Research and Training Office at the National Centre for Infectious Disease, Singapore
- Professor Thomas Schulthess, Director of the Swiss National Supercomputing Centre (CSCS)

Summary:

The session began with an overview of the ACDP (Australian Centre for Disease Preparedness) by **Brett Sutton**, who highlighted the facility as the only BSL4 lab for large animals in the Southern Hemisphere. The lab focuses on investigating zoonotic diseases with high potential for public health impact. Brett emphasised that the lab’s research is crucial for understanding and preventing the spread of “high-risk” zoonotic diseases, providing a foundation for epidemic preparedness.

David Lye followed with a presentation on the Programme for Research in Epidemic Preparedness and Response (PREPARE), a Singapore-based international collaboration involving 14 sites across 7 countries. The programme is dedicated to addressing regional pandemic risks and improving early warning systems. David detailed how the collaboration works to strengthen pandemic preparedness in diverse regions by enhancing surveillance and developing effective response strategies to emerging health threats. The initiative aims to create a comprehensive and coordinated approach to managing regional pandemic risks.

Thomas Schulthess introduced CSCS (Swiss National Supercomputing Centre), a high-performance computing (HPC) facility in Switzerland that provided open access to researchers, including international teams, during the COVID-19 pandemic. CSCS played a pivotal role in providing computational resources for critical pandemic-related research, helping researchers across the globe analyse data and model the spread of the virus. Thomas emphasised the importance of open access in accelerating research and the role of HPC in addressing complex, data-heavy challenges like the pandemic.



During the panel discussion, several key themes emerged. The panel emphasised the need to connect pandemic preparedness RIs with the countries where pandemics are likely to originate. Engaging local researchers in these regions is critical to addressing the specific risks and challenges faced by those countries. By fostering collaboration and building local capacity, researchers can work more effectively on the ground to monitor, prepare for, and mitigate potential outbreaks.

The panel also discussed the importance of “ground-up” scientific organisations, which can build trust and facilitate data-sharing during crises. Unlike “top-down” organisations, which may lack local credibility, these ground-up networks have the advantage of strong, pre-existing relationships with communities and local researchers. Such networks enable faster, more efficient responses in emergencies, allowing for rapid data exchange and collaboration to address urgent health threats.

Another point raised during the discussion was the challenge of maintaining focus on pandemic preparedness during periods when no immediate threat is visible. The panel acknowledged that while it is easy to neglect preparedness efforts when pandemics are not at the forefront, this lack of attention can be detrimental when a crisis arises. The importance of sustained investment in preparedness, including research and infrastructure, was underscored as a crucial element for ensuring a swift and coordinated response in times of crisis.

The barriers to effective research collaboration were also examined. The panel noted that the challenges were often not medical in nature but rather stemmed from policy differences, divergent ethical standards, and varying regulatory environments across countries. These non-medical factors can hinder the establishment of international collaborations and limit the effectiveness of pandemic preparedness efforts.

The panel also explored the potential role of AI in pandemic preparedness, particularly in drug screening and predictive modelling. AI was seen as a valuable tool for identifying potential therapies and predicting future outbreaks. However, the panel cautioned that there would always be inherent uncertainty in AI predictions, particularly when it comes to the validation of drug screenings. There is a need for continued rigorous testing and validation to ensure that AI-generated predictions translate into effective, real-world interventions.

In conclusion, the session highlighted the importance of international collaboration, open access to resources, and building trust in local networks to strengthen pandemic preparedness efforts. It also emphasised the need for sustained focus on preparedness, despite the absence of immediate threats, and the role of AI in advancing research, while acknowledging the challenges that come with its application in predicting and responding to pandemics.



Digital research infrastructure for healthy communities

Wednesday, 4th December 3.00pm, Great Room 1, W Hotel

Digital infrastructure will play a pivotal role in advancing health and medical research worldwide. This session explored the latest innovations in digital research infrastructure and their transformative implications for building healthier communities.

Moderator: Ian Smith, Professor Emeritus at Monash University

Panel speakers:

- Professor Graeme Jackson, Clinical Director of the Florey Institute of Neuroscience and Mental Health
- Dr Merran Smith, Chief Executive of Australia's Population Health Research Network (PHRN)
- Tim Hubbard, Director of ELIXIR
- Professor Wojtek James Goscinski, Chief Executive Officer of the National Imaging Facility



Summary:

The session explored the critical role of research infrastructure in advancing global health and medical research, particularly in supporting healthier communities. RI was recognised for its potential to scale healthcare from localised to global levels, leveraging population-linked data to enable timely and effective health interventions.

Participants emphasised the necessity of integrating data use into RI from the outset, rather than as an afterthought. This proactive approach was exemplified by Australia’s cryo-electron microscopy revolution, which demanded rapid adaptation to new data-handling methods. A co-design environment was proposed to align RI with community needs and ensure its effectiveness.

The privacy, legal, ethical, and societal complexities of handling sensitive data were highlighted. In federated systems, jurisdictional regulations often hinder seamless data sharing. While many individuals are willing to share health data for broader benefits, concerns arise when personal interactions, such as local GP visits, are documented and shared.

The session reviewed initiatives such as the UK’s 1 Million Genomes Project and its expansion across Europe through federated systems facilitated by ELIXIR. These efforts aim to revolutionise medical care by integrating genomic data into healthcare systems, with incremental progress being made in Europe.

