Australian Academy of Science

AUSTRALIAN SCIENCE AUSTRALIA'S FUTURE

SCIENCE 2035

WHERE DO WE WANT TO BE?

ABRIDGED VERSION

Acknowledgement of Country

The Australian Academy of Science acknowledges and pays respects to the Traditional Owners of all the lands on which the Academy operates, and where its Fellows and employees live and work. The Academy recognises Australia's Aboriginal and Torres Strait Islander peoples and honours their enduring connection to Country, from which we are committed to learn. We pay our respects to, and recognise the cultural authority of, their Elders past and present.

Academy RAP Innovate plan cover artwork, created by Richard Allan, Director, Traditional Core.

AUSTRALIAN SCIENCE, AUSTRALIA'S FUTURE: **SCIENCE 2035**

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We want a future influenced by strategy and careful choices; one that might instil confidence that we can indeed ***build a better future.***

FOREWORD

Abridged version of opening speech delivered at the National symposium, *Australian science, Australia's future: Science 2035* (4 September 2025).

The *2025 Edelman trust barometer* published earlier this year reported that fewer than one in five (17%) of surveyed Australians thought that the next generation will be better off.[1]

If we are to respond to the challenges and not let pessimism become a destabilising and destructive force, it is up to organisations like this Academy to stand up and show leadership.

We want a future influenced by strategy and careful choices; one that might instil confidence that we can indeed build a better future.

The challenges have been well documented. And if we are to respond to them and build hope rather than despondency, it is up to leading organisations like this Academy to help shape a future – one characterised by strategy and careful choices, not by complacency and drift.

That is what this initiative is about. Pinpointing where we have neglected to build the sovereign capability to sustain the future we choose.

To build an Australia capable of delivering that promise – one that can manage and maximise benefits to Australians from shifts underway in the economy – we need to identify what to do, work out how to do it. And then to do it.

It is surely time for Australia to make real commitment to invest in a future we want rather than one largely determined by the directions set by governments elsewhere.

We do it again, and again: lament the present, tell ourselves to get better and sometimes even outline how, make commitments and then revert to the comfortable life that most of us lead that remains overly dependent on what we have been lucky to find rather than work to earn – even though just 17% of us think the next generation will be as lucky.

Surely that is not good enough. It is time to change - this time. And it is our time.

This report is an investigation by the Australian Academy of Science into Australia's scientific capability needs by 2035. It is a decadal plan that has been developed using existing data and based on multiple consultations. It identifies gaps in our capacity when assessed against the challenges identified in the Intergenerational Report.

The results are clear – and if we haven't got the machinery in place by 2035 the challenges of 2060 will not be met. .

We must act now: it takes time to develop the reservoir of talent in our people who will in their turn create the knowledge and develop the skills, the capacity and the inclination to use it.

It takes both time and patience.

This is our chance. The pessimists need reason to change – to view the future as one with opportunity and optimism.

They won't, and next generation will not be better off if those who could change the outcome have neither the will to cope with the inconvenience nor the courage to plan a better future. We must recognise that 'betterness' is not an entitlement that is our due because we are we.

Instead, let us be careful, selective, strategic and courageous – we can be better, but we have to make choices, work at it and invest appropriately. This report points to some of what we need to do.

Professor Chennupati Jagadish
AC PresAA FRS FREng FTSE
Australian Academy of Science President

EXECUTIVE **SUMMARY**

The prosperity and security of Australians depends on science.

Sovereign science is essential to develop the products and services that underpin national resilience, economic competitiveness, national security and social wellbeing.

Without science capability Australia will not effectively control its own destiny in a rapidly changing world.

Building sovereign science capability requires immediate action for long-term prosperity. If gaps are not addressed by 2035, Australia will not meet the challenges of 2060.

This report is a comprehensive, evidence-based effort to assess Australia's science capability against future needs.

At the core are the fundamental sciences: physics, chemistry, mathematics and biological sciences. The report describes the health of these disciplines.

For decades we have argued to grow investment in Australia's ability to deliver science in the national interest, but there has not been a convincing answer to questions about where those investments would best be directed. Where do we have strengths? Gaps? How does our science workforce capability connect with the ambitions of our country?

This report provides the answers to these questions, and provides a novel method to repeat this analysis for other sectors.

For the first time, we have a map of what needs to be done, backed by evidence.

This report provides the answers to questions, about where and why, based on where we have strengths, gaps and the connection between science capability and the ambitions of our country. We must face up to the challenges we need to resolve if coming generations will enjoy an Australia at least as good as the one most of us enjoy today.

There is a misalignment of skills with the current and future needs of Australia.

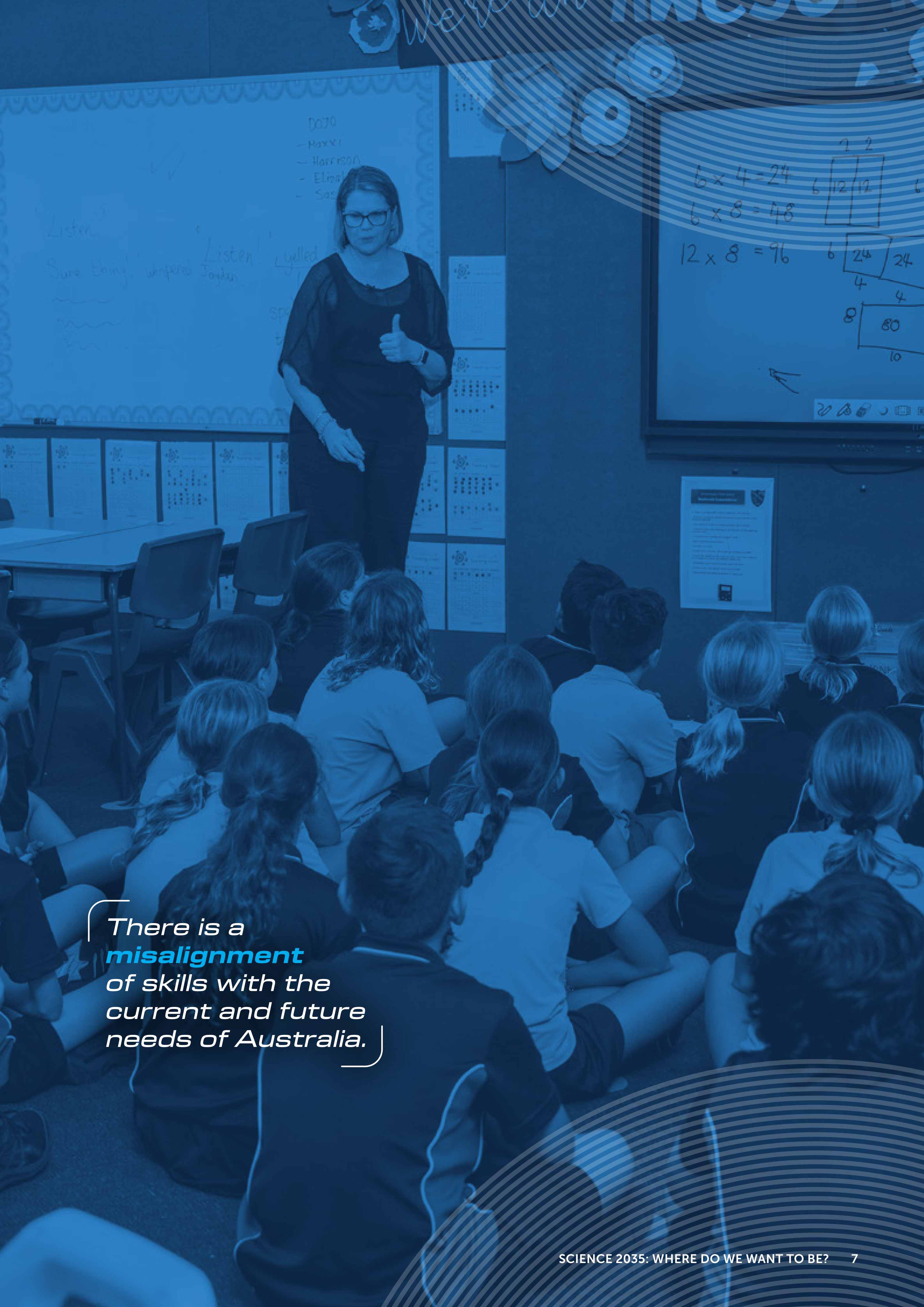
As shortages in skills become evident, the enrolments and graduations in relevant fields don't show signs of adaptability or responsiveness. That is partly due to the skills profile of the workforce being heavily dependent on the study choices of students from year 10 and beyond.

A system cannot adapt to what it cannot see. In some disciplines, including artificial intelligence and biotechnology, current gaps in data and classifications revealed in the analysis make it difficult to track our science capability, and to anticipate when it will, or won't, meet national demand.

Australia has tried to shift the dial on skills, innovation and productivity many times. This time, we have a guide for what we need to do to get to where we want to be.

It's time to change, this time.

SCAN THE QR CODE TO VIEW THE FULL REPORT



There is a ***misalignment*** *of skills with the current and future needs of Australia.*

INTRODUCTION

Australian science, Australia's future is a comprehensive review of national science capability undertaken by the Australian Academy of Science. This analysis seeks to answer a fundamental question:

Does Australia have the science capability and the capacity that it needs to meet the challenges faced by the coming generations?

The Academy's position is straightforward: the Academy believes that today's Australians owe future generations a quality of life with security, and social and economic prosperity and cohesion that is the envy of the world.

It can be achieved, and will be, with careful identification and implementation of what needs to be done – starting from now – to build the capacity required to face the future with confidence and to harvest the benefits from the opportunities it provides.

The reservoir of talent

Australia needs to build that reservoir of talent in our people. We will do so with an education and training system that is fit for a contemporary purpose. The expertise of individuals participating in a modern Australian education will be complemented by sustained capability within the system – teachers supported with professional development, trainers with up-to-date materials and knowledge, academics with research support that builds the capacity and expertise, the reservoir of talent, to be drawn on as required by innovators and implementers who seek to change the economy. And specifically augmented opportunities for re-skilling as the aspirations and needs of individuals and the workforce change.

The Intergenerational Report

A search for gaps in capability without a clear target would be like taking a seat on the first passing bus because it's a bus, not knowing where it's going until you arrive.

For this analysis we needed to work down from an aspiration and up to a target.

The analysis uses the Intergenerational Report as a guide to what we must plan for: challenges that can be met with sovereign capability in the sciences. It embraces the National Reconstruction Fund Priorities as achievements that must be met to influence the *forces shaping the economy* listed in the Intergenerational report.

