Submission
2016 National Research Infrastructure Roadmap
Capability Issues Paper

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Questions

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

Provided scope in those already defined is sufficient, No.

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

These governance characteristics are broadly appropriate, but there is an overarching issue arising from the lessons learned from recent assessments of research infrastructure investments and the way they have been made.

In Australia, (public) Research Infrastructure investment is normally authorised in one of two ways, being direct government investment (at whatever level, but mostly national); or institutional, (whether higher education or other research institutes/institutions).

National investments have often been made through a partnering contractual model between the Australian government and a range of lead agents. This was the technique in executing the NCRIS program. While arguably very successful in fostering collaborative approaches – world leading in some areas - the approach was chosen absent of an obvious durable trusted third party actor through which national policy objectives may otherwise have been sought. The NCRIS investments have had a range of outcomes and governance characteristics, from very successful to less so. One of the most frequently reported governance challenges arose from an inherent level of coordination difficulty in the program. Accordingly, a body of thinking has reaffirmed that governance will be optimal through a durable overarching process and structure, with thought given to how the custody and stewardship of national facilities is best exercised, especially with reference to categories, or kinds of services and facilities. (See also the answer at Q 9 about funding).

Institutional investment is erratic. There is evidence of significant variation in the higher education sector in particular, in the extent to which institutional research infrastructure investment (including skills and training) receives consistent strategic consideration. Despite regional attention to some forms of coordination

and co-investment (as in the case of State eResearch coordination), results on the ground at institutional level are disconcertingly variable. There is probably a role for government in considering, with institutional leaders, how this might be more systematically addressed, in terms of both human resources and "mid-range" facilities.

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

Yes, as appropriate for discipline and capability areas.

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

Where superior or globally unique capability is offered (eg at CERN) and Australian access is assured and secure, and where value for money assessments clearly indicate advantage.

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

Yes. In the 2014 consultation associated with the department's NCRIS eResearch Status Report process, the most frequently mentioned (and not always solicited), issues related to skills and expertise.

There are two particular challenges here that are internationally recognised. The first is about rapidity of change, (a), and the second is about the division of labour, (b).

(a) The new techniques in research are firstly complex and diverse, and secondly, developing at a speed that in turn reflects the extraordinary ongoing change in the principal enabling capacity, (ie revolutionary changes in computing and communications capabilities). In this context, mid-career (and later) discipline leaders may often lack functional literacy in e-infrastructure developments in their own spheres. This gap in knowledge and understanding can be magnified at the level of research leadership more broadly.

(b) The skill sets needed more or less divide into those associated with the needs of a modern academic workforce, (particularly awareness and use of tools, data and comms techniques); and a more specific range of technical skills associated with a number of functions, but particularly code and software requirements for HPC and developing toolkits, and data science and management and manipulation, where the foundational background is usually computer science. The hybrid nature of the knowledge and expertise required has generated substantial discussion. There are cases where sophisticated academic computer scientists/engineers have deliberately immersed themselves in a target discipline, such as Medicine, to develop the needed knowledge, and others where enterprising scientists have been able to develop the computing knowledge needed to allow them breakthroughs in practice,

but these developments are haphazard and uncoordinated, and dependent on unpredictable and uncommon degrees of random talent as well as self-funding initiative.

It is for these reasons that the skills deficit should be seen as an infrastructure issue, i.e. primarily because it appears unlikely or impossible to address through current funding and management approaches at institutional level. As governance associated with technology deployment across a range of activities matures (i.e. not just research), an ongoing learning is that skills and knowledge are the main challenge in achieving outcomes, no matter how sophisticated the kit.

It may well be argued however, that any national investment to address this should be time bound and target (program) driven. Such ideas have been flagged before but not implemented, though not, to my knowledge, because of any inherent faultiness in the thinking. (See also Q9 answer below).

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

As above, primarily by seeing a program of skills development as a valid, though possibly time-bound component of national research infrastructure investment. Any such program should be defined in association with complementary action at institutional level as per Q 7.

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

Greatly more than at present – in conjunction with Q 6. Desirable would be a program of seeding skills development and postgraduate training in research institutions. It would take some time to hammer out, but the components would include

- Defining and agreeing areas of greatest need, both research workforce and technical;
- Considering institutional incentives/distribution of responsibilities for developing both research workforce and technical workforce components;
- The time period to apply to any period of seeding or initiating funding.
- Considering the positioning of such development programs with other current imperatives in providing research training
- Consequently, considering how take up and even “compliance” might be considered and measured.

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

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

The most important single issue here is clarity at inception. While it may not always be easy to achieve, a great deal is to be gained by such clarity. A threshold condition for investment should be understanding by all contracting and significant deploying parties and partners of what is to be achieved, over what period, and how that will be monitored and reported.(This does not preclude long periods and periodic reporting for certain kinds of investment). It is essential for national public investment to be of a form which recognizes, broadly speaking, one of three forms of commission. These are:

1. those with significant longevity (measured in decades), though with variability in invested amounts per annum;
2. those which are episodic, sometimes with many years between investment activity;
3. those which are finite, with a completion and defunding or decommissioning timetable.

In the case of this third category, defunding will often actually mean handing off, as in the case where a nationally led initiative is taken over as a service and paid for by the research (institution) community (e.g. the AAF).

Examples of the above three categories are (1), national HPC (and other large instrument) capacity; (2) research networks, e.g. AARNet which will run as a service relying on fees for a long period but may, as a public good, need significant performance capacity uplift at crucial junctures, and (3) – one example - the ASHER program (establishing repositories for research output in institutions).

It might be argued that several of the NCRIS investments have been made without complete clarity about which of these categories might apply. Indeed, unresolved horizons may have been mutually understood, in the context of both the speed of technology innovation, and national investment patterns of opportunity. However in cases where there is contestability, it is better to have that out at the inception period, rather than later. In some cases, if it cannot be resolved it may be better for no investment to proceed. It goes without saying that institutions that may be agreeing to finite investment, need to do so in good faith, though some of the traditional patterns and habits of soliciting funds in the context of research do not necessarily engender that form of good faith.

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

Financing models and approaches have received significant commentary during and post the major NCRIS investments. These are perhaps most helpfully summarised as a series of dot points.

- Notwithstanding some concerns about coordination and overheads, co-investment remains persistently attractive in gaining commitment (and enduring and desired change) from other levels of government and institutions.
- Financing of innovative infrastructure can be done by direct investment or through the purchase of private sector based services and commodities, and in practice both. There have been significant market developments in the availability of commodity capacity, and discernible now, is a persistent pattern in which today's innovative high performance infrastructure becomes tomorrow's commercially viable service. However leading edge high performance research infrastructure will always require government financing.
- Experience has shown that constraining expenditures within commissioned programs by type of outlay (operational v capital) has led to suboptimal outcomes. Speed of change in the technology base of infrastructure suggests that financing parameters should be as flexible as possible.
- Most importantly, financing research infrastructure is best done through long term commitment with decadal approaches to the assurance of funding. Within such assurance significant variation in chosen forms of investment will occur, consistent with the various models outlined in the response to Q 9.

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

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

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?**

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

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?**

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?**

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

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?**

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?**

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

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?**

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?

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 discussion here includes reference to digitisation. The success of the Trove resource at the National Library is evidence of the enormous increase in capacity to support research that is enabled by such digitisation programs. The initial projected investments can be dauntingly large, but the benefits are extremely rewarding. Australia should seek to make good the lack of national coordination and funding that the Issues paper identifies, with resulting benefits across many fields, but notably support for the work encompassed by "Cultures and Communities".

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

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