Manufacturing and Engineering Industry Reference Committee

Skills Forecast and Proposed Schedule of Work 2019–2023

MEM05 Metal and Engineering +
MEM Manufacturing and Engineering Training Package
April 2019

IBSA MANUFACTURING

Administrative Information

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

Name of Skills Service Organisation (SSO):
Innovation and Business Skills Australia (IBSA Manufacturing)

About the Industry Reference Committee

The **Manufacturing and Engineering Industry Reference Committee** comprises 12 members and was constituted in November 2017.

The 2019 Industry Skills Forecast and Proposed Schedule of Work was reviewed and approved by the membership below:

Mr Ian Curry (Chair)
Mr Kristian Stratton
Mr Daniel Murray
Mr Mark Keenan
Mr Adrian Boden
Mr Mark Burgess
Mr David Tiller (Deputy Chair)
Mr Doug De Cean
Mr Michael Grogan
Mr Doug Searle
Mr Paul Baxter
Mr Steven Crocker

About the Skills Forecast

The Industry Reference Committee (IRC) Skills Forecast and Proposed Schedule of Work identifies priorities for training package development work to meet the needs of industry. This document is based on research, analysis and consultations with IRC members and industry stakeholders and provides evidence of current and emerging industry skills needs.

Industry Reference Committee Signoff

This 2019 return of the Manufacturing and Engineering IRC Skills Forecast and Proposed Schedule of Work was agreed as the result of a properly constituted IRC decision and was approved by:

IRC Chair: Ian Curry

Date: April 2019

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This IRC Skills Forecast and Proposed Schedule of Work has been prepared on behalf of the Manufacturing and Engineering Industry Reference Committee for submission to the Australian Industry and Skills Committee (AISC).

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Contents

Executive Summary

There are a number of workforce challenges and opportunities facing the manufacturing and engineering industry that have implications for skill development priorities, particularly:

- new Defence projects that will create substantial numbers of jobs and demand for engineering skills over coming decades
- changing technology, which is impacting the way in which work is conducted, providing new business opportunities, changing business models and assisting businesses to increase their efficiency and productivity
- an increasing focus on the sustainability of products and business practices
- skill shortages in several occupations (welding trades workers, sheetmetal trades workers and structural steel, and locksmiths) and recruitment difficulties in relation to Science, Technology, Engineering and Mathematics (STEM) skills, automation, big data and artificial intelligence solutions.

The Proposed Schedule of Work 2019–2020 to 2022–2023 was developed by the IRC, with support from IBSA Manufacturing, based on identified industry trends. The Schedule lists the priorities over the next four years, the rationale and the proposed timeframes for these activities. The priority identified as important and proposed for 2019–2020 is to address skill needs arising from new and converging technologies, including Non-Destructive Testing (NDT); planning, scheduling, logistics and supply chain management; maintenance and diagnostic skills; new diploma to cover the skills associated with the emerging technologies and applications; covering skills in emerging technologies mechatronics; and design and drafting skills. Further details about this priority can be found in the Proposed Schedule of Work. A Case for Change for this priority will be submitted in 2019–2020.

Sector Overview

The MEM05 Metal and Engineering and MEM Manufacturing and Engineering Training Packages cover a diverse range of businesses and occupations associated with designing, making, assembling, installing, maintaining and repairing manufactured products.

The qualifications in the MEM Manufacturing and Engineering Training Package relate to the following broad sectors:

- Engineering
- Boatbuilding and Shipbuilding
- Jewellery Manufacture
- Locksmithing
- Watch and Clock Service and Repair.

The Manufacturing and Engineering IRC has selected a number of Australian and New Zealand Standard Industrial Classification (ANZSIC) classes as representative of the manufacturing and engineering industry in Australia, including some or most of the sub-sectors or 'classes' within the following ANZSIC subdivisions and groups.

Table 1 – ANZIC subdivision code

ANZSIC Code	ANZSIC Subdivision or Group Name
21	Primary Metal and Metal Product Manufacturing
22	Fabricated Metal Product Manufacturing (including key and lock manufacturing)
24	Machinery and Equipment Manufacturing
94	Repair and Maintenance (including watch and clock service and repair, and key duplication)
239	Other Transport Equipment Manufacturing (including shipbuilding and boatbuilding)
259	Other Manufacturing (including jewellery and silverware manufacturing)

A list of the more detailed ANZSIC classes and the training package areas that they relate to can be found in Appendix A.[1]

1 Selected data from the Australian Bureau of Statistics (ABS) included in this report is based on two hierarchical classification systems – the Australian and New Zealand Standard Industrial Classification[1] (ANZSIC) and the Australian and New Zealand Standard Classification of Occupations[2] (ANZSCO). A list of ANZSIC and ANZSCO codes that have been identified by key industry stakeholders as relevant to the MEM Manufacturing and Engineering Training Package are provided at Appendix A and Appendix B.

Census data, the most recent being 2016, can generally be broken down to the four-digit levels of these classifications. However, annual data is only available at the three-digit levels. Some of the industries or occupations that are included at the available level of aggregation may not be specifically relevant to this training package.

Furthermore, the ANZSIC and ANZSCO classification systems were introduced in 2006, with minor revisions incorporated into the ANZSCO structure in 2009 and 2013. The MEM IRC has noted that some ANZSIC and ANZSCO codes are now outdated and do not represent some emerging industries or occupations. In addition, the classification systems may not be sensitive to localised specialisations. Despite these limitations, the data can be useful in highlighting recent trends and, when supplemented with qualitative advice from industry, can help to develop a useful picture

The manufacturing industry is the largest employer of people with skills developed through the MEM Manufacturing and Engineering and MEM05 Metal and Engineering Training Packages. Other industries, such as mining and resources, transport and construction also utilise these skills. However, due to the difficulty in identifying these roles within other industries, they are not included in this analysis.

One of the unique features of the MEM Manufacturing and Engineering and MEM05 Metal and Engineering Training Packages is their strong links to industrial relations arrangements and the central role they play in relation to award classifications and, in some cases, licensing requirements. For this reason, licensing requirements and IR arrangements are vitally important considerations in relation to training package standards in these industry sectors.

Industry Snapshot

After a period of declining growth and employment in recent years (a loss of 58,800 jobs in the five years to November 2017),[2] the Performance of Manufacturing Index (PMI) shows that overall, Australia's manufacturing industry is now growing. The October 2018 PMI reported another month of growth for the industry – the 25th month of 'uninterrupted recovery and expansion (results above 50 points)' and 'the longest run of recovery or expansion in this data series since 2005'.[3]

Although growth across the industry as a whole has been led by the wood and paper and food and beverages sectors, the metal products sector has also grown and the machinery and equipment sector has remained stable.

According to the PMI:

- the machinery and equipment sector employed 192,000 people in August 2018 (representing 21% of all manufacturing employment) and has been recovering for the past two years, but has recently stabilised due to the lower Australian dollar and lower sales in drought affected areas of Queensland and New South Wales
- the metal products sector employed 135,000 people in August 2018 (representing 15% of manufacturing employment) and while this sector has experienced growth, it is being impacted by strong competition from cheaper imported metal products.[4]

2 Department of Jobs and Small Business (2018) Australian Jobs 2018, Australian Government. p11.

3 AiGroup, 2018, Australian Performance of Manufacturing Index, October 2018.

4 AiGroup, 2018, Australian Performance of Manufacturing Index, October 2018.

There are some notable differences within some of the subsectors related to the MEM05 Metal and Engineering and MEM Manufacturing and Engineering Training Packages:

- The shipbuilding sector has experienced significant revenue growth (over 5% annually) for the past five years and is projected to continue to grow over the next five years. Growth has been driven by demand from Defence, with planned projects for the Collins-class submarine replacement, Anzac-class frigate fleet replacement and Offshore Patrol Vessels continuing to benefit local subcontractors over the next five years. Although commercial shipbuilding is no longer viable on a large scale due to cheaper overseas manufacturing environments, there are niche markets, such as high-speed catamarans, in which Australian manufacturers are competitive.[5]
- The boatbuilding sector has been in decline in Australia over the past five years and is projected to continue to decline, although not as rapidly, over the next five. This is due to declining consumer demand for 'luxury' products. However, the decline has been offset somewhat by increased demand for the repair of existing boats and for smaller, more affordable vessels.[6]
- The Defence sector is entering an extended period of growth with significant building projects such as LAND 400 a $10 - $15 billion-dollar project to build combat reconnaissance vehicles over the next 15 years. Rheimettal, a major German company has been contracted to undertake this work.[7]
- The watch and clock service and repair sector is shrinking, despite Australian demand for Swiss watches (as opposed to digital and 'smart' watches) growing by 11% over the past two years.[8] A decline in the supply of skilled watch and clock makers and repairers (see the Challenges and Opportunities section for further details), combined with challenges in gaining access to spare parts from watch manufacturers, is leading to a decline in the availability of repair services.
- Declining gold and silver prices have made jewellery more affordable, resulting in small but steady growth in the jewellery manufacture sector. There has been a notable increase in demand for handmade and custom-made jewellery.[9]

5 IBISWorld, 2018, IBISWorld Industry Report C2391: Shipbuilding and Repair Services in Australia.

6 IBISWorld, 2017, IBISWorld Industry Report C2392: Boatbuilding and Repair Services in Australia.

7 http://www.defenceindustries.qld.gov.au/land/project-land-400.html, accessed 15/04/2019.

8 Watch and Clockmakers of Australia http://www.wca.org.au/watchmakers-of-australia, accessed 20/11/2019.

9 IBISWorld, 2018, IBISWorld Industry Report C2591: Jewellery Manufacturing in Australia.

Business Landscape

According to Australian Bureau of Statistics (ABS) data,[10] there were over 52,465 businesses operating across the selected ANZSIC classes at the end of 30 June 2017. This represents a slight growth of 1% since 2015.

Almost one third of these businesses were located in New South Wales (31%), followed by Victoria (25%) and Queensland (23%).

The majority of businesses are small (48%) or non-employing (47%), with around 4% medium-size employers and less than 1% large employers.

There are some notable differences within individual sub-sectors related to the MEM05 Metal and Engineering and MEM Manufacturing and Engineering Training Packages:

- Of the 402 businesses operating in the shipbuilding and repair sector, almost 5% were medium and 2% large.
- More than one third of the 1,573 businesses operating in the boatbuilding and repair sector were located in Queensland.
- More than 60% of the 1,361 businesses in the jewellery manufacturing sector are non-employing.
- The number of businesses in the prefabricated metal building manufacturing sector has grown by 22% between 2015 and 2017 and the number of businesses in the machine tool and parts manufacturing sector has increased by 13%.

Key Industry Stakeholders

Industry associations and peak bodies in this sector are those related to manufacturing overall, as well as those related to the individual sub-sectors. They include:

- Advanced Manufacturing Growth Centre
- Australian Industry Group (AI Group)
- Engineers Australia
- Jewellers Association of Australia
- Locksmiths Guild of Australia
- Manufacturing Australia
- Master Locksmiths Association of Australasia Limited (MLAA)
- Watch and Clockmakers of Australia
- Weld Australia.

Employee associations relevant to this sector are:

- Australian Manufacturing Workers Union
- Australian Workers' Union
- Communications, Electrical and Plumbing Union
- Construction, Forestry, Maritime, Mining and Energy Union (CFMMEU)
- National Union of Workers
- United Voice.

Government and regulatory bodies relevant to this sector are:

- Australian Maritime Safety Authority (AMSA).

10 ABS 8165.0 Counts of Australian Businesses, including Entries and Exits, Jun 2013 to Jun 2017.

Large employers within engineering qualification-related sectors include:

- ABB group
- ASC Pty Limited
- Austal and Civmec Construction and Engineering
- BAE Systems Australia
- Baxter Healthcare
- BlueScope Steel Limited
- Bombardier Transportation
- Bradken
- Cochlear
- DuluxGroup
- Hastings Deering
- Incat Tasmania
- Lurrsen
- Naval Group
- Orora
- ResMed Holdings
- Rheinmetall Defence
- Thales Australia
- UGL
- VAE Rail Systems
- Valmont Group Holdings Limited.

In the boatbuilding sector, three major companies – Riviera Australia, Telwater and Haines Marine Industries – are all based in Queensland.

In the shipbuilding sector, the largest companies are those providing shipbuilding services for defence purposes as part of their operations – ASC Pty Limited, BAE Systems Australia Holdings Limited, Thales Australia, Austal and Civmec Construction and Engineering. However, another significant player, Incat Tasmania, manufactures catamarans. The Naval Shipbuilding IRC supports skills requirements for the naval shipbuilding sustainment industry. The work of this IRC cuts across a number of training packages including the MEM Manufacturing and Engineering Training Package.

In the jewellery manufacture sector, there are a few medium-size players, including:

- Pallion Group Pty Limited
- Michael Hill International Limited
- Wallace Bishop Pty Ltd.

Licensing and Regulation

Licensing requirements across the engineering trades vary considerably across jurisdictions. Examples of the variability include the following:

- The Certificate III in Engineering – Industrial Electrician leads to a special class of licence as an Industrial Electrician and was developed for use in the mining and resources industries; it is currently only used in one jurisdiction, Western Australia.
- There are a number of certifications that may apply to welders, depending on the type of welding required and whether they need to meet Australian or international standards.
- In some jurisdictions, locksmiths are required to hold a licence, as are metal fabricators but in other jurisdictions, these occupations are unlicensed. In the larger states (New South Wales, Queensland, Victoria and Western Australia), security licences are now required for certain aspects of locksmith work.

There are wide variations in the certification requirements for welders performing repair and maintenance work on boats and ships.

Non-Destructive Testing – Level 2 NDT practitioner is the subject of a variety of certification requirements.

Businesses in the manufacturing industry must also comply with:

- federal, state and local government environmental standards,
- product safety standards and
- occupational health and safety regulations.

There are also a wide range of sub-sector-specific regulations which need to be met. An example of this is the specific regulations that apply to medical equipment and are administered under the Therapeutic Goods Administration.

Regulations in the shipbuilding industry are governed by the International Maritime Organisation and include matters relating to safety and environmental regulations, as well as maritime security and shipping efficiency.

The boatbuilding sector is governed by AMSA, which covers issues associated with safety, stability and water-tight and weather-tight integrity.