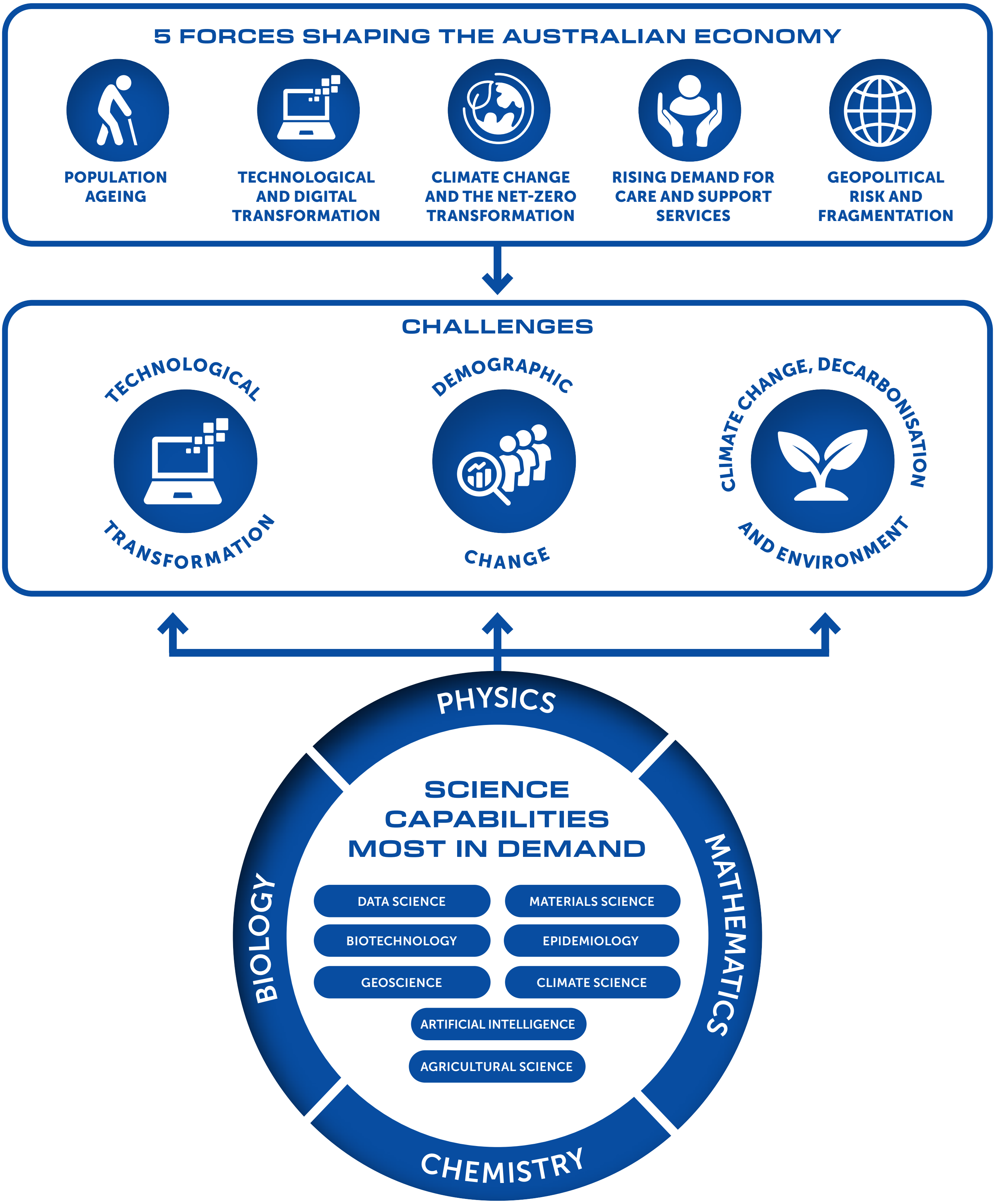
This is a study based on where our priorities and aspirations aim to take the nation – and asks whether we have the scientific capability and capacity to get us close to the goal.

The Academy takes the view that Australia needs to get the basics right by 2035 if we are to meet the obligation of intergenerational equity.

It will take close to ten years to get the policies, processes and incentives in the right place and functioning well. To grow the skill-sets to fill the gaps means not only persuading school students to choose the right subjects in their final years, then in University or TAFE, then postgraduate if relevant. It means thinking about the subjects students are offered, and whether they are fit for purpose and the teachers supported to teach them well. It means offering re-skilling opportunities as workforce requirements change. It means finding pathways for overseas students and skilled migrants to be part of filling the occupation shortages we have in critical areas. It means investment, and outcomes, not just costs.

Time and patience and careful development of policies will get us there, muddling along mixed with hope and exhortation will not.

Drawing on data dashboards, expert workshops, and foresight techniques, the Academy mapped scientific capability and shortfalls across three major challenge areas – technological transformation; demographic change; and climate change, decarbonisation and environment – all three underpinned by sovereign capability and science literacy.



The Academy's analysis – supported by data and informed by foresight methods – has shown where Australia's science capability is insufficient to meet our 2035 challenges.

It asks deep questions. For example, undergraduate student enrolments, and hence the teaching and research workforce, are not necessarily consistent with our ambitions and goals. How do we connect our national aspirations with who we are training?

If we have not built systems over the next 10 years that allow us to generate sustained momentum in the areas that matter to Australia, it will be too late.

If we have these systems in place by 2035, we can build the capacity Australia needs to provide its people with an enviable quality of life while contributing as a responsible global citizen.

METHOD

The key challenge areas were selected after a literature review of federal and state government reports and were based on where the science capability could be mapped as related to the forces shaping the economy as listed in the Intergenerational Report. They key challenges areas are:

TECHNOLOGICAL TRANSFORMATION

DEMOGRAPHIC CHANGE

CLIMATE CHANGE, DECARBONISATION AND ENVIRONMENT

Following this, the Academy used survey results to map the key areas of science capability that sit under each challenge area. This survey informed the fields of research in scope for the data analysis, and the discipline experts that were shortlisted and selected to join the challenge workshop series. Further experts were invited from the Learned Academy Fellowships and the Academy's National Committees for Science.

The Academy compiled data dashboards to present information on the relevant science capability. Data included:

- *EDUCATION AND TRAINING*
- *WORKFORCE AND SKILLS*
- *ACTIVITIES AND OUTPUTS (PUBLICATIONS, PATENTS, COLLABORATIONS)*
- *EXPENDITURE AND FUNDING*
- *CHALLENGE SPECIFIC DATA (E.G. EXPORT/IMPORTS, DEMOGRAPHIC TRENDS)*

The Academy conducted a series of workshops with Fellows from the Learned Academies, National Committee members and other leading experts to explore the future of the scientific disciplines, and used the data dashboards to examine where there will be gaps in capability looking forward to 2035.

Following this, the Academy interviewed a range of demand-side stakeholders who are users of science or peak bodies for industry. The analysis of these interviews was used to confirm the key areas of capability growing in demand.

In collaboration with Monash Business School, forecasting was conducted to identify shifts in the science workforce in Australia; to help anticipate future demand for science capabilities; and to highlight potential workforce gaps as ageing and retirement reshape the workforce. A potential limitation of this analysis is that is includes both domestic and international student data, and over recent years there has been a shift in dropping domestic enrolments and rising international enrolments that may mask the full reality of the future workforce gaps. This will be explored in more detail in future publications.

Data is presented on each of the areas of science capability growing most in demand throughout the report. For each data point on capability, a threshold was chosen for when it would be marked as 'increasing', 'decreasing' or 'remained similar'. These thresholds were selected with consideration of relative shifts over the coming decade, for example predicted size of workforce growth. These thresholds are detailed in Appendix B of the full report.

Academy Fellows engaged with Indigenous scientists in a series of yarns to gather a range of Aboriginal and Torres Strait Islander perspectives on the future of science. The format was informal and was an exchange of ideas and thoughts. With consent, these ideas have helped to inform and shape this report. The full method can be found in Appendix A of the full report.

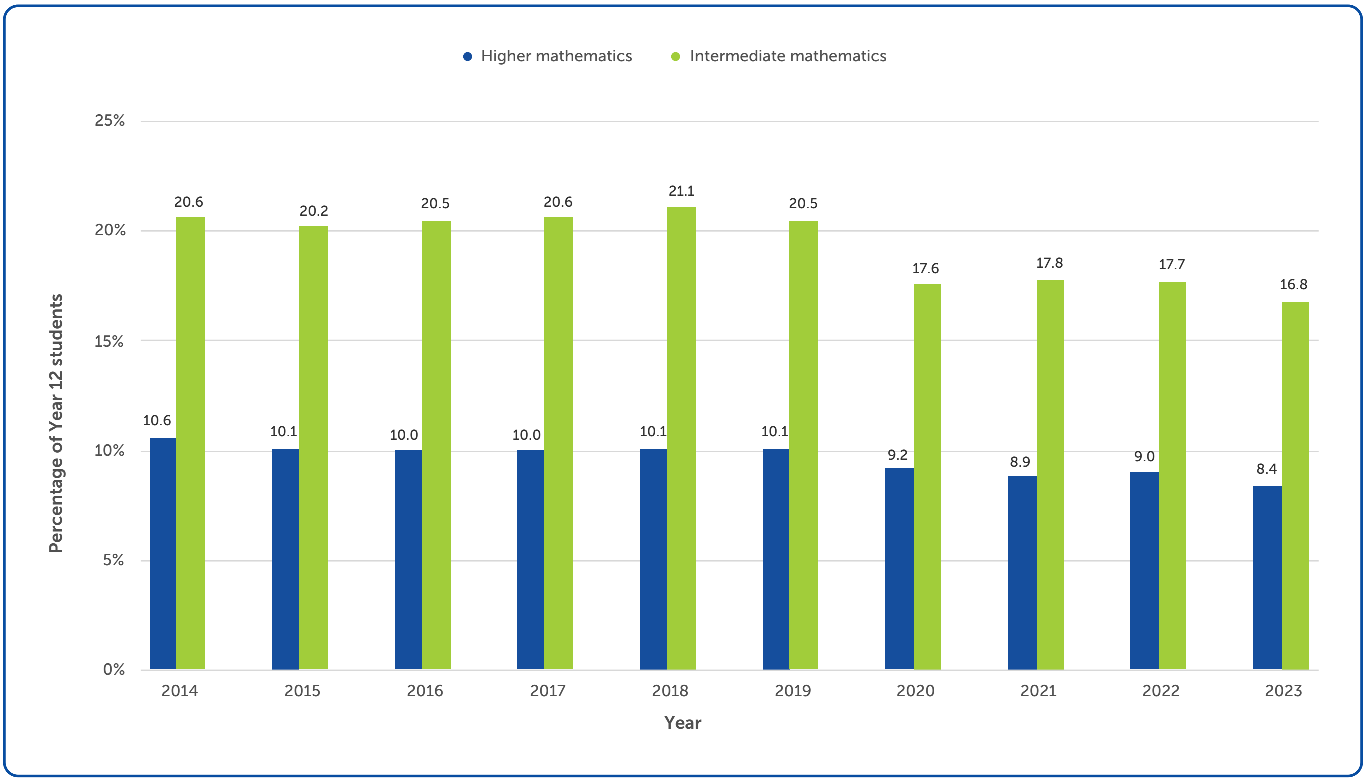
*Forecasting was conducted to identify shifts in the science workforce in Australia; to help **anticipate future demand** for science capabilities; and to highlight potential workforce gaps as ageing and retirement reshape the workforce.*

TRENDS IN **AUSTRALIAN SCIENCE**

Science education and training

- School performance in mathematics has declined since 2006 as recorded by PISA score.[2]
- In 2023 only 25.2% of students with a Year 12 qualification studied mathematics to at least intermediate level, compared to 30.6% in 2019 and 34.9% in 2008.[3,4]
- Teacher shortages have led to out-of-field teaching, with over a third of mathematics teachers and almost a quarter of science teachers teaching out of field in 2023.[5]

