Australian Academy of Science

Is Australian science ready for AI?

Introduction

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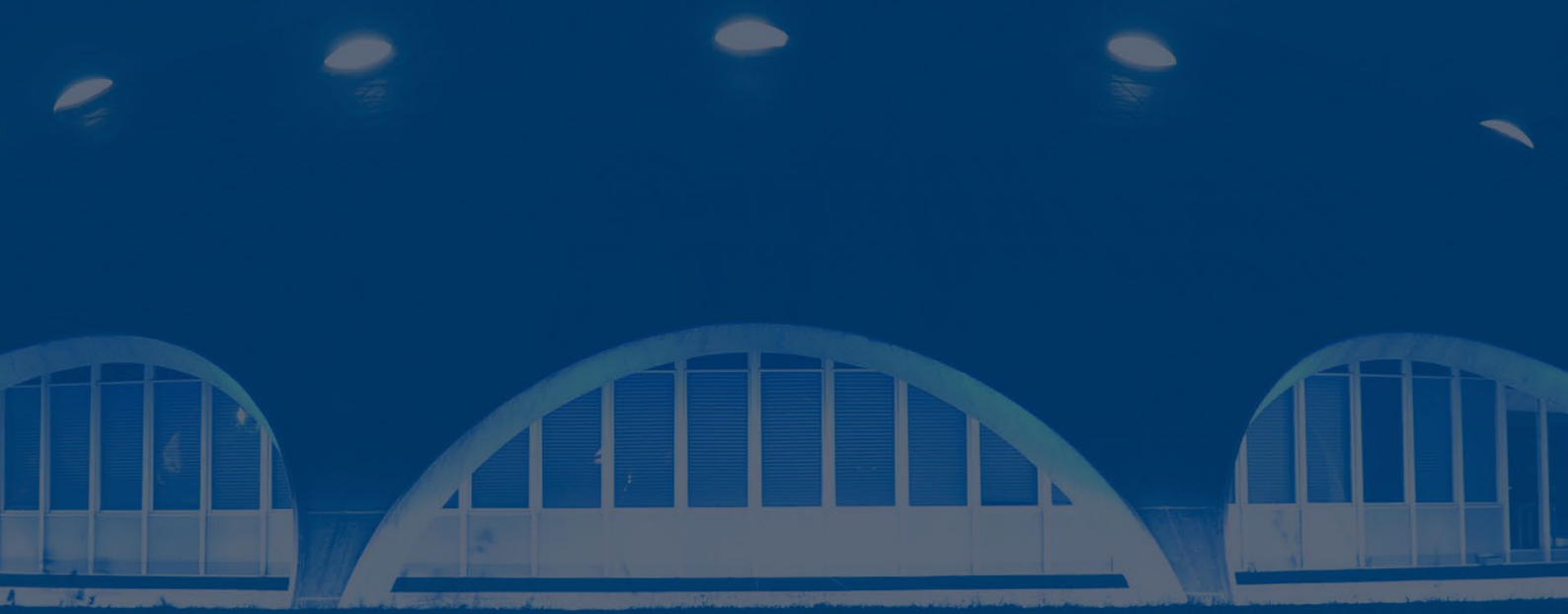

Is Australian science ready for AI?

Over the past decade, artificial intelligence (AI) has rapidly transformed scientific research worldwide, as reflected in the growing volume of research papers on AI and its increasing use across scientific disciplines.[1] AI tools are poised to become essential to most scientific fields in the coming decade.[2]

The proliferation of AI in science and applications across scientific disciplines raises important questions:

- Does the Australian science system have the capacity and capability to keep pace with the rapid advancement of AI?
- Where do gaps exist?
- What opportunities can be leveraged and supported?
- Are our research councils and research funding mechanisms prepared?
- How well are our ethical frameworks positioned?
- Is our education system adequately skilling researchers?
- What role can our science agencies play to help bridge the gap between research and practice in AI knowledge and skills?
- Is our research and educational infrastructure ready to support this transformation?
- Are our policies and legal frameworks fit for purpose?

A well-structured policy framework is crucial for Australian scientists to successfully navigate the challenges AI is presenting. Such a framework should direct strategic investments in infrastructure, establish ethical guidelines and foster educational programs, enabling scientists to responsibly and effectively benefit from AI's potential.

AI is anticipated to contribute $9–15 trillion globally, presenting significant opportunities for the Australian economy. Investing in AI has the potential to enhance scientific productivity and discovery, as well as its application and integration in society. While all sectors will feel the impact of AI, this series of briefs focuses on the specific implications and opportunities it offers for Australia's scientific community.

Given Australia's smaller size, we are in a favourable position to rapidly implement coordinated AI strategies. However, our limited scale means we cannot effectively host or control all necessary AI infrastructure for research domestically. Therefore, strategic international partnerships and collaborations will be vital to secure access to essential resources and maintain progress.

The Australian science system must be agile and proactive, prepared not only to capitalise on AI's potential but also to anticipate and mitigate associated risks.

