



Advancing Manufacturing Environmental Scan



**Jobs
Queensland**
Future skills. Future workforce.

October 2017

Jobs Queensland engaged Sagacity Consulting to undertake the Advancing Manufacturing Environmental Scan. This document represents the final report provided by Sagacity Consulting to Jobs Queensland.

FURTHER ENQUIRIES

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Front cover image: Staff member at HE Tech in Underwood.

Photo credit: Welcome to the Fold (November 2017).

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A word from the Chair



Manufacturing in Queensland is embarking on a journey to transition to the global environment of Industry 4.0 - the fourth industrial revolution. Low skilled jobs are diminishing as demand increases for people with high levels of technological skills and

high levels of language, literacy and numeracy skills who are willing to commit to undertake ongoing learning and skills development.

Manufacturing is one of Queensland's top 10 industries and one of the State's largest export industries. It is presently the State's eight largest employer and the fifth largest user of the apprenticeship and traineeship system. Manufacturing contributes \$20 billion a year to the Queensland economy, and \$16 billion in international exports. It accounts for nearly a fifth of the total Queensland business research and development (R&D) spend.

As the first stage of a project to develop a skills, training and workforce strategy to advance manufacturing in Queensland, Jobs Queensland has commissioned this environmental scan, focusing on advancing manufacturing in Queensland.

The objective of this report is to examine workforce supply and demand for Queensland manufacturing with a focus on advancing manufacturing. It includes both a statewide view of the industry and regional perspectives, based on analysis of impacts and drivers, current and future skills needs, barriers and current use of the apprenticeship and traineeship system.

Queensland has been less affected than other Australian states by the downturn in traditional manufacturing, primarily due to the composition of the industry where manufacturing operations are smaller and more flexible. The sector in Queensland is diverse and comprises 9,000 enterprises, 47 per cent of which are small and medium sized enterprises.

Manufacturing directly employs more than 170,000 Queenslanders, 88 per cent of whom are in full time positions. While the manufacturing industry is dispersed throughout Queensland's regions, more than half of the State's manufacturing jobs are in the Greater Brisbane region.

Global innovation including digital disruption and advanced technology is changing the industry's competitiveness with manufacturers needing to improve productivity and build competitive sustainability. The pace of change also creates challenges for workforce succession planning. Potential skills shortages in new and emerging enabling technologies present challenges in providing training in new technical skills.

This environmental scan provides a foundation for the development of a strategy to advance the manufacturing industry in Queensland through skills development.

Rachel Hunter
Chair, Jobs Queensland

1. CONTEXT

Jobs Queensland is responsible for providing advice to the Queensland Minister for Training and Skills about skills demand, future workforce development and the apprenticeship and traineeship system. Advanced manufacturing is viewed by the Queensland Government as a critical driver of innovation and productivity in the economy.

In December 2016, the Queensland Government released the Advanced Manufacturing 10-Year Roadmap and Action Plan which aims to design a plan for the growth of advanced manufacturing, fostering the continued transition of existing manufacturers into world-class advanced manufacturers who will grow the economy and generate future high value, high skilled jobs for Queenslanders.

As part of a project to develop a skills, training and workforce strategy to advance manufacturing in Queensland, Jobs Queensland has commissioned this environmental scan, focusing on advancing manufacturing in Queensland.

The objective of this report is to examine the current workforce supply and demand for Queensland manufacturing with a focus on advancing manufacturing. It includes both a statewide view of the industry and regional perspectives, based on analysis of impacts and drivers, current and future skills needs, barriers and current use of the apprenticeship and traineeship system.

The findings in this report are based on analysis of a range of current reports including the Queensland Productivity Commission 2017 Draft Report Manufacturing in Queensland, the 2016 Queensland Advanced Manufacturing 10-year Roadmap and Action Plan – powering the Queensland economy, and research including the Jobs Queensland Advancing Manufacturing Survey 2017, National Centre for Vocational Education Research (NCVER) three year training trend data, Queensland Advanced Manufacturing consultation outcomes, Sagacity's interviews with key Queensland stakeholders and a literature review of the manufacturing industry globally, with a focus on advancing manufacturing, examining workforce supply and demand, impacts and drivers, current and future skills needs, barriers and current use of the apprenticeship and traineeship system.

This report is Stage 1 of the broader project to develop an Advanced Manufacturing Skills, Training and Workforce Development Strategy. Stage 2 will involve consultation with industry and other stakeholders.

In the context of analysing data and developing findings, our approach is cognisant of the position held by the Queensland Government, including:

- growing advanced manufacturing is a critical driver of increasing innovation and productivity
- government and industry both have central roles to play in developing and strengthening the sector.

Innovation and Business Skills Australia (IBSA) replaced Manufacturing Skills Australia (MSA) as the Skills Service Organisation (SSO) for the Australian manufacturing sector from January 2017. It is responsible for:

- aerospace industry
- furnishing industry
- laboratory operations industry
- metal engineering and boating industries
- process manufacturing
- recreational vehicles industry
- textiles clothing and footwear industries
- cross industry/sustainability.

Jobs Queensland, in defining the manufacturing industry in Queensland, has broadened this scope to include the food processing and timber processing sectors.

2. KEY DEFINITIONS

Foundation skills: The National Foundation Skills Strategy for Adult (the National Strategy) 2012 defines foundation skills as a combination of:

- English language, literacy and numeracy (LLN) – listening, speaking, reading, writing, digital literacy and use of mathematical ideas, and
- employability skills, such as collaboration, problem solving, self-management, learning and information and communication technology (ICT) skills required for participation in modern workplaces and contemporary life.

Generic skills: There is no one definition list of generic skills, instead there are a number of lists which collectively have the following six common elements:

- basic/fundamental skills
- people-related skills
- conceptual/thinking skills
- personal skills and attributes
- skills related to the business world
- skills related to the community.

3. INTRODUCTION

Manufacturing remains a vitally important contributor to Australia’s economy. Manufacturing is one of Queensland’s top 10 industries and one of the state’s largest export industries. It is presently the state’s eight largest employer (see Figure 1 below) and the fifth largest user of the apprenticeship and traineeship system. Manufacturing contributes \$20 billion a year to the Queensland economy, and \$16 billion in international exports. It accounts for nearly a fifth of the total Queensland business research and development (R&D) spend.

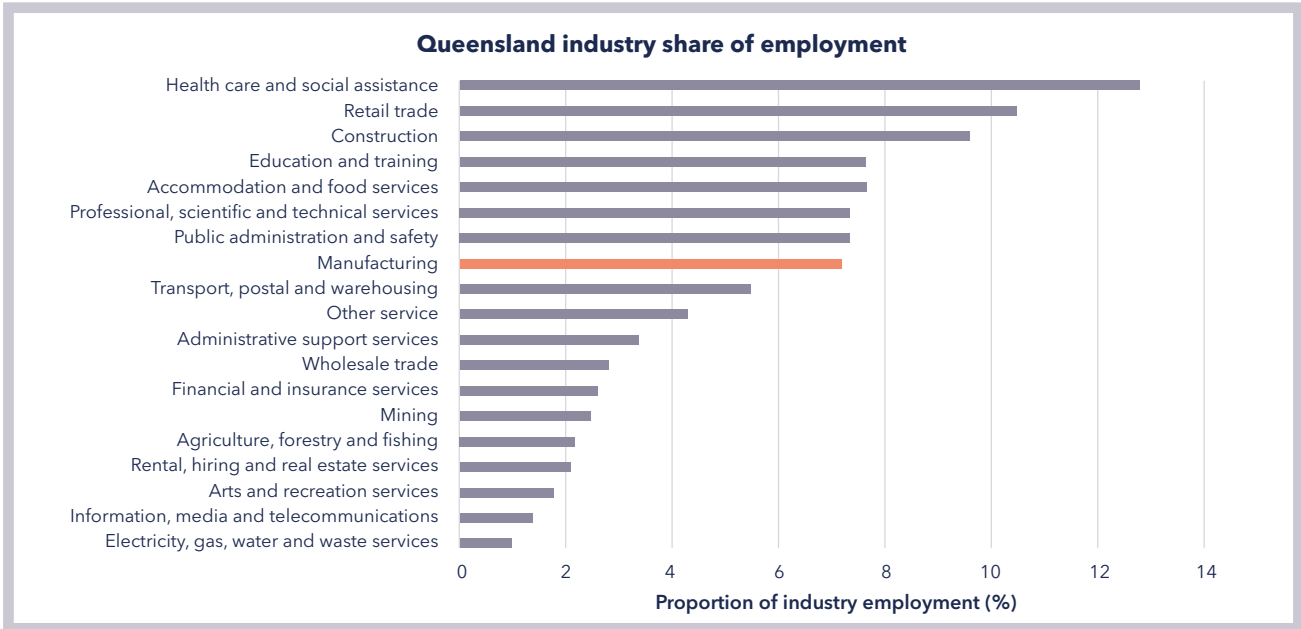


Figure 1: Queensland industry share of employment. Source: ABS May 2017.

Compared with other industries manufacturing ranks equal sixth with other services in terms of productivity as illustrated in Figure 2 below.

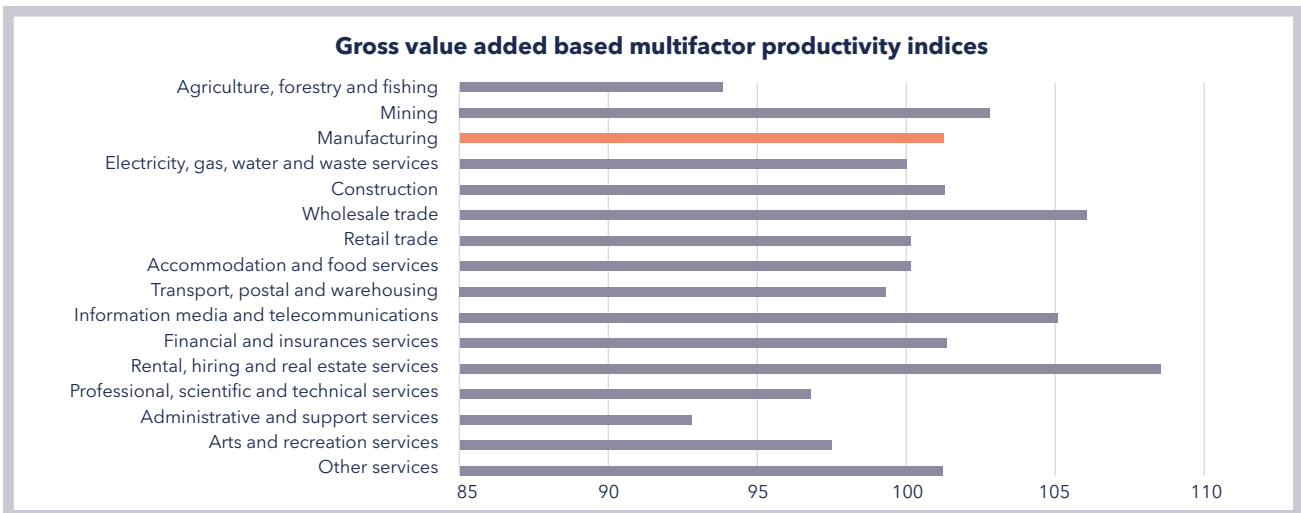


Figure 2: Gross value added based multifactor productivity indices. Source: ABS December 2016.

Global innovation including digital disruption and advanced technology is changing the industry's competitiveness with manufacturers needing to improve productivity and build competitive sustainability. The pace of change also creates challenges for workforce succession planning. Potential skills shortages in new and emerging enabling technologies present challenges in providing training in new technical skills.

Queensland has been less affected than other Australian states by the downturn in traditional manufacturing, primarily due to the composition of the industry where manufacturing operations are smaller and more flexible. The sector comprises 9000 enterprises, 47 per cent of which are small and medium sized enterprises. Manufacturing directly employs more than 170,000 Queenslanders, 88 per cent of whom are in full-time positions. More than half of Queensland manufacturing jobs are in the Greater Brisbane area as illustrated in Figure 3 below.



Figure 3: Queensland manufacturing employment profile by SA4 region. Source: ABS May 2017.

Queensland's diverse manufacturing industries range across food and beverages, metal products, non-metallic mineral products, machinery and equipment, petroleum, coal, chemical, polymer and rubber products, printing and recorded media, textiles, clothing, furniture and wood and paper. Food product manufacturing, machinery and equipment manufacturing and transport equipment manufacturing are the largest employing sectors in Queensland as illustrated in Figure 4 below. While the manufacturing industry is dispersed throughout Queensland's regions, more than half of the State's manufacturing jobs are in the Greater Brisbane region.

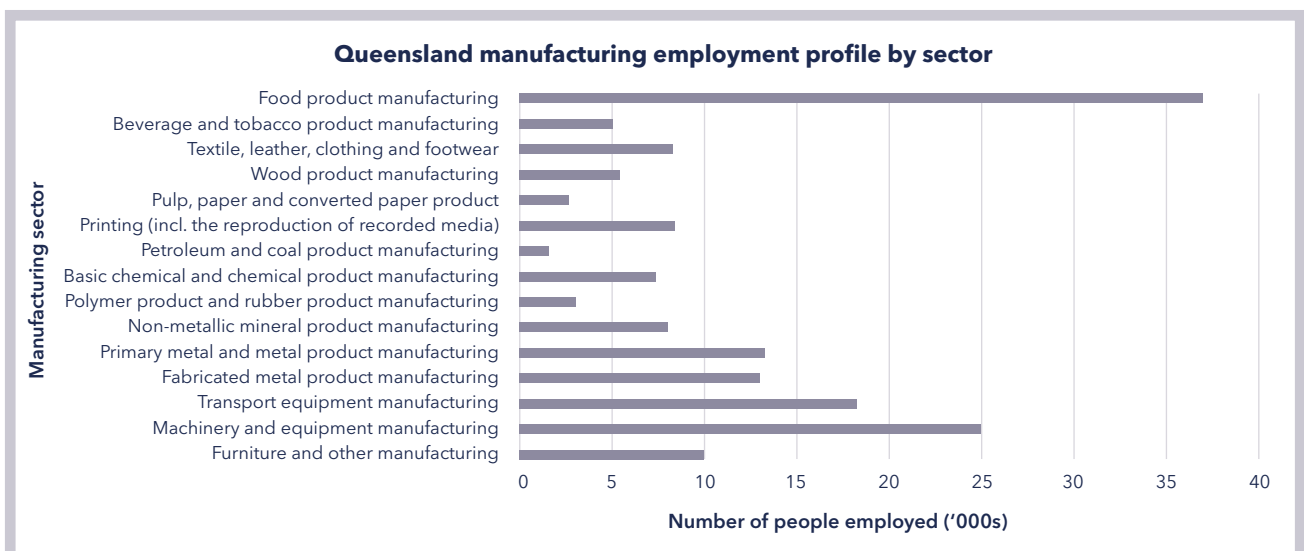


Figure 4: Queensland manufacturing employment profile by sector. Source: ABS May 2017.

The main sectors and markets in Queensland identified in the Advanced Manufacturing 10-year Roadmap and Action Plan are:

- aerospace
- automotive and transport
- biomedical and life sciences
- defence
- food and beverage processing
- industrial biotechnology and bio products
- mining equipment, technology and services
- precision agriculture
- renewable energy.

4. EXECUTIVE SUMMARY

Manufacturing in Queensland is embarking on a journey to transition to the global environment of Industry 4.0 – the fourth industrial revolution. Low skilled entry level jobs are diminishing as demand increases for people with high levels of language, literacy and numeracy and technological skills who are willing to commit to undertake ongoing learning and skills development.

The need to advance Queensland’s manufacturing industry is acknowledged as critical to its future success and viability. Driven by changes in global market access and technology and a shift from making things to making value, advanced manufacturing, crosses multiple industries, sectors and markets and therefore is difficult to define.

In Queensland, manufacturing is advancing into sectors such as agriculture, mining and medical and in markets such as defence. The blurred delineation between industries and markets, manufacturing and services presents challenges for benchmarking and opportunities to re-assess training purchasing to adapt to relevant and emerging industry-relevant qualifications.

As business models and practices change, so too do the technical and personal skills and qualifications required of the workforce. Manufacturing will continue to involve the traditional skills of cutting, bending, shaping and joining, however there will be an increased need for computer-enabled technologies and use of materials such as plastics and different composites.

The rapid pace of change limits accurate forecasting of future workforce needs, nevertheless it is clear that the ability for the workforce to apply science, technology, engineering and mathematics (STEM) skills is a critical requirement.

The number of people employed in the manufacturing industry in Queensland has declined over the past five years, however long term projections of possible future employment growth from 2020-21 indicate a steady upward trend. Employment in the manufacturing industry in South East Queensland is projected to increase from almost 150,000 workers in 2020-21 to more than 228,000 in 2040-41. There are shortages of workers with the required skills in regional areas and niche markets. People with design skills and design thinking are in high demand.

The relationship between the manufacturing industry and the education and training system is considered critical to achievements in advanced manufacturing, as is the role of schools in developing students’ skills in language, literacy and numeracy and the ability to apply STEM skills. Gateway schools provide opportunities for students to experience the industry and a potential pool of workers for employers.

Despite strong support for the apprenticeship and traineeship system, the proportion of apprentices and trainees in the Queensland manufacturing workforce is very low. The annual intake of apprentices and trainees in manufacturing has declined from 4530 in 2014 to 2806 in 2016.

State and non-state schools in 2016 delivered almost half of the Certificate I and II level training for the manufacturing and engineering qualifications. Schools enrolled 4885 participants compared with combined enrolments of 5031 for TAFE and privately operated organisations.

Progress has been made in incorporating foundation skills qualifications into manufacturing qualifications, however current training packages are considered not flexible enough to incorporate extra new specialist digital technology and communication core skills that support manufacturers to transition culture and productivity in the workplace.

While training packages have provision for industry competency based training, changes that would enable manufacturers and training providers to tailor training by packaging up a combination of a trade qualification with extra competencies for sector specific occupations will help meet future workforce needs.

Collaboration across the supply chain and culture change that embeds ongoing learning are important in upskilling and retaining the current workforce. Similarly, collaboration and partnerships between industry and entities like universities offer a range of opportunities for staff, skills and knowledge to develop sector specific workforce skills, and for students to apply their learning by undertaking industry work placements.

5. SUMMARY OF KEY FINDINGS

While there is not a universal definition for advanced manufacturing, Australia, along with Germany and Canada, has embraced the focus of Industry 4.0 which seeks to create an integrated advanced manufacturing system that connects human, mechanical and digital resources. The majority of Queensland manufacturers surveyed expressed support for the definition of advanced manufacturing used in Queensland's Advanced Manufacturing 10-Year Roadmap and Action Plan:

"A holistic approach to the way a manufacturing business operates, with a high level of technology and expertise applied throughout every step of the value chain."

As manufacturers become more advanced, the delineation between manufacturing and services, and industry sectors and markets becomes more blurred. Manufacturing in Queensland is advancing in sectors including agriculture, mining and medical and in markets such as defence.

Hence advanced manufacturing does not fit into a single sector and the misalignment between ABS data codes such as ANZSIC (industry subdivisions) and ANZSCO (occupations) and VET qualifications presents challenges for benchmarking. Future training purchasing should focus on qualifications that support manufacturing to advance in Queensland.

The rapid pace of change prevents accurate forecasting of future workforce needs, hence there are emerging trends worldwide to:

- retain current workers by incorporating ongoing manufacturing-centric learning and development into organisational culture
- collaborate with others across the value chain and lifecycle activities to participate more competitively
- invest in highly skilled R&D capability by partnering with others in the supply chain and focusing on applied learning
- better prepare entry level workers by improving basic skills such as language, literacy and numeracy, communication, and self and time management skills and applied STEM skills at the school level.

The Australian community's lack of knowledge about the size and importance of the manufacturing industry, combined with perceptions that the industry is in decline may be influencing options about future job prospects.

Overwhelmingly Queensland manufacturers consider there are no current or foreseen labour shortages, however there are shortages of workers with the required skills particularly in design, regional areas or

niche markets. People with design skills and design thinking are in high demand.

Key future skills requirements in manufacturing include:

- managerial competence and capability, leadership and entrepreneurship
- improvisation and adaptive capacity
- high performance technical skills across the supply chain
- higher quality general labour inputs including foundational skills, language literacy and numeracy and the ability to apply STEM skills
- interpersonal skills such as organisation, communication and critical thinking
- broad-based multi skills in technology and digital capability.

Broader more generic vocational skills and higher order skills associated with exploiting change are considered more valuable than specialist skills that will become quickly redundant.

Future pathways to advance manufacturing in Queensland could include higher level apprenticeships based on the Industry 4.0 project and/or Certificate III embedded into subsidised Certificate IV and/or Diploma qualifications.

While training packages have provision for industry competency based training, there is a need to allow manufacturers and training providers to tailor training by packaging up a combination of a trade qualification with extra competencies for sector specific occupations to meet Industry 4.0 workforce needs.

Certificate II level pre-apprenticeship training is a valuable introduction to jobs in industry, especially when combined with Certificate II level foundation skills.*

Apprentices and trainees comprise a very low proportion of the Queensland manufacturing workforce with commencements decreasing by more than 1000 in 2016, of which almost 700 were trainees.

6. DEFINING ADVANCED MANUFACTURING

Globally there are multiple definitions and business models of advanced manufacturing. Primarily the differences are due to whether policies are focused on technological revolution or a more holistic view of the evolution of change across the manufacturing supply chain. The Queensland Advanced Manufacturing 10-Year Roadmap adopts an Industry 4.0 approach, describing advanced manufacturing as the cutting edge of manufacturing, and an industry with global growth potential which incorporates

* Industrial Relations implications should be considered.

market products and a range of activities from design and research and development to production, distribution and after sales service.

The Australian Government Department of Industry, Innovation and Science describes advanced manufacturing as a broad set of enabling technologies, processes and practices that businesses from a wide range of industry sectors can adopt to improve their productivity and competitiveness. Examples of advanced manufacturing technologies and processes include:

- additive manufacturing/3D printing (i.e. a digitally based alternative to traditional 'subtractive' manufacturing)
- advanced materials (i.e. use of materials such as carbon fibre and graphene to make stronger, lighter or more durable products)
- Industry 4.0 (i.e. the 4th wave of the industrial revolution that connects big data and analytics with automation and robotics, cloud computing; and system/software integration to create 'smart factories')
- biotechnologies (e.g. genetically engineered crops, bio-remediation [microbes] to clean up oil spills)
- nanotechnologies (i.e. engineering and technology conducted at the nanoscale to produce products such as disease-targeted drugs and lighter sporting equipment)
- design-led innovation (i.e. the strategic 'design' of every aspect of an organisation's value-adding activities to improve its sustainable competitiveness).