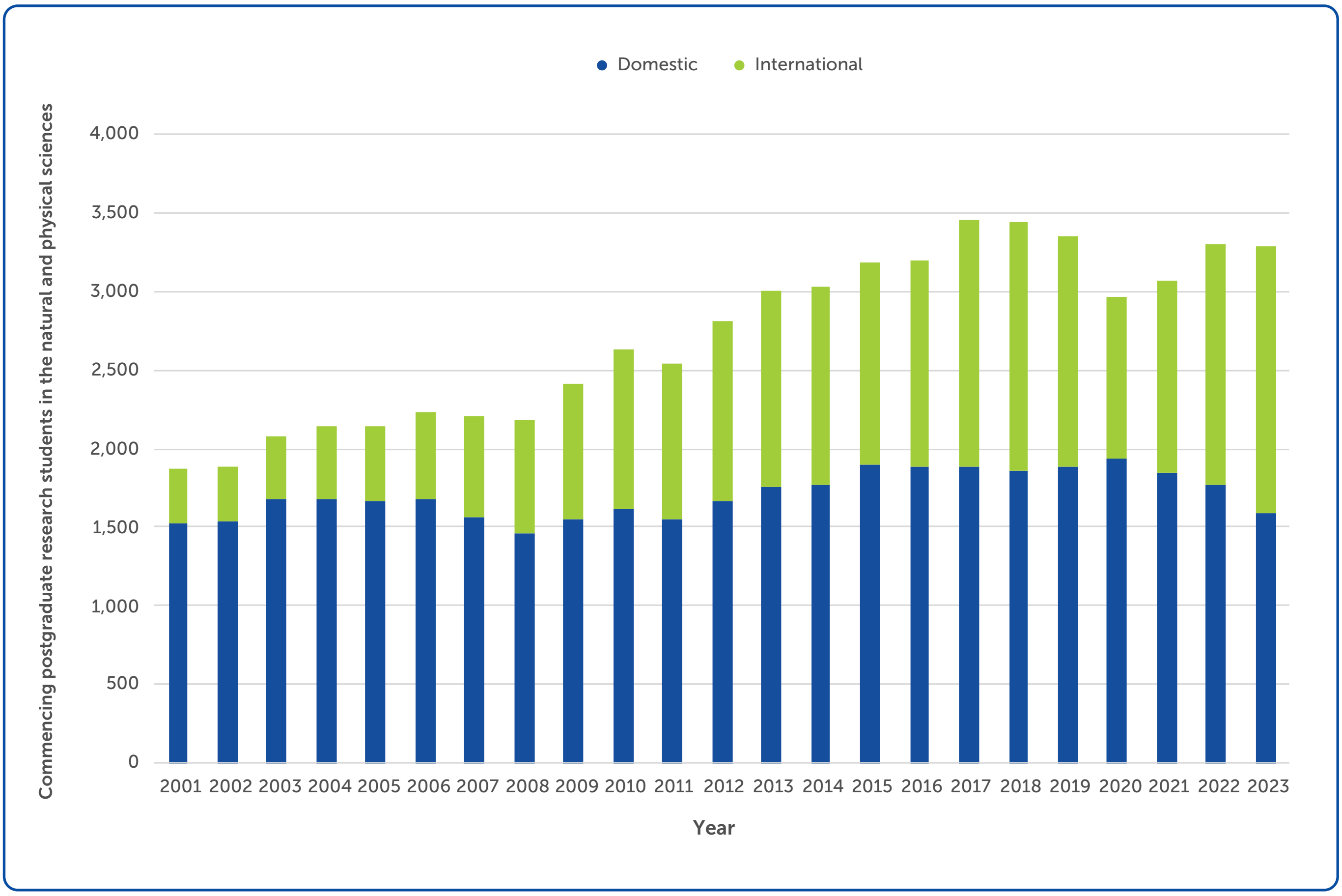
Figure 1 – The percentage of Year 12 students in Australia studying higher and intermediate mathematics. Source: Australian Mathematical Sciences Institute.



Higher education

- From 2019 to 2023, the number of VET enrolments in natural and physical science programs increased by 38% from 14,500 to 20,050.[15]
- Domestic undergraduate commencements in the natural and physical sciences have not returned to pre-COVID levels (36,296 in 2019 to 32,363 in 2023).[6]
- From 2020 to 2023, domestic postgraduate enrolments in natural and physical sciences fell 17%. At the same time, international postgraduate enrolments rebounded from the pandemic and surpassed domestic enrolments. In 2023, there were around 2,000 more international than domestic postgraduate enrolments in natural and physical sciences.[7]
- In Australia, Higher Degree by Research (HDR) students comprise over half the research workforce (57% in 2020).[8] Domestic enrolments are falling.
- The full-time base stipend for a PhD student in Australia is $33,511 (tax-free).[9] The minimum wage in Australia is $49,296 (subject to income tax).[10]
- Among international university students in Australia, 28% use their post-study work rights and 16% become permanent residents.[11]

Figure 2 – Commencing domestic and overseas postgraduate research student enrolments in natural and physical sciences. Source: Department of Education.

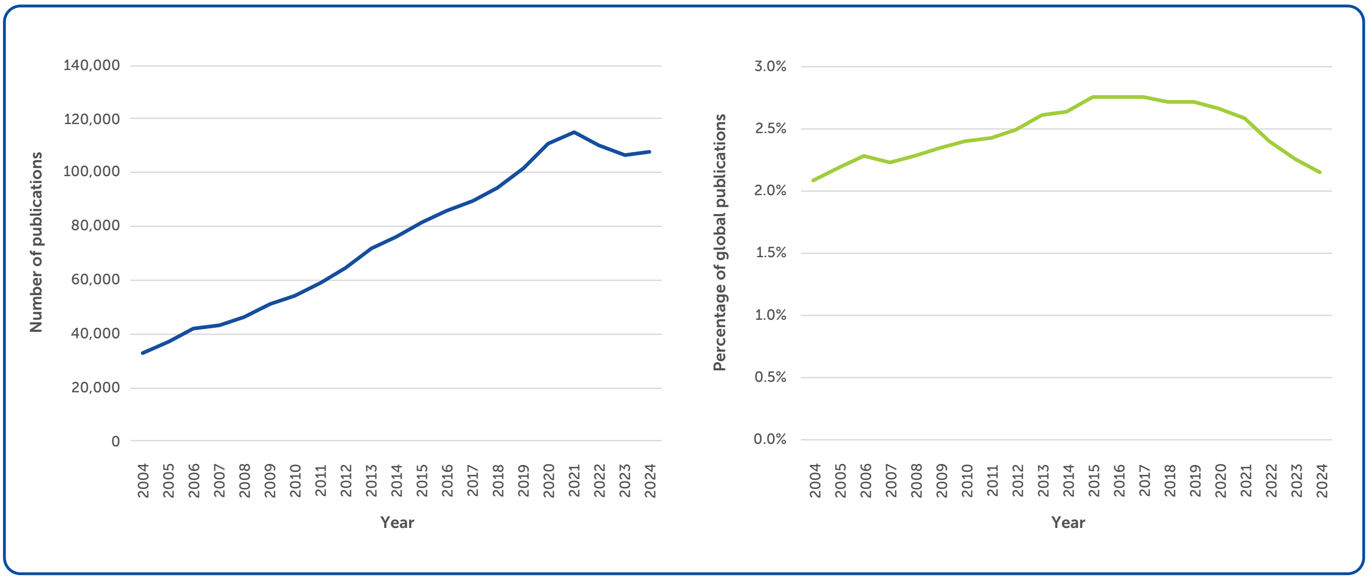


*Currently, Australian business R&D investment stands at just **0.89%** of GDP, less than half the OECD average of **1.99%**. In dollar terms, businesses invest **$32.5 billion** less than the OECD average.*

Research outputs

- In 2025, Australia produces 2.1% of the world's scientific publications despite having only 0.3% of the global population, ranking sixth among OECD nations for publications per capita/per million people.
- 4.5% of the most highly cited researchers globally are based in Australia.[12]
- Australia's number of research publications are increasing across many areas of science, with some exceptions such as geoscience and mathematics. However, Australian publications are broadly falling as a proportion of global publications due to other countries publishing more than ever before.

Figure 3 – Australia's publications in science* compared with Australia's publications in science as a proportion of global publications. Source: Dimensions AI.



**Includes the following fields of research (FoR) codes: 30 Agricultural, veterinary and food sciences; 31 Biological sciences; 32 Biomedical and clinical sciences; 34 Chemical sciences; 37 Earth sciences; 40 Engineering; 41 Environmental sciences; 42 Health sciences; 46 Information and computing sciences; 49 Mathematical sciences; 51 Physical sciences; and 52 Psychology.*

Research investment and infrastructure

- Federal R&D investment is spread across 151 programs and 13 portfolios.[13]
- Australia's R&D expenditure as a percentage of GDP has declined over the past 15 years to 1.68%.[14]
- Currently, Australian business R&D investment stands at just 0.89% of GDP, less than half the OECD average of 1.99%. In dollar terms, businesses invest $32.5 billion less than the OECD average.[14]
- Australian government investment in R&D is at a historic low. In dollar terms, the government underinvests in R&D by $1.8 billion per annum compared to the OECD average.
- Critical gaps exist in national research infrastructure, notably next-generation high-performance computing and data, satellite capability, and coordinated climate science.[15]

Diversity in STEM

- Aboriginal and Torres Strait Islander peoples remain underrepresented in STEM, with less than 1% holding a university STEM qualification in 2016, compared to 5% of the non-Indigenous adult population.[16]
- Women remain underrepresented in STEM holding only 15% of STEM-qualified roles in 2023, earning less, and holding fewer leadership roles.[17]

*Transitioning to a **net-zero** economy, and building national resilience against climate impacts, are imperative.*

AUSTRALIA'S CAPABILITY TO **MEET NATIONAL CHALLENGES**

This initiative analysed Australia's science capability to meet three national challenges, informed by the forces shaping the economy listed in the Intergenerational Report.

The challenges are defined as follows:

Demographic change: Australia is ageing, with 17% of the population over 65 years of age, while the total fertility rate is down from 3.5 in the 1960s to 1.6 in 2022. Growth in urban and regional cities and an increasingly diverse population poses unprecedented demands on healthcare, education, and food supply.

Technological transformation: Rapid technological change is occurring in most areas of life and living, from cars and cooking to communication, health and security. Rapid digitalisation and advances in artificial intelligence are predicted to create 150,000 jobs by the next decade. Australia's sovereign capabilities must be built and sustained and ensure the responsible adoption of emerging technologies.

Climate change, decarbonisation and environmental sustainability: Transitioning to a net-zero economy, and building national resilience against climate impacts, are imperative.

In the analysis, we describe two underpinning enablers that establish how science capability is built and delivered. Whatever Australia chooses to do, and however the challenges change over the coming decade, there are two enduring enablers:

Science literacy and education: Australians need both education and training. Education develops a capacity to learn and builds an ability to adjust to circumstances as they change. Training provides a particular skill set for a particular purpose. The outcome must be informed citizens who understand how science works and are more resilient to misinformation and disinformation.

Geopolitical tensions and national resilience: In an increasingly uncertain international environment, a lack of economic diversity and limited onshore capabilities leave Australia vulnerable to external shocks.

8 science capabilities increasing most in demand over the coming decade:

- AGRICULTURAL SCIENCE
- ARTIFICIAL INTELLIGENCE
- BIOTECHNOLOGY
- CLIMATE SCIENCE
- DATA SCIENCE
- EPIDEMIOLOGY
- GEOSCIENCE
- MATERIALS SCIENCE

Data descriptions

The sources used for the capability indicators listed in the following chapter can be found in Appendix B of the full report. Thresholds were chosen for each data type, to determine when describing a change as an increase, decrease, or remaining the same. The thresholds are described in Appendix B.

The COVID-19 pandemic had an observable impact on the education enrolments and completions data used. Care should be taken interpreting these trends in this context.

Where relevant, patterns observed between the start and end year for an indicator are noted to provide additional context.

