

**ADVANCED MANUFACTURING GROWTH CENTRE**

SUBMISSION TO INNOVATION  
AND SCIENCE AUSTRALIA

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# 1. Response to call for submissions

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- 1.1** Innovation and Science Australia's (ISA's) *2030 Strategic Plan* is an opportunity to establish a comprehensive vision for Australia's future prosperity – and place the nation on a long-term trajectory for economic growth and high-skilled jobs.
- 1.2** Established in 2015 by the Australian Government, the Advanced Manufacturing Growth Centre (AMGC) strongly supports ISA's goal for Australia to rank in the top tier of innovation nations. The AMGC is especially excited by the potential for manufacturing to lead this innovation effort and welcomes the opportunity to contribute to the *2030 Strategic Plan*.
- 1.3** In May 2017, the AMGC took the initiative to host two CEO roundtable sessions in Sydney and Melbourne with its member organisations. Its aim was to obtain the latest industry thought leadership about how to move more Australian manufacturing firms closer to the so-called 'innovation frontier' (the first challenge posed in ISA's *2030 Strategic Plan Issues Paper*<sup>1</sup>). This submission draws on the insights of the AMGC's members, and it sincerely thanks them for their participation.

<sup>1</sup> Innovation and Science Australia, *2030 Strategic Plan, Issues Paper*, 20 March 2017. Source: Advanced Manufacturing Growth Centre, *Sector Competitiveness Plan 2017*, p. 8. Source: [https://www.amgc.org.au/Attachment?Action=Download&Attachment\\_Lid=15](https://www.amgc.org.au/Attachment?Action=Download&Attachment_Lid=15)

## 2. A blueprint for the future of manufacturing

- 2.1** Manufacturing has a vital role to play in Australia's economic prosperity. It is Australia's third-largest employer, providing direct jobs for almost 900,000 people (more than mining and agriculture combined) and hundreds of thousands more in related industries.<sup>2</sup> Manufacturing is also one of Australia's biggest earners, contributing more than \$100.2 million in total exports during the 2015–16 financial year, up from \$96.1 billion in 2014–15. As noted by the Office of the Chief Economist, this represents a strong result given the value of merchandise exports contracted by 4.5 per cent over the same period.<sup>3</sup> According to the Australian Industry Group's Performance of Manufacturing Index, manufacturing sentiment in 2017 has reached heights not seen for 15 years.<sup>4</sup>
- 2.2** The key opportunity is that manufacturing now covers a much broader range of activities than production alone as the terms of the nation's manufacturing success are changing. Depicted in the so-called 'smiley curve' (see appendix), a new breed of 'advanced manufacturers' is adding value in this manufacturing process.
- 2.3** In the pre-production phase, advanced manufacturing firms contribute value through research and development (R&D) intensity or complex planning and design work. In the post-production phase, firms contribute value-adding services that support or complement products and foster long-term customer relationships. This shift to offering manufacturing 'as a service' involves focusing on customer needs – potentially by selling a capability, process, component or solution rather than merely a finished piece of equipment.
- 2.4** In its **Sector Competitiveness Plan 2017**<sup>5</sup>, the AMGC noted that as more traditional production activities are either automated or outsourced to low-wage countries, Australia's manufacturing success will depend almost completely on its ability to compete on value rather than price. This will require firms to offer a truly outstanding product by virtue of technology sophistication and/or service.
- 2.5** World-class Australian manufacturers are already following this path – ranging from the well-known Cochlear and ResMed to national leaders such as L&A Pressure Welding and H.I. Fraser Group. The AMGC further estimates that the 'size of the prize' from improving Australia's manufacturing competitiveness could be an additional 25–35% of national output, worth \$36 billion by 2026.
- 2.6** In developing this blueprint, AMGC's starting assumption is that every Australian manufacturer has the potential to advance, compete on value and realise export opportunities. To achieve this vision, the AMGC has recommended ISA address six crucial areas within its *2030 Strategic Plan*:
- › Develop Australia's innovation culture
  - › Address skills and knowledge gaps
  - › Identify areas of comparable advantage
  - › Realise the potential of Industry 4.0
  - › Improve firm succession planning
  - › Establish transparent metrics.