Queensland's advanced manufacturing businesses are acknowledged as some of the most innovative in the state, supported by enabling technologies including advanced robotics, nanoelectronics, biomanufacturing, advanced automation, big data analytics, sensors and embedded electronics.

FINDING 1

While there is not a universal definition for advanced manufacturing, Australia, along with Germany and Canada, has embraced the focus of Industry 4.0 which seeks to create an integrated advanced manufacturing system that connects human, mechanical and digital resources. The majority of Queensland manufacturers surveyed expressed support for the definition of advanced manufacturing used in Queensland's Advanced Manufacturing 10-Year Roadmap and Action Plan.

"A holistic approach to the way a manufacturing business operates, with a high level of technology and expertise applied throughout every step of the value chain."

7. TRANSITIONING TO ADVANCED MANUFACTURING

Queensland's history of smaller, more flexible manufacturing operations is considered well suited to the emerging manufacturing trends of smaller production runs of customised high-value niche products and services and the shift from making things to making value across the supply chain. Ninety per cent of Queensland manufacturers surveyed consider it is very important or essential for their business to transition to advanced manufacturing, driven by globalisation and the introduction of new technologies.

Queensland industry has identified the need to benchmark locally to work out where they are in the advanced manufacturing continuum. Key workforce-related success factors for globally competitive manufacturers include systems that converge skills and technology, and broader skills required to deliver value to the customer such as problem solving, staff management and leadership.

The Australian and New Zealand Standard Classification of Occupations (ANZSCO) has identified new manufacturing occupations such as fibre composite technician, plastics technician, corrosion technician and environmental auditor, however there are many occupations within the industry that are not currently recognised as part of the manufacturing workforce because they are traditionally classified as support or service occupations or because of the interrelationships with other sectors.

Nevertheless, Sagacity Consulting has undertaken the mapping of qualifications identified from this scan as industry relevant and these are outlined at Appendix 1.

FINDING 2

As manufacturers become more advanced, the delineation between manufacturing and services, and industry sectors and markets becomes more blurred. Manufacturing in Queensland is advancing in sectors including agriculture, mining and medical and in markets such as defence.

Hence advanced manufacturing does not fit into a single sector and the misalignment between ABS data codes such as the Australian and New Zealand Standard Industrial Classification (ANZSIC) (industry subdivisions) and ANZSCO (occupations) and Vocational Education and Training (VET) qualifications presents challenges for benchmarking. Future training purchasing should focus on qualifications that support manufacturing to advance in Queensland.

8. THE GLOBAL ENVIRONMENT

The convergence of the capabilities and competitiveness of the global economy and scarcity of resources, rapid advances in technology and availability of big data, a shift from making things to making value, and a growing need to change labour practices and organisational structures are the key characteristics of the modern manufacturing industry. Trends such as globalisation, diffusion of technology, changing consumer preferences, exchange rate fluctuations, and the imperative for increased resource efficiency are shaping manufacturing supply chains across the world, causing them to be highly interconnected and complex. As manufacturing becomes more innovative, the demand for skilled labour increases, surpassing supply as evidenced in recent years by manufacturers in Germany and the United States (US).

Examples of global industrial movements that are focused on manufacturing include Germany's Industry 4.0, the US-originated Industrial Internet Consortium which includes manufacturing industry business verticals, China's Made in China 2025, Japan's Industrial Value Chain Initiative, and South Korea's Manufacturing Innovation 3.0.

Policies and programs that are influencing manufacturing workforce decisions internationally include:

- The Fraunhofer Society's work including Design of Work and Development of Personnel in Advanced Manufacturing which focuses on job design to retain workers by fostering continuous learning and development of the workforce. For many businesses this requires significant cultural change.
- Manufacturing USA which is a network of institutes involving industry, academic and government that focus on transforming promising early-stage research into proven manufacturing capabilities that are ready for adoption by US manufacturers. The institutes provide manufacturers with access to state-of-the-art facilities and equipment and critical workforce training and skills development in these new technologies.
- The United Kingdom's High Value Manufacturing Catapult which focuses on continual learning and improving skills use and development in work, not just the provision of skills.

Global companies like Siemens and GE have fully embraced Industry 4.0, declaring it a core part of their identities. To ensure it can draw upon a suitable future workforce, Siemens is engaged in collaborations worldwide such as curriculum design with the Singapore Institute of Technology, apprenticeship pipeline projects in the US and Industry 4.0 apprenticeships in Austria.

Island learning with Siemens Industry 4.0 in Austria

For more than a year, apprentices in the Siemens training workshop in Linz, Austria, have been using "learning islands" to hone their skills for use in the digital factory of the future. These learning islands are mock-ups of complete systems for filling liquid media that can also simulate tank levels. On these very realistic models young workers can practice steps they will need to perform later on customer systems. These activities range from mechanical mounting, including cabling, motors, and sensors, to programming the system, and all the way to commissioning, including operation using mobile devices such as smartphones or tablets.

Industry 4.0 introduces a new level of control of the entire value chain across the lifecycle of products extending from idea to order to development and production, to delivery of a product to the end customer, through to recycling and related services.

The basis for Industry 4.0 is the availability of all relevant information in real time as well as the capacity to derive from this data an optimal value creation flow at any point in time. Businesses are moving to a focus on the entire system and making value for customers to reduce the likelihood of disruption by competitors or technology.

Nevertheless a 2016 Boston Consulting Group survey of German and US companies found that only 19 per cent of German manufacturers and 16 per cent of US manufacturers had already fully implemented Industry 4.0. By contrast, a 2016 McKinsey survey of German, US and Japanese manufacturers and technology suppliers showed more positive results with 56 per cent of German companies indicating they had made at least good or substantial progress over the year in implementing Industry 4.0 compared with 50 per cent of US and 16 per cent of Japanese companies.

A 2014 study of the impacts on the workforce of the US Advanced Manufacturing Program and Germany's Industry 4.0 produced recommendations for qualifications and skills for the factory worker of the future as illustrated in Figure 5 and Table 1 (on page 13).

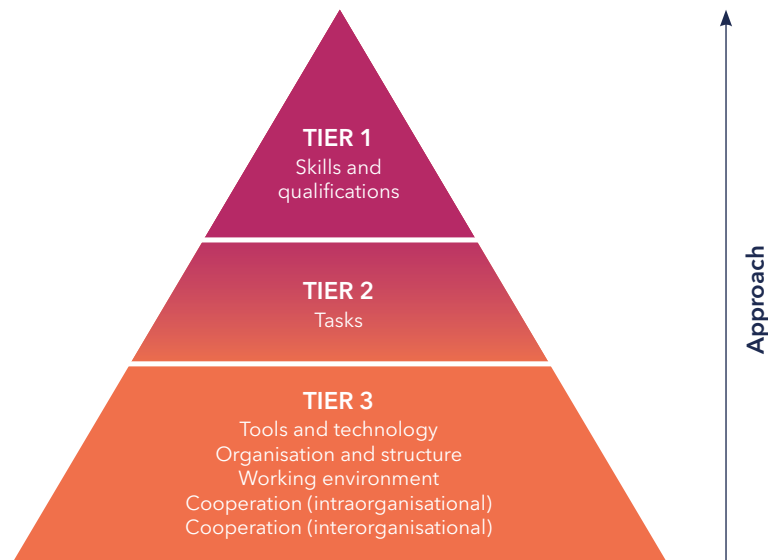


Figure 5: Approach to derive qualifications and skills for the factory worker of the future. Source: VDI and ASME 2015.

The analysis produced two main outcomes: in order to be successful in the manufacturing sector a skilled workforce is needed today and will be needed in the future; the set of needed qualifications and skills will fundamentally change.

The German and US education and training systems are somewhat different to the Australian system. The US rarely uses an apprenticeship model to teach young people a trade, whereas in Germany, learning on the job is a traditional component of the education system. Vocational training in Germany is guided not only by the requirements of the labour market, but also by the need for individuals to acquire skills, knowledge and competences that enable them successfully to prove themselves in the labour market.

Training programmes are designed on the principle that they should be as broad as possible and as specific as necessary. Nevertheless similar principles apply which can be summarised as:

- primary and secondary education needs to keep up with new STEM concepts that are relevant to jobs
- vocational or on the job training helps transition from school to work
- continuous vocational training is needed in manufacturing and this may be able to be achieved through standardised training.

| | Must | Should | Could |
|--|--|--|--|
| Technical qualifications and skills | IT knowledge and abilities | Knowledge management | Computer programming/coding abilities |
| | Data and information processing and analytics | | Specialised knowledge about technologies |
| | Statistical knowledge | | Awareness for ergonomics |
| | Organisational and processual understanding | | Understanding of legal affairs |
| | Ability to interact with modern interfaces (human-machine/human-robot) | | |
| Personal qualifications and skills | Self and time management | Trust in new technologies | |
| | Adaptability and ability to change | Mindset for continuous improvement and lifelong learning | |
| | Team working abilities | | |
| | Social skills | | |
| | Communication skills | | |

Table 1: Qualifications and skills of workers in a factory of the future. Source: VDI and ASME 2015.

Note: The order of listing within the three categories above does not indicate a prioritisation among the factors of the respective category and the list is not intended to be exhaustive.

The Organisation for Economic Cooperation and Development (OECD) recommended that workforce training and development in the US should comprise a system of portable, stackable manufacturing skill certifications. These would be used by employers in hiring and promotion and would help production workers obtain readily transferable and recognisable skills. The OECD also recommended development of online training and accreditation programs with federal support through job training programs.

China is aiming to raise the percentage of highly skilled workers to 28 per cent and the ratio of human capital investment to Gross Domestic Product to 15 per cent by 2020. Equipment manufacturing, ICT, biotechnology and new materials are among the specified priority areas for skills development. Made in China 2025 emphasises the importance of a comprehensive skills system in areas ranging from research and development (R&D), research translation and application, to production and management. A growing number of general undergraduate colleges are being transformed into vocational colleges to strengthen vocational and continuing education. Pilot projects for modern apprenticeships are also being developed. Modifications have been made to the National Catalogue of Disciplines and Specialties for Vocational and Technical College Education to include new disciplines such as industrial robotics, Internet of Things, engineering, 3D printing for aviation, cloud computing and big data.

Studies show a positive correlation between automation and jobs under the conditions of Industry 4.0, concluding that tasks, not jobs, will be replaced by automation and while most jobs will change they won't disappear. The biggest market for industrial robots is China, a relative newcomer to modern automation, however robot density is extremely low at around 30 robots per 10,000 workers. Germany's automotive sector holds the top position for robot density in Europe with about 1150 industrial robots per 10,000 employees. Siemens reports similar trends in the UK and in the US and a McKinsey Global Institute 2017 study concluded that more occupations will change than be automated away.

FINDING 3

The rapid pace of change prevents accurate forecasting of future workforce needs, hence there are emerging trends worldwide to:

- retain current workers by incorporating ongoing manufacturing-centric learning and development into organisational culture
- collaborate with others across the value chain and lifecycle activities to participate more competitively
- invest in highly skilled R&D capability by partnering with others in the supply chain and focusing on applied learning

- better prepare entry level workers by improving basic skills such as language, literacy and numeracy, communication, and self and time management skills and applied STEM skills at the school level.

9. MANUFACTURING IN AUSTRALIA

The Australian manufacturing sector in small in global terms, ranking 21st as a globally competitive nation, yet it is more important to the economy than most Australians realise because of its employment and export size. South Australia has the highest proportion of people employed in manufacturing by State/Territory (9.6 per cent) followed by Victoria (9.2 per cent) and then Tasmania, Queensland and New South Wales as illustrated in Figure 6 below.

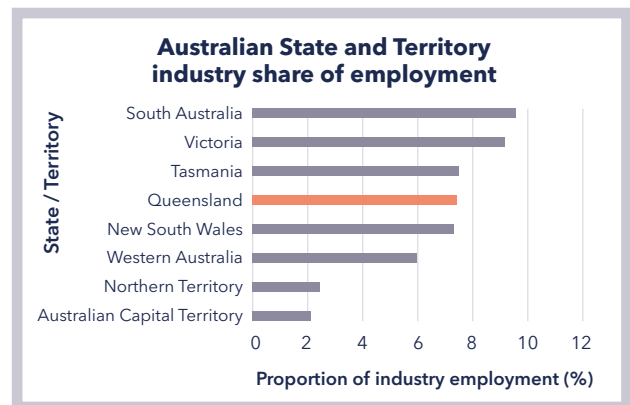


Figure 6: Australian State and Territory industry share of employment. Source: ABS May 2017.

About a quarter of Australian manufacturing output is from the food and beverages sectors, followed by machinery and equipment despite the progressive loss of automotive assembly that sits within this sector. The Australian Advanced Manufacturing Council estimates Australia has 2500 advanced manufacturers who are not only surviving but prospering. The Australian Industry Group considers that advanced manufacturing accounts for around a quarter of current manufacturing businesses.

The importance and size of manufacturing to the Australian economy is not well known and the community perceives the industry as in decline. Nevertheless, research by the Centre for Future Work, Australia Institute in April and May 2017 shows Australians continue to see the success of manufacturing as critical to national economic prosperity and there is wide public support for targeted policies to sustain and expand a viable domestic manufacturing base in Australia.

An effective manufacturing industry that is continuously advancing will help build social capital of communities and regions. However, there is a perception that governments focus more on those businesses that are high profile and high end rather than small to medium sized enterprises (SMEs) and clusters within supply chains that are embarking on the advancing manufacturing journey.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) identified six stages in the supply chain as detailed in Figure 7 below and found that advanced manufacturers perform activities across all the stages and increasingly with end of life management.

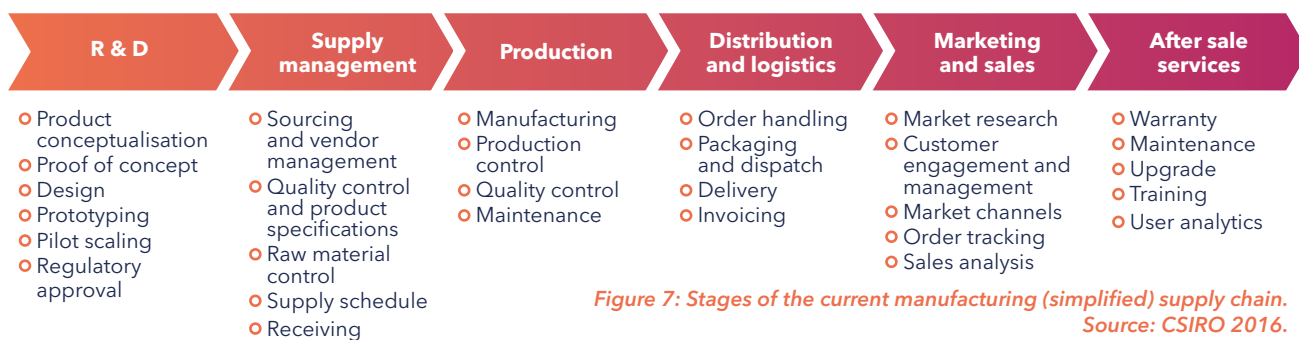


Figure 7: Stages of the current manufacturing (simplified) supply chain. Source: CSIRO 2016.

9.1 Workforce skills

Across Australia, 18 per cent of all manufacturing businesses identified the lack of skilled persons within the business and/or within the labour market as a barrier to general business activities or performance. This increases to 24 per cent for innovation-active manufacturing businesses.

Australian Workforce and Productivity Agency (AWPA) research shows that 42.5 per cent of the manufacturing workforce have no post-school qualifications and many of the post-school qualifications are in trade areas with little relevance to future technological adoption. There is acknowledgement that the range of skills needed by the manufacturing workforce to succeed in global supply chains is varied and includes a range of new technological and logistical skills.

Upskilling

AWPA and the Australian Manufacturing Workers Union (AMWU) consider upskilling should occur in

a strategic manner, with both formal and informal training aimed at developing capabilities and expertise that reflect the medium and long-term needs of the industry. They identified investment will be needed in training to raise capabilities in new areas such as digital manufacturing and an increased emphasis on skills not traditionally associated with manufacturing such as marketing and ebusiness skills.

AWPA research noted views about the importance of equipping workers with the ability to adapt quickly to constant structural change. However the use of generic skills should be at the core of training to ensure the future workforce has the capacity to capitalise on emerging opportunities that workers are equipped to cope with redeployment in times of structural change.

Skills gaps

NCVER research identified a range of skills gaps in advanced manufacturing, which are illustrated in Table 2 below.

| Advanced manufacturing | |
|--|--|
| Addressing skill gaps and future skills demand for existing workers | Specific workforce issues impacting on the way the education and training system responds |
| <ul style="list-style-type: none"> As the concept of manufacturing moves beyond technical and engineering activities to one of services offered and needed in global value chains, the occupation and qualification profiles and implications for future skills development will noticeably change. University-level skills and competencies are becoming the requisite level for many occupations in manufacturing. Emerging university graduates tend to lack practical competencies. The further development of advanced manufacturing technologies relies on high-level application of STEM and literacy skills, as well as ability to integrate R&D into manufacturing practice (Australian Workforce and Productivity Agency 2014). A balance of technical and theoretical skills is needed. There is an increase in diversity in the workplace profile, which increases the potential recruitment pool. Levels of numeracy, literacy and problem-solving in manufacturing are lower than in most other industries. Both VET and the higher education sectors need to emphasise employability skills and to foster agility and adaptability. Strategies will be needed to improve completions in apprenticeships, overcome barriers to work-integrated learning and address nationwide STEM issues (Australian Workforce and Productivity Agency 2014). | <ul style="list-style-type: none"> It is estimated that almost 50 per cent of workers in the manufacturing industry have language, literacy and numeracy (LLN) skills below the required functional level (Australian Workforce and Productivity Agency 2014). Structural adjustment is required, with employment over the last decade declining steadily in the majority of the industry's subsectors. Overall employment figures are expected to continue to decline, meaning a significant portion of workers have needed to look for new employment, both in and outside the manufacturing industry. The skills of manufacturing workers may not be easily identified as transferable. Attracting and retaining an appropriately skilled workforce is difficult. There are difficulties in recruiting employees with STEM skills. There is a lack of 'innovation' skills and digital literacy (Australian Workforce and Productivity Agency 2014). |

Table 2: Skills gaps in advanced manufacturing. Source: NCVER 2014.

STEM

There is widespread agreement about the importance of STEM in addressing the need for an innovative and skilled workforce in advanced manufacturing. This extends from extending the range of STEM skills that are taught, to upskilling teachers to ensure they keep up to date with changing technology and teaching students how to apply STEM skills in the workplace.

The Queensland Chief Scientist report acknowledged that to encourage greater participation in STEM subjects, there is merit in teaching to become more engaging, with practical sessions and placement with companies. There is also scope for incorporating design and business skills into the STEM curricula (design-led thinking, communication, project management, understanding business plans, intellectual property and basic legal skills) without compromising a solid STEM basis.

Research and development

The role of research and development in advancing the manufacturing sector is also well acknowledged. NCVER noted that despite pockets of excellence, there is a gap between the knowledge generated in universities and industry practice. The TAFE system is one bridge because of its strong links to workplaces and greater potential to translate research findings into practice and another is to connect young scientists into the business world.

The Australian Manufacturing Growth Centre (AMGC) found that Australia uses less high-skill workers than its competitors despite a significant cost advantage in higher skilled workers and that Australia's high-wage economy and distance from global markets were often drivers to succeed by being better, not just cheaper, than their competitors.

The report found that Australia has a low utilisation of high-skill workers relative to the US. The proportion of workers with higher skills is larger in the US than in

Australia in computer and electronics manufacturing, photographic and optical manufacturing, and aircraft manufacturing

The AMGC concluded these skill deficits are particularly stark given that Australia has a significant cost advantage in higher-skilled workers, as much as 40 per cent in some industries. Given our wage advantage in higher-skill roles, shifting a larger proportion of our employment into non-production roles and more skill intense sub-industries represents an opportunity to improve Australia's competitiveness and increase productivity.

FINDING 4

The Australian community's lack of knowledge about the size and importance of the manufacturing industry, combined with perceptions that the industry is in decline may be influencing options about future job prospects.

10. MANUFACTURING IN QUEENSLAND

Profiles of the current manufacturing workforce in Queensland and in regions, along with in training enrolments are outlined below.

10.1 Workforce profile

Compared with other industries in Queensland, manufacturing is the eighth largest employer (7.2 per cent) after health care and social assistance (12.8 per cent), retail trade (10.5 per cent), construction (9.6 per cent), education and training and accommodation and food services (both 7.7 per cent) and professional, scientific and technical services and public administration and safety (both 7.4 per cent).

While manufacturing employment in Queensland has declined over the past 10 years, it has remained relatively stable in the past two years as illustrated in Figure 8 below.

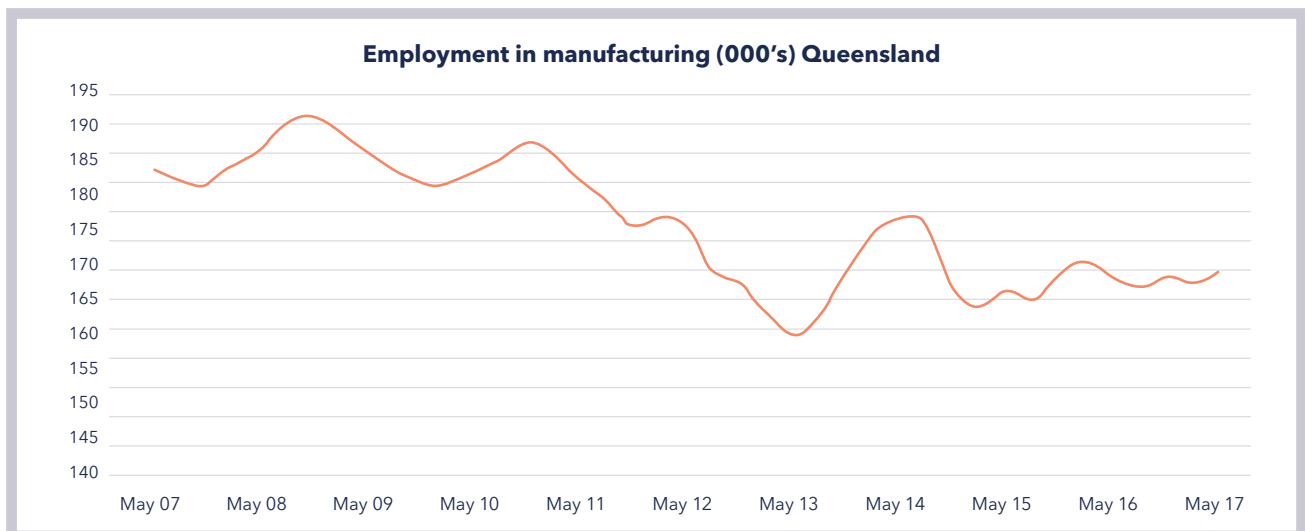


Figure 8: Queensland manufacturing employment from 2007 to 2017. Source: ABS May 2017.

