Australian Academy of Science

Is Australian science ready for AI?

Introduction

December 2025

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.

Reviewers

Expert reviewers

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AI and science

December 2025

'Is Australian science ready for AI?' is a series of discussion papers that explore the preparedness of the Australian science sector for AI advances.

How is AI being used to support science?

AI is changing the way scientific disciplines approach research. It has applications in fundamental, applied and clinical research, from the generation of new research hypotheses to automated data acquisition and faster data processing.[1] Some of these methods will drive a fundamental shift from traditional research to more data-centric approaches while enhancing efficiency and productivity in scientific research. As a result, there is a growing need to equip researchers with AI skills, suggesting the value of integrating these capabilities into research training programs.

AI is already used in science to analyse large datasets, improve predictive modelling in fields such as chemistry and epidemiology, and automate select laboratory procedures, speeding up research and supporting new discoveries. It also allows scientific data to be examined at a scale and complexity beyond human capability, changing how knowledge is generated and understood in data-driven science.

To solve the problems of today, we do not have the luxury of time

In light of pressing global challenges, it is imperative to expedite scientific discovery. Issues such as increasing antibiotic resistance, climate change and the emergence of infectious diseases necessitate prompt and effective responses.

For instance, the identification of novel antibiotics has traditionally been a labour-intensive endeavour, often requiring more than 10 years. However, AI is now expediting this process. By analysing datasets encompassing chemical compounds and protein structures, AI facilitates the identification of targets for prospective antibiotic candidates, while also predicting bacterial structures and their potential development of resistance.

How Australian science is using AI to tackle urgent issues

AI is being used to improve the efficiency and productivity of scientific research across many scientific disciplines.

AI technology underpins data-driven insights in smart farming, agricultural methods, environmental science and conservation. AI tools can drive new and personalised insights based on historical data and climate forecasting. SwarmFarm Robotics is an example of Australian innovation in this sector, using AI to automate tasks such as precision spraying and crop monitoring through an autonomous farming platform.

On the Great Barrier Reef, meta-genomic and image data (camera and remote sensing data) analysis is being used for identification, interaction, phenotyping and biomonitoring studies of organisms ranging from bacteria and lichens to coral reefs.[2]

Deep learning tools have been used in conservation efforts to identify and count endangered species using aerial surveillance, saving 8.4 years in human labour.[3] Deep learning systems can also help predict air pollution via smart monitoring techniques.[4] With a warming planet, AI can help us adapt to climate change's environmental and physical impacts.[5]

AI systems assist in detecting patterns and proving mathematical theorems by exploring logical paths for complex mathematical problems. This enhances human capacities regarding efficiency and speed, dealing with complexity and unlocking new potential for discoveries.

In medicine, AI systems can diagnose diseases and predict virus evolution by analysing existing medical data, potentially helping predict future COVID-19, flu and HIV mutations.[6] AI tools can also analyse a patient's medical data to personalise vaccines and treatments. Australian company Harrison.ai is contributing to this space, developing AI-driven clinical support tools to improve diagnostic accuracy and healthcare delivery.

AI is a key driver of precision health technologies, transforming clinical care through AI-powered analysis of community-wide health data to detect and tailor interventions for chronic disease.

How will AI affect the methods and practice of science?

AI and task augmentation

AI can be used to automate tasks and alter ways of working, impacting employment patterns in science and the wider economy.

Already, AI can predict high-impact research[7] and augment and automate tasks such as literature reviews, data analysis and bibliometric analyses. In doing so, AI automates research tasks traditionally carried out by scientists, which could yield a better use of scientists' time.[8]

The shift to adopting AI tools for certain tasks may require scientists to broaden their existing skills. Specific skill sets that may be needed include understanding the fundamentals of AI development and deployment, current AI applications in research processes, effective prompt generation, responsible data stewardship processes and procedures, ability to critique and assess the accuracy of outputs, and the ethical use of AI.

If AI tools will change the tasks traditionally performed by scientists, careful forethought and planning will be required to determine which roles should remain human-led, how AI tools can perform and support research tasks, and which tasks can be handled by AI systems either independently or with minimal human intervention.

This shift could also challenge perceptions of what scientific tasks need to be closely supervised by scientific experts. There are also concerns about the long-term systemic impacts if this task augmentation results in a reduction in critical thinking ability.

An AI-enabled science team?

The development of AI 'scientists' or assistants capable of operating under the direction of human researchers is on the horizon, indicating a transformative shift in the landscape of scientific inquiry. The concept of AI 'scientist' laboratories, where a single human scientist is supported by multiple AI counterparts – each able to respond to carefully designed prompts as accurately as the average human with a PhD level of research training while capable of working around the clock – could soon emerge as reality.[9]

This evolution presents an opportunity to accelerate research processes, enabling breakthroughs at an unprecedented pace and redefining the future of scientific exploration and innovation. However, caution must be exercised wherever human judgement and contextual knowledge are needed in producing and interpreting research, to prevent AI tools from 'supercharging' the spread of poor or inaccurate findings.

Therefore, there is an urgent need to consider the future of science both in Australia and globally, with a focus on human-centric design and implementation to ensure beneficial rather than detrimental outcomes.

Ethics and the use of AI in the scientific process

Integrating AI into research processes necessitates a nuanced and forward-thinking approach to uphold the principles of research integrity, including transparency, rigour and accountability.

While AI presents itself as a labour-saving tool in tasks such as grant writing and assessment, it introduces complex ethical considerations.

There is a critical need for clear, evidence-informed guidelines that address both the benefits and ethical issues AI brings to research.

Blanket bans or uninformed policies could hinder the productive use of AI; a thoughtful examination of AI's implications, conducted in advance, will ensure that its integration into research methods enhances rather than compromises the integrity of science.

