

Submission

2016 National Research Infrastructure Roadmap Capability Issues Paper

Name	Professor Peter J Cook
Title/role	Professorial Fellow
Organisation	University of Melbourne

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

The solid earth sciences are not as thoroughly considered as they should be, given the economic importance of mineral, energy, groundwater and infrastructure areas. As a minimum, energy should be specifically identified along with environment or else have its own specific capability category.

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 should also include a recognition of the need for an appropriate board structure and the importance of outstanding leadership at the Chief Executive and Director levels

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

Australia will in many areas wish to have access to international facilities and one of the best ways of ensuring this is through quid pro quo arrangements between Australian facilities and international facilities.

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

Where facilities are extremely expensive to develop, there may well be a case for prioritising an international facility over a national one. Additionally, some of the key research questions are truly international and global in scope and it is appropriate to take an international approach to the necessary facilities.

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

Employing the right staff and ensuring that they are highly trained is an essential part of world-class research infrastructure

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

It would be valuable to have training as a specific component of a national facility, rather than just leaving it to chance. Exchanges of technical staff between facilities could also be valuable.

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

Research institutions, CRC's and other bodies wishing to access research facilities do have a responsibility not only for training researchers but also the technical specialists, without which the infrastructure would not successfully function.

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

The cost of maintaining infrastructure is often very high and the relative incremental cost of undertaking the research low; it makes no sense to have expensive research facilities sitting idle just for the lack of a few thousand dollars of research money. In other words there is a need for a pragmatic approach to funding what might just turn out to be "interesting research" rather than always being driven solely by the sacred issue of 'peer review'. Serendipity can work on occasions!

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

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

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

Where a topic is being pursued in close collaboration with industry, it is likely industry standards have to be adhered to. Where a baseline study relating for example to an environmental issue is being undertaken, which could have a significance decades ahead, then standards and perhaps accreditation must be adhered to.

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

The deep sea drilling program (DSDP) and its successors, such as IODP may provide a useful example. The ships used are expensive state-of-the-art facilities with highly professional crews (employed under contract to the private sector) who maintain the highest standards of health and safety in their operations, such that potentially hazardous operations such as drilling have been undertaken over the past 40 years with no fatalities and remarkably few minor accidents. The facilities operated initially on the basis of all the funding coming from the United States, but now have a significant international contribution. The CO2CRC Otway project also involves drilling with the inevitable potential risks attached. Over the past 10 years those risks have been managed in a highly professional manner, both by the research organisation and by its contractors, such that the facility has a remarkably good safety and environmental record and an excellent record for producing results. A third example is the Antarctic facilities operated by the Antarctic Division, which have provided an outstanding platform for very important world -significant research over many decades.

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?

There is no specific mention of energy resources in the opening statement. Energy is an important social and political, and scientific issue and warrants greater attention than is given to it in section 6.

In 6.1.1 mention is made of the sustainable management of 7.741million km² of the continent but a more significant figure would be 7.741 million km³ if we include the top 1km of the crust or 15 million km³ if we include the top 2km? The subsurface environment hosts many of the most important resources including groundwater, minerals, energy. We have to think in terms of cubic kilometres not square kilometres if we really want to understand and manage the Australian continent. But our understanding of the subsurface is inadequate and there is a need to establish facilities to improve that understanding. The CO2CRC Otway facility could provide a starting point for the sort of subsurface facility that would be needed to enhance our subsurface understanding.

In section 6.1.2 there is some recognition of the issue of competing land uses for resources including energy. However, given that issues relating to onshore gas are currently some of the most fraught from a community and political perspective, as well as requiring careful scientific analysis, it would seem appropriate to give energy greater prominence.

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

One of the ways of developing a better understanding of the subsurface is by establishing an underground facility/observatory/laboratory - a downward-looking Observatory that will enable us to understand subsurface processes and anthropogenic impacts. In Australia an expanded Otway site represents an important local opportunity for doing this in a very cost-effective manner. Overseas the United States has recently initiated a program of subsurface facilities to enable it to understand and manage the subsurface continental United States. In Britain a program has recently been funded to establish a UK subsurface laboratory. Australia would have much to

gain from linking in with these initiatives and working with them in a collaborative arrangement.

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?