Training Snapshot

In 2017, a learner enrolled in a qualification from the MEM Manufacturing and Engineering or MEM05 Metal and Engineering Training Package was most likely to be:

ENROLLED IN AN ENGINEERING TRADE QUALIFICATION

STUDYING IN QUEENSLAND

IN THE 19-YEARS-AND-UNDER AGE BRACKET

IN AN APPRENTICESHIP OR TRAINEESHIP

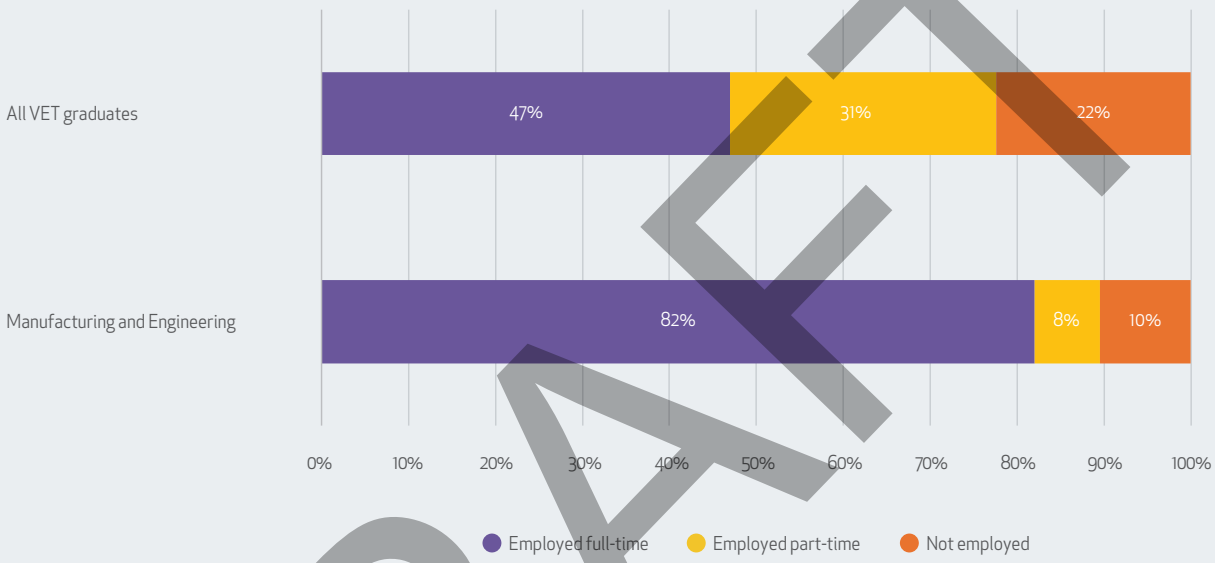
ENROLLED WITH TAFE

MALE

Graduate Outcomes

Of the graduates of MEM Manufacturing and Engineering Training Package qualifications in 2017, 90% were employed after training, with the large majority (82%) employed full-time. As illustrated in Figure 1 below, this level of post-qualification employment is significantly higher than that of Vocational Education and Training (VET) qualifications overall.[11]

Figure 1 – VET graduates' employment outcomes after training



More than half (55%) of the graduates of MEM Manufacturing and Engineering qualifications were employed in the same occupation as their training course, while 89% reported that the training they undertook was relevant to their job. Once again, these figures are notably higher than for graduates of all VET programs.[12]

11 NCVER VET student outcomes 2017, Data visualisation – VET graduate outcomes, all VET graduates.

12 NCVER VET student outcomes 2017.

Apprenticeships and Traineeships

Qualifications undertaken as part of an apprenticeship or traineeship accounted for one third of all enrolments in MEM Manufacturing and Engineering qualifications in 2017. This figure has remained relatively constant since 2014.

Of the 6,812 apprenticeship and traineeship commencements in 2017, 81% were in the Certificate III in Engineering – Fabrication Trade or Certificate III in Engineering – Mechanical Trade.[13] These two qualifications are funded as an apprenticeship in every state and territory, as is the Certificate III in Locksmithing.[14]

Other qualifications that are funded as an apprenticeship or traineeship in multiple jurisdictions include.[15]

- Certificate II in Engineering
- Certificate II in Engineering – Production Technology
- Certificate III in Engineering – Production Systems
- Certificate III in Engineering – Electrical/Electronic Trade
- Certificate III in Engineering – Technical
- Certificate III in Jewellery Manufacture
- Certificate III in Marine Craft Construction
- Certificate III in Watch and Clock Service and Repair
- Certificate III in Engineering – Composites Trade
- Certificate IV in Engineering
- Certificate IV in Engineering Drafting
- Diploma of Engineering – Advanced Trade
- Diploma of Engineering – Technical
- Advanced Diploma of Engineering.

13 NCVER VOCSTATS , extracted on 13/08/2018.

14 Australian Apprenticeships and Traineeships Information Service (AATIS) – website states This data is sourced from State and Territory Training Authorities and is provided for information only and must be confirmed with these authorities.

15 Australian Apprenticeships and Traineeships Information Service (AATIS) – website states This data is sourced from State and Territory Training Authorities and is provided for information only and must be confirmed with these authorities.

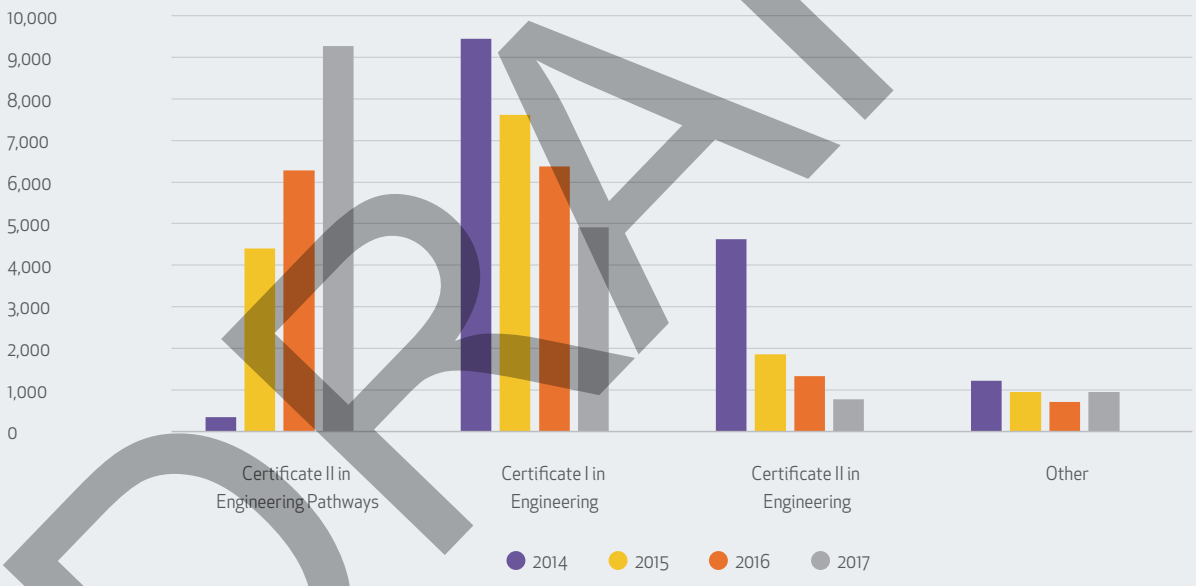
VET Delivered to Secondary Students

There were 15,905 enrolments in MEM Manufacturing and Engineering qualifications undertaken through VET delivered to secondary students (formerly VET in Schools) programs in 2017 – a figure that has remained relatively constant since 2014. 56% of these enrolments were in Queensland schools. Most of these enrolments, 94%, were in the following three qualifications:

- Certificate I in Engineering (4,915)
- Certificate II in Engineering pathways (9,264)
- Certificate II in Engineering (781)

Figure 2 below illustrates the most commonly undertaken qualifications for VET delivered to secondary students enrolments over the four-year period 2014–2017.

Figure 2 – VET delivered to secondary students enrolments by qualifications



Training Delivery

As illustrated in Table 2 below, delivery by TAFE accounts for the majority of enrolments, and this proportion has remained relatively constant since 2014.

Table 2 – Proportion of program enrolments by provider type

Provider type	Government funded enrolments 2016	Government funded enrolments 2017	Total VET enrolments 2016	Total VET enrolments 2017	Percentage provider type for 2017
TAFE	22,440	24,314	29,672	30,881	56%
Private training provider	7,399	7,208	12,048	11,828	21%
University	2,322	2,180	2,779	2,540	5%
Enterprise provider	45	10	46	12	0%
School	3,268	2,912	10,608	9,350	17%
Community education provider	458	564	719	936	2%

Table 3 indicates the number of Registered Training Organisations (RTOs) with MEM Manufacturing and Engineering or MEM05 Metal and Engineering qualifications on scope. This data is current at August 2018, per the listing on the National Register of VET available at www.training.gov.au.

Table 3 – Number of RTOs by nationally recognised qualifications on scope

Qualification name	No. of RTOs on scope
Certificate I in Engineering	111
Certificate I in Boating Services	3
Certificate II in Engineering	89
Certificate II in Engineering – Production Technology	23
Certificate II in Boating Services	7
Certificate II in Engineering Pathways	92
Certificate III in Engineering – Production Systems	18
Certificate III in Engineering – Mechanical Trade	67
Certificate III in Engineering – Fabrication Trade	81
Certificate III in Engineering – Electrical/Electronic Trade	13
Certificate III in Engineering – Technical	24
Certificate III in Jewellery Manufacture	6
Certificate III in Marine Craft Construction	5
Certificate III in Locksmithing	4
Certificate III in Boating Services	1
Certificate III in Watch and Clock Service and Repair	2
Certificate III in Engineering – Composites Trade	3
Certificate III in Engineering – Industrial Electrician	4
Certificate IV in Engineering	62
Certificate IV in Advanced Jewellery Manufacture	2
Certificate IV in Engineering Drafting	16
Diploma of Engineering – Advanced Trade	31
Diploma of Engineering – Technical	27
Diploma of Jewellery and Object Design	5
Advanced Diploma of Engineering	20
Advanced Diploma of Jewellery and Object Design	5
Graduate Diploma of Engineering	1
Certificate III in Manufacturing Technology	16
Certificate IV in Manufacturing Technology	9
Diploma of Manufacturing Technology	5
Advanced Diploma of Manufacturing Technology	2

Source: https://Training.gov.au. RTOs approved to deliver this qualification. Accessed August 2018.

Qualifications Available

The following qualifications and skill sets are included in the MEM Manufacturing and Engineering and MEM05 Metal and Engineering Training Packages:

Engineering

- Certificate I in Engineering
- Certificate II in Engineering
- Certificate II in Engineering – Production Technology
- Certificate II in Engineering Pathways
- Certificate III in Engineering – Fabrication Trade
- Certificate III in Engineering – Production Systems
- Certificate III in Engineering – Composites Trade
- Certificate III in Engineering – Electrical/ Electronic Trade
- Certificate III in Engineering – Mechanical Trade
- Certificate III in Engineering – Technical
- Certificate III in Engineering – Industrial Electrician
- Certificate IV in Engineering Drafting
- Certificate IV in Engineering
- Diploma of Engineering – Advanced Trade
- Diploma of Engineering – Technical
- Advanced Diploma of Engineering
- Graduate Diploma of Engineering.

Boatbuilding, Shipbuilding and Boating Services

- Certificate I in Boating Services
- Certificate II in Boating Services
- Certificate III in Boating Services
- Certificate III in Marine Craft Construction
- Certificate IV in Boating Services.

Jewellery Manufacture

- Certificate III in Jewellery Manufacture
- Certificate IV in Advanced Jewellery Manufacture
- Diploma of Jewellery and Object Design
- Advanced Diploma of Jewellery and Object Design.

Locksmithing

- Certificate III in Locksmithing

Watch and Clock Service and Repair

- Certificate III in Watch and Clock Service and Repair

Skill Sets

- Non-Destructive Testing – Level 2 NDT practitioners.

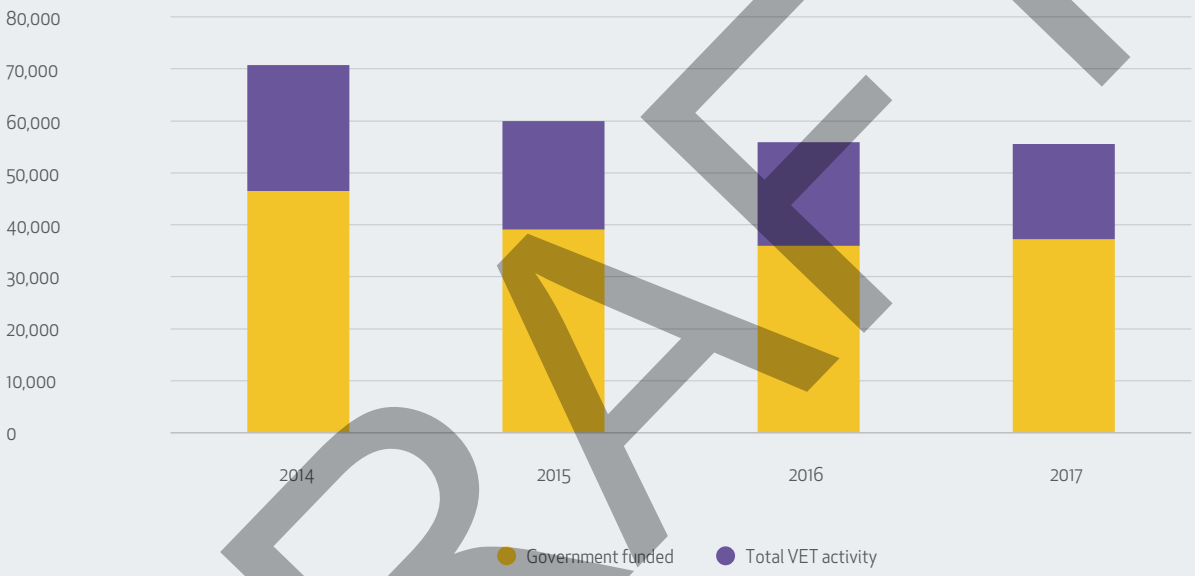
Current work is underway to ensure the qualifications from the MEM05 Metal and Engineering Training Package comply with current training package policy requirements and templates. For further details, refer to the Training Product Review – Current Activities section of this report.

Qualification Uptake

As illustrated in Figure 3, enrolments in MEM Manufacturing and Engineering Training Package qualifications have been declining since 2014. However, the rate of decline has slowed significantly, with only a 1% difference in total VET enrolments between 2016 and 2017.

The proportion of enrolments that are government funded has remained stable at around 64–67% over the four years.

Figure 3 – MEM Manufacturing and Engineering Training Package course enrolments, 2014–2017



Source: NCVER VOCSTATS, extracted on 15/08/2018.

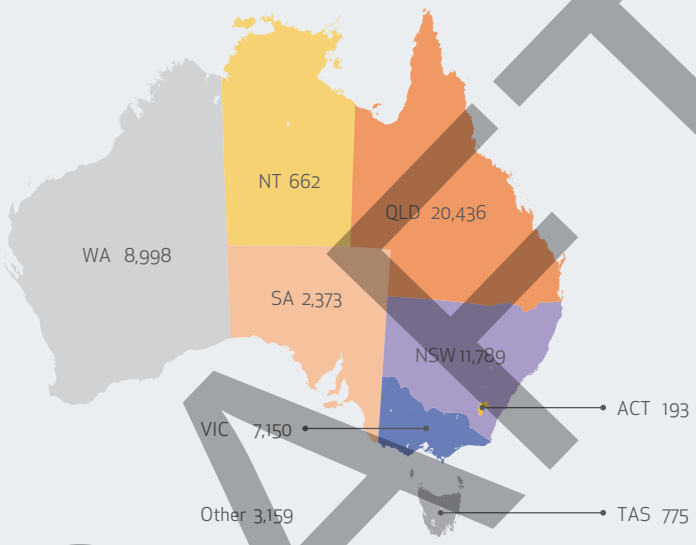
In 2017, the numbers of enrolments in the Certificate II in Engineering Pathways overtook the numbers of enrolments in the previously most utilised qualifications of Certificate III in Engineering – Fabrication Trade and Certificate III in Engineering – Fabrication Trade (see Figure 4). This aligns with a significant increase in VET delivered to secondary students enrolments in the Certificate II in Engineering Pathways qualification from 2016 to 2017. However, the absence of destination data makes it difficult to ascertain the employment outcomes attached to the VET delivered to secondary students programs.