The panel discussed Australia’s pathway toward personalised medicine, noting the limitations of legislative solutions due to overlapping regulations. A research-driven approach, exemplified by the 100,000 Genomes Project in England, was presented as a model for integrating genomic medicine into standard healthcare practices. This project demonstrated the benefits of genomic sequencing and contributed to the expansion of the 1 Million Genomes initiative.

Efforts to democratise healthcare were addressed, with examples from the UK and Australia. The UK’s genomic efforts aim to benefit entire populations through systemic integration. In Australia, a new healthcare model has improved access for remote and regional communities by enabling routine health appointments remotely. Participants noted that healthcare systems often lack the capacity for internal reform, suggesting that technological innovation, driven by external companies, would be pivotal.



The session concluded with a discussion on Tier-2 funding, affirming its importance in specific circumstances. Participants stressed the need for clarity in the purpose of Tier-2 investments and recognised the unique capabilities of universities in scaling up RI to benefit broader communities.

Using RI to investigate and document the impacts of the environment on human health

Wednesday, 4th December 2.00pm, Great Room 2, W Hotel

This session examined the complex interplay between environmental factors, social determinants, climate change, and human health, focusing on the vital role of global collaboration in research infrastructures.

Moderator: Dr Gary Miller, Vice Dean for Research Strategy and Innovation at the Mailman School of Public Health of Columbia University

Panel speakers:

- Dr Charlotte Roehm, Acting Deputy Division Director for the Division of Biological Infrastructure in the Directorate of Biological Sciences at the National Science Foundation (NSF)
- Carthage Smith, Head of the OECD Global Science Forum (GSF)
- Jan Hrušák, Senior Research Fellow at the J. Heyrovsky Institute of Physical Chemistry of the Czech Academy of Sciences
- Professor Jana Klánová, Director of RECETOX, the European Centre of Excellence in Environmental Health Sciences
- Professor Jochen Mueller, Professor at University of Queensland

Summary:

The session focused on the concept of the exposome, which represents the environmental complement to the genome and its impact on human health. The moderator introduced the topic, highlighting its importance in understanding how environmental factors affect human health.

Jana Klánová began by discussing the gap in research identified in the 2018 ESFRI Roadmap, particularly regarding the environmental impact on human health. Recognising the need for extensive and distributed research infrastructure to tackle this gap, Professor Klánová shared the establishment of two exposome RIs, one of which is EIRENE (Environmental Risk Evaluation for Human Exposome). This project involves 21 countries and is structured around six pillars: three experimental (labs focused on chemical exposure, studying the effects of exposure, and assessing toxicological impacts) and three data-related pillars (experimental data, clinical data, and tools for data harmonisation). EIRENE also collaborates closely with global health organisations such as the United Nations Health and the World Health Organisation (WHO) to enhance the legitimacy and global coordination of the project.

Carthage Smith noted the challenges in exposome research are not unlike those faced in other global collaborations. These challenges include navigating the different ministries and sectors within countries, such as health, education, science, and the environment, each with its own priorities and cultures. Moreover, exposome research struggles to attract funding and to define who should bear the responsibility for it. Carthage emphasised that engaging influential bodies such as the WHO is crucial for intergovernmental coordination and legitimacy in global research efforts.

Charlotte Roehm referred to a recent National Science Foundation report that identified opportunities for RIs to coordinate across both national and international initiatives. She pointed out that exposome research is a prime example of how RIs can benefit from such coordination. Charlotte highlighted the National Ecological Observatory Network (NEON), a coordinated network of 81 observation sites across the United States. Observations made through such networks can yield valuable insights into human health and contribute to global collaborations like the Global Ecosystem Research Infrastructure (GERI).

Jochen Mueller further emphasised the significance of exposome research, especially in light of the increasing number of chemicals being produced without adequate regulation. He pointed out that exposome research in Australia faces gaps, such as the delayed establishment of breast milk monitoring initiatives compared to other countries. However, Jochen suggested that Australia's unique climate conditions, remote locations, and potential for engaging First Nations people in research present opportunities to generate valuable and impactful exposome research.

Jan Hrušák presented the findings from the ESFRI 2020 White Paper, "Making Science Happen," which outlined the new ambitions for Research Infrastructures in the European Research Area. The report emphasised the importance of scientific excellence, addressing socially relevant research challenges, and providing holistic services, all of which are exemplified by exposome research. Jan stressed that this type of research is not only scientifically important but also socially impactful, as it can address crucial issues related to public health.



During the discussion, the panel acknowledged that international collaboration in exposome research can be complicated by political concerns within individual countries. They stressed the importance of involving less-engaged countries, particularly low-income nations, from the outset of projects. The panel emphasised the need to listen to the specific needs and priorities of these countries, rather than imposing a predetermined end-product, to ensure more inclusive and effective collaboration.

In conclusion, the session underscored the importance of exposome research in understanding the environmental factors influencing human health. It highlighted the challenges of

international collaboration, including navigating diverse political and institutional landscapes, but also stressed the value of coordinated efforts and the need to include all stakeholders, especially those from less-engaged regions. The development of distributed research infrastructures and global partnerships, such as EIRENE, was emphasised as crucial for advancing this field and achieving meaningful scientific and societal impact.