Food product manufacturing remains the largest industry sector employing 37,200 people or 22.3 per cent of the Queensland manufacturing workforce. Machinery and equipment manufacturing employs 24,800 (14.9 per cent) and transport equipment manufacturing employs 18,400 people (11.1 per cent) of the workforce. The Australia Institute noted that food product manufacturing in Queensland is a substantial employer, employing more than double the number of people currently employed in the coal industry and almost 10 times as many people employed in oil and gas extraction. It also noted that while manufacturing is expected to decline overall, the decline is small relative to the size of the manufacturing industry.

The Queensland Productivity Commission noted that in Queensland, the manufacturing industry is a key employer of engineering trades workers, particularly sheet metal trades and structural steel and welding. Metal fitters and machinists, butchers, cabinetmakers and mechanical engineers are employed across a number of industries including manufacturing. Queensland manufacturers surveyed reported that nearly 38 per cent of current employees are process workers, 21 per cent are trades and less than three per cent are apprentices and trainees.

10.2 Regional profile

More than half of Queensland manufacturing jobs (56.1 per cent) are in the Greater Brisbane area with Ipswich and Logan-Beaudesert collectively having more than a fifth of the state's manufacturing workforce (10.4 and 10.1 per cent respectively). Brisbane South (7.3 per cent) and Brisbane East and Moreton Bay South (both 6.8 per cent) also have substantial employment compared to other Greater Brisbane regions.

The Gold Coast region has the most employment for the Rest of Queensland (10.4 per cent) equal to Ipswich, and both regions have the largest employment compared with other Queensland regions. For the Rest of Queensland, Fitzroy (5.5 per cent), Cairns (5.3 per cent) and Wide Bay (4.1 per cent) have the next largest employment. Manufacturing is particularly important in Logan-Beaudesert which is ranked seventh, and Ipswich which is ranked eighth in Australia for the proportion of manufacturing workforce to the total local government area (LGA) workforce.

Employment variances over the five years from August 2012 to May 2017 are illustrated in Table 3 (page 18) as is manufacturing employment as a proportion of each region's total employment.

| Area | Region (SA4) | Total manufacturing employment ('000) | Manufacturing as a proportion of total employment in each region (%) | 5-Year variance* | | Comments |
|-------------------------|-----------------------|---------------------------------------|--|------------------|---|--|
| | | | | ('000) | (%) | |
| Qld | | 169.8 | 7.20% | 0.1 | > 1.0% | Overall employment in Queensland has been consistent over the 5 years. |
| Greater Brisbane | Whole of region | 95.2 | 8.00% | -1.8 | < 1.8 % | There has been a shift from Greater Brisbane to the Rest of Queensland over 5 years. Notwithstanding Greater Brisbane has 56 per cent of manufacturing employment and 54 per cent of sales as of May 2017. |
| | Brisbane East | 11.5 | 9.70% | -0.7 | <5.4% | Reasonably consistent since 2015 with notable decline in 2013. |
| | Brisbane North | 6.6 | 5.70% | 0.7 | > 12.6% | Since 2012, lows in 2014-15 with steady marginal increase between 2015-17. |
| | Brisbane South | 12.4 | 6.00% | 0.8 | > 7.0% | Notable highs in 2014, decline in 2015 and slowly recovering. |
| | Brisbane West | 6.1 | 4.00% | 0.9 | > 18.0% | Smallest manufacturing workforce of the Greater Brisbane area and notable fluctuations from year to year. |
| | Brisbane Inner City | 6.3 | 6.00% | -1.1 | < 14.5% | There has been a shift away from the Brisbane Inner City region. |
| | Ipswich | 17.6 | 11.00% | -2 | < 10.0% | Has experienced a decline greater than the Greater Brisbane decline. However, compared with other regions across Australia, Ipswich is ranked 8th for the proportion of manufacturing workforce to total LGA workforce. Manufacturing continues to be important to the region. |
| | Logan Beaudesert | 17.2 | 11.80% | 0.7 | > 4.0% | Ranked 7th in Australia for the proportion of manufacturing workforce to total LGA workforce and has been consistent since 2012. |
| | Moreton Bay North | 11.5 | 11.00% | 0.9 | > 8.0% | Low periods in 2013-14 but steady increases from 2014 to 2017. |
| | Moreton Bay South | 6 | 5.80% | -2.1 | < 26.0% | There appears to have been a decline however steady since 2016. |
| Rest of Qld | Whole of region | 74.6 | 7.00% | 1.9 | > 2.6% | Increased in proportion to the decline in Greater Brisbane. |
| | Cairns | 8.7 | 8.00% | 4.4 | > 104.3% | Fluctuated from a low of 4200 to a high of 8700 workers during the 5-year period, and the per cent increase is misleading with the region's history of fluctuations. |
| | Darling Downs-Maranoa | 5.7 | 9.00% | 2.8 | > 97.0% | Experienced a steady 5-year increase, noting that 2012 was low period, hence the 97 per cent increase. |
| | Fitzroy | 9.4 | 8.00% | 2.7 | > 39.0% | Experienced a steady 5-year increase. |
| | Gold Coast | 17.6 | 5.80% | -1.6 | < 8.3% | Fluctuations have resulted in an overall small decline. |
| | Mackay | 6.5 | 6.50% | -1.5 | < 19.1% | Fluctuations from mining and METs activity with a high of 9000 workers reached from November 2012 to February 2013. |
| | Qld Outback | 0.4 | 1.00% | 0 | < 6.9% | Annual workforce fluctuations over the 5-years between 400 and 2000 workers. |
| | Sunshine Coast | 9 | 5.60% | -1.0 | < 9.9% | Fluctuations of about 1000 workers from year to year. |
| | Toowoomba | 4.9 | 6.60% | -1.4 | < 22.4% | Steady since 2014-15, had a relatively high number of workers in 2012 (6200) compared with 4900 in 2017. |
| | Townsville | 5.4 | 5.00% | -1.1 | < 16.3% | Recent decline evident – most has come steadily since 2015. |
| Wide Bay | 7 | 6.00% | -1.4 | < 16.4% | Pattern of variances (both up and down) of up to 3000 workers a year. | |

Table 3: Queensland manufacturing employment variances by region.
Source: Queensland Government Statistician's Office (QGSO) 2017.

* 5-year variance from August 2012 to May 2017

10.3 Training profile

NCVER data showing the number of people in training in 2016 in manufacturing industry relevant qualifications in each region is detailed at Appendix 2. A summary overview is provided below indicating potential clusters of SMEs within some regions.

Aeroskills

The total enrolment of 230 comprises 191 Certificate IV in Aeroskills including avionics, mechanical and structures and 39 Diploma level. Cairns has the highest enrolments with 36, followed by Brisbane North with 31 and Brisbane Inner City with 29.

Automotive manufacturing production

There are 147 people enrolled in automotive training. More than 80 per cent (119) of these are in Certificate III in Automotive Manufacturing Technical Operations – bus truck and trailer and 15.9 per cent (22) in Certificate II in Automotive Manufacturing Production – passenger motor vehicle. Ipswich has the highest number of enrolments with 31 followed by Logan-Beaudesert with 27 and Moreton Bay North with 19.

Electrotechnology and electronics

Of the 7674 people in training, 6979 are enrolled in Certificate III in Electrotechnology Electrician, 333 in Certificate III in Instrumentation and Control and more than 170 in each of Certificate III in Electronics and Communications and Certificate III in Electrical Fitting. Gold Coast has the highest enrolments with 826 followed by Fitzroy with 571 and Logan-Beaudesert with 491. There are no people in training in the Advanced Diploma of Computer Systems Engineering and Advanced Diploma of Engineering Technology – electronics.

Engineering

Total enrolment in this sector is 17,798. The highest enrolments are in Fitzroy with 1590, Mackay with 1549 and Wide Bay with 1514. Of the total enrolment 52 per cent are in Certificate I and II level qualifications, 37 per cent are in Certificate III level and 11 per cent in Certificate IV and above. The predominant Certificate II enrolments are in Engineering Pathways (5388), with highest enrolments in Wide Bay with 617, Logan-Beaudesert with 566, Ipswich with 479 and Townsville with 403. There are a total of 3271 people enrolled in Certificate III in Engineering – Mechanical Trade, followed by 2996 in Certificate III in Engineering – Fabrication Trade. There are 2764 enrolments in Certificate I in Engineering with the highest enrolments in Mackay, Fitzroy and Wide Bay and Townsville. Certificate IV and Advanced Diploma intake is 1993, the majority of which are in Certificate IV in Engineering.

Food processing

There are 1837 people enrolled in this sector, 370 in Logan-Beaudesert, 259 in Ipswich and 251 in the Gold Coast. The vast majority (1628 or 88.6 per cent) are enrolled in Certificate III in Food Processing

followed by 210 in Certificate II in Food Processing and 66 in Certificate I. Sixty-five of the Certificate I enrolments are in Moreton Bay North. There are 10 enrolments in Certificate IV and Diploma level qualifications.

Laboratory operations

Of the 2237 total enrolments in this sector, 491 are in the Gold Coast, 322 in Moreton Bay North, 241 in Brisbane South and 209 in Logan-Beaudesert. More than 55 per cent of enrolments (1245) are in Certificate II Sampling and Measurement followed by Certificate IV in Laboratory Techniques with 368 enrolments and Certificate III in Laboratory Skills with 341 enrolments spread across all regions.

Manufacturing

Of the 7957 people in training, 71 per cent are enrolled in Certificate I and II level qualifications. The highest number of enrolments are in Brisbane South with 1186 (14.9 per cent) followed by Cairns with 804, Logan-Beaudesert with 681 and Fitzroy with 618. Certificate I in Manufacturing Pathways* has the largest enrolment with 3378 or 38.7 per cent of the total. Brisbane South has the largest enrolments with 508 followed by Fitzroy with 495 and Logan-Beaudesert with 267. There are 2240 people enrolled in Certificate II in Manufacturing Technology – 642 of whom are in Cairns and 570 in Brisbane South.

Twenty-six per cent of total enrolments are in Certificate III level qualifications, predominantly 1713 people enrolled in Certificate III in Process Manufacturing. Of these 283 are in Mackay and 229 are in Logan-Beaudesert. The Sunshine Coast has 70.8 per cent (179) of the 253 higher level enrolments for this sector. The majority of people enrolled in higher level enrolments are in Certificate IV in Process Manufacturing (241).

Manufactured mineral products

There are low enrolments statewide, with 12 enrolments in Certificate III in Manufactured Mineral Products and two in the Certificate IV.

Meat processing

Total intake in this sector is 2010 with the highest enrolment in Darling Downs-Maranoa with 396 followed by Logan-Beaudesert with 328 and Toowoomba with 262. More than 71 per cent of the total enrolment is in Certificate II level qualifications, predominantly in Certificate II in Meat Processing – abattoirs (1373) with the highest enrolments in Logan-Beaudesert (310), Darling Downs-Maranoa (218) and Toowoomba (200). Twenty-two per cent of the total enrolments are in Certificate III level qualifications, including 125 people enrolled in Certificate III in Meat Processing – retail butcher across the State with the most at Wide Bay (16) and 115 enrolled in Certificate III in Meat Processing – food services, all of whom are at Darling Downs-Maranoa and Toowoomba.

* Certificate I in Manufacturing Pathways is a school-based qualification that does not result in an occupational outcome nor is it an entry level qualification for the manufacturing industry

There are 133 enrolments in Certificate IV qualifications, almost half of which are in meat processing quality assurance.

Polymer product manufacturing

Total intake in this sector is 563 with 82 in the Sunshine Coast followed by 48 in Moreton Bay North, 47 in Logan-Beaudesert, 46 in Moreton Bay South, 42 in Fitzroy and 40 in the Gold Coast. Dominant qualifications are Certificate IV in Polymer Technology with 278 enrolments and Certificate III in Polymer Processing with 260.

Primary industries

Total enrolment in manufacturing related primary industries qualifications is 1465 with 344 in Wide Bay, 246 in Cairns, 133 in Darling Downs-Maranoa and 131 in Fitzroy. The highest intake is 785 in Certificate III in Forest Growing and Management, an important part of the wood product manufacturing supply chain, followed by 308 in Certificate III in Harvesting and Haulage and 204 in Certificate III in Sawmilling and Processing. There are six enrolments in Certificate IV level qualifications in timber truss and frame design and timber truss and frame manufacture, all in Moreton Bay North and a total of 79 enrolments in Certificate II level qualifications.

Textiles Clothing and Footwear

There are 802 people enrolled in this sector with 140 in Brisbane South, 85 in the Sunshine Coast, 77 in Brisbane Inner City and 71 in Gold Coast. Diploma and Advanced level qualifications in Applied Fashion Design and Technology represent 49.6 per cent of total enrolments, comprising 291 people enrolled in the Diploma and 107 in the Advanced Diploma. There are 64 people enrolled in Certificate IV in Applied Fashion and Technology, 94 enrolled in the Certificate III and 193 people enrolled in Certificate II.

Transport and logistics

The intake for manufacturing related transport and logistics qualifications is 836 with 147 or 17.6 per cent in Logan-Beaudesert followed by 92 in the Gold Coast and 91 in Brisbane East. The main qualification is in Certificate IV in Warehouse Operations with 766 enrolments or 91.6 per cent of the total. There are 32 enrolments in Certificate IV in Logistics and 35 enrolments in the Diploma of International Freight Forwarding.

Table 4 (on pages 21 and 22) shows the predominant 2016 enrolments in manufacturing industry relevant qualifications in each region. Three regions – Brisbane West, Townsville and Queensland Outback are not in the top three for any group of qualifications identified, although Townsville has a significant enrolment in engineering.

Brisbane South is the state's largest training region, ranking first in manufacturing and textiles clothing and footwear and third in laboratory operations and transport and logistics. Fitzroy ranks first in engineering and second in electrotechnology and electronics. Logan-Beaudesert ranks first in food processing and transport and logistics, second in automotive manufacturing and meat processing and third in manufacturing.

Gold Coast ranks first in electrotechnology and electronics and laboratory operations and third in food processing. Wide Bay ranks first in primary industries and second in engineering. Cairns ranks first in aeroskills and second in manufacturing and primary industries. Darling Downs-Maranoa ranks first in meat processing and third in primary industries. Ipswich ranks first in automotive manufacturing and second in food processing, although numbers are small. Sunshine Coast ranks first in polymer product manufacturing and second in textiles clothing and footwear, although numbers are again small.

Mackay ranks second in engineering and polymer product manufacturing. Moreton Bay North ranks second in laboratory operations and third in automotive manufacturing. Moreton Bay South ranks third in electrotechnology and electronics. Toowoomba ranks thirds in meat processing.

Manufacturing industry relevant qualifications and in-training numbers by region in 2016.

| Region (SA4) | Manufacturing industry relevant types of qualifications predominant in the region | Total number in-training | Most in-training in Qld | Second highest in Qld | Third highest in Qld |
|----------------------------|---|--------------------------|-------------------------|-----------------------|----------------------|
| Greater Brisbane | | | | | |
| Brisbane East | Engineering | 552 | | | |
| | Manufacturing | 202 | | | |
| | Food processing | 102 | | | |
| | Transport and logistics | 91 | | * | |
| | Aeroskills | 29 | | | * |
| Brisbane North | Engineering | 481 | | | |
| | Manufacturing | 344 | | | |
| | Aeroskills | 31 | | * | |
| Brisbane South | Manufacturing | 1186 | * | | |
| | Engineering | 606 | | | |
| | Electrotechnology and electronics | 489 | | | |
| | Laboratory operations | 241 | | | * |
| | Textiles, clothing and footwear | 140 | * | | |
| | Transport and logistics | 81 | | | * |
| Brisbane West | Manufacturing | 412 | | | |
| | Engineering | 275 | | | |
| | Laboratory operations | 116 | | | |
| Brisbane Inner City | Manufacturing | 309 | | | |
| | Engineering | 292 | | | |
| | Textiles, clothing and footwear | 77 | | | * |
| Ipswich | Engineering | 1383 | | | |
| | Electrotechnology and electronics | 429 | | | |
| | Manufacturing | 420 | | | |
| | Food processing | 259 | | * | |
| | Automotive manufacturing production | 31 | * | | |
| Logan-Beaudesert | Engineering | 1409 | | | |
| | Manufacturing | 681 | | | * |
| | Electrotechnology and electronics | 526 | | | |
| | Food processing | 379 | * | | |
| | Meat processing | 328 | | * | |
| | Laboratory operations | 209 | | | |
| | Transport and logistics | 147 | * | | |
| | Polymer product manufacturing | 47 | | | * |
| | Automotive manufacturing production | 27 | | * | |
| | | | | | |
| Moreton Bay North | Engineering | 846 | | | |
| | Laboratory operations | 322 | | * | |
| | Manufacturing | 306 | | | |
| | Electrotechnology and electronics | 310 | | | |
| | Automotive manufacturing production | 19 | | | * |
| Moreton Bay South | Engineering | 670 | | | |
| | Electrotechnology and electronics | 529 | | | * |
| | Manufacturing | 358 | | | |

continued over the page...

| Region (SA4) | Manufacturing industry relevant types of qualifications predominant in the region | Total number in-training | Most in-training in Qld | Second highest in Qld | Third highest in Qld |
|------------------------------|---|--------------------------|-------------------------|-----------------------|----------------------|
| Rest of Queensland | | | | | |
| Cairns | Engineering | 1064 | | | |
| | Manufacturing | 804 | | * | |
| | Primary industries | 246 | | * | |
| | Aeroskills | 36 | * | | |
| Darling Downs-Maranoa | Engineering | 989 | | | |
| | Meat processing | 396 | * | | |
| | Primary industries | 133 | | | * |
| | Manufacturing | 100 | | | |
| Fitzroy | Engineering | 1590 | * | | |
| | Electrotechnology and electronics | 634 | | * | |
| | Manufacturing | 618 | | | |
| | Meat processing | 157 | | | |
| | Textiles, clothing and footwear | 131 | | | |
| Gold Coast | Engineering | 951 | | | |
| | Electrotechnology and electronics | 906 | * | | |
| | Laboratory operations | 491 | * | | |
| | Manufacturing | 254 | | | |
| | Food processing | 251 | | | * |
| Mackay | Engineering | 1549 | | * | |
| | Manufacturing | 540 | | | |
| | Electrotechnology and electronics | 378 | | | |
| | Laboratory operations | 70 | | | |
| | Polymer product manufacturing | 51 | | * | |
| Queensland Outback | Engineering | 677 | | | |
| | Manufacturing | 461 | | | |
| | Electrotechnology and electronics | 228 | | | |
| | Textiles, clothing and footwear | 107 | | | |
| Sunshine Coast | Engineering | 916 | | | |
| | Electrotechnology and electronics | 460 | | | |
| | Manufacturing | 421 | | | |
| | Polymer product manufacturing | 82 | * | | |
| | Textiles, clothing and footwear | 85 | | * | |
| Toowoomba | Engineering | 634 | | | |
| | Meat processing | 262 | | | * |
| | Electrotechnology and electronics | 186 | | | |
| | Manufacturing | 104 | | | |
| | Laboratory operations | 89 | | | |
| Townsville | Engineering | 1400 | | | |
| | Electrotechnology and electronics | 499 | | | |
| | Manufacturing | 114 | | | |
| | Laboratory operations | 103 | | | |
| Wide Bay | Engineering | 1514 | | | * |
| | Primary industries | 344 | * | | |
| | Manufacturing | 323 | | | |
| | Electrotechnology and electronics | 277 | | | |
| | Food processing | 186 | | | |

Table 4: Manufacturing industry relevant qualifications and in-training numbers by region in 2016. Source: NCVET 2017.

11. LABOUR AND OCCUPATIONAL SHORTAGES IN QUEENSLAND

The employment outlook for manufacturing compared with other industries in Queensland, the projected employment within manufacturing and possible changes in regions are examined below.

11.1 Employment outlook

The Australian Government Department of Employment projects a decline of 4.4 per cent in Queensland manufacturing jobs from 2015 to 2020, as illustrated in Figure 9 below. Nonetheless some manufacturing industry sectors, including food product manufacturing and machinery and equipment manufacturing, are expected to increase their levels of employment, as identified by the Australia Institute.

