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

Genomics investigations are required for soil DNA to ensure mine sites are restored after mining is concluded. This is conducted via collecting soil samples from multiple locations before mining commences and at multiple time points during mining operations and final samples collected after closure of mining site. Whole genome sequencing or 16S rRNA gene sequencing is conducted on samples to understand changes in the soil and plan for mine site restoration. These studies require the latest Oxford nanopore technology based long read sequencers to enable large scale studies at the lowest cost possible and HPCs for data storage and analysis.

Q22.

Food and Beverage

Genomics technologies will be critical for food security, preventing mis-labelling and protecting Australia's agricultural export industry.. Some examples of how this may be achieved would be 1. Improving crop yield through genomics applications such as RNAseq for pest-management. 2. Studying the impact of climate change on crop yield through genomics applications such as Differential gene expression through RNAseq, Genetic changes through whole genome sequencing and gene regulatory changes through whole methylome sequencing or ATAC-seq. 3. Creating a catalogue of reference genomes of Australian strains of crops to enable identification of gene changes in research investigations 4. Identify country of origin of animal products especially marine products through investigating genetic markers via whole genome sequencing. 5. Identify animal product mis-labelling through whole genome sequencing. 6. Identifying high yield and high quality seeds through identification of genetic markers via whole genome sequencing. 7. Creating high nutritional value grains and improving their yield by genetic manipulation eg CRISPR technologies followed by genomics applications such as differentially expressed genes analysis through RNAseq or through whole genome sequencing. These studies require the latest Oxford nanopore technology based long read sequencers to enable large scale studies at the lowest cost possible and HPCs for data storage and analysis.

Q23.

Medical Products

1. Genomics applications for personalized medicine: The concept of personalized medicine requires targeting of medications appropriately to patients based on variants present in their genome sequence and investigation of genetic variations introduced through disease process. Precision medicine reduces side effects and improves response to medications, thus ensuring better outcomes for patients and can only be achieved through the use of genomic technologies such as Whole genome sequencing, identification of genetic variations through targeted panels or exome sequencing, identification of cancer specific gene mutations including structural variants, deletions, insertions and gene fusions through specialist panels such as TSO 500, monitoring disease progression gene expression changes identified through RNAseq. 2. Bio-engineering products provide a scaffold for cells to grow in vivo. It is critical to test that the bioengineering materials do not introduce genetic variations in cells. This can be achieved through profiling gene expression changes at a single cell resolution through single cell sequencing. These studies require the latest Oxford nanopore technology based long read sequencers to enable large scale studies at the lowest cost possible and HPCs for data storage and analysis.

Q24.

Defence

Identification of biosecurity threats onsite is critical for our forces. Genomics can be used for sequencing samples directly without extraction of DNA using whole genome sequencing on oxford nanopore sequencers. Their latest offering ElysION comes with a liquid handler and provides a sample to data solution where samples are loaded onto a cartridge, the process from DNA extraction, sequencing to data analysis is automated on board the instrument. The outcome is whole genome sequencing data or data from 16S rRNA gene within a few hours of loading the instrument. The technology does not require high end skills. The instrument is new and has limited applications but it may be expanded to other workflows such as RNA or cDNA sequencing in the future so DNA and RNA based security threats can be identified through gene sequencing in a timely manner These studies require the latest Oxford nanopore technology based long read sequencers to enable large scale studies at the lowest cost possible and HPCs for data storage and analysis.

Q25.

Recycling and Clean Energy

Q26.

Space

Creating nutritional plants for space travel is critical for colonization of the moon or other suitable planets. This can be achieved through modifying plants so they survive without gravity or in microgravity within controlled environments. The process to modify plants will require extensive genomics sequencing of plants not only to identify gene and regulatory changes induced by space travel but also to confirm that nutritional enhancements designed within plants are active. These studies require current Next generation short read and long read sequencers to enable large scale studies at the lowest cost possible and HPCs for data storage and analysis.

Q27.

Environment and Climate

1. Genomic sequencing of Coral growing in the filed is critical to identify gene changes introduced due to temperature changes. 2.Identifying differences in gene expression between coral grown at low and high temperatures is critical to identify gene expression changes induced via climate change. 3. Sequencing rRNA genes or whole genomes of eDNA in soil or ice samples at different depths will help identify microbial changes due to climate change. 4. Long read genome sequencing of all above samples will help identify structural variants introduced due to climate change. These studies require the latest short and long read next generation sequencers to enable large scale studies at the lowest cost possible and HPCs for data storage and analysis.

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

Transportation and storage of kits at ambient temperature, ensuring storage warehouses within Australia to reduce freight related emissions and incentives for recycling plastics in genomics labs will all be essential to reduce our footprint and contribute towards this initiative. While vendors are slowly transitioning to ambient shipping, many vendors source each item from overseas warehouses. Perhaps incentives to house reagents and instruments within Australia may be required. Genomics sequencing is truly mainstream and requires digital infrastructure and energy. While we are discussing HPC requirements and their scaling up to ensure they are able to meet the needs, we also need to consider energy required to provide appropriate cooling and power to these HPC clusters that are expected to run 24/7 with no downtimes. Investing in renewable energy sources and investing in new battery designs (that have reduced risk of fire) will be critical to ensure we are able to house this critical infrastructure within Australia for data security reasons.

Q31.

Supporting healthy and thriving communities

The next phase of personalized medicine is essential to support healthy communities. Diagnostic tests using latest genomics technologies where applicable with the quickest turnaround times will be critical to increase the uptake and participation of communities in research. Ensuring that the diversity in Australian population is captured in genomics investigations, Educating communities and the public about the benefits of community participation, creating interest and awareness through education via programs on ABC and on social media platforms will bring public support for investment in the latest technologies and for upskilling staff to create capacity and skills within Australia.

Q32.

Elevating Aboriginal and Torres Strait Islanders knowledge systems

Engagement with our first Nations people to regain their trust, deliver test results and personalized treatments in a timely fashion and demonstrating improved health outcomes will be key to ensure participating in genomic research and equitable access to of contemporary treatments. Such engagements and education require time, effort and persistent advocacy. In addition, our first nations people have a vast knowledge of native plants and their medicinal uses. It is critical to protect and preserve such knowledge but also to use it in modern medicine for the development of truly Australian treatments. The Australian biodiversity legislation provides such protection and also returns to the knowledge holders commercial benefits in sharing knowledge. Investment in creating an indigenous STEM workforce to engage with elders in such communities is required to tap into their knowledge, set up commercial agreements and also to enhance their participation in trials.

Q33.

Protecting and restoring Australia's environment

Using latest genomics technologies to create a genomic atlas to catalogue our Australian native plants, their expected medicinal properties known through indigenous knowledge or through research activities, threats to them due to pests, disease, climate change is critical so we can create processes for protecting and restoring our environment.

Q34.

Building a secure and resilient nation

This requires training in STEM, AI, innovation to ensure power needs are met with minimal footprint, meet digital infrastructure needs and availability of latest equipment to keep up with technological advances

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.

Our NRI facilities have experienced and skilled staff who are capable of providing high level training to enhance STEM skills. For genomics such trainings also require access to latest instruments. Adding a second function to NRI capabilities as advanced training centres will require little investment but deliver a huge impact. This will enable upskilling of local workforce to build capacity and capability within Australia to meet our needs.

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:

- ☐ I did not know about it
- ☐ Other facilities suit my needs better
- ☐ I would like to, but cannot get access due to geographical location
- ☐ I would like to, but believed that access was only available to academic researchers
- ☐ I am not aware of any capability that meets my needs
- ☐ Other (please specify) [ ]

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.