



Manufacturing and Engineering Industry Reference Committee (IRC)

MEM05 - Metal and Engineering Training Package

MEM - Manufacturing and Engineering

MSA07 - Manufacturing Training Package

IRC Skills Forecast and Proposed Schedule of Work 2017-2021

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www.ibsa.org.au

manufacturing@ibsa.org.au

(03) 9815 7099

Level 11, 176 Wellington Parade,
East Melbourne, Victoria, 3002



Prepared on behalf of the Manufacturing and Engineering IRC for the Australian Industry and Skills Committee (AISC)

IRC Skills Forecast and Proposed Schedule of Work 2017-2021

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IBSA also acknowledges the September 2016 Four Year Work Plan, produced by Manufacturing Skills Australia (MSA), on which this version is based.



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Executive Summary

The Manufacturing and Engineering Industry Skills Forecast and Proposed Schedule of Work, links the sector trends, workforce skill priorities and training plan to effectively meet the future skill needs of this sector in transition by:

- providing an understanding of the industry including its primary activities, its size and sub sectors, type and location of employers, and opportunities and challenges (*Sector Overview*);
- outlining the critical workforce challenges and opportunities (*Employment*);
- forecasting future skills priorities by describing trends in workplace and job design (*Skills Outlook*); and
- proposing and prioritising training product development and review activities (*Training Product Review Plan*).

This April 2017 update to the Manufacturing and Engineering Industry Skills Forecast and Proposed Schedule of Work augments the earlier work plan submitted in September 2016 with an executive summary, incorporation of updated priorities for training product development and review following recent consultations with the Manufacturing and Engineering IRC and State Training Authorities.

What is the manufacturing and engineering industry?

The manufacturing and engineering industry comprises diverse sectors that include all of the people who conceive, design, make, assemble, install, repair, package and sell manufactured products. The machinery and equipment repair and maintenance service sectors reflect the greatest number of businesses that are under the coverage of the manufacturing and engineering training package.

The major hubs for the manufacturing and engineering industry are located on the eastern seaboard with the industry dominated by non-employers and small businesses. Restructuring continues with transitioning to leaner business models, investments in advanced technologies and large businesses focusing on core business. Accompanying this restructuring has been a decline in the number of workers.

Opportunities for sectors vary with ship building expected to reap benefits from the 2016 Defence White Paper and professional and scientific equipment manufacturing predicted to continue to grow through innovations in product and technology. Fabricated metal product manufacturing has been impacted by China's rapid growth and now slowing economy, while electrical equipment manufacturing has seen the closure of domestic manufacturers and a move to offshore manufacturing by large international companies. Advanced manufacturing using new business processes and new technologies and additive manufacturing is providing major opportunities for the industry.

The cost and availability of energy is providing a challenge as well as an opportunity for renewable energy infrastructure such as battery storage.

Variations between international, national and jurisdictional licenses and regulations are reported to impede on businesses operating nationally and globally.

Critical workforce challenges and opportunities

Significant workforce supply challenges exist including:

- managing an ageing workforce with the associated loss of institutional knowledge and technical skills;

- attracting and retaining suitable new entrants with the required foundation and STEM skills;
- upskilling experienced workers in sophisticated new technologies and processes that improve productivity, efficiency and business sustainability; and
- accessing training providers with qualified trainers able to train in new technologies.

Employers raised workforce supply side opportunities to align synergies between the skills of displaced automotive mechanical work and heavy diesel engineering and manufacturing and structural steel production and construction.

Forecasting skills priorities

The skills priorities have been informed by international and national trends and stakeholder feedback.

Workplace and job design are being impacted by technology which continues to revolutionise automation and requires workers to develop new skills and ways of working including those around 'lean' and sustainability. The advent of the internet of things allowing machine to machine communications and real time remote monitoring is driving smart manufacturing requiring digitally literate workers who can analyse and respond to data.

Computer Aided Design (CAD), Computer Aided Manufacturing (CAM) and CNC machining as well as coding and design skills are expected to be in demand. Engineering drafting is expected to grow in demand for steel construction and welding and skills in non-destructive testing (NDT) which applies to multiple sectors is also growing in demand.

Training Package priorities

The Training Package Review Plan 2017-18 to 2020-21 was developed by the IRC with support from IBSA Manufacturing based on identified industry trends. This plan lists the priorities over the next four years, the rationale for these priorities, and the proposed scope and timeframes for these activities.

The items identified as critical and proposed for inclusion as a priority for the 2017-2018 schedule of work are:

- **Welding** - Development of new qualifications and standards for Welding to meet the emerging needs of Welding Supervisor and Welding Inspection occupations.
- **Welding** - Restructuring the hierarchy of welding Units of Competency and Qualifications leading to the higher-level welding processes and standards associated with advanced and coded welding standards.
- **Non-destructive testing** - New Qualifications and standards to reflect contemporary non-destructive testing hierarchies and emerging forms of testing and associated work organisation and job design.
- New qualifications and standards associated with training package gaps to cover engineering and technical work associated with:
 - **planning and scheduling**
 - **supply chain management**
 - **logistics**
 - **quality systems management, including through the supply chain**
 - **configuration management**
- **Trainer/Supervisor/Coordinator** - Development of standards/post qualification Skill Sets/Qualifications associated with the Trainer/Supervisor/Coordinator classifications in the Manufacturing & Associated Industries & Occupations Award 2010.

The IRC Skills Forecast and Proposed Schedule of Work 2017-18 to 2020-21 table provided at the end of this document lists the priorities for subsequent years.

Administrative Information

Name of Industry Reference Committee (IRC): Manufacturing and Engineering IRC

Skills Service Organisation (SSO): Innovation & Business Skills Australia (IBSA Manufacturing)

Sector Overview

Manufacturing and Engineering - Snapshot of the industry

The manufacturing, engineering and boating sector is a diverse sector that covers over 25,928 businesses¹ employing 355,900 people². It includes all the people who conceive, design, manufacture, assemble, install, repair, package and sell manufactured products. Many people with metal and engineering skills also work in many other areas, including building and construction, mining, agriculture, health, food, hospitality and other manufacturing sectors who are not included in the statistics above. The manufacturing, engineering and boating sector has been active in reshaping itself over the last decade and has embraced new technologies, innovation and more efficient production practices.

The major hubs for the manufacturing and engineering industry are located in two states, New South Wales and Victoria, with Queensland being the only other state of significance. Within the industry there are some variations on this pattern. For example, in the area of nickel and other non-ferrous metal manufacturing, the hubs for industry are largely located in the less populous states, with Western Australia accounting for around 75% of Australia's revenue from non-ferrous smelting.³

Shipbuilding and boatbuilding - Snapshot of the industry

Riviera Australia is the leading company within the boatbuilding sector. The sector has experienced downturn in profitability over the past five years and with it an increase in employee turnover. Like other sectors it has been impacted heavily by competition from lower cost imports and current global uncertainty. IBISWorld predicts that these conditions will continue over the next five years.⁴

By contrast, the shipbuilding sector is expected to experience a resurgence with the awarding of significant Defence contracts recently. The main beneficiary of these contracts will South Australia. There is expected to be a flow on effect to other states due to the size of the contracts.⁵

The major hubs for ship and boatbuilding are located in three states, Queensland, New South Wales, and Western Australia, accounting for 75% of the industry.⁶ Other major shipbuilders are located in South Australia, where ASC

¹ Australian Bureau of Statistics. Counts of Australian Businesses, including entries and exits, 2014-15.

² Australian Bureau of Statistics, 2016. Labour Force Australia, detailed, quarterly. May 2016. Note: figure quoted is for ANZSIC subdivisions 21, 22, 23 and 24 which includes classes not covered by this Training Package. For further detail see specific entries in this report.

³ IBISWorld, various.

⁴ IBISWorld, 2016, C2392 Boatbuilding and repair in Australia

⁵ Grattan, M, 2016, French firm DCNS wins \$50 billion submarine contract, The Conversation, <http://theconversation.com/french-firm-dcns-wins-50-billion-submarine-contract-58409>

⁶ IBISWorld, Ibid and IBISWorld, C2391 Shipbuilding and repair in Australia

currently employ 2,600 men and women to work on submarines and warships⁷, and Victoria with BAE Systems shipyard in Williamstown, Melbourne.

According to the CSIRO⁸, manufacturing contributes the following to the Australian economy:



Sectors included in this infographic are design and production of textiles, wood-based products, chemicals, polymers, machinery and equipment.

Qualifications available in MEM05 and the MEM Manufacturing and Engineering Training Packages

- MEM10105 Certificate I in Engineering
- MEM10205 Certificate I in Boating Services
- MEM20105 Certificate II in Engineering
- MEM20205 Certificate II in Engineering - Production Technology
- MEM20305 Certificate II in Boating Services
- MEM20413 Certificate II in Engineering Pathways
- MEM30105 Certificate III in Engineering - Production Systems
- MEM30205 Certificate III in Engineering - Mechanical Trade
- MEM30305 Certificate III in Engineering - Fabrication Trade
- MEM30405 Certificate III in Engineering - Electrical/Electronic Trade
- MEM30505 Certificate III in Engineering - Technical

⁷ ASC, 2016, ASC welcomes Future Submarine announcement, 26 April, <http://www.asc.com.au/en/News-Media/Latest-News/ASC-welcomes-Future-Submarine-announcement/>

⁸ CSIRO Futures, 2016. Australia 2030 – Navigating our uncertain future, May 2016 <http://www.csiro.au/en/Do-business/Futures/Reports/Australia-2030>.

- MEM30605 Certificate III in Jewellery Manufacture
- MEM30705 Certificate III in Marine Craft Construction
- MEM30805 Certificate III in Locksmithing
- MEM30905 Certificate III in Boating Services
- MEM31010 Certificate III in Watch and Clock Service and Repair
- MEM31112 Certificate III in Engineering - Composites Trade
- MEM31215 Certificate III in Engineering - Industrial Electrician
- MEM40105 Certificate IV in Engineering
- MEM40205 Certificate IV in Boating Services
- MEM40311 Certificate IV in Advanced Jewellery Manufacture
- MEM40412 Certificate IV in Engineering Drafting
- MEM50105 Diploma of Engineering - Advanced Trade
- MEM50212 Diploma of Engineering - Technical
- MEM50311 Diploma of Jewellery and Object Design
- MEM60112 Advanced Diploma of Engineering
- MEM60211 Advanced Diploma of Jewellery and Object Design
- MEM80112 Vocational Graduate Diploma of Engineering

Qualifications available in MSA07 Manufacturing Training Package

The MEM IRC is considering a request to transfer the following Manufacturing Technology qualifications from MSA07 to the MEM Manufacturing and Engineering Training Package.

- MSA30208 Certificate III in Manufacturing Technology
- MSA40108 Certificate IV in Manufacturing Technology
- MSA50108 Diploma of Manufacturing Technology
- MSA60108 Advanced Diploma of Manufacturing Technology

These qualifications are used across a broad range of businesses in the manufacturing industry. The considerations of the MEM IRC will include opportunities to rationalise potential duplication.

Business numbers and size

Information is gathered using the Australian and New Zealand Standard Industrial Classification (ANZSIC) system.

The manufacturing, engineering and boating industries are classified in the following subdivisions in Division C:

- Subdivision 21 – Primary Metal and Metal Product Manufacturing (excluding classes related to metal refining)
- Subdivision 22 – Fabricated Metal Product Manufacturing
- Subdivision 23 – Transport Equipment Manufacturing (excluding group 231 – Motor Vehicle and Motor Vehicle Part Manufacturing and class 2394 – Aircraft Manufacturing and Repair Services).
- Subdivision 24 – Machinery and Equipment Manufacturing

The industries also include the following classes in Division S – Other Services⁹:

- Class 9421 - Domestic Appliance Repair and Maintenance
- Class 9422 - Electronic (except Domestic appliance) and Precision Equipment Repair and Maintenance
- Class 9429 – Other Machinery and Equipment Repair and Maintenance
- and some sections of Class 9499 Other Repair and Maintenance not elsewhere classified

There is also significant overlap with other industries as people holding qualifications primarily from the manufacturing, engineering and boating industries can be found working in a variety of occupations and industries.

⁹ Australian Bureau of Statistics Australian and New Zealand Standard Industrial Classifications 2006, [http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/19C21C5659BCAE73CA2574C8001474E4/\\$File/12920_2006.pdf](http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/19C21C5659BCAE73CA2574C8001474E4/$File/12920_2006.pdf)

These people are often classified as maintenance persons or production technology workers. An example of this crossover can be seen in the new modern awards such as the Sugar Industry Award 2010 classifications, in particular Clause 39.4 – 39.17¹⁰.

The boatbuilding and shipbuilding industries are also classified in subdivision 23 Transport Equipment Manufacturing – Group 239; Class 2391 Shipbuilding and Repair Services and Class 2392 Boatbuilding and Repair Services. The manufacture of sails however is included in Class 1333 Cut and Sewn Textile Product Manufacturing and covered by the MSF Furnishing Training Package.

There is overlap with the automotive industries in that marine engines are included in the automotive retail, service and repair sector. Statistics relating to the boating industry may not be differentiated in the ABS data.

Note: Unless otherwise stated the data included in this IRC Skills Forecast and Proposed Schedule of Work is for the ANZSIC subdivisions listed above. MSA used as its main data sources, the latest statistics available from the Australian Bureau of Statistics (ABS) and the National Centre for Vocational Education Research (NCVER). This may result in variations between data collected.

The manufacturing, engineering and boating industries – business numbers and size

The ABS publishes 'Counts of Australian Businesses, including Entries and Exits' annually. Data is sourced from the Australian Bureau of Statistics Business Register (ABSBR). Businesses have been classified by the number of employees.¹¹

At the end of June 2009 there were 28,469 businesses operating in Australia within the manufacturing and engineering industries¹². Shipbuilding, boatbuilding and associated repair services added a further 2,611 businesses. There were also 1,562 jewellery and silverware manufacturing businesses.

A further 14,658 businesses supplied a variety of repair and maintenance services.

The majority of businesses were either non-employers (that is, they hadn't submitted an Income Tax Withholding (ITW) statement to the Australian Tax Office (ATO) for five consecutive years) or small businesses employing between 1 – 19 people¹³.

Note: In the charts on the following page, only data relating to the Manufacturing and engineering industries has been used. The other industries are discussed later in this document.

At the end of June 2015 there were 25,928 businesses operating in the manufacturing and engineering industry.¹⁴ This is a decrease of approximately 9% in business numbers over the five-year period from June 2011. Across the majority of sectors, New South Wales, Victoria and Queensland consistently have had the most number of businesses over the last five years.

¹⁰ Fair Work Commission, Modern Awards, MA000087 Sugar Industry Award 2010 https://www.fwc.gov.au/documents/documents/modern_awards/award/MA000087/default.htm

¹¹ Australian Bureau of Statistics, 2010, Counts of Australian Businesses including entries and exits, 2008-09

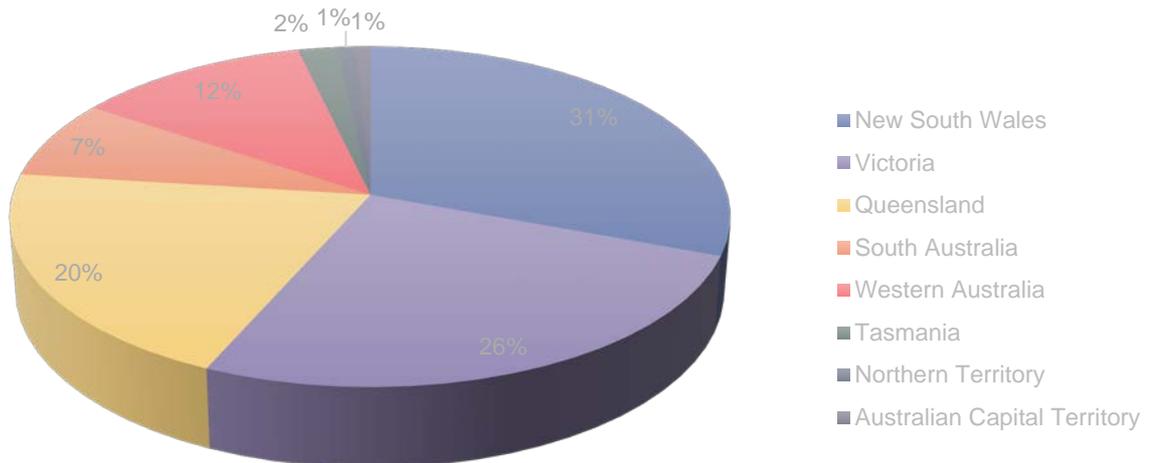
¹² Australian Bureau of Statistics, Ibid

¹³ Australian Bureau of Statistics, Ibid

¹⁴ Australian Bureau of Statistics, 2016, Counts of Australian Businesses, including entries and exits, 2014-15

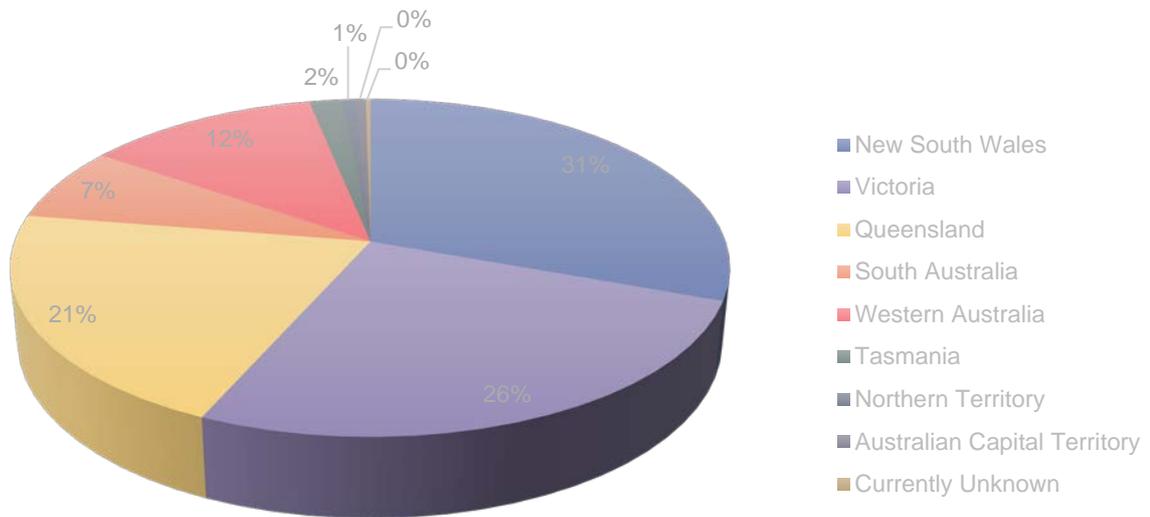
As evidenced in the tables on pages 10-29, since 2009 the industry has seen significant restructuring that has led to a decline in employment numbers. Many large companies have divested themselves of non-core or less profitable business units, transitioned to leaner business models, or invested in advanced technology.