Scientific integrity

While AI tools could help detect data manipulation, plagiarism or image manipulation, they could also help scientists game the system or commit fraud.[10]

Potential risks from the present generation of AI tools include:

- facilitating misconduct, such as inappropriate use to 'hallucinate' (a failed or misleading attempt to produce a suitable response to a prompt), mimicking genuine research, using large language models to produce research papers or theses, and fraudulently presenting outputs as the author's work
- facilitating data manipulation – generative AI can create realistic texts, images and data but often lacks factual accuracy. This tendency to 'hallucinate' risks spreading false findings and creating convincing-looking data that have been falsely produced
- facilitating pollution of scientific research – malicious users may misuse AI to fabricate datasets or entire research papers, flooding the literature with unverified information. Such actions threaten peer-reviewed research integrity and undermine scientific reproducibility
- algorithmic bias and transparency – AI models are trained on historical data that may contain inherent biases. When integrated into research methodologies, these biases can lead to skewed results and erroneous conclusions, particularly in fields that rely on large-scale data analysis
- threats to authorship and originality – automated writing can produce seemingly novel text from recycled patterns, risking plagiarism and diluting original thought. Unclear documentation of AI-assisted methods complicates peer review, making it hard for reviewers to discern AI's role in research output. This gap may compromise study reproducibility, which is essential for scientific progress
- threat of model collapse, which occurs when generative models are trained on data that contain their own outputs, resulting in the loss of the diversity and quality

of the original data distribution. This can pose a serious challenge for the future of large language models that rely on web-scraped data.[11]

AI to detect scientific misconduct

AI can also assist in detecting scientific misconduct, including through the development of advanced detection tools and digital watermarking.[12] These tools can identify when figures and data have been artificially generated, reused from other authors or misrepresented.

AI can also be used to identify particular trends in citations and other publication metrics, which can help to identify areas for further investigation into potential predatory journals or citation cartels.

AI plays a vital role in verifying the reproducibility of studies, thereby improving transparency. These technologies help identify integrity issues and create strong validation protocols that support ethical research practices and encourage public confidence in scientific results.

In addition to using AI tools themselves to mitigate against deliberate or accidental misuse, measures can be taken such as:

- practising open science
- strengthening peer review
- developing and strengthening ethical guidelines and education.

As AI continues to advance, its integration into scientific research and teams will reshape the landscape of science in Australia and globally. New AI-driven opportunities and challenges will require careful consideration, training, ethical frameworks and guidelines, and collaboration to ensure they benefit both science and society.

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Is Australian science ready for AI?

Policy and funding mechanisms

December 2025

Are science policy and funding mechanisms ready for AI?

The interim response from the Australian Government on the safe and responsible use of AI aims to balance innovation and competition with community safeguards to protect privacy and security.

At time of publication, there is currently a lack of clarity regarding the overarching strategy for a comprehensive AI investment framework. However, the Australian Government has made targeted investments – most notably in the Australian Institute for Machine Learning and National Artificial Intelligence Centre – to foster responsible and transparent AI adoption and strengthen domestic research capabilities.

Enhancing Australia's AI expertise through such initiatives is essential for maintaining technological sovereignty and developing robust regulatory frameworks that support the nation's strategic interests.

Funding for AI science in Australia

Accurately identifying the present level of investment in AI capability across the science sector is complex.

Data from the Australian Research Council (ARC) shows a total investment of $240 million in research in AI field of research (FoR) codes from 2010 to 2023. This amount is comparable to the investment in quantum physics ($226 million) FoR codes over the same timeframe.

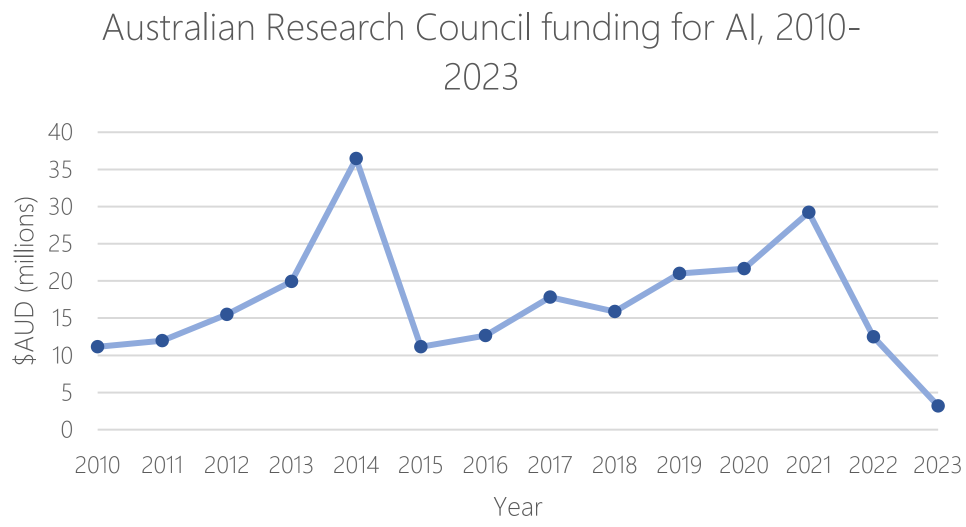
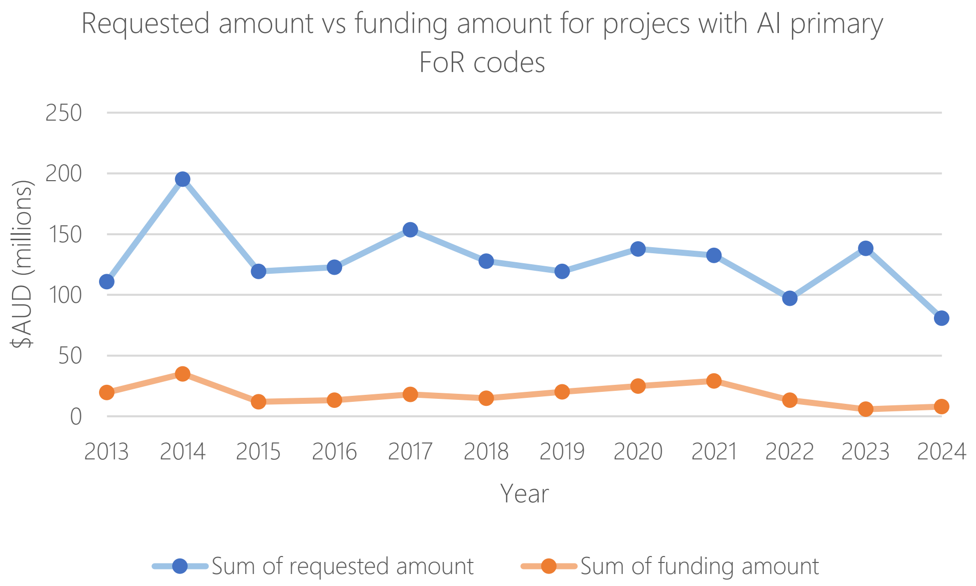


Figure 1. ARC Funding for AI research field of research codes 2010–2023. Note that this data does not include other ARC-funded initiatives such as the Centre of Excellence for Automated Decision Making and Society ($33.4 million).

