Submission
2016 National Research Infrastructure Roadmap
Capability Issues Paper

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Health and Medical Sciences

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

The Issues Paper provides a useful summary of likely future research infrastructure requirements and priorities, however the framework itself has some weaknesses, which should be addressed. While the capability area framework has been useful for assessing Australia's future research needs, it may not be suitable for ongoing conceptualisation and management of national research infrastructure, for the following reasons:

- A distinction needs to be drawn between 'Foundation' areas, which provide generic and very widely used research infrastructure, and 'Capability' areas, which map to specific research areas and therefore more specialised research infrastructure.
- The proposed capability areas 'Underpinning Research Infrastructure' and 'Data for Research and Discoverability' both support the research system as a whole, as well as being critical to supporting other capability areas identified in the Issues Paper. As such, these areas should be considered the highest priority for investment and consideration given to whether they should be governed, managed and funded in a different way to reflect this.
- Many national facilities (e.g. microscopy, fabrication) serve multiple capability areas, and cross diverse fields of research. Some infrastructure, such as our national ocean research vessel, will not neatly fit into any one capability area as they are currently articulated.
- Biotechnology and manufacturing systems are two examples of research areas that cross proposed capability areas. If the capability area framework is retained, it will be important to continue to monitor such intersections between capability areas, as demand and benefit for emerging research infrastructure may not be obvious until two or more capabilities are considered together.

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

The governance characteristics are broadly appropriate – the other factors that should be considered for optimal governance relate to how these characteristics are implemented:

- UTS supports the call made by the ATN and Universities Australia for a permanent, independent and national body to oversee research infrastructure and to ensure ongoing advocacy for Australia's research infrastructure, effective coordination at the national level, alignment across capability areas and facilities, and inclusiveness across Australia's diverse research institutions.

- A national body would also be well placed to evolve the research infrastructure system to incentivise better management and unnecessary duplication of investment within and across individual institutions, freeing up funding for more strategic investment in research infrastructure.
- The priority for national investment should be 'Underpinning Research Infrastructure', 'Data for Research and Discoverability', and high-end, world-class research infrastructure in the other capability areas.
- The proposed capability areas 'Underpinning Research Infrastructure' and 'Data for Research and Discoverability' should be managed nationally, with fewer separate entities involved.
- The current NCRIS node model is appropriate for other capability areas but adjustments should be made to ensure more effective engagement with Institutions across the system, including those who are not currently or directly involved, to ensure equitable access and inclusion of emerging research infrastructure capabilities as they arise in future.
- For the investments to continue to yield good returns, annual performance review and a management model of continuous improvement needs to be in place that considers impact across facilities and is open to necessarily evolutions in facility management and governance. For example, IMOS and TERN both utilise satellite data (for marine and terrestrial application, respectively) but the links between them are elusive – governance of those facilities has been independent previously, but there are good reasons why it should merge.

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

Yes. Roadmaps for each capability area should clearly indicate where the strategy for capability is to utilise and/or invest in international facilities. In these cases, access to international facilities should be considered a core responsibility of the national facility.

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

Access to international facilities should be prioritised if facilities are predominantly used in the context of large international research projects or if there is limited demand for the infrastructure by Australian researchers.

While we fully support a reasonable contribution of Australian resources to build international research infrastructure it is important that we do not sacrifice the building of a robust national infrastructure alongside a global system. For example, while many humanities and social sciences researchers work on projects that are internationally relevant it is not unusual that their work focuses on national cultures and communities.

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

Yes. The primary demand for research infrastructure is from people with specialist skills - we can't expect infrastructure to be well utilised or deliver benefit without considering the pull by users.

Another critical issue is appropriate support and career paths for specialist technical staff. Australia must develop and retain the specialist expertise in order to have world-class infrastructure. While technical experts are not academics or subject to other academic

performance expectations, they are research active professional staff who need to be supported to stay active in their fields. Potential solutions include ensuring providing dedicated funding for regular conference attendance and presentation, participation in international communities, involvement in research projects, and offering positions with more permanency.

In addition, academic and technical experts in research infrastructure leadership roles may have responsibility for strategic and operational management of complex specialist facilities, with large teams and budgets, and will require appropriate access to management training.

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

National facilities should have a defined role in training and skills development, which has been agreed with key stakeholders in industry and research institutions.

In particular, digital literacy is a critical skills gap across all disciplines. This should be addressed at a national level, in all capability areas. Research data management, data analysis, and reproducible research are all examples of areas where improved capability is urgently required. Nationally designed and delivered (online or otherwise) training could make a valuable contribution to the use of Australian research infrastructure for research in all capability areas.

