

National Research Infrastructure Roadmap: JCU Submission

James Cook University supports the intent of the 2016 National Research Infrastructure Roadmap exercise to identify the priority research infrastructure investments needed to support innovative research in fields of strategic priority that will enable Australia to optimise its research effort.

JCU recognises the central role of high-quality, fit-for-purpose research infrastructure in enabling sustainable development of the research enterprise at all levels from National through Regional to Institutional levels and welcomes the opportunity to comment on the 2016 National Research Infrastructure Capabilities Issues Paper. In addition to responses to some specific questions raised in the issues paper JCU emphasises the following three needs;

- The need to ensure sustainability of the broader research infrastructure system,
- The need to balance scale and regional advantage to advance the national interest,
- The need to develop environmental infrastructure associated with decision-making and management of key, nationally and internationally relevant, ecosystems at risk.

Sustainability of the broader research infrastructure system

The scope of the 2016 National Research Infrastructure Capabilities Issues paper was focused on understanding the capabilities and need for national scale facilities, with little emphasis on the capacity of the broader Australian research system to support those facilities. By their nature, national scale facilities exist at the top level of the research ecosystem. The ability of the broader research system to support those facilities is dependent on the ability of research institutions to provide and resource the institutional-scale research infrastructure that underpins research. This capacity is critical to providing a research workforce and programs enabled to maximise the value of national scale facilities. Consequently, any examination and consideration of the strategic value of investment in national research infrastructure needs to consider how that fits within the broader investment into research infrastructure at other scales. Specifically, that requires concurrent consideration of the level of investment via Research Block Grants and ARC-LIEF to provide a sustainable basis for the lower levels of the research and innovation ecosystem. This is particularly true for the development of human capital, which is overwhelmingly conducted at the institutional level.

Balancing scale and regional advantage to advance the national interest

The need for universal access- It is clear that it is in the national interest that access to major research investment is widespread and universal. IRU research shows that currently 80% of NCRIS investment is concentrated within Australia's largest cities, particularly Sydney, Melbourne and Canberra. This is seen as a positive strategy, maximising access to the concentrations of expertise. However, the corollary of that is that researchers outside those immediate areas are inevitably disenfranchised to some extent, particularly as regards development of the potential human capital across the nation. In some cases this is logical, avoiding unnecessary duplication by basing national facilities in locations closest to the greatest concentration of research expertise relevant to that facility and achieving the greatest value of a limited research investment.

However, there are two ways in which building further scale and concentration in few locations does not meet the national interest. Firstly, where there is no intrinsic logic in concentrating activity within a few large cities and second where there is a regional advantage that dictates that investment should be geographically located within the area of need/advantage.

Regional advantage- There are a number of high priority areas requiring national scale investment that must logically be located within areas of need. Among others, it is clear that development of aquaculture for warm waters must be located in the north of Australia. Developing that research provides substantial value for the national interest, providing the potential for northern Australian institutions and businesses to provide the research base and innovation required by Asia to continue to grow aquaculture-based protein production in a sustainable way. Arguably there is value in investing in cold-water aquaculture in southern Australia (as is currently the case) and warm-water in northern Australia.

Biosecurity is another research domain in which Australia's national interest dictates that investment is required in northern Australia. Australia's greatest biosecurity risks are posed by movement of disease, weeds, and invasive species from our northern neighbours. This is particularly obvious when we consider the potential for spread of Zika virus in northern Australia- the vector mosquitoes are well established in northern Australia and already responsible for the transmission of Dengue fever within Australia almost every wet season. Multi-drug resistant tuberculosis is well established in PNG within easy reach of Australia's Torres Strait island communities, with the result that a number of multi-drug resistant Tb cases resulting in fatalities have already occurred within Cairns Base Hospital, at extremely high cost to our health-care system. The national interest logically requires that research investment designed to address biosecurity concerns should be made in the geographic location best suited to provide results.

Social value of regional development- In the case of national scale research infrastructure where there is either no inherent value of concentration in one location, or a value in risk minimisation related to distributed investment, there is socio-economic value of distributing educational/research investment across Australia. This provides high value jobs that maintains the innovation system in regional areas that otherwise suffer from a crippling drain of expertise to major cities or internationally. It is demonstrably not in the national interest for regional areas to lose all capacity for innovation. Careful consideration of the benefit of distributed investment in research can be used to stimulate regional economies. It is clear that the socio-economic case for development of northern Australia underlies the current strategy for Northern Australia. eResearch capabilities are a case in point here- while there are good reasons to concentrate some aspects of eResearch investment in one or few locations eg. a national supercomputing facility, there is no inherent need to concentrate other eResearch capabilities and human eResearch capital across Australia as a key component in the innovation system.