Manufacturing and engineering industries, Australia Business numbers by state June 2009



Source: Australian Bureau of Statistics, Counts of Australian Businesses 2008-09

Manufacturing and engineering industries, Australia Business numbers by state, June 2015



Source: Australian Bureau of Statistics, Counts of Australian Businesses, including entries and exits, June 2015

Due to the large and diverse nature of the manufacturing and engineering industry data has been grouped according to primary activities for ease of discussion. These groupings are:

- Shipbuilding and boatbuilding and repair
- Primary metal and metal product manufacturing
- Fabricated metal and metal product manufacturing
- Professional and scientific equipment manufacturing
- Jewellery and silverware manufacturing
- Electrical equipment manufacturing
- Pump and compressor manufacturing
- Machinery and tool manufacturing
- Machinery and equipment repair and maintenance services

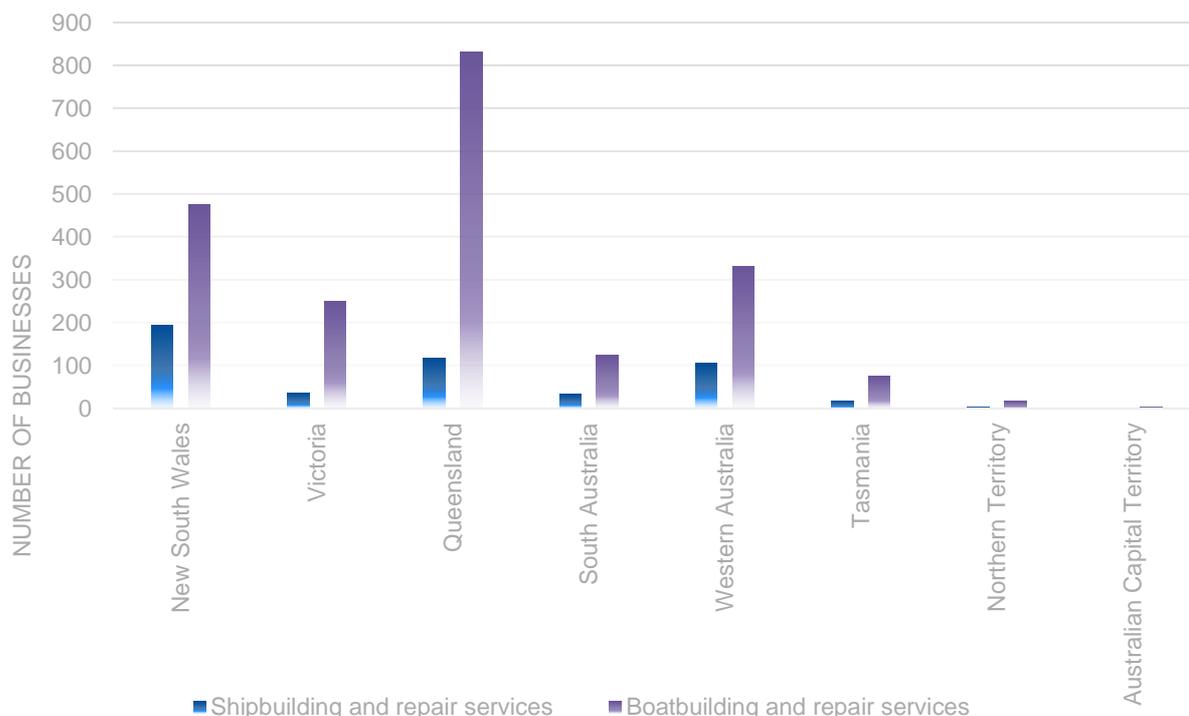
Shipbuilding and boatbuilding and repair

Boatbuilding and shipbuilding are included in the ANZSIC group 'Other Transport and Equipment Manufacturing' together with 'motor vehicle and motor vehicle parts manufacturing' and 'railway equipment manufacturing'. At the end of June 2009, there were 507 shipbuilding businesses and 2,104 boatbuilding businesses operating in Australia. New South Wales had the most number of shipbuilding and repair businesses (195) while there were 830 boatbuilding and repair businesses in Queensland (approximately 40% of the industry)¹⁵.

By the end of June 2015, there were 408 shipbuilding businesses and 1,590 boatbuilding businesses operating in Australia. The majority of shipbuilding businesses were lost from New South Wales, where 32% of shipbuilding businesses closed in the period from 2009 to 2015. Queensland still had the most number of boatbuilding and repair businesses of any state in Australia in June 2015, however has also suffered a decline in numbers over the past six years, with 291 or 35%, of businesses closing. Overall the sector has lost 514 businesses (24% of the industry) since June 2009.¹⁶

Shipbuilding and boatbuilding industries, Australia

Businesses operating by state, June 2009

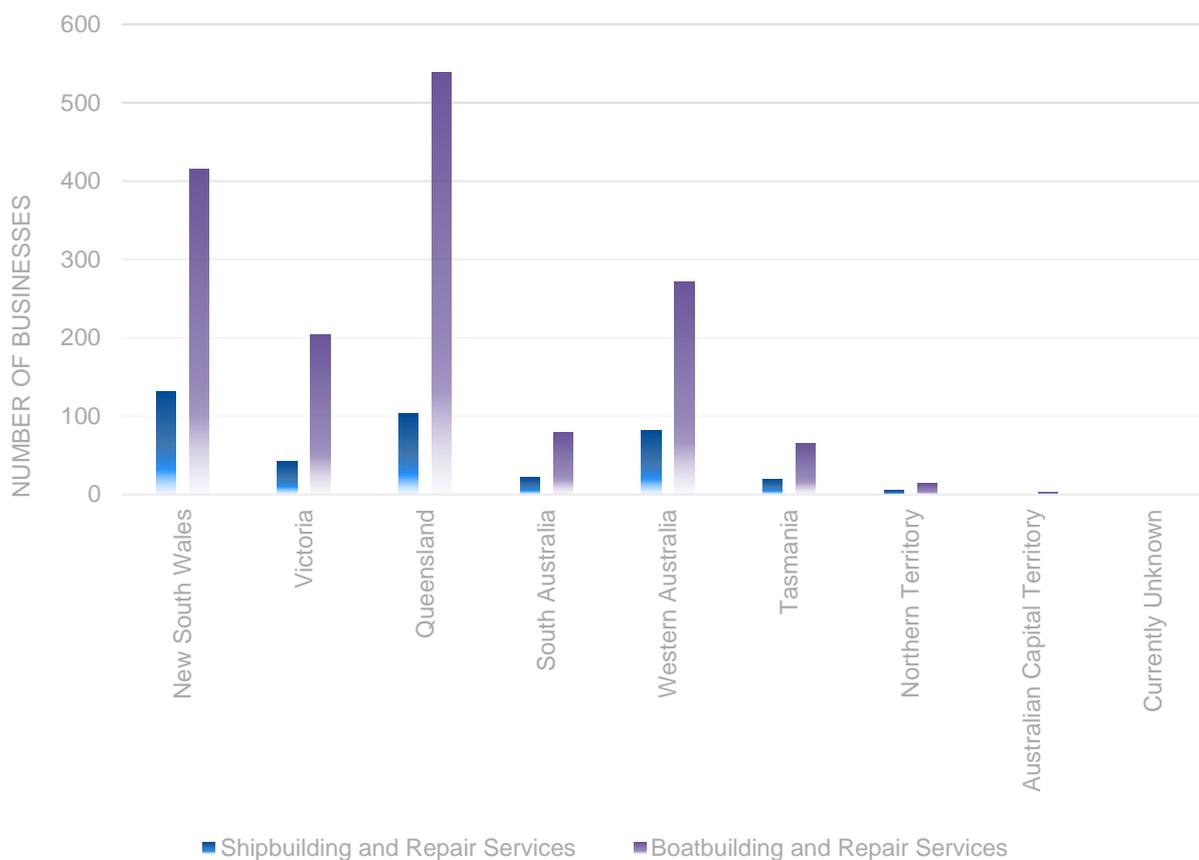


Source: Australian Bureau of Statistics, Counts of Australian Businesses, including entries and exits, 2008-09

¹⁵ Australian Bureau of Statistics, 2010, Counts of Australian Businesses, including entries and exits, 2008-09

¹⁶ Australian Bureau of Statistics, 2016, Ibid

Shipbuilding and boatbuilding industries, Australia Businesses operating by state, June 2015



Source: Australian Bureau of Statistics, Counts of Australian Businesses, including entries and exits, June 2015.

According to data from the ABS, New South Wales, South Australia and Western Australia are the only states where there are companies with 200 or more employees.¹⁷ Significant companies in the shipbuilding industry include ASC Pty Ltd, Austal Limited, BAE Systems, Thales Australia Holdings Pty Ltd, Forgacs Engineering Pty Ltd and Incat Tasmania Pty Ltd.¹⁸

The recent release of the 2016 Defence White Paper and associated Defence Industry Policy Statement¹⁹ offers this industry significant opportunity for growth. The Australian government has also recently advised that the 'Future Submarines' project has been awarded to the French company DCNS and the submarines will be built in South Australia.²⁰

¹⁷ Australian Bureau of Statistics, 2016, Counts of Australian Businesses, including entries and exits, 2014-15

¹⁸ IBISWorld, 2015, Shipbuilding and Repair Services in Australia

¹⁹ Department of Defence, 2016, Defence White Paper, <http://www.defence.gov.au/WhitePaper/>

²⁰ Hudson, P. and Nicholson, B, 2016, Malcolm Turnbull's surprise Adelaide visit for subs announcement, The Australian, <http://www.theaustralian.com.au/national-affairs/defence/malcolm-turnbulls-surprise-adelaide-visit-for-subs-announcement/news-story/da129be9409eef2f7ff1173e0844302e>

Riviera Australia Pty Ltd, who manufacture in Australia and export globally, are considered by IBISWorld to be the only major player in the boatbuilding industry. A number of other Australian companies operate producing well-known brands such as Quintrex and Seafarer.²¹ Steber are another notable manufacturer, with 65 years' experience manufacturing in Australia.

Primary metal and metal product manufacturing

The primary metal and metal product manufacturing grouping encompasses the following ANZSIC classes:

- Class 2122 Steel pipe and tube manufacturing
- Class 2141 Non-ferrous metal casting
- Class 2142 Aluminium rolling, drawing, extruding
- Class 2149 Other basic non-ferrous metal product manufacturing

This grouping takes the refined ore and begins the process of turning this ore into finished products. Products from this grouping include:

- Seamless or welded ferrous pipes or tubes
- Ferrous metal pipe or tube fittings
- Cast non-ferrous metal products
- Aluminium bars, foils, pipes, rods, flakes, sheets, wire, etc.
- Other non-ferrous metal bars, foils, pipes, rods, flakes, sheets, wire, etc.

As displayed in the chart on the following page, this grouping is dominated by micro and small businesses with 87% of all businesses employing less than 20 people. Queensland was the only state with businesses with more than 200 employees at the end of June 2015.²²

Steel pipe and tube manufacturing is the largest sector in this group with 209 businesses operating at the end of June 2015. This industry group has been led by one of Australia's largest and most successful companies – BHP Billiton. However, over the last few years the company has divested itself of its interests in this group resulting in the emergence of Arrium and BlueScope.²³ These two companies hold a market share of over 60%²⁴, although the balance may shift with Arrium's operations in Whyalla under administration²⁵.

²¹ IBISWorld, 2016, Boatbuilding and Repair Services in Australia

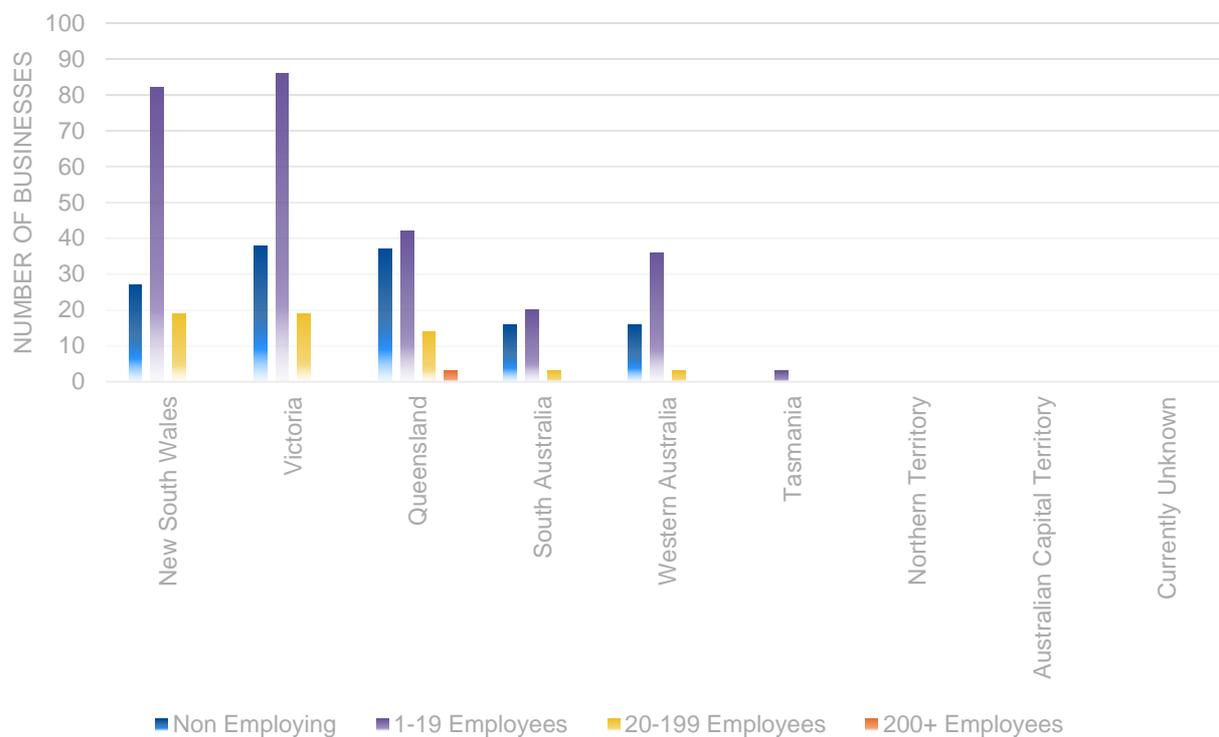
²² Australian Bureau of Statistics, Counts of Australian Businesses including entries and exits, 2014-15

²³ IBISWorld, 2015, various

²⁴ IBISWorld, 2016, Steel Pipe and Tube Manufacturing in Australia

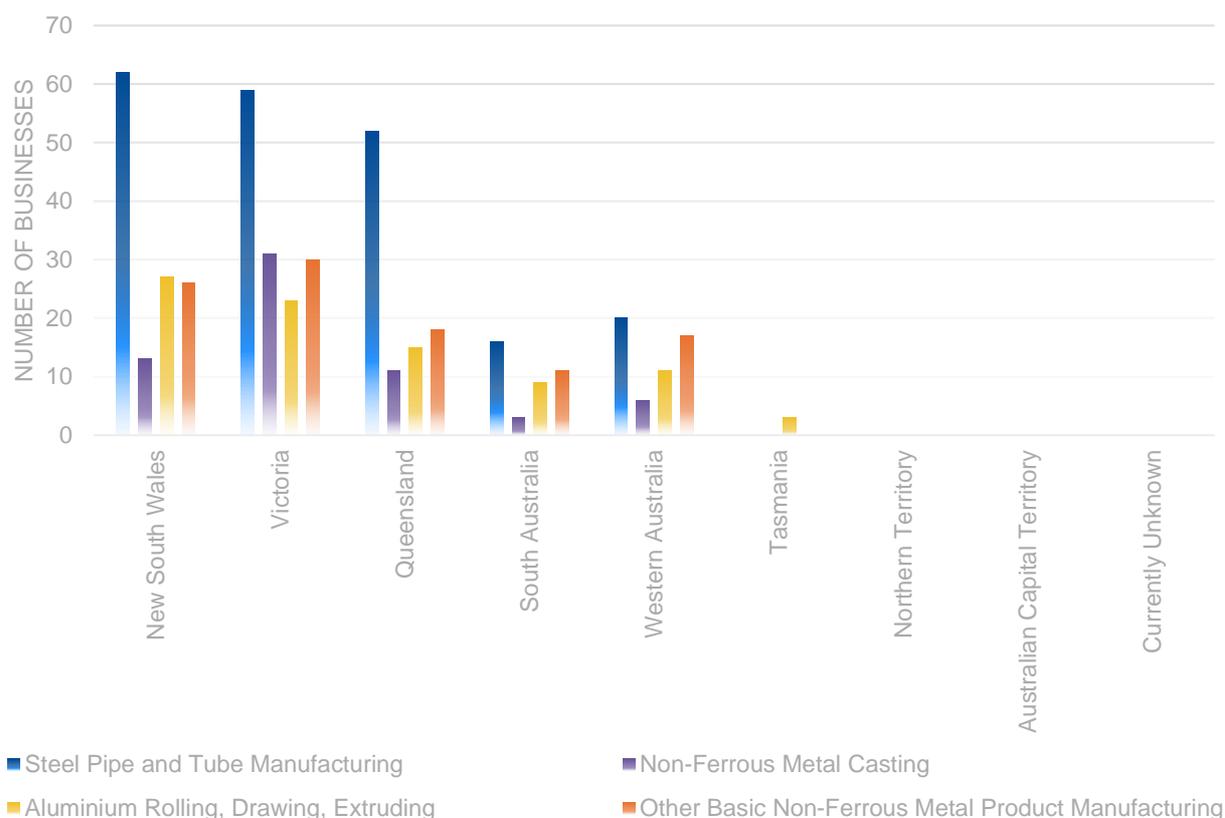
²⁵ Harmsen, N. 2016. Arrium: SA Premier to hold talks on Whyalla's future with steelmaker's administrator. ABC News. 3 May 2016, <http://www.abc.net.au/news/2016-05-03/arrium-administrator-whyalla-talks-with-jay-weatherill/7377800>

Primary metal and metal product manufacturing, Australia Business numbers by state and size, June 2015



Source: Australian Bureau of Statistics, Counts of Australian Businesses June 2015

Primary metal and metal product manufacturing, Australia Business numbers by state and ANZSIC class, June 2015



Source: Australian Bureau of Statistics, Counts of Australian Businesses, including entries and exits, June 2015.

Fabricated metal product manufacturing

Businesses in this grouping are classified in ANZSIC subdivision 22 Fabricated Metal Product Manufacturing and include all classes within the subdivision except Class 2223 Architectural Aluminium Product Manufacturing. This is covered in the Furnishing industry as this class covers the manufacturing of aluminium and glass doors, windows, shower screens and similar products.