How RI is supporting sustainable agriculture, nutrition and development

Tuesday, 3rd December 3.00pm, Great Room 3, W Hotel

This session offered guidance on prioritising efforts and funding for research infrastructures over the next decade to ensure global nutrition with minimal environmental impact. Key sub-themes include addressing climate change's effects on food production, such as water scarcity and shifting agricultural zones.

Moderator: Richard Dickmann, Chief Executive Officer of the Australian Plant Phenomics Network (APPN)

Panel speakers:

- Professor Danielle Way, Director of the Australian Plant Phenomics Network (APPN)
- Professor Paul Gauthier, Professor of Controlled Environment Agriculture
- Stijn Dhondt, Head of the VIB Agro-incubator
- Professor Wei Guo, Associate Professor at the Graduate School of Agricultural and Life Sciences, the University of Tokyo, Japan
- Professor Sushil Kumar, Director of Research at the University of the South Pacific



Summary:

The session emphasised the critical role of RI in addressing the challenges posed by climate change, food security, and the growing demands on agricultural systems. Agriculture, which accounts for 4.27% of global GDP and employs 35% of the global population, faces significant environmental pressures. It contributes 22% of global greenhouse gas emissions and consumes 70% of the world's freshwater. Despite the dramatic impacts of climate change, agricultural practices, particularly manual labour, have largely remained unchanged.

The session highlighted the growing concern over food scarcity, with projections suggesting that by 2025, food production will not meet global demand. The impact of climate change is particularly pronounced in regions like Australia, where temperatures are rising faster than the global average, exacerbating extreme weather events such as floods. In 2022, 29% of Australians faced food insecurity, underscoring the urgency of addressing food production challenges. Australia has become increasingly reliant on food imports, particularly from China, and needs to invest in sustainable farming practices and the next generation of farmers to secure its food future.

The panel emphasised the need for RI to focus on future conditions and long-term solutions. Research should tackle both immediate challenges and longer-term issues related to food and climate security. Development of new breeding technologies is crucial for adapting crops to future conditions.

The importance of a multidisciplinary approach to agricultural sustainability, integrating various practices and technologies to create a more circular and sustainable agricultural system was highlighted.

Vertical and indoor farming were identified as potential solutions to water scarcity. These farming systems recycle water, eliminate runoff, and could create symbiotic relationships with nearby CO₂-producing industries. While not a replacement for traditional farming, indoor farming could complement existing agricultural practices, especially in areas with water scarcity.

A key initiative in Queensland focused on protected cropping and food security was discussed, with strategies developed to ensure long-term food security. The Queensland Department of Agriculture and Fisheries (DAF) and the Queensland Alliance for Agriculture and Food Innovation (QAAFI) are working to define short, medium, and long-term strategies for agricultural development, treating food security as a national security priority.

Stijn Dhondt shared insights into similar challenges faced in Europe, including reduced agricultural yields and food quality due to climate change. The European Union has set ambitious targets to reduce the use of agrochemicals, further complicating the challenge. EMPHASIS aims to facilitate plant phenotyping to assess crop performance across diverse environments, with 200 installations of infrastructure across Europe, including controlled and intensive field facilities.

Sushil Kumar discussed the challenges faced by small island nations like Fiji, where agriculture constitutes a major part of the economy. These islands are highly vulnerable to food insecurity due to their unique environments, such as volcanic soils, limited water resources, and the

threat of cyclones. Furthermore, there is a lack of policy and funding support for research infrastructure in these regions, further exacerbating their challenges.

Wei Guo presented the Global Wheat Dataset initiative, where Japan, facing challenges in wheat production, collaborated with other countries to build a comprehensive AI model capable of detecting wheat head weight from images. This initiative involved sharing datasets from multiple countries to train the AI, leading to a more accurate and diverse model.

Danielle Way emphasised that while RI is essential, its success depends on talented staff and the human resources behind the infrastructure. Without skilled personnel, RI cannot function effectively, proving the importance of investing in human capital.

In conclusion, the session underscored the need for innovative research infrastructure to address the pressing challenges of sustainable agriculture, food security, and climate change. It highlighted the importance of collaboration, advanced technologies, and investment in human capital to secure the future of global food production.

Closing Ceremony

Thursday, 5th December 12.00pm, Great Room Plenary, W Hotel

Brisbane statement

- Claire Sainsbury, Australian Department of Education
- Dr Alex Cooke, ICRI Co-Chair
- Michael Arentoft, ICRI Co-Chair and Head of Unit, Open Science, Directorate-General Research and Innovation at the European Commission

Australia's Plenary Address

- Dr Cathy Foley, Australia's Chief Scientist

Thank you from Australia

- Andrew Powell, Minister for Science and Innovation for the Queensland Government

Thank you from the European Commission

- Michael Arentoft, ICRI Co-Chair and Head of Unit, Open Science, Directorate-General Research and Innovation at the European Commission

Baton pass to 2026 host

- Dr Alex Cooke, ICRI Co-Chair
- Marco Lazzarino, Scientific Attache, Italian Embassy, Australia

Summary:

The session highlighted the transformative role of research infrastructures in tackling global challenges such as climate change, health crises, energy needs, and food security, underlining the significance of international collaboration. This central theme was embodied in the presentation of the Brisbane Statement, which builds on the earlier Brno Declaration to create a globally integrated RI ecosystem.

