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

National high performance computing (HPC) and data infrastructure are essential to advancing Australia’s capabilities in Resources Technology and Critical Minerals Processing. They enable large-scale modelling, simulation, and analysis for mineral exploration, resource characterisation, and process optimisation—leading to more efficient, lower-impact extraction and refining. HPC also powers artificial intelligence and machine learning tools that support automation, predictive maintenance, and smarter supply chain management across the mining and minerals sectors. Beyond technical operations, HPC and national data systems enhance sustainability, traceability, and sovereign capability. They enable lifecycle assessments, support ESG reporting, and underpin secure digital tracking of critical minerals through global supply chains. By providing secure, high-performance digital environments for collaborative research and innovation, national HPC infrastructure accelerates the development of new processing technologies and strengthens Australia's strategic position in the global critical minerals economy.

Q22.

Food and Beverage

High performance computing (HPC) and national data infrastructure play a growing role in transforming Australia’s food and beverage industry through precision agriculture, supply chain optimisation, and food innovation. HPC enables large-scale modelling of climate, soil, and crop data to support yield prediction and sustainable farming practices. In manufacturing, it powers AI and data analytics for process automation, quality control, and waste reduction. HPC also supports research into food safety, nutritional modelling, and the development of novel food products. By enabling secure, data-driven innovation across the value chain, HPC enhances productivity, traceability, and global competitiveness in the sector.

Q23.

Medical Products

An enhanced scale of high performance computing (HPC) infrastructure will be required to support the growing compute and data requirements of advanced medical research in the short to medium term. Supercomputers support advanced medical research in areas such as accelerated genomic and epidemiological analyses, enabling breakthroughs in personalized medicine and disease surveillance. HPC enables advanced modelling and simulation for drug discovery, biomolecular research, and personalised medicine, significantly reducing development time and cost. It supports the analysis of large-scale genomic and clinical datasets to identify new treatments and optimise patient outcomes. In medical device design, HPC allows virtual prototyping and testing, improving safety and efficiency. National HPC capabilities also ensure secure handling of sensitive health data, supporting regulatory compliance and strengthening Australia’s sovereign capability in medical innovation.

Q24.

Defence

High performance computing (HPC) and national data infrastructure are equally vital to Australia’s defence sector, supporting advanced modelling, simulation, and AI-driven analytics for mission planning, systems design, and strategic decision-making. HPC enables the rapid processing of vast, complex datasets—from satellite imagery to cyber intelligence—enhancing situational awareness and threat detection. It also supports the development and testing of defence technologies, such as autonomous systems and advanced materials, in secure virtual environments. By underpinning sovereign capabilities and reducing reliance on foreign computing platforms, national HPC infrastructure strengthens defence resilience, innovation, and operational readiness in an increasingly data-driven security landscape.

Q25.

Recycling and Clean Energy

The demand for large-scale compute to address modern research areas such as climate prediction and renewable energy optimization will continue to grow in the short to medium term. Advanced computation is an essential to support and enhance research areas such as climate and weather modeling (HPC provides high-fidelity simulations that guide emissions targets, mitigation strategies, and climate policy) and renewable energy optimization (by simulating numerous configurations of solar, wind, and storage systems, HPC identifies cost-effective decarbonization pathways).

Q26.

Space

As requirements grow in data-intensive science areas such as space and radio astronomy, there will be greater demand on existing HPC facilities and a requirement for these facilities to expand to meet the requirements. High performance computing (HPC) and national data infrastructure are critical enablers for Australia's growing space sector, supporting everything from satellite design and mission simulation to Earth observation and space situational awareness. HPC allows for the processing and analysis of massive volumes of data from satellites and telescopes, enabling real-time monitoring of environmental changes, natural disasters, and orbital debris. It supports complex simulations for spacecraft trajectories, propulsion systems, and communications networks. By providing sovereign, high-performance capabilities, national HPC infrastructure strengthens Australia's ability to contribute to global space missions, advance space science, and develop commercial space technologies.

Q27.

Environment and Climate

The scale of national CPU capability required to support existing and emerging large research groups such as climate will continue to grow in the short to medium term. Advanced national research HPC facilities are necessary to process massive dataset at high speed which is essential for data-intensive science such as environment and climate. High performance computing (HPC) and national data infrastructure are essential tools for understanding and addressing environmental and climate challenges. HPC powers complex climate models, weather forecasting, and environmental simulations that inform policy, disaster preparedness, and sustainable land and water management. It enables high-resolution analysis of atmospheric, oceanic, and ecological systems, supporting research on biodiversity loss, carbon emissions, and climate change impacts. National data infrastructure allows for secure storage, sharing, and analysis of massive environmental datasets from satellites, sensors, and field studies—enhancing Australia's ability to protect natural resources, meet international climate commitments, and build climate resilience.

