

SCIENCE & TECHNOLOGY AUSTRALIA

POLICY SUBMISSION

4 DECEMBER 2023

NATIONAL DIGITAL RESEARCH INFRASTRUCTURE: RESPONSE TO THE DRAFT STRATEGY

Science & Technology Australia thanks the Department of Education for the opportunity to give feedback on the draft National Digital Research Infrastructure Strategy.

Science & Technology Australia is the peak body for the nation's science and technology sectors, representing 139 member organisations and more than 115,000 scientists and technologists. We connect science and technology with governments, business and the community to advance science's role in solving some of humanity's greatest challenges.

NDRI Strategy Section-specific Responses

Please provide your view on the following statements.

Vision for future NDRI ecosystem: A user-centric design (outlined in the "Vision for future NDRI ecosystem" section) is an appropriate foundation for Australia's NDRI ecosystem over the next 10-15 years.

- Strongly agree
- Agree
- **Neutral**
- Disagree
- Strongly disagree

The draft strategy proposes the vision: *"User-centric design must lie at the heart of Australia's NDRI system"*. Australia's national digital research infrastructure must be user-centric – if it is not, it would hardly be fit-for-purpose – but this alone is not a sufficient vision for a National Digital Research Infrastructure Strategy.

As well as serving users' needs, the National Digital Research Infrastructure strategy must support Australia's research sector to remain competitive in the coming decades, as scientific research becomes increasingly data-intensive and more globalised. To ensure the entire system remains competitive and is user-centric to all, the strategy should also acknowledge the different types of users across the entire system. This will be essential to ensure collaboration and effective translation across different disciplines, domains and end uses.

A more comprehensive vision would be:

"A user-centric national digital research infrastructure system that supports the tools, systems and workforce to deliver Australian research at the highest global quality and to maximise translation and commercialisation opportunities."

Science & Technology Australia recommendation:

1. The National Digital Research Infrastructure Strategy vision should be more ambitious, and based in supporting the entire research sector, e.g.: *“A user-centric national digital research infrastructure system that supports the tools, systems and workforce to deliver Australian research at the highest global quality and to maximise translation and commercialisation opportunities.”*

Outcomes

The six Outcomes (identified in the "Outcomes" section) adequately capture the priority features of an Australian NDRI ecosystem that will meet the Vision (described in the "Vision for future NDRI ecosystem" section).

- Strongly agree
- **Agree**
- Neutral
- Disagree
- Strongly disagree

The six priority outcomes are sensible.

While perhaps implicit in the listed outcomes, building and maintaining a sovereign digital research infrastructure for Australia is not explicitly included. Given the severe risks inherent in assuming Australia can rely on other countries or commercial providers for high-performance computing and other digital research infrastructure needs, the keeping pace with international developments is crucial. Securing Australia’s sovereign capabilities should be included as a priority outcome for the strategy.

The draft strategy notes the importance of ensuring ethical and responsible approaches to Indigenous research and data, including [the AIATSIS Code of Ethics for Aboriginal and Torres Strait Islander Research](#) and the [CARE Principles for Indigenous Data Governance](#). Science & Technology Australia suggests this, along with ensuring ethical frameworks for data collection, curation and access, be elevated to a specific outcome.

Alignment with international standards and protocols should also be included as a priority area.

The strategy should look to examples of NDRI strategies from other countries to ensure Australia maintains capabilities that will foster the international collaborations that will be critical to future research. Australia must also keep up with international standards and protocols or risk being relegated to a non-competitive position on the outskirts of international research.

Science & Technology Australia recommendations:

1. The strategy should include specific outcomes for:
 - a. Securing Australia’s sovereign digital research infrastructure capabilities – including high-performance computing, storage and software tools.
 - b. Ethical practices for data collection, curation and access, including specific governance protocols for Indigenous data.
 - c. Alignment with international standards and protocols to ensure Australia remains globally competitive and has data capabilities on par with other countries.



Challenges

The identified Challenges (outlined under the headings for Outcome 1 to 6) adequately describe the major issues facing the Australian NDRI ecosystem over the next 10-15 years.

- Strongly agree
- Agree
- **Neutral**
- Disagree
- Strongly disagree

Do you have any additional comments relating to the identified Challenges? Max 1000 characters.

N/A.

Outcome 1. Underpinned by training frameworks for researchers and NRI workforce

The content in the "Underpinned by training frameworks for researchers and NRI workforce" section adequately presents the high-level information expected for this section of the NDRI Strategy.