Figure 4 – Top six MEM Manufacturing and Engineering qualifications, 2014–2017

Source: NCVER VOCSTATS, extracted on 15/08/2018.

Queensland has by far the largest number of enrolments in MEM Manufacturing and Engineering qualifications, with 39% of enrolments coming from that state in 2017 (see Figure 5). This represents a growth of 5% since 2016 and almost 10% since 2014.

Figure 5 – Program enrolments in MEM Manufacturing and Engineering qualifications by state/territory of student residence

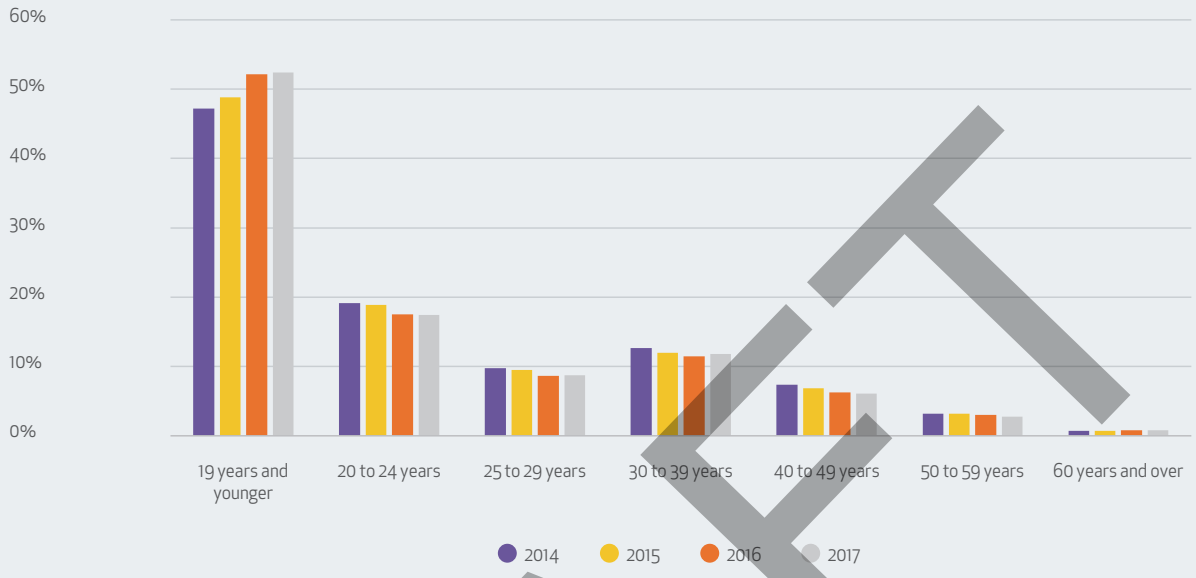


Source: NCVER VOCSTATS, extracted on 15/08/2018.

Enrolments in MEM Manufacturing and Engineering qualifications continue to be male-dominated, accounting for 94% of all enrolments in 2017. However, an increasing number of female enrolments has shifted the balance by 2% since 2014.

The proportion of enrolments that fall into the 19-years-and-younger age group has been steadily increasing since 2014, accounting for 52% of all enrolments in 2017 (see Figure 6). This has been accompanied by a 10% increase in the proportion of enrolments at Certificate II level over the same period.

Figure 6 – MEM Manufacturing and Engineering qualifications by age group 2014–2017



Source: NCVER VOCSTATS, extracted on 15/08/2018.

The Certificate III and Certificate IV in Boating Services have had no enrolments between 2014 and 2017. Consultations with the Marina Industries Association suggest that the qualification Certificate III in Marina Operations, which belongs to the MAR Maritime Training Package, is being used to meet skill development needs in this area.

Other qualifications that have had no or low enrolments (i.e. fewer than 20 enrolments) over this period are:

- Certificate IV in Advanced Jewellery Manufacture
- Graduate Diploma of Engineering
- Diploma of Manufacturing Technology
- Advanced Diploma of Manufacturing Technology.

It is worth noting that, whilst there have been no or low enrolments in the Certificate IV in Advanced Jewellery Manufacture, industry feedback indicated that there is a need for ongoing training beyond the entry level trade qualification Certificate III in Jewellery Manufacture.

Consultations also identified that the specialist streams of the manufacturing technology qualifications (which include metallurgy, polymer technology and structural steel detailing) overlap with other MEM Manufacturing and Engineering which is likely to be impacting on demand.

Challenges and Opportunities

For Industry and Employers

Defence Projects

One of the biggest drivers of growth and change in engineering-related skills will be Defence projects that are starting to be rolled out and will continue for the next 50 years. The projects include:

- Construction of 12 new submarines under the Future Submarines project, which is expected to begin in Adelaide in 2022 and continue through to the late 2040s. The project is anticipated to create an average of 2,800 direct jobs across the life of the project.[16]
- Construction of the new fleet of Offshore Patrol Vessels, which will commence in 2018 at the Osborne Naval Shipbuilding Precinct, located in Adelaide. Construction of the 12 new vessels will create more than 400 direct jobs and many more supply chain opportunities.[17] The project will transfer to Perth in 2020, where engineering company Civmec estimates it will provide jobs for up to 1,000 people, including 100 new apprentices and trainees.
- The Future Frigates project will commence in Adelaide in 2020 and is expected to create a further 1,500 direct jobs, along with supply chain opportunities.[18]
- The Land 400 project is expected to deliver 675 military vehicles over 15 years and require ongoing maintenance and support for those vehicles for up to 30 years. The successful tenderer, Rheinmetall, will establish its headquarters and Military Vehicle Centre of Excellence in South East Queensland.[19]

As part of the Naval Shipbuilding Plan, the Australian Government officially launched the Naval Shipbuilding College in November 2018. The College, which is headquartered in Adelaide, will enable students to undertake studies through partnerships with approved VET and higher education providers across the country as part of efforts to ensure a suitably skilled and qualified workforce is available to meet the needs of the naval shipbuilding program.[20]

These projects will have a massive impact on the industry, not only through the creation of direct employment, but also through the economic impact on the wider sectors involved in the project supply chains. The need for ongoing sustainment of the new vessels and vehicles, and the creation of new technology and skills, will flow on to other industries.

The Naval Shipbuilding IRC was established to support the Naval Shipbuilding Plan. The IRC aims to establish a sustainable, long-term naval shipbuilding industry in Australia through the design and construction of a number of modern naval vessels. The Manufacturing and Engineering IRC will collaborate with the Naval Shipbuilding IRC so that nationally recognised training packages are able to support the naval shipbuilding industry.

16 Defence Connect, November 2017, Size of Future Submarines revealed, accessed online at https://www.defenceconnect.com.au/maritime-antisub/1532-size-of-future-submarines-revealed, accessed 1/11/2018.

17 https://www.defencesa.com/projects/offshore-patrol-vessels, accessed 1/11/2018.

18 https://www.defencesa.com/projects/future-frigates, accessed 1/11/2018.

19 http://www.defenceindustries.qld.gov.au/land/project-land-400.html, accessed 1/11/2018.

20 http://www.defence.gov.au/NavalShipbuilding/College/ , accessed 1/11/2018.

Changing Technology and Increasing Automation and Digitisation

The other major driver of change in the manufacturing and engineering industry is technology change. Global trends around automation, robotics, sensors, data analytics, advanced materials, additive manufacturing and augmented and virtual reality are impacting on the ways in which work is conducted, as well as providing new business opportunities and increased efficiency and productivity for businesses.

Research by the World Economic forum shows that although technology is unlikely to eliminate many job roles entirely, almost all jobs will be affected in some way, with tasks involving predictable physical work, data processing and data collection the most susceptible to being automated.[21] It also suggests that by 2022, at least 54% of all employees will require significant reskilling and upskilling, while all workers will need a 'mindset of agile learning as they shift from the routines and limits of today's jobs to new, previously unimagined futures'.[22]

In the jewellery manufacturing sector, where 3D printing technology has made the manufacture of custom-made jewellery more efficient and affordable. Computer-aided design and 3D printing are allowing quick production of prototypes that customers can then refine and adapt to their own specifications. Skilled workers then produce the final product.[23]

Consultations in the locksmithing sector also identified changing technology as the biggest driver impacting on skills needs in the workforce. The major change in the sector is a shift from mechanical devices and mechanisms to electronic ones, to the point where locksmiths are now more 'technicians' than 'smiths'. Services provided by the sector now also include highly sophisticated security systems, CCTV, access control systems and automotive key and security systems, which are impacting on the complexity and combinations of skills needed within the workforce.

As routine, repetitive and predictable tasks become increasingly automated, skill demands will move to non-automatable tasks – particularly those involving problem-solving and interpersonal skills. The increased adoption of new technologies is also driving a need for new applications of existing skills and new combinations of skills, such as the combination of mechanical and electronic skills, particularly in the areas of maintenance and diagnostics, as well as in the field of mechatronics.

A recent AI Group survey of its members found that employers are experiencing difficulties recruiting employees with STEM skills, particularly technicians and trades workers and professionals. They also identified that the most significant capability improvements required by managers are in the areas of technology/digitalisation, with employers prioritising managers for digital technology training.[24]

21 McKinsey and Company (2016) Where machines could replace humans – and where they can't (yet), McKinsey Quarterly July 2016.

22 Centre for the New Economy and Society (2018) The Future of Jobs Report, World Economic Forum. Pix.

23 IBISWorld (2018) Industry Report C2591 Jewellery Manufacturing in Australia.

24 Australian Industry Group (2018) Skilling: A National Imperative.

Advanced Manufacturing

Given that Australia is positioned to compete with overseas markets in the manufacture of low-cost, mass-produced goods, the Australian businesses that are succeeding are those that are focused on niche markets and the production of bespoke, high-quality products. Some of these businesses may be 'high-tech', but many are also focused on non-technological innovations such as new business models, innovative design and improved manufacturing methods.[25]

Australia's Advanced Manufacturing Growth Centre also describes today's successful manufacturing businesses as being characterised by advanced knowledge, advanced processes and advanced business models.[26]

Work conducted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) on advanced manufacturing identified that sustained growth in the industry will require investment and translation of enabling science and technology, including sensors and data analytics; advanced materials; smart robotics and automation; 3D printing; and augmented, mixed and virtual reality, which in turn has implications for underpinning digital literacy and STEM skills across the workforce.[27]

Changing Business Models

Changing business models are seeing businesses shift their focus from the manufacture of 'widgets' to the development of integrated solutions, with those consulted citing many examples of businesses that have transformed themselves into producers of high-value added whole products, and services, not just component manufacturers. Speed to market of products will be increased through rapid prototyping services used to make, test and alter new designs and bespoke products co-designed with customers.[28]

At the same time, other businesses are turning to specialisations, as resourcing every part of the manufacturing process can be cost-prohibitive, and they are therefore increasing their level of collaboration with other businesses within the supply chain.

Research suggests that to remain competitive, manufacturers also need to take advantage of opportunities in the adoption of:

- Customised high-margin solutions – these include design services, and the manufacture of superior components and novel products
- Selling services – these include maintenance and repair services, workflow management services and health and biosecurity services
- Global value chains – which have been shown to provide businesses with exposure to new technologies, processes and skills.[29]

25 Roy Green, 2015 in The Conversation, Australia's 'five pillar economy' – manufacturing, available online at https://theconversation.com/australias-five-pillar-economy-manufacturing-40639, accessed 23/11/2018.

26 Advanced Manufacturing Growth Centre, Advanced Manufacturing: A new definition for a new era.

27 CSIRO (2016) Advanced Manufacturing: A Roadmap for unlocking future growth opportunities for Australia.

28 CSIRO (2016) Advanced Manufacturing: A Roadmap for unlocking future growth opportunities for Australia.

29 CSIRO (2016) Advanced Manufacturing: A Roadmap for unlocking future growth opportunities for Australia.

Sustainability

An increased focus on sustainability is driving innovation in product design and development, as well as a focus on continuous improvement of processes and practices to improve efficiency and productivity.

Sustainable manufacturing, both in terms of business models and processes and the manufacture of sustainable products, was identified by CSIRO as one of the key opportunities for Australia's manufacturing sector.[30]

Sustainability in manufacturing is also an important focus of Queensland's recently released 10-Year Roadmap and Action Plan for the manufacturing sector, with support to be provided for local manufacturers to 'address input costs such as energy and electricity, reduce waste and to meet the increasing customer demand for products that are both affordable and have a light environmental footprint'.[31]

Supply-side Challenges and Opportunities

The watch and clock repair services sector is facing supply-side challenges. Only two training providers deliver training for the whole of Australia, and only one of these, TAFE NSW, offers apprenticeships in watch and clock repair. Stakeholder feedback has indicated that changes to government subsidies for training has impacted enrolment numbers.

At a broader level, the VET sector is seen by many as not keeping up with the pace of technological change in terms of its ability to supply the skills needed in the workforce.

At IBSA Manufacturing's 2018 Industry 4.0 conference, 88% of delegates described the challenge of technology as either significant (48%) or very significant (40%) and almost two-thirds (62%) identified skills or training as forming part of that challenge. When asked whether or not the VET sector was keeping up with changing technology, 72% of delegates said 'no', adding comments such as:

- 'Often VET prepares workers for current work roles with little capacity to adapt to changes, especially when they are rapidly occurring'.
- 'There is not much awareness of technological impacts in the development of training packages'.[32]

Improved speed to market of training packages is required to keep up with changing technology in industry.

30 CSIRO (2016) Advanced Manufacturing: A Roadmap for unlocking future growth opportunities for Australia.

31 Advance Queensland (2018) Queensland Advanced Manufacturing 10-Year Roadmap and Action Plan, Department of State Development, Manufacturing, Infrastructure and Planning. p30.

32 https://ibsa.org.au/industry-4-0-unpacking-the-skills-challenges-conference/, accessed 25/10/2019.

A recent report by the National Centre for Vocational Education Research (NCVER), which analysed the potential impact of technological disruption and the Fourth Industrial Revolution on workplaces and the implications for the VET system, suggested that:

- training needs to equip the workforce with the knowledge and skills to use new technologies as well as prepare them for an expanded scope of tasks within job roles
- generic/soft skills will play an essential role in preparing workers to be flexible and cope with the rate and scope of change
- in some firms (especially in advanced manufacturing firms), specialist technology skills will be needed
- there is a need for collaboration between employers and the VET sector to support lifelong learning within the workforce.[33]

The research also identified a shortage of local training providers with the capacity to deliver training in the skills needed to utilise new technologies.[34]

For Learners and Training Package Development

Consultations have found that many key stakeholders are waiting for Release 2 and 3 of the MEM Manufacturing and Engineering Training Package to be approved before they are able to provide input on further work that may need to be done on the Training Package.

The Case for Endorsement for Release 2 was submitted to the AISC in late-2017. However, in February 2018, the AISC advised they required further work to be undertaken. After ongoing discussions, a revised Case for Endorsement was agreed to by the AISC at the December 2018 meeting. IBSA Manufacturing expects the new Training Package components to be publicly available in early-2019.