2 Australian Department of Industry, Innovation and Science, Manufacturing Data Card – September Quarter 2015. Source: <https://industry.gov.au/industry/ManufacturingPerformance/Pages/ManufacturingDataCard.aspx#>

3 Office of the Chief Economist, Australian Industry Report 2016, p. 39.

Source: <https://www.industry.gov.au/Office-of-the-Chief-Economist/Publications/AustralianIndustryReport/assets/Australian-Industry-Report-2016-Chapter-2.pdf>

4 Australian Industry Group, Manufacturing strengths in April. Source: <https://www.aigroup.com.au/policy-and-research/mediacentre/releases/PMI-April2017/>

5 Source: Advanced Manufacturing Growth Centre, *Sector Competitiveness Plan 2017*, p. 8. Source: [https://www.amgc.org.au/Attachment?Action=Download&Attachment\\_id=15](https://www.amgc.org.au/Attachment?Action=Download&Attachment_id=15)

### 3. Develop Australia's innovation culture

- 3.1** Australia has largely failed to develop an innovation culture that emphasises collaboration as opposed to competition; is comfortable with experimentation (where necessary, 'failing forward'); and where new ideas and research are swiftly progressed to market. During the AMGC's roundtable sessions, CEOs observed that many Australians look to overseas examples of innovation rather than looking within their own shores. In the words of one participant, Australia has to be more than simply a quarry or a beach. *"There is no incentive to try something new, [whereas] in Israel, if you don't innovate, you die."*
- 3.2** The AMGC has heard that about 45% of Australian firms across all sectors are 'innovation active'.<sup>6</sup> This leaves a 'long tail' of firms that are not attempting to do anything new from year to year.
- 3.3** Despite limited data, the story appears similar within Australia's manufacturing sector. The AMGC's analysis of 300 small- and medium-sized Australian companies<sup>7</sup> (to be published in full later this year) found that only 4% of Australian manufacturing firms collaborated with academic researchers in pursuit of innovation in the year prior to the survey period. Only 15% invested in the ongoing development of a new good or service, and only 33% hired employees with skills in the so-called STEM (science, technology, engineering and maths) disciplines. The vast majority of Australian manufacturers also lagged in their outreach to new markets. Only one in six were exporters, and just one in four had introduced a new service or good.
- 3.4** Australia's innovation performance also lags significantly behind that of other mature economies. In Germany, South Korea and Japan – all characterised by a continuous culture of co-innovation – manufacturers fund 85–90% of total national R&D investment by all businesses.<sup>8</sup> In Australia, the equivalent figure was about 27% in 2013–14.<sup>9</sup>
- 3.5** There is a legitimate debate as to whether efforts to encourage innovation should focus on a broad or narrow base of firms. One CEO argued that the quality of innovation is more important than its quantity, stating: *"One good innovation is worth a thousand ordinary ones."* However, it was also noted that even an incremental increase in innovation among Australia's broad mass of small- and medium-sized firms has the potential to deliver big gains for the nation's economy.
- 3.6** Small- and medium-sized firms in Australia face serious innovation barriers. Most manufacturing companies are simply trying to survive from 'Monday to Friday' while battling urgent production deadlines and customer demands. This leaves them with little capacity to take on additional risk or think too far ahead in terms of updating their equipment or introducing new products and services. In the words of one CEO, *"They might have once had the ambition to grow and become world-class, but the flame flickered and burnt out. They just don't have the energy for it. They can't focus on the next overseas market when they're exposed to the next suburb."*

6 Australian Bureau of Statistics, Innovation in Australian Business 2014–15, July 21 2016. Source: <http://www.abs.gov.au/ausstats/abs@.nsf/mf/8158.0>

7 Australian Bureau of Statistics' Business Characteristics Survey. Data drawn from two panels of companies: 2009–13 and 2010–2014.