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

Research institutions contribute to the development of infrastructure ready researchers, both through HDR training, and training for existing researchers. Research institutions should also actively engage with national facilities, to inform the design and delivery of training and skills development. Research institutions should also support HDR students and researchers to participate in nationally delivered training, generating demand for training opportunities and assisting national facilities to build meaningful links with industry.

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

UTS supports the widest possible accessibility to and utilisation of research infrastructure, across all proposed capability areas, within a framework of research excellence. A key objective of investment in national research infrastructure is to drive research impact. This occurs through basic and applied research conducted by researchers in research institutions and industry. Access (including funding and pricing) principles should reflect this, with real or perceived barriers to utilisation of infrastructure removed.

UTS also strongly supports the following comments made in the Universities Australia submission:

"Major national infrastructure should serve the entire national research system and not only those institutions that are financially or geographically linked to a facility. Geographical barriers to access can be managed where appropriate by creating facilities with multiple nodes across Australia. Businesses and industry often face an additional barrier of visibility of research infrastructure. Facilities should be encouraged to be genuine accessible to the broader innovation system".

The level of cost recovery for the majority of facilities should reflect a range of considerations. The pricing regimes for industry and international researchers should balance users' capacity to pay with the value of encouraging industry to conduct research onshore and the benefits of research collaboration. The cost of providing some services is such that they must be delivered as a public good, and for others identifying the cost of individual users is not possible or practical."

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

UTS supports the proposed approach to defunding and decommissioning, noting that utilisation targets and the intended research impact of the facility should be clearly articulated in the facility's strategic plan and reported on regularly, with facility directors and managers actively encouraged and supported to identify and address any issues with the facility prior to a decision to defund or decommission.

It is important to distinguish between the life cycles of research infrastructure and research assets. For example the research assets contained in repositories such as biobanks, libraries, galleries and museums may have life cycles of centuries, and in many cases these facilities operate under a mission statement that explicitly seeks to archive and retain research assets. Associated research infrastructure, including technologies needed for discoverability and analysis will need ongoing investment to remain at the cutting edge. Repositories may need a different approach to defunding and/or decommissioning than other types of research infrastructure, to reflect their longer lifecycles.

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

Infrastructure is a real cost of doing research that the government should fund as public good. While co-investment from state governments, industry, and philanthropy is welcome and desired, it should not be relied upon as an essential component of the financing model. Industry stakeholders are most likely to engage indirectly as facility users or research collaborators, and may not see value in co-investing in facilities directly. UTS supports the Universities Australia comments regarding financing models, in particular that:

"A key lesson from NCRIS is that allowing flexibility for state and territory governments to deliver on co-investment commitments encouraged a higher level of co-investment than would have otherwise been achieved by requiring co-investment up-front."

Financing models must fund both capital and operating costs. Ongoing, sustainable funding, in particular for operational support is critical – there is no point spending capital on infrastructure if the infrastructure is not supported properly, including with appropriate investment in technical expertise (see the response to Question 5) and 'Underpinning Research Infrastructure' and 'Data for Research and Discoverability' capabilities.

UTS supports the planning and funding timeframes suggested in the ATN submission:

"The ATN suggests that planning and funding timeframes for national research infrastructure, to be managed by the National Research Infrastructure independent body, should be on a 7 year cycle with a comprehensive review after year 4 of each cycle, and minimum 20 year horizon plans."

Further consideration should be given to how to incentivise and assist research institutions to invest their own funds in infrastructure. This could include encouraging institutions to reduce duplicated investment and underutilisation, to increase the effectiveness of existing investment in institutional research infrastructure and free up funding for investment in national infrastructure.

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

UTS supports a greater focus on standards and accreditation, and capabilities should be expected to address standard and accreditation requirements where they exist, unless there is a compelling reason why this would be detrimental to research.

It should be noted that standards are not only restricted to industry – standards also exist for collection of scientifically rigorous data that is comparable between instruments, programs, and countries. As research leaders, facility directors and staff should be supported to actively engage in and contribute to standards communities and professional accreditation bodies.

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

In the United States, access to research infrastructure involving ships is built into the competitive grants program, so there is not a separate process of applying for ship time versus operational project funds as in Australia. This model could also be explored for other national infrastructure.

Question 13: In considering whole of life investment including decommissioning or defunding for national research infrastructure are there examples domestic or international that should be examined?

No comment.

