

# SCIENCE & TECHNOLOGY AUSTRALIA

## POLICY SUBMISSION

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### AUSTRALIA'S NATIONAL SCIENCE AND RESEARCH PRIORITIES

Science & Technology Australia is the peak body for the nation's science and technology sectors, representing 144 member organisations and more than 115,000 scientists and technologists. We connect science and technology with governments, business and the community to advance science's role in solving some of humanity's greatest challenges.

We thank Australia's Chief Scientist and the Department of Industry, Science and Resources for the opportunity to offer input on revitalising Australia's National Science and Research Priorities, and the development of a renewed National Science Statement.

#### KEY POINTS

- **Australia's next National Science Statement and National Science and Research Priorities should be bold statements of ambition and a clarion call to urge many more Australians to study and work in science, technology, engineering and maths.**
- **The priorities should change Australia's cultural relationship with science, putting science and technology front and centre in the national consciousness as the drivers of every advance on which future Australian jobs, economic growth, health and wellbeing will rely.**
- **The priorities should declare a vision to make Australia a global STEM superpower – and set big national challenges for our nation's science and technology community to solve.**

#### A CHALLENGE-BASED APPROACH

Science & Technology Australia strongly supports adopting a challenge-based approach in a refreshed set of National Science and Research priorities for Australia.

Framing Australia's science and research priorities around major challenges facing the nation over the coming years would focus minds and signal the urgency required to meet those challenges. It would also crystallise a deeper sense of shared purpose by drawing together the research community, policymakers and society to tackle the most complex challenges we face.

Such challenges need to be clear, relevant and applicable to all Australians. This approach would highlight the value of Australia's research sector to meeting our country's greatest needs.

National science and research challenges should be broad, yet sufficiently focused to set clear research goals and objectives. They should highlight that coordinated work across disciplines is needed to meet these grand challenges, backed by policy, investment and industry engagement.

The national science and research priorities should reflect Australia's strengths, unique advantages and opportunities, and our singular position in the world - including our regional responsibilities.

**Broad themes for Australia's next science and research challenges could include:**

### **Inspire a culturally confident nation from our unique shared national identity**

Australia is the only country in the world with the privilege of being home to the oldest continuous living cultures on the planet. This inspiring fact is a unique aspect of Australia's national identity. This inheritance lives in the deep knowledge of the continent held by Aboriginal and Torres Strait Islander people. It includes vast scientific, technological, maths and engineering knowledge embedded in Aboriginal and Torres Strait Islander languages, cultures and the deep knowledge systems of the Country. Indigenous STEM knowledge is the long and impressive first chapter of Australia's contemporary STEM knowledge base.

Research focus areas for this challenge could include:

- Elevate and invest in First Nations STEM to enable deeper understanding of these knowledge systems to inspire all Australians;
- Create stronger First Nations STEM education and career pathways that are grounded in First Nations priorities and connected to community, culture and Country;
- Embrace First Nations Knowledge with authenticity and respect – and deploy this deep knowledge in science and research that benefits Indigenous people and Australia;
- Appoint an Indigenous Chief Scientist. Such a role could engage deeply with the breadth and diversity of Indigenous voices and knowledges across diverse First Nations communities; and
- Embed Indigenous Knowledges and history more comprehensively in school curricula, shared cultural traditions, and our shared national identity.

### **Make Australia a clean energy and sustainability superpower**

The single biggest existential threat of our time is climate change. A challenge-based science and research focus in this area on this could draw together all the strands needed to respond to with the scale and urgency needed to avert disaster. This challenge could encompass climate science, the energy transition, new energy technology development, and how to speed the pace and scale of carbon-negative breakthroughs.

Research focus areas for this challenge could include:

- Deepen our understanding of past and future climate change;
- Support sustainable ecosystems;
- Stop the alarming loss of our biodiversity and speed restoration initiatives;
- Combat plastic and micro-plastic pollution;
- Drive the shift to a circular economy;
- Actively secure healthier oceans with an array of research-based actions; and
- Spur clean tech and carbon negative tech advances amid a transition to renewables.