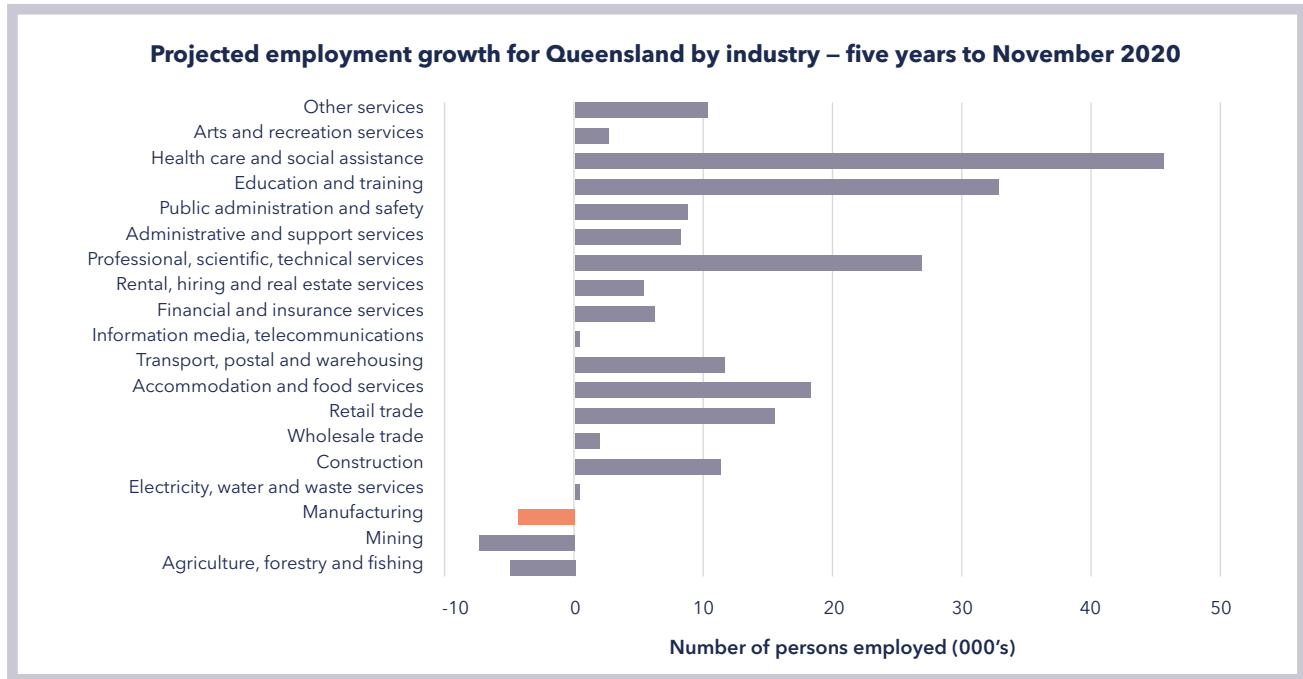


Figure 9: Projected employment growth for Queensland by industry – five years to November 2020. Source: Australian Government Department of Employment.

While there has been a decline in the number of people employed in the manufacturing industry in Queensland from 2010-11 to 2015-16, long-term projections of possible future employment growth from 2020-21 indicate a steady upward trend, both for South East Queensland and the Rest of Queensland. These projections are based on, and consistent with, the Queensland Government population projections, 2015 edition (medium series), State budget forecasts (2015-16) and a range of other assumptions and variables including no policy change, and are illustrated in Figure 10 below.

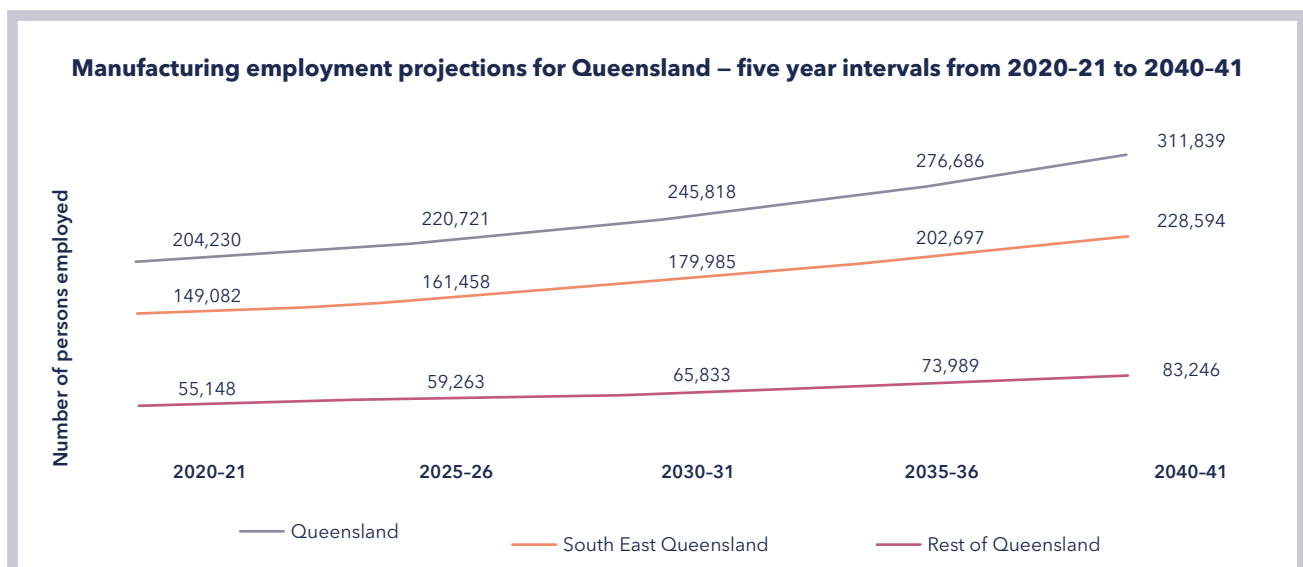


Figure 10: Manufacturing employment projections for Queensland – five year intervals from 2020-21 to 2040-41. Source: Queensland Government Statistician's Office.

11.2 Regional employment outlook

Employment in the manufacturing industry in South East Queensland is projected to increase from almost 150,000 workers in 2020-21 to more than 228,000 in 2040-41. The increase in manufacturing employment is projected to be consistent for each five-year interval as illustrated in Figure 11a below.

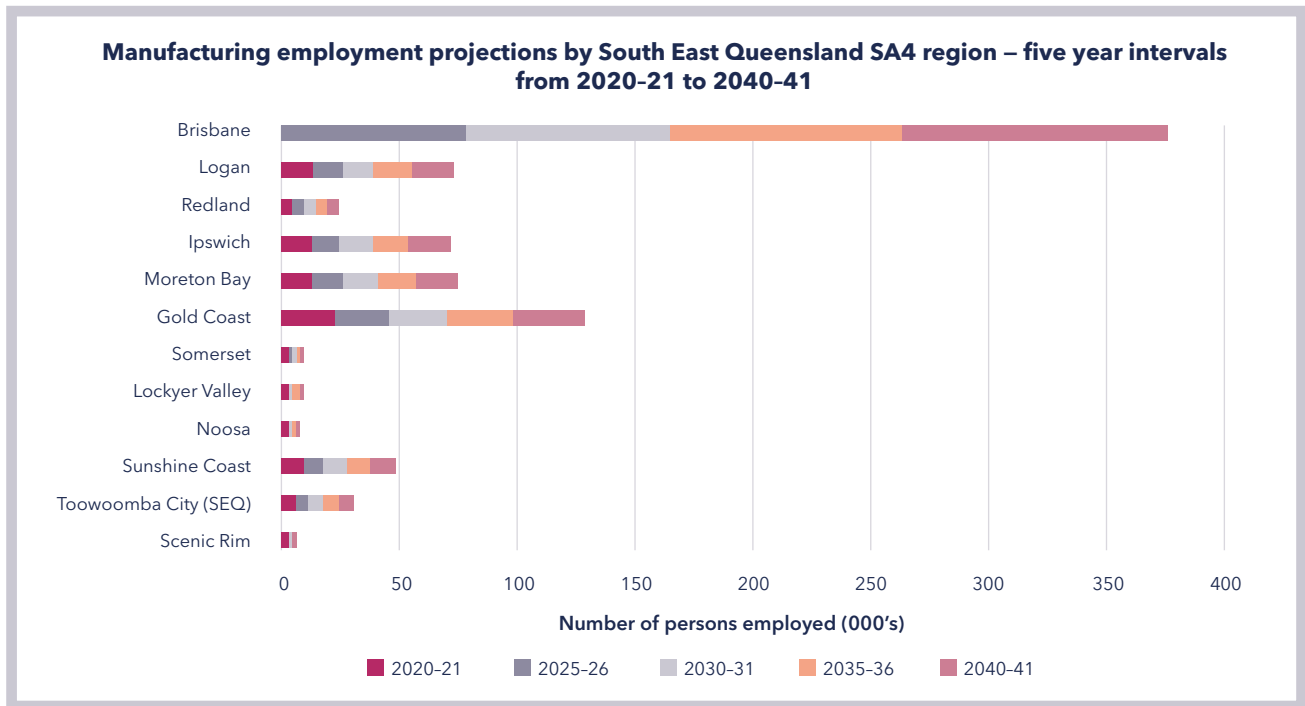


Figure 11a: Manufacturing employment projections by South East Queensland SA4 region – five year intervals from 2020-21 to 2040-41. Source: Queensland Government Statistician's Office.

Similarly manufacturing industry employment in the Rest of Queensland is projected to increase each five-year interval from 2020-21 to 2040-41 from 55,147 to more than 83,000 workers. Regions projected to have the largest number of manufacturing workers over this time include Central Queensland followed by Wide Bay Burnett and Townsville as illustrated in Figure 11b below.

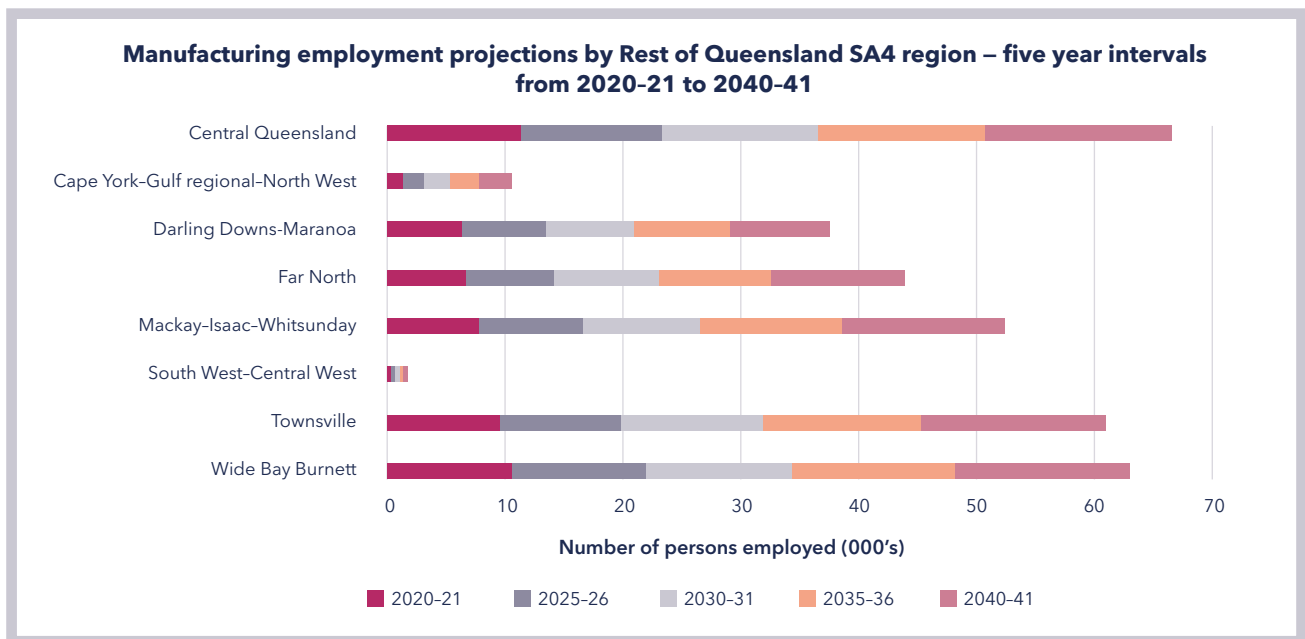


Figure 11b: Manufacturing employment projections by Rest of Queensland SA4 region – five year intervals from 2020-21 to 2040-41. Source: Queensland Government Statistician's Office.

11.3 Challenges

The Queensland Productivity Commission found that for manufacturing businesses, the challenge is to attract and retain workers with skill sets to meet changing needs and for manufacturing workers, the challenge is to acquire new skills and quickly adapt, in an environment of uncertainty over which new technologies will develop next. For government, the challenge is to put in place sufficiently flexible policies and programs to accommodate a range of possible future needs.

The most significant challenges identified by Queensland manufacturers surveyed are costs (including energy, new technology and costs associated with changes in the resources sector), upskilling staff, accessing skilled staff to fit the business, the time needed to introduce change and to transition and to train staff, and government policy and support.

Queensland manufacturers surveyed identified that developing competitive advantage is the major driver to improve productivity and increase innovation. Other drivers are the introduction of new technologies, the need to develop new markets and energy costs. These drivers will result in transformational change that will need leadership, planning and technical support to introduce new processes.

11.4 Skills shortages

Department of Employment labour market data show there are statewide shortages for cabinetmakers and trade qualified butchers with customer service and merchandising skills, and difficulties recruiting structural engineers and some senior civil engineering positions. In the 12 months to June 2017 there was a 36.5 per cent increase in vacancies for machinery operators and drivers and a 19.6 per cent increase in vacancies for technicians and trade workers. This includes regional recruitment difficulties with automotive electricians with industry specific experience, fitters and turners, fitter machinists and diesel fitters.

Design skills

The importance of design skills and design thinking is widely recognised, especially due to the ability to solve complex problems through a solutions and action orientated approach. While design thinking is becoming more common in school curricula and the range of design skills training is increasing at the VET and higher education level, these highly sought after skills are difficult to access in the current workforce. Eighty per cent of Queensland manufacturers surveyed report that design skills and thinking are incorporated into their transition to advanced manufacturing business models yet almost 40 per cent of those find it either difficult or very difficult to access these skills.

Basic skills levels

Employers expressed ongoing concerns with the level of the basic skills in the manufacturing workforce and the differences in the capability and capacity of workers 'beyond the production line' including language, literacy and numeracy and the application of STEM skills in the workplace. While the Australian Core Skills Framework (ACSF) has formalised core skills and helped raise entry level skills through initiatives such as literacy and numeracy diagnostic testing for FEE Help loans, there are views that minimum core skills levels requirements could be raised to ACSF level III and greater emphasis placed on digital technical skills.

11.5 Key sector variances

Aerospace

The aerospace industry is reporting difficulty recruiting fitter machinists and CNC machinists and a general reluctance of potential employees to seek apprenticeships in the industry. Furthermore there is a shortage of engineers particularly at senior technician graduate and postgraduate level. IBSA has identified the four most important skills for this workforce within the next three to five years as information technology, electronic digital programming, through-life support and logistics support analysis. MEA qualifications typically provide pathways to jobs in maintenance (e.g. Certificate IV, Diploma and Advanced Diploma lead to employment in maintenance management, and Diploma and Advanced Diploma of Aeronautical and Avionic engineering lead to paraprofessional engineering roles).

Automotive

The automotive industry is reporting an increase in interest in apprenticeships and traineeships from mature age, women and people from non-English speaking backgrounds, which it attributes principally to the downturn in the resources sector.

Biomedical

There is a reported shortage of biomedical professionals for the manufacturing industry. The annual median salary for a four-year degree qualified biomedical engineer is \$86,960 with demand expected to grow by 27 per cent in the 10 years from 2012 to 2022, fuelled by technological advances in healthcare. Career paths for senior technicians, technical specialists and laboratory supervisors are becoming increasingly constrained unless technicians undertake university study. The Certificate II in Sampling and Measurement and the Certificate III in Laboratory Skills offer potential pathways to higher level qualifications and biomedical careers.

Food processing

The food processing industry has identified a need for workers to have mandatory broader knowledge in food hygiene training (HACCP), prerequisite programs of good manufacturing practices (GMP) and for people to operate machines with programmable logic controller (PLC) expertise.

The industry has an appetite for exploring a new apprenticeship in advanced food manufacturing, high level internships in food laboratory technology and science and higher level skills for line operators, technical support services and R&D in food manufacturing.

Plastics

The plastic industry reports there are key labour or occupational shortages in niche jobs and around existing workers who need to consistently develop unique skills and knowledge to be able to keep up with technological advancements and changes. There is a need to continually upskill existing workers and a need to upskill teachers including contemporised experience on operating computer assisted manufacture (CAM) and computer numerical controlled (CNC) machines and other screen systems.

The industry needs more people with higher level knowledge and skills in applied science. Industry preferred pathways include starting with a Certificate III apprenticeship followed by competencies that upskill workers and lead to a Certificate IV qualification, as well as employing workers with other qualifications (eg another trade or university degree) and upskilling with industry relevant Certificate IV competencies.

IBSA notes industrial design is an emerging skills area for the industry. New techniques coming from the US that combine the use of 3D printing and traditional plastics materials and manufacturing techniques will require an enormous amount of specific knowledge.

Wood product manufacturing

The east coast region of Queensland is well positioned in the wood manufacturing industry. There are no labour shortages however there are shortages of people with soft skills such as work ethic, communication, time management, problem solving and working in teams. The rapid rate of change in advanced manufacturing has influenced an industry focus on the ability of people to learn. Cadetships have been reintroduced by some employers because they provide applied learning experiences and the opportunity for cadets to work across the whole supply chain process to enable a full understanding of the business.

FINDING 5

Overwhelmingly Queensland manufacturers consider there are no current or foreseen labour shortages, however there are shortages of workers with the required skills particularly in design, regional areas or niche markets. People with design skills and design thinking are in high demand.

12. SKILLS AND TRAINING REQUIREMENTS IN QUEENSLAND

Manufacturing will continue to involve the traditional skills of cutting, bending, shaping and joining, however there will be an increased need for computer-enabled technologies and use of materials such as plastics and different composites. The Queensland Productivity Commission confirmed the key role a robust and flexible VET sector plays in delivering an appropriately skilled manufacturing workforce.

The NCVER student outcomes survey reported student outcomes for Queensland VET graduates in engineering and related technologies have fallen since 2013, in some cases quite considerably.

In 2016, Queensland graduates' satisfaction with the courses undertaken and the impact of training on their employment prospects were generally lower than the Australian average.

13.1 Current training systems

There is general agreement among employers about the value of on the job and practical training. There is support for the TAFE system and its potential role in developing and delivering training for the future manufacturing workforce. Mentoring and sharing of apprentices among different companies across the manufacturing supply chain are regarded as useful methods of expanding skills.

Employers consider TAFE has a key role to play in developing and delivering advanced technical skills, business skills programs and using TAFE workshops for pilot plant manufacture, short runs of specialty equipment while a small company becomes established, incubator space for new start companies and providing Industry 4.0 training.

The rapid pace of change in technology is driving the use of original equipment manufacturer (OEM) training, which combined with in house training is the most common methods of training used by Queensland manufacturers surveyed.

In 2016, state and non-state schools delivered almost half of the Certificate I and II level training for the manufacturing and engineering qualifications. Schools enrolled 4885 of the total enrolments of 10,758 as illustrated in Figure 12a on page 27.

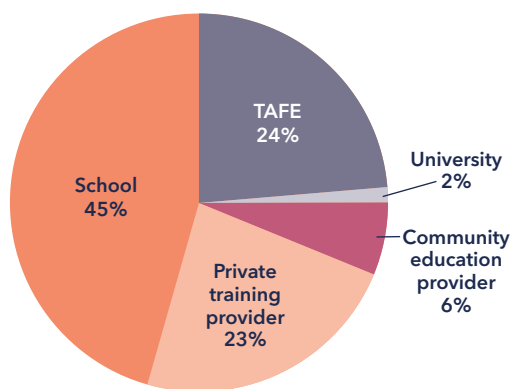


Figure 12a: Proportion of manufacturing and engineering Certificate I and II qualifications by Type of Training Provider for Queensland in 2016. Source: NCVER 2017.

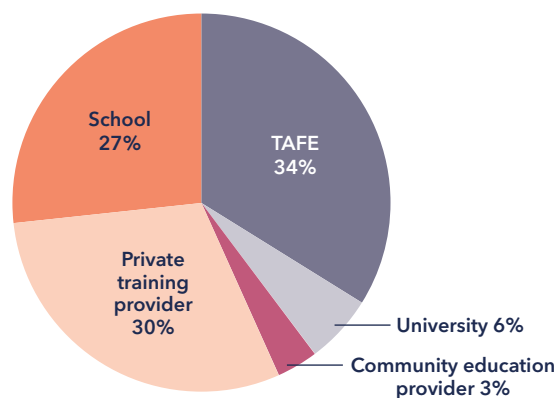


Figure 12b: Proportion of manufacturing and engineering Certificate I, II and III qualifications by Type of Training Provider for Queensland in 2016. Source: NCVER 2017.

Looking more broadly at Certificate level I, II and III level manufacturing and engineering qualifications, school share decreased to 27 per cent or 4931 of the total enrolments of 18,485 as illustrated in Figure 12b.*

Table 5, below and on page 28, details the manufacturing industry relevant Certificate I and II level qualifications delivered by schools and enrolments from 2014 to 2016 compared with other training organisations, including TAFE, university, community education providers, enterprise providers, and private training providers.

| Manufacturing sectors | Qualifications | Type of Training Organisations | | | | | | Comments |
|-------------------------------------|--|--------------------------------|------|------|--------------------|------|------|--|
| | | Schools (enrolments) | | | Other (enrolments) | | | |
| | | 2014 | 2015 | 2016 | 2014 | 2015 | 2016 | |
| Aeroskills | n/a | | | | | | | |
| Automotive manufacturing production | n/a | | | | | | | |
| Electrotechnology and electronics | n/a | | | | | | | |
| Engineering | MEM10105 - Certificate I in Engineering | 4609 | 3157 | 2123 | 1275 | 377 | 636 | Just over half of enrolments are in schools (51 per cent over three years) with most in Certificate level I however enrolments in Certificate level II have been increasing. |
| | MEM20105 - Certificate II in Engineering | 449 | 315 | 147 | 1688 | 675 | 835 | |
| | MEM20413 - Certificate II in Engineering Pathways | 207 | 868 | 1072 | 130 | 2471 | 4324 | |
| Food processing | FDF10111 - Certificate I in Food Processing | 42 | 43 | 64 | 0 | 2 | 2 | Small enrolments in schools. |
| | FDF20111 - Certificate II in Food Processing | 0 | 0 | 32 | 190 | 369 | 186 | |
| Foundation skills | FSK10113 - Certificate I in Access to Vocational Pathways | 455 | 711 | 771 | 389 | 342 | 469 | Just over half of enrolments in schools (51 per cent over three years). Other training organisations are more focused on Certificate II level. Significant increase in enrolments in 2016 across all training organisations. |
| | FSK10213 - Certificate I in Skills for Vocational Pathways | 358 | 516 | 629 | 62 | 392 | 820 | |
| | FSK20113 - Certificate II in Skills for Work and Vocational Pathways | 211 | 1577 | 5786 | 1032 | 2936 | 4208 | |
| Furnishing | MFS20313 - Certificate II in Furniture Making | 191 | 417 | 426 | 158 | 623 | 1203 | |

continued over the page...