Question 14: Are there alternative financing options, including international models that the Government could consider to support investment in national research infrastructure?

UTS is not aware of any research infrastructure funding models that have proved successful internationally, other than adequate and long-term strategic government funding.

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?

UTS notes the absence of research infrastructure to support primary health and community based research (for example in general practice, nursing, sports science, physiotherapy, etc.) and suggests that additional engagement with a broader set of health and medical researchers might be required for this capability area.

UTS would also like to see further consideration of how to better leverage investment in public and private health infrastructure (e.g. clinics, medical imaging facilities) for research purposes. In the context of big data, the scope should be widened to include health data collected in non-government, private and research contexts.

As for the other capability areas, there is an urgent need to build expertise and capability in data analysis, for example, mathematical modelling and machine learning (see also the response to Question 5).

5.3.3. 'Bioengineering solutions for precision medicine' may be too narrow a category – other emerging areas of research in this area include research infrastructure used in the development of medical devices, biomarkers, and diagnostics. Potential areas of overlap with the 'Advanced Physics, Chemistry, Mathematics and Materials' should be explored further.

Integrated biological facilities for plant and animal sciences are mentioned in 6.3.3., the context of the 'Environment and Natural Resource Management' capability area, but these should also be considered in the context of the 'Health and Medical Sciences' capability area.

Similar infrastructure is used across the life sciences for research into natural systems (human, animal and plant), for example 'omics capability and bio-banking. There may be efficiencies of scale and increased opportunities for interdisciplinary research if related life sciences facilities were grouped or networked.

Question 16: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

No comment.

Question 17: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Health and Medical Sciences capability area?

No comment.

Environment and Natural Resource Management

Question 18: Are the identified emerging directions and research infrastructure capabilities for Environment and Natural Resource Management right? Are there any missing or additional needed?

Additional emerging needs in this area include:

- Advanced production facilities to improve quality and quantity of bio-products that have various end users (for example, pharmaceutical, aquaculture, agricultural industry) and are therefore linked with human health and food production.
- Operationalising systems from observation to prediction or early warning is an important emerging area of research (for example, forecasting severe storms for marine industries, shipping and navigation etc.)

Increasingly the focus for researchers will be on quantitative skills in modelling, bioinformatics, data mining/analysis/visualisation to meet these challenges, and facilities in this capability area could play an important role in training and skills development.

Question 19: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

Asian partners may be interested in partnering around modelling systems – South East Asia for eastern Australia and India for Western Australia. In addition, India has excellent remote sensing capability that we could better tap into – this expertise needs to be fostered with the EU and USA.

Question 20: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Environment and Natural Resource Management capability area?

No comment.

Advanced Physics, Chemistry, Mathematics and Materials

Question 21: Are the identified emerging directions and research infrastructure capabilities for Advanced Physics, Chemistry, Mathematics and Materials right? Are there any missing or additional needed?

UTS notes the need for additional capability around nanoparticle production, particularly of non-silicon materials.

Question 22: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

No comment.

Question 23: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Advanced Physics, Chemistry, Mathematics and Materials capability area?

No comment.

Understanding Cultures and Communities

Question 24: Are the identified emerging directions and research infrastructure capabilities for Understanding Cultures and Communities right? Are there any missing or additional needed?

Indigenous research infrastructure should be the priority in this capability area, with significant resources invested in consolidating and building on existing research infrastructure around Indigenous cultures and knowledges in order to create a cutting-edge, national, ethically-managed series of Indigenous research resources including collection and conservation of Indigenous experiences and cultures (including, but not limited to, languages, stories and material artefacts).

As custodians of the Aboriginal and Torres Strait Islander Data Archive (ATSIDA) referenced in the Issues Paper, UTS notes the need to support existing research infrastructure in addition to investing in new systems, to better enable capability to be developed and shared across the sector.

The other emerging directions listed in the Issues Paper are appropriate: translation (impact), digital humanities, digital repatriation, the future role of cultural (/data) institutions, urban studies and the networking of existing national and state institutions are key elements for consideration in the National Research Infrastructure Roadmap.

The Issues Paper correctly identifies the ongoing digitisation of cultural materials - including the creation of metadata and the making accessible of data – as important elements for future consideration. This sits alongside the continuing need to conserve materials, and to research and share knowledge on the best ways to conserve materials. We support a focus on community-managed cultures in ensuring ethical accessibility of such research materials.

Question 25: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

No comment.

Question 26: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Understanding Cultures and Communities capability area?

No comment.

National Security

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

No comment.