- Strongly agree
- Agree
- **Neutral**
- Disagree
- Strongly disagree

There are three components of workforce training that are essential to ensure a strong National Digital Research Infrastructure system:

- **Digitally literate and sufficiently trained researchers** – as all disciplines deploy increasingly data-heavy research approaches, it is critical that researchers are digitally literate and well-trained on appropriate techniques and protocols in data collection, usage and storage. However, it is not practical nor possible to train all researchers to the level of specialist expertise that will be required to develop the software applications and engineering solutions complex research will demand.
- **Highly skilled workforce to manage computing and other digital research infrastructure facilities and systems** – Australia must maintain world-class high-performance computing facilities, which require highly specialised personnel. This workforce must be nurtured, or we risk losing our ability to maximise investments in physical and digital infrastructure. The strategy should acknowledge the imperative of being competitive with industry salaries and employment conditions. Retention of this highly skilled workforce in predominantly publicly funded facilities and organisations – which often have constrained career paths – is an ongoing challenge.
- **A specific workforce component to develop software and tools** – as researchers are required to analyse and manage ever-increasingly complex datasets, a specialised workforce with deeper computing and data management expertise beyond the level of individual researchers is needed. This workforce will collaborate with domain experts to develop software and tools, and assist researchers with complex, and potentially bespoke, data tasks. These solutions will likely cross discipline boundaries and maximise efficiency and



benefit across the research sector. This workforce would include skills in AI and machine learning applications, as well as other computing and programming expertise.

Science & Technology Australia recommendations:

2. The strategy should take a comprehensive approach to workforce development and outline a commitment in the strategy to:
 - a. Train Australia's researchers to a minimum base level of digital and data literacy.
 - b. Nurture our nation's highly specialist workforce to maintain research infrastructure facilities and projects, including digital research infrastructure facilities, services and resources – including appropriate remuneration and career pathways.
 - c. Develop a specialist digital research infrastructure workforce that integrates deep and cutting-edge domain expertise with research computing, software and data expertise to support the research sector with discipline specific applications and program/software development.

Outcome 2. Responsive to disruptive technological and societal shifts

The content in the "Responsive to disruptive technological and societal shifts" section adequately presents the high-level information expected for this section of the NDRI Strategy.

- Strongly agree
- Agree
- **Neutral**
- Disagree
- Strongly disagree

The increasing prevalence and power of artificial intelligence (AI) applications will likely transform the digital research infrastructure landscape over the coming years. It's difficult to think of a discipline in which AI does not present a game-changing opportunity to analyse, interpret and interpolate massive datasets. For Australian research to stay globally competitive, the strategy must include the development of AI tools and the capacity to train researchers (Outcome 1).

The strategy should address the challenges of maintaining pace with the speed of developments and the need to remain not just current and relevant but anticipate future needs and directions.

The strategy should also acknowledge the ethical, safety and cybersecurity considerations involved in the collection and storage of large datasets, particularly those pertinent to medical or other personal data. The strategy should include strong governance frameworks that address ethical and social considerations (see Recommendation 1).

Science & Technology Australia recommendations:

3. The National Digital Research Infrastructure Strategy should include the development of critical AI tools that will:
 - a. build Australia's sovereign capability
 - b. support research across the sector
 - c. train researchers in potential applications
 - d. enable Australia to respond to disruptive technological and societal shifts.



Outcome 3. Consistent in its standards for data collection, curation and access

The content in the "Consistent in its standards for data collection, curation and access" section adequately presents the high-level information expected for this section of the NDRI Strategy.

- Strongly agree
- Agree
- **Neutral**
- Disagree
- Strongly disagree

Consistent and standardised approaches to data management – wherever possible and practical – are important. However, the strategy must note the different and specific needs and practices of different disciplines that dictate how data is collected, manipulated and managed. Consistency across large scale global collaborations will also be difficult, if not impossible, to attain. The strategy should allow for a nuanced approach, with consistency as a driving principle, but noting that it will not always be possible.

Interoperability is equally important – and the strategy should also ensure data protocols to support this, as well as identifying areas of overlap and cross-application of protocols or data manipulation techniques. This is where the skilled specialist workforce in Recommendation 2 will be critical in identifying both the common and specific needs of researchers and facilities across the sector.

Ensuring alignment with international standards and protocols will also be critical to ensure Australian research maintains credibility with global collaborators. Consistent application and adherence to standards are also essential to ensure authentication and verification of data quality and origin, as well as tracking data use and impact.

As systems – and the sector's needs – evolve, data management, curation and archiving systems must remain accessible – 'future-proofing' data storage and manipulation methods will also be a key consideration. The strategy should be regularly reviewed to ensure it maintains pace with the rapid pace of change in the sector.

Science & Technology Australia recommendations:

4. The National Digital Research Infrastructure Strategy should aim to ensure consistency in standards for data collection, curation and access but also develop frameworks with sufficient flexibility to allow for the varying and disparate needs of different disciplines.
5. The National Digital Research Infrastructure Strategy should align with international standards and protocols wherever possible.
6. The National Digital Research Infrastructure Strategy should take into account the rapidly evolving nature of the research sector's capabilities, needs as well as the digital infrastructure systems and tools themselves.
7. The strategy should be regularly reviewed to ensure it remains fit for purpose.

Outcome 4. Integrated across levels of computing and data

The content in the "Integrated across levels of computing and data" section adequately presents the high-level information expected for this section of the NDRI Strategy.