Products from this grouping include:

- Iron and steel forging
- Forged steel products such as chain, fittings, valves
- Mass produced horse shoes
- Structural steel products such as girders, joists, rafters, reinforcing mesh and steel rods, roof trusses and scaffolding
- Prefabricated metal buildings such as bus shelters, carports, garages and kit homes
- Guttering and roofing components that aren't made from aluminium
- Balconies and balustrading, curtain walls, metal doors and door frames (including fire doors), gates, etc. that aren't made from aluminium
- Boilers, tank and other heavy gauge metal containers
- Metal containers such as bins, cans (including food and drink cans), letterboxes, tool boxes, etc.
- Products such as pressed or spun metal hollowware, air ducts and bottle closures
- Wire, cable (not electrical cable), wire netting, nails or rolled steel fence posts

- Nuts, bolts screws and rivets
- Hand tools, general hardware, and other fabricated metal products

It also includes the applications of various treatments to metals such as engraving, polishing, heat treating, plating, galvanising, anodising, colouring, etc.

The industry has been heavily impacted by China's rapid growth and now slowing economy and this has led to pressure on many of the major companies.^{26 27}

There are several major companies in this grouping including Arrium and Valmont Group who account for 58% of market share in the iron and steel forging sector. Both also operate in other sectors such as spring and wire manufacturing and structural metal product manufacturing. Another major company is BlueScope Steel which operates across a number of the classes.²⁸

At the end of June 2015, there were 12,901 businesses operating in the fabricated metal product manufacturing grouping. The majority of businesses were micro and small businesses (94% or 12,106 businesses). Over 50% of businesses were located in New South Wales and Victoria.²⁹

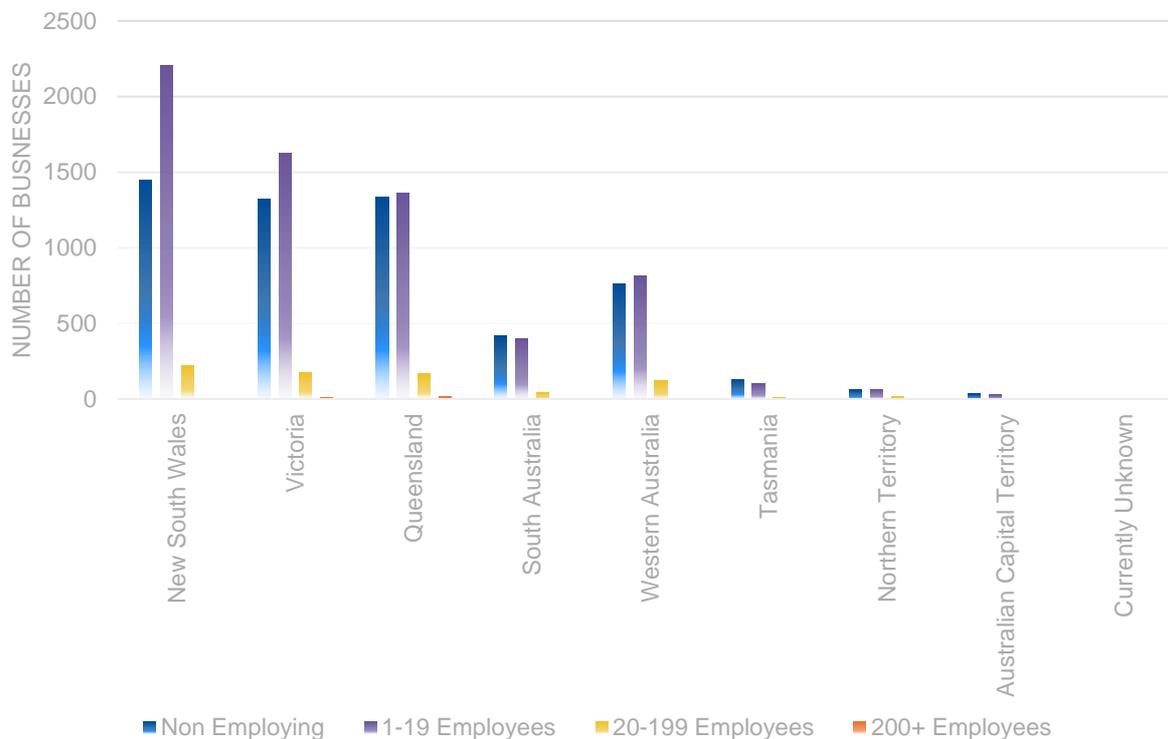
²⁶ Carney, M., 2016, Downsizing of China's steel industry causes job losses, social unrest, ABC News, 19 February, 2016 <http://www.abc.net.au/news/2016-02-19/china-steel-industry-downsize-sees-job-losses-and-social-unrest/7182696>

²⁷ Potter, B., 2016, Christopher Pyne says industry 'injured' by cheap Chinese steel, Australian Financial Review, 18 February, 2016 <http://www.afr.com/news/economy/trade/christopher-pyne-says-industry-injured-by-cheap-chinese-steel-20160218-gmxa83>

²⁸ IBISWorld, 2015, various

²⁹ Australian Bureau of Statistics, Counts of Australian Businesses, including entries and exits, June 2015

Fabricated metal product manufacturing, Australia Business numbers by state and size, June 2015



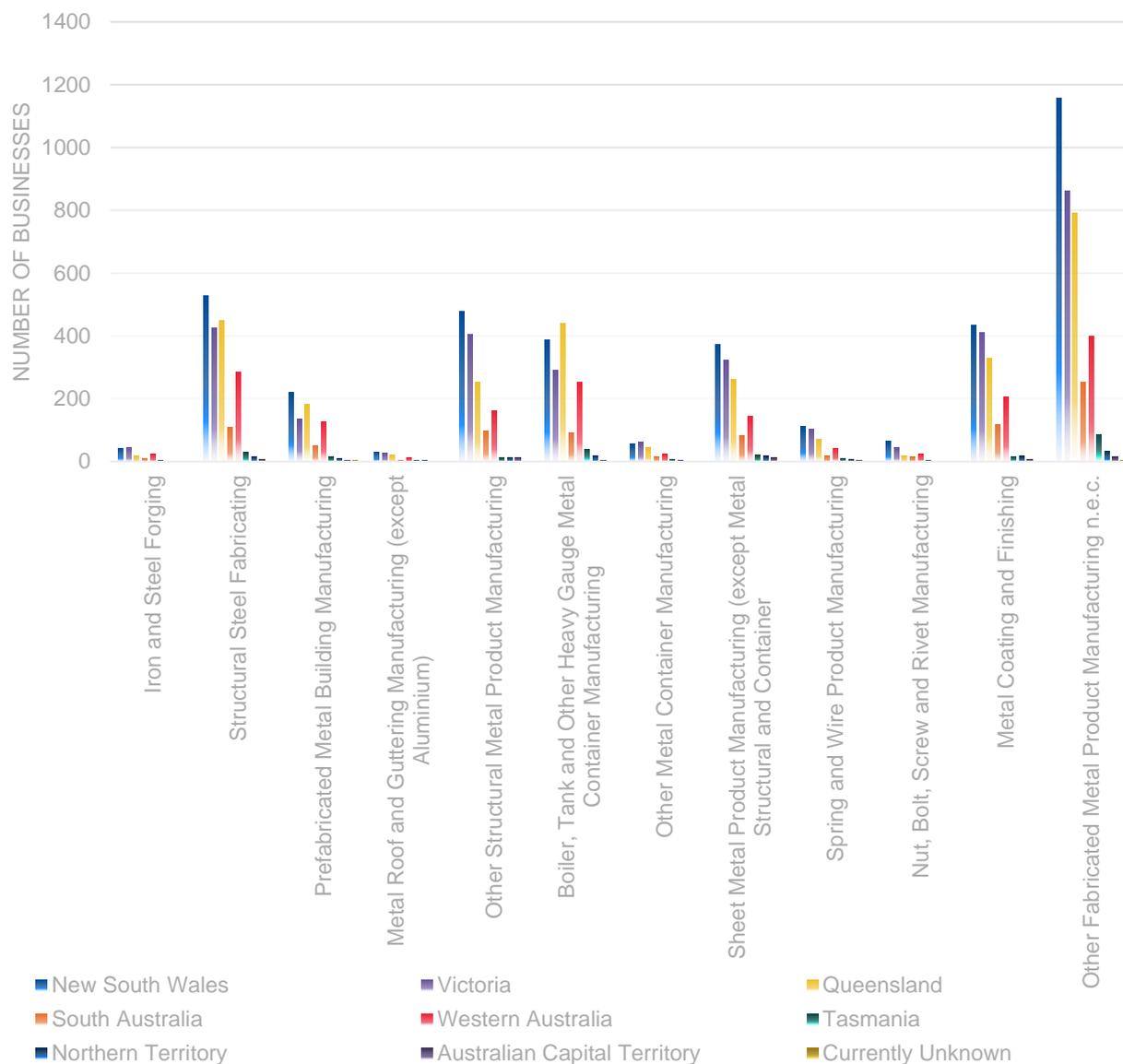
Source: Australian Bureau of Statistics, *Counts of Australian Businesses including entries and exits. June 2015*

This grouping is dominated by businesses operating in the 'Other fabricated metal product manufacturing not elsewhere classified' class. In June 2015, there were 3,598 businesses operating. This was almost twice as many as any other class.³⁰ Businesses in this class manufacture a wide range of products including ammunition, metal awnings and blinds, metal buttons, drill bits, door handles, garden tools, locks, aluminium masts and steel wool.³¹

³⁰ Australian Bureau of Statistics, 2016, *Counts of Australian Businesses, including entries and exits, 2014-15*

³¹ Australian Bureau of Statistics, 2013, *Australian and New Zealand Standard Industrial Classification (ANZSIC), 2006 (Revision 2)*

Fabricated metal product manufacturing, Australia Businesses by state and ANZSIC class, June 2015



Source: Australian Bureau of Statistics, Counts of Australian Businesses, including entries and exits, June 2015

Professional and scientific equipment manufacturing

The professional and scientific equipment manufacturing grouping encompasses the following three ANZSIC classes:

- Class 2411 Photographic, optical and ophthalmic equipment manufacturing
- Class 2412 Medical and surgical equipment manufacturing
- Class 2419 Other professional and scientific equipment manufacturing

Businesses in this grouping produce cameras, lenses, spectacles, equipment for use in hospitals, doctors' surgeries, laboratories and other health care facilities as well as clocks and watches, GPS equipment, meters, laboratory equipment, etc.

Research commissioned by the Medical Technology Association of Australia³² found that the sector has a combined annual turnover of more than \$10 billion and employs more than 19,000 workers. Because of the ageing of the world's population, this sector is predicted to continue to grow significantly over the next few years. It is also a sector which has produced and will continue to produce significant innovations, both in product and technology.

This sector has seen strong growth over the past five years with companies such as Cochlear and ResMed being recognised as industry leaders internationally in the area of medical and surgical equipment manufacturing. Cochlear, ResMed and SDI Limited are the only major Australian companies in this sector with all other major players being multinational subsidiaries. The photographic, optical and ophthalmic equipment manufacturing sector is dominated by smaller Australian companies such as Redflex Holdings Limited and Ellex Medical Lasers Limited.³³

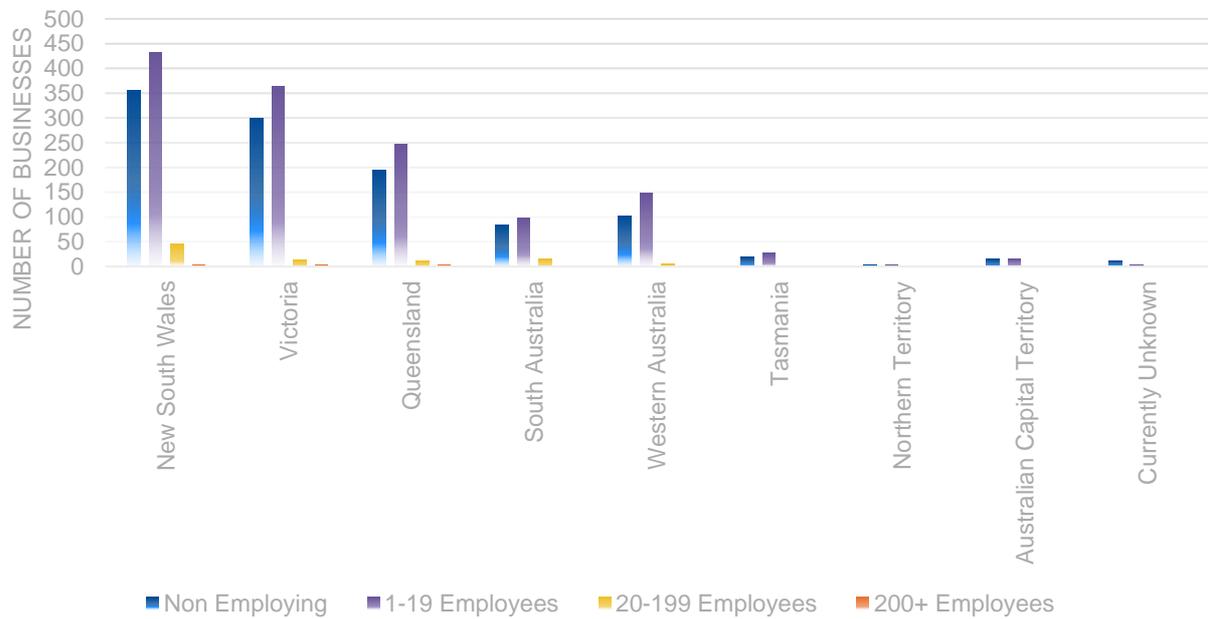
At the end of June 2015, there were 2,808 businesses operating in this grouping. The majority were in New South Wales followed by Victoria (838 and 697 respectively). 95% were micro or small businesses employing less than 20 people.³⁴

³² Deloitte Access Economics, 2015, Medical technology industry workforce and skills review, http://www.mtaa.org.au/docs/media-releases/52184---medical-technology-industry-workforce_final_web.pdf?sfvrsn=2

³³ IBISWorld, 2015, various

³⁴ Australian Bureau of Statistics, 2016, Counts of Australian Businesses, including entries and exits, 2014-15

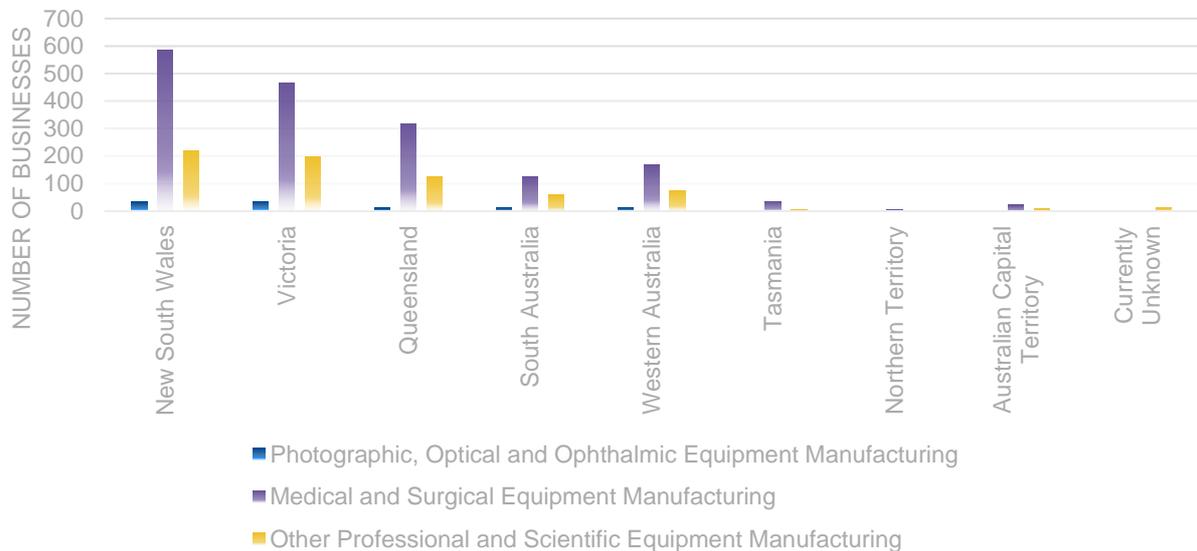
Professional and scientific equipment manufacturing, Australia Business numbers by state and size, 2015



Source: Australian Bureau of Statistics, 2016, Counts of Australian Businesses, including entries and exits, 2014-15

The largest number of businesses operating were in the medical and surgical equipment sector.³⁵

Professional and scientific equipment manufacturing, Australia Business numbers by state and ANZSIC class, June 2015



³⁵ Australian Bureau of Statistics, 2016, Counts of Australian Businesses, including entries and exits, 2014-15

Source: Australian Bureau of Statistics, 2016, *Counts of Australian Businesses, including entries and exits, 2014-15*

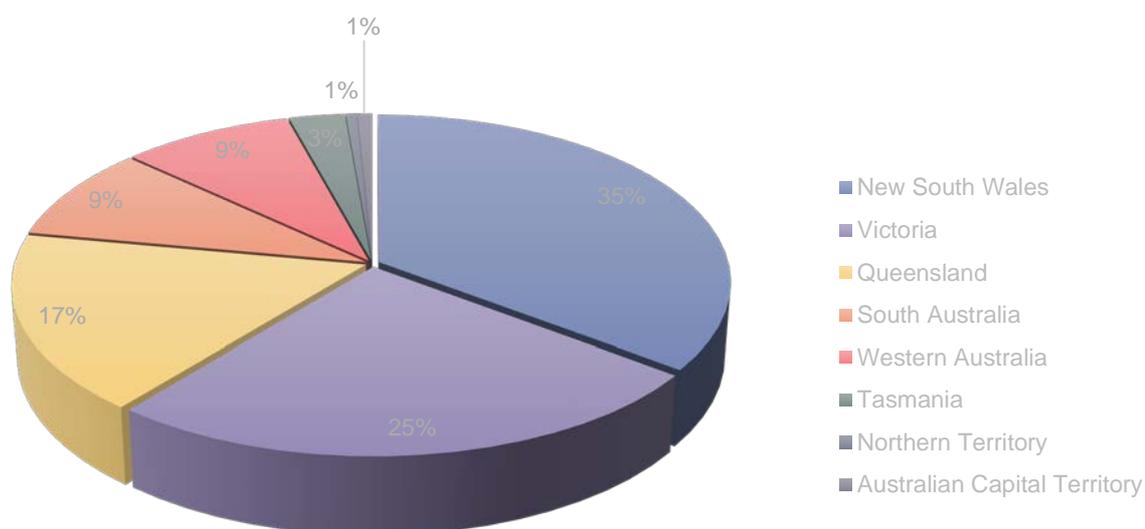
Jewellery and silverware manufacturing

Jewellery and silverware manufacture is another sector included in the manufacturing and engineering industry. It is included in group 294 'Other Manufacturing'.

