Please note: the substantive content of the 2026 NRI Roadmap Survey begins at Question 20 (with prior questions dealing with administrative and other information).

As such all submissions that are published include the responses submitted from Question 20 onwards only.

Q20.

Part 2: Research themes

2.1 NRI comprises the assets, facilities and associated expertise to support leading-edge research and innovation in Australia and is accessible to publicly and privately funded users across Australia and internationally. We are seeking your input on possible directions for future national-level investment - i.e., where the requirements are of such scale and importance that national-level collaboration and coordination are essential.

The 2021 Roadmap used a challenge framework to support NRI planning and investment. With this in mind, consider likely future research trends in the next 5 - 10 years, and with respect to one or more of the 8 challenge areas identified in the 2021 Roadmap as listed below:

- describe emerging research directions and the associated critical research infrastructure requirements that are either not currently available at all, or not at sufficient scale and
- describe current national infrastructure requirements that you anticipate will no longer fit the definition of NRI in 5-10 years.

Do not limit your commentary to NCRIS funded capabilities.

Q21.

Resources Technology and Critical Minerals Processing

Q22.

Food and Beverage

Q23.
Medical Products

7T TGA-approved whole body MRI system in a clinical environment in NSW (NIF) There are a large number of people with brain disorders, such as epilepsy, multiple sclerosis, dementia and stroke, with increase in numbers expected in upcoming years. For many of these disorders, no effective treatment is currently available as their pathogenesis is unknown. State-of-the-art magnetic resonance imaging instrumentation is required to better study these disorders, in particular 7T whole body MRI systems. Such systems are available in Victoria and Queensland as part of NIF infrastructure, however, there is no such system in New South Wales and none is a clinical setting. A 7T MRI scanner installed at the UNSW NIF node could match specifications of the two existing 7T scanners in the NIF network and would have the advantage of being fully integrated in a clinical setup to make it easily accessible to patients of health care providers, thereby enabling easier roll-out of multicentre studies and accelerated enrolment of study participants including active hospital network patients Optically Pumped Magnetometers - Magnetoencephalography (OP-MEG) (NIF) MEG is a non-invasive technology for recording brain function in real time, which has propelled great discoveries about brain function. Compared with EEG, MEG has better spatial resolution and better sensitivity, especially for deeper brain structures. OP-MEG offers significant advances over traditional MEG, with better signal strength, lower operating costs and greater flexibility. Due to these benefits, it's research utility and clinical potential, it is likely to be increasingly adopted in coming years, offering Australia a chance to be at the forefront of this cutting-edge technology for uncovering brain function. There are many applications, especially in Psychology, Medicine and Health care. In addition, there is a potential link into the Frontier Technologies and Modern Manufacturing Theme as access to this technology allows Biomedical Engineers to research, develop and test efficacy of new wearable and implanted sensor technology. RNA therapeutics (TIA) Research in RNA-based therapeutics is advancing rapidly, driven by technological progress and the potential of RNA to treat various diseases, including mRNA vaccines, siRNA antivirals, cancer treatments, and gene editing applications. Despite significant investment in GMP manufacturing of RNA therapeutics in Australia, there has been limited investment in the research and development pipeline and pre-clinical translational infrastructure. Australia's RNA Blueprint aims to build a national RNA ecosystem by fostering collaboration among academia, industry, and government. This ecosystem requires 10-20 years of sustained support, from discovery research to GMP manufacturing and commercialization. Facilities like the UNSW RNA Institute's RNA Accelerator support pipeline development by producing high-quality RNA formulations and training the future

Q24.
Defence

Q25.
Recycling and Clean Energy

Photovoltaics-related research is covered below under frontier technologies.

Q26.
Space

Q27.