33 Seet, P., Jones, J., Spoer, J. and Hordacre, A. (2018) The Fourth Industrial Revolution: the implications of technological disruption for Australian VET, NCVER, Adelaide. p9–10.

34 Seet, P., Jones, J., Spoer, J. and Hordacre, A. (2018) The Fourth Industrial Revolution: the implications of technological disruption for Australian VET, NCVER, Adelaide. p36.

However, consultations with representatives of the locksmith sector have identified a number of issues relating to the current Certificate III in Locksmithing. Most significantly, those consulted highlighted that the qualification is out of date and not meeting the needs of the shift towards a greater use of electronics in the sector. In addition:

- the increasing range of services provided by the sector is increasing the range of skills and knowledge that needs to be covered by the qualification. Suggestions were made that the qualification needs to allow for learners to start with broad skills and knowledge and then move into specialisations
- problem-solving, communication and other interpersonal skills are very important for locksmiths and need to be adequately covered in training
- the current measurement unit is more complex than is needed for the role. Something at a lower level would be more suitable for inclusion in the qualification
- to the need to develop a new unit with a strong focus on the understanding of electronic systems and processes.

Cross-industry Challenges and Opportunities

The challenges and opportunities facing the manufacturing and engineering industry sectors in relation to changing technology and increasing automation are also likely to affect other manufacturing industry sectors.

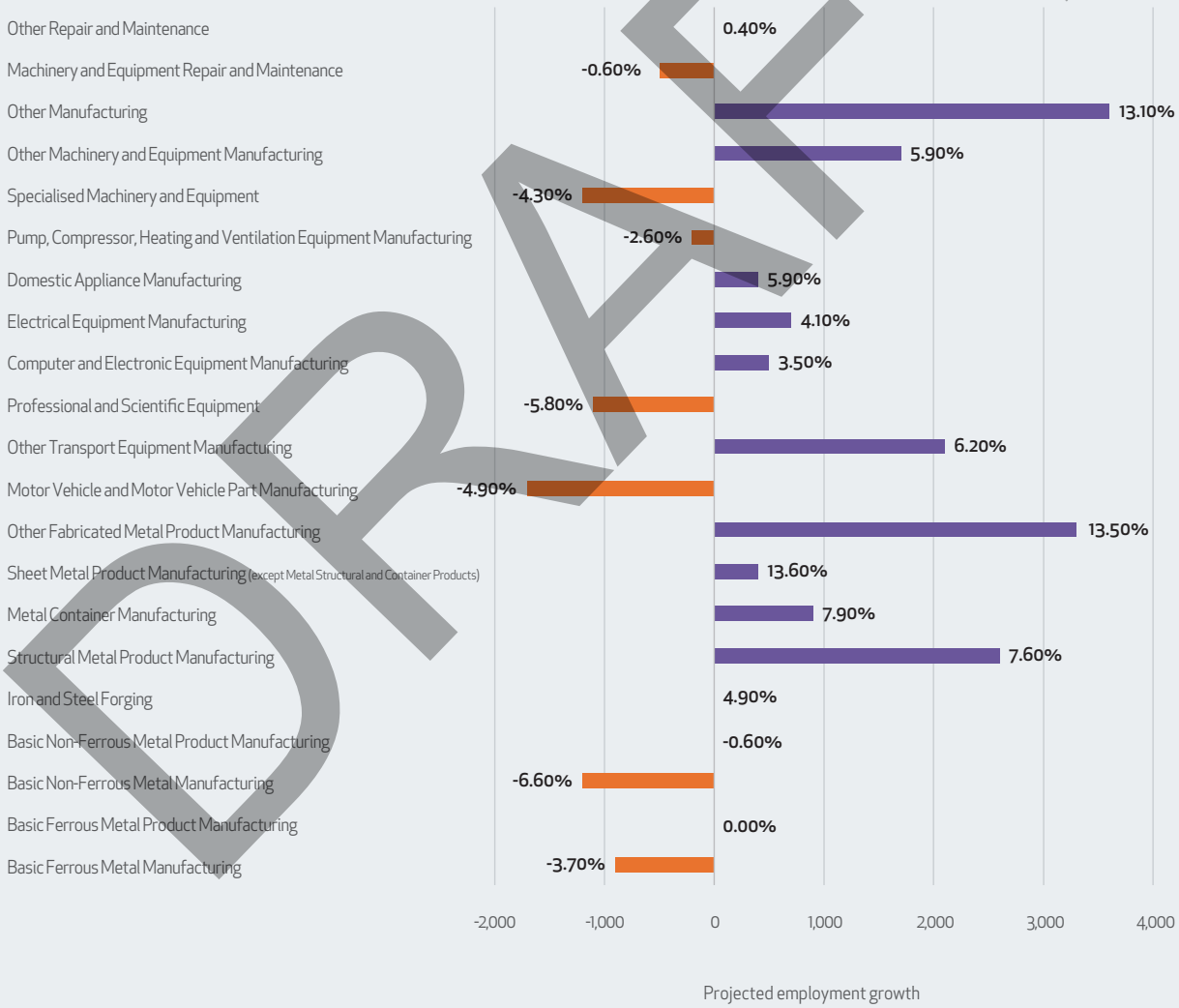
Opportunities may also exist through existing cross sector projects (e.g. Supply Chain Skills). The IRC will engage with cross sector projects to provide input on the skill needs and experiences of the manufacturing industry. See the Cross Sector Projects section for more details.

Employment and Skills Outlook

Employment Outlook

Employment projections support comments made in the Industry Snapshot section that, overall, the manufacturing industry is growing. Across all of the selected ANZSIC industry groups related to MEM Manufacturing and Engineering qualifications, employment is projected to grow by 2.2% in the five years to 2023. However, as illustrated in Figure 7 below, the pattern of employment will vary considerably across different sectors.

Figure 7 – Projected employment growth by ANZSIC industry group



Similar variations in employment patterns can be seen in trends and projections by Australian and New Zealand Standard Classification of Occupations (ANZSCO) occupation groups. Notable changes from Table 4 below include:

- projected employment growth of more than 5% for Production Managers, Management and Organisation Analysts, Other Miscellaneous Technicians and Trades Workers and Product Assemblers over the five years to 2023
- projected declines in employment of more than 5% for Industrial, Mechanical and Production Engineers, Mechanical Engineering Draftspersons and Technicians, Precision Metal Trades Workers, Electronics Trades Workers, Clothing Trades Workers, Engineering Production Workers and Metal Engineering Process Workers. However new job roles are emerging in response to Industry 4.0 and the Internet of Things. These job roles will require a different range of high-level skills in the areas of data, analysis, automation, AI, augmented and virtual reality and robotics.[35]

35 Preparing for Industry 4.0 – will digital skills be enough?, IBSA Manufacturing, https://ibsa.org.au/wp-content/uploads/2018/11/IBSA-Manufacturing-Preparing-for-Industry-4-will-digital-skills-be-enough.pdf

Table 4 – Number of employees and expected growth in employment over the next five years for the main occupations covered by the MEM Manufacturing and Engineering Training Package.

ANZSCO Occupation Unit Group		Estimated Number of Employees (rounded to nearest 100)			Projected number of employees	% Growth over five years
		2016	2017	2018	2023	2018–2023
1335	Production Managers	54,300	61,800	53,300	56,300	5.6%
2247	Management and Organisation Analysts	64,500	61,500	64,200	70,800	10.3%
2335	Industrial, Mechanical and Production Engineers	25,700	32,500	30,300	28,100	-7.2%
3120	Building and Engineering Technicians nfd	5,800	5,600	2,500	2,500	-0.9%
3125	Mechanical Engineering Draftspersons and Technicians	3,800	4,300	4,700	4,400	-7.2%
3129	Other Building and Engineering Technicians	27,200	24,700	21,100	21,700	2.9%
3220	Fabrication Engineering Trades Workers nfd	0	0	100	100	4.5%
3222	Sheetmetal Trades Workers	6,000	6,500	8,100	8,500	4.7%
3223	Structural Steel and Welding Trades Workers	71,200	74,800	78,900	82,700	4.8%
3230	Mechanical Engineering Trades Workers nfd	100	400	200	200	1.5%
3232	Metal Fitters and Machinists	113,900	94,500	111,500	113,800	2.1%
3233	Precision Metal Trades Workers	8,300	7,100	6,100	5,700	-6.2%
3400	Electrotechnology and Telecommunications Trades Workers nfd	1,900	1,800	900	900	-5.0%
3411	Electricians	155,700	147,300	156,400	163,500	4.5%
3421	Airconditioning and Refrigeration Mechanics	26,200	27,700	28,500	29,200	2.4%
3423	Electronics Trades Workers	29,600	30,700	26,000	24,600	-5.2%

ANZSCO Occupation Unit Group		Estimated Number of Employees (rounded to nearest 100)			Projected number of employees	% Growth over five years
		2016	2017	2018	2023	2018–2023
3932	**Clothing Trades Workers**	6,200	7,000	8,700	8,100	-6.2%
3990	**Miscellaneous Technicians and Trades Workers nfd**	0	100	100	100	0.3%
3991	**Boat Builders and Shipwrights**	4,900	4,900	4,900	4,900	0.8%
3994	**Jewellers**	3,900	4,200	5,800	6,000	3.9%
3999	**Other Miscellaneous Technicians and Trades Workers**	16,200	16,400	17,900	21,100	17.9%
7112	**Industrial Spraypainters**	6,900	5,000	5,700	5,500	-3.9%
7123	**Engineering Production Workers**	17,700	17,800	18,200	13,800	-23.9%
8322	**Product Assemblers**	26,300	27,500	33,800	35,900	6.3%
8391	**Metal Engineering Process Workers**	10,200	8,400	12,300	10,500	-14.6%

Source: Department of Jobs and Small Business, Labour Market Information Portal.

Occupation time series data (May 2014 to May 2017) has been sourced from the ABS 6291.0.55.003 Labour Force, Australia, Detailed, Quarterly, May 2018. Figures are average of preceding four quarters, whereas May 2018 and projection to May 2023 figures are seasonally adjusted and trended as sourced from LMIP.

Workforce Supply Challenges

Several occupations relating to MEM Manufacturing and Engineering qualifications are currently experiencing skill shortages and are on national or state skill shortage lists. These are:

- Sheetmetal Trades Workers (national shortages; state-wide shortages in the Northern Territory, Queensland and Victoria and shortages in metropolitan areas of New South Wales)
- Structural Steel and Welding Trades Workers (national shortages; state-wide shortages in the Australian Capital Territory, New South Wales, Northern Territory and Victoria and shortages in regional areas of Western Australia).[36]
- Locksmiths (national shortages).

Some of these shortages were also highlighted in consultations.

Conversations with representatives of the locksmithing sector identified that young people are dropping out of training courses because they are outdated, which in turn is contributing to skill shortages. They have found that young people are most interested in learning to use modern technology and often leave the Certificate III in Locksmithing to take up an electronics qualification because it is more up to date and more relevant to a broad range of job roles.

Other conversations highlighted a critical shortage of welders in Victoria, which has led one private company (Bombardier Transportation) to train and certify welders against EN 15085 Certification for Welding of Railway Vehicles and Components (CWRVC) for the rail industry".[37] The issue is being exacerbated by the fact that existing manual welders are being upskilled to run robot welding equipment, which is creating demand for new manual welders.

The 2018 AI Group survey report identified three major skill-related issues impacting upon workforce supply across the manufacturing industry. These were:

- Skills shortages, which were reported by 75% of survey respondents and represented a 49% increase from the previous year's survey. Skills shortages were most significant in technician and trades worker roles and recruitment difficulties most often experienced in relation to STEM skills, automation, big data and artificial intelligence solutions.
- Insufficient levels of literacy and numeracy, which were reported as a challenge by 99% of respondents. This was a slight increase from 92% in the previous year.
- Lack of leadership and management skills, with 62% of respondents believing that a lack of leadership and management skills is having a high impact on the business. This was an increase from 56% in the previous year.[38]

36 Department of Jobs and Small Business, Skills Shortage Lists 2017.

37 http://www.marketwired.com/press-release/bombardier-achieves-accreditation-to-certify-welders-for-australias-rail-industry-tsx-bbd.b-2223623.htm sourced 18/03/2019.

38 Australian Industry Group (2018) Skilling: A National Imperative.

The Manufacturing and Engineering IRC also identified several trends that will impact on the future workforce supply:

- Technology trends around automation, use of advanced materials, and augmented and virtual reality are creating new ways of working and new business opportunities and models, which will impact on the skills that are in demand in the sector.
- Changing work and career values are a challenge for the industry, in terms of attracting new, highly capable entrants to the industry and ensuring an ongoing supply of skills in an ageing workforce. The IRC noted that there is a need to change perceptions of the industry to reflect modern manufacturing environments, which are focused on continuous improvement and innovation.
- The accelerating adoption of new technologies is driving a need for a new cross-disciplinary combination of skills.[39]

The new Defence projects will also drive workforce demands in the shipbuilding and military vehicle manufacturing sectors. For example, the Naval Shipbuilding Plan suggests that 'South Australian shipbuilders will need to increase their workforce by some 3,600 staff from anticipated minimum levels in 2021, with a strong concentration on the skilled trades. Demand for workers with structural skills, such as fabricators and welders, will be particularly strong, and numbers will need to increase by a factor of four from current levels. Demand will also be strong for workers with outfitting skills, such as electricians, carpenters and pipe welders. Numbers of professional staff, including managers and naval engineers/architects, will also need to increase.'[40]

Three skill areas identified by the recently established Naval Shipbuilding College as being of critical importance to the shipbuilding sector are welding, pipefitting, and marine engineering.[41]

39 Manufacturing Future Skills Outcome Summary, accessed 25/10/2018.

40 Naval Shipbuilding Plan, Defence (2017), Commonwealth of Australia. p67.

41 https://nationalindustryinsights.aisc.net.au/industries/manufacturing-and-related-services/metal-engineering-and-boating-industries, accessed 25/10/2018.

Skills Outlook

Key Generic Skills

The Manufacturing and Engineering IRC noted that the categorisation of generic skills, in particular the grouping together of skills that differ significantly (e.g. management versus leadership), renders the ranking of the generic skills listed below quite unhelpful in terms of training product development.

Table 5 shows the ranking of key generic skills by the Manufacturing and Engineering IRC. Where there are only certain aspects of the generic skill area that are seen as important, these have been highlighted within the text in the table.

Table 5 – Key generic workforce skills[42]

Combined Manufacturing IRCs		Manufacturing and Engineering IRC	
1	Design mindset/Thinking critically/Systems thinking/ Solving problems skills	1	Design mindset/Thinking critically/Systems thinking/ **Solving problems skills**
2	Technology use and application skills	1	Technology use and application skills
3	Learning agility/Information literacy/Intellectual autonomy and self-management skills	2	STEM skills
4	Communication/Collaboration including virtual collaboration/Social intelligence skills	2	**Learning agility**/**Information literacy**/Intellectual autonomy and self-management skills
5	STEM skills	3	Language, Literacy and Numeracy (LLN) skills
6	LLN skills	4	**Communication**/Collaboration including virtual collaboration/Social intelligence skills
7	Data analysis skills	4	Managerial/Leadership skills
8	Managerial/Leadership skills	5	Data analysis skills
9	Customer service/Marketing skills	6	Environmental and Sustainability skills
10	Environmental and Sustainability skills	7	Customer service/Marketing skills
11	Entrepreneurial skills	7	Financial skills
12	Financial skills	7	Entrepreneurial skills

42 Demand for generic skills may vary considerably between industry sectors, regions and individual businesses. Employers may prioritise some generic skills over others depending on their particular context, workforce and business imperative. All of the identified generic skills are important throughout the workforce. This ranking represents the importance of generic skills across an industry but should not be expected to reflect the specific experience of every business and employer within that industry.