This policy brief series aims to initiate a critical dialogue about how AI will reshape the policies, institutions, legal frameworks, funding models and cultural norms that underpin our national science ecosystem. Additionally, it will consider how the use of AI will have broader implications within Australia's social fabric, economic stability and critical infrastructure.

The policy briefs examine:

- how AI is changing science (Paper 2)
- the impact of AI on policy for science and funding systems (Paper 3)

- AI's impacts on science infrastructure, focusing on national computing infrastructure (Paper 4)
- the implications of AI use for the provision of science advice (Paper 5)
- AI's impact on scholarly publishing and other systems for disseminating knowledge (Paper 6)
- what AI means for science skills and the scientific workforce (Paper 7)
- whether our regulations and laws can anticipate the adoption and diffusion of AI (Paper 8).

These briefs seek to engage scientists, technologists and policymakers in some of the challenges and opportunities that AI's emergence poses.

What is AI?

While no unanimous definition exists, Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) defines AI as "a collection of interrelated technologies used to solve problems autonomously and perform tasks to achieve defined objectives without explicit guidance from a human being."[4]

Current popular uses of AI include generative AI, which can generate novel content, such as text, images, music, and computing code, in response to a user prompt.[5] AI systems such as ChatGPT and Claude are examples of generative AI powered by large language models. Large language models specialise in generating human-like text by training on vast quantities of text.[5]

AI tools are rapidly advancing in capability and accessibility. This progress is driven by the growing availability and volume of training data, improvements in data quality, increased computing power, significant investments and the development of new algorithms and interfaces.[6]

What is a national science system?

A national science system[7] is a network of interconnected elements that shape and contribute to the practice of science and its outcomes within a country. These elements include people, institutions, infrastructure, regulations, laws, policies, practices, norms, funding mechanisms and knowledge dissemination systems.

Spanning government, higher education, business and non-profit sectors, the elements of a national science system interact to conduct, administer, govern and use science in a country.

Within a national science system, governments expect science to contribute to the nation's goals and aspirations. In turn, governments provide structure and resources to the nation's scientific endeavours, establishing legal, policy, regulatory and public funding structures for science.

National science systems interact with each other and with the global science system, the international collaborative network of scientists and the pool of scientific knowledge. Although the global science system is distinct from national science systems, it operates symbiotically and shares common elements, such as scientists active in both systems.

This framing of the national science system has been selected to emphasise how the various components interact to influence the whole. This lens aims to perceive the potentials and risks of AI not solely within each discipline but within the broader ecosystem of actors, goals and priorities.

The framing also offers a preliminary exploration of how responsibility is defined and distributed throughout the science system as the discourse shifts from readiness for AI to responsible intervention to address AI challenges and harness its potential.

This series of briefs explores how AI may impact the following elements of Australia's national science system:

The role of trust in AI to its adoption in science

Australia is a signatory to the Bletchley Declaration,[8] which asserts that AI should be designed, developed and deployed in a human-centric, responsible and trustworthy manner. It is also a signatory to the Seoul Declaration,[9] which addresses both the opportunities and risks posed by AI.

Australia is not a signatory to the Council of Europe Framework Convention on Artificial Intelligence,[10] despite contributing to its drafting. As the first legally binding treaty on AI, the Convention aims to ensure AI systems uphold human rights, democracy and the rule of law through safeguards across their life cycle; formal accession could reinforce Australia's international alignment with and commitment to ethical and accountable AI governance.

Trust in AI is directly and positively predictive of user behaviour and acceptance,[11] which is fundamental to scientific fields that use AI, such as health and medical research.[12] In a survey conducted in September and October 2022 of 17,193 participants from 17 countries, Australia ranked equal 12th for trust in AI systems, last for perceptions of the trustworthiness of AI systems and ninth for acceptance of AI, with only 23% of Australian respondents willing to accept AI.[13]

Although Australia's societal trust in institutions such as government and business has declined recently, Australians continue to demonstrate some of the highest levels of trust in scientists globally.[14,15] Efforts must leverage this trust in scientists to promote acceptance of AI-driven scientific discoveries. This can be achieved through public engagement strategies

and by demonstrating to the public that scientists use AI responsibly and transparently, ensuring that trust in scientists extends to the AI systems they employ.

Preparing Australian science for AI

AI will fundamentally reshape how science is practised by augmenting scientific capabilities and accelerating discovery.

The absence of explicit guidance on preparing and adapting our science sector presents a significant challenge to Australia. It could potentially jeopardise our sovereign capability and undermine our ability to shape our scientific future independently.

Areas of priority include building Australia's sovereign AI capability by addressing Australia's skills gap, investing in high-performance computing, improving data storage and governance, supporting high-quality research and data generation, and implementing measures to build trust in AI.

If action is taken, it will not only ensure the continued strength and relevance of the Australian science sector, reinforcing Australia's disproportionate contribution to global science, but also solidify our position in the global scientific community as a forward-thinking and adaptable leader.

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