

# SCIENCE & TECHNOLOGY AUSTRALIA

## POLICY SUBMISSION

3 APRIL 2023

### DEVELOPING ADVANCED MANUFACTURING IN AUSTRALIA

Science & Technology Australia thanks the House of Representatives Standing Committee on Industry, Science and Resources for the opportunity to make a submission to its inquiry on [Developing Advanced Manufacturing in Australia](#).

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.

At this historical turning point, the world is poised at the start of a new era of rapid scientific and technological development on a pace and scale unlike any in human history. The stakes are high.

**Australia must keep pace with the next era of science and technology development in advanced manufacturing to secure our country's future productivity and prosperity. If we don't, we risk a collapse in Australia's future living standards and future economic strength.**

The COVID-19 pandemic laid bare the risks to the nation in not having strong sovereign capabilities in advanced manufacturing. Strengthening Australia's capabilities in advanced manufacturing will drive new economic growth, generate new jobs and enhance productivity to secure Australia's prosperity.

To assist the Committee, we have deployed the expertise of our membership community working across an array of high-tech capabilities with strong advanced manufacturing potential to develop a series of practical recommendations in this submission.

### KEY POINTS

- **To become an advanced manufacturing superpower, Australia must invest more heavily in R&D and in developing a diverse, highly-trained, specialised, STEM-skilled workforce.**
- **Stronger Government support is needed for early-stage prototype development and scale-ups to spur industry to invest in next-stage development and manufacturing.**
- **Australia's smartest play is to develop more 'multi-platform technologies' in advanced manufacturing that can be applied in more than one sector of our economy.**

Science & Technology Australia would be delighted to assist the Committee's work further, including by giving expert evidence to any hearings.

**Professor Mark Hutchinson**  
President  
Science & Technology Australia

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Chief Executive Officer  
Science & Technology Australia

## SCIENCE & TECHNOLOGY AUSTRALIA'S RECOMMENDATIONS

### Science & Technology Australia recommendation 1:

To spur stronger development of Australian advanced manufacturing, create a powerful new inter-departmental committee to align all current Government programs and policy levers in education, research and development, commercialisation, entrepreneurship, and manufacturing.

### Science & Technology Australia recommendation 2:

Australia should invest in a strategic network of facilities to support early-stage product development and process testing, as 'proof-of-concept' testbeds to spur next-stage industry investment.

### Science & Technology Australia recommendation 3:

Australia should support 'multi-platform' technologies – from research through to commercialisation and manufacturing – with the potential to boost advanced manufacturing in more than one sector.

### Science & Technology Australia recommendation 4:

Australia must invest more deeply to develop a highly skilled specialised STEM workforce and cutting-edge discovery research in frontier technologies to drive high-tech advanced manufacturing.

### Science & Technology Australia recommendation 5:

Government initiatives to support advanced manufacturing should mandate a deep commitment to environmental sustainability, regional development, and a diverse and inclusive workforce.

## 1. A SHARED GOAL ACROSS ALL GOVERNMENT PROGRAMS

To build stronger advanced manufacturing capability in Australia, we need a diverse array of Government funding levers and programs to work together more cohesively. Policy levers and funding programs in education, research and development, commercialisation, entrepreneurship, and manufacturing will need to be better coordinated to seize this opportunity for Australia.

The National Reconstruction Fund is the centrepiece of this Government's support for advanced manufacturing development. To maximise its success, the NRF should 'forward scout' new cutting-edge research breakthroughs and applied research emerging from other Government-funded initiatives such as Australia's Economic Accelerator program, Cooperative Research Centres, Australian Research Centres of Excellence, and innovations developed in sophisticated facilities supported by the National Collaborative Research Infrastructure Strategy.

There is a vast opportunity to support advanced manufacturing opportunities emerging from university research programs. Two examples of trailblazing prototyping facilities that develop and validate manufacturing techniques are the [Battery Hub](#) at Deakin University and the [Discovery to Device Facility](#) at RMIT University. They demonstrate the opportunity created by strong partnerships between universities, manufacturers, and industry (encompassing large, SMEs, and start-ups).

### Science & Technology Australia Recommendation 1:

To spur stronger development of Australian advanced manufacturing, create a powerful new inter-departmental committee to align all current Government programs and policy levers in education, research and development, commercialisation, entrepreneurship, and manufacturing.