* Certificate III is mostly delivered by TAFE and privately owned organisations, hence the decrease in school share between Figures 12a to 12b.

| Manufacturing sectors | Qualifications | Type of Training Organisations | | | | | | Comments |
|--------------------------------|--|--------------------------------|------|------|--------------------|------|------|--|
| | | Schools (enrolments) | | | Other (enrolments) | | | |
| | | 2014 | 2015 | 2016 | 2014 | 2015 | 2016 | |
| Information Technology | ICA20111 - Certificate II in Information, Digital Media and Technology | 6022 | 4853 | 821 | 940 | 922 | 146 | Most enrolments in schools (85 per cent over three years). In 2016 significant decline in other training organisation enrolments. |
| Laboratory operations | MSL20109 - Certificate II in Sampling and Measurement | 366 | 389 | 292 | 0 | 377 | 845 | Just over half of enrolments are with other training organisations (54 per cent over three years) with a significant increase in 2016. |
| | MSL20116 - Certificate II in Sampling and Measurement | 0 | 0 | 118 | 0 | 0 | 0 | |
| Manufacturing | MSA10107 - Certificate I in Manufacturing (Pathways) | 1190 | 1052 | 839 | 2 | 0 | 0 | Certificate level I is a school-based qualification and these enrolments decreased slightly in 2016. |
| | MSA20208 - Certificate II in Manufacturing Technology | 561 | 636 | 610 | 297 | 66 | 76 | |
| | MSM10216 - Certificate I in Manufacturing (Pathways) | - | - | 80 | - | - | 0 | For Certificate II most enrolments are in schools (67 per cent over three years). |
| | MSM20216 - Certificate II in Manufacturing Technology | - | - | 12 | - | - | 0 | |
| Manufacturing mineral products | n/a | | | | | | | |
| Meat processing | n/a | | | | | | | |
| Polymer product manufacturing | n/a | | | | | | | |
| Primary industries | n/a | | | | | | | |
| Sustainability | n/a | | | | | | | |
| Textile, clothing and footwear | LMT11107 - Certificate I in Textiles Clothing and Footwear | 64 | 23 | 24 | 15 | 0 | 0 | Most enrolments in schools (59 per cent over three years). |
| | LMT21707 - Certificate II in Applied Fashion Design and Technology | 120 | 107 | 77 | 105 | 57 | 114 | |
| Transport and logistics | n/a | | | | | | | |

Table 5: Certificate I and II level manufacturing industry relevant qualifications delivered by schools and enrolments from 2014 to 2016. Source: NCVET 2017 Total VET Activity.

12.2 Future skills needs

To take advantage of global opportunities, Queensland manufacturers surveyed identified that they most need to develop skills in quality control, creativity, complex problem solving, coordinating with others, critical thinking and negotiation.

To transition to advanced manufacturing, they identified the need for skills in international business development/marketing, data analytics, energy efficiency, critical thinking, lean/5S or other business process planning tools and sustainability.

The Queensland Chief Scientist concluded that the convergence of skills from widely varying disciplines is a continuing trend, as manufacturing becomes more reliant on the application and coordination of information, automation, computation, software, sensing, and networking, and/or making use of cutting edge materials and emerging capabilities enabled by the physical and biological sciences. A 'manufacturer' may now be classified as an entrepreneur, a 'brand manager' or an 'integrator' that does not actually own any physical capital.

The Queensland Productivity Commission found that new and emerging technologies place new demands on workers, changing the tasks and activities undertaken in manufacturing, and the associated skill sets required. Increasing automation creates risks for workers with low or obsolete skills, or those workers unable to readily acquire new skills. The capabilities that are more difficult to automate will become more important and highly valued.

The importance of the logistics supply chain was reinforced by many Queensland manufacturers. There is an opportunity to identify how to better position advanced manufacturing in the broader logistics chain and to examine the flow on effect a new product has on the whole supply chain.

Foundation skills

The manufacturing industry in Queensland needs to attract young people who have the necessary foundation skills and ability to apply STEM skills especially critical thinking, curiosity and problem solving. The relationship between the manufacturing industry and the education and training system is considered critical to achievements in advanced manufacturing. The importance of foundation skills in language, literacy and numeracy (at a minimum of ACFS level 3) and STEM being developed in schools is a common theme. There is widespread agreement that improved performance in STEM skills is critical to providing pathways to the development of further technical and commercial competencies which are essential for advanced manufacturing. Some work has already occurred with the mapping of foundation skills to individual units of competency in the MSM Manufacturing Training Package.

Culture change

The culture of manufacturing businesses will be a key factor in successfully implementing change. The shift to advanced manufacturing will require a highly skilled workforce capable of embracing change and innovation. While trade skills will remain highly important to the sector, trade roles will include higher skilled positions. Employers, existing employees and potential employees all need to understand how things are changing and be prepared to adapt to change. Continual upskilling, reskilling and cross skilling of existing workers with the ability to learn is the preferred approach of most employers to transition into new forms of manufacturing, overcome shortages, retain workers in the industry and improve business competitiveness.

Workforce development and succession planning

The ageing profile of the traditional manufacturing workforce will require employers to implement integrated strategies such as workforce development and succession planning, along with the need to identify the new skills required for an advanced manufacturing role. While the future skills and qualifications for an Industry 4.0 workforce are expected to have a strong STEM focus, the personal qualities of adaptability and openness to continuous improvement and life learning will be important in helping older workers transition. Workers aged 50 or older are likely to need targeted assistance to either transition to new jobs with more digital interface with machinery or to alternative jobs within the industry sector.

FINDING 6

Key future skills requirements in manufacturing include:

- managerial competence and capability, leadership and entrepreneurship
- improvisation and adaptive capacity
- high performance technical skills across the supply chain
- higher quality general labour inputs including foundational skills, language literacy and numeracy and the ability to apply STEM skills
- interpersonal skills such as organisation, communication and critical thinking
- broad-based multi skills in technology and digital capability.

Broader more generic vocational skills and higher order skills associated with exploiting change are considered more valuable than specialist skills that will become quickly redundant.

Industry 4.0 in Queensland

B&R Enclosures is a Queensland business operating across Australia and globally from its head office in Brisbane's south west producing residential, commercial, electronic and customised enclosures, data racks and cabinets, switchboards and hazardous area equipment, and is currently implementing Industry 4.0 across the business.

With the rapid advances in processes, B&R Enclosures has increasingly invested in developing a skilled workforce across many disciplines using VET and higher education pathways including technical trades, fabrication, mechanical, electrical and industrial engineering, mechatronics, sales and leadership to name a few.

B&R Enclosures employs 220 people (in Queensland) with more than 10 per cent of employees in the production team being apprentices and trainees. B&R Enclosures focuses on upskilling existing employees to ensure they continue to evolve and advance.

Apprenticeship training is customised and delivered on-site by the Registered Training Organisation. Training package flexibility is essential for B&R Enclosures to combine qualifications such as sheet metal manufacturing light with competencies from other training packages (e.g. fabrication and information technology), and on-site delivery enables the training to be more efficient and contextualised to the business's specialised production lines.

B&R Enclosures invests in building and giving employees the opportunity to learn on the job skills (e.g. project management, robotics, data analysis, continuous improvement and emerging technologies).

Core skills are vital for the business success including digital literacy/technology, negotiation and communication, change management and commercial acumen.

B&R Enclosures' experience is not one of labour shortage but rather skills shortages and specifically electrical designers which requires a pathway of: trade system electrical, broader industry experience installing switch boards, an electrical engineering degree for designing systems and componentry, and applied learning.

13. DEMAND FOR HIGHER LEVEL SKILLS AND FORMALISED PATHWAYS

Low skilled entry level jobs are diminishing as demand increases for people with high levels of language, literacy and numeracy and technological skills who are willing to commit to undertake ongoing learning and skills development.

NCVER has endorsed the importance of scientific and technical education and skill formation as intrinsic in the VET sector and not limited to schools and universities.

The traditional pathway of a Certificate III as a subsidised apprenticeship may not be sufficient to meet the future workforce needs. Presently the Department of Education and Training subsidises some industry related higher level qualifications (Certificate IV and above) including utilities-electrotechnology and water, engineering, laboratory operations, process plant technology, primary industries-forestry and aeroskills avionics, mechanical and structures.

Industry has expressed a need for access to part-time studies for technicians in areas such as electrotechnology, solutions systems engineering and working with structural steel.

The Industry 4.0 higher level apprenticeship project involving Siemens Ltd and related companies is achieving the benefits of apprenticeship skills through the delivery of a new Diploma and Associate Degree in Applied Technologies developed in collaboration with Swinburne University of Technology. This will directly articulate into a Bachelor Degree, producing a qualification that aims to meet the needs of industry with a focus on the adoption of high-level technology skills and the tools required for the future workforce.

QMI Solutions and Impact Innovation Group (IIG) deliver programs that offer educational pathways for manufacturers in Queensland and are valued by industry, especially SMEs. IIG's Innovate Queensland program helps SMEs grow their business by implementing practical innovation and technology commercialisation solutions. The free pathways program workshops focus on innovation, technology commercialisation, and innovation planning and R&D design.

QMI Solutions was the first to successfully introduce 3D printing to Australia and was a leader in the introduction of lean manufacturing, whole-of-industry benchmarking and design-led innovation. QMI Solutions has also established a research partnerships fund with the University of Queensland.

13.1 Higher education

Queensland universities offer their own self accredited undergraduate and post-graduate manufacturing relevant qualification programs for school leavers and some existing workers. Bridging programs can help people update their knowledge of specific subjects. Advanced engineering short courses of relevance to advancing manufacturing in Queensland include:

- food processing technology
- polymer engineering
- computer integrated manufacturing
- lean manufacturing.

Degree qualifications include:

- Bachelor of Business/Bachelor of Engineering (Honours)
- Bachelor of Engineering (Honours)/Bachelor of Information Technology
- Bachelor of Engineering (Honours)/Bachelor of Mathematics
- Bachelor of Engineering (Honours)/Bachelor of Science
- Bachelor of Engineering (Honours) (Computer and Software Systems)
- Bachelor of Engineering (Honours) (Electrical and Aerospace)
- Bachelor of Engineering (Honours) (Electrical)
- Bachelor of Civil and Architectural Engineering (from 2018)
- Bachelor of Design - Major in Product and 3D design
- Bachelor of Electronic Engineering
- Bachelor of Electronic and Energy Engineering
- Bachelor of Electronic and UAV Engineering (from 2018)
- Bachelor of Electrical Engineering
- Bachelor of Engineering (Honours)
- Bachelor of Engineering (Honours)/Bachelor of Industrial Design
- Bachelor of Engineering (Mechanical) (Honours)
- Bachelor of Engineering Technology in Electronic and Computer Engineering
- Bachelor of Environmental Engineering
- Bachelor of Mechanical Engineering
- Bachelor of Software Engineering.

There is no current shortage of mechanical engineers, however engineers with project management, high level of computer aided design (CAD), auto CAD, PLC and industry experience are highly desirable.

Manufacturing industry experience such as internships or work experience is important in enabling university students to transition from the university environment into the rapidly changing manufacturing industry and to gain the necessary sector-specific knowledge and skills.

Australian first advanced design and manufacturing institute planned

A planned Griffith University Advanced Design and Manufacturing (AdAM) Institute at Griffith University's Gold Coast Health and Knowledge precinct is believed to be the first of its kind in Australia.

It will be an industry focused facility to provide a nexus for innovative digitally enabled design, new material development and usage, prototype development and foster skills growth in 3D printing and advanced manufacturing.

The four key areas of focus for AdAM include additive manufacturing, advanced materials and nanotechnology, digitally enabled technologies (robotics, big data and analytics, imaging and data capture and spatial and biomedical informatics) and next generation electronics.

AdAM will work with a range of industries including health and medicine (medical devices, implants, biomedical and dental) marine and boat building, creative arts and film, automotive, construction and infrastructure, humanitarian logistics, sport technologies, aviation and aerospace.

FINDING 7

Future pathways to advance manufacturing in Queensland could include higher level apprenticeships based on the Industry 4.0 project and/or Certificate III embedded into subsidised Certificate IV and higher qualifications.

14. BARRIERS TO ATTRACTION AND RETENTION IN QUEENSLAND

Training package design, the job readiness of potential employees and the cost of higher level training are considered the key barriers to attraction and retention of workers in advancing manufacturing sectors in Queensland.

14.1 Training packages

Queensland manufacturers expressed concern about the design of training packages becoming too prescriptive and the ability of both training packages and training organisations to keep up-to-date with the rapid technological changes impacting the industry.

Manufacturing and Engineering Training Package components are currently being reviewed and transitioned to the 2012 Standards for Training Packages. Proposals to upgrade 18 qualifications and 457 units of competency in the Manufacturing and Engineering Training Package to meet 2012 standards were submitted to the State and Territory Training Authorities for endorsement on 10 August 2017 after three years of development. Proposals to upgrade all remaining training package components are due by 30 June 2018.

While progress has been made in incorporating foundation skills qualifications into manufacturing qualifications, current training packages are considered not flexible enough to incorporate extra new specialist digital technology and communication core skills which support manufacturers to transition culture and productivity in the workplace. There is also an opportunity to reverse map the higher level skills needs of industry across the supply chain to the training package competencies to better match training with industry needs while maintaining quality and standards.

14.2 Job readiness

Experience of the industry and job readiness skills are both considered essential for today's workforce. Concerns were expressed about the job readiness of potential employees and the lack of meaningful pre-employment courses in the VET system. Schools and industry are starting to introduce students to industry opportunities from Year 7. Job profiling tools such as the Harrison instrument are widely used across a range of industries. There are benefits in tailoring such tools to manufacturing jobs to help potential employees test their interest and aptitude for the industry and to make the right subject choices.

Certificate II level qualifications can offer introductory experiences, pre-apprenticeships and pathways to career opportunities in advancing manufacturing industry sectors. For example, in 2016 more than 12,000 people in Queensland undertook Certificate I or II in Foundation Skills and 5000 people undertook the Certificate II in Engineering Pathways which focuses on practical projects using engineering tools and equipment.

14.3 Cost and accessibility of higher level training

The cost of training to the individual, especially Certificate IV and Diploma level qualifications, is considered expensive for operator/leading hand employees who earn moderate wages in the manufacturing industry, for example:

- sheet metal worker – \$40,000 to \$74,000
- production worker – \$37,000 to \$60,000
- boilermaker – \$44,000 to \$93,000
- glazier – \$39,000 to \$71,000
- laboratory assistant – \$35,000
- food technologist – \$60,000 to \$64,000.

Table 6 (on page 33) provides a comparison of course costs for workers compared with their average weekly full-time earnings before tax for 2014 as provided by the Australian Government myskills website.

| Manufacturing related qualifications | Examples of fees for full-time courses | Average weekly full-time earnings before tax 2014 |
|--|---|--|
| Aeroskills | | |
| MEA40615 - Certificate IV in Aeroskills (Avionics) | \$5000 - 1 year course | Aircraft maintenance engineers \$1759 |
| MEA40715 - Certificate IV in Aeroskills (Mechanical) | \$4750 - 8 month course | |
| MEA41315 - Certificate IV in Aeroskills (Structures) | | |
| MEA41215 - Certificate IV in Aeroskills (Armament) | | |
| MEA41015 - Certificate IV in Aeroskills (Mechatronics) | | |
| MEA50115 - Diploma of Aeroskills (Avionics) | | |
| MEA50215 - Diploma of Aeroskills (Mechanical) | | |
| MEA50315 - Diploma of Aeroskills (Maintenance Management) | | |
| Business | | |
| BSB42515 - Certificate IV in Small Business Management | \$1290 - 12 month course \$4200 - 27 week course | Office manager \$1225 |
| BSB42615 - Certificate IV in New Small Business | \$2900 - 12 month course | |
| BSB51413 - Diploma of Project Management | \$5000 - 12 week course | |
| BSB51415 - Diploma of Project Management | \$10,000 - 52 week course | |
| Electrotechnology and electronics | | |
| UEE40910 - Certificate IV in Industrial Electronics and Control | | Electronics trades workers \$1200 |
| UEE40911 - Certificate IV in Industrial Electronics and Control | \$14,280 full fee, \$4960 subsidised - 28 week course | |
| UEE60411 - Advanced Diploma of Computer Systems Engineering | | |
| UEE61711 - Advanced Diploma of Engineering Technology - Electronics | | |
| Engineering | | |
| MEM40412 - Certificate IV in Engineering Drafting | \$6000 - 6 month course | Mechanical engineering draftspersons, technicians \$1713 |
| MEM50105 - Diploma of Engineering - Advanced Trade | \$9000 - 2 year course | |
| MEM50205 - Diploma of Engineering - Technical | | |
| MEM50211 - Diploma of Engineering - Technical | | |
| MEM50212 - Diploma of Engineering - Technical | | |
| MEM50311 - Diploma of Jewellery and Object Design | | |
| MEM60105 - Advanced Diploma of Engineering | \$11,000 - 2 year course | |
| MEM60111 - Advanced Diploma of Engineering | \$22,000 over a 49 cycle | |
| MEM60112 - Advanced Diploma of Engineering | \$27,000 - 1 year course (university provider) | |
| MEM60211 - Advanced Diploma of Jewellery and Object Design | | |
| Food processing | | |
| FDF40311 - Certificate IV in Food Science and Technology | | Production managers \$1390 |
| FDF50110 - Diploma of Food Processing | | |
| FDF50311 - Diploma of Food Science and Technology | \$8330 full fee, \$6029 subsidised - 1 year course | |
| FDF41012 - Certificate IV in Flour Milling | | |
| Information technology | | |
| ICA40111 - Certificate IV in Information Technology | | ICT support technicians \$1263 |
| ICA50111 - Diploma of Information Technology | \$3270 (upfront), \$3850 (payment plan) | |
| ICT40115 - Certificate IV in Information Technology | | |
| ICT40815 - Certificate IV in Digital Media Technologies | | |
| ICT50115 - Diploma of Information Technology | | |
| ICT60415 - Advanced Diploma of Information Technology Project Management | \$13,280 full fee, \$10,000 subsidised - 1 year course | |

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| Manufacturing related qualifications | Examples of fees for full-time courses | Average weekly full-time earnings before tax 2014 |
|---|--|---|
| Laboratory operations | | |
| MSL40109 - Certificate IV in Laboratory Techniques | \$5270 full fee - 1 year course | |
| MSL40116 - Certificate IV in Laboratory Techniques | | |
| MSL50109 - Diploma of Laboratory Technology | | |
| MSL50116 - Diploma of Laboratory Technology | \$9974 average fee myskills | |
| MSL60109 - Advanced Diploma of Laboratory Operations | | |
| MSL60116 - Advanced Diploma of Laboratory Operations | \$16,680 full fee - 1 year course/average fee myskills | |
| PML50104 - Diploma of Laboratory Technology | \$9974 | |
| Manufacturing | | |
| MSA40108 - Certificate IV in Manufacturing Technology | \$4000 average fee myskills | |
| MSA40311 - Certificate IV in Process Manufacturing | | |
| MSA41108 - Certificate IV in Competitive Manufacturing | | |
| MSA50108 - Diploma of Manufacturing Technology | | |
| MSA50311 - Diploma of Production Management | \$7300 - duration not specified | Management and organisation analysts \$1652 |
| MSA51108 - Diploma of Competitive Manufacturing | | |
| MSA61108 - Advanced Diploma of Competitive Manufacturing | | |
| MSA71109 - Vocational Graduate Certificate in Competitive Manufacturing | | |
| MSM40116 - Certificate IV in Process Manufacturing | | |
| MSM41015 - Certificate IV in Recreational Vehicles | \$4000 average fee myskills | Other factory process workers \$938 |
| MSM40116 - Certificate IV in Process Manufacturing | | |
| Manufactured mineral products | | |
| PMC40116 - Certificate IV in Manufacturing Mineral Products | Unable to identify | Other building and engineering technicians \$1773 |
| Meat processing | | |
| AMP40215 - Certificate IV in Meat Processing (General) | | |
| AMP40415 - Certificate IV in Meat Processing (Quality Assurance) | | |
| AMP40516 - Certificate IV in Meat Processing (Meat Safety) | Unable to identify | Primary products inspectors \$1318 |
| AMP50215 - Diploma of Meat Processing | | |
| Polymer product and rubber product manufacturing | | |
| PMB40107 - Certificate IV in Polymer Technology | | |
| PMB50107 - Diploma of Polymer Technology | Unable to identify | Other technicians and trades workers \$1170 |
| PMB60107 - Advance Diploma of Polymer Technology | | |
| Primary industry | | |
| FPI40211 - Certificate IV in Timber Processing | | |
| FPI40411 - Certificate IV in Timber Truss and Frame Design | | |
| FPI40310 - Certificate IV in Timber Truss and Frame Manufacture | | |
| FPI40311 - Certificate IV in Timber Truss and Frame Manufacture | | |
| FPI40410 - Certificate IV in Timber Truss and Frame Design | | |
| FWP40216 - Certificate IV in Timber Processing | Unable to identify | Paper and wood processing machine operators \$800 |
| FWP40416 - Certificate IV in Timber Truss and Frame Design | | Carpenters and joiners \$1120 |
| FPP40110 - Certificate IV in Pulping Operations | | |
| FPP40116 - Certificate IV in Pulping Operations | | |
| PPM40116 - Certificate IV in Pulping Operations | | |

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| Manufacturing related qualifications | Examples of fees for full-time courses | Average weekly full-time earnings before tax 2014 |
|--|--|---|
| Textile, clothing and footwear | | |
| LMT40107 - Certificate IV in Textile Technology and Production | | Sales representative \$1197 Clothing trades workers \$687 |
| LMT40307 - Certificate IV in Clothing Production | \$9500 full fee, \$2470 subsidised - 1 year course | |
| LMT40407 - Certificate IV in Custom-made Footwear | | |
| LMT41007 - Certificate IV in Applied Fashion Design and Technology | | |
| LMT41107 - Certificate IV in Textile Design and Development | | |
| LMT41207 - Certificate IV in Fashion and Textiles Merchandising | \$10,000 full fee, subsidised | |
| LMT50307 - Diploma of Applied Fashion Design and Technology | \$5000 - 1 year course | |
| LMT50507 - Diploma of Textile Design and Development | | |
| LMT60307 - Advanced Diploma of Applied Fashion Design and Technology | | |
| LMT60407 - Advanced Diploma of Textile Design and Development | | |
| MST40316 - Certificate IV in Custom-Made Footwear | | |
| MST40416 - Certificate IV in Millinery | | |
| Transport and logistics | | |
| TLI41810 - Certificate IV in Warehousing Operations | \$5040 full fee, \$3507 subsidised, \$3178 concession - 6 month course | Purchasing and supply logistics clerk \$1200 Transport and despatch clerk \$1100 |
| TLI41816 - Certificate IV in Warehousing Operations | | |
| TLI42010 - Certificate IV in Logistics | | |
| TLI42016 - Certificate IV in Logistics | | |
| TLI50310 - Diploma of International Freight Forwarding | | |
| TLI50316 - Diploma of International Freight Forwarding | | |

Table 6: Cost of Certificate IV and Diploma level qualifications. Source: <https://myskills.gov.au/>.

