# ADVANCED MANUFACTURING

## A NEW DEFINITION FOR A NEW ERA

> By focussing on innovation through R&D, use of state of the art technology and smart business models the AMGC has clearly demonstrated that a new Advanced Manufacturing future is within Australia's grasp.
>
> **Dr Keith McLean**, Director Manufacturing, CSIRO

> D+I believe that the future success of Australian manufacturing depends on its ability to embrace innovative design and technology. This report, and the work of the AMGC in general, provide valuable support and guidance for any manufacturer committed to implementing innovative design and technology in their business.
>
> **Murray Hunter**, Founder, Design + Industry

> AMGC debunks the gloomy prospects seen in mainstream media to provide with success stories, insights and paths for Australian manufacturers, no matter their size or sector. It gives the end-to-end supply chain the place it deserves as a value enabler that supports advanced manufacturing – in its modern definition.
>
> **Thomas Vandenbogaerde**, Director, Freelog Australia Pacific

> This report defining the meaning of Advanced Manufacturing is long overdue and I applaud the initiative of the AMGC in tackling this project.
>
> **Geoff Crittenden**, Chief Executive, Welding Technology Institute of Australia

> We will not survive competing on cost & we will not survive competing amongst ourselves, but, we will thrive by aligning our excellence across the nation and competing on the global stage. The AMGC understands this and proactively connects and enables our pockets of excellence to advance and position the entire sector with this globally competitive edge.
>
> **Dr Nathan Kirchner**, Future Robotics Lead, Laing O'Rourke – Engineering Excellence Group

The AMGC acknowledges input and support from the Australian Government Department of Industry, Innovation and Science for this report.

This AMGC report provides more clarity by focusing on the niche manufacturing activities and the value add manufacturing service offerings that necessarily surround the production. I believe this broader and frankly more exciting narrative will capture the imagination of the current generation of Australian government and industry leaders, as well as the next generation of manufacturers.

**Chris Williams**, Managing Director, HiFraser Group

MHG Asia Pacific's vision is to manufacture a better tomorrow than today. It also speaks to the impact that a strong and vibrant manufacturing sector has on our nation's long term prosperity and the opportunities this creates for future generations. We applaud AMGC's efforts in this space and fully support the recommendations in this report.

**Dean Haritos**, Group Managing Director, MHGroup

I was very impressed with the depth of thought and coverage of the topic and especially how it relates to Australian Manufacturers.

The employment opportunities created within manufacturing and leveraged by training, consulting and marketing professionals will follow at a level commensurate with manufacturing growth.

**Neil Wilson**, Managing Director, Romar Engineering

CSR welcomes the AMGC initiative in defining a new era in which manufacturing in Australia adopts principles which reach well beyond just production. CSR is pleased to see that AMGC has recognised the importance of knowledge. CSR employees understand that knowledge is particularly beneficial when it is shared with our customers, our suppliers and the industry.

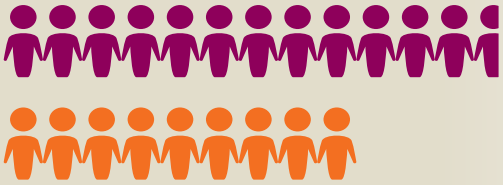
**Bill Thompson**, Research and Development Manager, CSR Building Products

An insightful report for manufacturers on where they should focus their business and digital transformation initiatives across the extended manufacturing value chain to become truly advanced, remain competitive and deliver new outcomes through the digital disruption cycle.

**Bruce Sneddon**, DXC Technology – Manufacturing

## Australian manufacturing is larger and more diverse than thought

Supporting
**1,27 million** jobs in both its workforce and the inputs it purchases

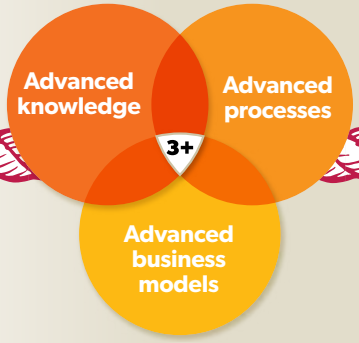




vs. the **905,000** currently counted by the ABS

## Being advanced is not *what* a manufacturer makes, but *how*

A manufacturer is more advanced when it uses




[based on an analysis of 3,000 global companies]

## Australian manufacturers need to compete on value, not on cost

Investment in innovation, modern machines and trade is highly concentrated

**5%** of companies make up **99%** of the industry's export value

# Every single manufacturer in Australia has the potential to be advanced

# FOREWORD

When you ask ten people what is Advanced Manufacturing, you'll probably end up with eleven different answers. The team at the Advanced Manufacturing Growth Centre (AMGC) found it was about time to bring well substantiated clarity to the matter. With this report, *Advanced Manufacturing, a new definition for a new era*, we demystify what it means to be an advanced manufacturer.