According to IBISWorld, there are only two major companies operating in this industry – Gold Corporation which trades as the Perth Mint and is owned by the Western Australian Government and the Royal Australian Mint, a division of the Commonwealth Department of Treasury.³⁶ There are many other smaller companies who are very well known internationally – such as Paspaley Pearls.

At the end of June 2009 there were 1,562 businesses operating in Australia. The majority of these businesses (552) were located in New South Wales³⁷.

Jewellery and silverware manufacturing, Australia Businesses by state June 2009



Source: Australian Bureau of Statistics, *Counts of Australian Businesses, including entries and exits, June 2015*

At the end of June 2015 there were 1,387 businesses operating Australia wide. There has been an 11% reduction in business numbers since June 2009. The majority of businesses continue to operate in New South Wales, although

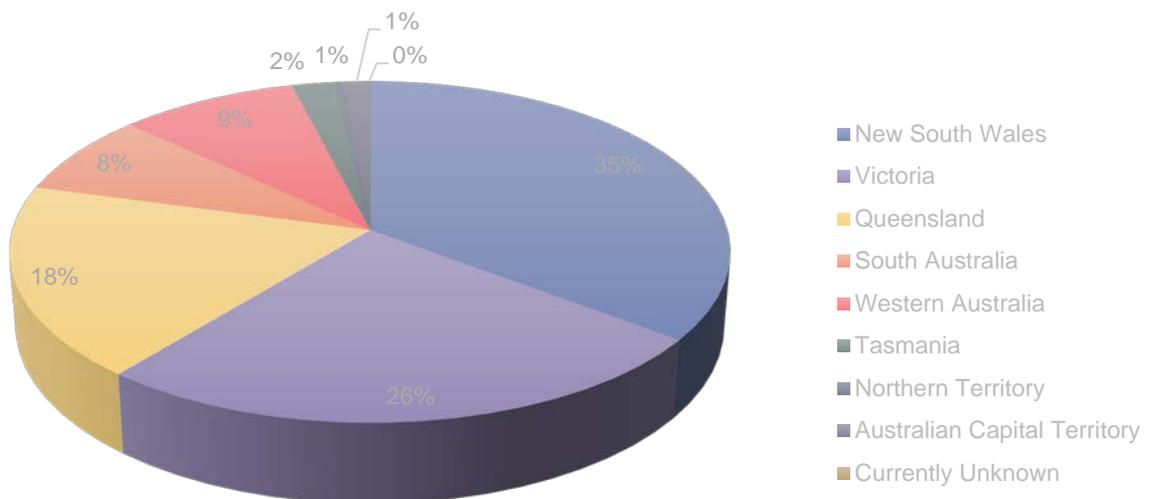
³⁶ IBISWorld, 2015, *Jewellery Manufacturing in Australia*

³⁷ Australian Bureau of Statistics, 2010, *Counts of Australian Businesses, including entries and exits, 2008-09*

there have been a small number of closures in the state over the five year period. Victoria maintains 25% of all businesses operating in the sector and, like New South Wales, saw a small number of closures. South Australia and Queensland both had a 2% increase in business numbers from 2009 to 2015.³⁸

More than 60 % of businesses were sole traders while another 37% employed less than 20 people. The fragmented nature of the industry has made training engagement difficult.

Jewellery and silverware manufacturing, Australia Businesses by state, June 2015



Source: Australian Bureau of Statistics, Counts of Australian Businesses, including entries and exits, June 2015

Electrical equipment manufacturing

The electrical equipment manufacturing grouping encompasses the following ANZSIC classes:

- Class 2421 Computer and electronic equipment manufacturing
- Class 2422 Communication equipment manufacturing
- Class 2429 Other electronic equipment manufacturing
- Class 2432 Electric lighting equipment manufacturing
- Class 2439 Other electrical equipment manufacturing
- Class 2441 Whiteware appliance manufacturing
- Class 2449 Other domestic appliance manufacturing

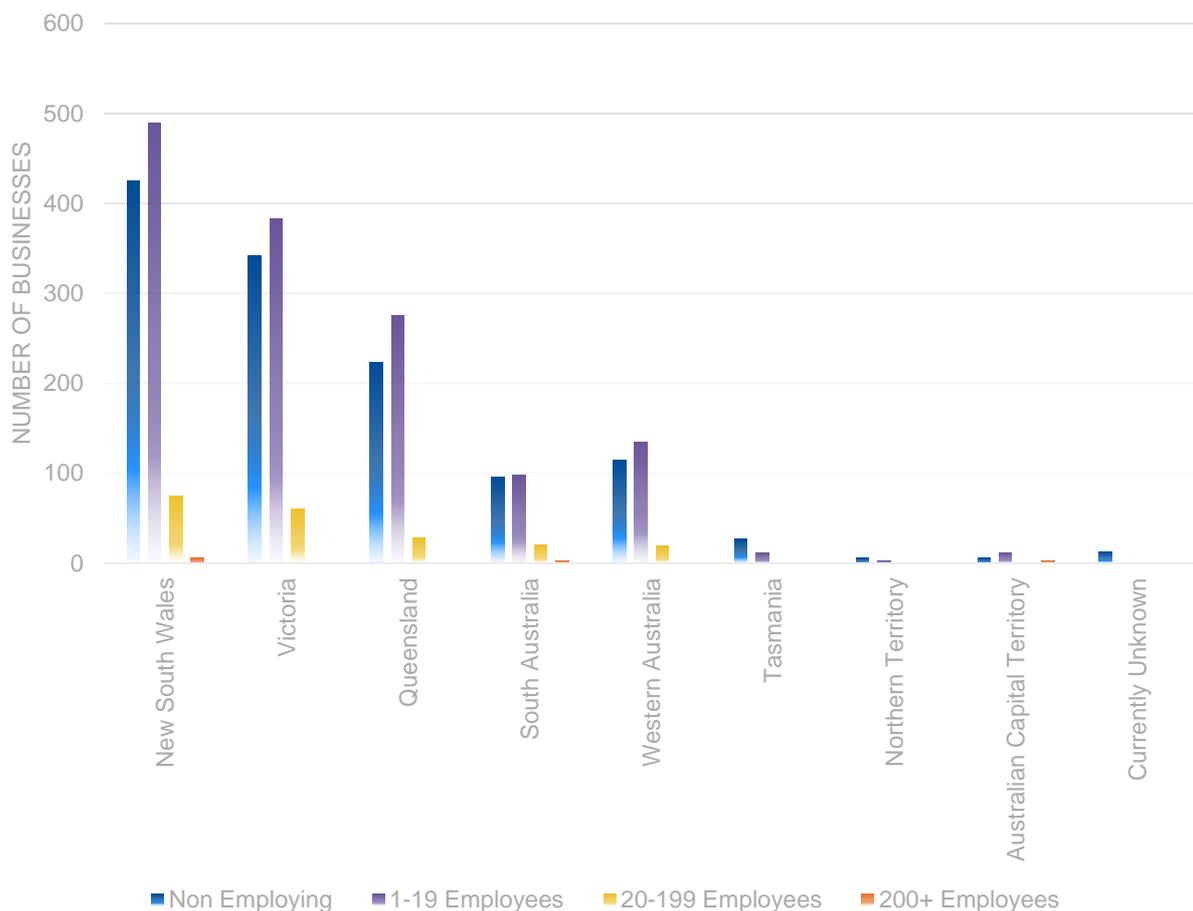
³⁸ Australian Bureau of Statistics, 2016, Counts of Australian Businesses, including entries and exits, 2014-15

Businesses in this grouping manufacture computers and related electronic equipment including electronic systems for Defence applications as well as civil, audio visual equipment, LED lighting technology, lighting control systems, electronic signs and displays, switch gears, transformers and other equipment for the utilities and resources sectors, batteries of all sizes and for all industries, as well as white goods such as refrigerators and ovens for domestic use.³⁹

At the end of June 2015, there were 2,874 businesses operating in this grouping in Australia. The eastern states of New South Wales, Victoria and Queensland are home to the majority of business in this industry. According to the ABS, only three states had businesses employing more than 200 people – New South Wales, South Australia and the Australian Capital Territory.⁴⁰

It should be noted that Electrolux, the last manufacturer of refrigerators in Australia, closed their factory in Orange NSW in April 2016.

Electrical equipment manufacturing, Australia Businesses by state and size, June 2015

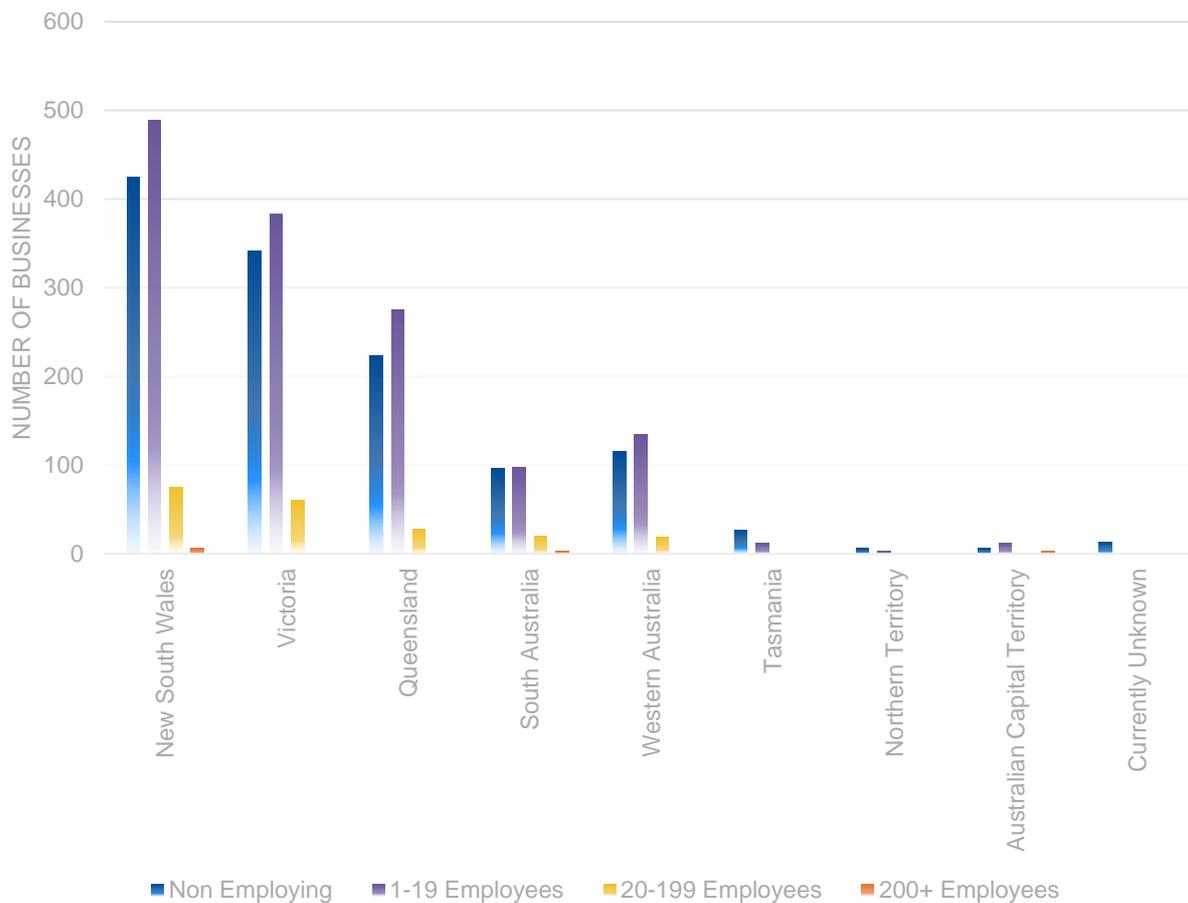


Source: Australian Bureau of Statistics, Counts of Australian Businesses, including entries and exits, June 2015

³⁹ Australian Bureau of Statistics, 2013, Australian and New Zealand Standard Industrial Classification (ANZSIC), 2006

⁴⁰ Australian Bureau of Statistics, 2016, Counts of Australian Businesses including entries and exits, 2014-15

Electrical equipment manufacturing, Australia Businesses by state and size, June 2015



Source: Australian Bureau of Statistics, *Counts of Australian Businesses, including entries and exits, June 2015*

The industry is dominated large international companies, many of whom manufacture offshore. As a result, the industry has been struggling in recent years due to cheap imports from Asia. Many domestic manufacturers have closed or moved to being 'service only' organisations. There are some notable exceptions – for example Acer, a Taiwanese computer manufacturer who manufactures in Australia for the domestic market. Other manufacturers differentiate themselves by specialising in supply to a particular market, e.g. the resources sector or in a specific product such as semi-conductors.⁴¹

An Australian success story in the sector is Codan, a designer and manufacturer of high value-add electronics based in Adelaide. It specialises in three core areas: radio communication systems, metal detectors and mining technology solution. Codan currently exports globally to over 150 countries.⁴²

⁴¹ IBISWorld, 2015, various

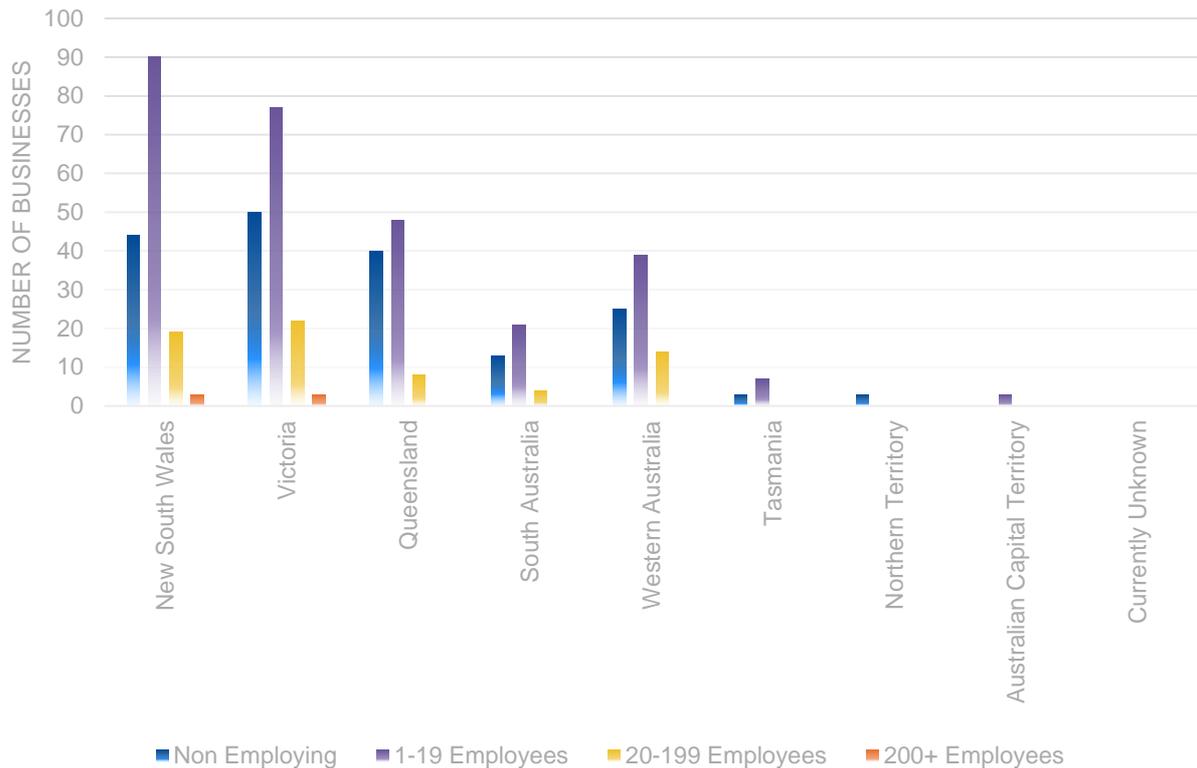
⁴² CEDA, 2014, *Advanced Manufacturing: Beyond the production line*, <http://www.ceda.com.au/research-and-policy/research/2014/04/30/advancedmanufacturing>

Pump and compressor manufacturing

The pump and compressor manufacturing grouping includes businesses which manufacture a wide range of pumps and compressors and also those that manufacture fixed space heating, cooling and ventilation (HVAC) equipment.