Q28.

Frontier Technologies and Modern Manufacturing

To ensure that Australian researchers remain internationally competitive and on the leading edge, there is a need for critical infrastructure with new architectures that are AI-oriented or GPU heavy. Leveraging AI and accelerated compute architecture like GPUs is critical for modern research particularly in emerging fields such as machine learning, large language models (LLMs), and data-intensive simulations. HPC enables the design, testing, and optimisation of advanced materials, additive manufacturing (3D printing), robotics, and quantum technologies through high-fidelity simulations and digital twins. It supports AI-driven automation, real-time process control, and predictive maintenance, enhancing productivity, reducing waste, and improving product quality. For modern manufacturers, access to national HPC infrastructure allows faster innovation cycles, greater customisation, and resilience in global supply chains—positioning Australia to lead in high-value, technology-driven manufacturing sectors.

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

Advanced national research high performance computing (HPC) facilities are necessary to process massive datasets at high speed which is the essential for data-intensive science, complex modelling, and innovative research solutions in areas such as: - Climate and weather modeling: HPC provides high-fidelity simulations that guide emissions targets, mitigation strategies, and climate policy. - Renewable energy optimization: By simulating numerous configurations of solar, wind, and storage systems, HPC identifies cost-effective decarbonization pathways. - Carbon capture and storage: HPC analyzes geological formations for long-term CO_2 storage, informing CCS project viability. - Industrial process innovation: Advanced modeling helps to refine low-emission methods for sectors like steel and cement to cut waste and energy use. Additionally given the environmental impact of HPC, investment in energy efficient systems and green computing initiatives will be essential in the short to medium term. The focus will be on carbon-neutral operations (powered by renewable energy and employing advanced cooling technologies), and energy-efficient algorithms (AI models that optimise computational tasks to reduce unnecessary energy consumption).

Q31.

Supporting healthy and thriving communities

Research to support healthy and thriving communities is becoming more data-intensive and will require greater investment in HPC and supporting data and storage infrastructures to enable Australia's HPC offerings to meet the growing requirements of these research communities. Examples of areas where advanced HPC can enhance research efforts include: - Advanced medical research: Supercomputers accelerate genomic and epidemiological analyses, enabling breakthroughs in personalized medicine and disease surveillance. - Epidemiological modeling: Large-scale simulations predict disease spread under different interventions, helping optimize healthcare resources. - Social science analytics: HPC processes massive datasets to identify vulnerable groups and guide evidence-based policy. - Urban design and planning: "Digital twins" of cities model infrastructure, traffic, and population changes to support better public services.

Q32.

Elevating Aboriginal and Torres Strait Islanders knowledge systems

Australia's Tier-1 HPC can enhance the elevation of Aboriginal and Torres Straight Islanders knowledge systems through: - Data management platforms: HPC supports secure, culturally sensitive repositories for Indigenous data and heritage projects. - Environmental and land management: HPC integrates Indigenous knowledge to improve bushfire mitigation, water sustainability, and ecosystem models. - Cultural mapping and language preservation: Advanced computing processes large multimedia collections, aiding language reclamation and translation tools. - Community-led research: Partnerships ensure HPC solutions address Indigenous priorities in health, environment, and cultural documentation.

Q33.

Protecting and restoring Australia's environment

With a growth in research focus on protecting and restoring Australia's environment, the scale of HPC infrastructure required to support the data-intensive science and complex modelling associated with this research will also need to be expanded. Examples of areas where expanded advanced HPC can support this research include: - Ecosystem and biodiversity modeling: Supercomputers combine remote sensing and species data to guide conservation and habitat restoration. - Marine and coastal research: HPC underpins high-resolution ocean and reef simulations, informing fisheries management and reef protection. - Natural hazard planning: Advanced weather and disaster modeling boosts emergency responses and infrastructure resilience. - Agricultural sustainability: Detailed HPC-driven models optimize crop yields, water use, and pest control under changing climate conditions.

Q34.

Building a secure and resilient nation

Efforts to build a secure and resilient nation in the future will require both advanced supercomputing facilities and technical expertise to accelerate research in areas such as: - Cybersecurity and encryption: HPC helps develop robust encryption and simulate cyberattacks for stronger threat detection. - Disaster risk reduction: Predictive modeling of hazards leads to more effective emergency plans and infrastructure safeguards. - Resource and energy security: Large-scale simulations optimize supply chains for critical resources and prevent disruptions. - Advanced manufacturing and defense: HPC speeds prototyping and testing of new materials, ensuring reliability. - Quantum Integration: Preparing for quantum computing will revolutionize areas like cryptography and drug discovery. - AI-Driven Resource Management: AI will optimize resource allocation, energy use, and system performance. - Edge and Cloud Integration: Incorporating edge computing nodes will enhance real-time data processing and resource management.

