

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

EMERGING RESEARCH DIRECTION: Tier-3 agricultural data to support credible carbon sequestration and emissions reduction models. IMPORTANCE: - Enabling Australia's agricultural industry to meet regulatory requirements. - Facilitating access to domestic and global markets. - Capitalising on carbon credit opportunities. - Maintaining agricultural productivity in a changing climate. CRITICAL INFRASTRUCTURE NEEDS: - Expanded sensor networks in agricultural systems. - Digital infrastructure to integrate and harmonise sensor, satellite and farm management data. - Support for advanced modelling capabilities. - End-user applications (e.g., apps, visualisation tools). EXISTING FOUNDATIONS: NCRIS-funded TERN Australia already possesses the requisite digital infrastructure and domain expertise upon which these and adjacent capabilities could be built.

Q23.
Medical Products

Q24.
Defence

Q25.
Recycling and Clean Energy

Q26.
Space

EMERGING RESEARCH DIRECTION: Enable widespread utilisation of satellite data in research applications across all domains. IMPORTANCE: Despite being widely available, satellite data is not routinely used in research due to the substantial costs and technical complexities required to transform raw satellite imagery into analysis-ready data. This leads to significant missed opportunities across research, government, industry, and communities. Key challenges include the need to apply cleaning and corrections (e.g., optics, cloud removal) to make satellite data suitable for domestic conditions, as well as using ground-based observations to calibrate and validate satellite data. These processes are resource-intensive, and centralising them would benefit the entire nation. There is also a strong case for centralising the production of key satellite-derived environmental variables, such as biomass, vegetation abundance, agricultural productivity, and freshwater quantity, which are crucial inputs for research, policy, and industry decision-making. CRITICAL INFRASTRUCTURE NEEDS: - Centralised modelling capabilities to convert satellite data into reliable environmental intelligence. - Ground-based data for calibration and validation of satellite observations. - AI/ML-powered algorithms and automated workflows to streamline satellite data preprocessing. - Scalable, cloud-based platforms for query-driven data extraction and analysis, leveraging existing NCRIS infrastructure. EXISTING FOUNDATIONS: TERN Australia, along with other NRI ecosystem partners such as Geoscience Australia (GA) and CSIRO, possess the foundational infrastructure needed to develop and expand these critical satellite data integration and processing capabilities for Australia.

Q27.
Environment and Climate

EMERGING RESEARCH DIRECTION: Solidify and integrate a cross-domain Australian Super Site Network for observation and experimentation. IMPORTANCE: • While each environmental NCRIS facility currently operates a select number of heavily instrumented sites across Australia, these locations rarely coincide across NCRIS, limiting the depth and scope of cross-domain research. • Integrated efforts across NCRIS have typically been short-lived, project-based collaborations or have focused on broad geographic spans (e.g., coasts). Long-term spatial convergence on a select number of sites would provide both the depth and continuity needed for substantial, longitudinal research, and offer significant long-term advantages. • Super sites would provide an ideal setting for co-locating experimental infrastructure, allowing researchers, government agencies, and industry to A/B test potential interventions in real time. This would significantly accelerate our ability to understand and respond to environmental changes before irreversible damage occurs. These experimental sites would benefit from the full environmental observation pipeline—from molecular to atmospheric, or from terrestrial to oceanic. • High-cost infrastructure, such as characterisation tools, is expensive to deploy at a large scale across a vast network. Concentrating these resources at super sites would reduce duplication, optimise deployment and ensuring cost-effective use in the most intensive and critical locations. CRITICAL INFRASTRUCTURE NEEDS: • A framework to prioritise super sites, maximising multi-domain integration and research potential. • The required base observation infrastructure in selected super sites, alongside new experimental infrastructure for testing and validating environmental interventions. • Deployment of high-cost characterisation infrastructure at super sites • A centralised data portal, complemented by robust cross-domain modelling and analytics capabilities, and supported by AI/ML-powered systems to integrate, analyse, and provide actionable insights. EXISTING FOUNDATIONS: • NCRIS-funded facilities, including TERN Australia, AuScope, ACCESS-NRI, APPN, IMOS and others, already possess valuable observation data and expertise that can form the foundation for an Australian environmental super sites network.

Q28.

Frontier Technologies and Modern Manufacturing

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

EMERGING RESEARCH DIRECTION: Tier-3 agricultural data to support credible carbon sequestration and emissions reduction models. IMPORTANCE: - Enabling Australia's agricultural industry to meet regulatory requirements. - Facilitating access to domestic and global markets. - Capitalising on carbon credit opportunities. - Maintaining agricultural productivity in a changing climate. CRITICAL INFRASTRUCTURE NEEDS: - Expanded sensor networks in agricultural systems. - Digital infrastructure to integrate and harmonise sensor, satellite and farm management data. - Support for advanced modelling capabilities. - End-user applications (e.g., apps, visualisation tools). EXISTING FOUNDATIONS: NCRIS-funded TERN Australia already possesses the requisite digital infrastructure and domain expertise upon which these and adjacent capabilities could be built.