There are compelling economic and environmental reasons for improving our understanding of the subsurface, but there are also social reasons for doing so. First amongst these is the issue of social licence which very often revolves around uncertainties relating to underground processes, whether it is access to groundwater, protection of groundwater or the impact of fracking or other processes involved in the extraction of energy or minerals. Many of the community concerns relate to issues of risk and uncertainty which need to be addressed by better communication but also through more comprehensive multidisciplinary science. It is noted that section 6.3.2 makes mention of human socio-economic systems, but apart from recognising its importance, it is unclear how this might be integrated.

In addition to all of this there are many questions relating to fundamental science that warrant our attention. For example, our knowledge of intraplate earthquakes is inadequate. We know very little about the subsurface biota and its diversity, but we do know that the subsurface biomass is likely to be large.

Finally, in the snapshot for Environment and Natural Resources Management, it would be appropriate to include Otway and perhaps also the NGL as existing infrastructure. Similarly, the AusDEEP proposal could be provided as an example of potential new infrastructure

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?

This topic has a very important interface with resource extraction, and particularly onshore gas. Groundwater is another contentious area, as is carbon sequestration (CCS). There is community concern and conflict over these issues in some areas and it would be appropriate to recognise them in the “emerging directions”. At the present time, the actions of governments and companies are not able to address those concerns adequately. The theme of “understanding cultures and communities” could provide a basis the developing new and more effective methodologies when dealing with resource and community issues.

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

There are a number of international projects underway, often under the auspices of the resource industry, looking at social issues relating to resource extraction. Australia is already engaged in some of these.

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?

Many of the community concerns relate to resource extraction and use of the subsurface, which primarily occurs in rural and regional Australia. It would seem appropriate for the paper to place more emphasis on understanding regional and rural communities.

National Security

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

There is no mention of energy security, but recent events such as those in South Australia and the Longford event some years ago, as well as recent discussions within COAG, show how vulnerable, socially and economically Australia is to loss of electricity and gas. There are of course external security issues with energy such as interruptions to sea-borne oil supplies and perhaps more attention should be given to LNG as a transport fuel?

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?

Section 10 rightly identifies geospatial systems is important. But to this needs to be added the third dimension, that of depth. Our built environment, our resources including groundwater, energy, minerals, are all dependent on the third dimension. In some cases the third dimension extends the no more than a few tens of metres; in other cases it extends to hundreds and thousands of metres. The case has already been made earlier, why we need to have a much better picture of 'Australia's volume' and not just its surface. We have some infrastructure already in place to help us develop a more accurate picture of that third dimension, and to better understand the processes happening within it. Auscope is contributing to this. Activities being pursued under the umbrella of Uncover will also enhance our knowledge of Australia's subsurface, particularly as it relates to mineral deposits. The area of greatest need is undoubtedly to improve knowledge of sedimentary basins, the resources within them and the processes occurring within them, whether natural or anthropogenic in origin.

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

There are advanced subsurface laboratories (not dissimilar to AusDEEP) proposed by the USA and the UK and Australia should seek to collaborate in these proposed facilities and programmes. There is scope for Australia to establish an advanced subsurface facility or facilities that would represent a major new research opportunity not only for Australia but for the Asia-Pacific region. It would also serve as a unique focal point for collaboration with the resource industries and the related service sectors for the development and testing of innovative subsurface instrumentation and software

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 interface with Australian industry overall requires further consideration, including through the development of facilities that will serve the needs of science, technology, research and industry.

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?

The scientifically significant and the economically and environmentally important subsurface is a challenging area for collecting 3d and 4D data as well as for synthesizing and modelling the complex and presently little-known processes that are occurring there. The Issues document does not adequately address this and related topics, nor offer the necessary infrastructure. There is a need to monitor, model, sample and understand the deep subsurface, especially the sedimentary subsurface, with a degree of accuracy and a level of confidence that is presently not available to us

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?

The need for greatly enhanced subsurface facilities and capabilities are adequately addressed earlier in this response

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.

- Overall the solid earth sciences are not well covered, perhaps in part because of the nature of the Panel (which includes no earth scientists)
- Energy in particular is poorly covered
- Resources is the general term used but this is so all-embracing (agriculture, mining, minerals, water) that it is a bit meaningless in the context of facilities

- The use of the term 'facilities' becomes unclear when referred to topics such as cultures and communities
- Interdisciplinary and cross-disciplinary is seen as important, but this is difficult to put into practice
- The area of 'social licence' is particularly important to CCS and to resources generally but it is difficult to define the key capability or capabilities
- Auscope is rightly included in "existing infrastructure"; Otway and perhaps the NGL could also be included?\