Through the research and consultation processes for the development of this Industry Skills Forecast, the Manufacturing and Engineering IRC has identified the priority areas for training package development, listed in Table 6 below.

Table 6 – Priority areas for training package development

Rank	Skill	How identified
1	Higher level technician skills	Research and consultations
2	Planning, scheduling, logistics and supply chain management	Research and consultations
3	Maintenance and diagnostics skills	Research and consultations
4	Mechatronics	Research and consultations
5	NDT	Research and consultations

Key Drivers for Change and Proposed Responses

Table 7 – Priority skills and key drivers for change

Priority Skills	Key Driver for Change	Proposed Response
Changing Technologies and Major Projects		
NDT Planning, scheduling, logistics and supply chain management Maintenance and diagnostics skills Mechatronics Design and drafting skills	Changing technology is creating demands for new skills and new combinations of skills New Defence projects are also creating demands for certain skills	To be addressed through the proposed 'new and converging technologies' project
Higher-level technician skills	The rise of Industry 4.0 and associated technologies is creating demand for higher level technician skills	To be addressed through the proposed 'new and converging technologies' project
Changing Business Practices		
Computer-aided manufacturing Additive manufacturing Industrial instrumentation Composite materials Business skills	Changing technology is also creating demands for new manufacturing processes and new business models and practices	To be addressed through the proposed 'gaps in technology use and business skills' project
Generic Skills		
Generic skills, including maths and problem-solving	Rapidly changing technology is creating a demand for underpinning generic skills that enable workers to adapt to change and learn how to use new technology, as well as to work within new business models that often have increased customer interaction	To be addressed through the proposed 'Skill sets, AI machinery and underpinning generic skills' project

Priority Skills	Key Driver for Change	Proposed Response
Licensing Requirements		
Operation of AI mobile machinery	New licensing requirements for operating, driving and piloting artificially intelligent mobile machinery	To be addressed through the proposed 'Skill sets, AI machinery and underpinning generic skills' project
Skill Sets		
Electroplating Hydraulic hose fabrication	Skill sets are needed to address skill gaps in selected specialist areas	To be addressed through the proposed 'Skill sets, AI machinery and underpinning generic skills' project

Training Product Review

Current Activities

Welding, Technician and Trainer/Supervisor/Coordinator Skills

In October 2018, IBSA Manufacturing was commissioned to undertake training package development work on the MEM Manufacturing and Engineering Training Package. This project covers three key skill areas important to the manufacturing and engineering industries: welding skills, technician skills and trainer/supervisor/coordinator skills in demand across a range of industry sectors (not just in the manufacturing industry). Therefore, enhancement of skills in these areas will have a flow-on effect to the mobility, portability and transferability of skills within and across sectors.

The work will review existing qualifications and units of competency, which is expected to result in streamlining and rationalising of MEM Manufacturing and Engineering Training Package products.

- Welding skills: Review and revise units of competency, restructuring of qualifications and development of new training components to meet changes in welding standards, techniques, processes and procedures.
- Technician skills: Review and revise units of competency and/or development of new training components that reflect requirements for application of emerging and converging technologies and of advanced manufacturing processes and systems in technician roles.
- Trainer/Supervisor/Coordinator skills: The development of post trade training components to meet the needs of higher-level job roles with training, supervisory or coordination responsibilities.

The training package development work is due to be completed and submitted for Australian Industry and Skills Committee (AISC) consideration in March 2020.

Training Product Review – Activities Timeline

COMPLETE

MEM Release 2.0

Case for Endorsement submitted to the AISC in December 2017

IN PROGRESS

MEM Release 2.0 (Revised)

Case for Endorsement submitted to the AISC in early-2019

MEM Release 3.0

Consultation to commence on approval of Release 2.0

Welding, Technician and Trainer/Supervisor Coordinator Skills Project

Project to commence in 2019-2020

COMING UP...

New and Converging Technologies

2019–2020

Gaps in Technology Use and Business Skills

2020–2021

Skill Sets, AI Machinery/Drones and Underpinning Generic Skills

2021–2022

AISC Cross Sector Projects

In 2017, the AISC established nine cross sector projects in the common skill areas of: automation, big data, digital skills, consumer engagement through social media, cybersecurity, environmental sustainability, inclusion of people with disability in VET, supply chain, and team work and participation. This signalled a new approach to training package development that aims to simplify VET and improve mobility through recognition of qualifications between occupations.

To ensure cross sector units are relevant to multiple occupations and industry sectors, each project includes representation across multiple industries. Cross sector units of competency will be housed in the most relevant training package and marked with a cross sector identifier. Once available on training.gov.au, the units can be adopted across all industry training packages as qualifications and skills are reviewed or developed.

The following cross sector project has been identified as potentially impacting the MEM Manufacturing Training Package:

- The **Consumer Engagement Through Online and Social Media** cross sector project is looking at key skills for businesses to remain competitive in a global market including cultural awareness, customer service, marketing, communication and social media skills. The project proposes the development of eight new cross sector units and four skill sets in the areas of ethical practices, privacy regulations and protocols and awareness of online/social media users.
- The **Supply Chain Skills** cross sector project aims to support industries to increase efficiencies and meet consumer demands through the development of ten new skill sets related to the establishment and maintenance of high-performing supply chains.
- The **Teamwork and Communication** cross sector project aims to develop common team work and communication units that can be used across multiple industries. The project includes the development of five new units to be included in the BSB Business Services Training Package.

There are a further two cross sector projects that may also impact the MEM Manufacturing and Engineering Training Package: Automation Skills and Digital Skills. The next phase of work on these projects is being determined and the Manufacturing and Engineering IRC will continue monitoring their progress for consideration in future training package development work.

The Manufacturing and Engineering IRC will consider recommendations to integrate the new units developed under the above cross sector projects into qualifications in the MEM Manufacturing and Engineering Training Package once components are available.

Upcoming Activities

Priorities 2019–2023

Following consideration and analysis of the industry challenges and opportunities, current and emerging skills needs and the key drivers for change, the Manufacturing and Engineering IRC have identified a number of areas for training product development. These training priorities are outlined in the IRC's Proposed Schedule of Work 2019–2020 to 2022–2023 table, which lists the priorities for the next four years. This table also provides a rationale for the priorities, proposed scope and timeframes for these activities.

Important Priorities for 2019–2020

The IRC identified the following training priority as important and propose its inclusion as a priority for the 2019–2020 schedule of work.

- **New and converging technologies:** updating of selected units and qualifications and development of new qualifications and standards to meet the requirements of new and converging technologies, including those associated with Industry 4.0 and Defence projects.

A separate Case for Change will be prepared and submitted to the AISC for consideration.

Priorities Over the Next Three Years

The IRC identified the following training priorities to be considered over the next three years.

- **Gaps in technology use and business skills:** Review of content and creation of new content for units and qualifications to ensure coverage of skills associated with new processes, practices and business models arising from technological changes.
- **Skill sets, AI machinery and underpinning generic skills:** Development of skill sets to meet gaps in specialist skill areas, as well as review of generic skills needed to adapt to changing technology and updating of units of competency to meet requirements for AI mobile machinery.

Future Priorities

In their analysis of the industry challenges and opportunities, current and emerging skills needs and the key drivers for change, the Manufacturing and Engineering IRC identified the following areas for future training product development:

- Locksmithing – review qualification to ensure coverage of increasing use of electronics
- Boating Services – review qualifications for relevance
- Advanced Jewellery Design – review qualification for relevance and currency.

Consultation Undertaken

The 2019 Skills Forecast and Proposed Schedule of Work 2019–2023 builds on the consultations undertaken as part of the 2018 return. Feedback on industry imperatives were also captured as part of training package development projects undertaken throughout 2018.

More specifically, key individual industry and group stakeholders, identified by the Manufacturing and Engineering IRC, were consulted during the development of the Industry Skills Forecast. See Appendix E for the consultation list.

Feedback was gathered via the following methods:

- forums, meetings and focus groups – in person and via webinar
- interviews and one-on-one consultations – via phone/teleconference and/or face-to-face
- nationwide and organisation-specific surveys or questionnaires.

Issues and Sensitivities Raised

Industry consultation identified a number of issues and sensitivities, relating to particular areas within the industry, which have been outlined in the table below. The Proposed Schedule of Work section provides further information on the action to be taken to address these issues/sensitivities.

Table 8 – Issues and sensitivities raised by stakeholders during consultation

Area	Issue and/or sensitivity	Action to be taken
New and converging technologies	• There is a need to update selected units and qualifications, as well as develop new qualifications and standards to meet the requirements of new and converging technologies: – Changing technology and new Defence projects are creating demands for new skills and new combinations of skills. – Concerns that the training system is not keeping up to date with the skill needs arising from changing technology. – With the rise of Industry 4.0 and associated technologies, there is a need for higher level technician skills.	2019–2020 Case for Change
NDT	• Contemporary NDT hierarchies and emerging forms of testing (such as thermal testing) are not reflected in current units of competency and qualifications. • There is a need to address marine standards and standards related to heavy engineering applications, including resources, infrastructure and renewable energy.	
Planning, scheduling, logistics and supply chain management	• Training package gaps identified relating to engineering and technical work associated with: – planning and scheduling – supply chain management – logistics – quality systems management, including through the supply chain, and – configuration management.	
Maintenance and diagnostic skills	• Concerns that advances in maintenance techniques, including higher level maintenance techniques for fitting trades, are not reflected in the Training Package. • A need to identify training products to underpin diagnosis, fault-finding, maintenance and repair in fields exposed to converging technologies. • An identified a lack of qualifications, units and skill sets relating to hydraulics and pneumatics.	
New Diploma	• There is a need to develop a new national training package qualification to cover the skills associated with emerging technologies, applications and processes associated with Industry 4.0.	

Area	Issue and/or sensitivity	Action to be taken
Mechatronics	• In light of the growth in mechatronic systems, there is a need to scope skill implications, including explicit approaches to integrated mechatronic systems, for metals and engineering standards and training package components.	2019–2020 Case for Change
Design and drafting skills	• Concerns with the adequacy of content in design and drafting skills, where there is a construction and civil component, such as residential building units, reinforced concrete units and 3D solid modelling units, with reference to architecture, structure and mechanical, electrical and plumbing design and drafting and reinforced concrete detailing. • Lack of flexibility in Certificate IV requirements.	
Gaps in technology use and business skills	• Potential need for additional content related to code files used in computer aided manufacturing. • Increasing use of additive manufacturing techniques and reverse engineering at trade and post-trade level. • Use of 3D printing software. Need for a 3D printing skill set. • Lack of coverage of business basics in the Certificate III in Jewellery Manufacture qualification. • Certificate III in Watch and Clock Service and Repair does not reflect current industry practice. • Certificate IV in Engineering does not reflect new industrial electrician requirements. • Current practice in composite repairs, timber vessel repair and infusion are not reflected in the Training Package.	Proposed activity 2020–2021
Skill sets, AI machinery and underpinning generic skills	• Changing technology has created a need for upskilling of trade-qualified workers. • Need for underpinning generic skills, including mathematics, problem-solving (including advanced problem-solving and analytical problem-solving models), interpretation of supplied information, time-keeping, goal-setting, customer service skills, and project management skills. • Identified a potential need for skills sets/qualifications relating to: – Electroplating – Mobile machinery – Hydraulic hose fabrication	Proposed activity 2021–2022
Locksmithing	• Concerns that the current Certificate III in locksmithing is out of date, predominantly due to changing technology. • Identified a shift from mechanical devices and mechanisms to electronic systems, impacting on the services provided by the sector, which now includes highly sophisticated security systems, CCTV, access control systems and automotive key and security systems. Resulting in a workforce that requires more complex skills and a different combination of skills than previously.	Identified for future training product development

Area	Issue and/or sensitivity	Action to be taken
Boating Services	• The Certificate III and Certificate IV in Boating Services have had no enrolments between 2014 and 2017. Consultations with the Marina Industries Association suggest that the qualification Certificate III in Marina Operations, which belongs to the MAR Maritime Training Package, is being used to meet skill development needs in boating services.	Identified for future training product development
Advanced Jewellery Design	• There have been no or low enrolments in the Certificate IV in Advanced Jewellery Manufacture for several years. Consultations suggest that this is due to a lack of government funding but not a lack of demand for training. • There is an ongoing need for training beyond the Certificate III in Jewellery Manufacture; however, the Certificate III is currently the only qualification that receives government funding. • Jewellery manufacture courses are very expensive to run and the cost to individuals and employers can be quite prohibitive without government support.	Identified for future training product development

Proposed Schedule of Work 2019–2020 to 2022–2023

Manufacturing and Engineering IRC

MEM Manufacturing and Engineering Training Package

Contact details: Ian Curry

Date submitted to Department of Education and Training: April, 2019

Year	Items to be Included in the National Schedule
2019–2020	**New and converging technologies** New and converging technology and modern manufacturing business models are changing the way work is done in the manufacturing sector. To meet the demands of changing technology and processes workers require new skills and the ability to adapt existing skills to new applications. Industry feedback highlights employer's difficulty recruiting employees with the skills required, especially in the areas of STEM skills, automation, big data and artificial intelligence solutions. This project responds to the skill gap identified by the sector through the review and update of relevant MEM Training Package components to reflect current and emerging job roles. Rationale: **What has changed?** Changing skills and knowledge requirements in the manufacturing and engineering sector are being driven by new and converging technologies and the requirement to adapt existing skills as well as new combinations of skills to new applications. A key driver for these changes is defence industry projects which will have flow-on effects for the broader manufacturing and engineering industry. Qualifications need to be updated and developed to reflect current job roles and processes in the manufacturing and engineering sector. Below is a list of the key areas of change identified by industry along with a summary of how this project will respond: • **NDT:** Review of current units of competency and qualifications and development of new qualifications and standards to ensure adequacy in reflecting contemporary NDT hierarchies and emerging forms of testing, such as thermal imaging, and work organisation, with application to marine standards and standards related to heavy engineering applications, including resources, infrastructure and renewable energy • **Planning, scheduling, logistics and supply chain management:** 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, and – configuration management.