FINDING 8

While training packages have provision for industry competency based training, there is a need to allow manufacturers and training providers to tailor training by packaging up a combination of a trade qualification with extra competencies for sector specific occupations to meet Industry 4.0 workforce needs.

FINDING 9

Certificate II level pre-apprenticeship training is a valuable introduction to jobs in industry, especially when combined with Certificate II level foundation skills.

15. USE OF THE APPRENTICESHIP AND TRAINEESHIP SYSTEM

In 2016, 16,226 people commenced apprenticeships and 20,564 commenced traineeships in Queensland. Of these, 2806 or less than one per cent were in manufacturing. Compared with other industries in Queensland manufacturing was ranked fifth behind construction, accommodation and food services, administrative and support services and other services as illustrated in Figure 13 below.

Over the period from 2014 to 2016, the annual intake of apprenticeships and traineeships in manufacturing

declined from 4530 to 2806. Traineeship commencements more than halved as illustrated in Figure 14 on page 37. This was consistent with a large decline in traineeship numbers across all industries following a reduction in eligibility for incentives paid to employers in 2012.

Analysis of the decline in apprenticeships and traineeships over this time in relation to manufacturing occupations (ie ANZCO classification) is at Appendix 3. For traineeships there was a significant decline in commencements for meat, poultry and seafood process workers (664) and for meat boners and slicers and slaughterers (63).

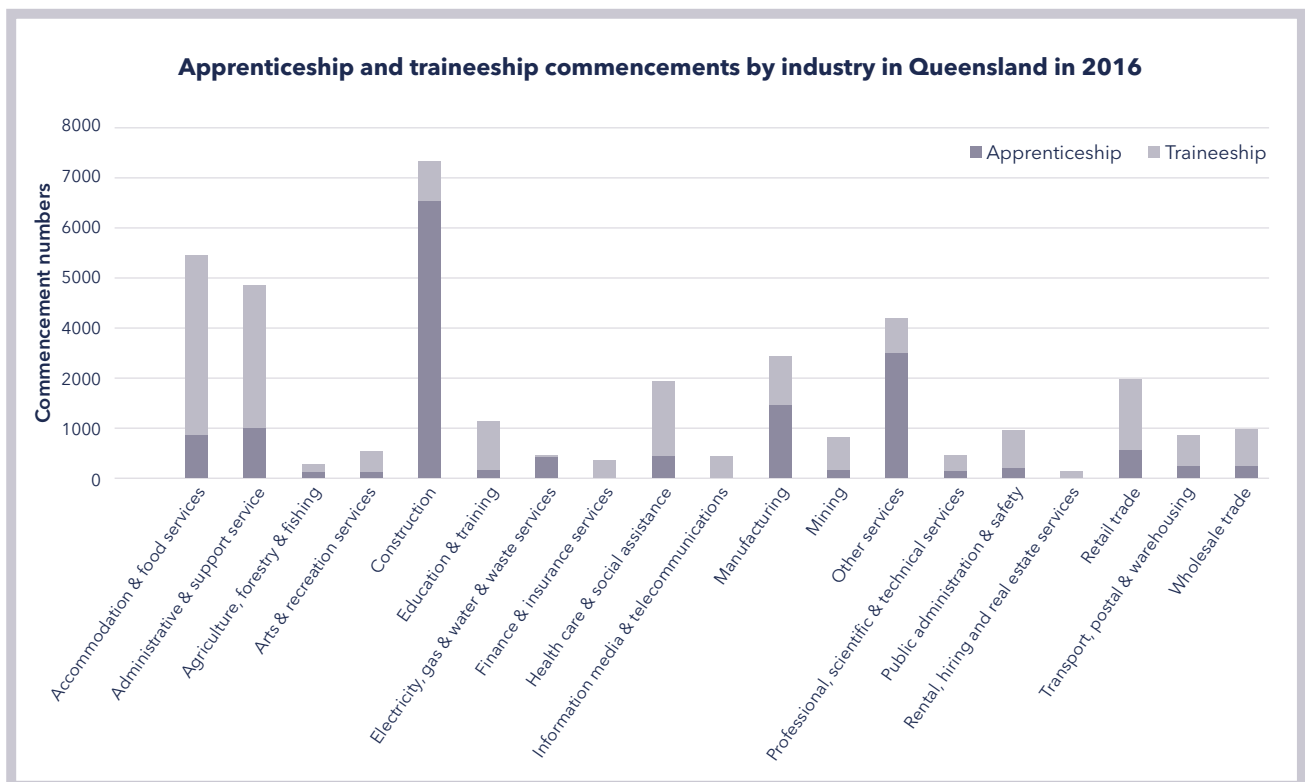


Figure 13: Apprenticeship and traineeship commencements by industry in Queensland in 2016. Source: DELTA.

There were slight declines in apprenticeship commencements for mechanical engineering draftspersons and technicians (69), structural steel and welding workers (53), glaziers (49) and printers (37). Completion rates are difficult to calculate given the competency based nature, the different times taken to complete qualifications and the lag in reporting.

Manufacturing ranks sixth in Queensland industry in terms of intake of apprentices and trainees as a proportion of the industry's workforce. The number of apprenticeship commencements for manufacturing in 2016 was 1.75 per 100 workers, almost half that of the construction industry, as illustrated in Figure 15 on page 37.

Although apprentices and trainees comprise a very low proportion of the manufacturing workforce, almost 25 per cent of Queensland manufacturers

surveyed reported they have accessed the apprenticeship and traineeship system to meet their skilling needs and more than 65 per cent of them believe apprentices and trainees will play a significant or critical role in transitioning the industry, however new skills are needed for the future.

Queensland's Gateway to Industry Schools Program (GISP) and school based apprenticeships and traineeships (SATs) are well regarded, however there are some concerns about industry's ability to provide apprenticeships for students when they complete school. A total of 44 Queensland secondary schools participate in the Manufacturing and Engineering GISP, engaging collaboratively with local manufacturing and engineering enterprises, training providers and universities to raise the profile of careers in manufacturing and engineering, provide professional development for teachers

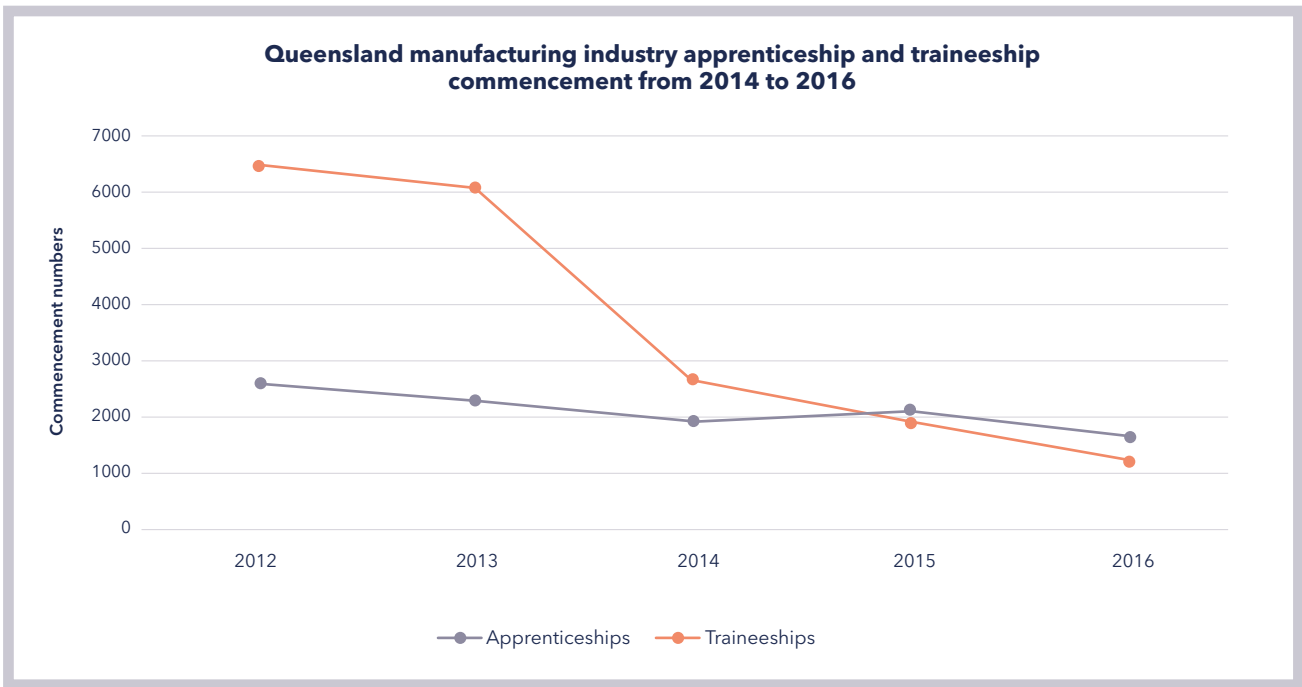


Figure 14: Queensland manufacturing industry apprenticeship and traineeship commencement from 2014 to 2016. Source: DELTA.



Figure 15: Queensland apprenticeship intake by industry in 2016 Source: NCVER, ABS, CSQ. Used with permission from CSQ.

in the context of manufacturing and engineering, develop and implement a range of manufacturing and engineering related activities across industrial technology and design, science, mathematics, English and other key learning curriculum areas and

create opportunities for work experience, structured work placements, SATs, full-time apprenticeships and pathways to university in preparation for trade, para-professional and professional careers.

Gateway Days

The Gateway to Industry Schools Program partner with industry champions to immerse teachers and students in industry to experience how STEM applies in real world engineering and manufacturing settings.

A typical Gateway Day would include visits to world leading businesses such as Euclidean (algorithms and manufacturing holographic 3x3 rooms and gaming software developer), Ferra Engineering (defence engineering and manufacturing specialising in aerospace structures and subsystems) and Watkins Steel (specialists in 3D scanning, metalwork and structural steel fabrication). Teachers and students see first hand how technology is being applied and changing businesses, and learn about the skills needed now and in the future.

Gateway Days also provide teachers with professional development that can contribute to the professional learning requirements of the Queensland College of Teachers.

Employers consider there is a future need and significant opportunity to increase the number of adult apprentices including those who have partially completed apprenticeships, trade assistants who wish to upskill, former defence personnel and Australian residents with overseas qualifications, especially when new types of apprenticeships are declared.

FINDING 10

Apprentices and trainees comprise a very low proportion of the Queensland manufacturing workforce with commencements decreasing by more than 1000 in 2016, 700 of which were trainees.

16. CONCLUSION

The findings of this environmental scan combined with Sagacity Consulting's mapping of qualifications considered relevant to advancing Queensland's manufacturing industry, profiles of the state and regional workforce and current training enrolments are intended to inform the development of the Advanced Manufacturing Skills, Training and Workforce Strategy to identify the new skills required in advanced manufacturing.

The overarching conclusion is that future training purchasing policy and decisions should focus on the qualifications identified as relevant to advancing manufacturing in Queensland (see Appendix 1).

In addition to Certificate III entry level qualifications purchasing policy could consider funding more higher level qualifications (Certificate IV and above) for a broader range of manufacturing sectors, subject to the importance of the sector to each regional economy in Queensland.

Purchasing policy could also consider funding skill sets from across training packages that have been identified by each industry sector as critical to advancing manufacturing and increasing growth and productivity.

It is important that purchasing policy as applied to the manufacturing industry, is not limited to one particular training package but open to including qualifications and skills that have been mapped by industry to the job.

Government investment would then help to stimulate the uptake of management and leadership skills and development for people in businesses that are transitioning to advanced manufacturing.

17. SUPPLEMENTARY OBSERVATIONS

Based on the research collected from this environmental scan Sagacity gained further observations that may be relevant to the scope of the Advanced Manufacturing Skills, Training and Workforce Strategy in regard to:

- exploring alternative training approaches for workers to improve their workplace readiness
- examining options to increase industry's mentoring role including using the knowledge and experience of senior and retired business people
- incorporating a stronger focus on training and education in design for application in additive manufacturing and other processes and explore methods for integrating design graduates into the workforce
- reviewing workforce planning and development issues and opportunities and develop workforce succession planning modules.

17.1 Alternative training approaches to improve work readiness

Pre-employment programs and work placements need to be mutually beneficial for potential workers and employers, providing the worker with a 'taste' of the job and the employer an opportunity to test the worker's suitability for the role. A combination of Certificate II level pre-apprenticeship training with Certificate II level foundation skills provides a valuable introduction to jobs in industry.

Role of schools in training provision

Training data show the significant enrolment share of Certificate I and II manufacturing and engineering qualifications delivered by schools as training organisations. Further analysis is required to ensure industry and student outcomes are maximised from this investment.

Application of STEM skills

Industry is seeking workers who can apply STEM skills in the workplace and adapt to emerging technology, indicating an opportunity to reassess the STEM school curriculum to ensure there is a strong practical element to teaching. It will also be important to upskill teachers in the use of new technology, software and the impact of new and emerging business models. Examples of applied STEM skills include design fundamentals, CAD/building information modelling (BIM) management and testing, rapid prototyping and project managing and 3D solid modelling using a variety of software packages. The success of this type of approach relies on coordination and collaboration between schools, training organisations, universities and employers.

Design skills

Gateway school hubs may help broaden entry-level qualifications to include Certificate II and III in digital media and design, providing students with valuable industry experience and responding to industry's demand for design skills. Government may also consider sponsoring the development of design fundamentals qualifications and supporting training by an approved prequalified supplier in Queensland. Summer and winter schools in manufacturing industry relevant design could also be offered to attract enrolments. New incentives for manufacturing specific SATS in technology and design with post school technical support may help attract people with design and technological skills into the industry.

17.2 Mentoring

Integrated mentoring training

Workers at all levels in businesses that are transitioning to advanced manufacturing will need access to mentoring services. At the management level business mentoring will be important to support changes needed to operate in local, national and global business ecosystems and across supply chains. For existing workers, mentoring could help drive a culture change of continuous learning and help

explore upskilling or reskilling opportunities. For new entrants, mentoring is regarded as fundamental to successful training outcomes. Formalising the role and expectations of mentoring in training (like universities' approach to doctorates) may be advantageous as Queensland businesses transition to advanced manufacturing.

Mentoring for Growth program

The Mentoring for Growth program offered by the Department of Tourism, Major Events and Small Business provides opportunities for Queensland small businesses who are transitioning to advanced manufacturing through its ability to harness the expertise of experienced business professionals to provide voluntary mentoring services.

17.3 Integrating design graduates into the workforce

Enabling manufacturers and training providers to tailor training by packaging up a combination of a trade qualification with extra competencies for sector specific occupations to meet Industry 4.0 workforce needs will help attract and integrate design students into the workforce. Further, higher level Industry 4.0 apprenticeships may offer attractive career pathways for design graduates.

17.4 Workforce planning and development issues and opportunities

Upskilling and reskilling

Older workers and existing workers need skill sets in digital media, design and CAD combined with options to participate in other value adding competencies. Incentives for manufacturing centric project management diplomas such as planning and scheduling may assist career changers and older workers, especially those from engineering trades, technician or machine operator backgrounds. Incentives may also be useful in the short to medium-term in improving supply chain management skill sets, as well as ICT, logistics skill sets and quality systems management including through the supply chain.

R&D

Industry and entities like universities acknowledge the need to collaborate to undertake the R&D necessary to innovate and advance the manufacturing industry in Queensland. This produces a range of opportunities for industry and academia to interchange staff, skills and knowledge to develop sector specific workforce skills, and for students to apply their learning by undertaking industry work placements. Increasingly the VET sector is exploring processes to better engage with employers to undertake applied research projects that value-add to both organisations and support industry innovation (e.g. TAFE Queensland's Red Space).

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APPENDIX 1: MANUFACTURING INDUSTRY RELEVANT QUALIFICATIONS

For completeness all qualifications have been mapped in terms of industry requirements and the training being offered, including those training packages/qualifications that are in transition.

Aeroskills

- MEA40615** - Certificate IV in Aeroskills (Avionics)
- MEA40715** - Certificate IV in Aeroskills (Mechanical)
- MEA41315** - Certificate IV in Aeroskills (Structures)
- MEA41215** - Certificate IV in Aeroskills (Armament)
- MEA41015** - Certificate IV in Aeroskills (Mechatronics)
- MEA41115** - Certificate IV in Aircraft Life Support and Furnishing
- MEA40915** - Certificate IV in Aircraft Surface Finishing
- MEA50115** - Diploma of Aeroskills (Avionics)
- MEA50215** - Diploma of Aeroskills (Mechanical)
- MEA50315** - Diploma of Aeroskills (Maintenance Management)
- MEA60415** - Advanced Diploma of Aeronautical Engineering
- MEA60315** - Advanced Diploma of Aviation Non-Destructive Testing
- MEA60515** - Advanced Diploma of Avionic Engineering

Automotive manufacturing production

- AUM20112** - Certificate II in Automotive Manufacturing Production - Passenger Motor Vehicle
- AUM20212** - Certificate II in Automotive Manufacturing Production - Bus, Truck and Trailer
- AUM20113** - Certificate II in Automotive Manufacturing Production - Passenger Motor Vehicle
- AUM20213** - Certificate II in Automotive Manufacturing Production - Bus, Truck and Trailer
- AUM30112** - Certificate III in Automotive Manufacturing Technical Operations - Passenger Motor Vehicle
- AUM30212** - Certificate III in Automotive Manufacturing Technical Operations - Bus, Truck and Trailer
- AUM30213** - Certificate III in Automotive Manufacturing Technical Operations - Bus, Truck and Trailer
- AUM35108** - Certificate III in Automotive Manufacturing (Bus/Truck/Trailer)

Business

- BSB42515** - Certificate IV in Small Business Management
- BSB42615** - Certificate IV in New Small Business
- BSB51413** - Diploma of Project Management
- BSB51415** - Diploma of Project Management

Sustainability

- MSS20312** - Certificate II in Competitive Systems and Practices
- MSS20316** - Certificate II in Competitive Systems and Practices
- MSS30312** - Certificate III in Competitive Systems and Practices
- MSS30316** - Certificate III in Competitive Systems and Practices
- MSS40211** - Certificate IV in Environmental Monitoring and Technology
- MSS40312** - Certificate IV in Competitive Systems and Practices
- MSS40316** - Certificate IV in Competitive Systems and Practices
- MSS50112** - Diploma of Sustainable Operations
- MSS50211** - Diploma of Environmental Monitoring and Technology
- MSS50312** - Diploma of Competitive Systems and Practices
- MSS50316** - Diploma of Competitive Systems and Practices
- MSS60312** - Advanced Diploma of Competitive Systems and Practices
- MSS60316** - Advanced Diploma of Competitive Systems and Practices
- MSS70211** - Graduate Certificate in Environmental Monitoring and Technology
- MSS70312** - Graduate Certificate in Competitive Systems and Practices

Electrotechnology and electronics

- UEE30811** - Certificate III in Electrotechnology Electrician
- UEE30911** - Certificate III in Electronics and Communications
- UEE31211** - Certificate III in Instrumentation and Control

UEE33011 - Certificate III in Electrical Fitting
UEE40910 - Certificate IV in Industrial Electronics and Control
UEE40911 - Certificate IV in Industrial Electronics and Control
UEE60411 - Advanced Diploma of Computer Systems Engineering
UEE61711 - Advanced Diploma of Engineering Technology -Electronics

Engineering

MEM10105 - Certificate I in Engineering
MEM20105 - Certificate II in Engineering
MEM20205 - Certificate II in Engineering - Production Technology
MEM20413 - Certificate II in Engineering Pathways
MEM30105 - Certificate III in Engineering - Production Systems
MEM30205 - Certificate III in Engineering - Mechanical Trade
MEM30298 - Certificate III in Engineering - Mechanical Trade
MEM30305 - Certificate III in Engineering - Fabrication Trade
MEM30405 - Certificate III in Engineering - Electrical/Electronic Trade
MEM30505 - Certificate III in Engineering - Technical
MEM30605 - Certificate III in Jewellery Manufacture
MEM30705 - Certificate III in Marine Craft Construction
MEM30805 - Certificate III in Locksmithing
MEM31010 - Certificate III in Watch and Clock Service and Repair
MEM31112 - Certificate III in Engineering - Composites Trade
MEM31215 - Certificate III in Engineering - Industrial Electrician
MEM40105 - Certificate IV in Engineering
MEM40311 - Certificate IV in Advanced Jewellery Manufacture
MEM40412 - Certificate IV in Engineering Drafting
MEM50105 - Diploma of Engineering - Advanced Trade
MEM50205 - Diploma of Engineering - Technical
MEM50211 - Diploma of Engineering - Technical

MEM50212 - Diploma of Engineering - Technical
MEM50311 - Diploma of Jewellery and Object Design
MEM60105 - Advanced Diploma of Engineering
MEM60111 - Advanced Diploma of Engineering
MEM60112 - Advanced Diploma of Engineering
MEM60211 - Advanced Diploma of Jewellery and Object Design
MEM80112 - Graduate Diploma of Engineering

Food processing

FDf10110 - Certificate I in Food Processing
FDf10111 - Certificate I in Food Processing
FDf20110 - Certificate II in Food Processing
FDf20111 - Certificate II in Food Processing
FDf20403 - Certificate II in Food Processing (Wine)
FDf20411 - Certificate II in Wine Industry Operations
FDf30110 - Certificate III in Food Processing
FDf30111 - Certificate III in Food Processing
FDf30210 - Certificate III in Pharmaceutical Manufacturing
FDf31012 - Certificate III in Sugar Milling Industry Operations
FDf40311 - Certificate IV in Food Science and Technology
FDf50110 - Diploma of Food Processing
FDf50311 - Diploma of Food Science and Technology
FDf41012 - Certificate IV in Flour Milling

Foundation skills

FSK10113 - Certificate I in Access to Vocational Pathways
FSK10213 - Certificate I in Skills for Vocational Pathways
FSK20113 - Certificate II in Skills for Work and Vocational Pathways