There were 536 businesses operating in this grouping at the end of June 2015. Nearly 60% of businesses were in New South Wales and Victoria.⁴³

Pump and compressor manufacturing, Australia Businesses by state and size, June 2015



Source: Australian Bureau of Statistics, 2016, *Counts of Australian Businesses Including entries and exits, 2014-15*

Imports account for a large share of domestic demand in the fixed space heating, cooling and ventilation equipment manufacturing (air-conditioning manufacturing) sector. The companies that do operate in this sector within Australia tend to focus on the production of equipment for commercial use in offices and factories, etc. There are some notable exceptions. Daiken, for example, manufacturers in Australia through its wholly-owned subsidiary, Daiken Australia Pty Ltd.⁴⁴

The pump and compressor manufacturing sector is dominated by Weir Group (Australian Holdings), subsidiary of the Scottish Weir Group, and commands nearly 30% of the market.⁴⁵

⁴³ Australian Bureau of Statistics, 2016, *Counts of Australian Businesses Including entries and exits, 2014-15*

⁴⁴ IBISWorld, 2015, *Heating, Cooling and Ventilation Equipment Manufacturing in Australia*

⁴⁵ IBISWorld, 2016, *Pump and Compressor Manufacturing in Australia*

Machinery and tool manufacturing

The machinery and tool manufacturing grouping includes the following ANZSIC classes:

- Class 2393 Railway rolling stock manufacturing and repair services
- Class 2399 Other transport equipment manufacturing not elsewhere classified
- Class 2461 Agricultural machinery and equipment manufacturing
- Class 2462 Mining and construction machinery equipment manufacturing
- Class 2463 Machine tool and parts manufacturing
- Class 2469 Other specialised machinery and equipment manufacturing
- Class 2491 Lifting and material handling equipment manufacturing
- Class 2499 Other machinery and equipment manufacturing⁴⁶

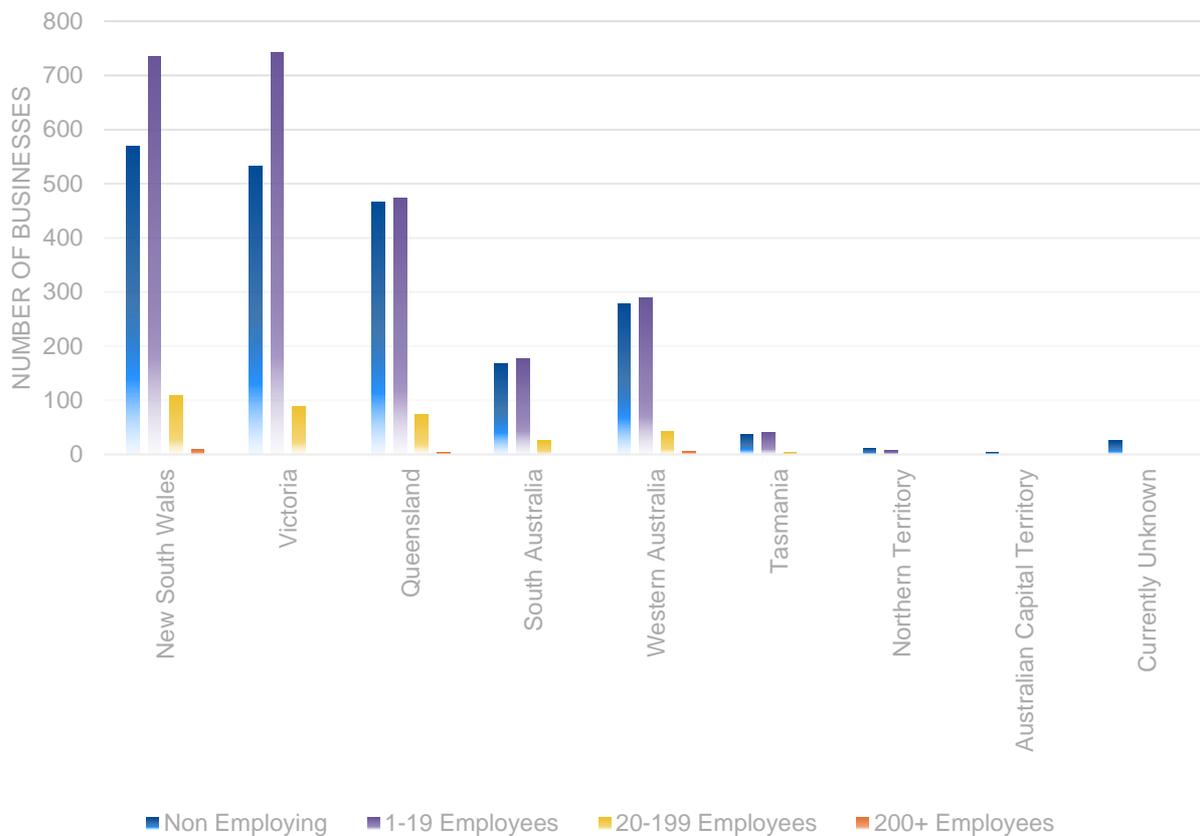
This grouping mainly manufactures specialised machinery and equipment for a range of industries including the food processing industry, mining and agriculture, and the leisure and gaming industry.

At the end of June 2015, there were 4,917 businesses from this grouping operating. The three eastern states – Queensland, New South Wales and Victoria – were home to 77% of businesses. 93% of businesses were micro or small businesses. Only three states had businesses with 200 or more employees – New South Wales, Queensland and Western Australia. In Queensland and Western Australia, all large employers manufactured mining and construction machinery and equipment.⁴⁷

⁴⁶ Australian Bureau of Statistics, 2013, Australian and New Zealand Standard Industrial Classification (ANZSIC), 2006

⁴⁷ Australian Bureau of Statistics, 2016, Counts of Australian Businesses, including entries and exits, 2014-15

Machinery and tool manufacturing, Australia Businesses by state and size, June 2015



Source: Australian Bureau of Statistics, *Counts of Australian Businesses, including entries and exits, June 2015*

This is an industry group in which many of the companies are specialist manufacturers. For example, the 'Other machinery and equipment manufacturing n.e.c.' sector is largely made up of gaming and vending machine manufacturers who only operate in this sector. The sector is dominated by Aristocrat Leisure and Ainsworth Game Technology.⁴⁸ Companies in the 'Other specialised machinery and equipment manufacturing' sector mainly manufacture industrial and commercial food processing equipment.⁴⁹ Sandvik Australia Holdings Pty Ltd is one of the very few companies that operate across sectors. The company is a subsidiary of the Swedish multinational, Sandvik AB. It operates largely in this group as a mining services company manufacturing, supplying and servicing a range of equipment and machinery for the resources industry.⁵⁰

⁴⁸ IBISWorld, 2015, Gaming and Vending Machinery Manufacturing in Australia

⁴⁹ IBISWorld, 2015 Food Processing Machinery Manufacturing in Australia

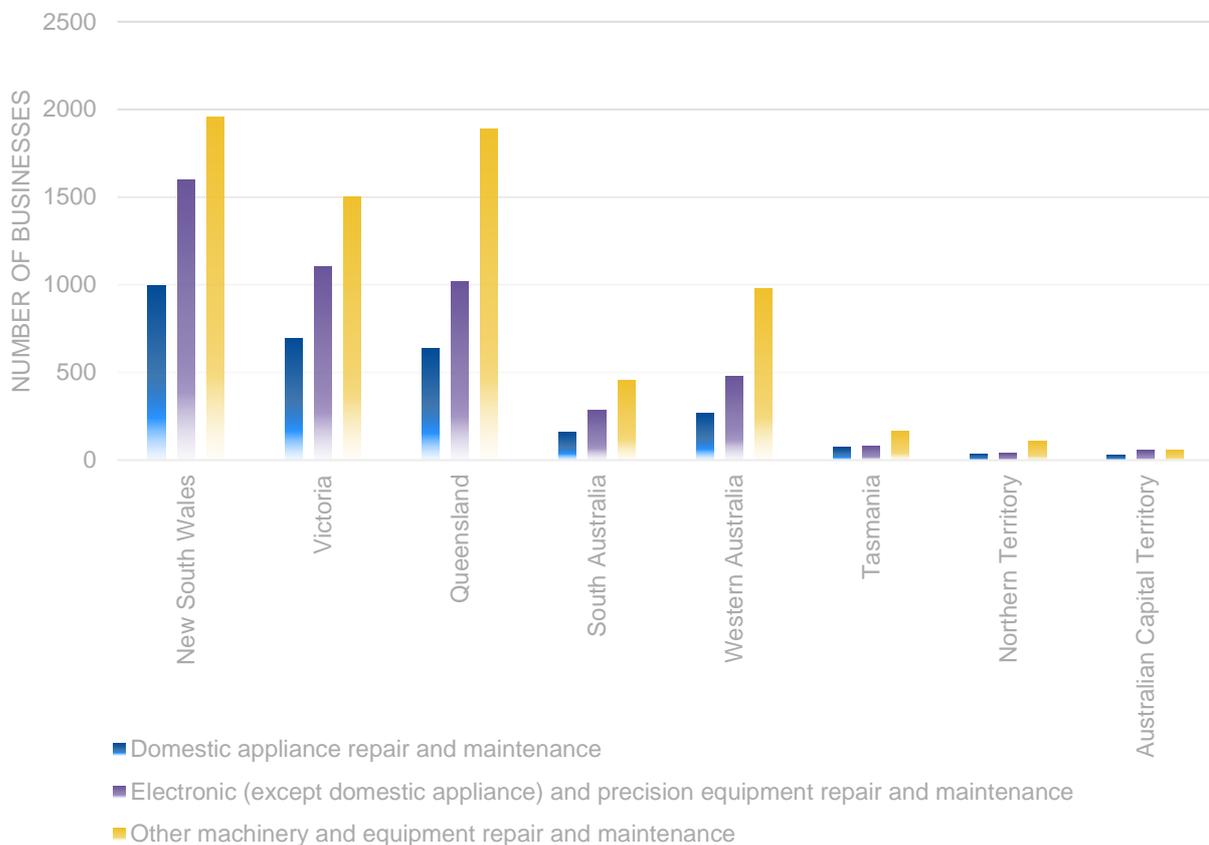
⁵⁰ IBISWorld, 2015, various

Machinery and equipment repair and maintenance services

Repair and maintenance services for machinery and electronic items is another sector within the Manufacturing and Engineering Training Package. Businesses providing these services are included in Group 942 'Machinery and equipment repair and maintenance'. At the end of June 2009 there were 14,658 businesses operating in Australia. The majority of these businesses (4,553) were located in New South Wales⁵¹.

Business numbers remain steady in this sector, with a total of 14,938 businesses operating at the end of June 2015, including the 'Other Repair and Maintenance n.e.c.' class. New South Wales (4,591), Queensland (3,630) and Victoria (3,403) had the greatest number of businesses. The machinery and equipment repair and maintenance sectors reflect the greatest number of businesses under coverage of the manufacturing and engineering training package, closely followed by Primary metal and metal product manufacturing.

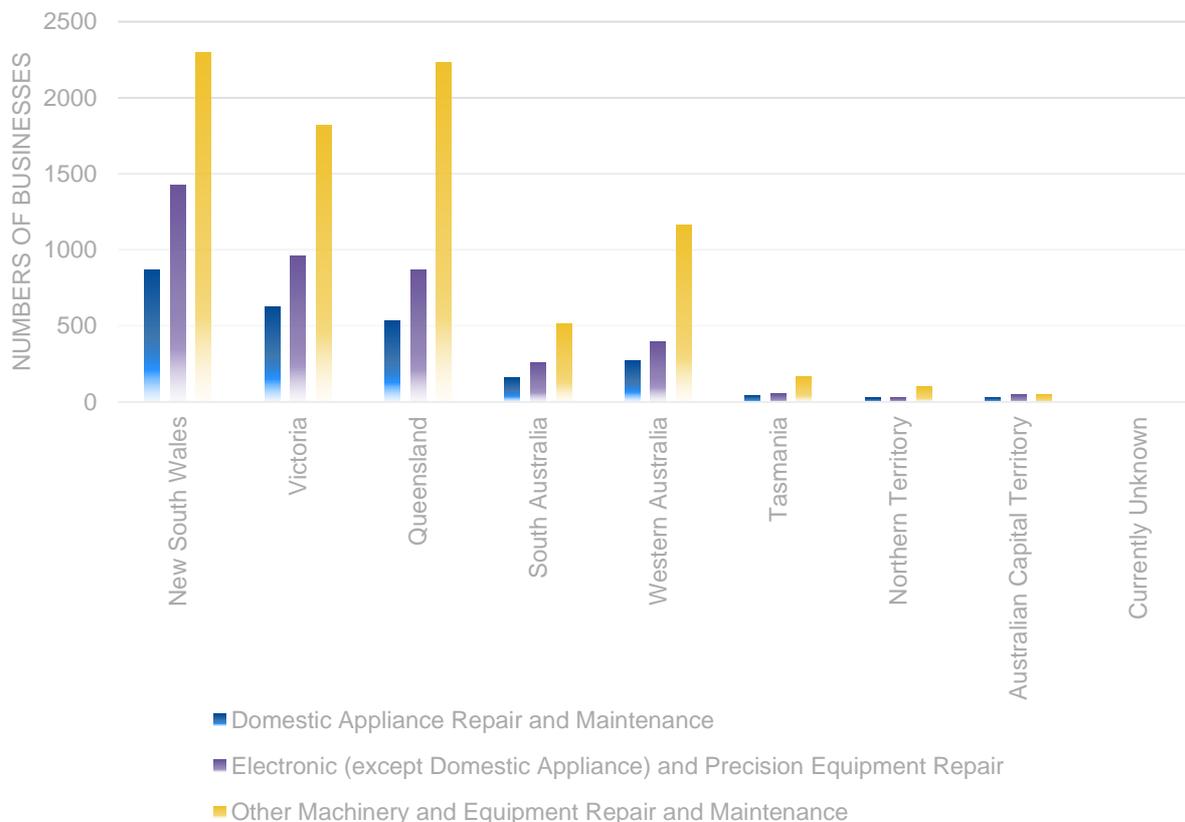
Machinery and equipment repair and maintenance, Australia Businesses by state, June 2009



Source: Australian Bureau of Statistics, 2010, Counts of Australian Businesses including entries and exits, 2008-09

⁵¹ Australian Bureau of Statistics, 2010, Counts of Australian Businesses including entries and exits, 2008-09

Machinery and equipment repair and maintenance, Australia Businesses by state and ANZSIC class, June 2015



Source: Australian Bureau of Statistics, Counts of Australian Businesses, including entries and exits, June 2015

This industry group is dominated by a very high number of micro and small companies. Many original equipment manufacturers (OEMs) provide through-life support for their products through authorised service agents or franchisees, e.g. Smeg Australia Pty Ltd, Komatsu Marketing Support Australia.⁵²

Licensing, regulatory or industry standards

Licensing requirements

Industry continues to be frustrated by the lack of a national licensing system. Jurisdictional based licensing impedes the free movement of employees and adds extra costs to businesses operating nationally. During consultation, stakeholders highlighted the need to resolve this issue in order to ensure sustainability and protect the integrity of the sector.

As well as some existing MEM units of competency and qualifications, there are also imported units of competency in MEM qualifications that can lead to licenced outcomes, or require a licence or permit in order to work in that occupation, for example TLILIC2001 Licence to operate a forklift.

⁵² IBISWorld, 2015, Domestic Appliance Repair and Maintenance in Australia

Industrial electrician

In some jurisdictions, the Certificate III in Engineering - Industrial Electrician leads to a licence to be an Industrial Electrician. This is the only single-focus qualification in the Metal and Engineering Training Package which may lead to a licenced occupation that is based on nationally agreed requirements. The qualification relevant to licencing can be found in the Appendix.

Electrical fitter

The Certificate III in Engineering – Electrical Electronic leads to a licence as an electrical fitter in some of those jurisdictions that have such a requirement.

Boiler Operators

There are two units imported into the MEM Training Package, MSMBLIC001 and MSMBLIC002, which lead to a licence to operate a boiler. This High-Risk Work licence is issued by state based regulators, and contact details for each jurisdiction can be found on Safe Work Australia site. Relevant units are listed in the Appendix.

Locksmithing

In New South Wales, locksmiths need to hold a Class 2C licence: “2C – Locksmith: authorises the licensee to sell, install, maintain, repair and service, and provide advice in relation to, security equipment (including electronic security equipment and barrier equipment) and to act as a locksmith”⁵³.

In Queensland, there is a requirement for locksmiths to hold a Security equipment installer licence to install, repair, service or maintain “basic locks for a commercial environment, or basic locks for common areas in a residential complex.”⁵⁴ Western Australia is investigating moving to a licensing system for locksmiths. The qualification relevant to licensing is listed in the Appendix.

Air-conditioning and refrigeration

In New South Wales, a supervisor certificate or contractor licence is required for air-conditioning or refrigeration work, requiring specific units of competency from either the MEM or UEE Training Packages. The MEM units related to this licence are listed in the Appendix. Nationally, those handling refrigerants need to satisfy ARCTICK requirements⁵⁵. Qualifications relevant to these licences are listed in the Appendix.

Metal Fabrication

Various State licensing authorities, such as the Queensland Building and Construction Commission and NSW Fair Trading issue a Metal Fabrication licence for the preparation, fabrication and erection of metal components in building work. See the Appendix for the relevant qualification.

⁵³ Master Locksmiths Association of Australia, 2012, NSW Security Licencing Information, http://www.masterlocksmiths.com.au/content/NSW_Security_Licensing_August_2012.pdf

⁵⁴ Queensland Government, 2015, Security Industry Regulation, <https://www.qld.gov.au/law/laws-regulated-industries-and-accountability/queensland-laws-and-regulations/regulated-industries-and-licensing/regulated-industries-licensing-and-legislation/security-industry-regulation/>

⁵⁵ Australian Refrigeration Council Ltd, n.d. Licence types <https://www.arctick.org/licensing/licence-types/>

Certification requirements

Boat Building

In boat building, and specifically in ship repair and maintenance, it can depend on who is responsible or the country of origin (insurance) as to which welding certificate will be required in order to perform repair and maintenance welding work. Tradespeople have been known to hold multiple tickets from international bodies, requiring a great amount of paperwork to essentially perform the same tasks. In response to this issue the International Institute of Welding (IIW) was established to attempt to create a uniformed standard. There are now 56 member countries, including Australia.

Non-destructive Testing

Industry regulation regarding Non-destructive Testing (NDT) is governed by the Australian Institute for Non-destructive Testing (AINT).⁵⁶ Units of Competency that lead to Certification by AINT can be found in the Appendix.

Medical Technology

Currently in Australia, all medical devices supplied domestically or exported must first receive regulatory approval from the Therapeutic Goods Administration (TGA) before being made available to patients. The increasing complexity of the regulatory framework has meant that regulatory affairs skills have become significantly more important in the Medical Technology sector over recent years.

Welding

Welding is an area with particular skills needs depending on the required outcomes. Regulators are looking for competency in specific Units of Competency in order to perform specific types of welding, such as pressure welding. The Australian standards for welders are AS1554, AS3992, and AS1796.⁵⁷ There are 12 certifications under which a welder can be certified⁵⁸. As well as standards from Standards Australia there are also other applicable international standards that may be called up in product or service specifications and/or engineering design specifications. References to standards are included in the Range Statement within relevant Units of Competency. Additionally, companies employing welders may also seek compliance with other international standards. The units relevant to certification are listed in the Appendix.

⁵⁶ Australian Institute for Non-Destructive Testing, 2016, <http://www.aindt.com.au/Certification/NDT-Certification>

⁵⁷ Source: Welding Technology Institute of Australia, <http://wtia.com.au/>

⁵⁸ WTIA Qualification and Certification Board, n.d. <http://www.wtiacertification.com.au/PCAS1796Cert1-9.html>

Challenges and opportunities in the sector/sub-sector at the international/national/jurisdictional or regional level

Stakeholders have identified the following potential challenges and opportunities facing manufacturing:

Challenges:

- Ageing workforce – the need to transfer knowledge from experienced workers to the new generation of manufacturers through embracing a framework of part time teaching and/or mentoring roles which have mutual benefits for both the retiring worker and the new starter
- Structural adjustment
- New technology/mechatronics
- Management capability and the design of work
- Impact of imports (surf board manufacturers/steel industry)
- Small/niche markets
- Downturn of the resources sector
- Supply of skills – Registered Training Organisations (RTOs)/apprenticeship commencements/parental expectations/career advisors
- The current approach to skilling and volatility in VET policy
- Science, Technology, Engineering and Mathematics (STEM) skills
- Supply of skilled workers – “How do we attract new apprentices or new people to the industry? How do we get state training authorities to fund apprentices in the industry?”
- Sustainability – climate change impacts in relation to emerging skills demand in the Australian context
- International competition and the volatility associated with the value of the Australian dollar
- Foundation skills/literacy and numeracy
- 457 visas

Opportunities:

- Advanced manufacturing
- Additive manufacturing uptake
- Reverse engineering (3D scanning)
- Robotics and automation
- New technology/mechatronics
- Defence White Paper
- Renewables – hardware and infrastructure
- Drone technology (unmanned systems, remote piloted systems)
- Defence expansion in the North
- Engineering drafting in structural and building services – building structures and reinforced concrete
- Value adding and higher end manufacturing
- Medical technologies regulatory compliance

The manufacturing and engineering industry is a very diverse group of industries as can be seen by the variety of challenges and opportunities that were identified by stakeholders.