#### *Australia's competitive advantage*

Our unique position and responsibility in the Asia-Pacific region and the southern hemisphere is to act with powerful positive leadership to stop the planet from warming to dangerous levels.

Australian researchers are leaders in solar and other clean-tech capabilities. Too often we have seen world-leading Australian research in solar and renewable energy go offshore for development and commercialisation. We need to support more Australian home-grown clean-tech development. This includes investing in synthetic biology innovations that enable biologically inspired energy provision.



Australia is also endowed with a wealth of renewable energy potential. We need to harness it to enable the country's transition to a net-zero emissions economy.

Australian researchers have paved the way in polymer sciences and sustainable materials development. We need to harness these deep capabilities more fully and apply them to the challenges of developing a circular economy – developing new plastics with a decreased environmental footprint and new recycling capabilities.

## Make Australia the healthiest country on Earth

A whole-of-lifetime approach to proactively managing our health and wellbeing - and reimagining healthcare through this frame - could be a powerful national science and research challenge. This could draw together our strengths in health and medical research, medical manufacturing and behavioural sciences to make Australia a world leader in health. It could also pick up how frontier technologies such as artificial intelligence, machine learning and quantum can be deployed in healthcare as world-first Australian advantages. This could also deliver strong savings to the nation and the Budget by slowing rising costs in healthcare, disability and aged care.

Research focus areas for such a challenge could include:

- Focus on equitable health enhancement and resilience, investing in illness prevention rather than relying on illness treatments, responses and interventions;
- Creating the world's healthiest brains throughout life, using advances in precision medicine and digital health;
- Harness Australia's strengths in developing new medicines, cell therapies, devices and vaccines;
- Develop new ways to combat antimicrobial resistance;
- Spur advances in Australian-developed medtech to export to the world; and
- Make Australia the health development centre for the world, leveraging our nimble regulatory frameworks, R&D incentives and unique population to trial new healthcare.

### *Australia's competitive advantage*

Australia must urgently cement its sovereign capability in medical manufacturing. This spans drug and vaccine production, medical equipment and devices, and specialised treatments at the very forefront of medical capabilities that will transform the delivery of personalised medicine.

Antimicrobial resistance – the rapidly-approaching point at which humanity will lose our ability to fight infections with life-saving antibiotics and antifungals amid the rise of terrifying new superbugs – is an urgent challenge. The future health of Australians and our agricultural sector rely on our ability to use effective antibiotics. Australia has strong research capability and we can powerfully secure our own future and that of the world by developing clever new ways to protect against this risk.

Australia has deep strengths in health and medical research. We are world leaders in discovery medical science, cell and gene therapies, and in clinical trials. Australian health data is valuable due to our relatively stable population (ideal for multi-generational studies) and multicultural society.

Australia has strong expertise in convergent neurosciences – from brain development in the earliest stages of life through to brain disorders and the many effects of ageing on the brain. We also have key strengths in brain health and wellbeing in multidisciplinary teams working across fields which have forged new understanding of the gut-brain axis, and the brain-immune relationship. We can build on these existing strengths to develop a life-long strategy to boost brain health.



## Make Australia a world leader in food and water security

Few issues are as high stakes as securing the future security of our food and water sources in the face of the vast shocks anticipated amid escalating climate change. This is a challenge that truly affects every Australian – and the threat is confronting.

Research focus areas for such a challenge could include:

- Develop new science-based methods to secure healthy waterways, monitor and remove water pollutants, regenerate river and water health; and ensure thriving aquatic ecosystems;
- Innovate with our agriculture sector – enabling Australia’s food and farm sector to be more agile, productive and resilient amid vast changes in climate, rainfall, fire and heat extremes;
- Support new agriculture technology developments to monitor diseases in plants and livestock, managing reproduction cycles for livestock, and improving feedstock to minimise methane production; and
- Develop new biotechnology-based solutions including synthetic biology to feed our future population and secure new export markets and income for Australia.