While the total investment in AI and quantum physics is similar, the nature of the investment between these two areas of research differs. AI funding has mostly come in individual discovery grants, while ARC funding for quantum physics is characterised by a continuum of Centres of Excellence. This reflects the ad hoc and atomised nature of AI projects being funded and limited coordination across fields of scientific expertise.

Looking at the difference between the requested funding amounts and the total funding for projects where AI was the primary FoR code (including 0801 Artificial Intelligence, 4601 Artificial Intelligence, and 4611 Machine Learning) highlights the low success rates of such projects being funded in Australia. In 2024, the success rate of these projects being funded was 16%.



Between 2002 and 2016, AI research was also funded in the now-defunct National ICT Australia (NICTA), which had machine learning as one of its five branches. In 2016, NICTA was merged with CSIRO, becoming Data61.

While there is no dedicated Cooperative Research Centre at the time of publication, AI is embedded in the operations of most centres and was the focus of round six of the Cooperative Research Centres Projects program in 2019.

Since 2018, the Australian Government has funded a range of bespoke initiatives around AI, including the National AI Action Plan (2021); establishing and supporting the National AI Centre at Australian Government Department of Industry, Science and Resources; a Next Generation Graduates Program; and an AI Adopt Program.

In contrast with other nations, Australia has not recently focused on building basic science AI capability. However, the Australian Government has flagged work on an AI investment plan.

International trends in AI research and investment

2000–2024: the number of AI publications (per capita, million) in Australia increased from 16.7 in 2000 to 69.9 in 2024. Canada and the UK showed similar trends, with increases from 19.2 to 70.7 for Canada and 24.7 to 71.8 for the UK. Singapore and Hong Kong lead in AI publications (per capita, million), each exceeding 250 publications per million people in 2024.

2012–2024: venture capital (VC) investment in AI in the US exceeded US$550,000 million, with China placing second at US$265,485 million. In the same period, Australia's VC investment in AI totalled US$5,551 million. Countries with a similar GDP per capita to Australia, such as Canada, recorded a total VC investment in AI of US$18,540 million, three times the amount invested in Australia.

(Source: OECD AI Policy Observatory Live data).

AI poses challenges to the research funding model

Accelerated AI adoption in science also poses challenges to public funding of science more broadly, including the allocations of funding councils and government block grants to universities.

Our grant funding system largely relies on a reliable, verifiable and repeatable scientific record – the track record. If this foundation is compromised, funding organisations may need to revise their practices and standards.

Conversely, AI tools could assist funding councils in creating mechanisms that allow them to reconcile the conservative leanings of peer review with the ambition to support more daring or innovative research. However, the adoption of AI in this context would require careful and informed consideration by the scientific community to fully understand its impacts and potential downstream effects on the broader science system.

Similarly, in Australia, despite the 2015 reforms, formulas for allocating block grants and research training grants to universities are still partly dependent on publication metrics. It is possible that AI could lead to the recalibration of such metrics making them less reliable, with no alternative or proxy for quality.

How are the research funding councils allowing use of AI?

The ARC and the National Health and Medical Research Council have policies for using generative AI in their processes.

While AI can be used to help write grant applications, applicants must ensure information is reflected accurately and in line with policies such as the *Australian code for the responsible conduct of research*.

The use of generative AI is prohibited in assessing applications to maintain confidentiality and integrity of the peer review process. Policies offer advice and caution in using AI but rely on established policies for enforcement.

The *Australian Universities Accord final report*[1] highlighted that using AI or machine learning can open up new possibilities in evaluating research. While using AI in part to evaluate and assess research has attractions, the report cautions that agencies will need to demonstrate they are operating in a manner that is fair, consistent and appropriate.

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Is Australian science ready for AI?

Infrastructure

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'Is Australian science ready for AI?' is a series of discussion papers that explore the preparedness of the Australian science sector for AI advances.

Does Australia have the infrastructure it needs to access AI opportunities?

AI demands serious computational muscle, but Australia's options are limited by access to hardware and data storage infrastructure. Gaps in Australia's semiconductor supply chain also pose a critical challenge.

While the US and EU are investing billions to secure their chip industries and introducing regulations to ensure access, Australia must decide whether to invest heavily on local supercomputing and data or remain reliant on foreign tech giants.

High-performance computing and data for AI

AI relies on powerful computing capabilities and extensive data storage to process and access the vast amounts of information needed for large-scale models in scientific research and science-based applications.

Scientific processes that can be augmented and/or automated by AI, such as complex climate and weather models, and drug discovery, demand high computing speeds and large data storage capacity. For instance, climate science models require high-resolution simulations that may need tens of thousands of Central Processing Unit (CPU) cores to run efficiently. Running century-scale simulations can span many months and use in the order of thousands of cores and generate terabytes of data, all of which require substantial computing power and data storage capacity.[1]

While cloud computing services from large companies (e.g. Amazon Web Services and Microsoft) can offer data storage, it is often insufficient to power the large-scale processes and calculations necessary, is costly for researchers to use, and when data and infrastructure is located offshore, comes with significant national security, research security and practical limitations around the handling of sensitive information.