- Strongly agree
- Agree
- **Neutral**



- Disagree
- Strongly disagree

Current – and future – research sector needs span the various levels of computing intensity – from Tier 1 high-performance compute to lower-level Tier 2 and other distributed computing facilities. While the draft strategy suggests a laudable approach of ‘integrated access to different tiers of computing capability and shared data’, in practice this may not be so simple.

Different disciplines and users have different needs and it may not be required to move from one ‘level’ to another, but more to have streamlined access to whatever type of system best meets users’ needs, with the appropriate support from facilities – or a dedicated digital research infrastructure workforce.

Another consideration is the need to support active collaboration between NCRIS organisations and digital research infrastructure users. This will ensure users’ needs are understood from the project outset and resources are allocated and used effectively.

Given the diversity of digital research infrastructure facilities and tools, the strategy should also consider how to ensure efficient and streamlined access for researchers that best meets their needs. This could include a consistent federated approach to access – noting the current state of different governance and investment models across different Tier 1 and Tier 2 facilities as well as the mix of commercial providers and public-private complementary services.

An essential first step to ensure the strategy meets the Australian research sector’s future – and even current – high-performance compute needs is to conduct a rapid and comprehensive stocktake of all current facilities, to better understand:

- the distribution of all Tier 1 and Tier 2 computing facilities across Australia
- the level of current and potential future demand on these systems, including from private industry
- how facilities are currently funded and the funding challenges they face
- how they interact with each other and international counterparts
- domain-specific use cases and future needs
- specific personnel needs and challenges.

This would deliver a thorough understanding of current capabilities and determine any gaps. The strategy should then work to address these gaps and apply strategic and cost-effective planning to ensure future demand on the system can be met.

Another critical digital research infrastructure component is storage. The increasingly data-heavy nature of research not only calls for more compute power across the sector but mechanisms for efficient storage of ever-bigger datasets. The strategy must consider how best to offer data storage solutions across the sector.

Science & Technology Australia recommendations:

8. As a matter of priority, the Department should conduct – or commission a trusted provider with relevant expertise – a **rapid and comprehensive** stocktake of Australia’s current computing facilities to inform the strategy’s direction and future government investment in high-performance computing capabilities.
9. The National Digital Research Infrastructure strategy must include data storage provisions, including cost, noting the diverse needs and nature of research data across the sector.



Outcome 5. Cybersecure, particularly for national-scale data and computing

The content in the "Cybersecure, particularly for national-scale data and computing" section adequately presents the high-level information expected for this section of the NDRI Strategy.

- Strongly agree
- **Agree**
- Neutral
- Disagree
- Strongly disagree

Cybersecurity is undoubtedly a primary concern for all forms of digital research infrastructure. Institutions and facilities are increasingly aware of the risks of cyber attacks, and measures must be in place to prevent these and mitigate any impacts. This must also include data security and integrity across the entire chain – from collection through analysis, storage and archival.

Noting the layers of current regulation, including the critical infrastructure regulations, the suggested approach of "*NCRIS provides tools, frameworks and resources for assessment and mitigation of risk posed by cybersecurity threats*" must be sure to not duplicate existing specialised regulations, resources and service provision. It would perhaps make more sense for the Australian Cyber Security Centre and/or the Cyber and Infrastructure Security Centre to lead this work, with the support of the NCRIS network.

Outcome 6. Maximised by openly available research software tools

The content in the "Maximised by openly available research software tools" section adequately presents the high-level information expected for this section of the NDRI Strategy.

- Strongly agree
- **Agree**
- Neutral
- Disagree
- Strongly disagree

Open-source software and tools are undoubtedly a strong mechanism to promote collaboration and further research goals across the sector. IP considerations must also be included in the strategy, with consideration for how best to serve Australia's interests in developing unique and potentially commercially valuable IP and applications.

The strategy should also look beyond the software and tools themselves and consider how to build and maintain a highly specialised workforce that will create these tools and support the sector with customised training and bespoke applications. As with all research infrastructure, the need to support world-class tools and facilities is accompanied by an equally urgent need/imperative to support the specialised workforce that builds and maintains them (Recommendation 2c).

The strategy should also consider ways to plan for future digital research infrastructure developments and next-generation compute and how best to prepare. This includes training the research sector, as well as ensuring facilities are sufficiently funded and developing a specialised workforce with the expertise to keep up to date.



Science & Technology Australia recommendation:

10. The National Digital Research Infrastructure Strategy should be driven by principles of open science, but also extend beyond software and tools to consider the specialised workforce that can develop custom applications (see also Recommendation 2c).

NDRI Strategy Overall Response

Overall, the presented NDRI Strategy will help shape a future Australian NDRI ecosystem that meets the rapidly growing demands of researchers and other users for increasingly complex digital tools and services.

- Strongly agree
- Agree
- **Neutral**
- Disagree
- Strongly disagree

Professor Sharath Sriram
President
Science & Technology Australia

Misha Schubert
Chief Executive Officer
Science & Technology Australia