Environment and Climate

Climate change is not merely an environmental challenge, it is more fundamentally an economic, financial and health issue. In particular, the research is increasingly heading toward understanding of climate as an economic resource or economic risk. Specifically, multiple users from disaster preparedness, through infrastructure resilience and on to financial disclosure of economic risk require what might be described as climate intelligence. This is not about environment, or how climate change impacts our environment in a general sense, rather it is about the ability to predict where and when climate change impacts systems of direct value to Australia. An example. We know climate is changing and we know that this will impact weather systems. In turn, this impacts where the sun shines, where cloud increases, and where large-scale patterns “still” the atmosphere to create wind droughts. Investors in renewable energy, and organisations like the Australian Energy Market Regulator (AEMO) needs to know where renewables can be located to make money, and where renewables are not correlated in a weather sense. Building our next generation of weather and climate models to be able to accommodate these needs is a huge undertaking and requires software engineering at a scale Australia has not really been prepared for - but ACCESS NRI is making major strides in the right direction. ACCESS NRI will be needed for as long as Australia needs climate intelligence. Separate, but strongly aligned, our modelling systems require a pathway to exascale compute to run models that are computationally impossible on systems like Pawsey or NCI. And because AEMO operates an energy grid on timescales of minutes we need data from our models on these timescales - and that will require data systems at a scale Australia has failed to invest in to date. The data systems and HPC systems have to be fully integrated as processing even petascale data requires considerable compute. Thus, looking at the next 5-10 years, Australia will require the ability to develop climate intelligence tools at a level of granularity that is currently not possible and this requires a fully integrated HPCD system with 21st century software engineering systems. The economic, financial and social impacts of failure to enable to research to provide this climate intelligence will leave Australia’s more vulnerable to climate extremes, lead to maladaptation and major failed investments in risk mitigation investment.

Q28.

Frontier Technologies and Modern Manufacturing

The development of photovoltaics is aimed at increasing efficiency with the use of environmentally friendly and abundant materials. These demands lead to the innovations including perovskite solar cells which is known for high efficiency, and tandem solar cells which capture a broader spectrum of sunlight. These advancements bring new challenges in the characterization of photovoltaic materials. Microscopy Australia has played a key role in bringing atomic level TEM characterization to new materials including solar advances. The next phase of capability requires time resolution down to nanosecond level. This is urgent for understanding how charges migrate and recombine in the state-of-the art photovoltaics’ performances particularly due the fast development of new materials and complex interfaces of multilayer structures. Yet the improvement in performances of solar cell devices also demands characterisation at the device scale. Quantum information technologies involve advancement in quantum computing, quantum communication, and quantum sensing. Fundamental research continues in discovering new materials and precision defect engineering for more robust qubits that can maintain coherence and minimize decoherence times, required for quantum operations. Moreover, at the device level, the integration of these materials into scalable architectures is crucial, requiring the development of high-quality interfaces and error correction techniques to achieve more reliable and larger scale quantum operations. Characterizing quantum materials presents challenges due to their inherent quantum mechanical properties and the sensitivity required for measurement. This requires understanding the ultrafast electronic and charge state changes of the precisely engineered defects. Moreover, measuring the quantum properties must operate at ultra-low temperatures and often in high magnetic fields to reveal quantum phenomena, necessitating ultrahigh time and spatial resolution electron microscope operating at low temperature. To meet these challenges and address the Australian national capability gap, this roadmap presents solutions of the new electron microscopy facility infrastructures. The new infrastructure encompasses (1) Multi-modal focused ion beam- scanning electron microscope (FIB-SEM) designed to achieve three-dimensional, cross-scale, and correlative imaging and sample preparation capability, to reveal device architecture, composition, microstructure and performances that are key to the innovation of solar cell and quantum device designs. (2) ultrafast time-resolved, high spatial resolution and multi-modal transmission electron microscopy (TEM) capable of operating at ultra-low temperature is essential in probing dynamic transport and transient atomic, electronic, optic and magnetic properties of new photovoltaic and quantum materials. Further discussion of quantum testing needs for industry is covered below.

Q29.

2.2 The 2024 statement of National Science and Research Priorities (NSRPs) includes outcomes linked to each priority to assist in identifying critical research needed in the next 5 to 10 years.
Consider the priority statements and, with respect to one or more of the 5 priority areas as listed below:

- describe emerging research directions and the associated critical research infrastructure requirements that are either not currently available at all, or
- not at sufficient scale and describe current national infrastructure requirements that you anticipate will no longer fit the definition of NRI in 5-10 years.

Do not limit your commentary to NCRIS funded capabilities, and where relevant, refer to the underpinning outcomes and research identified in the NSRPs document.

Q30.

Transitioning to a net zero future

As already mentioned above under Research Themes, Microscopy Australia (MA) requires next-generation infrastructure (multi-modal FIB-SEM and ultrafast, high spatial resolution, multi-modal TEM and a focus on in operando imaging) to support fundamental research and the development of next-generation photovoltaics, quantum technologies and many related applications. A new NRI, a Quantum Device TestBed Network, is proposed below which, alongside ANFF and MA, would support the engineering R&D emerging from Australian quantum research. This will continue to be an important national strength.

Q31.