### *Australia’s competitive advantage*

Australia’s unique geology, hydrology, geography, climate, and agricultural context mean we can’t rely on other nations’ research to inform our food production systems and healthy agricultural sector.

In our region, we also have a responsibility to our neighbours to support their efforts to maintain food security and develop sustainable agricultural practices in the face of escalating climate change.

## Make Australia a global leader in deploying cutting-edge technologies

The world is poised on the cusp of a new era of scientific and technological development at a scale and pace unprecedented in human history. These technological advances will transform almost every aspect of our lives and those of future generations – dramatically reshaping our jobs and economy, lifestyles and the devices on which we rely to engage in society. Australia can rightfully take a leadership role in shaping how these enabling technologies are used and applied.

Research focus areas for such a challenge could include:

- Drive new advances in computing science and high performance computing capabilities;
- Lead the world in AI, machine learning and automation – including in areas that advance the other challenges;
- Extend Australia’s global lead in the development of quantum technologies and computing for defined purposes;
- Develop a robust regulation and ethics framework around these powerful new technologies;
- Make Australia a world leader in cyber security;
- Ensure equity of access to new technologies to avert social dislocation and disadvantage; and
- Drive forward Australia’s space technology capabilities leveraging emerging technologies.

### *Australia’s competitive advantage*

Australia currently leads the world research in quantum technologies, but other nations are investing heavily and rapidly to catch up. To maintain our competitive advantage, we must focus efforts on collaborative work to advance our quantum capabilities.

Australia is rich in the critical minerals required for clean energy technologies. There is vast potential to take greater advantage of this natural strength and add significant value to our mining industry



through further refinement of our mineral wealth onshore. This will require realistic thinking about what place Australia should occupy in the global market and the scale at which we can operate.

As computing capabilities become increasingly important to nearly all areas of STEM research, it is vital Australia nurtures both skilled professionals in computer science (including cyber security) and also the high performance computing capability that supports data-heavy research analysis.

Australia must bolster our sovereign capabilities in data storage, data security and high-performance computing. We cannot afford to rely on other countries in these critical areas. Such investments and research focus enable smaller nations like Australia to remain competitive with larger economies.

It will also be crucial to maintain strong regulatory and ethical frameworks as new technological capabilities change the way our society operates. Ensuring equity of access and opportunity to the benefits of enhanced technologies is critical. STEM development in these areas must be informed by social science acumen to ensure humans remain front and centre.

Finally, Australia's research community has unique competitive advantages we can leverage in the development of frontier technologies. Our relatively small population drives a strong culture of collaboration, and our sprawling geography means that if we can develop solutions for our continent, they can work anywhere in the world. Finally, the diversity Australia draws from our successful multicultural society is our superpower – diversity in design thinking is key to breakthroughs.

## AUSTRALIA'S NEXT NATIONAL SCIENCE STATEMENT

### KEY POINTS

- **The next National Science Statement should declare an ambition to make Australia a global STEM superpower.**
- **It should be a clarion call to Australians signalling how crucial science and technology are to our national safety, prosperity and wellbeing.**
- **It should urge more Australians to study and work in STEM – the new essential skills for the next era in human history – and call us to action to build an array of new industries in our country driven by science and technology.**
- **It should recognise Australia's greatest asset in science and technology is our people.**
- **It should cast our science and technology strengths at the heart of our self-image as a nation, our economic and national security, and our education and research systems.**
- **This powerful statement should set out to change Australia's cultural relationship with science and put science and technology front and centre in our national consciousness.**

### Articulate a bold vision

This statement can powerfully drive the next phase of Australia's development of our sovereign capabilities in science and technology.

Australia's [new cultural policy REVIVE](#) – launched in January 2023 – is a recent Australian example of how such statements can articulate bold ambitions. It sets out a five year strategy to build and nurture national capabilities in the arts.