Rating scale

No trends decreasing. No gap or unlikely to have a gap in capability.

Some trends decreasing or no majority of increasing trends. Some gap or likely gap in capability.

Most trends decreasing. Existing gap or certain gap in capability.

Insufficient data available.

Credit: Mei Sun Yee / Monash University

GAPS IN CAPABILITY **AT A GLANCE**

	Agricultural science	Artificial intelligence	Biotechnology	Climate science	Data science	Epidemiology	Geoscience	Materials science
Year 12 enrolments	Sideways	Down	Down	Sideways	Down	Sideways	Sideways	Sideways
Vocational education and training (VET) completions	Sideways	Down	?	?	Down	Down	?	Sideways
VET enrolments	Sideways	Sideways	?	Down	Sideways	Sideways	Down	Sideways
University graduates	Sideways	Up	Up	Up	Up	Up	Down	Sideways
Undergraduate completions	Sideways	Up	?	Down	Up	Down	Down	Down
Postgraduate completions	Sideways	Up	?	Down	Up	Up	Sideways	Sideways
Undergraduate enrolments (commencing)	Sideways	Sideways	?	Down	Sideways	Sideways	Sideways	Down
Postgraduate enrolments (commencing)	Sideways	Sideways	?	Sideways	Sideways	Up	Sideways	Sideways
Current workforce	Sideways	?	Sideways	?	Sideways	?	Down	Sideways
Projected workforce	Up	?	?	Down	Up	?	Down	Down
R&D expenditure	Sideways	Up	?	Sideways	Sideways	Up	Sideways	Down
Publications	Up	Up	Up	Up	Sideways	Up	Sideways	Sideways
Patents	Sideways	Up	Up	Down	Up	Down	Sideways	Sideways

AGRICULTURAL SCIENCE

Underpinning fundamental science disciplines

CHEMISTRY | BIOLOGY | MATHEMATICS | PHYSICS

What is agricultural science?

Agricultural science is broadly defined as the science of food, feed, fibre and biofuel production, including plant-derived pharmaceuticals and industrial products.

Note: this report focuses specifically on food production, which was the primary focus of the workshops.

What is driving demand for agricultural science?

Australia is food secure, with approximately two thirds of fresh produce available for Australian consumers grown and processed in-country.

Approximately 70% of production is exported, largely to the region. Food and grocery exports totalled AUD48 billion in 2022–23 while agriculture, fisheries and forestry exports totalled AUD75.6 billion in 2023–24.[18,19]

Australia's food export sector has high growth potential, driven by strong and growing demand in our region. Unlocking this potential depends on innovation and resilience in the face of climate and variables such global market challenges.

Environmental challenges are increasing in complexity and intensity. They include climate and weather changes, microplastics, and changing soil quality.

These challenges will continue to alter growing conditions in Australia, requiring flexibility and capacity to deploy new approaches.

While 99% of Australian farm businesses are Australian-owned, much of the IP for crop development and new product development is owned by international multinationals.[20]

Australia imports fertilisers, agricultural chemicals, and animal pharmaceuticals. Nitrogenous fertilisers contribute over 60% of Australia's carbon footprint from crop production. They are a major cost for farmers.

Will Australia have sufficient capability to meet demand in agricultural science?

Enrolments and completions in agriculture across Year 12, VET and undergraduate university levels have either held steady or grown, indicating a sustained interest in the field.

However, domestic postgraduate enrolments in agriculture have declined, while international enrolments at this level have increased, a trend worth watching as we consider long-term national capability in agricultural science.

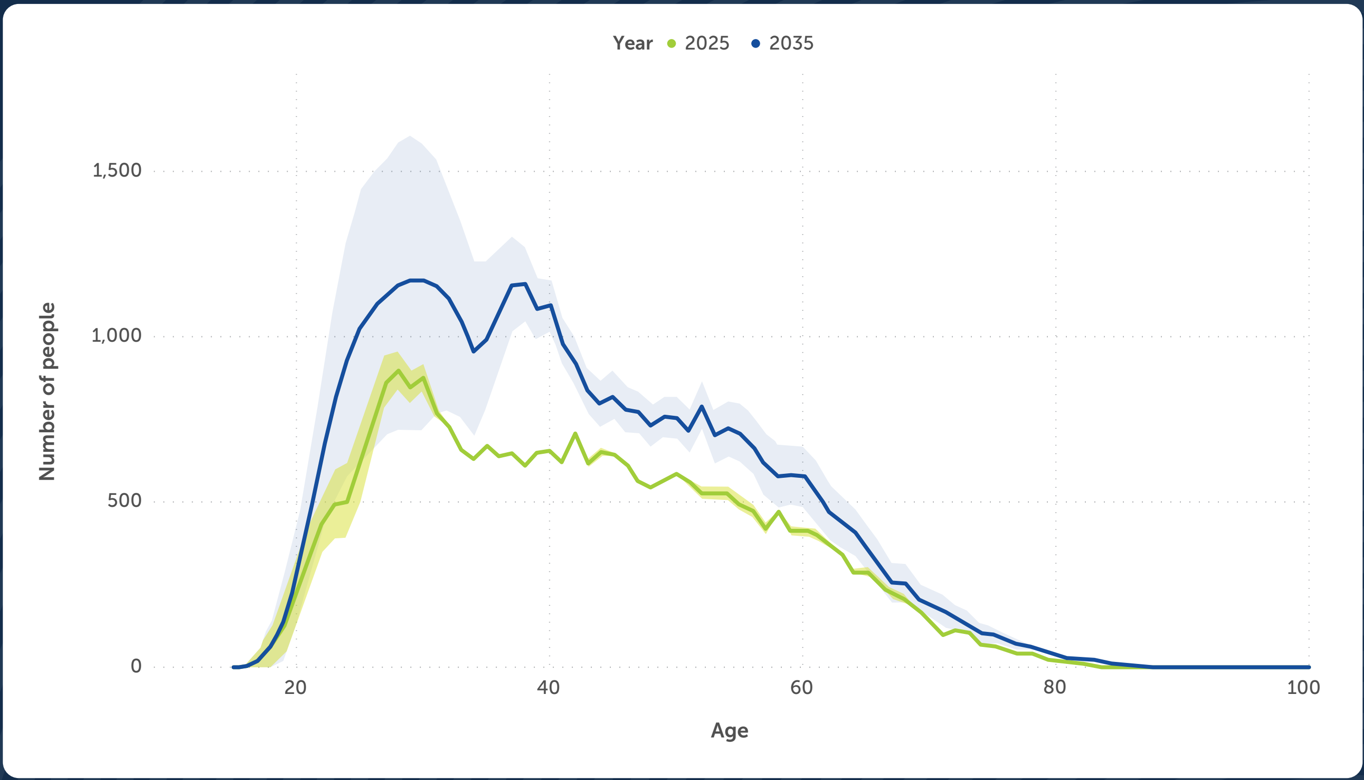
The teaching and research workforce in agriculture, environmental and related fields has grown, and there remains a shortage of agricultural research scientists in the broader workforce.

While business, higher education, and the private non-profit sectors have increased their investment in agricultural, veterinary and food sciences, government expenditure has declined.

Research output in agricultural science has increased, as measured by publication rates, though patent activity has remained stable.

Agriculture is projected to have an expansive workforce. However, the wide confidence interval is not conclusive as to whether this expansive workforce will be enough to meet national demand. The decrease in domestic enrolments suggests a need that may not be met.

Figure 4 – Forecasted age distribution of the working population with a university qualification in agriculture in 2025 and 2035. Shaded areas represent 90% prediction intervals.



Read in more detail in Appendix C of the full report.

ARTIFICIAL INTELLIGENCE

Underpinning fundamental science disciplines

CHEMISTRY | BIOLOGY | **MATHEMATICS** | PHYSICS

What is artificial intelligence?

The CSIRO defines artificial intelligence (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'.[21]

AI will be used to support research in multiple scientific disciplines, leading to high demand for scientists with AI skills.

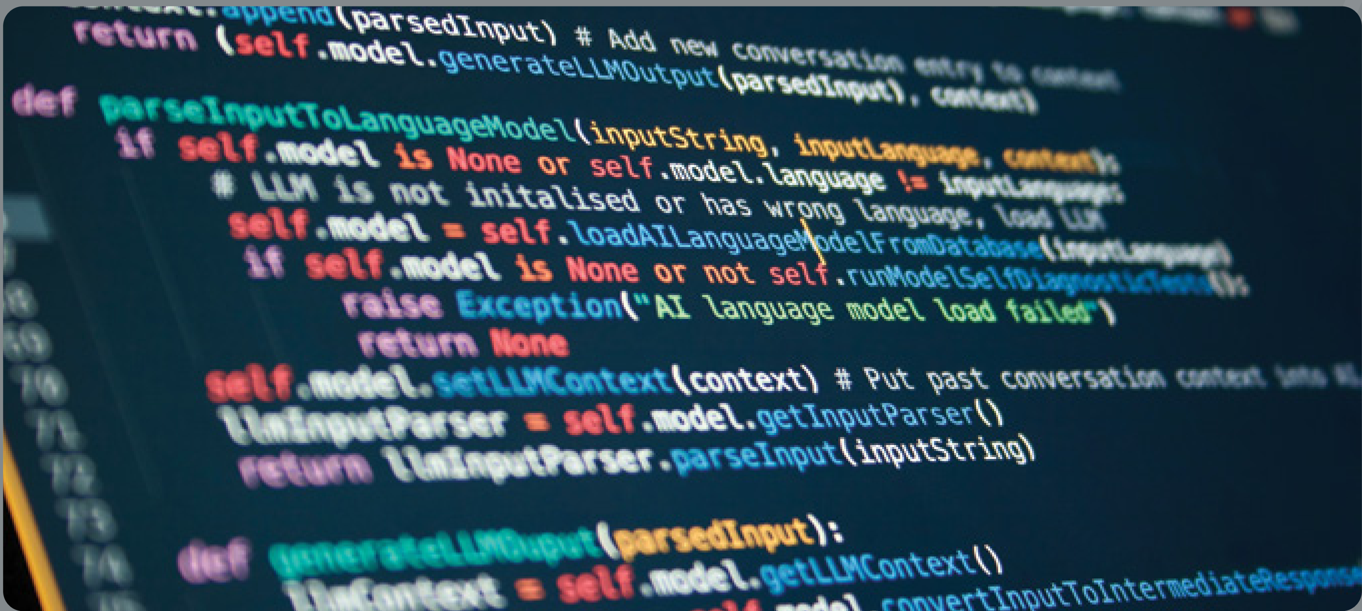
What is driving the demand for AI?

AI is an underpinning area for science – it is being used across multiple fields including food science, health, climate, agriculture, synthetic biology, RNA for agriculture, bioinformatics and new medicine development.

AI can be used to aid decision-making in multiple areas and is transforming research. For example, administrative tasks such as academic writing can be performed more quickly, AI can augment and automate literature reviews, and analyse large datasets. AI tools are also widely used to accelerate brainstorming, support the development of code, and assist in building software applications.

Greater use of AI in Australian industries is predicted to create 200,000 jobs before 2030. This demand will need to be met through a combination of entry-level training, re-skilling of existing workers and mid-career retraining.

Most AI tools used in Australia are based on large language models from the United States. These systems are trained on data that does not reflect Australia's cultural diversity, nor particulars of its context. Tailoring AI models to the Australian context requires Australian capability and expertise.