Supporting healthy and thriving communities

The National Imaging Facility (NIF) supports thousands of studies (ARC, NHMRC, MRFF) across cancer, mental health, neurology, cardiovascular disease, and beyond. Imaging enables earlier detection, precise disease tracking, and targeted interventions, improving patient outcomes. It is now indispensable for diagnosing, monitoring, and treating Australia's highest-burden diseases, including neurological disorders, cardiovascular disease, and cancer. Imaging, including PET, CT, MEG and MRI, advances precision biomarkers, allowing researchers to track disease progression and treatment effects. For example, NIF supports over 50 long-term studies on depression, anxiety, and addiction, facilitating the measurement of mental illness and experimental treatments. Imaging instrumentation, expert staffing and an imaging data ecosystem are all essential to support these goals. NIF has made significant inroads in the radiopharmaceutical and nuclear medicine research fields, since the 2021 roadmap. Industry demand is only increasing. It is therefore essential that both radiochemistry staffing and technology advances continue to be funded.

Q32.

Elevating Aboriginal and Torres Strait Islanders knowledge systems

Future NRI investments must align with Indigenous Data Sovereignty principles, ensuring Aboriginal and Torres Strait Islander communities have control over their data. This approach respects cultural protocols and supports self-determination, in line with the Australian Government's Framework for Governance and Indigenous Data.

Q33.

Protecting and restoring Australia's environment

The importance of climate intelligence is highlighted by Access-NRI, as well as by the longitudinal monitoring programs. At the same time, in order to make full use of this data and results, we must continue to provide national cutting-edge HPCD which is increasingly needed for all areas of research. A start has been made under the NDRI 2025 investment plan, but there is a lot more to do.

Q34.

Building a secure and resilient nation

Australia needs digital sovereign capabilities and secure research environments that underpin defence research.

Q35.

2.3 The case for a new NRI capability, or enhancements to existing capabilities, typically emerges through advocacy from research communities clustering around rigorously identified needs and goals. Such a concept could respond to a requirement for novel or expanded capacity within a domain, or across domains, and must be such that it could only be made available with national-level investment.
If you have identified such a requirement, briefly describe the need, the proposed infrastructure capability, the medium-term goals, impacted research communities, and the timeframe over which you advocate its establishment. Your response can include links to relevant existing reports.

Quantum Device Testbed Network - new UNSW advocates for the inception of a new NCRIS capability centred around quantum information technologies, the National Quantum Device Testbed Network in collaboration with colleagues in Queensland and Victoria. While Australia has established national networks using NCRIS infrastructure for the fabrication of quantum devices and materials (ANFF) and their visualization (Microscopy Australia), there is currently no equivalent national infrastructure for testing and operating these quantum devices and materials. The new Quantum Device Testbed Network would address this gap by providing essential national infrastructure to support quantum technologies research and development. It would offer quantum start-ups access to state-of-the-art facilities and expertise that would otherwise be cost-prohibitive and time-consuming to develop independently. The network would provide access to industry-friendly laboratories equipped with cryogenic quantum device measurement platforms, confocal systems with interferometry and single-photon detectors, quantum sensing labs, computing and quantum computing resources. Additionally, a Training Hub would be established to upskill Australia's workforce in this critical field. This would also provide the infrastructure to support workforce training initiatives by the recently funded Quantum Australia and FLiQC (Future leaders in Quantum Computing) training centres. Leveraging world-leading quantum expertise at UNSW, including the $3 million investment in the quantum industry lab from UNSW/ARC LIEF, as well as comprehensive device fabrication (ANFF) and materials and device imaging and physical characterization (MWAC) capabilities at UNSW, this initiative would also include nodes in Melbourne (University of Melbourne) and Brisbane (University of Southern Queensland), and potentially UWA and ANU. Importantly, this initiative aligns with the step-change and priority areas identified in the 2021 roadmap, including research translation infrastructure and the National Research Infrastructure Workforce, and the research theme of Frontier Technologies and Modern Manufacturing. Infrastructure on Australia's East Coast to support preclinical (animal) research (new under Phenomics Australia) The vulnerability of medical research using laboratory animals to supply shortages was highlighted over the past three years during a time of transition of the Western Australia government supported ARC to commercial management. Animal strains and services that were nationally available have been severely limited or not yet fully established during this time, delaying or preventing research outcomes. Shortages of supply and infrastructure support for animal species have also hampered research established in models other than rodents (aquatic species, guinea pigs). UNSW recognises the urgent national need to complement and support infrastructure for supply of laboratory animals in Western Australia by expanding capabilities on the east coast. This capability gap was also recognised in the 2021 Roadmap but not taken further. New infrastructure could come under Phenomics Australia and build on existing capabilities currently focusing on mice to possibly include: #Improved supply of rats at a high health status #Provision of rat reproductive services such as timed mating, rederivation, cryoarchiving #Coordination of supply of infrequently used species or strains for research which are not commercially viable (ie guinea pigs, low-demand rodent strains) #Capability for import, quarantine and distribution of aquatic species in Australia Functional and Structural Materials Manufacturing (FASMM) Network (new) UNSW supports the creation of the Functional and Structural Materials Manufacturing (FASMM) network led by Monash University. The FASMM network would encompass manufacturing, testing, and characterization capabilities to establish the necessary workflows for translating early-stage research. It would be specifically focussed on technology readiness level 3-5 infrastructure, with a view to scale and accelerate translation in a nationally coordinated way. These capabilities would include metal and functional materials processing, additive manufacturing and printing, as well as mechanical, in-operandum, and extreme environment testing. Digital Biobanking (new under NIF) We support NIFs proposal to make much better use of research data, reducing fragmentation and improving integration, discoverability and analysis. The NCRIS Health Group, and other NCRIS partners, would provide existing capacity and capability platforms to deliver this resource.