Environmental infrastructure associated with decision-making and management of key, nationally and internationally relevant, ecosystems at risk

A national collaborative network focused on key ecosystems at risk- Australia suffers from a major gap in funding of critical infrastructure in the fields of environment and natural resource management, between large-scale facilities (such as research vessels) and the less directed investment through ARC LIEF grants. The gap is the lack of strategic, focused investment to support critical research capabilities (including human capital) required to make informed management decisions associated with key nationally and internationally relevant ecosystems at risk. These capabilities are required for policy, legislation, and day-to-day decisions by governments, natural resource management bodies and NGOs. At present decision-making is poorly supported or fragmented, with little coordination between R&D groups and decision-makers.

The research capabilities required include;

- spatially-explicit modelling of the effects of land-use change and climate change on threats to biodiversity, including invasive species.
- scenario analysis of alternative futures for regions in Australia, including the potential influences of policy settings.
- cumulative impact assessment of spatially-explicit scenarios on selected ecosystems and species.

Bridging this critical gap requires a distributed, collaborative national network with nodes focused on key ecosystems at risk. The national significance of such a network is in its national scope, not in the

size of any one piece of infrastructure. Each of the nodes would require high quality eResearch capabilities- high-standard hardware with access to high performance computing capability, software developers, technicians to acquire and manipulate data, resources for liaison and collaboration between nodes, and knowledge brokers to connect with policy makers, government, NRM bodies etc. There might be up to a dozen of these nodes nationally. Each node would have the same generic brief, but adapt its approaches to particular physical, biological, economic, social, and political contexts. Regular contact between these nodes, combined with adequate resourcing of infrastructure, would regain the global leadership in environmental management once demonstrated by Australia.

The Great Barrier Reef as a key ecosystem at risk requires a node of the national network- The GBR is a national and international icon, critical to Australia's biodiversity and economy, and identified on a bipartisan basis as requiring further substantial government investment in environmental management. Despite past research and management investment, the GBR's condition has and continues to decline, alarming both the Australian and international Community.

The GBR's resilience to climate change, at least some of which is now inevitable, will depend on management of water quality, which is the only local "lever" we can manipulate. Despite years of investment in water quality programs, including the current NESP Hub, there has been too much emphasis on knowing what to do in a place, and not nearly enough on selecting the best places and timing for optimal outcomes. Consequently, we still lack a coherent strategy for fine-resolution prioritising of investments in GBR catchments to improve water quality while also maximising co-benefits for carbon and terrestrial biodiversity.

In part the GBR node would need to expand the capability of the Integrated Marine Observing System (IMOS). This has developed into a powerful tool for understanding the physical and biological processes operating in the oceans surrounding Australia. However, to date its mandate has not reached to the coast or into estuaries. Extending IMOS to incorporate these additional habitats will have significant benefits for the nation. In the case of the GBR it would provide a much more explicit link between terrestrial processes that drive coastal marine systems and ultimately the health of the reef itself. Estuaries and coastal waters are some of the most productive for human communities (e.g., commercial, recreational and indigenous fisheries) but also the most affected by human pressures. By developing monitoring systems for these key habitats and integrating it with IMOS would provide a more holistic understanding of Australia's marine environment and provide information on which improved and ongoing management can be based.

Identifying and filling these research gaps requires a strategic focus, directed to data and modelling. The national benefits from this are improved decision-making and legislation, better value for the significant investment already identified as required for sustainability of the GBR. The national network and particularly the GBR node will make it easier for decision-makers to get it right (by weighing options and indicating ways forward), and harder for them to get it wrong (by exposing poor decisions, and pre-emptively warning about them).

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 are broadly appropriate although some further emphasis could be placed on enabling infrastructure for the HASS disciplines.

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

Where there is a strong national interest case for need to maintain human capital relevant to a research area where the physical infrastructure cannot be realistically maintained in Australia.

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

Yes- this is one area where the value of regionally distributed infrastructure is relevant.

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

The fundamental training and skills development required to enable use of national scale facilities takes place at the level of institution. National facilities should augment that development.

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

The development of human capital in research infrastructure is fundamentally a task for research institutions.

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

Access must be universal and equitable- this requires assistance for regional researchers to access national facilities.

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?

See environmental infrastructure required to support management and decision making wrt key ecosystems at risk- above