## 2. MORE SUPPORT FOR EARLY STAGE PRODUCT TESTING AND SCALE-UP

To expand advanced manufacturing, Australia must invest more heavily in creating next-generation pre-cursor facilities where start-ups can test products and innovations and their viability for scale-up. Products that emerge from these test beds can then be developed into more comprehensive advanced manufacturing processes.



These translational facilities span the ‘valley of death’ across technology readiness levels 4 to 7. They enable Australian industry to confirm the viability of advanced manufacturing capabilities. And they deliver stronger evidence and confidence for Australian industry to justify new infrastructure investments to shareholders and investors.

Government support is critical at this early-translation stage. Ultimately, later-stage advanced manufacturing investment should come from industry – given these companies will generate revenue and profit from manufactured products. However, at the riskier early stages, there is a key role for the Government to spur prototype development and validation of manufacturing techniques. This would give Australian industry more certainty to invest more capital in the next stages.

Building these types of strategic manufacturing prototyping facilities, with ISO accreditation, could create advanced manufacturing hubs that serve both Australia and the broader Asia–Pacific region. We can position Australia as a key leader and partner in value-added manufacturing technologies.

These capabilities should ideally be able to be shared across different sectors to enable economies of scale for businesses looking to develop their capabilities and test early-stage products.

#### **Science & Technology Australia recommendation 2:**

Australia should invest in a strategic network of facilities to support early-stage product development and process testing, as ‘proof-of-concept’ testbeds to spur next-stage industry investment.

### **3. DEVELOP MORE ‘MULTI-PLATFORM’ TECHNOLOGIES**

To build a strong and resilient advanced manufacturing sector, Australia needs to develop new technologies that can be deployed in more than one sector of our economy. More and more often, ground-breaking new research and the techniques, processes or applications that arise from such research in one field are now being translated or applied in other – often seemingly completely disparate – sectors.

This is another area where the National Reconstruction Fund can play a crucial role. Clever strategic investment in technologies with the potential to be applied in more than one sector will generate stronger returns on investment and boost job creation across the economy.

Some examples of this include optical fibres used for high-speed internet also being used to create advanced probes to image human cells and organs for diagnosis. The same technology has been repurposed to grade the quality of meat to give Australia’s livestock producers rapid next-generation quality control tools.

Similarly, recent advances in 3D printing are now being used in a wide array of diverse sectors. Techniques to print houses out of concrete; just-in-time joint replacements during surgery using titanium; and micro-needle arrays for vaccine delivery from polymers are diverse examples of how a single manufacturing platform can have multiple applications.

Semiconductor manufacturing infrastructure is a similar cross-cutting multi-platform technology. Semiconductor chips are integral to every device we use from phones to parking meters, blood tests to MRIs, television to WiFi. Australian companies are designing some of the most advanced semiconductor chipsets, but with no local manufacturing or prototyping opportunities.

These sorts of dual- or multi-use technologies will also significantly add to Australia’s economic complexity – and resilience. A strategic focus on technologies that can be used in medicine, agriculture and defence will also contribute to stronger national security – as is the mission of the new [Safeguarding Australia through Biotechnology Response and Engagement Alliance](#).

#### **Science & Technology Australia recommendation 3:**

Australia should support ‘multi-platform’ technologies – from research through to commercialisation and manufacturing – with the potential to boost advanced manufacturing in more than one sector.



#### 4. INVEST MORE DEEPLY IN A DIVERSE HIGHLY-SKILLED WORKFORCE & R&D

A powerful research sector, combined with a strong culture of research commercialisation and entrepreneurship, will be key to strengthening Australia's advanced manufacturing capabilities. This is crucial to generate breakthroughs that will lead to new high-tech developments in technologies, products and processes.

A competitive and efficient advanced manufacturing capability will also require a strong research capability in automation and robotics technologies. The ultimate goal for advanced manufacturing processes is enhanced human-automation interaction, rather than having robots or automated processes entirely replacing people in the production process.

Repetitive or demanding physical tasks can be conducted by automated or robotic processes, freeing people to carry out more sophisticated and complex activities. Sophisticated approaches are essential for Australian-made products to be competitive with overseas workforces while safeguarding wages and workplace health and safety in Australia's manufacturing workforce.

Real- or near-real-time data collection and analytics enable more efficient and sustainable processes. The ability to develop virtual 'digital twins' of both products and processes can drive stronger efficiency and optimise advanced manufacturing processes.

Australia must develop stronger sovereign capability in machine learning, AI, robotics and automation. This is particularly crucial when these technologies are used in potentially sensitive applications, such as defence or health. Australia can not afford to rely on imported technologies in these critical areas. We must invest at a larger scale in areas crucial to our national needs.