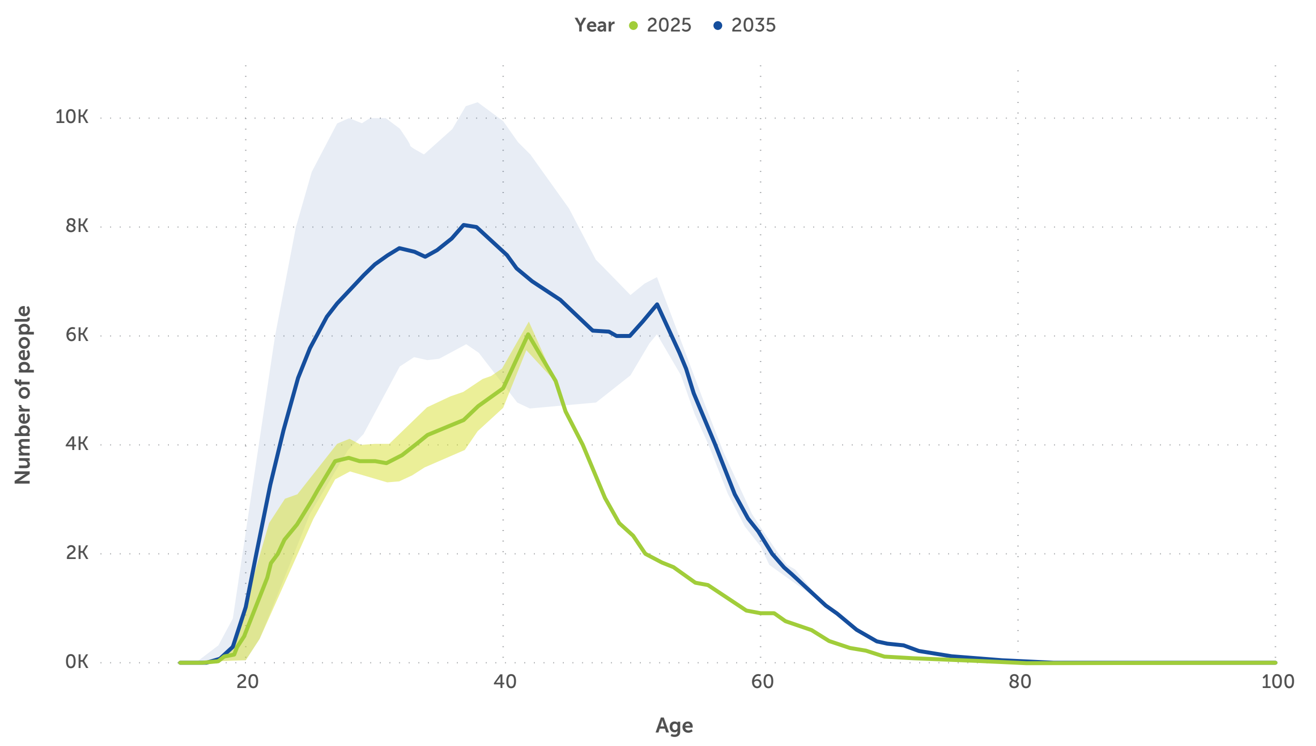
Will Australia have sufficient capability to meet demand in AI?

Year 12 enrolments in information technology, physics, and astronomy have declined, while participation in mathematical sciences has remained similar, which could indicate a potential gap emerging.

At the tertiary level, undergraduate and postgraduate university completions in AI have increased, alongside growth in enrolments and completions in computer science. However, domestic postgraduate completions have recently fallen, particularly in the past few years.

The computer science workforce is projected to be expansive. Available data suggests the AI workforce is expanding, but this is not well captured in standard occupational classifications. There is no direct occupational category for AI, creating a gap in how we track and plan for this emerging capability.

Figure 5 – Forecasted age distribution of the working population with a university qualification in computer science in 2025 and 2035. Shaded areas represent 90% prediction intervals.



The AI workforce is one undergoing substantial structural change, as it had low workforce numbers historically, and now is seeing greater numbers of entrants into the field. However, it is uncertain whether this growth will be sufficient to meet demand.

Research and development expenditure in information and computing sciences has increased across business, government, and higher education.

Australia's publications and patents in AI and machine learning are also on the rise, however the proportion of global publications is falling. This indicates we are not keeping pace with recent growth in these areas.

Read in more detail in Appendix C of the full report.

EDUCATION | WORKFORCE | FUNDING | RESEARCH OUTPUT

BIOTECHNOLOGY

Underpinning fundamental science disciplines

CHEMISTRY | BIOLOGY | MATHEMATICS | PHYSICS

What is biotechnology?

Biotechnology is often referred to as technology based on basic biology. It engineers processes from biological systems to develop products and materials for various applications.

What is driving demand for biotechnology?

Biotechnology is globally recognised as a critical technology. There is a need for local expertise to harness its value for Australians. Biotechnology draws from engineering and other technologies as knowledge is converted to beneficial products and services.

Key areas in demand will be:

- medical biotechnology (e.g. developing drugs, diagnostics and therapies)
- agricultural biotechnology (e.g. pest and disease resistant crops)
- industrial biotechnology (e.g. producing bio-based materials)
- environmental biotechnology (e.g. for waste management).

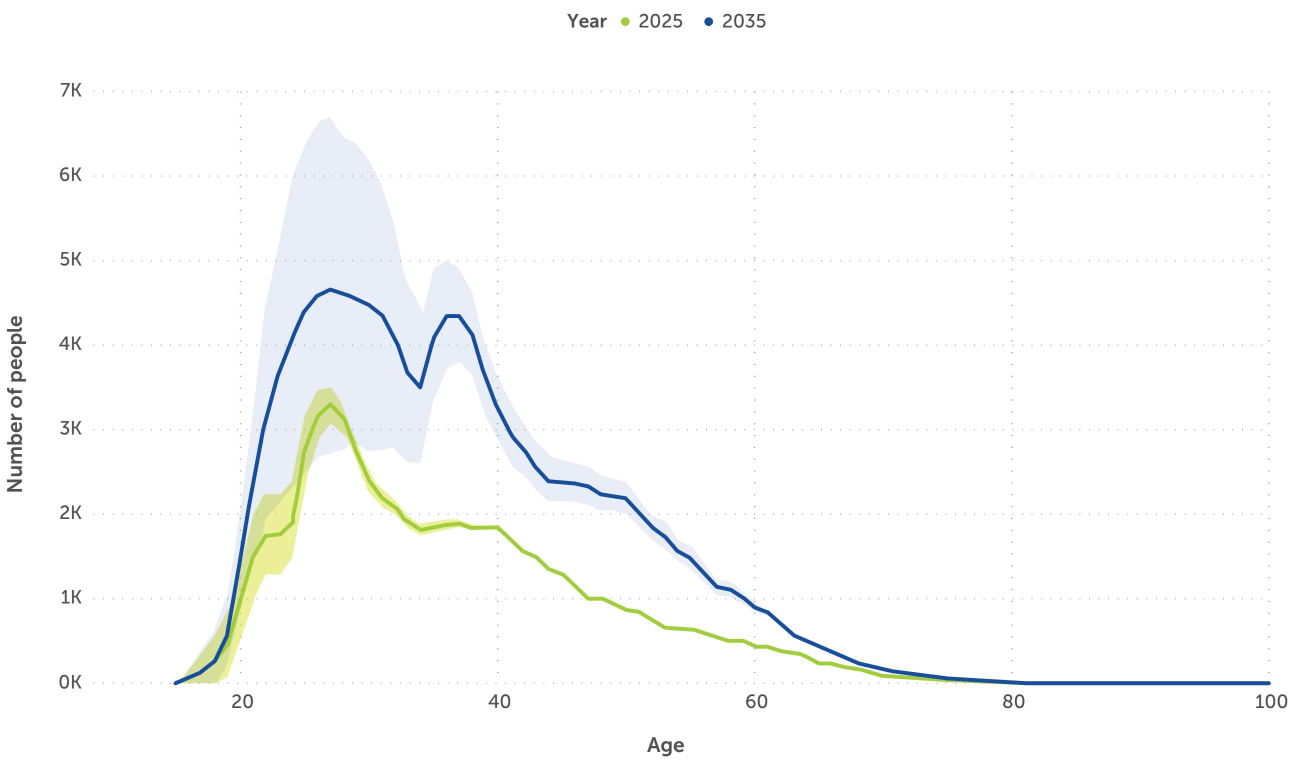
Australia has strong higher education programs that are relevant in this space, but lacks the complex facilities and coherent policy settings needed to draw maximum benefit.

Will Australia have sufficient capability to meet demand in biotechnology?

Year 12 enrolments in the biological sciences have increased, while enrolments in chemical sciences and other natural and physical sciences, including biotechnology, have declined. At the tertiary level, growth in food science and biotechnology graduates suggests capability is developing, though lack of Field of Education classification codes specific to biotechnology make it impossible to track progress with confidence.

While there are no declared shortages of biotechnologists, workforce data are limited and migration figures are too small to draw firm conclusions. Projections indicate workforce growth across the broader field called other natural and physical sciences, though this is not specific to just biotechnology.

Figure 6 – Forecasted age distribution of the working population with a university qualification in other natural and physical sciences in 2025 and 2035. Shaded areas represent 90% prediction intervals



On the research front, Australian publications and patents in biotechnology have increased or remained steady, but trends in R&D investment are harder to assess due to changes in the way biotechnology has changed within Field of Research codes over the past decade. This lack of clarity – across both education and research data – makes it increasingly difficult to monitor a capability area that will be central to Australia's health, environmental and economic ambitions in the decades ahead.

Read in more detail in Appendix C of the full report.

EDUCATION WORKFORCE FUNDING RESEARCH OUTPUT

CLIMATE SCIENCE

Underpinning fundamental science disciplines

CHEMISTRY BIOLOGY MATHEMATICS PHYSICS

What is climate science?

Climate science draws upon all fundamental disciplines of science and studies weather and climate, how it is changing, and how it will change in the future, including data, process-based understanding and modelling.

What is driving the demand for climate science?

Climate change is a threat to our environment and way of life.

Australia must adapt to mitigate the impact of planetary warming while working with the global community to reduce greenhouse gas emissions, including our own.

Australia will require expertise in climate science to undertake the climate transition effectively, and to manage risks during this transition, particularly in areas related to energy, adaptation, mitigation, water resource management, carbon management and agriculture.

Climate science is a critical input to developing future climate predictions and adaptation and mitigation strategies.

Will Australia have sufficient capability to meet demand in climate science?

Enrolments in Earth science and biological sciences have increased, while physics and astronomy, chemistry and information technology have seen declines.

VET enrolments and domestic university enrolments and completions in Earth sciences at both undergraduate and postgraduate levels are in decline. The number of university graduates in atmospheric sciences has remained similar, while graduates in soil science and oceanography have increased. Climate science may also be captured under physical science and mathematical science.

Climate science is not well captured in current occupation classification systems. There is no direct occupational category for climate scientists, making workforce planning and capability monitoring difficult. As noted in the Academy's *Decadal plan for Australian Earth system science 2024–2033*, demand is rising, particularly as businesses begin to grapple with climate risk, yet workforce planning has not kept pace.

Research publications in climate science have increased. There are few patents, which is to be expected given the nature of the field.

Care should be taken in interpreting trends in Earth sciences as an indicator for climate science capability, as declining trends in geoscience may disguise patterns in climate science (*see* Geoscience capability chapter).

Read in more detailin Appendix C of the full report.

EDUCATION | WORKFORCE | FUNDING | RESEARCH OUTPUT

DATA SCIENCE

Underpinning fundamental science disciplines

CHEMISTRY | BIOLOGY | MATHEMATICS | PHYSICS

What is data science?