The latest [UK science and technology strategy](#) – launched in March 2023 – seeks to “cement the UK's place as a global science and technology superpower by 2030”. It declares:



*“The motivation behind our [Science and Technology Superpower agenda](#) is simple: science and technology will be the major driver of prosperity, power and history-making events this century. The United Kingdom’s future success as a rich, strong, influential country, whose citizens enjoy prosperity and security, and fulfilled, healthy and sustainable lives, will correspondingly depend on our ability to build on our existing strengths in science, technology, finance and innovation.”*

Australia should be every bit as ambitious in our vision for our country.

## Guiding principles

### 1. Honour Australia’s First Nations STEM foundations

The National Science Statement should honour the fact that First Nations knowledge is the long and impressive first chapter and foundation of Australia’s contemporary STEM knowledge base.

It should speak of the deep capability and expertise in complex science, engineering, technology and maths in the first knowledge systems of the Country.

And it should articulate a goal that First Nations peoples and knowledge will be key in each of the challenge priorities – with authentic and considered engagement to bring that vision to life.

Each research challenge should actively support better outcomes for First Nations peoples. They will drive better health and wellbeing, wider recognition of skill and knowledge in caring for Country, and stronger participation of First Nations people in research and entrepreneurialism.

Indigenous IP should be retained by Indigenous peoples, and embracing First Nations Knowledges must not lead to appropriation.

These statement’s guiding principles should also acknowledge the vast diversity across Aboriginal and Torres Strait Islander peoples. This diversity needs to be reflected in representative structures.

“Elders in Residence” roles to honour the stature of and remunerate key First Nations knowledge holders are being created in Australian universities. This could be one potential model to deepen Indigenous recognition in STEM.

A final guiding principle in First Nations STEM is “relationship before task”. No-one has standing to ask anything of others until a relationship of trust and deep understanding is built. Only then will we have the strong foundations needed to work together to advance the priorities of First Nations peoples – rather than asking First Nations people to ‘add on’ to other people’s priorities.

### 2. Invest in Australian science and technology’s greatest asset: our talent

Australia’s greatest asset in science is our talent. Without the brilliant, driven and highly skilled minds who develop Australian science, we will not have a truly competitive national science capability.

Nurturing this talent starts in childhood and the early school years. Every aspect of our education system needs to instil a drive and passion for STEM that is developed across a school education and spurs many more Australian students to pursue careers in science and technology. We should set an ambitious new target to boost the percentages of Australian students studying STEM.

Australia must nurture its highly-skilled STEM workforce. The challenges are particularly acute in research careers, with a broken system of insecure work in the earliest stages of STEM research careers driving brilliant talent out. This takes a vast human toll, as does the current system of thousands of science researchers vying for a limited pool of competitive grant funding, effectively re-applying for their own job constantly at short intervals. The current system is a spectacular ‘own goal’ that undermines Australia’s urgent need to safeguard more of our existing brilliant science talent and to improve national productivity. We need to call more of our brilliant Australian science talent home with attractive career security. We should set an ambitious new target to have more of



our science research workforce on long-term employment arrangements to give them the security they need to throw themselves into doggedly pursuing new breakthroughs for Australia.

**The National Science Statement should set out a bold vision for Australia to become the best place in the world to pursue a career in science.** It should articulate a goal to create the best conditions for Australian scientists to thrive, and to act as a magnet to call home Australia's skilled science diaspora. And it should set a bold ambition to attract the world's best talent from other countries to complement our home-grown skilled science workforce.

### **3. Strengthen diversity, equity and social inclusion to strengthen Australian science**

If Australian science isn't reaching into the full breadth and depth of our potential talent pool, we are robbing ourselves of some of the best talent. **The National Science Statement should declare an ambitious goal to support science and science aspiration in diverse communities across Australia.**

Strong diversity in science participation isn't an 'optional extra'. It is the very key to excellence, achievement and breakthroughs in Australian science. A vast body of expert research highlights the crucial role of diversity in propelling stronger innovation and making new breakthroughs. Strengthening diversity, equity and inclusion is a crucial principle to pursue greater excellence in Australian science.