Requirements for high-performance computing and data capability

High-performance computing and data (HPCD) allow for parallel processing of large datasets, providing far greater speeds than desktop machines. HPC infrastructure is centralised and is often more economical to develop at scale on a national level. Planning for future capability must also account for the high energy requirements and water use of supercomputing facilities, which shape decisions about siting, sustainability and long-term operational resilience.

Graphics processing units are more efficient than CPUs in handling AI tasks, as they are engineered for concurrent applications. However, CPUs will remain preferred for many areas of research for the foreseeable future, including climate and weather. Science will continue to require both types of processing units. Maintaining computing capacity and advanced architectures appropriate for these different types of tasks will be essential.

Maintaining this infrastructure requires significant investment in both not only physical facilities, software and ongoing user support, including technicians and help-desk services.

HPCD depends as much on software as on hardware. Software platforms and workflow tools enable scientists to use advanced architectures efficiently and at scale, and need to be considered alongside investments in physical infrastructure.

Sovereign capability in computing and data is an asset and necessity

Sovereign computing and data storage are vital in securing Australia's strategic interests. They ensure that local regulations oversee sensitive information and guard against unauthorised access, especially from foreign entities. Australia's data protection framework highlights the necessity of keeping data within the country to uphold control and compliance. This strategy is essential not only for national security but also for protecting citizens' sensitive data in the public sector and ensuring a safe digital future for future generations.

Additionally, hosting data centres onshore mitigates vulnerabilities associated with reliance on undersea cables – recently demonstrated to be susceptible to disruption – and addresses latency concerns, as offshore centres cannot adequately support high-volume, real-time services.

Should onshore data storage and computing capabilities prove insufficient to handle Australia's increasing demands, the country will face a key juncture: either risking its data sovereignty by transferring sensitive data abroad or suffering from infrastructure limitations that impede global competitiveness.

Supply chains for computing and data infrastructure

Role of semiconductors in AI infrastructure

A range of raw materials and manufactured goods, such as semiconductors and the materials required for their fabrication, underpin the computing infrastructure required for AI. Semiconductors are materials with specific electrical properties that make them ideal for use in electrical components such as chips, which power the memory and processing units of computers.

AI is intrinsically linked to the global semiconductor supply chain, and the rapid development of AI is driving increased investment in HPC systems. Additionally, application-specific integrated chips are being developed for specific purposes, including AI.

However, the semiconductor supply chain is complex, requiring high levels of technical precision, and is fraught with geopolitical tensions. Aspects of the supply chain are often highly concentrated in single countries or even individual companies.

For example, the Taiwan Semiconductor Manufacturing Company currently produces almost all cutting-edge semiconductors, including AI chips.[2] Therefore, developing, securing and/or diversifying the semiconductor supply chain is crucial to ensuring the continued development of AI infrastructure in Australia.

International responses to global supply chain pressures

In the context of supply chain challenges emerging from the pandemic and international conflicts, and increasing geopolitical competition, the US passed the *Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act 2022*.[3] The CHIPS and Science Act represents an investment of US$53 billion in semiconductor manufacturing, R&D, and the workforce in the US, as well as tax incentives for capital investments in semiconductor manufacturing infrastructure. The US has also placed increasing restrictions on the supply of semiconductors and access to key elements of their supply chain to China.[4]

Similarly, In September 2023, the European Chips Act entered into force to strengthen the EU's technological leadership in semiconductors and address semiconductor shortages. The Act mobilises more than €43 billion of public and private investment for technological capacity building, innovation, manufacturing and coordination across the region.

Australia's position in the global supply chain

In the context of these broader developments, Australia is a small player in the global supply chain for semiconductors. This has been identified as a potential weakness in Australia's innovation, economy and security. For example, there could be instances where the Australian Government and partners look to fund a new HPC facility, but Australia is unable to access the necessary components to build it.

In recent years, the NSW Government has taken an interest in the development of Australia's semiconductor sector, for example, by commissioning the Australian Semiconductor Sector Study[5] and establishing the Semiconductor Sector Service Bureau.[6] The Australian Semiconductor Study found that "Australia's semiconductor sector is relatively small compared to some other economies, but Australia is not without areas of strength and strategic significance."[5]

These strengths include:

- basic research expertise in many disciplines related to semiconductors, including, but not limited to, materials science, quantum computing, communications (especially photonics) and nanotechnology
- world-class semiconductor design capabilities in radio frequency, millimetre wave photonics and radar
- natural mineral endowments alongside mining capability and world-class material science R&D capabilities
- some existing participation in the semiconductor value chain more generally.

While semiconductors have dominated supply chain concerns in recent times, other AI-related infrastructure shortages, such as electrical transformers, may also be on the horizon.[7]