Year	Items to be Included in the National Schedule
2019–2020	• **Maintenance and diagnostics skills:** Scoping of skills required to reflect advances in maintenance techniques, including higher level maintenance techniques for fitting trades, and identification of training products to underpin diagnosis, fault-finding, maintenance and repair in fields exposed to converging technologies. To include development of new hydraulic and pneumatics qualifications, units and skill sets. • **New Diploma:** The development of a new national Training Package qualification to cover the skills associated with the emerging technologies and applications. The new Diploma qualification will be designed to meet the Minimum Training Requirement for C5 - Engineering/Laboratory Technician—Level V, as described in the Manufacturing and Associated Industries and Occupations Award 2010 and will be the formal equivalent to the Diploma of Engineering – Technical specified in the Award definition. • **Mechatronics:** Scoping of skill implications of growth in mechatronics, including explicit approaches to integrated mechatronic systems, for metals and engineering standards and training package components. • **Design and drafting skills:** Review adequacy of content in design and drafting skills where there is a construction and civil component, such as residential building units, reinforced concrete units and 3D solid modelling units, with reference to architecture, structure and mechanical, electrical and plumbing design and drafting and reinforced concrete detailing. Also review Certificate IV requirements to improve flexibility. **Employer/Industry Drivers** The New and Converging Technology project responds to the above changes and provides a training package solution to skill workers to meet the challenges driven by new technologies, Industry 4.0 and the roll out of Defence projects. See Challenges and Opportunities section. **Employment Data/Occupational Outcomes** Across all the industry groups related to MEM Manufacturing and Engineering qualifications, employment is projected to grow by 2.2% in the five years to 2023, see Employment Outlook section. Also, employment opportunities will be provided through Defence projects in shipbuilding, Collins-class submarine replacement, Anzac-class frigate fleet replacement and Offshore Patrol Vessels and the Land 400 project to deliver 675 military vehicles. Further information on the job roles and expected occupational outcomes will be provided in the Case for Change. **Qualification Usage and History** Further analysis will be undertaken to define the full range of skills required in the Case for Change. This information will be used to identify training package components.

Year	Items to be Included in the National Schedule

Ministers' Priorities Addressed:

At its inaugural meeting, the Council of Australian Governments (COAG) Industry and Skills Council (CISC) agreed on six objectives for reform of the VET system. The table below outlines the priorities that would be addressed by this project.

Ministers' Priority	How Addressed
Removing obsolete and superfluous qualifications from the training system	The review will evaluate and remove obsolete and superfluous qualifications and units of competency where identified.
Making more information available about industry's expectations of training product delivery	The Implementation Guide will include information industry expectations.
Ensuring the training system better supports individuals to move easily from one related occupation to another	Transportability of skills will be supported through the redevelopment of qualification packaging rules and consideration of inclusion of skills skill sets.
Improving the efficiency of the training system by creating units that can be owned and used by multiple industry sectors and housing these units in a 'work and participation bank	Where relevant the updated training package components will use cross sector units. When reviewing or developing UoC consideration will be given to write units that can be used by multiple industry sectors.
Fostering greater recognition of skill sets	The project will consider opportunities to develop Skills Set/s to provide alternative pathway to upskill existing workers.

Consultation Plan:

The IBSA Manufacturing training development uses a five-phase methodology which follows the Training Development and Endorsement Process Policy that includes the establishment of a Technical Advisory Group (TAC), identification of key stakeholders, the creation of a project web page and coordination of project and work with the IRC.

A more detailed consultation plan will be included in the Case for Change.

Scope of Project:

Estimated Project Duration: 12 months

If approved, the project would be undertaken in stages.

Anticipated Start Date: April 2019

Anticipated Completion Date: Case for Endorsement to be submitted June 2021

Training products potentially impacted:

Details of individual components will be provided in the Case for Change.

Year	Items to be Included in the National Schedule
2020–2021	**Gaps in technology use and business skills** To address skill gaps in the application of various technologies and business skills, including: • **Computer-aided manufacturing:** Consideration of additional content relating to code files used in computer-aided manufacturing. • **Additive manufacturing:** Review relevant current units of competency to ensure they adequately reflect the increasing use of additive manufacturing techniques in conjunction with existing trade skills. In particular: – IT and computer skills, including use of 3D printing software – Units covering 3D printing and reverse engineering at trade and post-trade level – 3D printing skill set covering CAD, set up and run 3D printing machine, scanning, and prototyping with investment casting. • **Certificate III in Jewellery Manufacture:** Expand qualification to include coverage of business basics. • **Certificate III in Watch and Clock Service and Repair:** Update or create new content to reflect current industry practice. • **Certificate IV in Engineering:** Update industrial instrumentation content to reflect new industrial electrician requirements. • **Composite materials:** Update or create new content to reflect current practice in composite repairs, timber vessel repair and infusion. **Rationale:** As a result of the emergence and application of new technology and new business models, various skill gaps have been identified in current training products. **Training products potentially impacted:** • A list of training package components impacted will be provided at a later date.

Year	Items to be Included in the National Schedule
2021–2022	**Skill sets, AI machinery and underpinning generic skills** To address the potential for products for upskilling in a number of occupations, as well as the need for underpinning generic skills: • **Electroplating:** Examine the need for a skill set or qualification in electroplating. • **Mobile machinery:** Review current units of competency to ensure coverage of licence requirements for operating, driving and piloting artificially intelligent mobile machinery. • **Hydraulic hose fabrication:** Develop a skill set for hydraulic hose fabrication. • **Underpinning skills:** Review coverage of relevant underpinning skills in units of competency, including mathematics, problem-solving (including advanced problem-solving and analytical problem-solving models), interpretation of supplied information, time-keeping, goal-setting, customer service skills, and project management skills. Rationale: Underpinning generic skills are needed for adapting to changing technology and work practices, while changing technology is driving a need for upskilling of trade-qualified workers. Training products potentially impacted: A list of training package components impacted will be provided at a later date.

Appendix A: Occupation Classifications

For the purposes of analysing employment trends, the following ANZSCO codes have been used.

Four-digit classification		Six-digit classification		Related MEM Manufacturing and Engineering Qualifications
8391	Metal Engineering Process Workers	839111	Metal Engineering Process Worker	Certificate I in Engineering Certificate II in Engineering Certificate II in Engineering – Production Technology Certificate II in Engineering Pathways
3991	Boat Builders and Shipwrights	399111	Boat Builder and Repairer	Certificate I in Boating Services Certificate II in Boating Services
322	Fabrication Engineering Trades Workers			Certificate III in Engineering – Production Systems
323	Mechanical Engineering Trades Workers			Certificate III in Engineering – Mechanical Trade Certificate IV in Engineering
3222	Sheetmetal Trades Workers	322211	Sheetmetal Trades Worker	Certificate III in Engineering – Fabrication Trade
340	Electrotechnology and Telecommunications Trades Workers			Certificate III in Engineering – Electrical/Electronic Trade
3125	Mechanical Engineering Draftspersons and Technicians			Certificate III in Engineering – Technical Certificate IV in Engineering Drafting
3994	Jewellers	399411	Jeweller	Certificate III in Jewellery Manufacture Certificate IV in Advanced Jewellery Manufacture Diploma of Jewellery and Object Design Advanced Diploma of Jewellery and Object Design
3991	Boat Builders and Shipwrights	399112	Shipwright	Certificate III in Marine Craft Construction
3233	Precision Metal Trades Workers	323313	Locksmith	Certificate III in Locksmithing

Four-digit classification		Six-digit classification		Related MEM Manufacturing and Engineering Qualifications
3991	Boat Builders and Shipwrights			Certificate III in Boating Services Certificate IV in Boating Services
3233	Precision Metal Trades Workers	323316	Watch and Clock Maker and Repairer	Certificate III in Watch and Clock Service and Repair
3999	Other Miscellaneous Technicians and Trades Workers	399999	Technicians and Trades Workers nec	Certificate III in Engineering – Composites Trade
3411	Electricians	341112	Electrician (Special Class)	Certificate III in Engineering – Industrial Electrician
312	Building and Engineering Technicians			Diploma of Engineering – Advanced Trade
3129	Other Building and Engineering Technicians	312911	Maintenance Planner	Diploma of Engineering – Technical
3125	Mechanical Engineering Draftspersons and Technicians	312512	Mechanical Engineering Technician	Advanced Diploma of Engineering
3129	Other Building and Engineering Technicians	312999	Building and Engineering Technicians nec	Graduate Diploma of Engineering

Appendix B: Industry Classifications

For the purposes of analysing the business landscape, the following ANZSIC codes have been used.

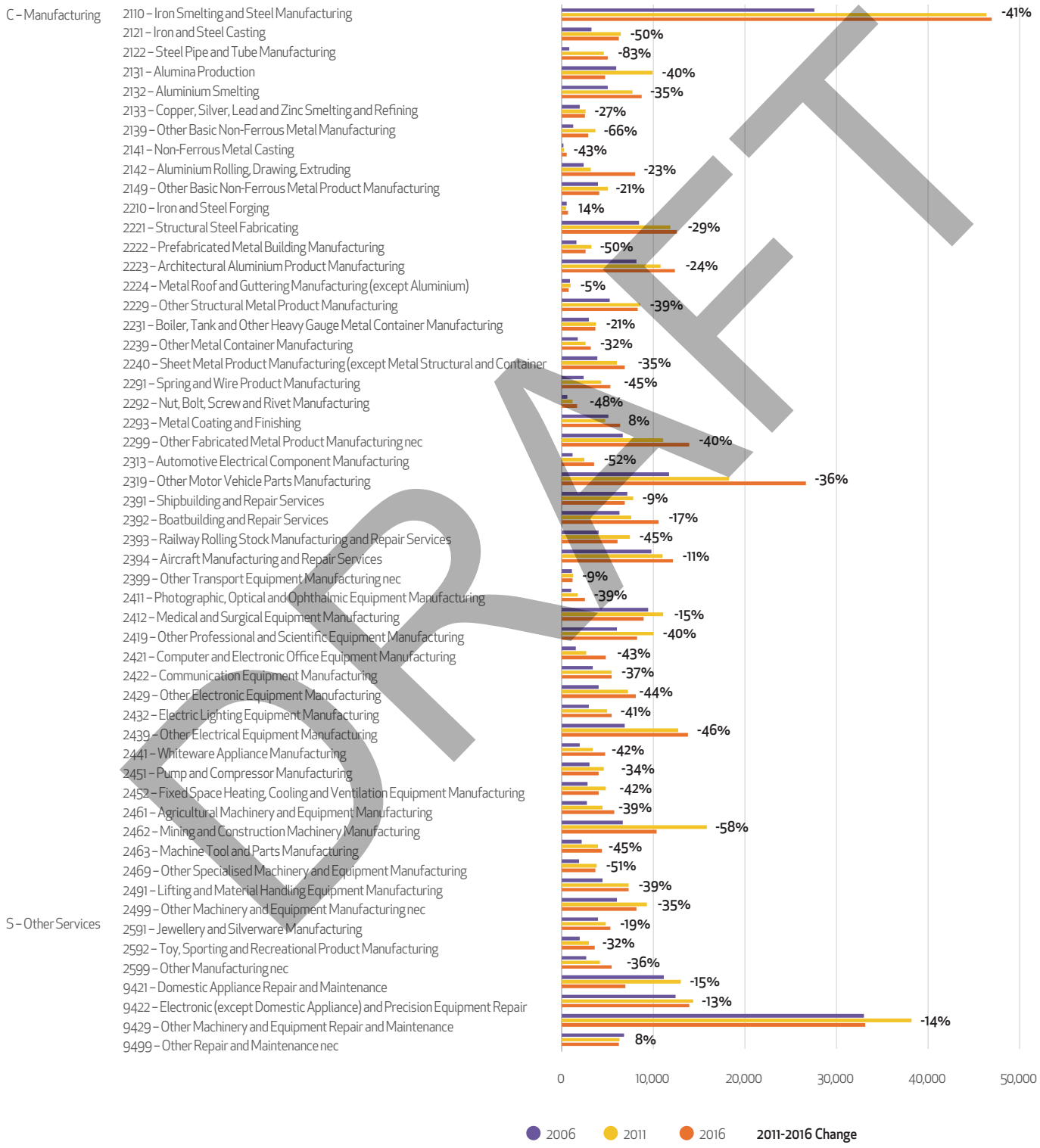
ANZSIC Code three-digit classification		ANZSIC Code four-digit classification		Related Training Package areas
212	Basic Ferrous Metal Product Manufacturing	2122	Steel Pipe and Tube Manufacturing	Engineering
214	Basic Non-Ferrous Metal Product Manufacturing	2141	Non-Ferrous Metal Casting	Engineering
214	Basic Non-Ferrous Metal Product Manufacturing	2142	Aluminium Rolling, Drawing, Extruding	Engineering
214	Basic Non-Ferrous Metal Product Manufacturing	2149	Other Basic Non-Ferrous Metal Product Manufacturing	Engineering
221	Iron and Steel Forging	2210	Iron and Steel Forging	Engineering
222	Structural Metal Product Manufacturing	2221	Structural Steel Fabricating	Engineering
222	Structural Metal Product Manufacturing	2222	Prefabricated Metal Building Manufacturing	Engineering
222	Structural Metal Product Manufacturing	2224	Metal Roof and Guttering Manufacturing (except Aluminium)	Engineering
222	Structural Metal Product Manufacturing	2229	Other Structural Metal Product Manufacturing	Engineering
223	Metal Container Manufacturing	2231	Boiler, Tank and Other Heavy Gauge Metal Container Manufacturing	Engineering
223	Metal Container Manufacturing	2239	Other Metal Container Manufacturing	Engineering
224	Sheet Metal Product Manufacturing (except Metal Structural and Container Products)	2240	Sheet Metal Product Manufacturing (except Metal Structural and Container Products)	Engineering
229	Other Fabricated Metal Product Manufacturing	2291	Spring and Wire Product Manufacturing	Engineering
229	Other Fabricated Metal Product Manufacturing	2292	Nut, Bolt, Screw and Rivet Manufacturing	Engineering
229	Other Fabricated Metal Product Manufacturing	2293	Metal Coating and Finishing	Engineering
229	Other Fabricated Metal Product Manufacturing	2299	Other Fabricated Metal Product Manufacturing nec	Engineering Locksmithing
239	Other Transport Equipment Manufacturing	2391	Shipbuilding and Repair Services	Shipbuilding

ANZSIC Code three-digit classification		ANZSIC Code four-digit classification		Related Training Package areas
239	Other Transport Equipment Manufacturing	2392	Boatbuilding and Repair Services	Boatbuilding
239	Other Transport Equipment Manufacturing	2393	Railway Rolling Stock Manufacturing and Repair Services	Engineering
239	Other Transport Equipment Manufacturing	2399	Other Transport Equipment Manufacturing nec	Engineering
241	Professional and Scientific Equipment Manufacturing	2411	Photographic, Optical and Ophthalmic Equipment Manufacturing	Engineering
241	Professional and Scientific Equipment Manufacturing	2412	Medical and Surgical Equipment Manufacturing	Engineering
241	Professional and Scientific Equipment Manufacturing	2419	Other Professional and Scientific Equipment Manufacturing	Engineering
242	Computer and Electronic Equipment Manufacturing	2421	Computer and Electronic Office Equipment Manufacturing	Engineering
242	Computer and Electronic Equipment Manufacturing	2422	Communication Equipment Manufacturing	Engineering
242	Computer and Electronic Equipment Manufacturing	2429	Other Electronic Equipment Manufacturing	Engineering
243	Electrical Equipment Manufacturing	2432	Electric Lighting Equipment Manufacturing	Engineering
243	Electrical Equipment Manufacturing	2439	Other Electrical Equipment Manufacturing	Engineering
244	Domestic Appliance Manufacturing	2441	Whiteware Appliance Manufacturing	Engineering
244	Domestic Appliance Manufacturing	2449	Other Domestic Appliance Manufacturing	Engineering
246	Specialised Machinery and Equipment Manufacturing	2461	Agricultural Machinery and Equipment Manufacturing	Engineering
246	Specialised Machinery and Equipment Manufacturing	2462	Mining and Construction Machinery Manufacturing	Engineering
246	Specialised Machinery and Equipment Manufacturing	2463	Machine Tool and Parts Manufacturing	Engineering
246	Specialised Machinery and Equipment Manufacturing	2469	Other Specialised Machinery and Equipment Manufacturing	Engineering
249	Other Machinery and Equipment Manufacturing	2491	Lifting and Material Handling Equipment Manufacturing	Engineering

