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

Micro analytical facilities are crucial in this field. This is relevant for the whole critical minerals supply chain from earth science to metallurgy. The variety of different critical minerals requires a range of analytical capabilties. This includes SEM with recently developed EDS systems, upgraded WDS systems on existing EPMA instruments, micro-XRF systems, various laser methods such as LAICPMS & LIBS. This includes quantitative data acquisition and semi-quantitative to qualitative mapping methods. Microscopy Australia is excelling in this field, and they deserve the full and continued support that they are currently receiving, with guarantee that it will continue to the future. Without Microscopy Australia, their dedicated teams, and excellent and well supported equipment, myself and others in my group simply cannot do anything and we might as well sit at home instead. However, none of this works well without reference materials ("standards") and I think that this is a serious limitation in our current analytical capabilities. There are no standardised and agreed materials used by everyone, which prevents accurate inter-lab comparability of many analytical results. NCRIS should expand its scope and invest in local reference material manufacturing capability. There are labs in Australia that can do this (including our own at ANU, but not limited to it) that can produce single crystals, glasses, and other materials that can rival the "gold standard" standards currently in used (mostly made by the US-based USGS and NIST). Since Australia has special needs with respect to critical minerals, those are the things that should be targeted. Currently we don't know how to measure some things accurately because of the lack of reference materials, and this should be addressed. Once these are made, the capabilities of any existing Microscopy Australia facilities will become even better.

Q22.
Food and Beverage

Not familiar with field

Q23.
Medical Products

Not familiar with field

Q24.
Defence

Not familiar with field

Q25.
Recycling and Clean Energy

Not familiar with field

Q26.
Space

Not familiar with field

Q27.

Environment and Climate

Not familiar with field

Q28.

Frontier Technologies and Modern Manufacturing

Not familiar with field

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

For this research direction, everything that I wrote in the previous page is holds. Transitioning to net zero requires the geological exploration of critical minerals, the mineralogical understanding of what they are and how they appear in the ore, their extraction and refining, and manufacturing of useful products out of them. Key to those capabilities are the microanalytical instruments held by Microscopy Australia. Enhancing those capabilities will be facilitated by synthesis of standard reference materials.

Q31.

Supporting healthy and thriving communities

Q32.

Elevating Aboriginal and Torres Strait Islanders knowledge systems

Q33.

Protecting and restoring Australia’s environment

Q34.

Building a secure and resilient nation

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.

Synthesis of standard reference materials as mentioned in the previous answers. This requires and interlab collaboration of new material characterisation to achieve an agreed-upon composition. Once these materials are made in the few labs that can do it (again, our ANU is on of them, but not the only one), they can be delivered to all academic, government, and even industry labs in Australia. This will also strongly increase data quality hence Australian competitiveness in the international scene. There isn't currently something like that in the world, and this could also be turned into a commercial opportunity (albeit modest), where such materials are sold worldwide (similar to how NIST reference materials are sold commercially). The knowledge on how to do this (both synthesis and analytical) exists in Australia, the greatest challenge is the dedicated personnel to actually do it, in several labs spread across Australia. This is where NCRIS has a role in my opinion, perhaps through established avenues such as AuScope and others. This will positively impact anyone who uses microanalytical equipments. This includes electon microprobes, isotope measurement (LAICPMS, SIMS, etc), scanning electron microscope (a ubiquitous piece of equipment!), and more. Medium-term goals? Essentially a common Australia-wide analytical language, and even global down the track. Timeframe is not necessarily too long, with quite a lot of work feasible to be done in only five years or so.

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.

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Q39.
3.3 Please indicate your (one or more) primary reasons for interacting with NRI:

- [x] For expertise or advice
- [ ] Access to research resources or products
- [x] Access to equipment for research
- [ ] Access to equipment for operational reasons
- [ ] Help in translating research
- [x] Access to data
- [ ] Support for clinical trials
- [ ] Other (please specify)

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.

I would add any links or reports about what I suggested above, but none exists. The lack of reference materials is something that everyone complains about (just go to any Microscopy Australia instrument operator..), but no one seems to have the initiative to do anything about it. This is what I am suggesting here - let's do something about it, as a national infrastructure initiative.