Data science covers methods and computing systems for working with data sets. Data science is multidisciplinary, including computer science and mathematical sciences (e.g. statistical science).

Data science is a capability of value to most scientific disciplines. This expertise is required to manage, secure, and use Australian and international data across diverse applications.

What is driving the demand for data science?

Australia already lacks sufficient data analytics capacity and supporting infrastructure. High-performance computing and data (HPCD) infrastructure will be critical to Australia's research and development capability in the next decade. Australia is also limited by its internet connectivity and speed.

This capability is needed to establish and sustain data sovereignty across many sectors of the economy (e.g. Australian specific climate data, Australian biodiversity data, health) and to support the uptake and creation of AI tools for the Australian context.

It is imperative that Australia maintains a highly trained workforce with a critical mindset – data needs to be available, interrogated, critiqued and adopted where relevant.

Credit: Jamie Kidston/ANU

Will Australia have sufficient capability to meet demand in data science?

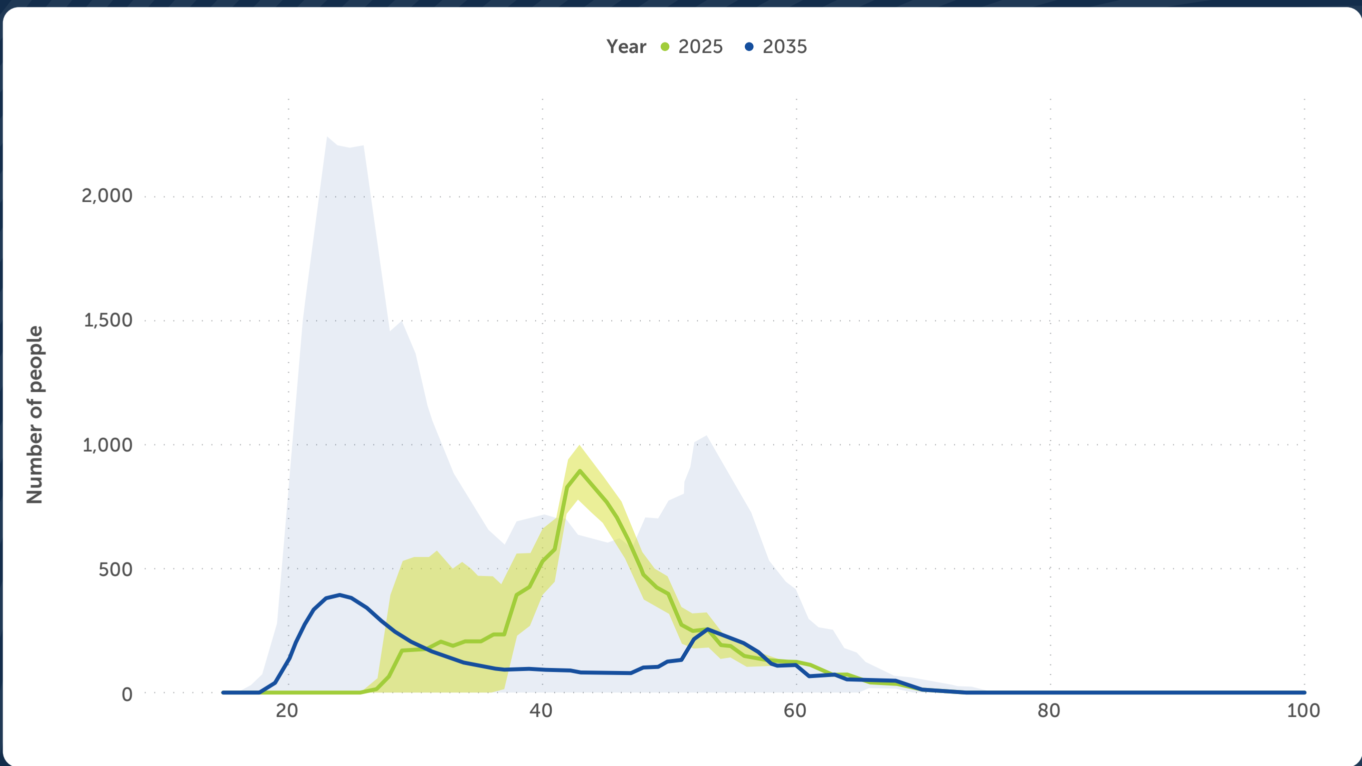
Participation in technology and information technology at Year 12 has declined, as have VET enrolments in computer science – despite rising demand for digital capability across sectors.

Enrolments in both information systems at the VET level and at the undergraduate level have grown, while postgraduate figures have remained steady.

In several states and territories, there are now identified shortages of mathematical science professionals, data analysts, and data scientists, roles that are also increasingly essential as enablers for other science disciplines.

Workforce projections point to expansion in computer science and the mathematical sciences jobs. The projection for the information systems workforce remains uncertain.

Figure 7 – Forecasted age distribution of the working population with a university qualification in information systems in 2025 and 2035. Shaded areas represent 90% prediction intervals



The data science workforce had small pre-existing numbers and is experiencing a large influx of graduates.

Research outputs show publications in data science and data management are increasing, while output in statistics has remained stable.

Read in more detailin Appendix C of the full report.

EPIDEMIOLOGY

Underpinning fundamental science disciplines

CHEMISTRY | BIOLOGY | MATHEMATICS | PHYSICS

What is epidemiology?

Epidemiology investigates all factors that determine the presence or absence of disease or disorders. It determines how many people are living with a disease, if that number is changing and how the disease affects communities and our wider society.

Clinical epidemiology applies epidemiologic principles to the individual patient to improve diagnosis and disease management.

What is driving the demand for epidemiology?

A complicated and interconnected world means that the health of populations is also connected: epidemics, pandemics, and parameters such as climate change, and population ageing all impact on local communities.

Epidemiological expertise is integral to population health. It is involved directly in clinical trials, observational studies, synthesis of evidence and guidelines, and the converting of evidence into practice. Capability is essential to both prevent disease transmission and to control any disease outbreaks.

Workshop participants emphasised:

- an increased need for epidemiologists to support healthcare for an ageing population with chronic health conditions
- environmental epidemiology to consider the impact of climate change on Australians' health (e.g. increased extreme weather events, air pollution, water quality).
- the nuances of personalised medicine adopted into routine clinical care
- demand for environmental epidemiologists (impacts of climate change on health), genetic epidemiologists (personalised medicine), and clinical epidemiologists (ensuring best clinical practice and high-quality clinical studies)
- current shortage of clinical epidemiologists, and no contingency plans for an ageing workforce.

Will Australia have sufficient capability to meet demand in epidemiology?

There is uncertainty regarding gaps in epidemiology capability.

Enrolments in relevant Year 12 subjects mathematics and science have remained steady.

While VET and undergraduate enrolments and completions in public health have remained steady or declined, postgraduate enrolments and completions have increased – suggesting growing interest at more advanced levels of study.

There is no direct ANZSCO match for epidemiologists. There are Australia-wide shortages of specialist physicians (not elsewhere classified). However, this occupation code includes fields other than epidemiology.

No age structure analysis was performed for epidemiology to forecast future workforce due to the lack of relevant data codes to perform meaningful analysis.

R&D expenditure relevant to epidemiology has increased or remained similar. Research activity in the field is growing, as reflected in the increase in epidemiology publications. Patent activity remains limited, and less relevant given the nature of the discipline.

Read in more detailin Appendix C of the full report.

EDUCATION WORKFORCE FUNDING RESEARCH OUTPUT

GEOSCIENCE

Underpinning fundamental science disciplines

CHEMISTRY BIOLOGY MATHEMATICS PHYSICS

What is geoscience?

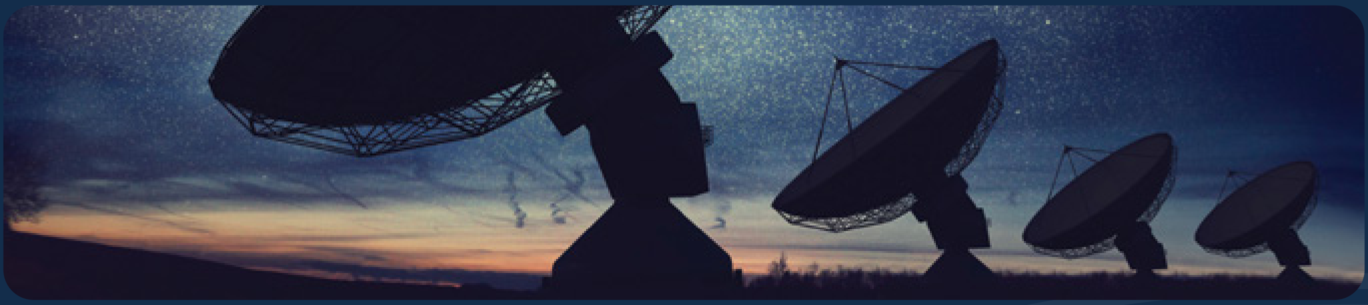
Geoscience covers Earth's physical processes and composition. It encompasses traditional disciplines such as geology, geophysics, and geochemistry, as well as satellite positioning, surveying, spatial science, marine science, Antarctic geoscience, earthquake monitoring, and Earth observation.

Geoscience informs the discovery, extraction, and sustainable utilisation of finite resources including the diverse minerals required by the decarbonising economy.

What is driving the demand for geoscience?

Geoscience is required for mining, groundwater management, earthquake monitoring, satellite location services, supporting the transition to net-zero, carbon management, and understanding environmental changes.

Expertise in geoscience can be seen as fossil fuel-related, but this capability will be important for transitioning those industries to new fields such as geothermal energy, carbon management and underground energy storage. Australia is heavily reliant on overseas sources to address these skill shortages.



Will Australia have sufficient capability to meet demand in geoscience?

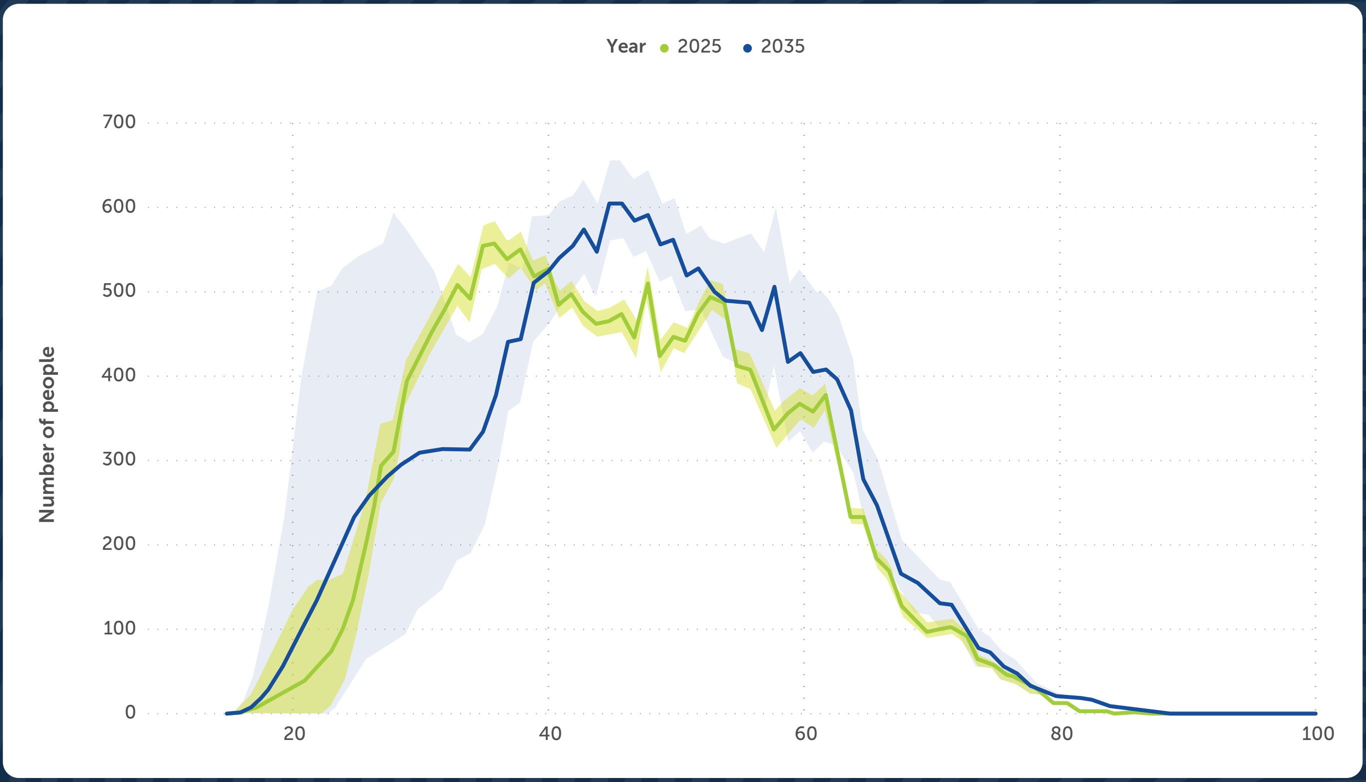
The geoscience capability pipeline in Australia is weak.