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.

The need In recent years there has been greater convergence between artificial intelligence (AI) and high performance computing (HPC). Cutting-edge HPC systems, such as Setonix, increasingly serve dual roles: running traditional scientific simulations and training or deploying AI models. Likewise, AI research at scale now relies on HPC-class infrastructure (multi-GPU clusters, supercomputers) to train massive neural networks. Examples of this work at Pawsey include: • Traumatic Brain Injury: https://pawsey.org.au/case_studies/traumatic-brain-injury-predictions/ • AI to support clinician to provide better care: Harnessing AI for Health with WA Supercomputers (businessnews.com.au) • Drug Development from Setonix to Frontier: https://www.linkedin.com/posts/giuseppemj-barca_breakthrough-in-hpc-quantum-chemistry-revolutionises-activity-7218863415480438784-NU4D?utm_source=share&utm_medium=member_desktop Enhancements to existing HPC/AI capabilities are required if Australia's HPC systems are to meet growing demand in AI and to ensure Australia's continues to stay competitive in the face of rapid advances in exascale computing and AI technologies. Proposed infrastructure capability With HPC becoming AI-enabled by design, and AI at scale essentially becoming HPC in practice, enhancement of GPU-accelerated HPC systems (such as Pawsey's Setonix) is required. The convergence between HPC and AI is driving co-development of hardware and software with modern HPC architectures featuring GPUs, tensor cores, AI accelerators and high-seed interconnects to enable increasing AI, HPC and simulation data to be handled. A future supercomputing research infrastructure capability in Australia would feature a convergence of heterogeneous architectures that are optimised for AI. In addition to the infrastructure capability, there would be a required upskilling of users and need to grow the skilled software engineering expertise needed to realise the potential of exascale computing as well as expanding access to AI architectures through an extension of the NCMAS scheme for AI. Medium-term goals • Maintain performance and scaling demand of Australian research. • Move Australia towards increasingly GPU dominated offerings to take advantage of the efficiencies of that technology while moving Australin into the AI and exascale regime. • Expand access to AI architectures through an extension of the NCMAS scheme for AI. • Enhance the research outputs of Australian researchers through AI and accelerated computing to drive the next era of scientific discovery. Impacted research communities Enhancing AI and accelerated compute architectures is critical for multiple research communities including climate/weather modelling, astrophysics, and molecular dynamics, and particularly in emerging fields such as machine learning, large language models, and data-intensive simulations. Timeframe for establishment Australia's HPC offerings (such as Pawsey's Setonix) have an existing strong foundation on which to enhance and expand the GPU-accelerated HPC systems available to Australian researchers. An enhanced offering could be established within a short timeframe.

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 (HPC) remains a cornerstone of Australia's research success, enabling critical advancements in fields such as climate modelling, genomics, materials science, artificial intelligence, and radio astronomy. By housing key HPC systems onshore, Australia safeguards data sovereignty, ensuring sensitive information is handled in secure environments and fostering advanced computational expertise within the national workforce. Multiple global initiatives—from EuroHPC to the U.S. National Strategic Computing Initiative—underscore the essential role sovereign HPC capability plays in driving both scientific discovery and economic growth, with OECD reports consistently emphasizing the need for sustained, strategic investments in HPC infrastructure. Equally important to national competitiveness is the coordinated operation of Tier 1 facilities, such as Pawsey and the National Computational Infrastructure (NCI), in tandem with Tier 2 centres. This federated approach to HPC aligns large-scale infrastructure with specialised or regional systems, providing researchers with seamless data management, sharing, and analysis services. A robust, shared data infrastructure not only accelerates the pace of scientific breakthroughs but also fosters collaboration across institutions, disciplines, and geographies, ensuring Australian research remains at the forefront of innovation. Central to maintaining a thriving HPC ecosystem is a planned and staged national Roadmap that synchronizes investment cycles, technology refreshes, and workforce development. As HPC systems grow in scale and complexity, mid-cycle and incremental upgrades—like those proposed for Pawsey's Setonix system—ensure continuity of service and allow Australia to negotiate effectively in global markets for next-generation technology. By clearly articulating resource needs and investment timelines, an effective national Roadmap underpins sovereign capability: it minimizes the risk of technological obsolescence, preserves high-end research capacity, and ensures that Australia remains an informed and active participant in the rapidly evolving HPC arena.

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.