Reviewers

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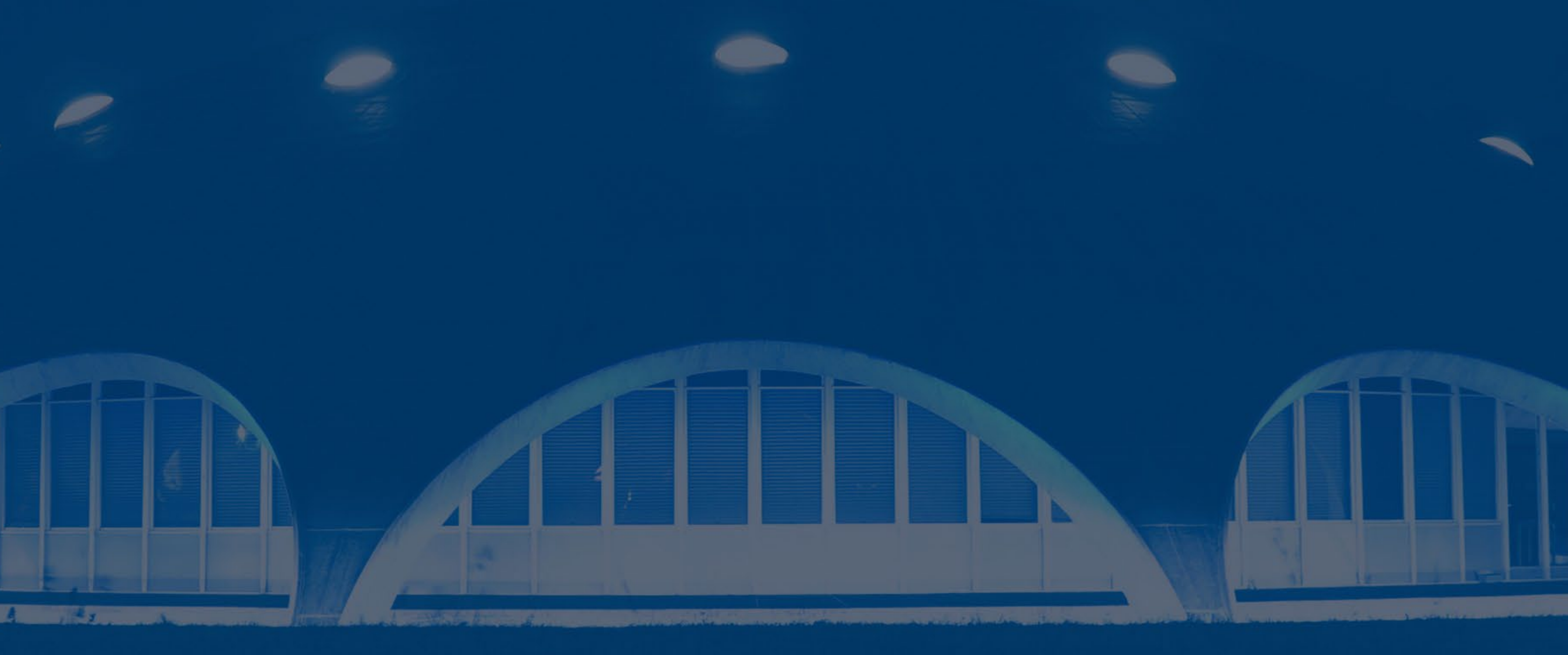
Australian Academy of Science

Is Australian science ready for AI?

Science advice mechanisms

December 2025



'Is Australian science ready for AI?' is a series of discussion papers that explore the preparedness of the Australian science sector for AI advances.

How will AI affect science advice?

In a rapidly changing world, decision-makers need access to the latest expertise to inform their decisions. Often, they need that advice rapidly. AI offers opportunities to streamline and fast-track science advice processes in Australia.

In Australia, science advice is primarily the role of various government departments, chief scientists, publicly funded science agencies, learned academies and knowledge broker practitioners across other research initiatives – such as the National Environmental Science Program hubs.

No guidelines on using AI in science policy or science advice have been developed to date. However, Australian Government advisers are covered by the interim guidelines issued by the Digital Transformation Agency, which seeks to implement Australia's AI Ethics Principles.[1]

Generative AI tools could speed up science advice

Generative AI could contribute to the expedition of science advice,[2] in particular, evidence synthesis, by:

- accelerating the process of identifying and weighting literature and data. Many tools now include the ability to include referencing, allowing the user to validate the points being made with the original publication
- summarising expert input and complex concepts, speeding up the production of evidence synthesis documents
- expediting routine literature searches, allowing researchers more time for critical data analysis – with further advancements in interpretation and analytic capabilities, large language models could contribute to synthesising scholarly sources
- effectively analysing textual data to identify trends. This capability can be applied in horizon scanning – processing extensive online content such as news articles and patents – to pinpoint emerging developments in science advice
- translating non-English articles to English, and English to other languages, thereby broadening the evidence base available for synthesis for our use, and expanding the reach of Australian science
- harnessing AI's pattern recognition, data analysis, and natural language generation abilities to help craft compelling narratives that simplify and effectively communicate complex scientific findings.

Generative AI can also assist with drafting policy briefs in a consistent style, helping assess the document's readability and predicting how people with different backgrounds may interpret it.[3] Additionally, there is an opportunity to use generative AI tools to support the analysis of the credibility of advice, including identifying sources of information.

AI tools are being used to read and assess submissions to government consultations and inquiries, saving substantial time in synthesising detailed summaries.

In other parts of the world, scientists and philanthropists are working together to create evidence banks – and use AI to create 'living syntheses' of information that can be used by many sectors, including by policymakers and in health care.[4]

Challenges of generative AI for science advice

Current generative AI tools still have limitations for scientific advice, including the reliability and age of the training dataset. Additionally, AI tools have several well-known limitations affecting their utility for scientific advice: blandness or over-simplification of ideas, bias, trustworthiness and reliability (hallucination), transparency and accountability.

These tools cannot yet critically analyse and weigh information with the same effect as a human expert; human experts must have a role in these processes. Currently, human expertise remains indispensable in science advice due to its capacity for contextual interpretation, ethical judgment, interdisciplinary integration, effective communication and adaptive decision-making. These qualities ensure that scientific guidance is evidence-based, aligned with societal values and responsive to dynamic policy environments.

There may also be scope limitations on which individuals and organisations can use these tools for science advice, what information can be used as inputs to ensure data transparency and security, and to protect classified or sensitive information. Much of Australia's scientific data are either not accessible for these models because it is behind journals paywalls, or it is not interoperable, meaning that generative AI tools cannot provide the most recent scientific results in their outputs. If data are made available, however, associated research protocols may not be, making data validation and interpretation difficult. These issues, therefore, can make available dataset usefulness limited in providing relevant scientific advice.

The FAIR (Findable, Accessible, Interoperable, and Reusable) and CARE (Collective benefit, Authority to Control, Responsibility, Ethics) principles provide a framework for open data and Indigenous data governance. Applying open data and FAIR and CARE principles would enable AI tools to provide the best possible outputs while also enhancing transparency and accountability.

The UNESCO Recommendation on Open Science provides a strong foundation for open science policy and practice. If implemented in Australia, it would enhance the ability of generative AI tools to responsibly maximise the potential of Australian data.

As these tools continue to develop, science policy professionals' skills and knowledge of AI tool creation, adoption and diffusion, and their relevance to and impact on the science system, must keep pace.[5]

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Australian Academy of Science

Is Australian science ready for AI?

