

Submission

2016 National Research Infrastructure Roadmap

Capability Issues Paper

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Question 1: Are there other capability areas that should be considered?

The capability areas provide comprehensive coverage of key research areas. Murdoch proposes the addition of:

- Data visualisation in “Data for Research and Discoverability”, encompassing the capture, linking and visualisation of complex datasets; and
- Rehabilitation Medicine in “Health and Medical Science”, building from exercise physiology, biomechanics, rehabilitation and sports science towards outcomes in Clinical and Human Performance Research.

Question 2: Are these governance characteristics appropriate and are there other factors that should be considered for optimal governance for national research infrastructure.

Ensuring governance structures are fit for purpose requires consideration of:

- the nature and usage of research facilities, especially the mix between virtual and physical;
- the overall funding mix, particularly where there may be investment from business and industry;
- clarity of Commonwealth ownership and responsibility for facilities;
- the ability to negotiate funding contracts and manage an investment portfolio to provide recurrent funding; and
- audit processes that address the need for and value of the specific infrastructure, including an exit/extension strategy.

Efficient administration of finances, human resources, and fair and equitable access to research infrastructure requires adequate resourcing and effective shared governance.

Duplicating governance and administrative structures across all NCRIS sites loses the potential for economies of scale and other administrative efficiencies (for example the ability to utilise a common reservation platform).

To meet these constraints, Murdoch University proposes that CSIRO provide governance and management structures for all NCRIS facilities. This has advantages that include:

- an awareness of the differential cost structures operating at a national level, for example loss of time and additional costs of travel to the East coast for researchers outside Sydney, Melbourne, Canberra and Brisbane;
- a history of working closely with industry, both in attracting research funding and facilitating the translation of research into business and industry practice; and
- promotion of deeper engagement between CSIRO and universities.

Question 3: Should national research infrastructure investment assist with access to international facilities?

Research and innovation is an increasingly collaborative venture. National and international partnerships underpin cultural and technological advances.

Australian universities have established strong research ties in Asia building research centres and multinational teams from individual research projects. Murdoch University has, for example, established the Singapore Centre for Research in Innovation, Productivity and Technology (SCRIPT) to facilitate engagement with the SME and government sectors in Singapore and has three joint research centres in China focused on wheat improvement, biotic and antibiotic stress in agriculture and forestry, and veterinary epidemiology.

In a global economy, shared access to large infrastructure facilities will reduce national costs and can give rise to economies of scale. There is potential for nations to reduce duplication of large-scale infrastructure where facilities are accessible in another country. Where virtual access is possible there can be significant savings without loss of capacity but Australia's geography means that physical access to facilities in South East Asia and access from those countries to Australia is relatively efficient.

Australia should consider how to make the greatest use of its scarce resources through effective international co-investment in research infrastructure. When determining where investment in Australia is of greatest value, consideration should be given to:

- local infrastructure that captures comparative advantage based on geography, such as the SKA or Antarctic research infrastructure based in Tasmania;
- local monopoly infrastructure, that is infrastructure that no-one else has, such as the SKA or extensive linked datasets;
- comparative advantage based on research expertise, for example expertise in linked datasets adding value to local facilities, or utilising Australian expertise in manipulation and analysis of the output of research infrastructure located internationally; or
- potential risks to national security and intellectual property rights from a third party having access to the outputs of facilities located offshore.

Cooperative international infrastructure strategies require a dedicated mechanism to manage researchers' access to that research infrastructure, both from and to overseas facilities. As indicated in Question 2, management by CSIRO would provide proven management and governance structures that also encompass international collaborations and partnerships.

Murdoch strongly supports the IRU position that Australia should take the lead in establishing an Asian Research and Innovation Zone similar to Europe's Research Area.

Question 4: What are the conditions or scenarios where access to international facilities should be prioritised over developing national facilities?

As indicated in Question 3, Australia should prioritise support for international infrastructure capacity where there is a comparative advantage based on research expertise. Mutual benefit can be gained where Australian researchers utilise their expertise in the design, collection and analysis of outputs/data from equipment located overseas. For example, using Australian expertise in genetic, molecular marker and bioinformatics technologies and large scale Chinese facilities to analyse wheat to improve quality attributes and yield.

The establishment of an Asian Research and Innovation zone would provide a formal mechanism to help identify instances where mutual access to infrastructure can avoid unnecessary duplication and capture economies of scale. The European Molecular Biology Laboratory (EMBL) provides an effective model of shared resources and research outputs that provides mutual benefit to the member countries.

Question 5: Should research workforce skills be considered a research infrastructure issue?