Information technology

- ICA20111** - Certificate II in Information, Digital Media and Technology
- ICA30111** - Certificate III in Information, Digital Media and Technology
- ICA40111** - Certificate IV in Information Technology
- ICA50111** - Diploma of Information Technology
- ICT40115** - Certificate IV in Information Technology
- ICT40815** - Certificate IV in Digital Media Technologies
- ICT50115** - Diploma of Information Technology
- ICT60415** - Advanced Diploma of Information Technology Project Management

Laboratory operations

- MSL20109** - Certificate II in Sampling and Measurement
- MSL20116** - Certificate II in Sampling and Measurement
- MSL30109** - Certificate III in Laboratory Skills
- MSL30116** - Certificate III in Laboratory Skills
- MSL40109** - Certificate IV in Laboratory Techniques
- MSL40116** - Certificate IV in Laboratory Techniques
- MSL50109** - Diploma of Laboratory Technology
- MSL50116** - Diploma of Laboratory Technology
- MSL60109** - Advanced Diploma of Laboratory Operations
- MSL60116** - Advanced Diploma of Laboratory Operations
- PML50104** - Diploma of Laboratory Technology

Manufacturing

- MSA10107** - Certificate I in Manufacturing (Pathways)
- MSA10207** - Certificate I in Process Manufacturing
- MSA20107** - Certificate II in Process Manufacturing
- MSA20208** - Certificate II in Manufacturing Technology
- MSA20610** - Certificate II in Recreational Vehicle Manufacture
- MSA30107** - Certificate III in Process Manufacturing
- MSA30208** - Certificate III in Manufacturing Technology
- MSA30309** - Certificate III in Surface Preparation and Coating Application
- MSA30510** - Certificate III in Recreational Vehicle Service and Repair

- MSA30610** - Certificate III in Recreational Vehicle Manufacture
- MSA31108** - Certificate III in Competitive Manufacturing
- MSA40108** - Certificate IV in Manufacturing Technology
- MSA40311** - Certificate IV in Process Manufacturing
- MSA41108** - Certificate IV in Competitive Manufacturing
- MSA50108** - Diploma of Manufacturing Technology
- MSA50311** - Diploma of Production Management
- MSA51108** - Diploma of Competitive Manufacturing
- MSA60108** - Advanced Diploma of Manufacturing Technology
- MSA61108** - Advanced Diploma of Competitive Manufacturing
- MSA71109** - Vocational Graduate Certificate in Competitive Manufacturing
- MSM21115** - Certificate II in Recreational Vehicle Manufacturing
- MSM30216** - Certificate III in Surface Preparation and Coating Application
- MSM41015** - Certificate IV in Recreational Vehicles
- MSM10216** - Certificate I in Manufacturing (Pathways)
- MSM20216** - Certificate II in Manufacturing Technology
- MSM30116** - Certificate III in Process Manufacturing
- MSM31015** - Certificate III in Recreational Vehicle Service and Repair
- MSM31115** - Certificate III in Recreational Vehicle Manufacturing
- MSM40116** - Certificate IV in Process Manufacturing
- MSM50316** - Diploma of Production Management
- MSM51015** - Diploma of Recreational Vehicles

Manufactured mineral products

- PMC40116** - Certificate IV in Manufacturing Mineral Products

Meat processing

- AMP20316** - Certificate II in Meat Processing (Abattoirs)
- AMP20415** - Certificate II in Meat Processing (Meat Retailing)
- AMP30116** - Certificate III in Meat Processing (Boning Room)

AMP30216 - Certification III in Meat Processing (Food Services)

AMP30316 - Certificate III in Meat Processing (Meat Safety)

AMP30516 - Certificate III in Meat Processing (Slaughtering)

AMP30616 - Certificate III in Meat Processing (General)

AMP30815 - Certificate III in Meat Processing (Retail Butcher)

AMP40215 - Certificate IV in Meat Processing (General)

AMP40415 - Certificate IV in Meat Processing (Quality Assurance)

AMP40516 - Certificate IV in Meat Processing (Meat Safety)

AMP50215 - Diploma of Meat Processing

MTM30611 - Certificate III in Meat Processing (General)

MTM30807 - Certificate III in Meat Processing (Meat Retailing)

MTM30811 - Certificate III in Meat Processing (Retail Butcher)

MTM30813 - Certificate III in Meat Processing (Retail Butcher)

MTM30911 - Certificate III in Meat Processing (Smallgoods)

MTM40211 - Certificate IV in Meat Processing (Meat Safety)

MTM40411 - Certificate IV in Meat Processing (General)

Polymer product and rubber product manufacturing

PMB20107 - Certification II in Polymer Processing

PMB20116 - Certificate II in Polymer Processing

PMB30107 - Certification III in Polymer Processing

PMB30116 - Certification III in Polymer Processing

PMB40107 - Certificate IV in Polymer Technology

PMB40116 - Certificate IV in Polymer Technology

PMB50107 - Diploma of Polymer Technology

PMB50116 - Diploma in Polymer Technology

PMB60107 - Advanced Diploma of Polymer Technology

PMB60116 - Advanced Diploma of Polymer Technology

Primary industry

FPI20311 - Certificate II in Sawmilling and Processing

FPI20511 - Certificate II in Timber Manufactured Products

FPI30211 - Certificate III in Harvesting and Haulage

FPI30213 - Certificate III in Harvesting and Haulage

FPI30111 - Certificate III in Forest Growing and Management

FPI30113 - Certificate III in Forest Growing and Management

FPI30311 - Certificate III in Sawmilling and Processing

FPI30511 - Certificate III in Timber Manufactured Products

FPI30711 - Certificate III in Sawdoctoring

FPI30911 - Certificate III in Timber Truss and Frame Design and Manufacture

FPI40211 - Certificate IV in Timber Processing

FPI40411 - Certificate IV in Timber Truss and Frame Design

FPI40310 - Certificate IV in Timber Truss and Frame Manufacture

FPI40311 - Certificate IV in Timber Truss and Frame Manufacture

FPI40410 - Certificate IV in Timber Truss and Frame Design

FWP20216 - Certificate II in Harvesting and Haulage

FWP30116 - Certificate III in Forest Growing and Management

FWP30216 - Certificate III in Harvesting and Haulage

FWP30316 - Certificate III in Sawmilling and Processing

FWP30816 - Certificate III in Woodmachining

FWP30916 - Certificate III in Timber Truss and Frame Design and Manufacture

FWP40216 - Certificate IV in Timber Processing

FWP40416 - Certificate IV in Timber Truss and Frame Design

FPP40110 - Certificate IV in Pulping Operations

FPP40116 - Certificate IV in Pulping Operations

PPM40116 - Certificate IV in Pulping Operations

Sustainability

- MSS20312** - Certificate II in Competitive Systems and Practices
- MSS20316** - Certificate II in Competitive Systems and Practices
- MSS30312** - Certificate III in Competitive Systems and Practices
- MSS30316** - Certificate III in Competitive Systems and Practices
- MSS40211** - Certificate IV in Environmental Monitoring and Technology
- MSS40312** - Certificate IV in Competitive Systems and Practices
- MSS40316** - Certificate IV in Competitive Systems and Practices
- MSS50112** - Diploma of Sustainable Operations
- MSS50211** - Diploma of Environmental Monitoring and Technology
- MSS50312** - Diploma of Competitive Systems and Practices
- MSS50316** - Diploma of Competitive Systems and Practices
- MSS60312** - Advanced Diploma of Competitive Systems and Practices
- MSS60316** - Advanced Diploma of Competitive Systems and Practices
- MSS70211** - Graduate Certificate in Environmental Monitoring and Technology
- MSS70312** - Graduate Certificate in Competitive Systems and Practices

Textile, clothing and footwear

- LMT21207** - Certificate II in Leather Production
- LMT30907** - Certificate III in Leather Production
- LMT32011** - Certificate III in Digitising and Computerised Embroidery
- LMT31909** - Certificate III in Engineering - TCF Mechanic
- LMT40107** - Certificate IV in Textile Technology and Production
- LMT40307** - Certificate IV in Clothing Production
- LMT11107** - Certificate I in Textiles Clothing and Footwear
- LMT20107** - Certificate II in Textile Production (Intermediate)
- LMT20507** - Certificate II in Textile Fabrication
- LMT20607** - Certificate II in Clothing Production (Intermediate)

- LMT20707** - Certificate II in Clothing Production (Complex or Multiple Processes)
- LMT21706** - Certificate II in Applied Fashion Design and Technology
- LMT21707** - Certificate II in Applied Fashion Design and Technology
- LMT30507** - Certificate III in Clothing Production
- LMT30707** - Certificate III in Footwear Production
- LMT31407** - Certificate III in Applied Fashion Design and Technology
- LMT40407** - Certificate IV in Custom-made Footwear
- LMT41007** - Certificate IV in Applied Fashion Design and Technology
- LMT41107** - Certificate IV in Textile Design and Development
- LMT41207** - Certificate IV in Fashion and Textiles Merchandising
- LMT50307** - Diploma of Applied Fashion Design and Technology
- LMT50507** - Diploma of Textile Design and Development
- LMT60307** - Advanced Diploma of Applied Fashion Design and Technology
- LMT60407** - Advanced Diploma of Textile Design and Development
- MST40316** - Certificate IV in Custom-Made Footwear
- MST40416** - Certificate IV in Millinery
- MST50116** - Diploma of Applied Fashion Design and Merchandising

Transport and logistics

- TLI31107** - Certificate III in Transport and Logistics (Logistics Operations)
- TLI41810** - Certificate IV in Warehousing Operations
- TLI41816** - Certificate IV in Warehousing Operations
- TLI42010** - Certificate IV in Logistics
- TLI42016** - Certificate IV in Logistics
- TLI50310** - Diploma of International Freight Forwarding
- TLI50316** - Diploma of International Freight Forwarding

LESS USED QUALIFICATIONS

Automotive retail, service and repair

AUR40612 - Certificate IV in Automotive Electrical Technology

AUR40616 - Certificate IV in Automotive Electrical Technology

Chemical, hydrocarbons and refining

PMA40116 - Certificate IV in Process Plant Technology

Electricity supply - generation

UEP40112 - Certificate IV in ESI Generation - System Operations

UEP40212 - Certificate IV in ESI Generation - Operations

UEP40312 - Certificate IV in ESI Generation - Maintenance (Mechanical)

UEP40412 - Certificate IV in ESI Generation - Maintenance (Fabrication)

UEP40512 - Certificate IV in ESI Generation - Maintenance (Electrical Electronics)

Furnishing

MSF20313 - Certificate II in Furniture making

MSF30213 - Certificate III in Furniture Making

MSF30913 - Certificate III in Blinds, Awnings, Security Screens and Grills

MSF40213 - Certificate IV in Furniture Design and Technology

MSF40313 - Certificate IV in Design of Kitchens, Bathrooms and Interior Spaces

MSF40413 - Certificate IV in Glass and Glazing

MSF50313 - Diploma of Furniture Design and Technology

Printing and graphic arts

ICP30512 - Certificate III in Printing and Graphic Arts (Printing)

ICP40115 - Certificate IV in Printing and Graphic Arts

ICP40515 - Certificate IV in Printing and Graphic Arts (Mail House)

ICP50115 - Diploma of Printing and Graphic Arts

Pulp and paper manufacturing

FPP40210 - Certificate IV in Papermaking Operations

PPM40216 - Certificate IV in Papermaking Operations

Seafood industry

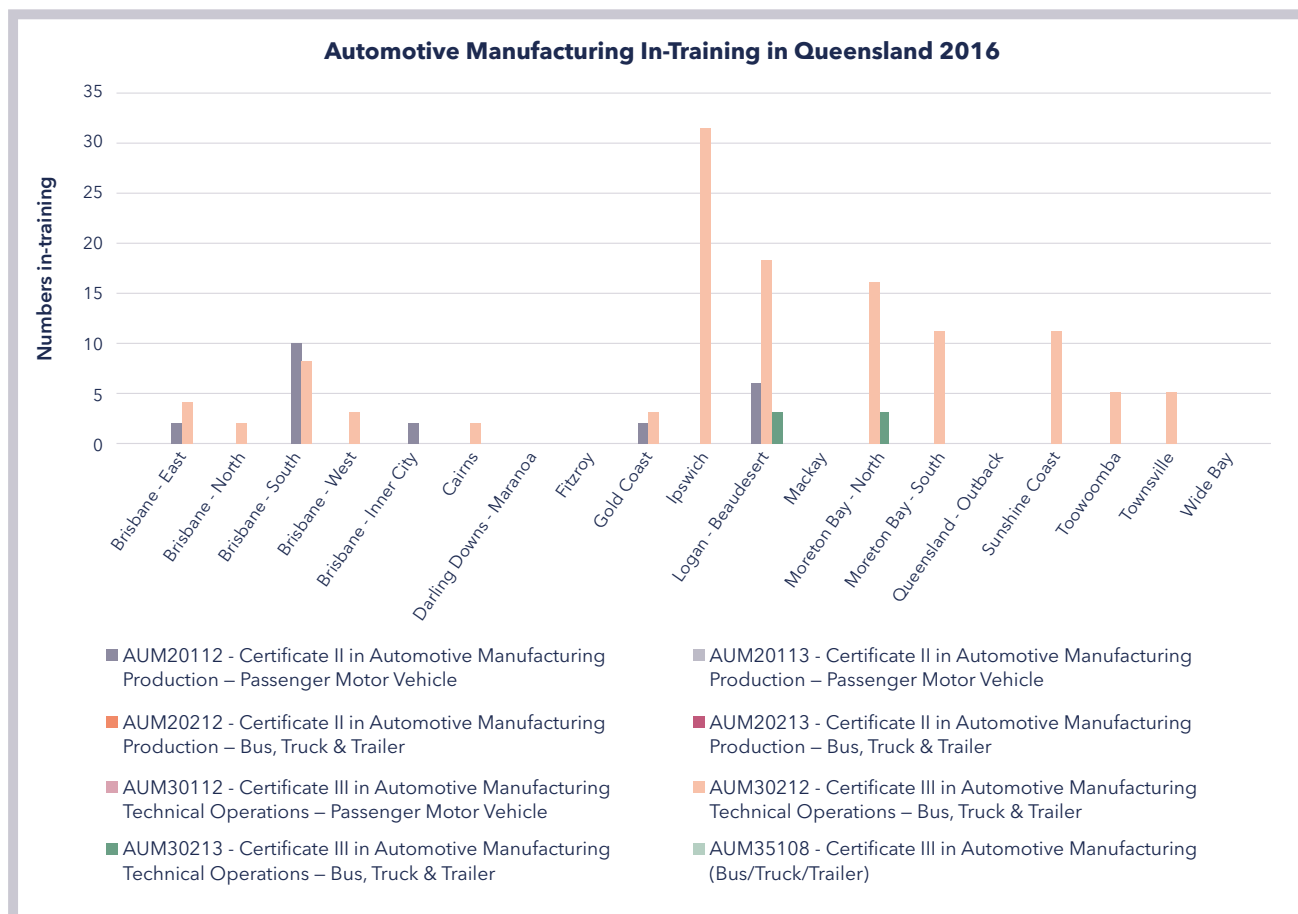
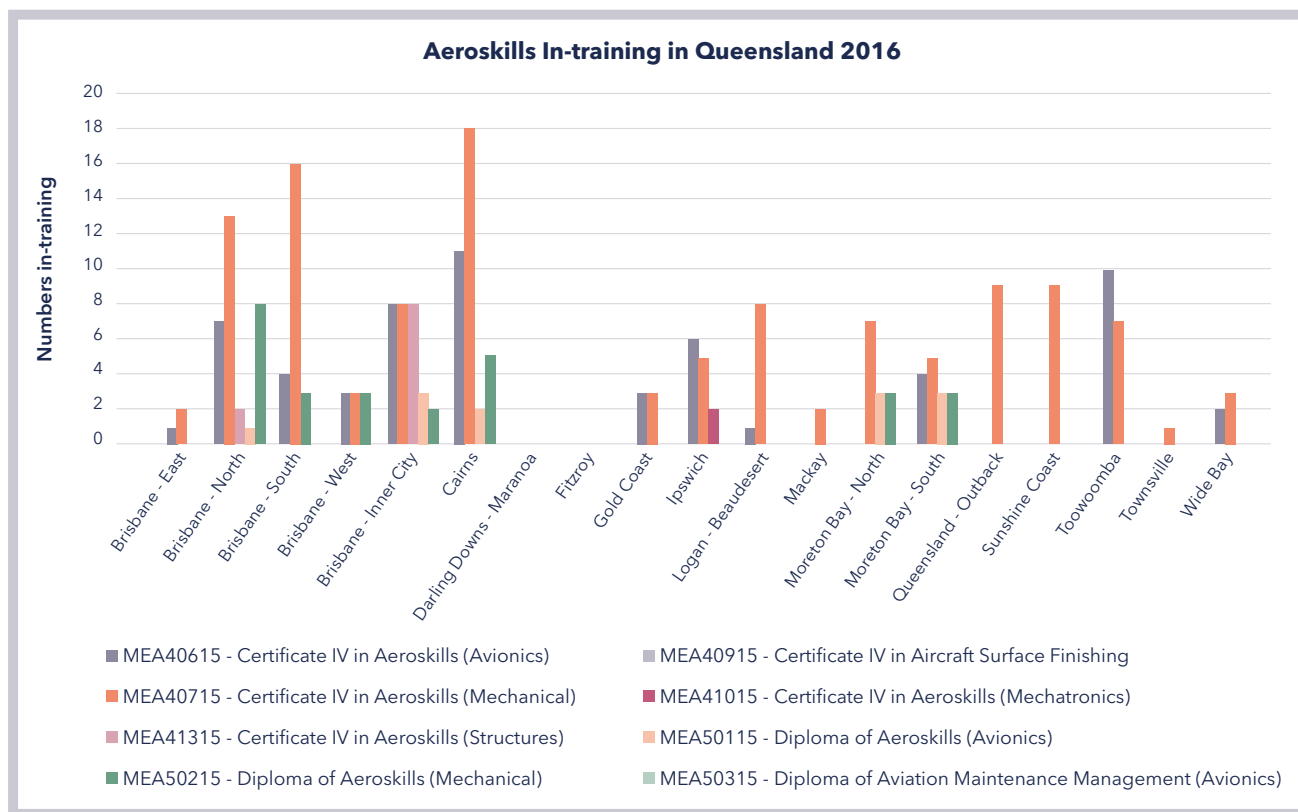
SFI40511 - Certificate IV in Seafood Processing

Water

NWP40515 - Certificate IV in Water Industry Operations

NWP40615 - Certificate IV in Water Industry Treatment

APPENDIX 2: IN TRAINING IN KEY MANUFACTURING INDUSTRY RELEVANT QUALIFICATIONS



Electrotechnology and Electronics In-training in Queensland 2016



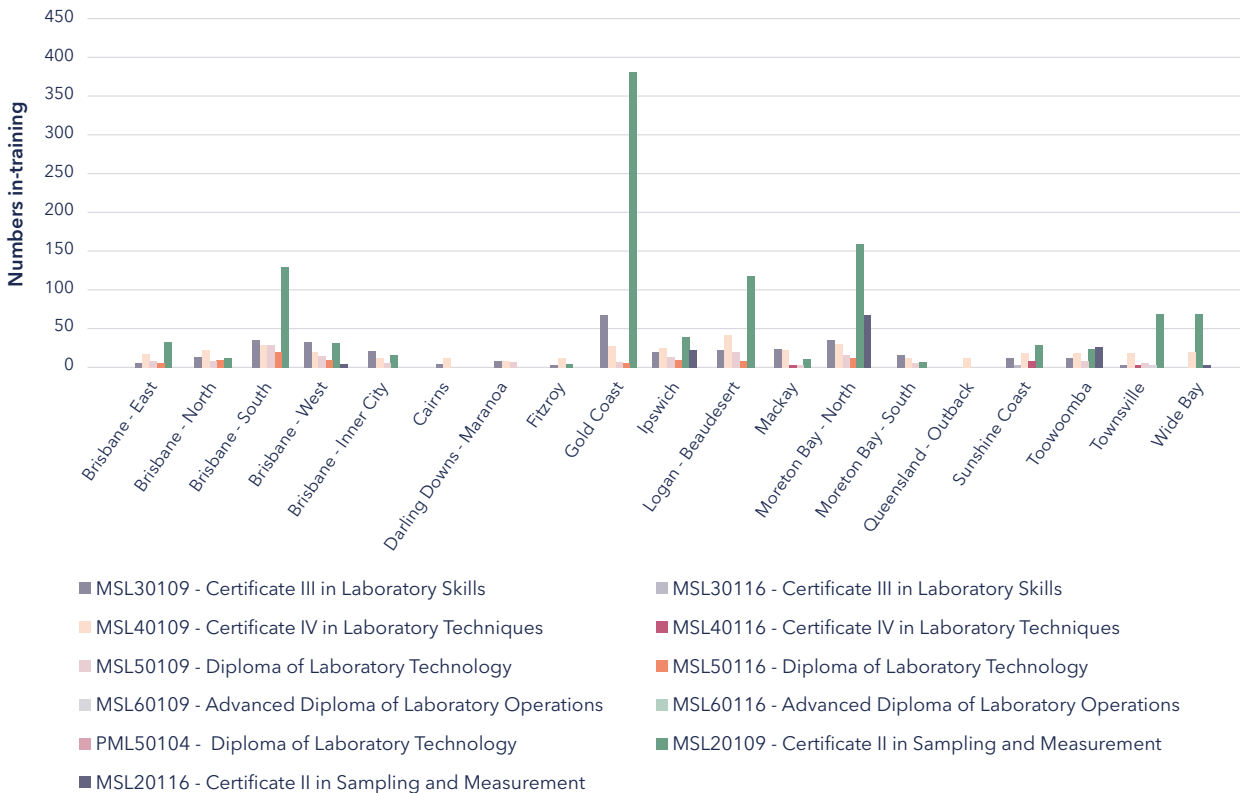
Engineering In-training in Queensland 2016



