

Submission to the Senate Standing Committee on
Economics

The Australian Manufacturing Industry

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Technology & Engineering

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THE AUSTRALIAN MANUFACTURING INDUSTRY

The Australian Academy of Technology and Engineering (ATSE)¹ welcomes the opportunity to provide feedback to the Senate Standing Committee on Economics for the inquiry into the Australian Manufacturing Industry.

ATSE shares the vision, outlined in the government's Modern Manufacturing Strategy, for Australia to be recognised as a high quality, sustainable manufacturing nation, helping to deliver a strong, modern and resilient economy for all Australians.² With Australia's abundant natural resources and highly skilled workforce, this transformation would be catalysed through targeted and strategic investment in advanced manufacturing, digital technology, and a STEM-skilled workforce.

Manufacturing includes the whole chain of activities from research and innovation, through to recovery and recycling. Physical fabrication is only a small part of the whole manufacturing process.³ A thriving manufacturing sector has economy-wide benefits; through associated research and development (R&D), manufacturing is currently the dominant source of new technologies for the increasingly technology-based services sector, such as banking.⁴

To build a strong modern manufacturing sector in Australia, at the highest level ATSE recommends that the Committee considers:

- A focus on STEM skills, at all levels, that will be required in order to support a competitive manufacturing industry for Australia.
- Seizing the opportunity that society-wide decarbonisation presents, by leveraging Australia's natural advantage of bountiful renewable energy into a competitive advantage and setting up new areas of manufacturing renewable, low-emissions and negative emissions technologies.
- The use of policy levers in R&D and government procurement of Australian-made products to boost domestic manufacturing capability.

Specific responses to select inquiry terms of reference are provided below.

a) What manufacturing capacities Australia requires for economic growth, national resilience, rising living standards for all Australians and security in our region

Sovereign manufacturing capability reduces dependency on materials that are likely to face supply shortages due to rapid decarbonisation of economies or changing regulatory or export environments. To achieve this capability and meet rising demand, all parts of the Australian-based manufacturing supply chain require access to the best equipment and skills.

To build and maintain sovereign manufacturing capability, Australia needs to identify key sectors in which to prioritise the provision of systems support, materials, knowledge, and skills.

¹ The Australian Academy of Technology and Engineering is a Learned Academy of independent, non-political experts helping Australians understand and use technology to solve complex problems. Bringing together Australia's leading thinkers in applied science, technology and engineering, ATSE provides impartial, practical and evidence-based advice on how to achieve sustainable solutions and advance prosperity.

² <https://www.atse.org.au/research-and-policy/publications/publication/modern-manufacturing-strategy-roadmaps/>

³ Roos, Goran (2012) Manufacturing into the Future. Available at:

https://www.researchgate.net/publication/274392157_Manufacturing_into_the_Future

⁴ The Royal Society (2009) Hidden wealth: the contribution of science to service sector innovation. Available at:

https://royalsociety.org/~media/Royal_Society_Content/policy/publications/2009/7863.pdf

Digital Technology Capability and Benefits to Manufacturing

ATSE commends the Government's \$124 million commitment to building Australia's artificial intelligence (AI) capability, including establishing a National AI Centre. This investment will build technology capability – particularly in robotics and AI – that will be critical for a competitive manufacturing sector. More than half of all European manufacturers are implementing AI solutions.⁵ The growing demand and wide uptake of digital technology applications, big data analytics, and AI tools during the pandemic is also likely to drive increased demand for relevant skills across Australia to realise the benefits of these technologies for businesses.

Many small and medium enterprises (SMEs) lack the relevant skills or financial resources to invest in digital technology or AI applications. Given the important role SMEs will likely play in Australia's burgeoning manufacturing supply chain, investing in this segment's capability to use digital technology to improve capacity, should be a priority.

Furthermore, as knowledge of how industry can use technology to support manufacturing is becoming increasingly siloed, technology adoption and the development of industry-relevant solutions are limited. Improved collaboration between academia and industry would enable faster translation and application of cutting-edge, advanced manufacturing technologies to maintain a competitive advantage and encourage innovation in to solve complex problems. Existing programs that are proven to successfully promote collaboration between academic and industry stakeholders (for example, by providing a platform for businesses to experience and road-test advanced digital manufacturing systems and develop new business strategies in collaboration with a university) could be replicated and rolled out more broadly to support collaboration and improve the uptake and use of digital technology in SMEs.