Systems to disseminate knowledge

December 2025

'Is Australian science ready for AI?' is a series of discussion papers that explore the preparedness of the Australian science sector for AI advances.

Are our systems for disseminating knowledge AI-ready?

Generative AI can supercharge manuscript preparation, but it can also drown publishers in a tidal wave of submissions, further straining an already fragile peer-review system.

AI poses risks for scientists and scientific publishing, mainly due to the system's dependence on profit-driven models. Publishers are increasingly experimenting with providing expedited peer reviews or licensing agreements that give large language model (LLM) developers access to scientific data. At the same time, AI tools are being used within the peer review process itself, raising concerns about data privacy, consent, and how unpublished scientific work is being handled within these systems.

This paper explores how generative AI is accelerating scientific knowledge dissemination while addressing the challenges it brings to the scientific publishing ecosystem.

Generative AI is accelerating manuscript preparation

AI has the potential to revolutionise scientific publishing by increasing the efficiency of research processes. It could also aid in faster and more thorough preparation of systematic reviews, metric analyses, and scientific evaluation.[1]

Large language models can rapidly summarise, synthesise and reveal novel connections within vast quantities of research literature.

One of the benefits of generative AI is assisting researchers with time-consuming tasks such as preparing manuscripts for publication. However, scientific publishing relies on the unpaid labour of peer reviewers, who may now, because of generative AI, be facing an even greater volume of publications to be reviewed. This could have flow-on effects on how long research takes to be published.

Additionally, generative AI may further encourage a process called 'salami slicing', where scientists publish slices of their work in separate papers to generate track record, rather than publishing it together as a single comprehensive paper. This can be supported by AI's rapid generation of text, including circumnavigating the detection of self-plagiarism by rephrasing text.

Scientific publishing and the AI challenge

While generative AI tools can improve the quality of research, expedite the process of conducting literature reviews and drafting journal articles, and increase efficiency, they also introduce significant challenges. These include the risk of incorporating misinformation and disinformation into scientific literature, as well as replicating and reusing published content without the knowledge, permission or proper attribution of authors or publishers.[2]

In this context, scientific publishing faces two major challenges: safeguarding the integrity of the scientific record by identifying and preventing misinformation and disinformation, and ensuring proper recognition and protection of authorship.

The traditional scientific dissemination system, predominantly dependent on journal-based models, is not adequately prepared for the transformative capabilities of AI.

Scientific publishing has long been monetised by publishers offering exclusivity and control over scientific knowledge. As generative AI undermines the value of traditional access and paywall models, this disruption could fundamentally shift how knowledge is validated, curated, applied and monetised.

Disruptions to scientific publishing can have broad impacts on the science system

The disruption to scientific publishing caused by AI has far-reaching effects on the Australian science system.

- AI could undermine the standing of the unit of the scientific paper fundamental to the record of science, thus affecting systematic reviews in fields including but not limited to health and environmental science.
- AI tools could be deliberately prompted to produce citation-heavy outputs, undermining the use of citation metrics in funding allocation across the science system, such as in formulas for research block grants to universities or metrics used within institutions and science agencies.
- Accurately measuring the quality and impact of science at an individual, institutional or national level could become more difficult.
- A flood of AI-influenced papers will confound processes like the assessment of grant proposals and promotion applications that rely, in part, on publishing track record.
- Use of AI systems can homogenise the style and directions of inquiry in scientific research, risking diversity of thought and potentially supressing novel ideas.

Ownership of journal articles and associated data by scientists

The rapidly growing popularity of AI tools is driving a worldwide race for vast quantities of data to train these tools, particularly large language models. This has made data held by publishers in the form of text that they own a commodity in rising demand. Large companies creating these AI tools have begun purchasing rights to data from publishers to train their models.

As generative AI continues to grow in popularity and be used by more scientists, the current publishing model could have its weaknesses exacerbated or improved.

On the one hand, a surge in quickly produced articles may cause delays in the review process, and researchers will need to pay to have their work published and see their work monetised by being sold as data to train AI models by publishers. On the other hand, AI may offer access to scientific knowledge long hidden behind paywalls, making it more accessible to the general public and policymakers, where it can be used to support evidence-informed decision making.

With thoughtful regulation and licensing models, AI systems could be required to recognise authors, could extend the reach and impact of science including to non-scientific audiences, and could reduce the cost of publication to researchers and research organisations. This could create an opportunity to reimagine the publishing model, where researchers could be content creators who are paid, rather than paying others to publish their work.

Academic publishers are responding to the use of these tools

Major academic publishers have released policy statements that have restricted the use of AI-generated text in publications, prohibited the inclusion of AI as authors, and set out guidelines for acknowledging where the text came from.

These policies, which focus on the authorship and creation of research outputs and how they are evaluated (publication and accountability), may be increasingly important to the management and maintenance of functional and robust science.

AI may aid science communication and democratise access to science

Science communication is the practice of the public communication of individual scientists, strategic communication of scientific organisations, science journalism, and other forms of public communication related to science.[3]

AI has the potential to remove barriers in science communication by democratising the dissemination of knowledge, overcoming language barriers that frequently restrict broader international participation. This could open new opportunities for scientific collaboration for Australia, where language barriers have prevented collaboration in the past.

Generative AI tools could also increase public understanding of scientific concepts and discoveries by providing reliable information and fostering dialogue between scientists and the public through:

- streamlining and automating the process of generating scientific communication content
- summarising scholarly publications and findings in an accessible manner or answering specific questions from a non-scientific perspective
- broadly democratising science by providing access to information.

On the other hand, the hallucination effect of generative AI raises questions about the accuracy of outputs science communicators may use. While newer versions of GPT and other AI tools have made improvements, it is essential to note that generative AI has limitations due to biases in training data and output modalities.

Synthetic training data – data created using algorithms rather than scientific sources – used to train AI models, can also feed into the hallucination effect, as scientists cannot generate original datasets rapidly enough to match AI training demands.

There are concerns that AI-powered language models could generate an overwhelming amount of information, leading to a pollution of reliable knowledge. The addition of mis- or disinformation could exacerbate this problem, and attempts to bypass built-in restrictions have already been observed. This could result in widespread falsehoods, especially in a communication ecosystem where scientific authority is contested.