Core research infrastructure needs to be managed across its lifecycle and operation. This needs to include capital investment, ongoing investment in maintenance, core technical staffing capacity for effective operation and maintenance, administrative capacity to ensure fair and equitable access on research merit, and costs for decommissioning the facility.

This also implies that research workforce skills should be part of research infrastructure capacity to ensure that the facility is used efficiently and effectively by all researchers who would be able to benefit for the research tools provided by the facility.

Active promotion of the capacities of each facility is an important function of an infrastructure strategy that seeks to generate new and innovative research.

Where Australia partners in research infrastructure located offshore, it is critical to build local expertise to make best use of the available equipment. EMBL provides a useful model in this regard, with a comprehensive range of training activities that includes conferences and courses as well as doctoral and postdoctoral programs.

Question 6: How can national research infrastructure assist in training and skills development?

Staff within a research facility have expertise in both the practical aspects of using the equipment housed in their facility and in research and method development. This is a valuable training resource for targeted research skills development nationally and internationally. For example, Murdoch's Separation Science and Metabolomics Laboratory has an international reputation for excellence in practical instrumental training for industry and other research facilities and has conducted courses across Australia and in Singapore, China, Malaysia, Thailand and India.

Active promotion of the capacities of each facility and development of appropriate training resources should be a required component of infrastructure funding.

Question 7: What responsibility should research institutions have in supporting the development of infrastructure ready researchers and technical specialists?

Research institutions actively encourage researchers and technical specialists to obtain the technical and research skills to utilise research infrastructure. As indicated in Questions 5 and 6, institutions who are participants in research facilities should be required to provide training for users to facilitate development of 'infrastructure ready researchers'. This avoids duplication of training programs at numerous institutions and allows individual users of a facility to obtain necessary training that could not be provided by their home institution.

This is of particular importance where Australia partners internationally, as indicated in Question 6.

Question 8: What principles should be applied for access to national research infrastructure, and are there situations when these should not apply?

Murdoch supports the IRU position that access and spread should be two key principles underpinning this research infrastructure roadmap. The opportunity cost to researchers, in time and additional expenses, to equipment requiring physical access needs to be recognised and appropriately managed in costing infrastructure.

Question 9: What should the criteria and funding arrangements for defunding or decommissioning look like?

Murdoch supports requirements for project plans to specify audit points that address the need for and value of the specific infrastructure, and processes for defunding and decommissioning or extension of the proposed research infrastructure.

Question 10: What financing models should the Government consider to support investment in national research infrastructure?

As indicated in Question 5, infrastructure investment needs to cover the lifecycle of the facility. Funding allocations could be structured across the projected life of the project, with the governing body for the facility charged with managing and maintaining an initial funding pool through appropriate investment strategies as well as by obtaining additional funding from users, and business and industry.

Murdoch's proposal for CSIRO to provide governance and management for all NCRIS facilities also brings expertise in the effective management of investment capital that would enable aggregation of different funding pools to maximise investment returns.

Question 11: When should capabilities be expected to address standard and accreditation requirements?

Effective industry engagement necessitates that facilities meet standard and accreditation requirements. Thus all infrastructure investment that has potential for use by business and industry, either in their own right or in partnership with universities and research institutes, should seek appropriate accreditation.

Relevant accreditation also assists in international collaboration by ensuring the cross-compatibility of research platforms and direct comparability of research data/outcomes.

Question 12: Are there international or global models that represent best practice for national research infrastructure that could be considered?

While technically an international model, EMBL's structure, governance and funding provide an effective model for infrastructure investment that covers the full infrastructure lifecycle, as well as ensuring development of new instruments and methods, and active technology transfer.

Health and Medical Sciences

Question 15: Are the identified emerging directions and research infrastructure capabilities for Health and Medical Sciences right? Are there any missing or additional needed?

National precision medicine research infrastructure linking genotype to phenotype. This infrastructure comprises:

- Clinical registries research infrastructure platform;
- Patient-centric biobank informatics platform;
- Meta-data archive for genotype/phenotype virtual laboratory;
- Integrative –omics analytic environment; and
- Synthetic Precision Oligonucleotide Therapeutic Development Platform.

With respect to the last item, the Centre for Comparative Genomics (CCG) at Murdoch University is uniquely placed in Australia, specialised on developing synthetic precision oligonucleotide therapeutic molecules for tackling a range of disease conditions, including rare diseases, neuromuscular diseases and solid cancers. CCG is the only institute in Australia capable of synthesising smart precision oligonucleotides with the state-of-the-art oligonucleotide synthesisers. The facility has pioneered synthesis of DNA and RNA oligonucleotides and chemically-modified oligonucleotides in small to large scales. CCG has attracted significant research collaborations across Australia, and the centre continues to receive huge demands on its capacity to synthesise smart oligonucleotides, and it would be ideal to further expand the facilities to meet the needs of the Australian research community and to further fruitful collaborations.