8 Organisation for Economic Cooperation and Development, *OECD Science, Technology and Industry Outlook 2014*. Available at [www.oecd.org/sti/oecd-science-technology-and-industry-outlook-19991428.htm](http://www.oecd.org/sti/oecd-science-technology-and-industry-outlook-19991428.htm)

9 Australian Department of Industry, Innovation and Science, Manufacturing Data Card – September Quarter 2015. Available at <https://industry.gov.au/industry/ManufacturingPerformance/Pages/ManufacturingDataCard.aspx#>

**3.7** The difficulty of accessing networks means that most firms don't know where to start in terms of pursuing innovation or linking to a wider science and research base. As one CEO noted, *"They simply don't know who to call. A business owner might have a great idea for an app but no idea how to get that app developed."* Another said, *"How do you even go about ringing up a university? It's a lost cause."*

**3.8** Due to the changing manufacturing value chain, large industrial players or 'primes' who are established in Australia have a direct interest in sustaining their in-country presence and supporting, and exploiting, the local innovation culture. As systems integrators, they will increasingly depend on having 'just in time' linkages with small- and medium-sized firms from whom they can source complex products. As one CEO noted, *"Most people think that Boeing is made only by Boeing. They don't see the hundreds of suppliers who sit behind it – some in Sydney, others in Geelong and places you never hear of."*

### **3.9** The AMGC recommends:

- › A stocktake occur of existing 'matchmaking' programs that help firms gain access to networks for the purposes of advice, research or funding; and further, that these programs be simplified, and improved where necessary, and their visibility increased.
- › Large firms be encouraged to further draw small- and medium-sized manufacturers into global supply chains, taking advantage of their shorter production runs and lead times.
- › New policies be introduced to attract foreign companies that commit to investing in the local supply chain from an innovation perspective.
- › Australia's R&D tax concession be recalibrated to encourage innovation activities that are geared towards commercialisation, as advocated in the recent review by Bill Ferris, Alan Finkel and John Fraser.
- › Given the fast-moving pace of technology and diminishing useful economic life of equipment, firms be allowed to depreciate their assets over a period that is shorter and more realistic than the current 10 years stipulated in the tax schedule – to benefit their cash flow and provide a greater incentive to update.
- › Existing initiatives be expanded, such as the National Collaborative Research Infrastructure Strategy, which currently helps about 50 companies each year; and the Automotive Transformation Scheme, which subsidises R&D activities and purchases of plant and equipment by eligible businesses in the Australian car industry.



