Submission
2016 National Research Infrastructure Roadmap
Capability Issues Paper

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Introduction

The University of Newcastle (UON) welcomes the opportunity to respond to the National Research Infrastructure Roadmap Capability Issues Paper. UON is encouraged by the extensive consultation process led by Australia's Chief Scientist, Dr Alan Finkel AO and the long term, strategic outlook of the issues paper.

UON is strongly of the view that national research infrastructure and access to international research infrastructure are critical to Australia's future international competitiveness. Australia's ambitions with regard to STEM, innovation and researcher/industry engagement are at stake. It is therefore critical that government understands that research infrastructure spending is an investment rather than merely expenditure.

UON's responses to the questions asked in the issues paper are set out below. Note that not all questions have been answered.

Capability Areas

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

The list of proposed capability areas is sensible. In an effort to stimulate research support across a wide range of strategic areas, issues such as immigration and emigration of researchers, national science policy and workforce, and economic and technology capabilities should be integrated into the national research infrastructure plan.

Governance

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

National research infrastructure would benefit from oversight by the Productivity Commission and being governed and funded in line with bipartisan economic policy. Long-term financial sustainability (equipment and maintenance and operations) needs to be committed over longer timeframes than those that typically occur in sitting governments. Research and the associated research infrastructure should not be planned outside of a national economic strategy – this sets us apart from countries like Singapore where infrastructure support for innovative research is tied to the economic framework of the country. This could be accomplished by

establishing a national oversight body like the Canadian Foundation for Innovation which runs annual funding rounds and has oversight of large scale research infrastructure.

International benchmarking and assessment of similar programs in other jurisdictions should also be reviewed to determine best practise for governance of national research infrastructure schemes.

International

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

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

Australia's national infrastructure will never be able to provide access to every facility needed by its researchers, therefore a mechanism to facilitate the participation of Australian researchers at key international facilities is required, which will include targeted, dedicated funding.

There are instances of capabilities that are essential for significant high level research but which would not have sufficient user base within Australia to justify funding a dedicated instrument. In addition, there are many techniques that require a different energy or time structure than is available at Australian sources such as (Synchrotron) Free Electron Lasers and many Time-Of-Flight neutron techniques at Spallation Neutron Sources and are therefore inaccessible to Australian researchers.

For example, as the only Neutron Scattering and Synchrotron X-ray facilities in Australia the Australian Neutron Scattering Centre at the ANSTO OPAL nuclear reactor in Sydney and the Australian Synchrotron in Melbourne provide excellent facilities and service. Unfortunately they are unable to provide access to all of the different types of neutron scattering or high level synchrotron techniques that exist. Even after recent investment in instrumentation, the Synchrotron has approximately 30% and the OPAL nuclear reactor 40% of their respective instrument capacity populated due to budget constraints.

Access to international facilities has a number of benefits:

i. They greatly supplement the facilities available in Australia thereby broadening the scope of Australian research through the application of cutting edge techniques
ii. They act as training in the most advanced techniques available and in some cases will provide the user base for future instruments to be built in Australia. It was expertise gained at overseas facilities that underpinned the neutron scattering instrument development teams at ANSTO and at the Australian Synchrotron.
iii. Major international neutron and synchrotron sources act as magnets for the world's best science across a broad spectrum of fields (physics, chemistry,

biology, medicine, materials science, engineering) and are therefore incubators of interdisciplinary research.

The primary difficulty for Australian researchers is obtaining sufficient travel funding to transport a team, typically 1 senior researcher, 1 postdoc and 1 or 2 PhD students, and associated equipment to distant experimental facilities. Historically, access to international neutron scattering and synchrotron facilities not available in Australia was provided under the Access to Major Research Facilities Program, which was discontinued some time ago. It is imperative that access to major international facilities not currently available in Australia is provided within NCRIS so that Australian access to research infrastructure can be in keeping with Australia's high level of scientific achievement and ambition.

Access to international facilities should be prioritised over developing national facilities in circumstances where the international facility is cutting-edge and where international access is the most efficient and strategic use of resources relative to building a national capability.

Skills and Training

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

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

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

The design, setup and operations of key strategic facilities requires unique skill sets that should be funded through the infrastructure fund. Particular assistance is required during the design and set-up of world class facilities and should form part of the cost envelope of these facilities.

National infrastructure provides the platform to improve the quality and consistency of training (and therefore the national skill base) and realise economies of scale.

The university and independent research institutions are very capable of training infrastructure ready researchers provided that there are national facilities or international partnerships at high quality facilities as a venue for training.

Access

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

Access to national research infrastructure must be provided to all publically funded research institutions. Access should be as broad as possible for research that is in the national interest and aligned with programs such as NISA. As discussed earlier, alignment of critical infrastructure investment in synergy with the economic framework of the country is critical to maximise the impact of critical infrastructure.

Access for those researchers not directly located at the national platforms must be granted and facilitated. In some cases, the government should explore the ability to fractionate facilities across an integrated national network which would provide enhanced access nationwide.