We need Australia's science and technology research to support social wellbeing – and for society to appreciate the crucial role science and research plays in their lives. Technologies and advances we invest in should emphasise improving access to health, wellbeing, learning, and lifestyle for all Australians – especially those with the greatest disadvantage and most complex needs.

A deep commitment to environmental sustainability and a diverse and inclusive workforce should be central to all initiatives under the statement and priorities.

### **4. Articulate a deep commitment to invest more deeply in discovery research**

Without new discoveries, Australian science would stall. Across the arc of human history, the biggest and most seismic breakthroughs in knowledge have come from discovery science – not from incremental applied or translational projects. This is research investigating the fundamental properties of our universe, humans and our environment.

The pursuit of breakthroughs that can change the world – and give Australia a leading edge advantage – is fundamental to our national wealth. Our investments in fundamental discovery research are crucial to Australia's economic success. The statement should reiterate this and emphasise the role of curiosity-driven research as the underpinning capability of all new knowledge and discoveries.

**The National Science Statement should articulate a deep commitment to the role of discovery research and to investing more deeply in it.** To advance this goal, Science & Technology Australia has set out [a bold vision](#) for how the Australian Government might advance its 2022 election commitment to work towards a target of investing 3% of GDP in research and development.

By creating an ambitious new Science Future Fund, the Government can forge an enduring legacy to put science investments beyond short-term funding cycles. Such a fund would be a gamechanger for Australian economic growth. Supercharging Australian discovery science would unleash a new golden era of breakthrough discoveries to power our nation's economic development in the decade ahead.

It would match the ambitions of our global technological allies and rivals; safeguard our national security and sovereign capability in an era of escalating global economic uncertainty; future-proof local jobs; and deliver a more prosperous future for all Australians.



Analysis by Science & Technology Australia shows that if a Science Future Fund is created at the scale and proven model of the Medical Research Future Fund, it could inject \$650 million every year from investment income into science breakthroughs. This would generate a massive \$2.3 billion in new economic returns every year for Australia, based on conservative estimates drawing on CSIRO models, without any extra public investment after the fund's initial capitalisation.

## **5. Back the complementary importance of research translation and commercialisation**

Australia's research system should always pursue a careful balance between discovery, applied and translational research, and support for research commercialisation.

**The National Science Statement should set out a sophisticated understanding of the careful balance between all parts of the research system, and articulate the importance of research translation and commercialisation powered by a wellspring of discovery science breakthroughs.**

Australia must continue to deepen the specialist skills, expertise and support needed to turn more great Australian science into new products, jobs and companies. This requires us to 'stay the course' with the new investments made in recent years through newer Government programs to support research commercialisation. Those newer initiatives include Australia's Economic Accelerator, a raft of new Industry Fellowships and the new National Industry PhD Program, which sit alongside Australia's mainstay long-running commercialisation successes with Cooperative Research Centre funding and other accelerating commercialisation initiatives. The statement should articulate a strong commitment to these initiatives to enable successful Australian research commercialisation.

The remaining gap in a broad suite of programs and initiatives to 'level up' Australia's performance in research translation and commercialisation is the lack of a powerful national training program to create a large-scale connected community of mid-career scientists, engineers and technologists who can commercialise their science and deep tech at scale. Science & Technology Australia's 'Bench to Boardroom' concept would powerfully fill that gap and give Australia the powerhouse community in science commercialisation that it needs to turbo-charge our national success.

## **6. Secure Australia's science future by securing investment in research infrastructure**

Australia's research infrastructure powers Australian science. An array of high-cost specialist facilities and large-scale state-of-the-art equipment is needed to pursue big bold science breakthroughs in everything from health and medical research to environment and bushfire management.