The Brisbane Statement was introduced as a product of nine months of dedicated effort by the ICRI International Program Committee. It emphasises international partnerships, data sharing, and technological advancements to address pressing global issues. The Statement is intended to guide stakeholders toward actionable outcomes between successive ICRI meetings.

The Brisbane Statement calls for increased investment and support for RIs, highlighting their role as hubs for international collaboration. The document underscored the "power of purpose" in fostering innovation and knowledge advancement.

Claire Sainsbury identified key global challenges, including the spread of transmissible diseases, environmental changes, and the need for adaptive responses. To address these challenges, she outlined four critical areas of focus:

- **Workforce Development:** Establishing career pathways and recognising RI workforce contributions.
- **Long-Term Planning:** Ensuring flexibility and readiness to adopt emerging technologies.
- **Adaptive Policies:** Creating supportive frameworks for global collaboration.
- **Promotion of RIs:** Effectively articulating their value to stakeholders and the public.



Claire emphasised the importance of engaging diverse stakeholders, including Indigenous and local communities, to translate research into societal benefits. Advocacy for RIs was deemed essential to secure funding and communicate their tangible benefits in solving global challenges.

Australia's Chief Scientist, **Dr Cathy Foley**, delivered a wide-ranging reflection on the impact of RIs. She highlighted historical contributions, such as the invention of the internet and Wi-Fi, as examples of how RIs push the boundaries of knowledge. Dr Foley stressed the necessity of global collaboration, particularly in addressing shared challenges like climate change and misinformation. She advocated for systemic changes to research career models to accommodate advancements in quantum technologies, AI, and HPC.

Dr Foley praised the inclusion of Indigenous knowledge systems in the research ecosystem, citing examples of successful integration, such as fire management practices and the use of spinifex grass in sustainable innovations. She concluded with a call for researchers to embrace curiosity, collaboration, and integrity, underscoring the vital role of RIs in shaping a better future.



Dr Alex Cooke pointed out this was first ICRI meeting hosted in the Asia-Pacific region, a significant milestone in bridging gaps between the Global North and South. He also mentioned how ICRI 2024 integrated underrepresented perspectives, particularly those of Indigenous peoples, and had focused on inclusivity and fostering long-term collaboration.

A symbolic handover to Italy, the next host nation, emphasised continuity and commitment to advancing the global RI agenda. Italian representatives highlighted their country's historical contributions to large-scale projects like CERN and the Einstein Telescope, underscoring their dedication to research and innovation.

Andrew Powell, Queensland's Minister for the Environment, Tourism, Science, and Innovation, addressed the conference, highlighting the state's dedication to fostering RIs and scientific collaboration. Andrew announced a \$2 million commitment to establish a National Indigenous Science Translation Centre, showcasing the integration of Indigenous knowledge into contemporary research. Examples included the use of spinifex grass for innovative applications, reflecting Queensland's leadership in sustainable development.

Andrew's address also celebrated Queensland's biodiversity and its potential for bio-discovery. He acknowledged the contributions of Chief Scientist Dr Cathy Foley and other scientific leaders in advancing impactful research. Powell concluded with optimism about the future of RIs in Queensland and globally, calling for continued collaboration and investment.

The Brisbane Statement

Introduction



Research Infrastructures constitute major strategic assets across all scientific disciplines, research fields and national, regional, and global scales. They support the research needed to produce breakthrough discoveries and address societal challenges.

For international cooperation and collaboration among RIs, it is necessary to develop and implement governance and funding models that build trust, manage risk and enable infrastructures to keep up with technological developments. Policymakers and funders play a critical role in the evolution of RI to harness it for new opportunities and different applications.

The [Brisbane Statement](#) arises from the 2024 International Conference on Research Infrastructures (ICRI 2024). It encourages all RI stakeholders to actively consider the role of RIs in addressing global challenges, and how strengthening international RI collaborations can help solve them.

Addressing Global Challenges

RIs underpin the research needed to address global challenges such as climate change, natural disasters, food security, pandemic preparedness, and improving human health. New digital technologies such as AI and big data can increase the impact of RIs addressing these challenges.

Addressing global challenges requires global collaboration, as different nations and regions bring both knowledge and data from their region, and diverse perspectives on possible solutions. When addressing these challenges, all nations have a unique role in the RI system, and there is a need for higher-income economies to support and engage on an equitable basis with the research communities in lower- and middle-income economies.

It is essential that RI managers, policymakers and other RI decision-makers have a clear long-term vision and enough flexibility to respond to urgent priorities and emerging opportunities.

Climate Change and the Energy Transition

RIs are a critical component of land, ocean and space observation systems, providing data that improves understanding of the global climate system and informs climate change mitigation and adaptation efforts. Social science and humanities RIs deliver critical information both on the causes of environment and climate change and societal responses to adaptation and mitigation policies.

RIs will enable research into the materials and processes necessary to advance new energy sources and cost-effective low-carbon technologies. RIs themselves are also working to become more environmentally sustainable through more efficient energy and material consumption, and other actions.