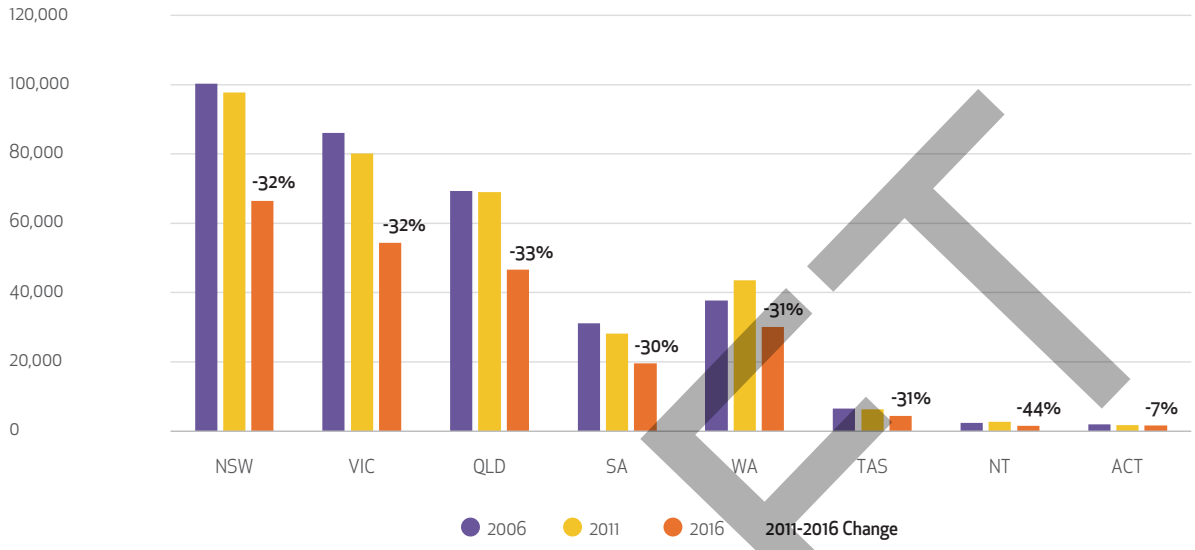
ANZSIC Code three-digit classification		ANZSIC Code four-digit classification		Related Training Package areas
249	Other Machinery and Equipment Manufacturing	2499	Other Machinery and Equipment Manufacturing nec	Engineering
259	Other Manufacturing	2591	Jewellery and Silverware Manufacturing	Jewellery
259	Other Manufacturing	2592	Toy, Sporting and Recreational Product Manufacturing	Engineering
259	Other Manufacturing	2599	Other Manufacturing nec	Engineering
942	Machinery and Equipment Repair and Maintenance	9421	Domestic Appliance Repair and Maintenance	Engineering
942	Machinery and Equipment Repair and Maintenance	9422	Electronic (except Domestic Appliance) and Precision Equipment Repair and Maintenance	Engineering
942	Machinery and Equipment Repair and Maintenance	9429	Other Machinery and Equipment Repair and Maintenance	Engineering
949	Other Repair and Maintenance	9499	Other Repair and Maintenance nec	Watch and Clock Service and Repair Locksmithing

Appendix C: Census Snapshot

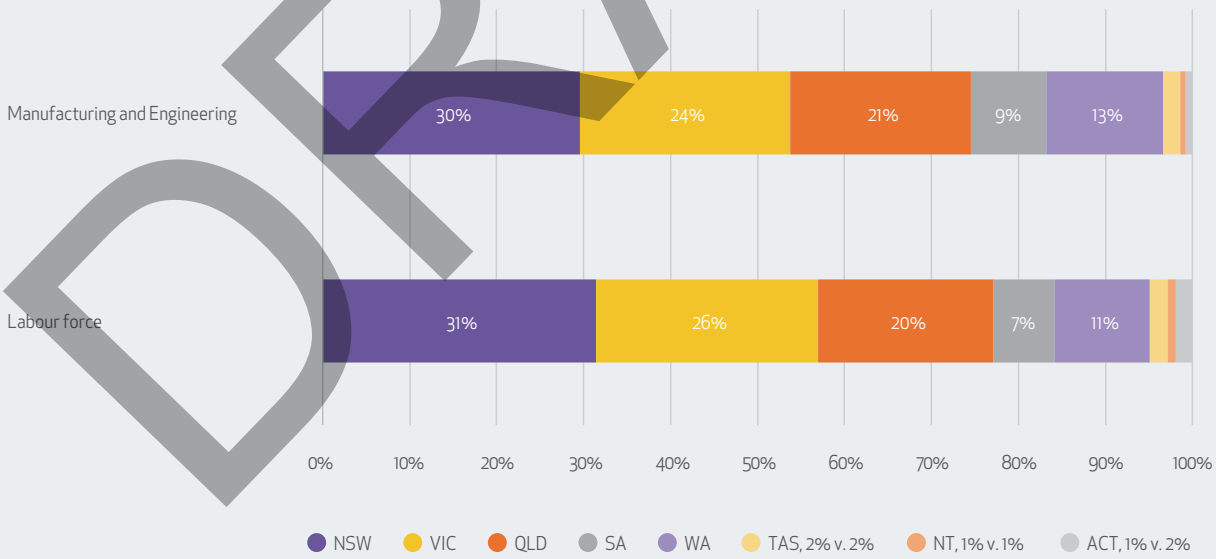
Number of employees in selected industry classes, Census 2006–2016, and five-year change from 2011 to 2016



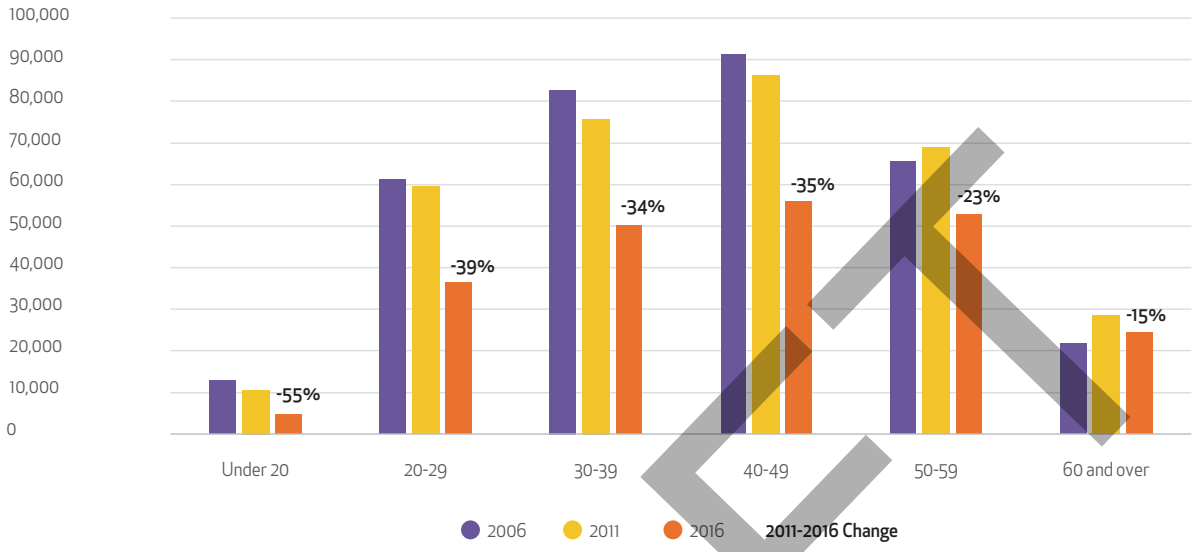
Number of employees in selected industry classes by state of usual residence, Census 2006–2016



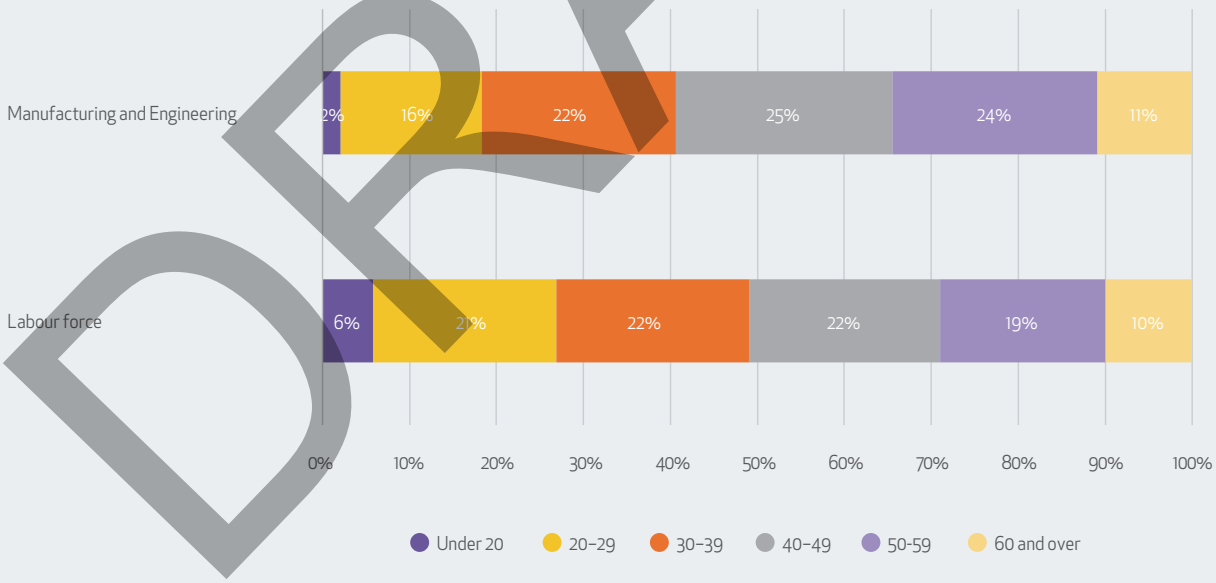
State of usual residence of employees in selected industry classes versus the general labour force, Census 2016



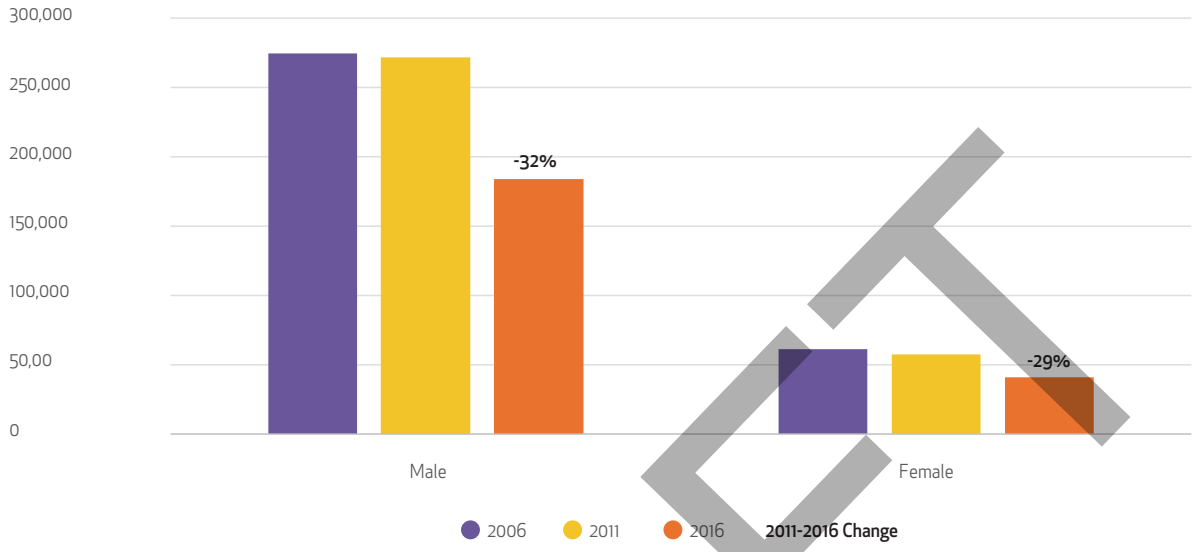
Total number of employees in selected industry classes by age, Census 2006–2016



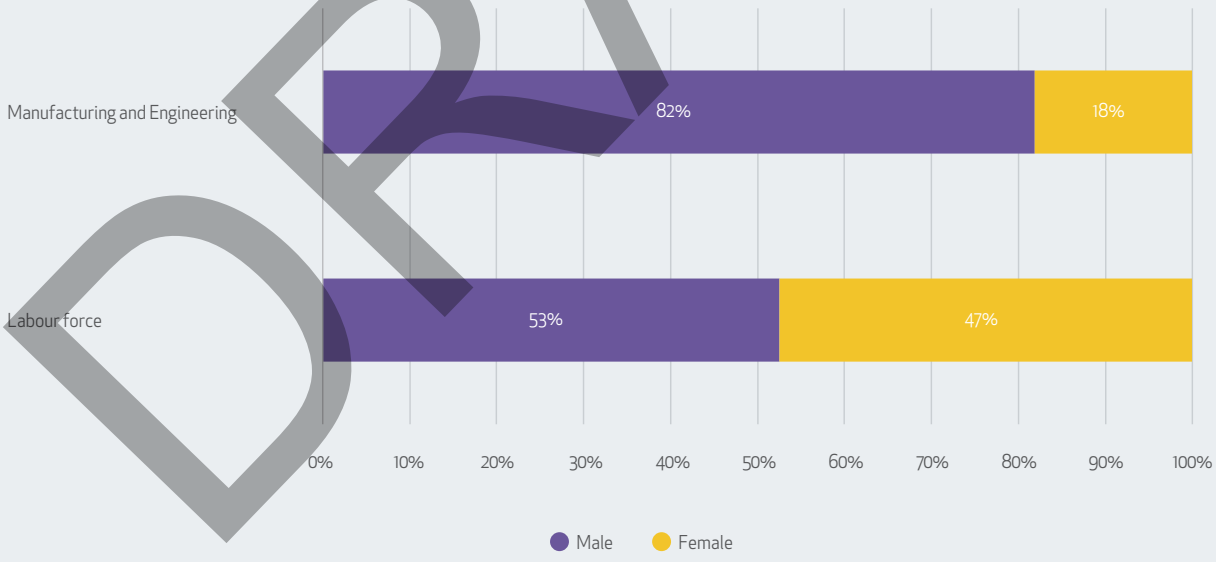
Age of employees in selected industry classes versus the general labour force, Census 2016



Total number of employees in selected industry classes by gender, Census 2006–2016