A STEM-skilled workforce

Development of domestic digital technology skills are a must if Australia is to maximise its opportunity to grow a thriving advanced manufacturing sector. Ensuring the entire future manufacturing workforce is technology literate, and has strong science, technology, engineering and mathematics foundations, will also be critical to transition and build the workforce required to support a burgeoning industry.

Further comments on manufacturing skills are provided under point (g)(vii) of this submission.

d) The strengths of Australia's existing manufacturing industry and opportunities for its development and expansion

The Modern Manufacturing Strategy identified several areas in which Australia has established global credibility, competence, skills capability, and natural advantage that can be swiftly leveraged to create jobs and economic growth. Of these, ATSE's November 2020 submission to the Modern Manufacturing Roadmaps identified **medical products, recycling and clean energy, resources technology and critical minerals processing, and food and beverage** as the areas offering greatest immediate opportunity for Australian manufacturing.⁶

These sectors offer the greatest immediate potential for Australia due to our established global credibility, competence, skills capability, and natural advantage in these sectors ensure Australia can move swiftly to create jobs and economic growth.

⁵ <https://research.aimultiple.com/manufacturing-ai/>

⁶ <https://www.atse.org.au/wp-content/uploads/2020/11/SUB-2020-11-09-MMS-ATSE-final.pdf>

For each of these proposed sectors, a supporting capability ecosystem must be built and maintained, to ensure businesses don't leave Australia for a location where this ecosystem already exists.

f) Identifying new areas in which the Australian manufacturing industry can establish itself as a global leader

ATSE has identified several areas in which the Australian manufacturing industry can establish itself as a global leader. These are all areas which capitalise on existing strengths in Australian industry to further support the continued growth of these industries. These areas include:

- ***Recycling and developing substitutes for rare earth metals and other scarce raw materials.***
 - The transition to renewable energy generation will increase demand for critical metals. This will require increased exploration and mining, as well as innovation to develop new technological solutions to recycle and find replacements for these metals into the future.
 - Ensuring manufacturing includes processes for recycling renewable energy technologies components (i.e. solar photovoltaic cells), will further cement Australia's ability to realise the benefits from both recycling and clean energy technology manufacturing, as well as the prolonged benefits of emissions reduction from widespread use of these technologies.
- ***Integrated Industry 4.0 equipment***
 - Developing equipment that uses different types of AI to achieve a high level of autonomous operation (such as agricultural robotics, for example), could improve productivity and resilience for Australian industries.
 - Creating and shaping the emergent Industry 5.0, with an emphasis on efficient and effective collaboration and cooperation between humans and emerging technologies, such as AI, Internet-of-Things (IoT), robotics and autonomous systems, virtual, augmented, and mixed reality, blockchain, and cyber-physical security.⁷
- ***Value adding manufacturing***
 - Developing manufacturing supply chains that can add value to raw material in-country to sectors where Australia holds an existing (e.g. mining and agriculture) or potential (e.g. hydrogen, macroalgae) comparative advantage, can work to increase jobs along the supply chain for these sectors.
 - Value-added products made in Australia will also likely boost the profitability of the end products from these sectors, increasing the economic benefits for Australia.
- ***Developing Indigenous knowledge into innovative engineering and manufacturing methods***
 - Indigenous scientific and engineering heritage is rich. Recognising this knowledge, removing barriers that limit Aboriginal and Torres Strait Islander people's ability to maintain intergenerational knowledge, and forming respectful collaborative partnerships to apply this knowledge to contemporary solutions can give Australia a unique global advantage.

⁷ Nahavandi, S. (2019) Industry 5.0 – A human-centric solution. Sustainability, 11(16), 4371.

g) The role that government can play in assisting our domestic manufacturing industry, with specific regard to:

i) Research and development

Governments should assist in the cost of acquiring, developing and implementing knowledge through technology diffusion programs, directed mostly as SMEs that don't have the capability to independently fund R&D or demonstration of emerging manufacturing or enabling technologies.

ii) Attracting investment

Access to capital is crucial for innovation and for building successful ventures. Governments can support domestic manufacturing businesses in attracting investment in two ways. Firstly, by supporting growth of existing manufacturing activities by enabling connection and collaboration to build knowledge, and secondly by supporting the creation of new activities and industries by building on existing, local R&D strengths.