Healthy Communities

RIs play a vital role in supporting better human health and wellbeing in areas such as pandemic preparedness, emerging diseases and malnutrition. They underpin research across a range of fields such as drug and vaccine discovery, human exposomics, epidemiology and biosecurity. RIs play a critical role in supporting research on the societal determinants of health and behavioural responses to health policies.

Technological advances such as the use of AI for medical imaging, high-performance computing to enable drug discovery, and advances in biobanking, increase the potential of international collaboration in RIs for health. These advances are supported by increasingly skilled technicians who enable the best use of new technologies. RIs also enable research projects that increasingly seek to integrate multiple disciplines and communities to explore the relationships between human health, animal health and environmental change.

RIs will need to build on existing multidisciplinary and international collaborations to continue to support improved global health outcomes and be supported by policy to adapt to shifts in health research caused by changes in technology, global issues and societal expectations.

Feeding the Planet

Understanding how the Earth's biodiversity and climate impacts future agricultural systems relies on RIs. They preserve seed samples, provide data for interdisciplinary projects, and characterise critical crops that have the potential for climate change adaptation. As a result, groundbreaking biotechnological advances and techniques, and social models for food sustainability, are unlocked through RIs.

RIs underpin global collaborative research efforts to ensure world-wide food security by working to overcome environmental challenges such as constrained soil and water resources, and threats from pathogens, pests and invasive species. Policymakers rely on researchers to discover not only the physical solutions to these challenges, but to build the social licence needed for citizens to embrace them. RIs are excellent hubs for engaging with local communities and bring society closer to scientific developments.

Ongoing support for RI capability is needed for these research efforts to continue to chart a global path toward future food sustainability.

RI for Translational Research

RI services hold great potential to accelerate the conversion of scientific knowledge into new applications and products. They can also help improve the sustainability of industrial production processes. In order to make the most of this potential, bridging the gap between academia and the public and private sectors is key. Converting research into practical applications brings innovation to critical areas, such as health, climate adaptation, manufacturing, construction and energy.

RI services can support the translation of research by considering this in their strategies and operational models, and working with researchers to ensure RI usage meets necessary regulatory requirements so their research can be used in commercial or societal contexts. In doing so, RIs can attract diverse users and funding, and maximise the impact of new knowledge across society.

Digital Research Infrastructure

Coordinated approaches to Digital Research Infrastructure (DRI), such as national digital research infrastructure strategies, are becoming increasingly important to national and global research and innovation efforts. These approaches enable RIs to manage increasing data volumes (including storage and curation), develop digital research skills, and provide cohesive access across different DRI resources and platforms to users. They also allow RIs to apply consistent data management and sharing protocols to make data more internationally interoperable. DRI needs to be more sophisticated and span across multiple domains and scales so that researchers can share, access, and analyse increasingly larger and more complex data.

Open science strategies depend on well-connected DRI to manage science and research data. RI data policies and governance should enable adherence to FAIR (Findable, Accessible, Interoperable and Reusable) data principles, and promote trust and identity verification, cybersecurity, quality assurance mechanisms, and appropriate access mechanisms for sensitive data.

Indigenous Knowledge Systems

Indigenous Knowledge systems (sometimes also referred to as Indigenous and local knowledge systems) are deeply rooted in connection to cultural identity, language and traditional kinship systems. These systems bring constantly evolving knowledge, values, understandings and beliefs into decision-making at different scales for the well-being of people and the planet.

RIs can play an important role in supporting and valorising Indigenous Knowledge systems. By incorporating a rights-based, people/purpose focused framework like the CARE Principles (Collective benefits, Authority to control, Responsibility, and Ethics), RIs can effectively enable Indigenous Data Sovereignty and support the rights of Indigenous Peoples to Indigenous Knowledge within the research ecosystem. The incorporation of the CARE principles is critical for RIs to effectively host or support the generation of Indigenous Data, such as in genomic sequencing, the collation of Indigenous environmental knowledge, and characterisation of cultural artefacts.

Culturally aware RIs can also actively support collaborative engagements with local Indigenous Knowledge custodians and work within Indigenous Knowledge systems in a manner that best supports each respective engagement. Where physical RIs are built on the lands of Indigenous Peoples, land use agreements for these sites should ensure that local cultural heritage is protected, and provide benefits such as community development, infrastructure, training and education.

By developing partnerships and co-designing policy with Indigenous communities from their inception, RIs can improve social buy-in, maximise positive impacts in local communities, and valorise Indigenous Knowledge systems.

Frontiers of Knowledge

The boundaries of what science can achieve are constantly expanding, and to explore them the research sector depends on the advancement of RIs.

RIs are essential in exploring and understanding our universe, from sub-atomic structures to space observation; basic chemistry to the complexity of the brain; simple ecosystems to the global earth; and from individual to population behaviours. Some of the equipment or networks of instruments required for this exploration are of such a scale, cost and level of complexity that their construction and operation require international collaboration, drawing on facilities and expertise from different parts of the world. This need for international collaboration will only increase as RI – and the research that can be achieved with it – becomes increasingly sophisticated.

To push the frontiers of knowledge and conquer some of the big questions in science, the RI staff of the future, such as facility managers and expert technicians, will need to

be trained in the increasingly interdisciplinary crossroads between research and technology. These personnel provide expert advice to develop RI, support RI users and provide field-specific support. RI staff will also need to be supported with career pathways, recognition of their achievements, and positive employment and workplace conditions. RI workforce strategies will need to attract, retain and train the uniquely skilled personnel who manage, maintain and operate these facilities.