Q31.

Supporting healthy and thriving communities

EMERGING RESEARCH DIRECTION: Understand the dynamics of carbon and climate in urban environments to improve public health, adapt to environmental changes, and mitigate emissions. IMPORTANCE: - Cities are major contributors to carbon emissions and climate dynamics, yet we lack the infrastructure to accurately monitor and model these processes at the scale required. - Most current carbon inventorying and accounting methods rely on top-down models or self-reported data, both of which lack the precision and reliability needed for effective climate action. - To address this gap, we need sensor networks in urban areas that can monitor key environmental factors, such as emissions, pollution, and heat dynamics. This should be complemented by IoT data and seamlessly integrated with accounting and reporting systems to drive informed decision-making and regulatory compliance. - Europe is currently leading the way in urban carbon monitoring, and Australia must increase its capabilities in this area to stay competitive and ensure our cities remain sustainable and resilient. CRITICAL INFRASTRUCTURE NEEDS: - Sensor networks deployed across cities to monitor carbon dynamics, air quality, temperature, emissions, and other critical environmental factors. - Integration of Internet of Things (IoT) data to enhance real-time monitoring and reporting capabilities. - Systems to seamlessly integrate sensor data with existing carbon accounting and reporting frameworks, aligning with Australian regulatory standards. - User-friendly platforms that allow easy integration into decision-making processes for local governments, industry, and communities. EXISTING FOUNDATIONS: TERN Australia has embedded decades of expertise in flux and environmental sensors, positioning it well to expand its terrestrial ecosystems approach into urban environments. Collaboration with AURIN and other partners with advanced urban data and analytics capabilities is critical to accelerate the development of integrated urban carbon monitoring systems.

Q32.

Elevating Aboriginal and Torres Strait Islanders knowledge systems

Q33.

Protecting and restoring Australia’s environment

EMERGING RESEARCH DIRECTION: Enhance ecosystems monitoring for comprehensive biodiversity protection. IMPORTANCE: Biodiversity is one of the most difficult environmental factors to monitor accurately, as it spans both macro and micro levels, from entire ecosystems to the microorganisms in the soil. Yet, it is essential for the health of our planet and human societies, supporting everything from food security to climate stability. Proper biodiversity tracking provides the evidence needed to understand the tipping points when ecosystems begin to degrade. Early detection of these changes is critical for effective management and intervention. Without accurate, timely data, it is challenging to track the effectiveness of conservation efforts or respond to emerging threats. Government initiatives such as biodiversity offsets and credits rely heavily on having clear baseline data (the state of biodiversity before degradation or development) and ongoing reliable measurements to ensure that restoration efforts are genuinely achieving positive outcomes. These initiatives require high-quality, large-scale biodiversity data that captures both visible and hidden aspects of ecosystems. CRITICAL INFRASTRUCTURE NEEDS: - Microbial and biodiversity characterisation infrastructure deployed at existing observation sites such as critical zone observatories, key transects, super sites, as well as in productive landscapes and freshwater catchments. This infrastructure will monitor microorganisms, soil microbiomes, and other small-scale organisms essential for ecosystem health. The infrastructure should include both in-situ monitoring where possible, and where necessary, the collection of samples for subsequent lab-based analysis (e.g., microbial communities and soil samples) to ensure comprehensive, high-resolution characterisation. - Massively expanded sensor networks across multiple ecosystems, enabling continuous, real-time monitoring and automated identification of species and environmental conditions at a scale never before achieved. These networks will leverage AI/ML-assisted species identification and other smart technologies to monitor biodiversity across vast landscapes, including remote and difficult-to-reach areas, ensuring that data capture is as comprehensive and accurate as possible. - Exploration of advanced technologies for more cost-effective and comprehensive tracking of a broader range of species, increasing the scope and accuracy of biodiversity monitoring. - Ecosystem complexity modelling capabilities to integrate biodiversity data across diverse spatial and temporal scales, enhancing our understanding of ecosystem dynamics and resilience.

Q34.