Food Processing In-training in Queensland 2016



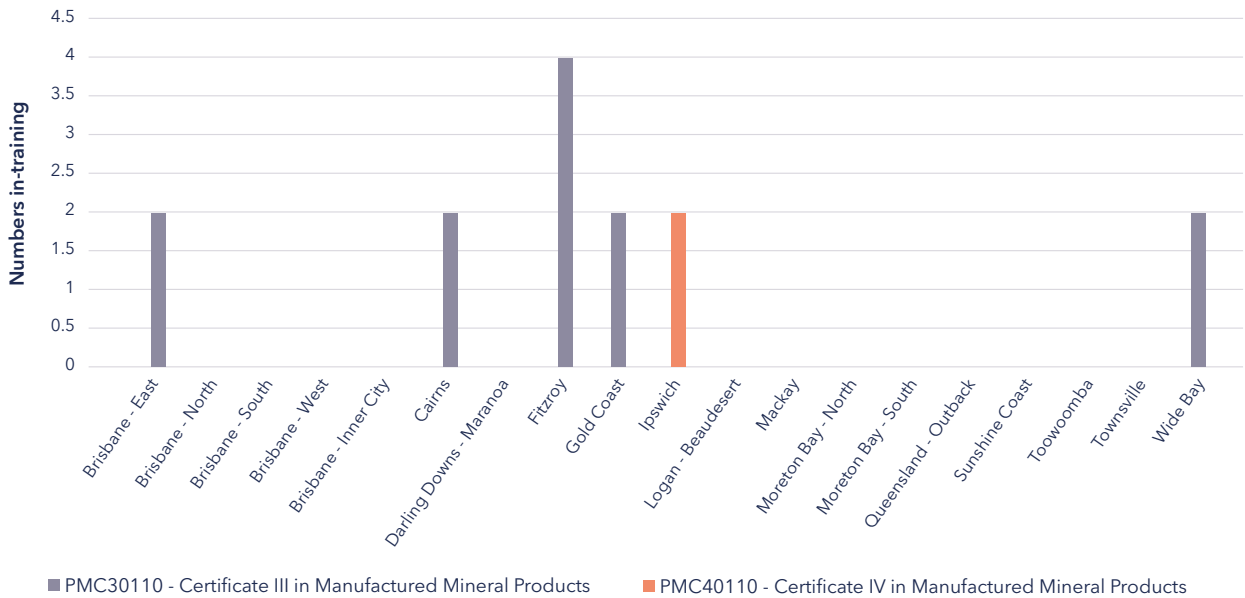
Laboratory Operations In-training in Queensland 2016



Manufacturing In-training in Queensland 2016



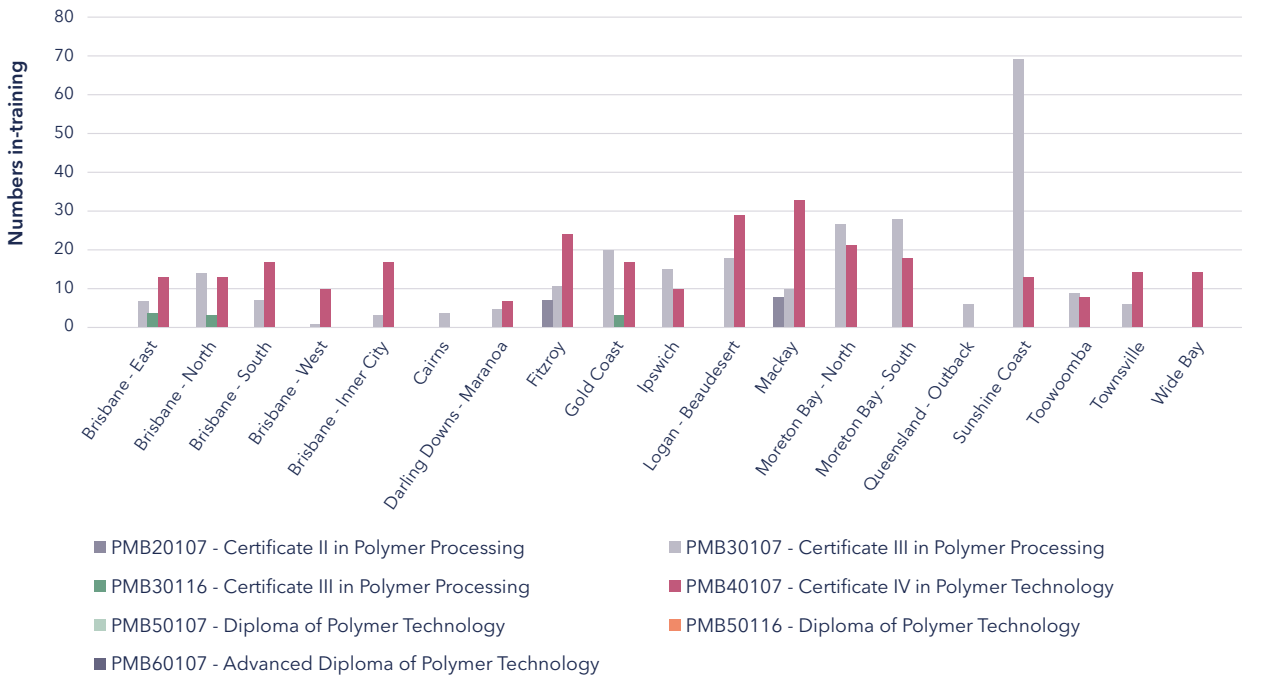
Manufactured Mineral Products In-training in Queensland 2016



Meat Processing In-training in Queensland 2016



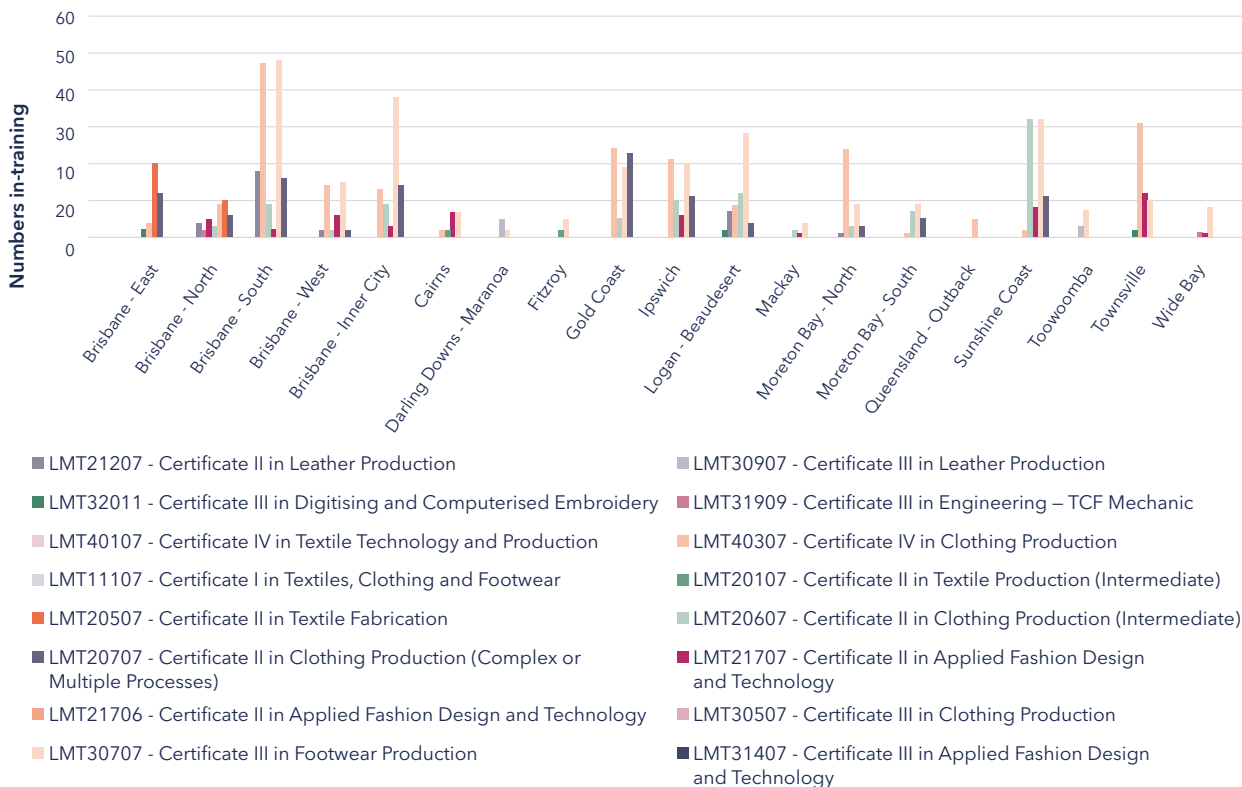
Polymer Product Manufacturing In-training in Queensland 2016



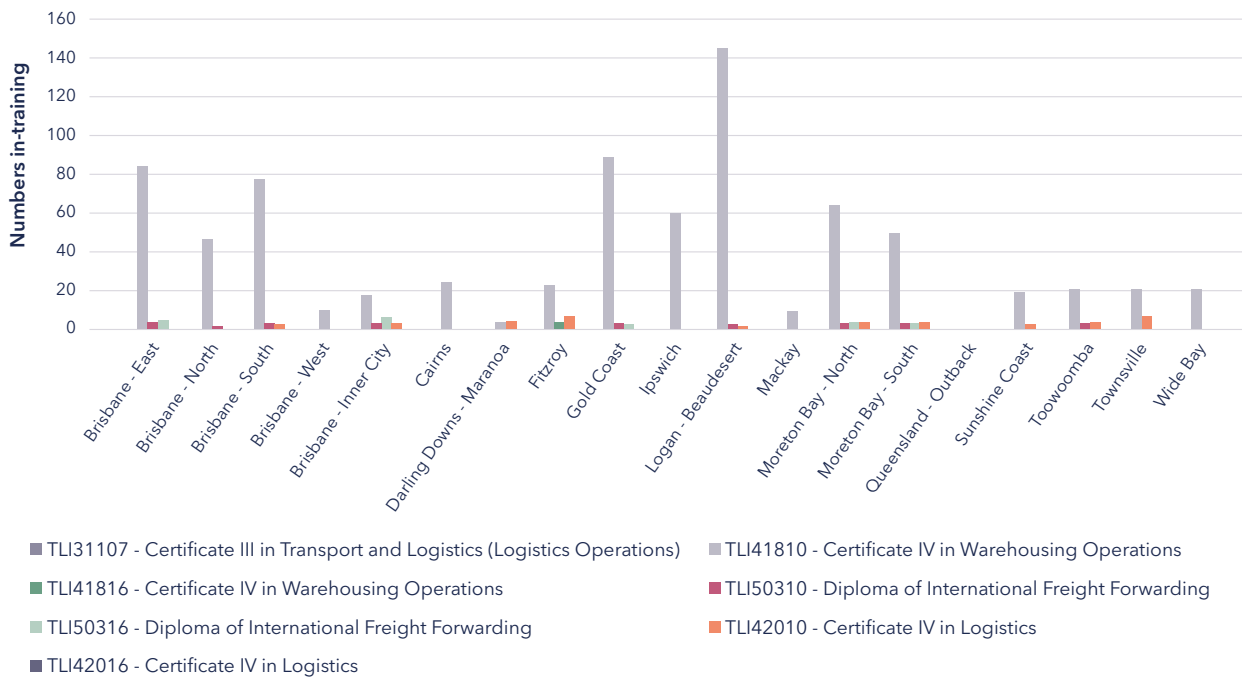
Primary Industries In-training in Queensland 2016



Textiles, Clothing and Footwear In-training in Queensland 2016



Transport and Logistics In-training in Queensland 2016



APPENDIX 3: QUEENSLAND MANUFACTURING APPRENTICESHIP AND TRAINEESHIP COMMENCEMENTS FROM 2014 TO 2016

[A] Apprenticeship [T] Traineeship

| ANZCO (4th level description) | 2014 | | 2015 | | 2016 | |
|---|------|----|------|----|------|----|
| | A | T | A | T | A | T |
| Uncategorised | 0 | 23 | 0 | 12 | 0 | 9 |
| 121300 - Livestock Farmers | 0 | 1 | 0 | 2 | 0 | 2 |
| 149900 - Other Hospitality, Retail and Service Managers | 0 | 6 | 0 | 0 | 0 | 0 |
| 211400 - Visual Arts and Crafts Professionals | 0 | 0 | 0 | 0 | 0 | 1 |
| 221100 - Accountants | 0 | 3 | 0 | 1 | 0 | 2 |
| 224700 - Management and Organisation Analysts | 0 | 0 | 0 | 0 | 0 | 1 |
| 225100 - Advertising and Marketing Professionals | 0 | 1 | 0 | 1 | 0 | 0 |
| 232400 - Graphic and Web Designers, and Illustrators | 0 | 0 | 0 | 0 | 0 | 1 |
| 311300 - Primary Products Inspectors | 0 | 14 | 0 | 5 | 0 | 4 |
| 311400 - Science Technicians | 0 | 25 | 0 | 17 | 0 | 25 |
| 312500 - Mechanical Engineering Draftspersons and Technicians | 141 | 10 | 145 | 12 | 72 | 7 |
| 312600 - Safety Inspectors | 0 | 0 | 0 | 0 | 0 | 1 |
| 312900 - Other Building and Engineering Technicians | 6 | 35 | 0 | 2 | 0 | 2 |
| 313100 - ICT Support Technicians | 0 | 11 | 0 | 15 | 0 | 7 |
| 321100 - Automotive Electricians | 24 | 0 | 22 | 0 | 37 | 0 |
| 321200 - Motor Mechanics | 152 | 0 | 115 | 0 | 129 | 0 |
| 322100 - Metal Casting, Forging and Finishing Trades Workers | 5 | 0 | 8 | 0 | 14 | 0 |
| 322200 - Sheetmetal Trades Workers | 97 | 0 | 133 | 0 | 102 | 0 |
| 322300 - Structural Steel and Welding Trades Workers | 333 | 0 | 302 | 0 | 280 | 0 |
| 323100 - Aircraft Maintenance Engineers | 48 | 0 | 30 | 0 | 27 | 0 |
| 323200 - Metal Fitters and Machinists | 175 | 0 | 140 | 0 | 151 | 0 |
| 323300 - Precision Metal Trades Workers | 6 | 0 | 14 | 0 | 11 | 0 |
| 323400 - Toolmakers and Engineering Patternmakers | 3 | 0 | 3 | 0 | 7 | 0 |
| 324200 - Vehicle Body Builders and Trimmers | 32 | 0 | 32 | 0 | 18 | 0 |
| 324300 - Vehicle Painters | 9 | 0 | 11 | 0 | 11 | 0 |
| 331100 - Bricklayers and Stonemasons | 13 | 0 | 15 | 0 | 18 | 0 |
| 331200 - Carpenters and Joiners | 51 | 0 | 52 | 0 | 37 | 0 |
| 332100 - Floor Finishers | 8 | 0 | 11 | 0 | 8 | 0 |
| 332200 - Painting Trades Workers | 0 | 0 | 1 | 0 | 0 | 0 |
| 333100 - Glaziers | 89 | 0 | 51 | 0 | 40 | 0 |
| 333200 - Plasterers | 1 | 0 | 1 | 0 | 1 | 0 |
| 333400 - Wall and Floor Tilers | 1 | 0 | 2 | 0 | 0 | 0 |
| 334100 - Plumbers | 9 | 0 | 184 | 0 | 5 | 0 |
| 341100 - Electricians | 120 | 0 | 97 | 0 | 101 | 0 |
| 342100 - Airconditioning and Refrigeration Mechanics | 12 | 0 | 14 | 0 | 14 | 0 |
| 342300 - Electronics Trades Workers | 17 | 1 | 16 | 2 | 21 | 10 |
| 342400 - Telecommunications Trades Workers | 0 | 53 | 3 | 13 | 0 | 28 |
| 351100 - Bakers and Pastrycooks | 163 | 0 | 158 | 0 | 162 | 0 |
| 351200 - Butchers and Smallgoods Makers | 46 | 36 | 43 | 29 | 48 | 8 |

| ANZCO (4th level description) | 2014 | | 2015 | | 2016 | |
|--|------|-----|------|-----|------|----|
| | A | T | A | T | A | T |
| 351300 - Chefs | 0 | 0 | 1 | 0 | 0 | 0 |
| 351400 - Cooks | 4 | 0 | 9 | 0 | 4 | 0 |
| 361100 - Animal Attendants and Trainers | 0 | 0 | 0 | 2 | 0 | 0 |
| 361300 - Veterinary Nurses | 0 | 1 | 0 | 0 | 0 | 0 |
| 362200 - Gardeners | 2 | 1 | 7 | 1 | 0 | 1 |
| 391100 - Hairdressers | 1 | 0 | 0 | 0 | 1 | 0 |
| 392100 - Binders, Finishers and Screen Printers | 41 | 0 | 30 | 0 | 14 | 0 |
| 392200 - Graphic Pre-press Trades Workers | 10 | 0 | 4 | 0 | 4 | 0 |
| 392300 - Printers | 54 | 0 | 43 | 0 | 17 | 0 |
| 393100 - Canvas and Leather Goods Makers | 21 | 0 | 9 | 0 | 6 | 0 |
| 393200 - Clothing Trades Workers | 2 | 0 | 4 | 0 | 0 | 0 |
| 393300 - Upholsterers | 9 | 0 | 6 | 0 | 11 | 0 |
| 394100 - Cabinetmakers | 132 | 0 | 154 | 0 | 155 | 0 |
| 394200 - Wood Machinists and Other Wood Trades Workers | 8 | 1 | 16 | 0 | 7 | 0 |
| 399100 - Boat Builders and Shipwrights | 24 | 0 | 15 | 0 | 27 | 0 |
| 399200 - Chemical, Gas, Petroleum and Power Generation Plant Operators | 0 | 52 | 0 | 134 | 0 | 75 |
| 399400 - Jewellers | 4 | 0 | 7 | 0 | 4 | 0 |
| 399600 - Signwriters | 13 | 0 | 23 | 0 | 18 | 0 |
| 399900 - Other Miscellaneous Technicians and Trades Workers | 0 | 67 | 0 | 26 | 0 | 70 |
| 431900 - Other Hospitality Workers | 0 | 81 | 0 | 25 | 0 | 32 |
| 451600 - Tourism and Travel Advisers | 0 | 36 | 0 | 7 | 0 | 2 |
| 511100 - Contract, Program and Project Administrators | 0 | 1 | 0 | 0 | 0 | 1 |
| 512100 - Office Managers | 0 | 25 | 0 | 8 | 0 | |
| 531100 - General Clerks | 0 | 67 | 0 | 89 | 0 | 73 |
| 532100 - Keyboard Operators | 0 | 2 | 0 | 1 | 0 | 0 |
| 541100 - Call or Contact Centre Workers | 0 | 376 | 0 | 147 | 0 | 0 |
| 551100 - Accounting Clerks | 0 | 1 | 0 | 0 | 0 | 1 |
| 551200 - Bookkeepers | 0 | 1 | 0 | 0 | 0 | 0 |
| 591100 - Purchasing and Supply Logistics Clerks | 0 | 1 | 0 | 0 | 0 | 0 |
| 591200 - Transport and Despatch Clerks | 0 | 33 | 0 | 35 | 0 | 24 |
| 599400 - Human Resource Clerks | 0 | 0 | 0 | 0 | 0 | 1 |
| 611300 - Sales Representatives | 0 | 3 | 0 | 0 | 0 | 4 |
| 621100 - Sales Assistants (General) | 0 | 4 | 0 | 16 | 0 | 4 |
| 621300 - Motor Vehicle and Vehicle Parts Salespersons | 1 | 2 | 2 | 0 | 2 | 0 |
| 621400 - Pharmacy Sales Assistants | 0 | 3 | 0 | 6 | 0 | 2 |
| 621500 - Retail Supervisors | 0 | 17 | 0 | 23 | 0 | 3 |
| 711100 - Clay, Concrete, Glass and Stone Processing Machine Operators | 0 | 1 | 0 | 7 | 0 | 0 |
| 711500 - Plastics and Rubber Production Machine Operators | 28 | 0 | 45 | 0 | 47 | 0 |
| 711600 - Sewing Machinists | 0 | 0 | 0 | 1 | 0 | 0 |

| ANZCO (4th level description) | 2014 | | 2015 | | 2016 | |
|--|-------------|-------------|-------------|-------------|-------------|-------------|
| | A | T | A | T | A | T |
| 711700 - Textile and Footwear Production Machine Operators | 0 | 1 | 0 | 0 | 0 | 0 |
| 711900 - Other Machine Operators | 0 | 6 | 0 | 0 | 0 | 0 |
| 712100 - Crane, Hoist and Lift Operators | 0 | 1 | 0 | 0 | 0 | 0 |
| 712200 - Drillers, Miners and Shot Firers | 0 | 17 | 0 | 20 | 0 | 11 |
| 712300 - Engineering Production Systems Workers | 0 | 2 | 0 | 0 | 0 | 0 |
| 721200 - Earthmoving Plant Operators | 34 | 12 | 64 | 9 | 11 | 9 |
| 721900 - Other Mobile Plant Operators | 0 | 34 | 0 | 0 | 0 | 0 |
| 731100 - Automobile Drivers | 0 | 31 | 0 | 9 | 0 | 7 |
| 733100 - Truck Drivers | 0 | 1 | 0 | 0 | 0 | 5 |
| 741100 - Storepersons | 0 | 27 | 0 | 19 | 0 | 11 |
| 811200 - Commercial Cleaners | 0 | 1 | 0 | 0 | 0 | 0 |
| 821200 - Concreters | 0 | 9 | 0 | 2 | 0 | 5 |
| 821700 - Structural Steel Construction Workers | 0 | 1 | 0 | 4 | 0 | 5 |
| 821900 - Other Construction and Mining Labourers | 0 | 0 | 0 | 1 | 0 | 0 |
| 831100 - Food and Drink Factory Workers | 0 | 97 | 0 | 122 | 0 | 85 |
| 831200 - Meat Boners and Slicers, and Slaughterers | 0 | 153 | 0 | 132 | 0 | 90 |
| 831300 - Meat, Poultry and Seafood Process Workers | 0 | 1186 | 0 | 890 | 0 | 522 |
| 832100 - Packers | 0 | 0 | 0 | 0 | 0 | 0 |
| 832200 - Product Assemblers | 0 | 0 | 0 | 2 | 0 | 2 |
| 839900 - Other Factory Process Workers | 0 | 0 | 0 | 1 | 0 | 0 |
| 841600 - Mixed Crop and Livestock Farm Workers | 0 | 0 | 0 | 0 | 0 | 1 |
| 899400 - Motor Vehicle Parts and Accessories Fitters | 0 | 2 | 0 | 1 | 0 | 0 |
| 899900 - Other Miscellaneous Labourers | 0 | 5 | 0 | 4 | 0 | 10 |
| Total | 1949 | 2581 | 2042 | 1855 | 1642 | 1164 |



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