The importance of data stewardship and sovereignty

AI research and development currently depends on open science because the sharing of datasets is required to continue to train AI models and enable large-scale data analysis.

ChatGPT, for example, has been trained on publicly available data including books, websites and articles. Australians are producing unprecedented amounts of data, yet Australia does not have an open science strategy and frameworks, and those that exist, such as the UNESCO Recommendation on Open Science, do not mention AI.

The pursuit of big data is transitioning to the pursuit of better-quality data. High-quality data is essential if AI systems are to make accurate predictions and build reliable and reproducible outcomes – processes that are fundamental to science.[4]

However, access to high-quality scientific data is increasingly shaped by commercial agreements such as licensing deals between publishers and AI developers, raising concerns about transparency, equitable access and the future of open science.

In 2021, the Academy warned that despite the increasing importance of data in research and public policy, Australia has no coherent national research data policy.[5]

Ensuring that data used to train AI models is accessible, interoperable, and reproducible, and dealing with the scientific challenges of corrupted data, remain significant challenges.

Australia's privacy protection framework takes strict approaches to sharing publicly held data while lacking the same level of control over privately held data.[4] Public sector data sharing is governed by various legislative frameworks prioritising privacy, proprietary control and informed consent. While some scientific sectors adhere to FAIR principles for reliable and transparent data, no national open science policy governs the ethical use of citizens' data across all sectors.

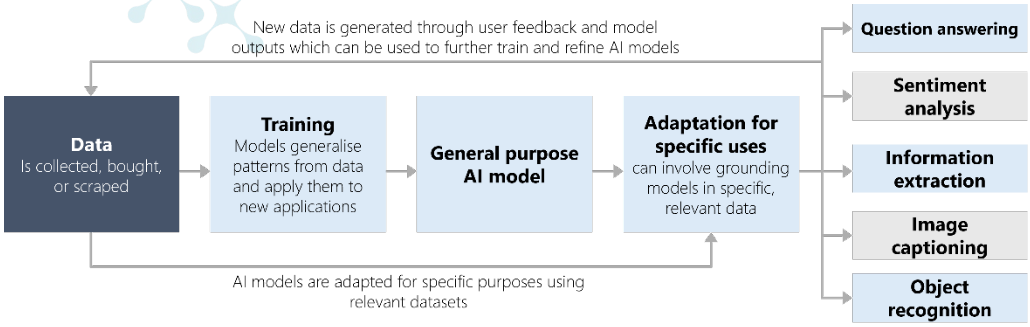

Figure 1. Data is both an input and an output of AI models. Adapted from the Productivity Commission (2024).[4]

Coupled with this is the need to respect Indigenous data sovereignty with data protocols like CARE principles that provide a framework for researchers looking to engage with Indigenous Knowledges and Indigenous Knowledge Holders.

Reviewers

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Acknowledgements

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Australian Academy of Science

Is Australian science ready for AI?

Skills and workforce

December 2025

'Is Australian science ready for AI?' is a series of discussion papers that explore the preparedness of the Australian science sector for AI advances.

Does Australia have the skills and workforce it needs?

The adoption of AI is impeded due to a shortage of diverse skilled people and insufficient understanding of AI across sectors.[1] Without targeted training programs and opportunities, Australia will fail to capture the full economic and strategic value of AI and risks being left behind. Other jurisdictions are coming to the same conclusions right now, so Australia must act quickly and decisively.

Australian research organisations and science agencies must offer competitive salaries and opportunities to be able to attract and retain AI talent, as they are often competing with attractive projects with domestic or international industry employers when hiring.

The ideal workforce will be built when education and training by schools, universities, TAFEs, and on-the-job learning are aligned with the evolving demands of industries and research, facilitating sustainable growth and innovation.

Education and data literacy

Supporting AI in education can improve talent, enhance data literacy, and ensure that educators are upskilled to teach future generations of students. Tools to equip Australians with notions of research integrity and responsible innovation must be integrated into the curricula to ensure we are not only equipped with knowledge and skills but also with the critical thinking and understanding of responsible innovation necessary to navigate complex issues, make informed decisions, and contribute positively to society.

Data literacy is an in-demand skill for employers. However, educators must be able to teach students of all ages these new skills, which may not have been part of their training. The Australian Human Rights Commission also recommends that "professional development and training be provided to teachers", and schools should introduce "programs to provide students with the skills needed, and to assist them in engaging with AI tools in a responsible and ethical way".[2]

Despite efforts by bodies like the Australian Research Data Commons and others, data literacy among scientists remains variable. Further, the changing geopolitical environment will require scientists to become data security literate.

Standards and policies must set clear requirements for data collection, storage and reporting, and ensure alignment with the FAIR[3] (Findable, Accessible, Interoperable, Reusable) and CARE[4] (Collective Benefit, Authority to Control, Responsibility, and Ethics) principles. Implementing FAIR and CARE data practices will enable broader adoption of AI in scientific disciplines.

When it comes to an AI specialist workforce, Jobs and Skills Australia projects that there will be a 14.7% increase in demand for computer network professionals in the coming five years (to 2029) and this will rise to a 25.1% increase in 10 years (to 2034).[5]

A diverse AI skilled workforce

Australia needs to build an AI-literate workforce that is technically literate and understands the design implications of various AI tools and LLMs. Developing diversity within this AI workforce is critical for effective training and gaining a better understanding of the positive and negative impacts arising from the adoption and diffusion of AI within the science system.[6] Only 20% of AI and computer science PhD students are female, while female authors account for only 12% of all relevant peer-reviewed articles in Australia.[7] Female talent only makes up 19% of the total pool available with skills in AI and automation in Australia.[8]

Gender inequality in AI

Gender inequality in AI reflects broader patterns across STEM, where data indicates that girls begin to opt out of STEM once subject choices are introduced in the curriculum.[20] Addressing this early disengagement through targeted initiatives such as Day of AI Australia is critical to building a diverse and inclusive future AI workforce. Such initiatives are essential to sustaining progress, particularly as Australia currently leads globally in gender diversity among new AI talent, with women making up 44% of those entering the AI workforce, however the numbers of women in AI research are far lower.[8]

There is no systematic assessment of the participation of First Nations people in AI. As a consequence, issues of importance to First Nations people do not receive adequate attention.