## 4. Address skills and knowledge gaps

- 4.1** By 2026, the AMGC estimates that Australia's manufacturing workforce will consist of an additional 47,000 high-skill jobs involving elite design or technical expertise, as well as 31,000 more sales and service workers. By contrast, it expects there will be 55,000 fewer manual or narrowly focused production roles in the lower-skill bracket.
- 4.2** Upskilling Australia's existing manufacturing workforce and increasing the supply of STEM labour by encouraging more young people into the STEM disciplines are vital to ensuring that sufficient numbers of people are trained to handle the jobs of tomorrow. As part of this necessary workforce transformation, critical knowledge gaps must be addressed within the nation's manufacturing base. These cover areas such as robotics and automated production; materials and composites; digital design; supply chain simulation and optimisation; biomanufacturing, nanomanufacturing, micromanufacturing and precision manufacturing; and virtual reality. These are the very fields that will determine Australian manufacturing's ability to advance, compete on value, rather than on cost, and engage with export markets in the future.
- 4.3** Mitigating against this, Australian manufacturing has an image problem. One CEO roundtable participant said, *"It's not perceived as cool and trendy. All the kids want to leave university and become software developers."* It was also noted that graduates may wrongly see manufacturing as a 'dying industry' – overlooking the trend of merging physical things with the cyberworld (Internet of Things), and this complicates the task of attracting new talent.
- 4.4** Insufficient aggregate opportunities for STEM-related labour (STEM demand), at this early stage of manufacturing's ongoing transformation, is another problem that has received less attention than STEM supply. Australia has only a limited number of large manufacturers that are able to recruit people through training schemes and internships – and few are willing to take a gamble on new hires for innovation-related activities. In the words of one CEO, *"Australia not only needs a supply of STEM skills, but also a greater demand for STEM. Building the workforce of the future requires a combination of push and pull factors – we need both horses running in parallel."*
- 4.5** The innovation ambitions of Australian manufacturers rely on having access to a mix of domestic and global sources of talent, knowledge and capital. If international students attending leading Australian research centres are permitted to return to their country of origin, their intellectual property goes with them.
- 4.6** Several CEOs were also highly critical of the federal government's recent changes to the laws governing the hiring of foreign labour, including the elimination of 457 visas. According to one: *"It's just nonsense – if we're in a global economy with connected supply chains, we need not only goods and services but also skills to move freely."* Another CEO noted, *"I couldn't contribute to Australia's economy without 457 – this is what brought me and my family here."*
- 4.7** The AMGC recommends:
- ▶ Detailed modelling be conducted to estimate Australia's workforce needs by 2030 across all sectors. The AMGC stands ready to share its methodology how it is modelling the manufacturing sector.
  - ▶ The government amend the key performance indicators and funding applied to universities to incentivise better engagement and collaboration with industry, ensuring that more graduates emerge with workforce-relevant skills.
  - ▶ Innovative strategies be considered to improve the supply of, and demand for, STEM-related labour, as well as to upskill Australia's existing manufacturing workforce over a ten-year projection.
  - ▶ The government encourage international students to remain in Australia, and reverse any policies that reduce manufacturers' flexibility to hire a mix of local and international labour to address skills gaps and thereby harming Australia's global competitiveness.

## 5. Identify areas of comparable advantage

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**5.1** Australia can take advantage of its natural assets or other areas of existing strengths in pursuing ambitious initiatives or 'moon shots'. According to one CEO: *"If we're trying to be good at everything, we don't have the luxury."*

**5.2** Several CEOs suggested that Australia identify areas of comparable advantage, assess key enablers and attempt to stimulate future growth. For example, an obvious opportunity for Australia would be to leverage its abundant mineral resources, including lithium, cobalt, vanadium and titanium, to create a local innovation ecosystem for the fast-growing electric car industry. One CEO argued, *"We should be developing a vision around industries like this instead of just shipping those raw materials out."*

**5.3** Another CEO highlighted the illogicality of Australia exporting lithium, allowing nations such as Malaysia to make lithium batteries, and then buying those batteries back. He said a better alternative would be to harness Australia's potential as a manufacturer of electrical power storage solutions. This should include concerted efforts to attract foreign investment. *"Tesla's Elon Musk is building a massive battery Gigafactory in Nevada – let's get him to build a second one here."*

### **5.4** The AMGC recommends:

- › A select number of 'moon shot' innovations be identified and supported, with a particular focus on areas where Australia's mineral resources give it an advantage over international competitors.