The ageing workforce was identified by many stakeholders as a major challenge for several reasons. Concerns were expressed about the lack of new entrants in manufacturing and the difficulty that businesses were having attracting and retaining apprentices. Reasons identified for this ranged from the poor perception of manufacturing portrayed in the media ('dirty, dangerous and dying') and supported by parents and career advisors; the poor image of apprenticeships in general ('a lot of hard work for little pay'); shortage of training providers; competition from other industries; and the promotion of university pathways as the only way to achieve enhanced social and economic standing.

Stakeholders are also concerned that as older workers retire, institutional and intrinsic knowledge is being lost from the industry because opportunities to pass on that knowledge to younger workers is not supported through apprenticeships, mentoring programs and/or collaborative learning opportunities. Another concern is that as older business owners reach retirement age, they are closing their businesses rather than passing them onto the next generation or selling them (because there is no one to sell them to). This is having a detrimental effect in regional and rural areas where the business may be the only one in the town offering that service. As a consequence, customers need to travel outside of the region to obtain the service which adds to the cost. It also contributes to the issue of youth unemployment in regional and rural areas.

Compounding the challenge of attracting new entrants is the challenge of low foundation skills and STEM skills. It is acknowledged by stakeholders that the occupations in the industry are becoming increasingly technology-driven and require new entrants to have strong foundation skills and STEM skills. Increasingly school leavers being directed into vocational pathways lack STEM skills as there is little understanding within the school system of the STEM requirements for vocational pathways. The report released by the Chief Scientist on Australia's STEM workforce shows that the Vocational Education and Training (VET) sector provides more than two thirds of Australia's STEM workforce. Manufacturing is one of the top five industries employing STEM graduates, employing 10% of the STEM workforce.⁵⁹

It is clear that more work needs to be done with the relevant Training Packages to specify realistic standards for STEM related competency requirements.

Upskilling the existing workforce to meet the changing occupational requirements, especially with the introduction of new technology is also a challenge facing the industry. Current workers need to be upskilled in the new technologies to improve productivity, efficiency and business sustainability. However, many existing workers have been in the industry for many years, and may lack either the opportunity for the formal education that they need or the confidence to undertake further learning.

Computer aided drafting (CAD) with skills in the use of 3D technology, computer aided manufacturing (CAM) including robotics and computer numeric controlled (CNC) machining, while not new technologies are increasingly being used by the industry and stakeholders report that the technology is becoming increasingly sophisticated.

Stakeholders in niche and thin markets in particular are concerned by the tightening access to a skilled workforce and having reasonable access to training delivery as RTOs tighten their scope and competition drives a reduction in RTO delivery of some qualifications. For the jewellery manufacturing sector, there is concern that the lack of

⁵⁹ Office of the Chief Scientist, 2016, Australia's STEM workforce, http://www.chiefscientist.gov.au/wp-content/uploads/Australias-STEM-Workforce_for-distribution.pdf

apprenticeship opportunities is resulting in many people self-educating through TAFE and private RTOs. This is leading to a sector that is highly skilled but not formally recognised. The locksmith trade is facing increasing competition from other industries such as the construction industry with stakeholders reporting that handy men and carpentry trades people were increasingly working in this area which was undermining the reputation of the sector. Stakeholders also face the challenge of changing technology with locking systems increasingly becoming electronic resulting in a need for new skills in electronics for locksmiths.

The increasing convergence of mechanical and electrical/electronic technologies driving a need for workers with skills in both was raised by stakeholders from across a range of occupations. Occupations identified as requiring these skills included fitting and machining, especially fluid power; mechanical fitting; and plant mechanics. Mechatronics is also seen by stakeholders as a growth area.

Another niche sector facing the challenge of access to a skilled workforce is the sewing machine repair sector. The sector faces a significant shortfall in qualified workers due to a lack of training opportunities with very few RTOs offering the Certificate III in Engineering – TCF Mechanic. Consequently, Blessington, a major importer and distributor of domestic sewing machines, is now providing all training for their workforce and contractors.

Advanced manufacturing (which includes the use of new business processes as well as new technologies) is regarded by stakeholders as a major opportunity. Stakeholders are divided on additive manufacturing (or as it is sometimes known, direct digital manufacturing) as an opportunity. At the moment the technology only supports rapid prototyping and small scale niche manufacturing and outputs are still relatively costly to produce. However, it has the potential to present the industry with significant opportunities and the technology is improving almost daily.

While new technologies pose a challenge for the industry, stakeholders also saw them as providing a significant opportunity. Manufacturers welcome the introduction of new technologies as a means of improving the sustainability of the industry. Robotics and other forms of automation are seen as providing part of the solution to some skills shortages, especially in sectors with lower level skill requirements. Businesses expect that introducing robotics and automation will enable them to reskill existing workers into more technical roles, thereby meeting the supply of skilled labour needs internally. The new technologies also are seen as a means of combating the relatively high cost of production in Australia. At the same time stakeholders are also saying that they will need to invest in upskilling their workforce to use these new technologies.⁶⁰⁶¹

Composites and advanced materials are also areas of opportunity for the industry as these are involved in many of the new and emerging technologies⁶².

Along with the introduction of new technologies, stakeholders also considered that new processes need to be introduced to improve sustainability. They identified processes such as Lean and other competitive business processes as pertinent to their industry's viability.

⁶⁰ International Federation of Robotics, 2016, 248,000 industrial robots revolutionising the global economy, *Manufacturers' Monthly*, 23 June 2016, <http://www.manmonthly.com.au/news/248000-industrial-robots-revolutionising-the-global-economy/>

⁶¹ Balinski, B. 2016, From granola to granular – getting to the crunch with Industry 4.0, *Manufactures' Monthly*, 24 June 2016, <http://www.manmonthly.com.au/features/granola-granular-industry-4-0-comes-crunch/>

⁶² Potter, B. 2016. Election 2016: CSIRO Manufacturing wrote Turnbull's script. *Financial Review*, 15 June, 2016, <http://www.afr.com/business/manufacturing/election-2016-csiro-manufacturing-models-the-innovation-strategy-20160607-gpdban>

Another area in which stakeholder's report opportunities opening up is the engineering drafting sector, especially for people with skills in structural and building services drafting. There has been, and the industry expects to continue to see, a growth in structural steel construction in Australia. The introduction of Building Information Modelling (BIM) technology is impacting on the industry and there are opportunities across several sectors for growth (engineering drafting, structural steel production and construction, fabrication, to name a few).

There are variations in the challenges and opportunities facing the industry in different jurisdictions. Western Australia, the Northern Territory and Queensland are all being impacted by the downturn in the resources sector as construction work for new projects dries up. This is resulting in many engineering trades people now needing to find work in other sectors/industries. Stakeholders report that workers returning from the resources sector are requiring significant reskilling to meet the needs of the manufacturing and engineering industry as result of being out of the industry for a lengthy period. This is adding to the cost of hiring skilled workers.

At the same time, new opportunities are opening up in these jurisdictions. The Defence White Paper offers significant opportunities in 'northern Australia' which encompasses parts of all three jurisdictions. Defence expansion in the Northern Territory is emerging as the current mid to long term driver of growth. The Territory is already planning to take advantage of these opportunities with stakeholders reporting that a range of initiatives have been proposed, including:

- New truck designs built in the Northern Territory
- Heavy and light steel construction
- Major infrastructure projects such as roads, ports, bridges and transport hubs⁶³

All of these projects offer opportunities for the manufacturing and engineering industry in that jurisdiction.

The Queensland Government recently released the Queensland Advanced Manufacturing 10 Year Roadmap discussion paper⁶⁴ for consultation. The discussion paper has identified a number of opportunities for advanced manufacturing in Queensland, including:

- Building on existing competitive advantages and advanced manufacturing niches, particularly whole-of-life service capabilities
- Capitalise on export opportunities especially in the market for scientific instruments
- Upstream processing of Queensland's resource, forestry and agricultural industries
- Niche areas of knowledge intensive manufacturing including unmanned aerial vehicles (UAVs)

There are several challenges that face the advanced manufacturing industry in Queensland. The industry currently faces a shortage of skilled workers, especially in the heavy fabrication and engineering sector, due largely to an ageing workforce. The impacts of accelerating and disruptive technologies are increasing the level of competition from formerly low cost countries as they move to more technology focussed economies. As well a range of specific challenges for the development of an advanced manufacturing industry in Queensland are identified. These include the failure of Queensland manufacturers to adopt advanced manufacturing technologies; low levels of participation in

⁶³ Information provided by the Transport, Engineering and Automotive Training Advisory Council Northern Territory (TEATACNT)

⁶⁴ Department of State Development, 2016, Queensland Advanced Manufacturing 10 Year Roadmap Discussion paper for consultation, <http://www.statedevelopment.qld.gov.au/resources/paper/qld-adv-manufacturing-roadmap-paper.pdf>

global supply chains, low numbers of businesses developing into medium-sized, globally-focused businesses and failure to benchmark performance. The final version of the Roadmap is expected to be released late 2016.

Queensland has also identified both the bio-medical and life sciences industry and the mining equipment, technology and services (METS) industry as potential growth areas for the state. A discussion paper for the bio-medical and life sciences industry has been released and a similar discussion paper for the METS industry is planned for release in later this year.⁶⁵

One of the big challenges facing manufacturing in northern Australia is the cost of energy. Therefore, research and investment into renewable energy sources provides both a challenge and an opportunity for the industry – a challenge due to the costs of research and development and an opportunity because of the potential market for low cost renewable energy infrastructure. Advances in battery storage technology have the potential to meet some of these challenges.⁶⁶

Another challenge is the small population base. Stakeholders report that population growth in the north of Australia is stagnant and, while the resources sector has bought skilled workers, they are typically fly-in, fly-out (FIFO) workforce who leave once the project is complete and whose economic impact in the region is limited. While the proximity to the emerging South East Asian market base is an opportunity, stakeholders report that local and regional businesses require skills in market analysis to determine what opportunities are there.

The recent announcement of Australian Defence Force commissioning 33 new warships will provide significant stimulus to Adelaide and Perth. Construction of twelve Offshore Patrol Vessels (OPVs) will commence in Adelaide in 2018, employing 400 workers. From 2020, construction of the OPVs will transfer to Western Australia when Adelaide shipbuilders are scheduled to begin construction of nine new frigates, a \$35 billion program that will employ more than 2,000 people. Twenty-one steel-hulled Pacific Patrol Boats (PPBs) will be built at Henderson, in southern Perth, and employ more than 130 people, with intentions to conduct ongoing maintenance in Cairns.⁶⁷

While the announcement of these contracts is good news for Adelaide and Perth, it does not ensure continuity for the workforces in those regions with some businesses reducing their workforce until the new projects commence⁶⁸. Other regions have also seen a loss of workforce capability due to delays in the announcement of defence contracts. Defence supplier BAE Systems announced job losses of 325 jobs in the second half of 2016, with warnings of up to 1,000 further more to be axed at its Melbourne shipyards unless the government funds new projects⁶⁹. Considering that BAE Systems did not tender a bid to design and build the Pacific Patrol Boats, these losses seem inevitable⁷⁰.

⁶⁵ Department of State Development, 2016, Mining equipment, technology and services (METS), <http://www.statedevelopment.qld.gov.au/industry-development/mining-equipment-technology-and-services.html>

⁶⁶ Norris, G, 2016, Nano-Nouvelle charges ahead in the development of new batteries, The Courier Mail, 24 May 2016, <http://www.couriermail.com.au/business/nanonouvelle-charges-ahead-in-development-of-new-batteries/news-story/13de5cc6e3394dc2c7014d0353acaeaf?csp=37da542a540bad75a7d563f863e028c2>

⁶⁷ Turnbull, M., April, 2016. The Australian Government, Federal Member for Wentworth, Prime Minister of Australia, Media Release. <http://www.malcolmtturnbull.com.au/media/continuous-naval-shipbuild>

⁶⁸ ABC, 2016. ASC Adelaide shipyards to shed 640 workers by end of 2017. <http://www.abc.net.au/news/2016-05-05/asc-to-shed-640-staff-by-end-of-2017/7388424?section=business> ABC News, 5 May 2016

⁶⁹ Gomez, K., 2014. BAE Systems warns of 1000 job losses in Melbourne. *Manufacturers' Monthly*, February, 2016 <http://www.manmonthly.com.au/news/bae-systems-warns-of-1-000-job-losses>

⁷⁰ Edwards, J., 2015. Hundreds of shipbuilding jobs under threat at BAE Systems in Melbourne. ABC News, 16 June 2016 <http://www.abc.net.au/news/2015-06-16/hundreds-of-shipbuilding-jobs-at-bae-systems-under-threat/6549642>

As is evident in the closure of automotive manufacturing in Australia, the businesses downstream on the supply side of the manufacturers also suffer. One of Australia's oldest engineering firms has only just come out of voluntary administration, and will be bidding for submarine work as part of its survival.⁷¹

⁷¹ Balinski, B., 2016. Coffs engineering firm to bid aggressively for submarine work. Manufacturers' Monthly, 3 June 2016
<http://manmonthly.com.au/news/coffs-engineering-firm-to-bid-aggressively-for-submarine-work/>

Employment

Employment outlook

The recent upturn in the Australian Performance of Manufacturing Index (PMI) has been a positive sign for the industry. Up until August, Australian manufacturing had experienced 13 consecutive months of positive growth, the longest growth period since 2006.⁷²

Employment outlook varies across sectors within the manufacturing and engineering industry. Businesses that can tap into proposed Defence projects and/or major infrastructure projects are more positive about the employment outlook for the industry. Advanced manufacturers are also positive about employment as they move into the high-end, value adding segment of both domestic and global markets. Automation and robotics will continue to impact employment in low skilled roles as businesses continue to look for a 'competitive edge'.

The steel manufacturing sector continues to face job losses⁷³. With the downturn in the Chinese economy, and shift to a more service-based economy, Australia has seen an influx of lower priced, lower quality steel imports. As the Chinese government continues to support their inefficient steel manufacturers, this situation is not expected to change in the next four to five years.⁷⁴

Engineering drafting is one sector in which stakeholders expect employment demand to grow significantly in the next four to five years. This will be driven by demand from the steel construction industry, especially in the infrastructure sector. New technologies such as BIM will have a big impact on the skills required of the engineering drafting workforce.⁷⁵ Welders continue to be in demand, especially those that can meet the required standards and have experience.

Another sector that is seeing increasing demand for workers is the NDT sector. This is again another sector/occupation that operates across multiple industries and sectors. It is seeing a growth in demand as businesses increasingly seek to meet quality standards both within Australia and globally.

Technology will continue to be a big driver of growth and people with skills in CAD, CAM, CNC machining as well as coding and design skills will be in demand across the industry. Stakeholders report that specialist occupations such as sewing machine repair technicians, manufacturing jewellers, locksmiths (especially those with skills and experience with electronic locks) will also be in demand. New South Wales reported an increased demand for recreational boat repairers. Nationally stakeholders report shortages in all these occupations.

⁷² Australian Industry Group, 2016, Manufacturing Correction in August, Performance of Manufacturing Index (PMI), August, http://cdn.aigroup.com.au/Economic_Indicators/PMI/2016/PMI_Aug_2016845764v.pdf

⁷³ Chambers, M., 2016, 7000 jobs at risk at Arrium, Business Spectator, 7 April 2016 <http://www.businessspectator.com.au/news/2016/4/6/industries/7000-jobs-risk-arrium=>

⁷⁴ Carney, M., 2016, Downsizing of China's steel industry causes job losses, social unrest, ABC News, 19 February 2016, <http://www.abc.net.au/news/2016-02-19/china-steel-industry-downsize-sees-job-losses-and-social-unrest/7182696>

⁷⁵ BECA, 2016, Emerging trends in Engineering – Part 1: Draughting http://www.aeol.com.au/databases/news/16/06/beca_emerging_trends_engineering.html?zoom_highlight=software+cad+gis+bim+spatial+geospatial+%22data+centre%22+3d+%22point+cloud%22+%22information+management%22

Workers who have the flexibility to be able to work in a diversified business across a range of areas are also in demand. Examples include:

- Mechanical trades with restricted electrical capabilities
- Mechanical trades with fabrication capabilities
- Fabrication trades with mechanical capabilities

Workforce supply-side challenges and opportunities

The majority of workforce supply challenges identified by stakeholders focused on two major issues:

- attracting and retaining apprentices
- the decreasing number of training providers offering key Training Packages qualifications

Attracting apprentices is a major challenge. Lack of awareness of career paths and options in manufacturing and engineering is resulting in young people not being attracted to the industry. Furthermore, the ongoing negative images of manufacturing and apprenticeships in the media are turning young people away from a trade occupation. The differing apprenticeship arrangements across jurisdictions has also been identified as a supply side challenge. Stakeholders would like to see more pathways being offered for young people transitioning from school to work with a focus on the engineering trades.

Others expressed concern that once they managed to attract an apprentice, it was difficult to find a provider to work with. A common comment was that TAFEs were downsizing or closing their engineering departments due to jurisdictional funding arrangements exacerbated by competitive pressures. The industry also reported a shortage of adequately experienced and qualified trainers who had the skills needed for training apprentices, especially in the area of new technologies. The challenge of thin markets only increases supply side challenges. RTOs will not deliver training if there are not enough students to make delivery financially viable. Industry is seeking alternate training solutions to meet its needs which is leading to the uptake of non-accredited training options.

Competency based progression benefits both employers and apprentices alike, however some stakeholders report that it is providing some challenges. One concern is that the shortening of apprenticeships may not provide enough time for the apprentice to consolidate their skills in the workplace, with one stakeholder saying “it doesn’t work with the engineering trades”.

Stakeholders also saw the changes to funding arrangements for VET as a workforce supply challenge. Such changes are leading to a reduction in the number of courses on offer (qualifications and skill sets) as more RTOs (both private and public) reduce their offerings to meet budgetary restraints. As one stakeholder said, financially it’s better to offer hairdressing than engineering.

Supply side opportunities identified included the reskilling of workers from the automotive sector. Stakeholders could see a synergy between automotive mechanical work and heavy diesel engineering for example. Another area in which stakeholders see a synergy is manufacturing and construction. There is growth in steel frame construction and engineering drafting skills, welding and fabrication are all required. The composite trade qualification has been identified as having synergy across a range of industries (manufacturing, automotive, recreational vehicles, boat building, aerospace, furniture, etc.).

When looking at training figures, enrolments by Government-funded students and courses have decreased by 8% over the past five years, from 57,498 enrolments in 2010, to 52,689 in 2014. However, with the introduction of Total

VET Activity (TVA) reporting in 2014, this showed total enrolments in MEM qualifications were 70,582, an extra 17,893 enrolments recorded through fee-for-service places. It is important to remember that TVA data is now identifying enrolments in programs that were not previously captured. These are not necessarily enrolments that would otherwise have been government funded as it also captures training provision by enterprise providers, private training providers and Australian providers (both public and private) delivering offshore.