Building a secure and resilient nation

EMERGING RESEARCH DIRECTION: Establish integrated research infrastructure for freshwater systems to enable sustainable management and resilience. **IMPORTANCE:** - Freshwater systems are vital for human survival, agriculture, and industry, but monitoring infrastructure is largely absent, impeding informed management. - Climate change, land use, pollution, and over-extraction are placing increasing pressure on these systems. Real-time data is essential to assess and manage these challenges effectively. - Freshwater ecosystems also hold deep cultural and spiritual significance for Indigenous communities, whose traditional knowledge is key to sustainable water stewardship. Integrating - Indigenous values ensures culturally relevant approaches to water management. **CRITICAL INFRASTRUCTURE NEEDS:** - Sensor networks in key Australian river basins, strategically deployed across longitudinal sections from headwaters to mouth, to monitor water quality, flow, temperature, turbidity, nutrients, and biodiversity. - Integration of satellite and remote sensing data to provide a comprehensive view of freshwater dynamics at multiple scales. - Standardised monitoring protocols to ensure consistent, cross-region data collection that supports long-term trend analysis and adaptive management. - Collaborative data-sharing frameworks across research institutions, industry, and Indigenous communities, ensuring inclusive and actionable insights. - Governance structures that embed Indigenous leadership, values, and decision-making frameworks in freshwater monitoring, ensuring that research and management practices align with Indigenous knowledge systems and cultural responsibilities. **EXISTING FOUNDATIONS:** - TERN Australia is well-placed to expand its terrestrial ecosystem monitoring to include freshwater systems, leveraging existing data platforms and networks. - With experience in sensor deployment, data standardisation, and long-term observation, TERN can lead the development of a national freshwater monitoring network that integrates scientific and Indigenous knowledge. ===== **EMERGING RESEARCH DIRECTION:** Tier-3 agricultural data to support credible carbon sequestration and emissions reduction models. **IMPORTANCE:** - Enabling Australia's agricultural industry to meet regulatory requirements. - Facilitating access to domestic and global markets. - Capitalising on carbon credit opportunities. - Maintaining agricultural productivity in a changing climate. **CRITICAL INFRASTRUCTURE NEEDS:** - Expanded sensor networks in agricultural systems. - Digital infrastructure to integrate and harmonise sensor, satellite and farm management data. - Support for advanced modelling capabilities. - End-user applications (e.g., apps, visualisation tools). **EXISTING FOUNDATIONS:** NCRIS-funded TERN Australia already possesses the requisite digital infrastructure and domain expertise upon which these and adjacent capabilities could be built.

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.

IDENTIFIED NEED AND PROPOSED CAPABILITY There is a critical gap in Australia's research infrastructure ecosystem: a well-funded, well-governed bridge between researcher communities and NCRIS. Australia has dedicated funding streams for research (ARC) and research infrastructure (NCRIS), however opportunities to align their goals remain fragmented. The solution would not involve a new NCRIS facility, but a targeted funding stream to support decadal planning for research infrastructure. **CURRENT STATE** Currently, the function of aligning the two sectors is addressed through a variety of dispersed mechanisms: - National Science and Research Priorities. These are recognised in the NCRIS funding process as a criterion for funding allocation. While they effectively ensure that NCRIS investments align with government priorities, they do not fully address the need for direct engagement with researcher communities to understand their specific infrastructure needs. - Academies' Decadal Plans. These plans outline research directions but are not comprehensive across all disciplines. Only some decadal plans directly or comprehensively address research infrastructure needs (see examples at the end). NCRIS funding does not formally recognise Decadal Plans as a criterion for investment. - ARC funding process. The ARC process requires researchers to consider existing infrastructure before proposing new investments (this is great), but it lacks a formal mechanism to incorporate emerging infrastructure needs from ARC-supported research projects, meaning these needs are not systematically considered in NCRIS funding decisions. - Ad hoc consultations by NCRIS facilities. Some NCRIS facilities are attempting to bridge this gap by directly consulting researchers, but NCRIS are not structured as representative, community-based organisations. This approach risks reinforcing existing biases, overlooking disciplines and bypassing established processes and institutions, such as Academies, that are designed to provide sector-wide input. - NCRIS 2026 Roadmap consultation. This very consultation is another attempt to bridge the research-infrastructure gap, which highlights the need for a more structured, systematic approach. **PROPOSED SOLUTION** The renewed emphasis of the NCRIS programme on user-focused infrastructure (NDRI Strategy) is commendable, but without a formal mechanism to connect the research and research infrastructure sectors, alignment remains ad hoc. Given the scale and long-term nature of infrastructure investments, ad hoc alignment is insufficient. A robust, comprehensive mechanism is required to create alignment between NCRIS and ARC priorities. The proposed solution is decadal research infrastructure planning. Rather than creating new NCRIS facilities, a dedicated funding stream could be established to support structured, discipline-spanning Decadal Planning for Research Infrastructure where it is already occurring (e.g. Academies). This funding should be allocated to: - Develop decadal plans for research infrastructure covering all domains - Engage established community-based research associations, ensuring representation for EMCRs and unaffiliated researchers - Integrate NCRIS facilities into the process to ensure that infrastructure perspectives are included - Collectively consider the infrastructure needs of ARC projects Finally, these decadal plans will need to be empowered by making their priorities a recognised funding criterion for NCRIS investment **MEDIUM-TERM GOALS & TIMEFRAME** - By release of the 2026 Roadmap: Include Decadal infrastructure planning among the criteria for NCRIS investment and allocate funding for their development. - Within 2 years: Publish the first round of infrastructure decadal plans. **IMPACTED RESEARCH COMMUNITIES** This initiative would benefit all research communities by ensuring that research infrastructure investments are demand-driven and strategically aligned, rather than fragmented or reactive. **EXEMPLARS:** - Decadal Plan for Social Science Research Infrastructure 2024-33 (Academy of the Social Sciences) - Decadal Plan for Australian Earth System Science 2024-2033 (Australian Academy of Science)

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.

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.