Year 12 enrolments remained stable, albeit with small numbers (4,444 Year 12 enrolments in Earth Sciences compared to 36,516 in Chemical Sciences and 25,984 in Physics and Astronomy in 2023).

Undergraduate and postgraduate completions have fallen, and no recent data are available on VET completions.

Workforce shortages in geology and geophysics have been identified at a national level. The impact of shortages will be compounded by the ageing profile of the current Earth science workforce, and made worse by a drop in skilled permanent migration for geologists and geophysicists.

Figure 8 – Forecasted age distribution of the working population with a university qualification in earth sciences in 2025 and 2035. Shaded areas represent 90% prediction intervals



Observed trends may understate the scale of the loss. Recent structural changes in the higher education sector, including the closure of Earth science departments and the discontinuation of undergraduate majors, occurred after the period covered by much of this data.

Read in more detailin Appendix C of the full report.

EDUCATION | WORKFORCE | FUNDING | RESEARCH OUTPUT

MATERIALS **SCIENCE**

Underpinning fundamental science disciplines

CHEMISTRY | BIOLOGY | MATHEMATICS | PHYSICS

What is materials science?

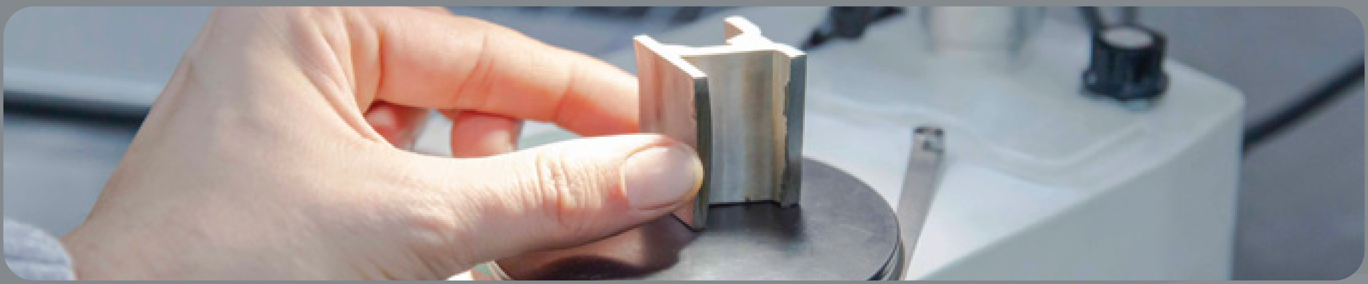
Materials science is multidisciplinary. It studies the properties, structure, processing, and performance of materials, focusing on how a material's composition and internal structure determine its behaviour and potential uses.

It designs, creates, and improves materials for a wide range of applications, such as electronics, medicine, aerospace, and energy.

What is driving the demand for materials science?

Australia's demand for materials scientists and expertise is growing. Novel materials and expertise in their development and use are needed to:

- build sovereign capability (and decrease close to total reliance on international supply chains) to generate new materials underpinning new technologies: in space science, defence, health, semiconductors, quantum and AI servers
- support effective and efficient care for an ageing population by improving health technologies
- tackle climate change and other environmental challenges via greenhouse gas removal methods, hydrogen production and other energy technologies, bushfire resilience and environmental sensors.



Will Australia have sufficient capability to meet demand in materials science?

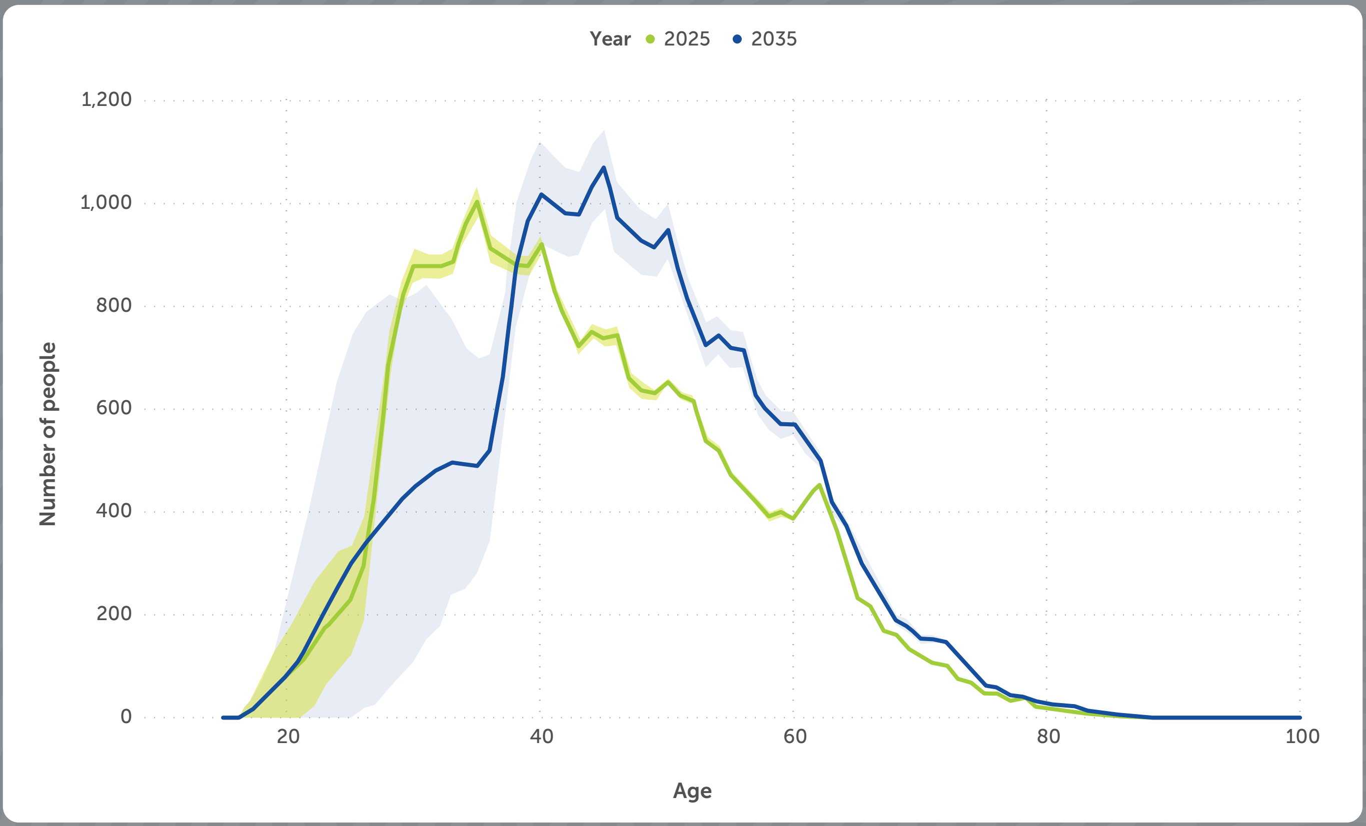
Across materials science capability areas, indicators point to a system under quiet strain.

Enrolments in relevant Year 12 subjects and undergraduate degrees have declined, while participation at the VET level has remained steady. Completions in undergraduate programs have also decreased, with VET and postgraduate completions remaining similar.

There are national shortages of materials engineers, while no current shortages are recorded for chemists.

The workforce in process and resources engineering is projected to be declining, and in the chemical sciences, it is projected to be stationary. These are not signs of a system responding dynamically to evolving national needs, and indicate an existing gap on track to be worsening.

Figure 9 – Forecasted age distribution of the working population with a university qualification in process and resources engineering in 2025 and 2035. Shaded areas represent 90% prediction intervals.



Funding for research in chemical sciences has decreased, while investment in physical sciences has grown. Research output is mixed, and patent activity is stable or growing.

Taken together, the data show a sector where early warning signs are evident.

Read in more detailin Appendix C of the full report.

Australia needs to design an R&D system that is ***coordinated, coherent, and fit*** *for national purpose.*

KEY ENABLERS FOR AUSTRALIA'S **SCIENCE CAPABILITY TO 2035**

Australia faces a rapidly changing global and geopolitical context.

The forces shaping our future, not least our economy, require a science system that is collaborative, connected, with more capability and capacity: coordinated, coherent, and fit for national purpose.

Reimagining a modern, coordinated R&D system

Australia needs to design an R&D system that is coordinated, coherent, and fit for national purpose.

That means building genuine alignment across states, territories, portfolios, and sectors, so that we are not simply funding projects, but shaping a system. A system that connects capability with need, investment with impact, and knowledge with the challenges and opportunities that define Australia's future.

Science literacy and education

Equitable access to high-quality teaching resources – paired with ongoing professional learning – will help ensure consistency in STEM education across the diverse range of contexts and form the foundation on which our future scientifically literate population will be able to make informed decisions.

Shaping the workforce we will need in 2035, for 2060

Australia's ability to meet its national ambitions depends on the strength and adaptability of its scientific workforce. Yet, from school to career, the pipeline remains rigid, fragile and misaligned with the country's future needs.

Flexibility is key. More responsive education pathways, cross-sector mobility programs, and targeted incentives to develop capability in under-supplied areas can help realign workforce supply with strategic need. But these changes must be supported by a long-term view: one that treats people not just as inputs to a system, but as the foundation of national capability.

Geopolitical uncertainty and international collaboration

There is a lack of system-level visibility into the nature of Australia's research collaborations, including what capabilities they build, what vulnerabilities they expose, and how they align with Australia's strategic interests.

In a world where science is increasingly part of the architecture of statecraft, Australia must be prepared not just to participate, but to shape its future with clarity and purpose.

How AI is transforming science and the productivity of scientists

By 2035, AI will have transformed how science is conducted, automating routine tasks, accelerating discovery, and enabling new forms of analysis across disciplines. Planning for Australia's future science capability must consider not just what science we need, but how it will be done, with AI central to driving scientific productivity and innovation.