The scope of enrolments by Government-funded students and courses includes the following:

Funding type	TAFE and other Government providers	Community education providers	Other registered providers
Commonwealth and State funding	✓	✓	✓
Domestic fee-for-service	✓	✗	✗
International fee-for-service	✓	✗	✗

Source: VOCSTATS <http://www.ncver.edu.au/resources/vocstats.html>

Total VET activity covers VET delivered by:

- TAFE institutes
- universities and other government providers
- community education providers
- enterprise providers
- private training providers
- schools
- Australian VET institutions delivering VET at overseas campuses

The majority of extra enrolments shown in TVA data were in MEM10105 Certificate I in Engineering (8,423) and MEM20105 Certificate II in Engineering (5,846), which can largely be explained as VET in schools (VETiS) delivery⁷⁶. Government funded enrolments in MEM20105 reduced from 12,433 in 2013 to 6,459 in 2014 following changes in qualification rules that restricted delivery of the Certificate II in schools. At the same time, enrolments in MEM10105 increased from 2,466 in 2013, up to 5,183 in 2014.⁷⁷

In 2013, MEM20413 Certificate II in Engineering Pathways was endorsed to support VETiS delivery. There were 473 students enrolled in this qualification through government funded delivery in 2014, and a further 294 via fee-for-service providers. In 2015, the number of enrolments had grown to 3,467 through government-funded training places, with an additional 2,820 enrolments reported through TVA.⁷⁸

⁷⁶ VOCSTATS <http://www.ncver.edu.au/resources/vocstats.html> Total VET activity database, extracted on 01/04/16

⁷⁷ VOCSTATS <http://www.ncver.edu.au/resources/vocstats.html> Government funded students and courses database, extracted on 01/04/16

⁷⁸ VOCSTATS <http://www.ncver.edu.au/resources/vocstats.html> Government funded students and courses database; Total VET activity database, extracted on 30/09/16

Other qualifications showing strength in fee for service enrolments are:

- Certificate II in Boating Services (76 enrolments, which is more than double those enrolled at TAFE and other Government providers)
- Certificate III in Engineering – Mechanical Trade (813 enrolments, or 7% extra)
- Certificate III in Engineering – Fabrication Trade (1,330 enrolments, or 10% extra)
- Certificate III in Engineering – Technical (135 enrolments, or 13% extra)
- Diploma of Engineering – Technical (422 enrolments, or 25% extra)⁷⁹

This increase in fee for service delivery of the Certificate III level qualifications may be in part due to international student enrolments. There is some concern with the numbers of students engaging in the trade qualifications under the fee for service model, as without the apprenticeship arrangement, the candidate lacks industry experience and is unlikely to find work in Australia. For students undertaking an Australian qualification for migration purposes, education providers need to ensure that the advice given to these students reflects the job market in Australia. In a time when industry is experiencing skill shortages, it is a waste of talent to have highly educated and potentially high contributing migrants in low paid work, for example taxi driving, due to poor advice being provided by education providers.

All of the Certificate III level qualifications have seen a decrease in enrolments over the past five years except for the Certificate III in Engineering – Technical. This qualification has grown from 446 enrolments in 2010, up to 1,072 in 2014, as well as an additional 135 fee for service enrolments. The Certificate III in Engineering – Technical has cross-sectoral relevance due to the high number of computer aided drafting units. It is on scope at 28 RTOs including six private, one school and one industry association.

One qualification to show a steady increase in enrolments is the Certificate IV in Engineering, from 6,170 enrolments in 2010 up to 8,646 enrolments in 2014. There is a growing trend for Certificate III qualified tradespeople to utilise this qualification to upskill in hydraulics and pneumatics, CNC machining, or welding. This qualification is also a declared apprenticeship in some states. The Diploma of Engineering - Technical and the Advanced Diploma of Engineering are also attracting strong enrolments.

⁷⁹ VOCSTATS <http://www.ncver.edu.au/resources/vocstats.html> Total VET activity database, extracted on 01/04/16

Delivery options can be an issue affecting training uptake, and the following qualifications have few RTOs with scope:

Qualification	Total number RTOs on scope	Non-public providers by type
Certificate I in Boating Services	6	1 school, 1 ACE provider
Certificate III in Jewellery Manufacture	6	1 private
Certificate III in Marine Craft Construction	7	-
Certificate III in Locksmithing	5	1 private
Certificate III in Boating Services	2 (Both in QLD)	-
Certificate III in Watch and Clock Service and Repair	1	-
Certificate III in Engineering – Composites Trade	4 (All in VIC)	-
Certificate IV in Boating Services	0	-
Certificate IV in Advanced Jewellery Manufacture	1	-
Diploma of Jewellery and Object Design	4	-
Graduate Diploma of Engineering	1	1 private

Source: <http://training.gov.au/Home/Tga>

Additional information

The following graphs have been supplied by the Department of Education and Training. The Department has sourced national occupation-related data from the Department of Employment and the Australian Bureau of Statistics to inform the work of the IRCs.

IRC analysis

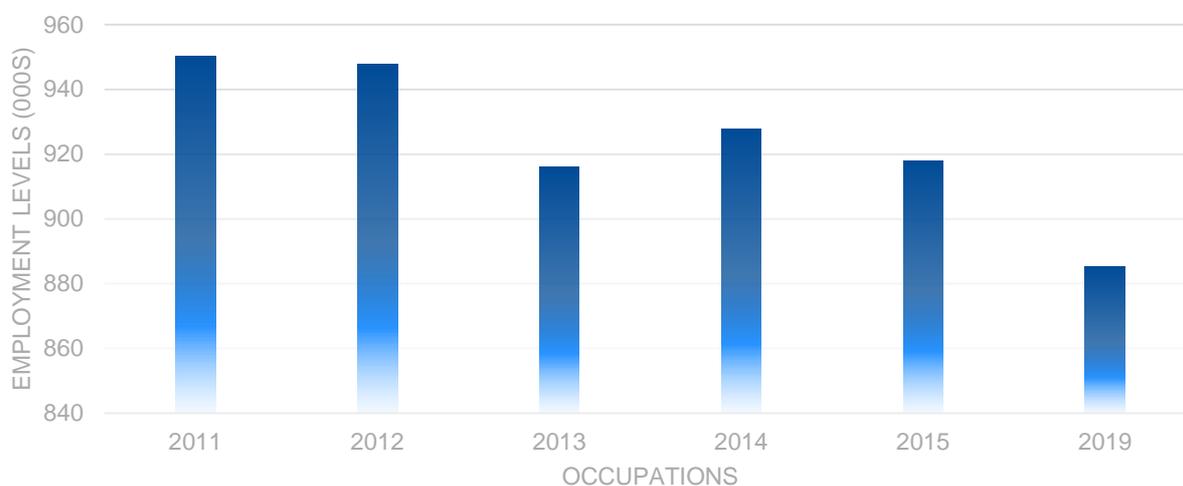
The first graph, 'Manufacturing – Employment Levels' displays figures for employment levels covering ANZSIC Division Level C. This division covers the broad spectrum of manufacturing⁸⁰, when the occupation relevant for the MEM Manufacturing and Engineering Training Package is that of the Industrial Electrician.

The Department of Employment has predicted that by 2020 there will be a decrease of 47,500 jobs across Division C Manufacturing⁸¹. A breakdown of these figures shows this to be made up by the following divisions:

- 23 Transport Equipment Manufacturing (-29,400 of which 27,500 are attributed to Motor Vehicle and Motor Vehicle Part Manufacturing)
- 13 Textile, Leather, Clothing and Footwear Manufacturing (-6,900)
- 22 Fabricated Metal Product Manufacturing (-5,400)
- 25 Furniture and other Manufacturing (-3,300)

As such we can see that despite the drop-in employment predicted by 2020, only a small proportion of this is relevant to the sectors utilising the MEM Manufacturing and Engineering or MEM05 Metal and Engineering Training Packages.

Manufacturing – Employment Levels (000s)⁸²



⁸⁰ Australian Bureau of Statistics, 2006 (Revision 2), 1292.0 Australian and New Zealand Standard of Industrial Classification (ANZSIC)

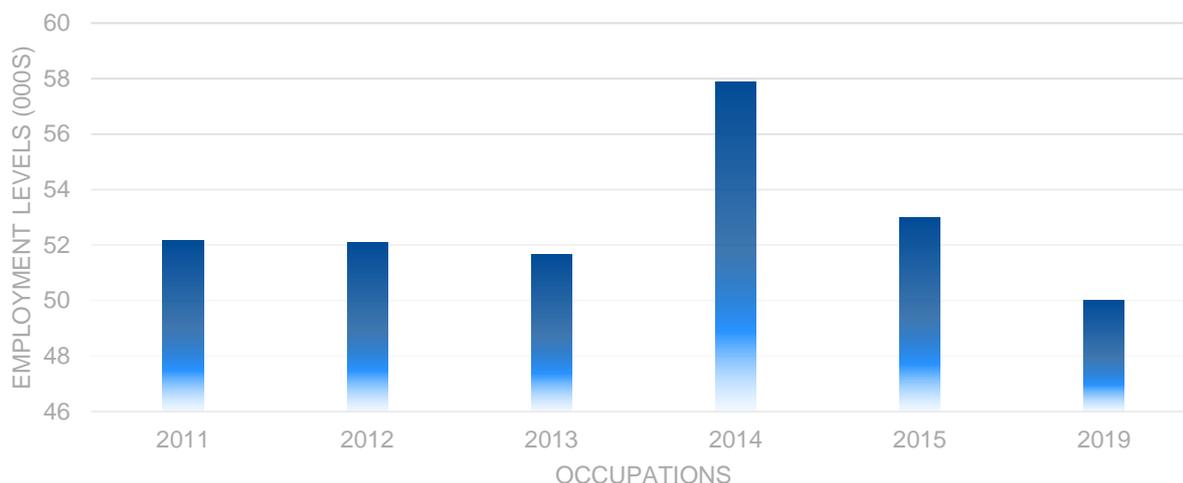
⁸¹ Australian Bureau of Statistics, 2006 (Revision 2), 1292.0 Australian and New Zealand Standard of Industrial Classification (ANZSIC) Division C Manufacturing,

⁸² Note: Figures are displayed at the ANZSIC Division Level C. The graph includes current and historical employment levels, as well as a projected employment level to 2019

Source: Department of Employment Labour Market Information Portal.

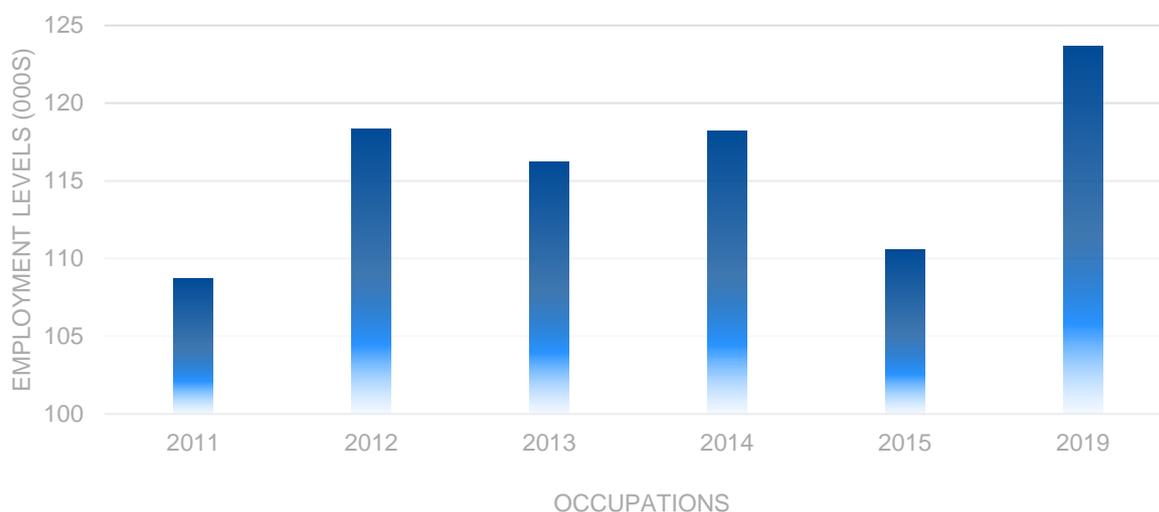
The second graph, also provided by the Department of Education and Training, displaying Fabricated Metal Product Manufacturing – Employment Levels', separates out the ANZSIC Division 22 for analysis but fails to include the other six divisions covered by the MEM05 Metal and Engineering Training Package.

Fabricated Metal Product Manufacturing – Employment Levels (000s)⁸³



Source: Department of Employment Labour Market Information Portal.

Machinery and Equipment Manufacturing – Employment Levels (000s)⁸⁴



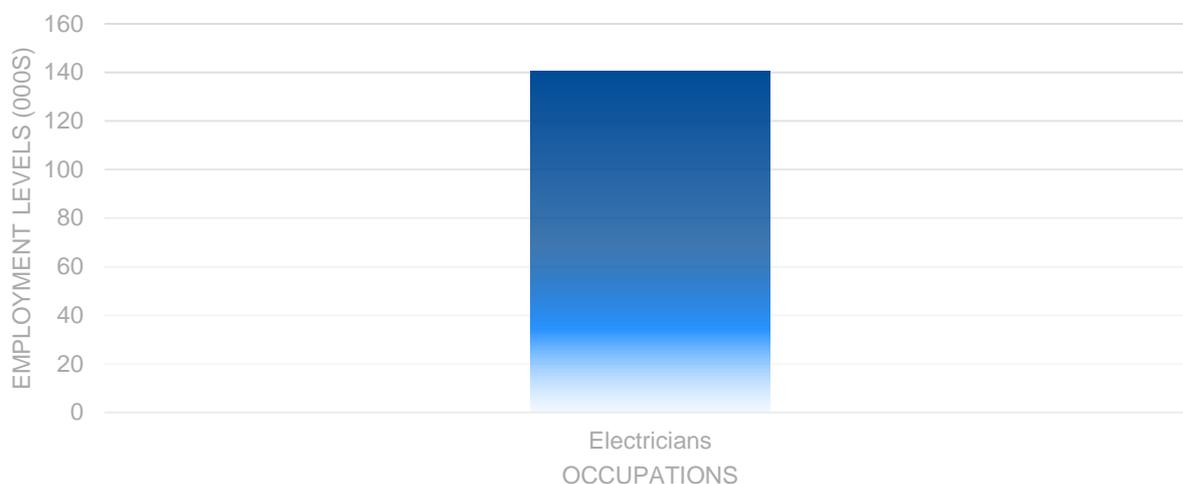
⁸³ Note: Figures are displayed at the ANZSIC Division level 22. The graph includes current and historical employment levels, as well as a projected employment level to 2019

⁸⁴ Note: Figures are displayed at the ANZSIC Division level 24. The graph includes current and historical employment levels, as well as a projected employment level to 2019

Source: Department of Employment Labour Market Information Portal.

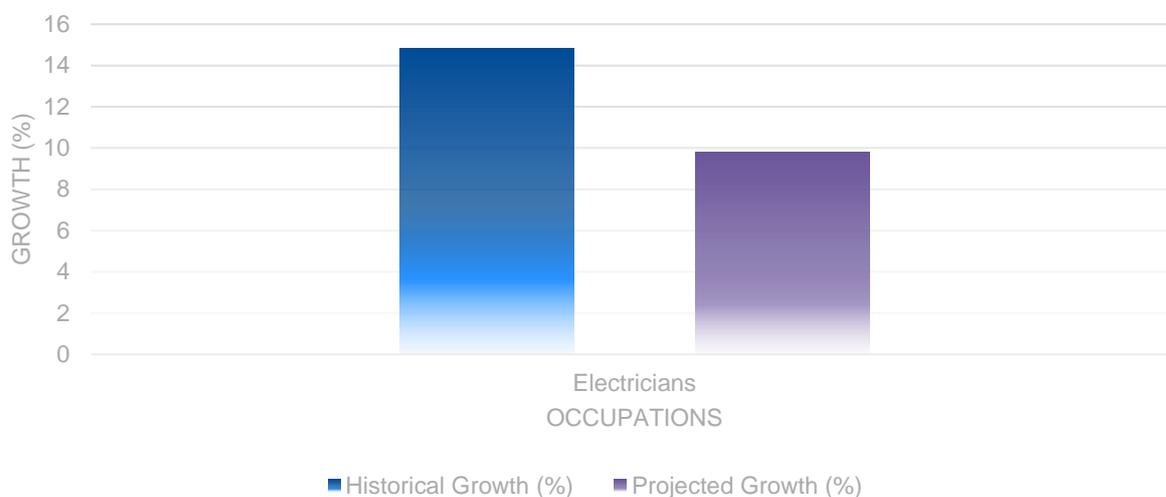
MEM Training Package

Key Occupations – Employment Levels (000s)⁸⁵



Source: Australian Bureau of Statistics (ABS)

Key Occupations – Historical and Projected Employment Growth (%)⁸⁶



Source: Historical employment growth from the Australian Bureau of Statistics (ABS) and projected employment growth from the Department of Employment.

⁸⁵ Note: Occupations are at the four digit ANZSCO code. Employment levels are the five year annual average to 2015. Figures include all employed in the occupation across the economy, not just the relevant industry.

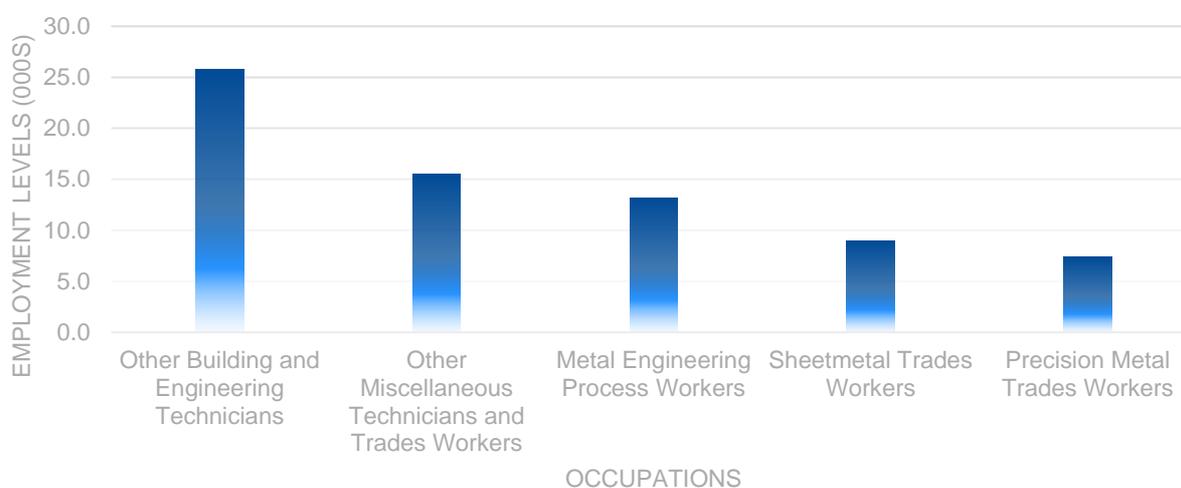
⁸⁶ Note: Occupations are at the four digit ANZSCO code. The historical employment is the five year growth rate to 2015 and the projected employment growth rate is the expected growth rate to 2019. Rates are based on figures that include all employed in the occupation across the economy, not just the relevant industry..