These support systems must be in place to take advantage of any significant investment, particularly from outside Australia. While inward foreign direct investment could bring useful knowledge to be acquired by Australian companies, it may create a skills shortage. Local demand for talented and high-skilled workers could increase with a swell of new investment from multinational corporations,⁸ such that Australian talent becomes more expensive for local businesses. It is therefore critical as industries grow to balance the need for new investment opportunities, with mechanisms to provide a sufficient pool of talent to fill roles at all levels across the manufacturing supply chain.

iii) Supply chain support

Short-term government support is critical to mitigate the impact of the COVID-19 pandemic on manufacturing supply chains in Australia. In the longer term, strategic mapping is necessary to rebalance supply chains and ensure efficiency, resilience, and skills.

iv) Government procurement

Government procurement that supports Australian-made products is an important tool for developing a sustainable local industry, and should be used to stimulate innovation across the manufacturing industry by creating demand. This can be significantly beneficial for Australian businesses that are smaller, regional, have limited resources, or are under economic stress.⁹

vi) Skills and training

Skills development is needed at all levels of manufacturing, to avoid individuals and communities being left behind, and to fulfill the skills requirements of manufacturing businesses making digital and sustainability transitions.

Given the breadth of employment opportunities across the supply chain, this includes both STEM post-graduate education and VET level training.

A consistent, strong, national VET sector will be critical in supplying the skills needed to Australian manufacturing, including digital technologies as immigration slows due to the COVID-19 pandemic.

⁸ Becker, B., Driffield, N., Lancheros, S., & Love, J. H. (2020). FDI in hot labour markets: The implications of the war for talent. *Journal of International Business Policy*, 3(2), 107-133.

⁹ Roos (n 3)

h) The opportunity for reliable, cheap, renewable energy to keep Australia’s manufactured exports competitive in a carbon-constrained global economy and the role that our manufacturing industry can play in delivering the reliable, cheap, renewable energy that is needed.

Electrification of the economy, powered by renewable energy sources, is necessary to reduce net emissions. Transition towards net zero will increase the total demand for electricity – as transport, stationary energy (i.e. burning gas for heating and industrial processing), and other industrial processes are electrified. The financial and environmental costs of energy have an impact on the competitiveness of manufacturing products, and these costs must reduce to foster competitiveness of Australian products locally and in an international market.

As of June 2021, renewable energy is now the cheapest new-build power in Australia.¹⁰ This trend towards increasingly affordable renewable energy will allow Australian-manufactured products to be produced affordably with a low carbon footprint. Investment in renewable energy infrastructure and R&D to improve the efficiency of renewable energy generation technologies will support Australian industries remain globally competitive in a carbon-constrained global economy.

To continue to build workforce capability to support the continued improvement, manufacture, deployment and maintenance of renewable energy technologies it is necessary to improve support for STEM education from secondary school on. This includes upskilling current energy sector workers to support this technology.

Business, digitalisation, data analytics, and customer orientation will also be essential for a modern renewable energy-powered economy, especially in combination and with cross-disciplinary collaboration. A highly skilled, digital technology enabled workforce will allow Australia’s energy sector to grow R&D capabilities, and produce technologies with high export potential, thus contributing valuably to Australia’s economy and the nation’s transition to low emissions.

With leadership across applied science, engineering and technology in all Australian sectors, ATSE is well placed and experienced in connecting science and industry, which will be key to establishing a globally competitive manufacturing industry in Australia. ATSE welcomes the opportunity to provide further input, clarification, or advice to the committee, drawing on our extensive network of leaders from industry, academia, the public sector and research institutes.

For further information, please contact the ATSE Policy Team (AcademyPolicyTeam@atse.org.au).

¹⁰ Graham, P., Hayward, J., Foster J. and Havas, L. (2021), GenCost 2020-21: Final report, Australia. Available at: <https://www.csiro.au/en/news/News-releases/2021/CSIRO-report-confirms-renewables-still-cheapest-new-build-power-in-Australia>