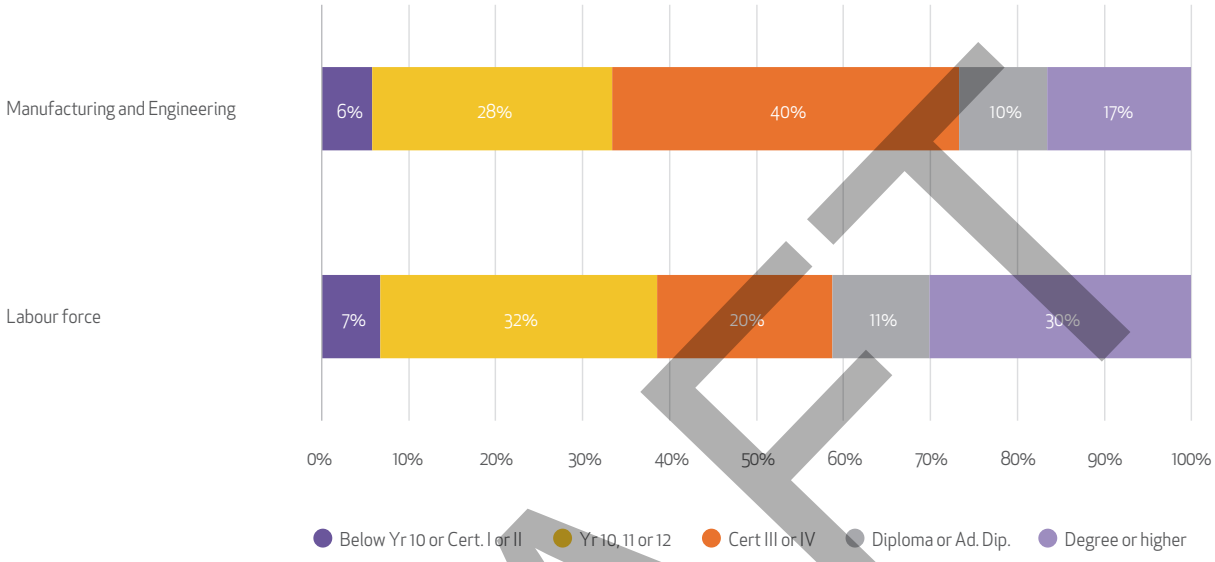


Gender of employees in selected industry classes versus the general labour force, Census 2016



Highest educational attainment of employees in selected industry classes versus the general labour force, Census 2016

excludes those whose educational attainment was not stated or not applicable

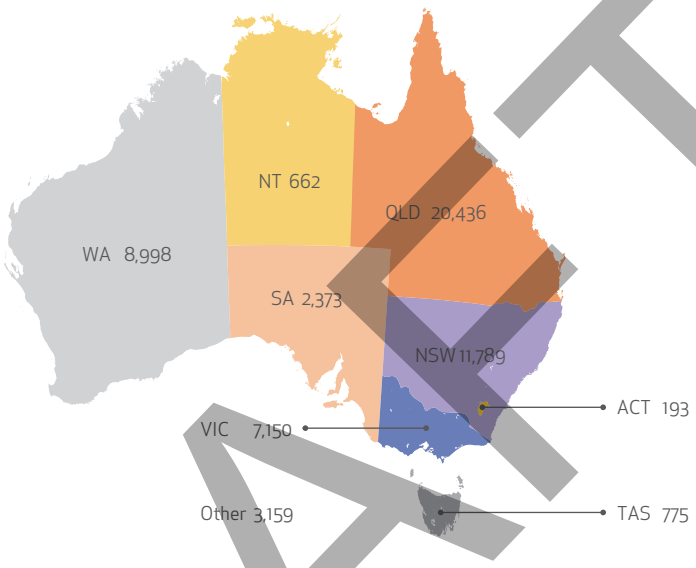


Source: Australian Bureau of Statistics (ABS) Census of Population and Housing: 2016 Census – Employment, Income and Education; 2011 Census - Employment, Income and Unpaid Work; 2006 Census – Labour Force. Data extracted using TableBuilder.

Appendix D: Enrolment Snapshot

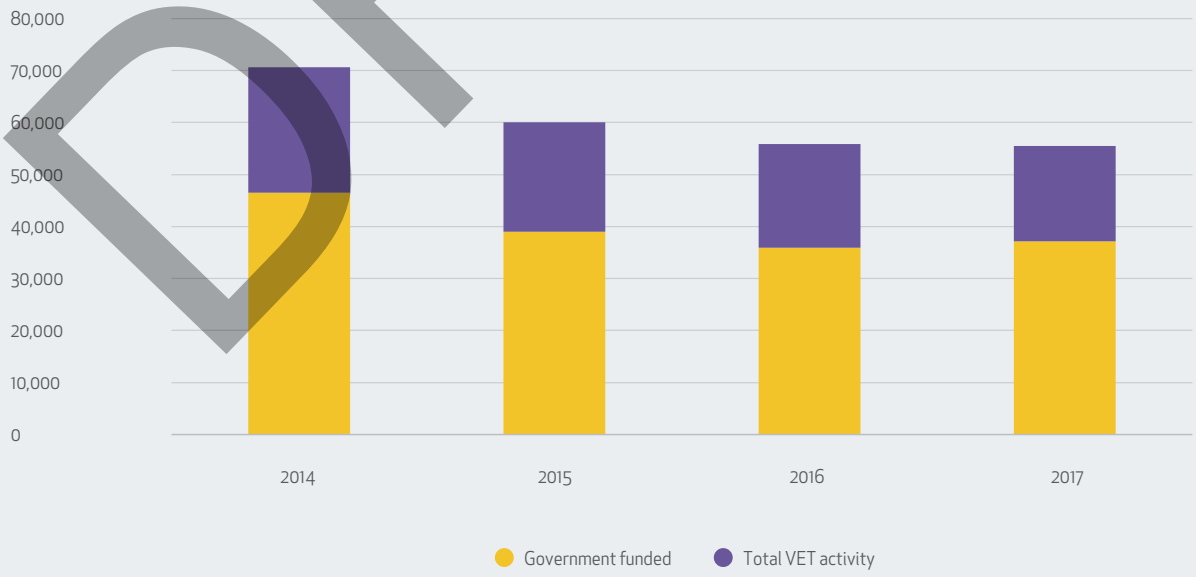
Program enrolments in MEM Manufacturing and Engineering qualifications by state/ territory of student residence

2017 Total VET Activity



Total program enrolments in MEM Manufacturing and Engineering qualifications

2014–2017 Total VET Activity



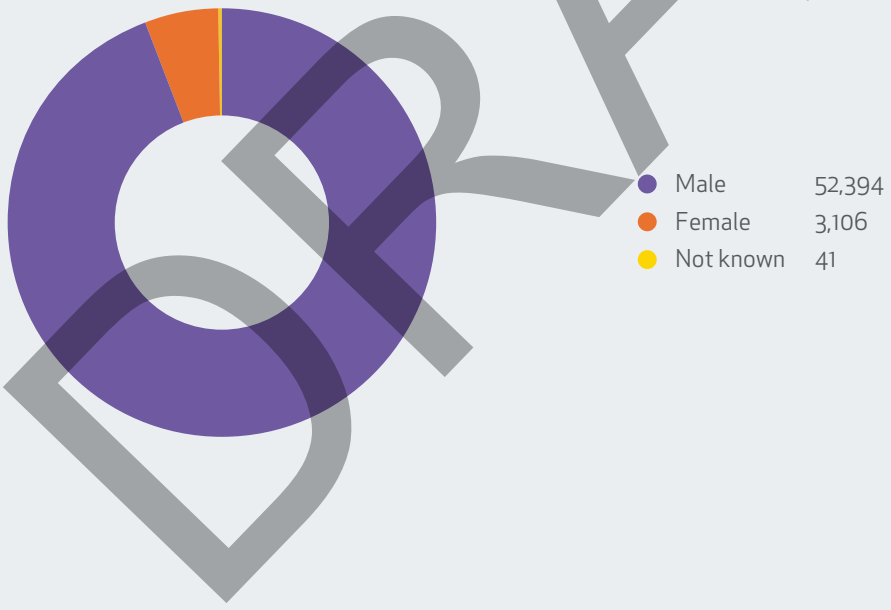
Proportion of program enrolments in MEM Manufacturing and Engineering qualifications by training provider type

2014–2017 Total VET Activity

Provider Type	2014	2015	2016	2017
TAFE	58%	54%	53%	56%
Private training provider	18%	21%	22%	21%
University	5%	5%	5%	5%
Enterprise provider	0%	0%	0%	0%
School	20%	19%	19%	17%
Community education provider	0%	0%	1%	2%

Program enrolments in MEM Manufacturing and Engineering qualifications by gender

2017 Total VET Activity

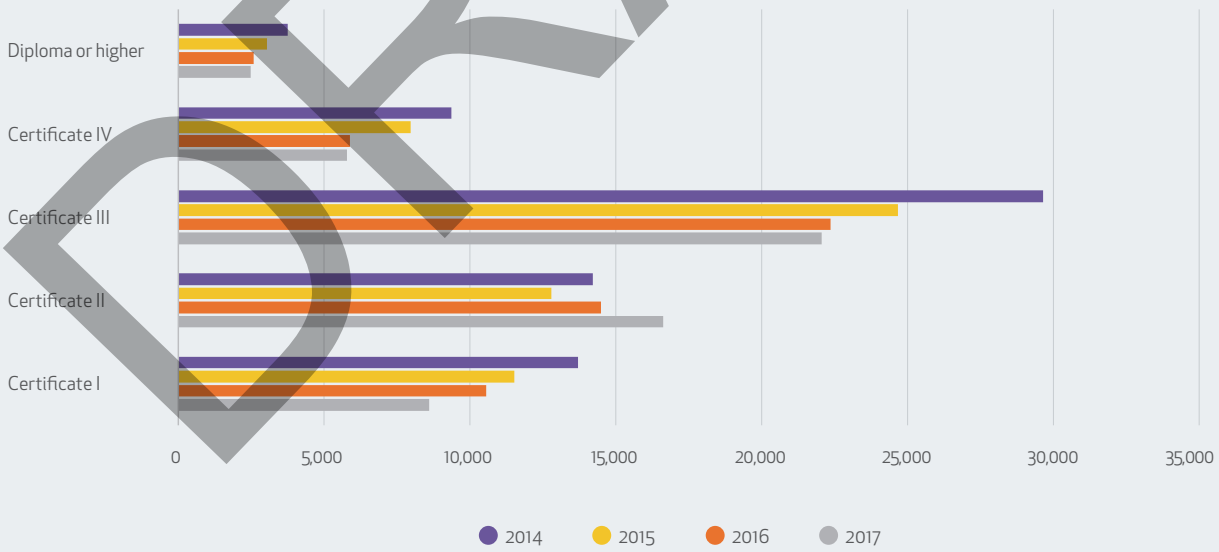


Program enrolments in MEM Manufacturing and Engineering qualifications by age group

2014–2017 Total VET Activity

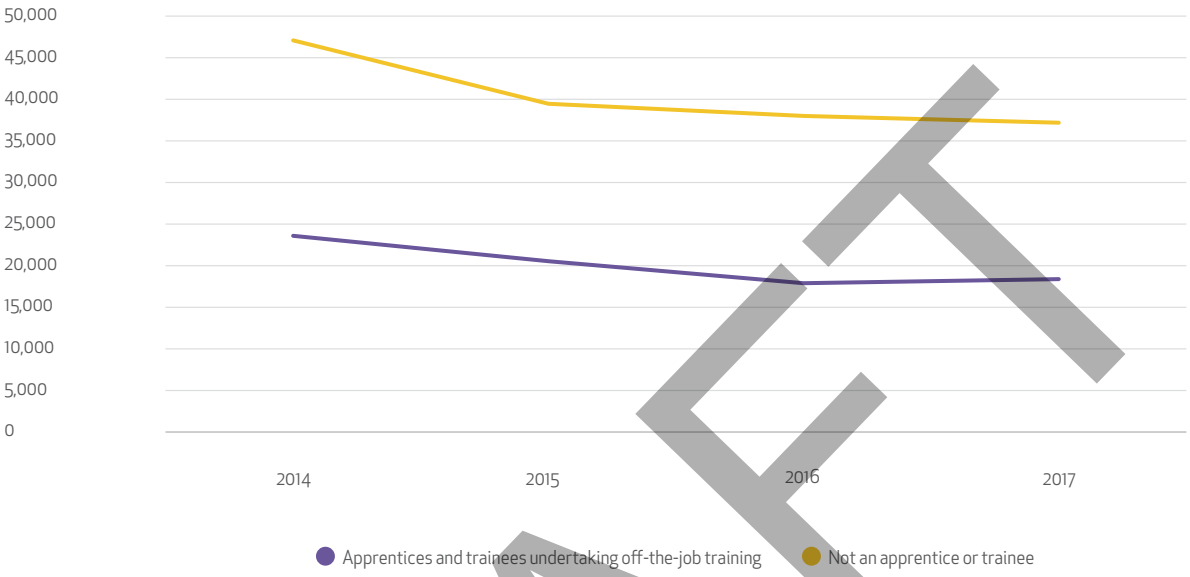
Program enrolments by qualification level in MEM Manufacturing and Engineering and Refining qualifications

2014–2017 Total VET Activity



Program enrolments in MEM Manufacturing and Engineering qualifications by apprentice/trainee undertaking off-the-job training

2014–2017 Total VET Activity



Source: All data in this appendix was extracted from VOCSTATS on 15/08/2018 by IBSA Manufacturing who take responsibility that the information extracted is appropriate for its intended use.

VOCSTATS data are 'randomly' adjusted by small amounts by a data perturbation tool to avoid the release of confidential data. Hence numbers are only approximate. The perturbation impact is negligible for most practical purposes. The effect can be significant and must be considered when interpreting small numbers.

Appendix E: Consultation List

The 2019 Skills Forecast and Proposed Schedule of Work 2019–2023 builds on the consultations undertaken as part of the 2018 return. Feedback on industry imperatives were also captured as part of training package development projects undertaken throughout 2018.

More specifically, key individual industry and group stakeholders, identified by the Manufacturing and Engineering IRC, were consulted during the development of the Industry Skills Forecast. See the consultation list below.

Feedback was gathered via the following methods:

- forums, meetings and focus groups –in person and via webinar
- interviews and one-on-one consultations – via phone/teleconference and/or face-to-face
- nationwide and organisation-specific surveys or questionnaires.

Consultation List

Organisations

Access Locksmith W19W2:W20	Master Clock and Watch Makers of Western Australia Inc
ADC Security Engineers	Master Locksmiths Association of Australasia (SAS Locksmiths)
Auslock	Melbourne Polytechnic
Boating Industry Association Ltd (NSW)	Master Locksmiths Association of Australasia
BullAnt Security	MinRes Training Institute
Class Locksmiths	Rechenberg Security
Composites Australia	Ruswin Locksmiths
Echuca Locksmiths	Skillstech
Fortec Security	South Met TAFE
GOTAFE Vic and NSW	TAFE NSW
Independent Locksmiths	TAFE NSW – Manufacturing Division
Jewellers Association	TAFE NSW – SITU
Locksmiths Guild of Australia	Watch & Clockmakers of Australia Inc (WCA), including State branches in NSW, QLD, VIC and SA
Marina Industries Association	