Q36.

Part 3: Industry perspectives

This section is seeking input specifically from industry-based respondents. Other respondents can skip this section.

Recommendation 6 of the 2021 Roadmap related to improvements in industry engagement with NRI. To complement work on this topic that has occurred since then, we are seeking additional advice on NRI requirements as perceived by current or potential industry-based users.

Q37.

3.1 Have you (or your organisation) interreacted with or used Australia's NRI?

- ◯ Yes
- ◯ No

Q38.

3.2 If so, please briefly outline the NRI capabilities you (or your organisation) have interacted with or used. Do not limit your response to NCRIS capabilities.

This question was not displayed to the respondent.

Q39.

3.3 Please indicate your (one or more) primary reasons for interacting with NRI:

This question was not displayed to the respondent.

Q40.

3.4 If you answered no, please indicate your (one or more) primary reasons:

This question was not displayed to the respondent.

Q41.

Part 4: Other comments

4.1 Please elaborate on any of your above responses or add any other comments relevant to the development of the 2026 Roadmap. Your response can include reference or links to existing reports that you recommend be considered during the 2026 Roadmap development process.

High Performance Computing and Data HPCD is funded under the current 2021 Roadmap with its importance recognised as a Priority and Step Change Area via the National Digital Research Infrastructure strategy, but the level of funding is not sufficient to meet the growing and diverse research demand (e.g. GPU capacity; very large daasets). With HPCD underpinning every aspect of modern research, It is essential for HPCD to continue to be in the 2026 Roadmap as a priority. Microscopy Australia Microscopy underpins broad science disciplines, from medical, soft matter, plant, materials, agricultural and geological sciences, that require cutting-edge microscopy to address Australia's future research and industry needs. Next-gen microscopy is essential for 4,000 researchers and their industry partners. It supports some $1bn in research grants over a 4-year period. UNSW is one of the founding nodes and houses nationally significant infrastructure, including a $6M aberration corrected transmission electron microscope. A significant uplift in advanced microscopy is urgently required across the country. The continuation of long-term investment (10+ years) in national research infrastructure, including specialist staff, is critical. Staff have the expertise and capability to support next-gen microscopy and long-term NCRIS support for their funding and career development is needed. Continuity of expert staff funding in all areas of NRI is essential to future research. All NRI must be evaluated against attributes such as: - Leading edge research and innovation - Long term research, industry and societal impact - Support to realise national policy, and of course - National significance. In the imaging and characterisation sectors, and in other sectors such as environmental monitoring, stand-alone facilities or capabilities that operate in isolation without national integration will become less relevant. Research is increasingly driven by large-scale, multi-site studies requiring interconnected imaging networks, standardized protocols, and shared, integrated digital infrastructure. ANFF National Perspective ANFF is a key competitive advantage for Australian research that must be sustainably funded to maintain Australia's position in the international knowledge economy. ANFF, and NCRIS projects more broadly, have an outstanding track record of empowering innovation and collaborative R&D in Australia. Proactive engagement with the user-base and research trends enables ANFF to dynamically target their strategies to ensure Australia researchers remain internationally competitive by access state-of-the-art fabrication capabilities. NRI funding for ANFF must be maintained, and preferably expanded, to ensure Australian researchers continue to reap the benefits of innovation for the Australian economy.

Q49.

4.2 Optional Document Attachment.

Note: Our strong preference is that answers are provided against the relevant questions in the survey. However, this file upload option is available for submissions in file format, where needed. Please ensure the document includes your name or organisation.