In addition to computing, robotics and automation technology research, Australia must invest more heavily in the highly skilled specialised STEM workforce we need to power a new wave of high-tech advanced manufacturing. The needs are especially acute in maths, physics and engineering, as well as in material sciences. To power our advanced manufacturing sector, Australia will need a much larger workforce of highly skilled technicians and operators to oversee efficient production and quality assurance, as well as regulation and compliance.

##### **Science & Technology Australia recommendation 4:**

Australia must invest more deeply to develop a highly skilled specialised STEM workforce and cutting-edge discovery research in frontier technologies to drive high-tech advanced manufacturing.

#### 5. BUILD SUSTAINABILITY, EQUITY AND DIVERSITY INTO DESIGN

A deep commitment to environmental sustainability and a diverse and inclusive workforce should be central to all initiatives to strengthen advanced manufacturing in Australia. This agenda should also put strong emphasis on 'circular economy' re-uses of proposed technologies or products.

One reason Australia currently imports so many products is that the true climate and environmental costs of shipping and transport are not factored into our pricing calculations. One way to truly incentivise a stronger Australian manufacturing sector would be to insist on the climate cost being compensated for and reflected in price costs to Australian consumers.

Future global supply chains and trade relationships will have ever-higher sustainability standards – with strong environmental credentials becoming a mandatory component of trade partnerships. Australia needs to safeguard our global reputation for producing clean, green and ethical products – and build more sustainable future industries with low or zero carbon emissions. If we don't, we risk being shut out of international agreements and supply chains.

There is vast potential for an expanded Australian advanced manufacturing sector to generate new jobs and income for Australia. These dividends should benefit all Australians. There should be a concerted focus on new strategies to support advanced manufacturing in regional Australia. This may



involve identifying and promoting regional strengths, capabilities and needs, capitalising or repurposing existing infrastructures, and building networks and partnerships between companies, research institutions and government agencies to support local manufacturing closer to markets.

Ensuring all Australians can access the jobs provided through advanced manufacturing also requires ensuring that all Australians have the opportunity to benefit from a strong STEM-based education. Targeted work to boost equity and underrepresented groups' participation – particularly First Nations people – in STEM education and training will be critical to enable a diverse workforce and an equitable future.

**Science & Technology Australia recommendation 5:**

Government initiatives to support advanced manufacturing should mandate a deep commitment to environmental sustainability, regional development, and a diverse and inclusive workforce.

**A CASE STUDY: DRUG, VACCINE AND ADVANCED THERAPY MANUFACTURING**

Australia is a world leader in vaccine development and drugs to combat human and livestock parasites that have the potential to devastate our agricultural sector and human population.

It is crucial to Australia's future biosecurity that we develop sovereign manufacturing capabilities in both drug production as well as new point-of-care testing tools and equipment.

Australia also has key strengths in developing highly specialised advanced gene and cell therapies. These therapies target rare diseases such as sickle cell disease, haemophilia and ALS as well as more prevalent diseases including cancer, diabetes, stroke and Parkinson's disease. They involve the development of nuanced, living drugs – often based on the patient's own cells or other living cells – that have been processed in a highly specialised and carefully curated environment.

Developing advanced manufacturing in these types of advanced therapies will depend strongly on the integrity of our manufacturing processes – both in the highly sophisticated equipment and technology, as well as strict quality assurance and regulation.

As the hugely exciting field of personalised medicine advances, demand for gene and cell therapies will grow – global demand already outstrips capacity. Investing in Australia's capability to manufacture these advanced therapies would not only bolster our sovereign capability, but would also position the country as a supplier of advanced therapies to the Asia-Pacific. Investment in a robust manufacturing system will enable more Australian-generated IP to be registered and turned into manufacturing capability here – rather than being manufactured by other countries. This will deepen the returns to Australia from our investment in the original research.

As with all advanced manufacturing, the development of a deeper local manufacturing capability in these specialised fields will require a highly skilled specialised STEM workforce. We will need to train or recruit more highly-skilled staff with expertise in equipment production and medical technologies to develop the therapies. In addition, specialised training and accreditation will be required to develop the compliance and regulatory workforce to maintain the entire system's integrity.

More detail about the advanced manufacturing opportunities in this specialised field can be found in the submission to this inquiry from the Australian Society for Stem Cell Research – one of Science & Technology Australia's member organisations.