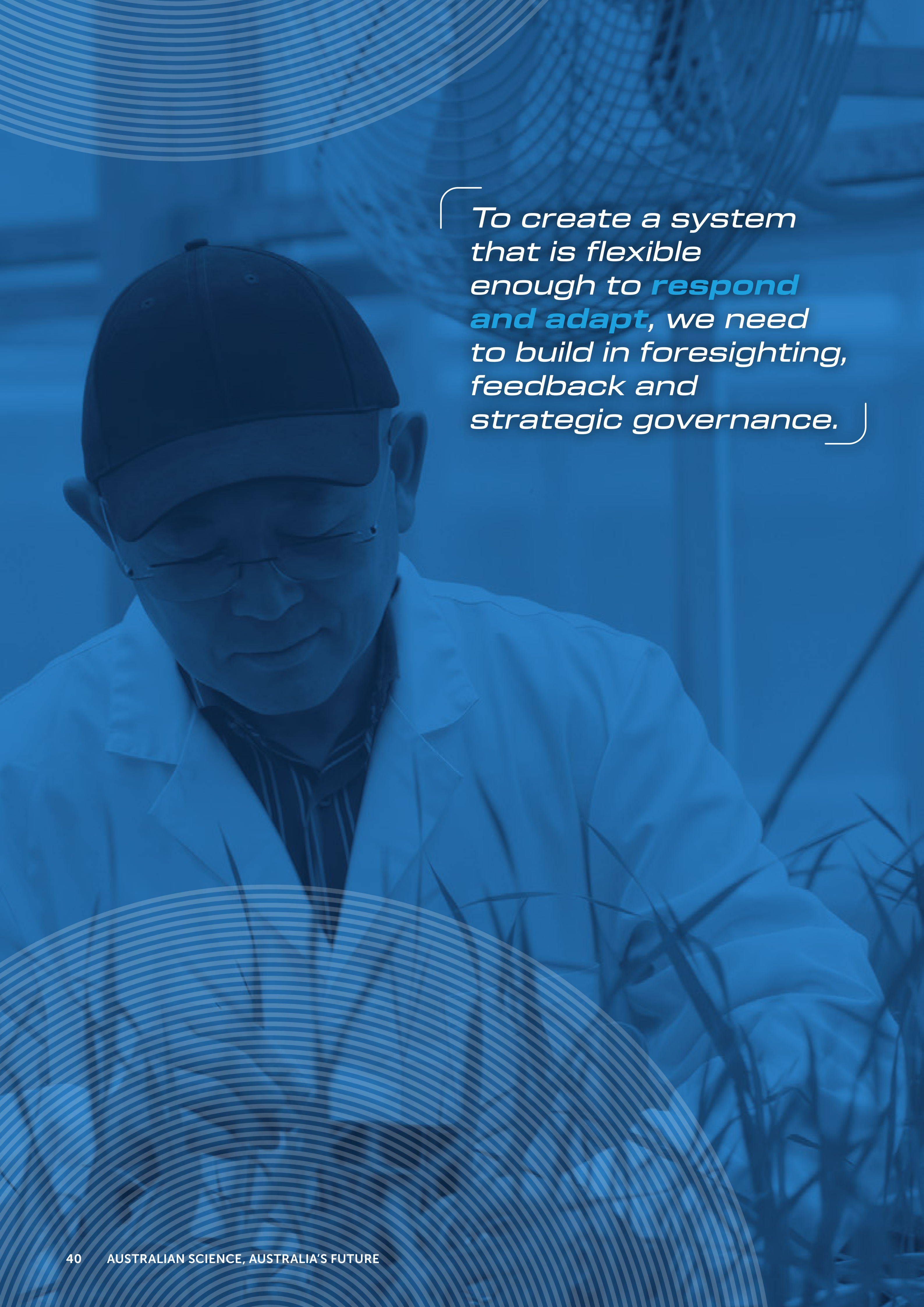
Computing and data infrastructure enabling the next generation of science

Building AI capability in Australia starts with access to high-performance computing and data (HPCD) infrastructure. Without a national strategy to acquire, sustain, and scale next-generation HPCD, Australia will lack the computational backbone required to support AI-enabled science, undermining our ability to innovate, respond to emerging challenges, and maintain sovereign capability in critical areas.

Many disciplines will need to work together to address challenges

For Australia, collaboration is not just beneficial, it's essential. Our geographic isolation and relatively small population mean we must engage actively with neighbours and international partners to share knowledge, anticipate regional pressures, and learn from others' experiences as we face our own growth, environmental shifts, and technological acceleration.

*Australia must be prepared not just to participate, but to **shape its future** with clarity and purpose.*



*To create a system that is flexible enough to **respond and adapt**, we need to build in foresighting, feedback and strategic governance.*

TIME TO **CHANGE**

Building our science capability must start now.

The world is undergoing a massive structural change where new knowledge must translate into advanced products, processes and services to meet pressing domestic and global challenges.

To create a system that is flexible enough to respond and adapt (bold enough to stop some things, not just start new ones) we need to build in foresighting, feedback and strategic governance. That means moving beyond an expectation of continual expansion to one that values reflection, course correction and measured risk.

A system capable of change must be supported by funding and performance frameworks that reward collaboration, adaptability and long-term impact. Crucially, we need governance structures with the authority and confidence to redirect effort when needed. Not simply to back the next new beaut idea, but to reshape the system in the nation's interest.

But a system cannot adapt to what it cannot see. The current gaps in data and classifications make it difficult to track our science capability or anticipate when it will, or won't, meet national demand.

Building a responsive system requires investing in the infrastructure to understand it so we can shift direction with purpose, not hunches.

A nation that does not understand the science it depends on will one day find that science is not there to depend on.

We must invest in knowledge, in capability, and in capacity. When we support the people who ask the hard questions we do two things: we build the reservoir of talent in our people and we reduce dependence on borrowed research or knowledge. We also build capacity to get answers, even if those answers are inconvenient or discomforting.

There are forces shaping our future, and Australians should know them. They have been developed and argued in the Intergenerational Report.

While the intergenerational forces are high level, the National Reconstruction Fund priorities offer a more immediate focus to influence the forces shaping the economy.

Most would surely argue that capacity to make decisions for ourselves about what to do, what to adopt, and how and why is critically important.

It is a long-term proposition. But even a notion of responsibility of present generations to those which follow would mean that investment is made, carefully and patiently.

Looking after ourselves as much as we sensibly can requires patience. We speak of commercialising the output of our researchers as if it's akin to using a light switch – flick it and she'll be right.

It is not that simple.

We speak of the pace of innovation as though it were a universal constant, but the reality is more textured. In pharmaceuticals, for instance, the journey from initial discovery to market approval stretches across 10 to 15 years, sometimes 30 or more in complex fields like gene therapy. That's not sluggishness; it's the result of rigorous checks and balances to ensure safety and efficacy.

In materials science, the so-called 'twenty-year rule' is a telling guidepost. A new compound or material conceived in a lab today may not see commercial application until two decades later. The mining sector mirrors this slow march, held up not by lack of will, but by a complex dance of permitting, environmental assessment, and infrastructure build-out.

Medical devices are another reminder: it takes about 17 years, on average, to translate into actual patient benefit. That's not a failure of science, but a signal of the systems and safeguards we rightly demand when lives are on the line.

So, if we want policy that truly enables innovation, we must respect these timelines. Science is not a sprint. It's a relay – handing knowledge from lab bench to pilot project to market shelf, with public trust riding alongside at every handover.

Investing today, getting our platform right, could mean 10 – 20 years before any pay-off. But if we do not, we will be importing back our knowledge, our smarts, our solutions from overseas at a premium – just as we have done too often.

IT'S TIME TO CHANGE, THIS TIME.

REFERENCES

1. *Edelman*. Edelman Trust Barometer. *Trust and the crisis of grievance* https://www.edelman.com/trust/2025/trust-barometer (2025).

2. OECD. PISA: Programme for International Student Assessment. https://www.oecd.org/en/about/programmes/pisa.html.

3. Marchant, T. & Kennedy, S. Year 12 mathematics participation report card. (2024).

4. Australian Mathematical Sciences Institute. Year 12 mathematics participation report card. https://amsi.org.au/?publications=year-12-mathematics-participation-report-card-numbers-remain-at-record-lows-and-female-participation-declines (2025).

5. Australian Teacher Workforce Data. National trends teacher workforce. https://www.aitsl.edu.au/research/australian-teacher-workforce-data/atwd-reports/national-trends-teacher-workforce-jun2025 (2025).

6. NCVER (National Centre for Vocational Education Research). DataBuilder. https://www.ncver.edu.au/research-and-statistics/data/databuilder (2025).

7. Australian Government Department of Education. Key findings from the 2023 higher education student statistics. https://www.education.gov.au/higher-education-statistics/student-data/selected-higher-education-statistics-2023-student-data/key-findings-2023-student-data (2025).

8. Universities Australia. Research workforce. https://universitiesaustralia.edu.au/policy-submissions/research-innovations/research-workforce/.

9. Australian Government Department of Education. Research training program. https://www.education.gov.au/research-block-grants/research-training-program (2025).

10. Fair Work Ombudsman. Minimum wages increase 3.5% from 1 July 2025 . https://www.fairwork.gov.au/about-us/workplace-laws/annual-wage-review/annual-wage-review-2024-2025 (2025).

11. Universities Australia. Australia must join global race to settle international students. https://universitiesaustralia.edu.au/media-item/australia-must-join-global-race-to-settle-international-students/ (2022).

12. Clarivate. Highly cited researchers - 2024 analysis. https://clarivate.com/highly-cited-researchers/analysis/ (2025).

13. Australian Government Department of Industry Science and Resources. *Strategic Examination of R&D Discussion Paper*. https://storage.googleapis.com/converlens-au-industry/industry/p/prj31a02fa37c9ece8370e29/page/SERD_Discussion_Paper.pdf (2025).

14. Australian Academy of Science. *Issues Paper: Incentivising Business Investment in R&D*. https://www.science.org.au/supporting-science/science-advice-and-policy/reports-and-publications/issues-paper-incentivising-business-investment-in-rd (2025).

15. Australian Academy of Science. *Submission—2025–26 Pre-Budget Submission*. https://www.science.org.au/supporting-science/science-advice-and-policy/submissions-to-government/submission-2025-26-pre-budget-submission (2025).

16. Australia's Chief Scientist. 2020 Australia's STEM Workforce Report. https://www.chiefscientist.gov.au/news-and-media/2020-australias-stem-workforce-report (2020).

17. Department of Industry Science and Resources. The state of STEM gender equity in 2023. https://www.industry.gov.au/news/state-stem-gender-equity-2023 (2023).

18. Australian Food and Grocery Council. *Food and Grocery Export Growth Strategy 2023*. https://afgc.org.au/wp-content/uploads/2024/10/Food-and-Grocery-Export-Growth-Strategy-2023-Final.pdf (2023).

19. Collins, J. & Chisholm, A. Joint media release: Aussie agriculture celebrated on the world stage. https://minister.agriculture.gov.au/collins/media-releases/aussie-agriculture-celebrated-world-stage (2024).

20. Australian Bureau of Statistics. 99% of farm businesses in Australia are Australian owned. https://www.abs.gov.au/AUSSTATS/abs@.nsf/0/F98DB4640388725FCA257905007C152A (2017).

21. Hajkowicz, S. A. *et al. Artificial Intelligence: Solving Problems, Growing the Economy and Improving Our Quality of Life*. https://www.csiro.au/en/research/technology-space/ai/artificial-intelligence-roadmap (2019).

Australian Academy of Science