Long-term, collaborative, strategic planning for RIs is necessary to ensure that the critical research and exploration they enable continues in the decades to come.

Looking Forward

RIs are the foundation of global research excellence and underpin the research sector's ability to adapt to new challenges and answer new scientific questions. RIs provide researchers with the tools and services to address emerging challenges, and empower advances in research by providing inclusive, collaborative and interdisciplinary networks for an increasingly wide range of users.

The incredible discoveries and achievements made possible by RIs demonstrate their importance and provide inspiration for the future, and the next generation of researchers. RIs require ongoing policy support and consistent funding to fully realise this potential.

RIs demonstrate the importance of long-term planning in the research system, and the value of funding models that allow RI leaders to proactively initiate collaborative ventures. The RI community is inherently international and collaborative, and the International Conference on Research Infrastructures provides the opportunity to celebrate and encourage these connections.

The Brisbane Statement calls on all RI stakeholders worldwide to support, invest in, and grow the collaborative global research infrastructure ecosystem. The world will continue to rely on RIs for addressing future challenges, both foreseen and unforeseen, and with strong global connections, research can continue to advance society to meet these challenges.

Side events

Imaging networks for global impact

Hosted by Australian National Imaging Facility (ANIF)

Monday 2 December 11am – 12.30pm | Customs House, Brisbane City

Imaging plays a crucial role in fields such as health, energy, the environment, and agriculture. This gathering brought together global imaging infrastructure community leaders who are collaborating across countries and borders to increase accessibility to advanced imaging.

“Imaging networks for global impact” discussed how imaging infrastructures are working together to tackle common challenges and enhance their impact on both national and international levels.

Participants included:

- Representatives from Global Bioimaging
- Members of Euro Bioimaging ERIC
- Representatives from major continental imaging networks in North America, South America, and Southeast Asia
- Representatives from NCRIS
- Leaders of major research initiatives utilising national and global imaging networks

Health research infrastructure ecosystems symposium

Hosted by Population Health Research Network (PHRN) – Invitation only

Monday 2 December 2pm – 5pm | Customs House, Brisbane City

This mini symposium brought together health research infrastructure experts from Europe, Australia, Asia Pacific and other regions. It focused on the exchange of information related to national and international health research infrastructure initiatives and collaboration opportunities. It covered research infrastructures including phenomics and other omics, imaging, therapeutics and population outcomes. Objectives included progression of collaborations developed at the Australian and European Health Research Infrastructure Symposium held in Prato in September 2023 and development of new collaborations.

Global Science Forum (GSF): Workshop on research security and consequences for research infrastructures

Hosted by GSF – Invitation only

Monday 2 December 9am – 5pm | CSIRO Ecosciences Precinct

The objective of this workshop, organised by the GSF in collaboration with CSIRO, was to explore and discuss the implications of security concerns for RI governance and operation. This

workshop focused on the particular challenges and specificities of research infrastructures, given their critical role in serving the global research ecosystem, and in ensuring the integrity and security of research. It explored the lessons learned from the real-life experiences of RIs and discussed policies and actions that can be implemented to effectively identify and manage security risks whilst maintaining open international cooperation. It brought together RI managers, funders and policy makers, including those with responsibility for integrity and security.

Enabling global FAIR data: WorldFAIR investment recommendations for research infrastructures

Hosted by CoDATA

Monday 2 December 1pm – 5pm | W Hotel Brisbane

Research infrastructures now play a crucial role in providing data products that support interdisciplinary research and address global challenges through the integration and analysis of diverse data. The WorldFAIR project demonstrates that a fundamental shift from the current bibliographic approach to data stewardship to a data engineering approach is required.

This session discussed the Cross-Domain Interoperability Framework (CDIF) and presented the outcomes of the WorldFAIR project. It explored the challenges and opportunities it presents, and the necessary investments in infrastructure, technology, standards, and capacities to support these developments.



Human exposure assessment for the evaluation and prevention of chemical risks

Hosted by Queensland Alliance for Environmental Health Sciences (QAEHS)

Monday 2 December 12:15pm – 5pm | QAEHS

This event focused on the integration of existing research infrastructures into activities that investigate the impact of chemical exposure on health and the factors influencing it. The goal is to establish a Pacific Regional infrastructure network, leveraging existing networks from Europe and North America, to contribute to global efforts in creating a comprehensive human biomonitoring system.

Leveraging research infrastructures for addressing climate change risks

Facilitated by EGI

Monday 2 December 9am – 12pm | W Hotel Brisbane

Climate change poses a significant threat, demanding a coordinated global response. Research infrastructures play a critical role by providing data and expertise to understand and address climate change-driven risks.

This session explored how RIs from various regions can be leveraged for comprehensive climate action strategies. These included the need for a Whole System approach in addressing climate risks such as droughts, heatwaves, food security, flooding, landslides, and air quality.

It focused on building a collaborative interdisciplinary RI framework for global climate risk mitigation and adaptation, international cooperation for data sharing and knowledge exchange, identifying gaps and opportunities.

The session heard from representatives in the IRISCC Project, ICOS, EIRENE, SAEON (South Africa), and TERN (Australia).