One common misperception of our industry, supported by current measurements, points to a narrow view of advanced manufacturing and it excludes the so-called traditional sectors. However, backed by our analysis and reason, we can unequivocally argue that being advanced relies little on what you make but how you make it.

This report offers a comprehensive view on Australian manufacturing. We demonstrate that manufacturing is more than production. Manufacturing today comprises of R&D, design, supply chain and logistics, mass customised goods, post-sales support and services.

Australia has advanced manufacturers across the entire spectrum – from textiles to welding to medical technology and aerospace. Companies across all areas can innovate and compete through offering exceptional technical solutions or services, making them less dependent on pure production.

Our sector has grown to almost 1.3 million manufacturing employees, representing close to 10 per cent of the Australian workforce when considering the entire value chain of manufacturing activities.

We believe that transforming our industry to become more advanced must be led by industry. Transformation can be achieved through implementing one or a combination of the following traits:

**Advance knowledge:** continuously innovate with a high degree of R&D investment.

**Advance process:** focus on using state-of-the-art technology, become familiar with digitalisation.

**Advance business model:** offer niche solutions, often highly customised and highly valuable.

A consistent theme throughout this report echoes our earlier research, the AMGC's 2017 *Sector Competitiveness Plan* – to compete on value, not on cost. Our definition of advanced manufacturing reinforces this message.

A new era of manufacturing requires a new definition to accurately measure where we stand and how we benchmark our progress. We have learnt through our analysis that our sector is larger and more dynamic, yet there remains ample opportunity to grow.

I believe this report captures the true nature of our sector and celebrates the potential for every Australian manufacturer to be advanced.

**Dr Jens Goennemann**
**Managing Director**
Advanced Manufacturing Growth Centre Ltd

# EXECUTIVE SUMMARY

## INTRODUCTION

Manufacturing is undergoing a historic transformation across the industrialised world. Firms are creatively diversifying their focus across different stages of the manufacturing process, both before and after goods are produced. As production activities are gradually being outsourced to developing countries offering cheap labour, more Australian manufacturers are recognising the need to compete on value rather than cost. Most commonly, this involves contributing innovative products, components or services within global supply chains.

It is against this background that AMGC seeks to provide a more contemporary understanding of manufacturing in Australia and to clarify the definition of an 'advanced manufacturer'. Building on the directions contained in AMGC's Sector Competitiveness Plan, this will more accurately capture the sector's overall role in Australia's economy and form a credible basis for ongoing policy, regulatory and funding reform. AMGC is also keen to guide local firms seeking to reinvent themselves and seize new opportunities along the value chain. Every single manufacturer in Australia has the potential to be advanced.

## TOWARDS A NEW DEFINITION

Advanced manufacturing is currently defined by the Australian Government as "any manufacturing process that takes advantage of high-technology or knowledge-intensive inputs as an integral part of its manufacturing process". The Government further stipulates that advanced manufacturing includes chemical and medicinal manufacturing, as well as vehicle and transport, professional and scientific equipment, computer and electronic, and specialised machinery and equipment manufacturing. However, AMGC's analysis of more than 3,000 global manufacturing companies finds that belonging to a certain sub-industry, whether or not it is officially classified as 'advanced', says little about a company's ability to complete and remain profitable in an increasingly challenging market environment. This means it may be time to update and expand the current definition of what it means to be an advanced manufacturing firm. A starting point would be to recognise that manufacturers across the developed world succeed not because they make certain products, but because they have adopted sophisticated business models and production techniques. They typically use a combination of three factors to remain competitive: advanced knowledge, advanced processes and advanced business models.

A new, broader definition of advanced manufacturing would focus on the sophistication of businesses, rather than on the products they make. It would emphasise that there is no hard line separating advanced manufacturers from others and recognise that there could be degrees of advancement in every single sub-industry, not just in some.