## 6. Realise the potential of Industry 4.0

- 6.1** The digitalisation of the economy offers great opportunities for Australia, making its traditional geographic distance from world markets less relevant. This is particularly the case with respect to Industry 4.0/ Internet of Things technologies that leverage new digital and machine learning techniques into the production process. This involves combining manufacturing machines with cloud services and Internet of Things sensors to create a so-called 'smart factory'. One of the most exciting innovations is 3D printing, which allows goods to be produced anytime and anywhere.
- 6.2** The AMGC is committed to collaborating with Swinburne University of Technology's Manufacturing Futures Research Institute, and other institutions, with respect to testing next-generation Industry 4.0 initiatives. The AMGC is also a member of the Prime Minister's Industry 4.0 Taskforce, which is working towards the launch of a national test lab network.
- 6.3** Nonetheless, CEO roundtable participants expressed concern that Industry 4.0 is not sufficiently accessible for Australian manufacturing firms. Rather than looking for a 'big bang' impact, companies should see its looming emergence as an opportunity to reassess their existing assets and operating environments, and consider how to better serve customers. According to one CEO: *"Manufacturers need to work out the actual business problems they want to solve for Industry 4.0 first. In a real factory environment, what aspects are you actually going to connect to the internet? That is the answer most small- and medium-sized enterprises don't have yet."*
- 6.4** The current debate about Industry 4.0 in Australia makes it seem like a new modus operandi that is reserved for large manufacturers and equipment providers, as well as factories that are already somewhat automated and technologically advanced. It should also be emphasised that small- and medium-sized firms also stand to leapfrog their competitors from upgrades that can involve a relatively modest capital investment.
- 6.5** The AMGC recommends:
- › Efforts be accelerated to create a national network of 'living labs' that are designed to demonstrate promising Industry 4.0 use cases and invite small- and medium-sized enterprises to explore and access Industry 4.0 applications.
  - › A nationwide information strategy be devised, with support from relevant industry and government bodies, and backed by necessary funding, to make resources available to Australian firms to demystify the concept of Industry 4.0 and help them understand potential business opportunities.

## 7. Better firm succession planning

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- 7.1** Australian manufacturing faces a looming succession problem. This is occurring as the original founders of small- and medium-sized firms retire and their children seek alternative careers. This is making it hard for businesses to continue. According to one CEO: *“They ran their business well and have retained significant value – but many will have to close their doors because they don’t have a buyer.”*
- 7.2** Some ageing firms are struggling to adapt to globalisation, and technological and market change. One CEO noted that *“they have a lot of old stuff sitting around that could be reenergised”*. These firms need assistance to recapitalise and transition to the new era of advanced manufacturing. This might involve futureproofing themselves by digitising aspects of their production that previously required manual processes, or installing sensors to better manage their physical assets and pre-empt failures. Critically, apprentices, and university graduates, can provide a valuable link to new thinking for firms facing succession difficulties.

### **7.3** The AMGC recommends:

- › Strategies be considered to help established small- and medium-sized Australian manufacturers extend their businesses and connect with prospective partners who can help them succeed in the new global economic environment.