Decreasing the environmental impact of research infrastructures

Hosted by GreenDIGIT

Monday 2 December 9am – 12pm | W Hotel Brisbane

This event discussed how to improve energy efficiency of existing scientific facilities (such as high energy consuming accelerators) while decreasing their environmental impact and optimising scientific workflow.

It also discussed the role of research infrastructures in supporting research for climate action and adaptation by providing essential data and tools for generating scientific knowledge.

It covered recent developments in Europe such as ESFRI, discussion on RI sustainability and energy efficiency and numerous national initiatives in Europe. It also facilitated cooperation with the Australian research community.



Addressing sweltering cities with a coherent urban climate research infrastructure

Hosted by AURIN

Monday 2 December 1:30pm – 4:30pm | AWS Offices

Facilitated by AURIN, with key contributions from other NCRIS-funded facilities such as ACCESS-NRI, ARDC and NCI, as well as international participation from Cooling Singapore 2.0 program, the workshop explored how to establish a replicable Urban Climate Research Infrastructure, bringing together:

- a coherent urban monitoring system in major cities and regional centres,
- a scalable digital research infrastructure that will allow for seamless data exchange and long-term storage, and support effective model orchestration, and
- a modular model orchestration, based on Docker-created and Kubernetes-managed containers.



Empowering research infrastructures for global impact: digital tools and collaborative solutions

Hosted by EGI

Monday 2 December 2pm – 5pm | W Hotel Brisbane

To maximise their potential, RIs must leverage advanced digital technologies and foster collaboration. This session explored how digital tools can empower RIs to overcome challenges, optimise resources, and achieve greater impact.

It showcased the latest digital innovations and best practices through a focus on digital infrastructures for RIs, data-driven research and innovation, AI for RIs, future computing needs and trends, building sustainable and collaborative research ecosystems.

Projects highlighted included ENVRI-Hub NEXT interoperable environmental data and services, iMagine AI-powered image analysis tools, PHENET for analysing large phenotyping datasets, the South African Environmental Observation Network (SAEON), ARDC, South Korea's national platform DataON, and the Research Software Alliance.



Enhancing development pipelines through microfab collaboration

Hosted by Australian National Fabrication Facility (ANFF)

Monday 2 December 2pm – 5pm | Sustainable Institute, University of Queensland

This workshop fostered collaboration among microfabrication facilities to strengthen development pipelines. It explored innovative networking strategies that optimise the use of research infrastructure and enhance the value and impact of public investments. By joining forces, microfab facilities can expand their operational models to support a broader spectrum of development stages, thereby servicing a wider array of clients and communities.





ICRI Welcome reception

Hosted by Queensland University of Technology (QUT)

Monday 2 December, 6pm – 8pm | QUT Campus, The Cube

To celebrate the start of ICRI 2024, a welcome reception was held at QUT’s Gardens Point campus. The venue was “The Cube”, one of the world's largest digital interactive learning and display spaces consisting of 26 multi-touch screens across two storeys.

Attendees heard from QUT’s Professor Christopher Barner-Kowollik, as well as the ICRI International Program Committee Co-Chairs Dr Alex Cooke and Michael Arentoft.





ICRI Conference Cocktail Event

Hosted by CSIRO

Tuesday 3 December, 6.30pm – 9.30pm | Queensland Art Gallery (QAGOMA)

Around 350 delegates attended this networking event. In keeping with ICRI 2024's regional focus, it allowed guests from around the world to view the Asia Pacific Triennial of Contemporary Art and hear a set by Waveney Yasso, a Brisbane-based singer/songwriter and a South Sea & Yuwi Burra descendant.

CSIRO Deputy Chief Executive Kirsten Rose spoke about the importance of RI in confronting global challenges and the role science can play in doing so.





Indigenous Knowledge Systems – perspectives from Australia’s First Astronomers

Hosted by Astronomy Australia Limited (AAL)

Wednesday 4 December, 5:45pm – 9:30pm | Brisbane Planetarium

This event offered ICRI delegates an opportunity to hear from Elders and astronomers who shared Indigenous perspectives on astronomy. The experience highlighted the richness of Indigenous scientific traditions and the importance of Indigenous science and engagement to contemporary scientific research, with a particular focus on research infrastructure.

The event took place at the Brisbane Planetarium and included a Welcome to Country, panel discussion on Indigenous astronomy, Viewing of *Skylore* – an exhibition featuring some of Australia’s leading Aboriginal and Torres Strait Islander Elders sharing star knowledge and a Planetarium screening of *The Earth Above*.



16th Meeting of the Group of Senior Officials (GSO) on global research infrastructures

Hosted by GSO – Invitation only

Thursday 5 December 2pm – 5pm, Friday 6 December 9am – 5pm, Monday 9 December 9.30am – 4pm | University of Queensland Boat Club

The GSO on research infrastructures is a working group under the G7. It focuses on areas which require international cooperation on global challenges or where it makes sense to pool investments to secure the best value for money. The GSO is composed of representatives from Australia, Brazil, Canada, China, France, Germany, India, Italy, Japan, Mexico, South Africa, UK, USA, and the European Commission. OECD acts as an observer to ensure good coordination with the Global Science Forum (GSF).