A business model to ensure continued operation of the facilities would rely on a combination of base government support and revenue generated by the user community. Pricing models could take into account the public good nature of the research, the capacity to pay, encouraging optimal use and encouraging industry (both mature and start-ups) to engage with national research infrastructure.

Defunding and Decommissioning

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

The issues paper outlines a reasonable approach to defunding and decommissioning. Privatisation of key national facilities could be considered should the government and research community deem that the facility no longer meets national priorities.

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

Funding models for each national research platform may vary depending on a number of key market factors including the nature of the research undertaken at the facility. Flexibility is key in allowing for each facility to meet its research mandate while being a viable "business". In some cases this may require continued government support in addition to user fees.

Government capital funding will continue to be vital for national research infrastructure. The private sector is unlikely to invest in such long term infrastructure on its own. The funding model should accommodate co-contributions from industry partners that ultimately benefit from the research. Consideration could be given to charging full market rates for usage by established companies and international researchers who are not partnered with an Australian researcher.

An examination of global best practise would be useful in establishing financing models for each national research platform.

Standards and Accreditation

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

National research infrastructure is designed to ensure Australia's international competitiveness, therefore it must meet all relevant standard and accreditation requirements.

Examination of global best practise and existing accreditation schemes should be undertaken to develop accreditation that makes Australian facilities world class and

can be used to attract international users who add value, functionality and prestige to the national facilities.

International Best Practise

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

Australia's national research infrastructure model is sound and is rated highly internationally. However, it makes sense to consider others as part of this review. The Canadian Foundation for Innovation can be looked at as global best practise for the creation of a national platform for funding large scale critical strategic 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?

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

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?

A missing emerging direction is in the area of medical devices where developments in science and engineering are driving medical application (e.g. printed organic electronics for sensor applications).

It is not clear that strategic direction for health and medical science national research infrastructure has been tested against the national economic plan.

There should be a focus on a national virtual network of biobanks. Currently there is no national platform - biobanks often exist in isolation and do not meet international standards. In the absence of government investment national biobanking is not being given the attention it needs. The facilities that do exist are funded by philanthropists, so there is a co-contribution opportunity for national infrastructure here. Without national biobank infrastructure there is a risk that Australia will fall behind international competitors.

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

Key pharmacology projects to engage with include drug development in antimicrobials and using existing drugs more effectively, particularly when off patent. Australia would benefit from better integration with international data systems, for example World Health Organisation alert systems regarding the spread of antibiotic-resistant microbes.

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?

The roadmap could consider development of a network of rapid-prototyping centres across the country that are focussed on the fabrication of medical devices and structures for the Health and Medical Sciences.

The roadmap could also consider development of a national early phase drug trial unit – currently there are limited numbers in few cities, and they are often under-resourced, a situation exacerbated by a workforce shortage of clinical pharmacologists. Having one national, independent, facility where all drug company and investigator initiated studies could be run would be more cost effective, accessible and consistent.

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?

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

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?

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?

Key missing capability is in scale-up fabrication, which is crucial for the translation of physics/chemistry and materials science into economic, health and social impact over the next decade.

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

The roadmap could consider development of an international fabrication network, providing Australian researchers with access to global fabrication facilities, similar to the International Synchrotron Access Program.

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?

The roadmap could consider development of a network of rapid-prototyping centres across the country that are focussed on the fabrication of cutting-edge devices and structures for industry.

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?*

The issues paper emphasises 'capturing' existing archival material as well as born-digital cultural data. This is important, and has been transformative in humanities scholarship internationally in increasing access and shaping research. However, there should be greater emphasis on building the infrastructure for digital content creation alongside content capture, in both scholarly and industry-based contexts. Examples would include shared, large-scale software development for mapping, editing, or gaming applications, and allowing the creation of new digital resources from existing, digitised datasets.

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

Two research infrastructure collaborations in the digital humanities that Australia would benefit from joining are:

i. the transatlantic Digging into Data Challenge

ii. the well-established EU program DARIAH

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?*

We note the Chief Scientist's verbal advice provided at a public consultation session that 'urban settlements' and 'urban research' in 'urban environments' includes regional areas and that non-urban areas are not excluded.

National Security

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

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

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

There is a clear opportunity for enhanced engagement with other NCRIS capabilities (for example ANFF) to address issues of sensing and detection for biosecurity applications.

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?

UON supports the proposed capabilities, particularly with regard to e-research: fast and reliable data connectivity both domestically and internationally, the ability to store ever larger amounts of data, and ensuring that data remains secure.

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

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

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?

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

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?

Other comments

Domestic as well as international accessibility is a key consideration. Infrastructure at a national scale (unless it is IT) will usually be in a single location (for example the Synchrotron), and invariably this is a capital city (or nearby). This advantages those institutions and industries that are located nearby, both in terms of ease of access and cost to access (travel, accommodation, etc). This needs to be addressed, given this is national infrastructure – for example, by providing funding support for travel, and technical support to run samples etc. on behalf of the distant researchers.