Question 28: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

No comment.

Question 29: Is there anything else that needs to be included or considered in the 2016 Roadmap for the National Security capability area?

No comment.

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?

This capability area is of paramount importance, as it supports all other capability areas, and the Australian research system overall. As such, there are some critical issues that should be addressed within this capability area:

- Expert support: It is globally recognised that more capability is required to support technologies and train the researchers of the future. It is particularly important to find ways to fund data scientists and programmers to support and undertake research as part of multi-disciplinary teams dealing with large research questions (see also our response to Question 5).
- Continuity and coordination: World-class and integrated research infrastructure requires reliable long-term funding. Infrastructure planning, funding and provisioning is very fragmented, including within NCRIS (e.g. ANDS, RDS, NeCTAR etc.). Consider letting AARNet or another entity take a stronger leadership and/or coordinating role. AAF should be funded to provide more fully featured federated access nationally and internationally.
- Policy and regulation: Stronger drive from funders (especially ARC and NHMRC) to require best practice research data management. Investment in resolving barriers to shared-data and broad-scale collaboration, in particular streamlining legislative and policy regimes around health data.
- Research Data Management: A greater emphasis on and support for research data management is required – improved capability in this area is fundamental to the excellence and impact of Australian research. This is currently included in the proposed 'Data for Research and Discoverability' capability area but would sit better under 'Underpinning Research Infrastructure'.

UTS argues that digitisation and other technologies associated with collection, curation and preservation of research assets should be a priority for the 'Data for Research and Discoverability' capability area, rather than 'Underpinning Research Infrastructure'.

We question the inclusion of the Synchrotron in this capability area. Large scale, stand-alone research infrastructure, like the Synchrotron and the national ocean research vessel, have very different characteristics to the predominantly eResearch capability identified as 'Underpinning Research Infrastructure' and will require different governance and management.

Question 31: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

No comment.

Question 32: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Underpinning Research Infrastructure capability area?

The roadmaps developed for each of the other capability areas should inform the roadmap and priorities for the 'Underpinning Research Infrastructure' capability area, to ensure eResearch systems and support are in place to handle the volume and complexity of data produced in the course of research using NCRIS funded facilities.

Alignment with other infrastructure funding programs is also required to ensure that underpinning research infrastructure is developed in line with demand from researchers. Government research funding (ARC, NHMRC, RBG) should incentivise the development and utilisation of shared research infrastructure by researchers and universities. ARC LIEF in particular could have a greater focus on reducing unnecessary duplication of research infrastructure, and should better recognise the underpinning research infrastructure required to support equipment.

End users must be involved in planning and development of 'Underpinning Research Infrastructure' and funding for IT infrastructure should support iterative approaches: release early, release often, and focus on researcher access.

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?

While research data and discoverability are recurring themes in the Issues Paper, the 'Data for Research and Discoverability' capability area is insufficiently defined and addressed in this section of the paper. The 'Understanding Cultures and Communities' and other sections of the Issues Paper do raise a number of issues relating to repositories and discoverability, which should be considered holistically.

If this capability area is retained in the framework, it should be refocused on oversight, funding and coordination of the following repository capabilities at the national level:

- Physical repositories of research assets requiring long term management (for example, biobanks, libraries and museums, etc.)
- Digitisation capability.
- Digital repositories of research data.
- National subscriptions and memberships to international data sources.
- Expertise in international data sharing and access, including policies and standards.

Digitisation and other technologies associated with collection, curation and preservation of research assets should be a priority for the 'Data for Research and Discoverability' capability area, rather than the 'Underpinning Research Infrastructure' capability area.

Alongside digitisation it is important to remember (as noted in our response to Question 24) that material conservation remains an important part of many research disciplines. It should not be assumed that digitisation can make all necessary research materials available for researchers.

Infrastructure to support research data management should be included in the 'Underpinning Research Infrastructure' capability area, to ensure seamless integration of research data throughout the research data lifecycle. A distinction should be made between research data storage (end to end research data management) and research data repositories (research data and other materials made available for discovery and reuse).

Question 34: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

Open access to research data is improving the quality and efficiency of research processes and maximising public good from public money. Consideration should be given to how best to protect repositories for the public good and avoid a recent adverse trend of publishers buying formerly open research data repositories (e.g. Elsevier buying SSRN and PURE, Figshare). Strategic government investment in open access repositories may be required. UTS recommends further examination of successful trans-national infrastructure models in specific disciplines (for example physics, genomics, astronomy).

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?

No comment.

Other comments

No further comments.