National Security

Question 27: Are the identified emerging directions and research infrastructure capabilities for National Security right? Are there any missing or additional needed?

The development of a national plant biosecurity virtual laboratory would enhance biosecurity programs.

Underpinning Research Infrastructure

Question 30: Are the identified emerging directions and research infrastructure capabilities for Underpinning Research Infrastructure right? Are there any missing or additional needed?

The Pawsey Supercomputing Centre is a world class supercomputing facility which together with NCI in Canberra provides nationally available capability supporting Australian researchers working with massive data sets and developing simulation modelling capability accelerating scientific and industrial outcomes.

The Australian Government should continue to invest in maintaining the two existing 'Tier One' supercomputers in Australia and all efforts should be made to ensure that these investments:

- ensure stability of services for Australian researchers through upgrading processes;
- are primarily based on merit allocation schemes;
- encourage industry engagement with universities;
- support development of Early Career Researchers; and
- support priority research areas but have the flexibility to support emerging areas of research.

To remain as a world class facility the Pawsey Centre requires a capital refresh in the order of \$100 million for its computing infrastructure every four years. The current infrastructure requires an upgrade in 2018. At its meeting on 25th August the Pawsey Board reviewed its financial status and agreed that if the capital refresh is not available, the Pawsey Centre would need to cease operations by the end of 2018.

It is also important that major Tier 1 and Tier 2 Facilities have the ability to provide data storage not only for computational projects but also for data repositories of major collections. Repositories relating to world heritage sites should be prioritised but State based collections are also of significance, especially where there are extensive time series or massive linked datasets.

It is important that both facilities have autonomy that reflects the operational contribution that are made by partners at each site (including Universities and State Governments and their agencies). A stronger alliance between NCI and Pawsey is needed to ensure:

- coordination of upgrading of facilities to ensure stability for the Australian research community;
- coordination of merit allocation schemes; and
- sharing of resources including training and technical support.

Data for Research and Discoverability

Question 33 Are the identified emerging directions and research infrastructure capabilities for Data for Research and Discoverability right? Are there any missing or additional needed?

It is critical that high quality service of eResearch platforms is provided. This ensures:

- Fair merit allocation;
- Supercomputing and cloud services are provided to meet user needs; and
- Secure storage.

As indicated in Question 1, Murdoch proposes the addition of Data visualisation, encompassing the capture, linking and visualisation of complex datasets.

Question 35: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Data for Research and Discoverability capability area?

eResearch platform physical hardware needs to be aggregated to an appropriate recognised facility for quality of service, such as NCI at ANU and Pawsey in WA.

eResearch infrastructure (web-based virtual laboratory) and capability (skills) needs to be embedded in the research community where these skills are required and, not in the infrastructure providers themselves. As an example, the CCG has developed unique research infrastructure that includes:

- A global patient clinical registry platform;
- A hospital-grade patient-centric biobank system;
- Funded through NCRIS, a national meta data capture system that houses a range of reference datasets of national significance including: Biome of Australian Soil Environments, Marine Microbe, Antibiotic Resistant Pathogens, Great Barrier Reef, Melanoma, Wheat Pathogens Transcript, Wheat Pathogens Genomes, Wheat Cultivars, Barcodes, and Stem Cells;
- An integrative *-omics* analytic environment; and
- National Plant biosecurity virtual laboratory.

These virtual laboratories can be made available to the broader Australian research community through appropriate resourcing through national research infrastructure.

Merit allocation processes for eResearch infrastructure need to have integrity and transparency. Additionally, they need to cater for the dynamic nature of the scientific process, rather than applying rigid constraints.

The nature of the technology environment is such that there are many providers of eResearch infrastructure, including commercial operators. It is therefore critical that infrastructure providers operate under a principle of competitive neutrality.

eResearch platforms require a reliable, secure, ubiquitous on demand computing environment (public cloud). Business and industry have already solved many of these issues and are therefore important partners in developing eResearch capacity.

Other comments

If you believe that there are issues not addressed in this Issues Paper or the associated questions, please provide your comments under this heading noting the overall 20 page limit of submissions.

It is important that national infrastructure investment helps build capacity across all universities and research institutes. This requires that institutions make clear their strategic priorities and the research infrastructure needed to address their strategic research directions. Over time, this would provide an aggregate sense of the research infrastructure required to support the national research enterprise.