Under this new approach, an apparel manufacturer, a typical business operating outside the ABS' current classification of "advanced manufacturing" industries, could still be considered advanced if it employs innovative production techniques and business strategies. For example, a manufacturer that uses 3D printing technology, a high level of automation, or customises its products to a niche market segment would - under the new definition proposed in this report - qualify as an advanced manufacturer. Another benefit of defining manufacturing more broadly is to include workers along the value chain in research and development (R&D) and design, logistics, and sales and service occupations. These are people who serve manufacturing indirectly but are now employed in supporting companies. Properly accounting for them increases the size of Australia's direct and indirect manufacturing workforce to an estimated 1.27 million: significantly more than the 905,000 currently counted by the Australian Bureau of Statistics (ABS).

## THE CHARACTERISTICS OF SUCCESSFUL MANUFACTURERS

Chapters 2 to 4 of this report translate this revised understanding of manufacturing into practical guidance for Australian firms and government. Using the latest Compustat and ABS Business Longitudinal Analysis Data Environment (BLADE) business survey data, AMGC's analysis of successful global and Australian manufacturers finds they share a range of advanced characteristics.

- **Advanced knowledge:** successful manufacturers tend to be *innovation leaders*, scoring highly on measures such as R&D spending, information and communication technology (ICT) intensity, patent portfolio size, employee qualifications and research collaboration.
- **Advanced processes:** many successful manufacturers are also *process winners* who make smarter use of technology, scoring highly on measures such as capital intensity, use of automation, energy and water efficiency, and having newer equipment.
- **Advanced business models:** finally, successful manufacturers tend to lift the value of their products by acting as *niche market players* or *service champions*, scoring highly on measures such as trade intensity, linkages with other firms and greater share of services in total revenue.

## RECOMMENDATIONS FOR COMPANIES

The development of an empirically robust profile of successful manufacturers should significantly inspire Australian firms. There is a golden opportunity to pick one or more areas of focus and seek to advance by emulating best practice traits. Manufacturers should closely examine their current business models, strengths and growth prospects. AMGC's qualitative and quantitative research further indicates that they would do better to concentrate on improving their performance on a small number of advanced metrics, rather than progressing on all characteristics simultaneously.

Most Australian manufacturers have considerable room to grow in developing advanced characteristics. Currently, just 5% of firms drive 94% of the sector's entire capital spending and 54% of its entire R&D spending. This group are responsible for virtually all the nation's manufacturing exports. BLADE data covering the 2014–15 period further shows that upwards of 80% of Australian manufacturers could break new ground to collaborate with academic researchers, increase their ICT spend, introduce a new product-related service or use patents to protect their novel ideas.

> Currently, just 5% of firms drive 94% of the sector's entire capital spending and 54% of its entire R&D spending.

## RECOMMENDATIONS FOR GOVERNMENTS

It is vital that Australia moves boldly into a future typified by sustainable, high-value-added manufacturing. The nation must also accurately monitor the impact of manufacturing activities on other industries in an increasingly service-based economy. Based on the findings contained in chapters 1 to 3, AMGC recommends three urgent actions:

- **Developing a new statistical tool to track whether Australian manufacturers are advancing.** Alongside traditional metrics such as output, jobs and exports, this would monitor short- and medium-term changes in the prevalence of key advanced characteristics among Australian firms, such as R&D intensity, patent use, collaboration, relative wage levels, ICT expenditure, capital intensity, new goods or services, new marketing or operational processes, and trade intensity.
- **Changing how Australia's manufacturing output and jobs growth are reported.** Official data on Australian manufacturing should fully capture all activities linked to the sector, instead of disaggregating the value chain and counting ancillary functions as part of 'services'. The United States Bureau of Labor Statistics, which constructs annual employment tables for 168 sub-industries, provides an example of how to measure manufacturing jobs and output that are created both directly and indirectly.
- **Better target industry assistance.** Governments should ensure that business capability-building initiatives are designed to increase the prevalence of traits associated with more advanced and successful companies. Evaluation criteria should be adjusted accordingly for programs offering financial incentives or support. Initiatives that could be better targeted include the Entrepreneurs' Programme; Industry Skills Fund; Education and Training Advisors; Innovation Connections; the R&D Tax Incentive; the Cooperative Research Centres Programme; the Tradex Scheme; venture capital programs; and state-based industry assistance funds.

Australian Government
Department of Industry, Innovation and Science

Industry Growth Centres