Delegates visited six National Collaborative Research Infrastructure Strategy (NCRIS) projects at The University of Queensland to see how NCRIS' networked nature fosters close collaborative relationships across RIs and across research institutions. The projects visited were Phenomics Australia, Microscopy Australia, Bioplatforms Australia, Therapeutic Innovation Australia, Australian National Fabrication Facility and the National Imaging Facility.

ASEAN Meeting: Exploring new opportunities for research infrastructure collaboration

Hosted by ASEAN

Thursday 5 December, 2pm – 4pm | W Hotel

This session shone light on the untapped potential for research infrastructure collaboration with partners in ASEAN and encouraged further exploration with this rapidly developing region. The ten member countries of the Association of Southeast Asian Nations (ASEAN) – Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam (and soon Timor Leste) – are an economic powerhouse with a combined population of over 672 million. ASEAN is a diverse region known for its economic growth, biodiversity, cultural richness, and its vibrant and increasingly tech-savvy young population. ASEAN countries offer a wealth of opportunities in research infrastructure that are often overlooked. This event explored the untapped potential and emerging trends in research infrastructure across ASEAN member states, and highlighted opportunities for international collaboration.



Global Ecosystem Research Infrastructure (GERI)

Hosted by Battelle – NEON & TERN

Thursday 5 December, 1pm – 4pm | University of Queensland, Brisbane City

The ‘Global Ecosystem Research Infrastructure’ (GERI) is an integrated network of six site-based research infrastructures around the world that have come together to better understand ecosystems across global biomes. GERI focuses on establishing the pathways for network-to-network activities across continents and cultures, garnering community support, eliminating barriers for researchers to work together, and federating data together. GERI prepares and provides data to better understand environmental change at a global scale and supports the next decade of Earth system science research.

Future digital infrastructure requirements for research infrastructure

Hosted by Amazon Web Services (AWS)

Thursday 5 December, 2pm – 5pm | AWS Offices

A roundtable workshop from national RI leaders on how they are using the commercial cloud to deliver their services to the research community and discuss the barriers and future opportunities to partnering with commercial cloud providers. The event included a panel discussion on current and future uses for commercial cloud, a discussion of what barriers are preventing partnerships with commercial cloud providers and discussed future trends in technology.



Alps Down Under: Digital RIs and open science

Hosted by the Embassy of Switzerland

Thursday 5 December, 3pm – 5pm | Westin Hotel Brisbane

Brought to you by the Embassy of Switzerland in Australia and Swissnex, Alps Down Under showcased successful RI collaborations between Australia and Switzerland and featured a keynote from Prof. Thomas Schulthess, Director of the Swiss National Supercomputing Centre (CSCS). The event was followed by networking.

Euro-Australian research infrastructure collaboration in the molecular life sciences

Co-hosted by Australian BioCommons and ELIXIR

Friday 6 December, 8.30am – 1.30pm | University of Queensland, Brisbane City

An insight into the Partnership between the Australian BioCommons and ELIXIR.

Australian BioCommons is a digital infrastructure enhancing Australia's research capabilities. ELIXIR is a European intergovernmental organisation dedicated to helping researchers leverage vast amounts of life science data. The collaboration agreement between the organisations is an example of a successful global partnership that has yielded fruitful outcomes for the global community of practitioners.

This meeting provided examples of successes to date including key outcomes, and future plans. It shared best practice for other research infrastructures looking to establish their own global partnerships and collaborations.

Designing nationally distributed collections infrastructure to solve global research challenges

Hosted by the Queensland Museum and the Atlas of Living Australia

Friday 6 December, 10am – 3pm | Queensland Museum

Advanced technologies, including genomics, imaging, artificial intelligence and machine learning, are rapidly expanding the potential role of biological collections in supporting science, industry and government decision-making. Individual collections play an important geographic, taxonomic and socio-cultural role in any national system demanding a distributed approach supported by effective partnership and coordination mechanisms.

This event, hosted by the Queensland Museum (QM) and CSIRO's Atlas of Living Australia (ALA), explored the core elements and opportunities of establishing a distributed collections research infrastructure: sectoral leadership, collection digitisation, storage and management; digital infrastructure, data access and integration; emerging transformational technology, and skills and workforce development.

It included a special back-of-house Queensland State Collection tour hosted by QM's biodiversity and geosciences team.



Samford Ecological Research Facility (SERF) site visit

Hosted by Queensland University of Technology (QUT)

Friday 6 December, 9am – 1pm, SERF

QUT's Samford Ecological Research Facility (SERF) is a 51-hectare property located in the Samford Valley, 45min from Brisbane's CBD.

The workshop included presentations on the Australian Acoustic Observatory (a continental-scale acoustic sensor network) and sustainable agriculture (QUT researchers from the fields of sustainable agriculture, positive global change, and food security). Attendees also visited QUT's "Engaging Science" Trail to look at the type of monitoring and educational activities being undertaken at SERF.

It was hosted by QUT in collaboration with TERN (Australia's ecosystem observatory) and the National Earth and Environment Scientific Facilities Forum (NEESFF), an Australian federation of NCRIS and other government funded NRIs that seek to integrate and harmonise their respective domain activities to enable a more holistic understanding of Earth Systems.



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ICRI 2024 volunteers

Many thanks to the friendly and enthusiastic CSIRO staff members who volunteered their time to assist with the running of ICRI 2024.

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Co-funded by the
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