## 8. Establish transparent metrics

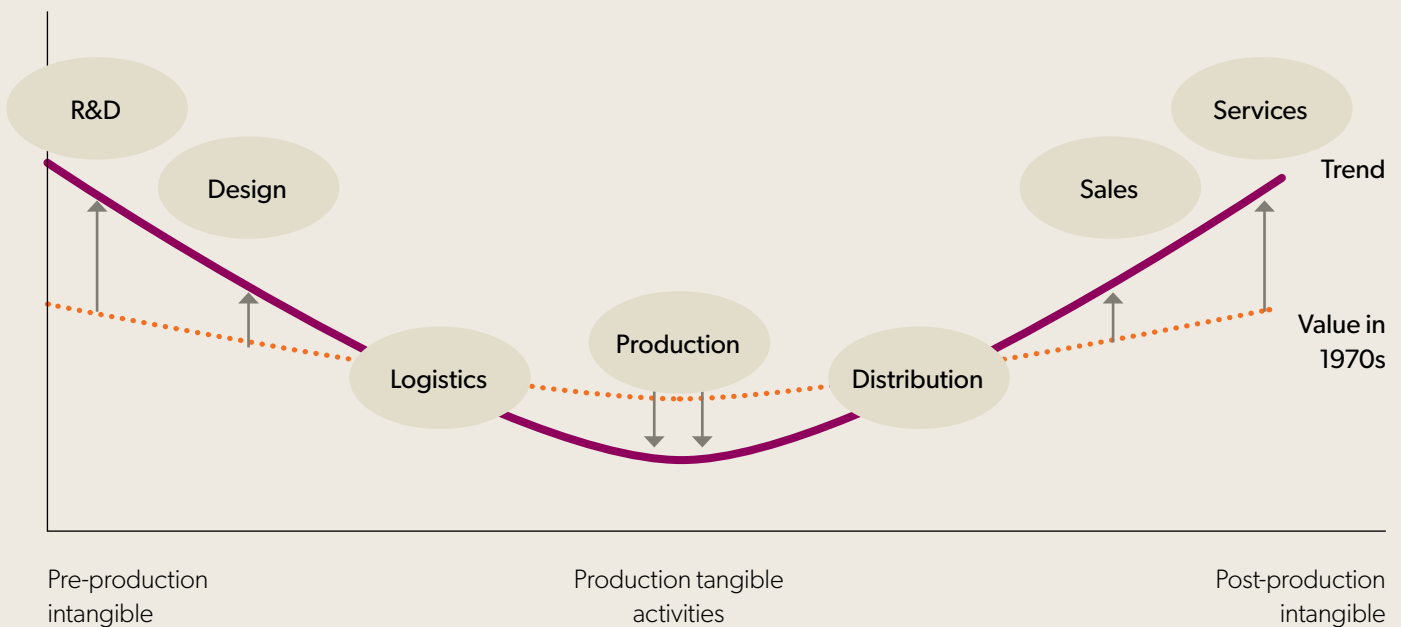
- 8.1** Finally, establishing the sources of Australia's future economic prosperity depends on having clear measurements of the contributions made by each sector. The AMGC contends that this is a particular challenge for manufacturing, as reports of job losses are being exaggerated and many shifted manufacturing jobs are not even being captured in official statistics.
- 8.2** Today, many non-production roles within the manufacturing process are being outsourced: everything from product design and materials engineering to purchasing and customer service. Workers in these roles might once have been directly employed by manufacturing companies. However, many are now employed by supporting companies – and treated for counting purposes as belonging to the services sector. Modelling by the AMGC indicates that these workers comprise an additional 340,000 people, taking the number of jobs to approximately 1.2 million that directly or indirectly rely on manufacturing.
- 8.3** A second issue relating to metrics is that the federal government, for the time being, is not able to capture the full extent of 'advanced manufacturing' activity within the economy. The current approach, used by the Australian Bureau of Statistics (ABS), relies on classifying manufacturing sub-industries as either 'advanced' or 'basic', depending on what is produced. Accordingly, the scope of advanced manufacturing is limited to a select number of Australian and New Zealand Standard Industrial Classification (ANZSIC) codes.
- 8.4** This fails to reflect the fact that many successful companies with advanced characteristics operate in so-called basic industries. One CEO participant even suggested that the ABS develop a statistical model based on what roles and responsibilities Australian manufacturers are currently recruiting for – for example, people with machine learning skills – and to redevelop the ANZSIC system. Another CEO noted, *"we need to acknowledge that advancement in manufacturing is now more along the lines of 'how' we make things and not only 'what' we make."*
- 8.5** The AMGC recommends:
- › **New metrics be developed to ensure that manufacturing job losses are not exaggerated and that the true extent of sector activity is captured transparently and fairly.**

## 9. Next steps

For further comment on the issues raised in this submission, please contact Dr Jens Goennemann, [jens.goennemann@amgc.org.au](mailto:jens.goennemann@amgc.org.au)

## Appendix: the new manufacturing value chain<sup>10</sup>

### Value added, illustrative



<sup>10</sup> Advanced Manufacturing Growth Centre, *Sector Competitiveness Plan 2017*, p. 8. Source: [https://www.amgc.org.au/Attachment?Action=Download&Attachment\\_Lid=15](https://www.amgc.org.au/Attachment?Action=Download&Attachment_Lid=15)





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