IRC analysis

At the time of publication of this IRC Skills Forecast and Proposed Schedule of Works, the only qualification in the MEM Manufacturing and Engineering Training Package is the Certificate III in Engineering – Industrial Electrician. These graphs display data for the occupation of Electrician at the four digit ANZSCO code (most likely group 3411 Electricians) which includes the broad scope of work an electrician undertakes, and excludes Automotive Electricians⁸⁷. The value of the information in these graphs is therefore limited by the large scope of other electrical trades workers included in the data and the inability of the data to examine those employed specifically in the industrial environment.

MEM05 Training Package

Key Occupations – Employment Levels (000s)⁸⁸



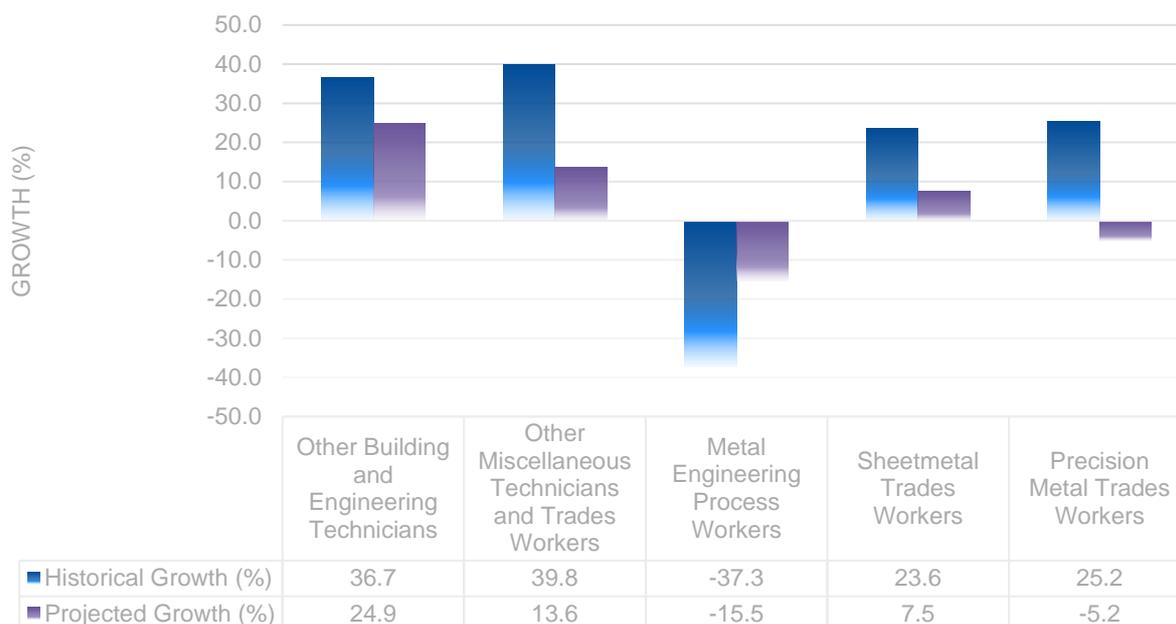
Source: Australian Bureau of Statistics (ABS)

⁸⁷ Australian Bureau of Statistics, 2016

<http://www.abs.gov.au/ausstats/abs@.nsf/Product%20Lookup/1220.0~2006~Chapter~UNIT%20GROUP%203411%20Electricians>

⁸⁸ Note: Occupations are at the four digit ANZSCO code. Employment levels are the five year annual average to 2015. Figures include all employed in the occupation across the economy, not just the relevant industry.

Key Occupations – Historical and Projected Employment Growth (%)⁸⁹



Source: Historical employment growth from the Australian Bureau of Statistics (ABS) and projected employment growth from the Department of Employment.

IRC analysis

Data provided in the graphs above represent five Key Occupations as determined by the Department of Employment. These occupations are a very small selection of occupational outcomes from the MEM05 Training Package. The following table provided to the IRC uses Occupational Projections made by the Department of Employment⁹⁰. It more accurately reflects the Key Occupational outcomes of training identified by stakeholders for qualifications from the MEM05 Training Package.

A 4.9% decrease in employment for Mechanical Engineering Draftspersons and Technicians is projected by 2020. This does not concur with feedback provided by stakeholders, who identified this as an occupational area predicted to grow over the next four years, particularly in Defence projects and related sectors. Both structural steel and welding trades workers will be in demand in the next five years as Australian governments begin to roll out proposed major infrastructure projects and Defence shipbuilding works begin. Industry stakeholders are projecting that there will be a skill shortage in this area by 2020, especially if the predicted decrease in employment eventuates. The skills of toolmakers and engineering patternmakers are in demand in Australia's advanced manufacturing sector and stakeholders report expecting the demand to increase by 2020.

⁸⁹ Note: Occupations are at the four digit ANZSCO code. The historical employment is the five year growth rate to 2015 and the projected employment growth rate is the expected growth rate to 2019. Rates are based on figures that include all employed in the occupation across the economy, not just the relevant industry.

⁹⁰ Department of Employment, 2016, Labour Market Information Portal, Employment Projections <http://lmip.gov.au/default.aspx?LMIP/EmploymentProjections>

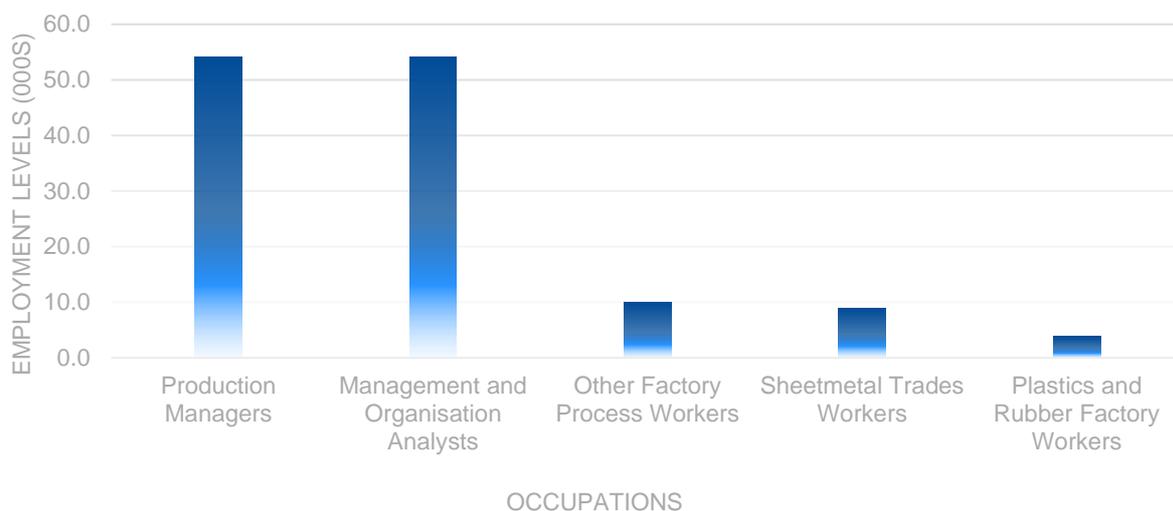
ANZSCO Code	Occupation	Employment level - November 2015 ('000)	Department of Employment Projections		
			Projected employment level - November 2020 ('000)	Projected employment growth - five years to November 2020	
				('000)	(%)
3125	Mechanical Engineering Draftspersons and Technicians	3.4	3.2	-0.2	-4.9
3223	Structural Steel and Welding Trades Workers	70.6	63.2	-7.4	-10.5
3232	Metal Fitters and Machinists	117.2	109.9	-7.3	-6.2
3234	Toolmakers and Engineering Patternmakers	4.8	5.2	0.3	7.1
7123	Engineering Production Workers	17.3	14.4	-2.9	-16.6

Source: Department of Employment, 2016 Occupational Projections – five years to November 2020.

MSA07 Training Package

The Department of Education and Training has provided the following two graphs.

Key Occupations – Employment Levels (000s)⁹¹



⁹¹ Note: Occupations are at the four digit ANZSCO code. Employment levels are the five year annual average to 2015. Figures include all employed in the occupation across the economy, not just the relevant industry.

Source: Australian Bureau of Statistics (ABS)

Key Occupations – Historical and Projected Employment Growth (%)⁹²



Source: Historical employment growth from the Australian Bureau of Statistics (ABS) and projected employment growth from the Department of Employment.

IRC analysis

Considering the proposal to move some qualifications from the MSA07 Training Package to the MEM Manufacturing and Engineering Training Package (see page 8 of this Skills Forecast and Proposed Schedule of Works), the Manufacturing Technology qualifications are the only ones relevant for discussion. None of the occupations listed in the two graphs above are occupational outcomes of these qualifications. MSA provided the data for the occupation most relevant to outcomes of training from the Manufacturing Technology qualifications (See ANZSCO Code 3125 in the table on the preceding page).

⁹² Note: Occupations are at the four digit ANZSCO code. The historical employment is the five year growth rate to 2015 and the projected employment growth rate is the expected growth rate to 2019. Rates are based on figures that include all employed in the occupation across the economy, not just the relevant industry.

Skills outlook

International and national trends

According to the CSIRO, growth opportunities exist for Australian manufacturers in the development of intelligent and connected products and solutions, high value products, sustainable products and domestic market opportunities. This includes:

- utilising 'big data' to develop products and services in response to embedded technologies in products,
- incorporating advanced materials to produce products that are high quality, lighter and more durable than existing products,
- a shift to 'manufacturing on demand' through the incorporation of additive manufacturing (3-D printing) which also has the potential to decrease waste and promote a more sustainable image of manufacturing, and
- increasing use of digitisation in design, development and production to increase through-put and minimise costs⁹³

This is in line with trends identified by stakeholders.

They identified automation and robotics as two international trends that are impacting on workplace design and also job design. Manufacturers are increasingly moving to automation to remain competitive. New technology is "cleaner and greener" and replacing older technology and/or lower skilled roles within the workplace. This is having an impact on job roles as roles become increasingly technology driven.⁹⁴

While robotics and automation in manufacturing is not new, the advent of the Internet of Things (IoT) which allows machine-to-machine communications and real-time data monitoring is driving the move to "smart manufacturing". Increasingly jobs will require digitally literate workers who are able to analyse and respond to data provided by the machines in their workplaces.⁹⁵ IoT will also facilitate the so-called Industry 4.0 or the fourth industrial revolution.

Management of scarce resources such as energy and water as well as materials will become increasingly important in the next five to ten years, especially as costs rise. This will result in the need for workers to develop new skills in sustainability as well as process efficiency.

At a national level, there is a trend towards increased quality certification against Australian standards. Stakeholders see this as a means to providing Australian customers with certainty about the quality of the product they are purchasing. For this reason, sectors such as Locksmithing are investigating the introduction of a national licensing system.

⁹³ CSIRO Futures, 2016, Australia 2030 – Navigating our uncertain future, <http://www.csiro.au/en/Do-business/Futures/Reports/Australia-2030> May, 2016.

⁹⁴ Tutty, J, 2016, Robots, work and the jobs of tomorrow, The Courier Mail, 30 May 2016, <http://www.heraldsun.com.au/news/national/robots-work-and-the-jobs-of-tomorrow/news-story/f18c006b91b91f352a029966af0b1856?csp=e8fb78b603a6e06de4e80d1e68c50420>

⁹⁵ Columbus, L, 2016, 10 ways machine learning is revolutionising the manufacturing industry, CloudTech, 4 July, <http://www.cloudcomputing-news.net/news/2016/jul/04/10-ways-machine-learning-is-revolutionizing-manufacturing/>

Sector skill needs

The five most important skills for the sectors workforce within the next three to five years.

Rank	Skill	How identified
1	Detail Drafting	Industry consultations
2	Communications	Industry consultations
3	Welding	Industry consultations
4	CNC & robotic programming	Industry consultations
5	Production planning	Industry consultations

Generic workforce skills⁹⁶

Ranked from 1 being the most important to 12 being the least important.

1	Communication / Virtual collaboration / Social intelligence
2	Technology
3	Managerial / Leadership
4	Learning agility / Information literacy / Intellectual autonomy and self-management
5	Customer service / Marketing
6	Environmental and Sustainability
7	Data analysis
8	Entrepreneurial
9	STEM
10	Design mindset / Thinking critically / System thinking / Solving problems
11	LLN
12	Financial

⁹⁶ Pre-populated table supplied by the Department of Education and Training

Other relevant skills-related insights for this sector

Workplaces are becoming leaner as new processes are being introduced and competition from international manufacturers continue to squeeze profit margins. As result employers are looking for employees with both trade skills and technical skills. Robotics, a knowledge of new materials and processes, ability to be flexible and adaptable and work across a range of areas are all seen as important. Another new technology that is expected to impact workplace and job design is drone (remote piloted equipment) technology. The introduction of this technology will remove the worker from the workshop floor to a control room which may not even be located in the same building, let alone the same room.⁹⁷

Australia is moving towards a predominantly 'advanced manufacturing' nation. According to the Australian Industry Group, currently 23% of all manufacturers in Australia classify themselves as 'advanced' manufacturers, employing 29% of the manufacturing workforce.⁹⁸ According to research in the United Kingdom, the skills needed in advanced manufacturing and which have been reported as in short supply include:

- Technical/practical or job-specific skills (75%)
- Planning and organising skills (52%)
- Problem solving skills (48%)
- Team working skills (43%)
- Customer service skills (36%)⁹⁹

In Australia, stakeholders have reported that these skills are also in short supply. They also added skills in global value chain (GVC) management and collaboration skills (to work with researchers and designers) to the mix. A greater emphasis on developing these skills through the training system is needed.

This industry requires workers with well-developed science, technology, engineering and mathematics (STEM) skills. The importance of STEM skills to the workforce has been highlighted in recent reports from the Office of the Chief Scientist¹⁰⁰ and acknowledged in the NISA.

The Future Submarine project will further drive the transition to advanced manufacturing, especially the need to upskill the existing workforce to meet the technical paraprofessional skills required to build the new submarines. It will also offer employment opportunities in a number of states affected by the demise of the car manufacturing industry although extensive reskilling will be needed to transition workers.¹⁰¹

⁹⁷ De Propris, L, 2016. A fourth industrial revolution is powering the rise of smart manufacturing, Manufacturing Monthly, 22 June 2016 <http://www.manmonthly.com.au/features/a-fourth-industrial-revolution-is-powering-the-rise-of-smart-manufacturing/>

⁹⁸ Australian Industry Group, 2016, Australian manufacturing: trends, influences and outlook, presentation to CEDA, 7 June 2016

⁹⁹ UK Commission for Employment and Skills, 2015, Sector insights: skills and performance challenges in the advanced manufacturing sector, Evidence report 93, June 2015, UK Government, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/439270/150626_AM_SLMI_report.pdf

¹⁰⁰ Office of the Chief Scientist, 2014, Science, Technology, Engineering and Mathematics: Australia's Future, http://www.chiefscientist.gov.au/wp-content/uploads/STEM_AustraliasFuture_Sept2014_Web.pdf

¹⁰¹ Crowe, David, 2016, Australian submarines: France wins \$50bn contract, The Australian 26 April, <http://www.theaustralian.com.au/national-affairs/australian-submarines-france-wins-50bn-contract/news-story/986ee35387c768a0c401f3edc97c5402>

Training Product Review Plan – 2017-2021

In September 2016 stakeholders identified a range of training product items that need to be considered in the Training Product Review Plan. For this report the IRC have prioritised these activities.

The IRC Skills Forecast and Proposed Schedule of Work 2017-18 to 2020-2021 table provided at the end of this document list the priorities for the next four years. This table also provides the rationale for these priorities, the proposed scope and timeframes for these activities.

Items identified as time critical and to be included in the priorities for 2017-18

The items identified as critical and proposed for inclusion as a priority for the 2017-2018 schedule of work are:

- **Welding** - Development of new qualifications and standards for Welding to meet the emerging needs of Welding Supervisor and Welding Inspection occupations. For content associated with alternative international welding standards and weld procedure development.
- **Welding** - Restructuring the hierarchy of welding Units of Competency and Qualifications leading to the higher level welding processes and standards associated with advanced and coded welding standards. *Review of Units of Competency and Qualifications to ensure adequacy in meeting the needs of new applications such as continuous ship building, submarine manufacture and related heavy engineering applications including infrastructure and renewable energy.*
- **Non-destructive testing** - New Qualifications and standards to reflect contemporary non-destructive testing hierarchies and emerging forms of testing and associated work organisation and job design. *Review of units of competency and qualifications to ensure adequacy in reflecting contemporary testing hierarchies and emerging forms of testing and work organisation, with particular application to marine standards as well as other standards related to heavy engineering applications including the resources industry, infrastructure and renewable energy.*
- New qualifications and standards associated with training package gaps to cover engineering and technical work associated with:
 - **planning and scheduling**
 - **supply chain management**
 - **logistics**
 - **quality systems management, including through the supply chain**
 - **configuration management**
- **Trainer/Supervisor/Coordinator** - Development of standards/post qualification Skill Sets/Qualifications associated with the Trainer/Supervisor/Coordinator classifications in the Manufacturing & Associated Industries & Occupations Award 2010.

IRC Signoff

This IRC Skills Forecast and Proposed Schedule of Work was agreed as the result of a properly constituted IRC decision and was approved by the Chair, Ian Curry in April 2017.

Appendix

Occupation regulated	Unit of Competency or Qualification related to licence / certification
Industrial Electrician	MEM31215
Welding	MEM05045B, MEM05042B, MEM05043B, MEM05044B, MEM05046B
Non-destructive Testing	MEM24002B, MEM24004B, MEM24006B, MEM24007B, MEM24008B, MEM24010B, MEM24011B, MEM24012B
Boiler Operators	MSMBLIC001, MSMBLIC002
Air-conditioning and refrigeration	MEM20105, MEM30205, MEM05006B, MEM09002B, MEM10002B, MEM10009B, MEM10010B, MEM12002B, MEM12023A, MEM18001C, MEM18002B, MEM18049B, MEM18055B, MEM18086B, MEM18088B, MEM18088B, MEM18092B
Metal Fabrication	MEM30298
Locksmithing	MEM30805