This infrastructure includes facilities that enable vast amounts of data to be collected and processed in ultra-rapid timeframes compared to past eras – such as the beamlines at the Australian Synchrotron in Melbourne, our two world-class Australian supercomputers – Pawsey in Perth and the NCI in Canberra – and the powerful new astronomy infrastructure being built in the remote WA desert as the Square Kilometre Array.

The backbone of Australian science infrastructure is the network of complex shared specialist facilities funded under the National Collaborative Research Infrastructure Strategy. This network of 24 highly-sophisticated science-enabling centres enables Australia to make major advances in complex medical, genomic and biodiversity research; drives data advances; powers crucial climate and earth modelling; equips Australia's geoscience exploration on land and at sea; develops advanced manufacturing prototypes for industrial advances; and prepare Australia to prevent future pandemics – among its wide array of essential capabilities.

These specialist facilities must be properly resourced – with secure, long-term and growing funding for both equipment and the highly-skilled specialist staff who run these complex facilities. When funding to the scheme was threatened last decade, and an outcry ensued, a forward commitment was made to fund the overall Budget envelope for NCRIS for a decade. However the rollover and





renewal of the most recent investment plans for each NCRIS facility in 2022 took significantly longer than it should have. This caused significant uncertainty in the system, risking the loss of skilled specialist staff, and re-funding the facilities at a lower level of baseline funding than needed to continue operations at proper scale.

**The National Science Statement should make a strong commitment to secure Australia’s research infrastructure by renewing a ten-year investment commitment and lifting base funding for each NCRIS facility to the level required to operate at proper scale.**

## **7. Equip more Australians with advanced maths and physics skills to power our tech ambitions**

For Australia to compete in the frontier technologies that will soon transform almost every aspect of human existence – such as quantum, artificial intelligence and machine learning – we will need to dramatically grow the numbers of Australians with advanced skills in maths and physics.

This is an urgent challenge for Australia. Without more home-grown talent acquiring the ambitions to develop such skills, we will have to rely even more heavily on skilled migration to fill this gap. While skilled migration will always be a crucial component of our science system, and brings strong diversity benefits to Australia, we cannot rely on it to do all of the heavy lifting to build this workforce.

Australia urgently needs a strategy to excite more young people in our own country about the power and excitement of maths and physics and technology skills, and build their confidence and ambitions to pursue study and careers in these fields. This will require us to urgently enhance the training and support of the significant percentage of Australia’s high school teachers without specialist maths and science education themselves who we are currently asking to teach advanced maths and science to students in the latter years of high school.

**The National Science Statement should set out a commitment to inspire many more Australians to acquire advanced skills in maths and physics, and give Australian teachers extra support and specialist training to inspire more of the next generations of young Australians into STEM.**

## **8. Change Australia’s cultural relationship to science and galvanise community support**

Our strengths and success in science and technology will be key to safeguard Australia’s economic strength in the next era of human progress. These capabilities will decide which nations prosper – and which ones falter. Australians cannot afford to consign ourselves to become a nation of consumers, reliant on other countries to buy – or beg to buy – the next wave of economy-powering technologies.

The health, safety and living standards of every Australian in the next decade will rely on our ability to advance our science and technology leadership, generate new science breakthroughs and industries, and deploy science to solve the biggest, urgent, complex challenges facing humanity.

Engaging and exciting all Australians in the crucial role of science to secure our collective national wealth and wellbeing is an urgent task. It is also pivotal to ensure a strong pipeline of talent to feed the STEM careers of the future – inspiring our children to investigate, explore, ask questions and embrace STEM education and ultimately a career in STEM.

To realise this vision, Australia’s science communicators, educators and teachers can be a powerful national force to communicate these high stakes to all Australians. There is a powerful national imperative to ensure our whole country understands and rallies behind this vision and priorities.

**The National Science Statement should set out a goal to change Australia’s cultural relationship with science – and put it at the centre of our self-image as a nation.**