Ethical and responsible progress cannot occur with such narrow talent driving the future of AI, especially when the tools begin from a condition of substantial inbuilt bias. Building diverse teams is the most effective approach to ensuring responsible and ethical AI development and deployment.[6] Organisations should prioritise diversity and inclusion by training and hiring talent from under-represented communities to foster inclusion and amplify under-represented voices in AI models.[9]

Citizen participation

Science has not always reflected the diversity of humanity. Inequalities can often affect the record of science. For example, a 2022 report in *Nature Medicine* estimated that 86% of genomic research in the world is carried out on genes of people with white European ancestry, roughly 12% of the global population.[10] Such bias in who is represented in the data results in unfair advantages in medications and therapies as well as preferential treatment in hiring practices[11] and a higher likelihood of being incorrectly identified by facial recognition software.[12]

AI is no different. AI systems are trained on the available data, which can result in these biases being perpetuated, such as discrimination against non-white and/or non-male[13,14] individuals, which was part of the training of early AI systems and persists today. These biases result in high levels of distrust of AI among people who are under-represented or marginalised, including women, people in regional areas, First Nations people, people who are unemployed or underemployed, and people with a disability.[15]

The use of AI in the science system needs to minimise biases and harm to marginalised communities through inclusive design, community engagement, robust testing, and transparency.

Citizen participation

Citizen participation in community-designed decisions is recommended to inform the performance of AI devices used by diverse communities.[16] For instance, via the Indigenous data sovereignty movement, AI is being used in Kakadu to care for Country, resulting in the return of thousands of magpie geese through the collection and analysis of data, identification, and drone monitoring.[17] Researchers are also using AI to co-design systems to improve assisted-living privacy for people living with disability[18] and to advance monitoring technology for individuals living with chronic mental illness.[19]

One effective way to ensure AI reflects the whole community is to involve people across the social spectrum to participate in its development.

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Australian Academy of Science

Is Australian science ready for AI?

Regulation and law

December 2025

'Is Australian science ready for AI?' is a series of discussion papers that explore the preparedness of the Australian science sector for AI advances.

Can our regulations and laws governing science anticipate the adoption of AI?

The Australian science sector requires a strong policy framework to ensure it is prepared for AI. This framework is needed to guide the development of necessary infrastructure, establish ethical guidelines and support educational programs for Australian researchers to harness AI's potential responsibly and effectively.

Technological advances in AI and the rapid adoption in the conduct of research represent a fundamental shift rather than incremental progress in science, driven by an unprecedented pace of innovation that surpasses the capacity of existing regulatory frameworks to adapt. Rapid global investment in AI research is facilitating entirely novel capabilities while shaping market dynamics that could result in the concentration of power overseas, raising critical concerns for national sovereignty.

Consequently, AI regulation and law must outline clear parameters with enough flexibility to advance novel technologies for scientific, economic and social gains while understanding and managing risks. It is crucial that these regulations avoid imposing unnecessary and disproportionate burdens on Australia's research and development sector, which could hinder innovation and progress.

AI development will not pause while a policy framework is established, and as such, Australia must act quickly to build its sovereign AI capability and guide its adoption responsibly.

The role of anticipatory governance and regulation

Anticipatory governance and regulation are defined as a broad capacity within society to manage emerging knowledge-based technologies.

Anticipatory governance embraces non-linear, constructive approaches, flexibility in scientific R&D, linear policy decision-making processes, foresight and flexibility under uncertainty, public engagement, participatory technology assessment and responsible innovation.[1]

Anticipatory regulation for policy design incorporates horizon scanning and foresighting methods to identify the potential impacts of change. It can also take a more future-facing approach to regulating technological impacts on the broader society. This approach recognises the need for adaptability, progressiveness and the ability to pivot in response to evolving industry and political dynamics.

Anticipatory governance and regulation help policymakers move beyond reactive decision-making by integrating foresight, public engagement and adaptable frameworks. This assists with delivering science and technology policy that can respond to uncertainty and align with societal values.

The Australian Government's approach to regulation

The Australian Government's interim response to 'Safe and responsible AI in Australia' focuses on identifying regulatory gaps for managing the risks associated with AI, particularly those in high-risk contexts where harm could be substantial and irreversible. The

Government intends to strengthen existing laws, including privacy and online safety, and is considering new legislation for AI safety guardrails in high-risk applications.

There is an emphasis on the collaborative development of AI standards and safeguards involving industry, community and international partners to ensure safe and responsible AI deployment.

In 2024, the government conducted public consultations on proposed approaches to introduce mandatory guardrails for AI in high-risk settings.[2] Within this consultation, three different options were presented on how to implement these mandatory guardrails. These were:

1. A domain-specific approach – adopting the guardrails within existing regulatory frameworks as needed.
2. A framework approach – introducing new framework legislation to adapt existing regulatory frameworks across the economy.
3. A whole-of-economy approach – introducing a new cross-economy AI-specific Act (for example, an Australian AI Act).

In its submission to this consultation, the Australian Academy of Science argued that the creation of an Australian AI Act would be the best option to provide necessary consistency across the economy. The proposed establishment of an independent AI regulator would help delineate key differences across various sectors of the economy.

While the government's interim response on AI and its proposed mandatory guardrails addresses the immediate risks, more work remains to anticipate future opportunities and harms, in addition to the work that will need to be done to build sovereign AI capability.

Reviewers

Expert reviewers

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Acknowledgements

The production of this discussion paper was supported by staff of the Australian Academy of Science, with Dr Sage Kelly, Dr Hayley Teasdale, Dr Ben Swinton-Bland, Alexandra Lucchetti, Dr Rakshanya Sekar, and Chris Anderson gratefully acknowledged. Edited by Lydia Hales.

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