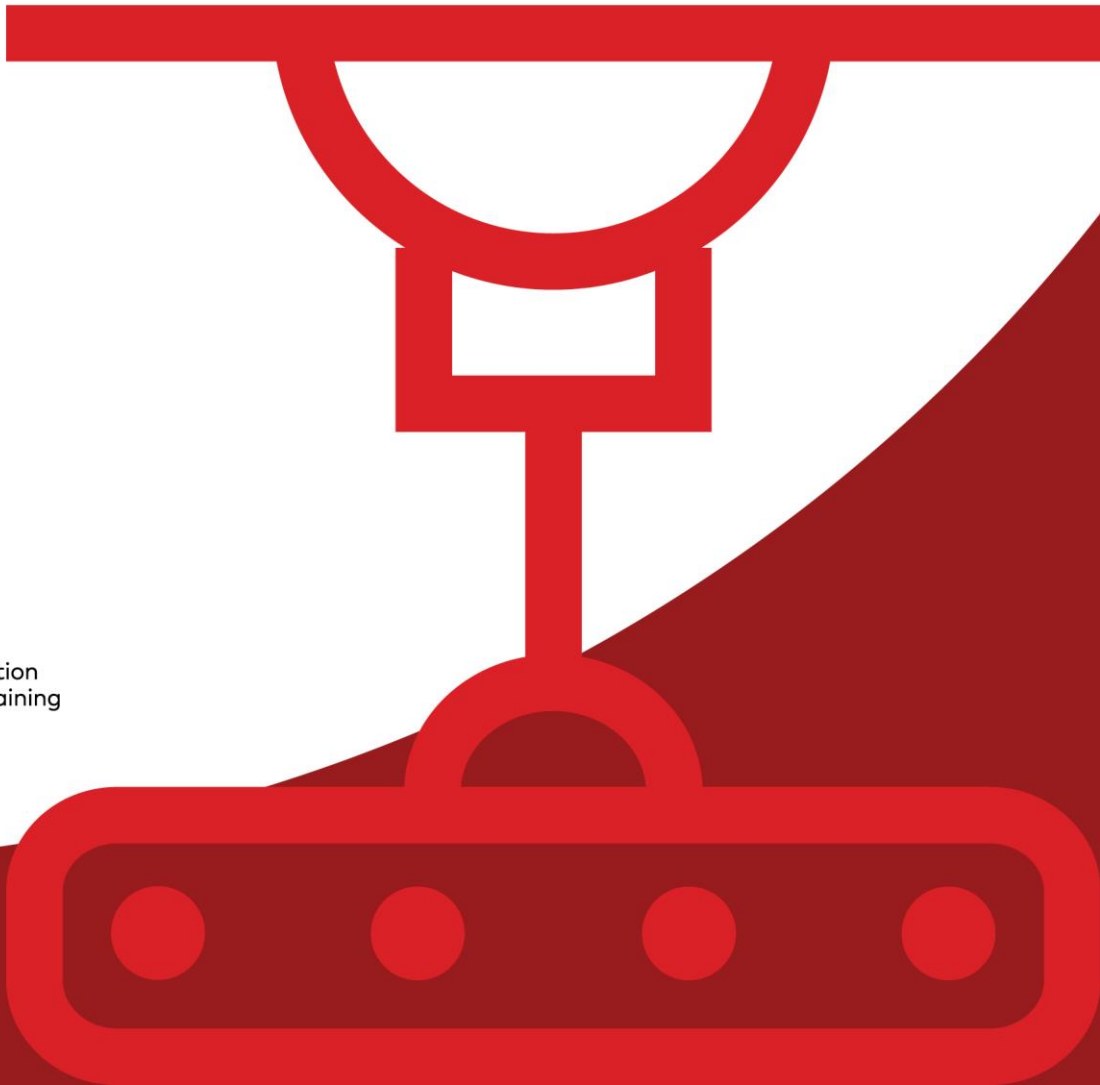
Victorian Skills Authority

Victorian Skills Plan

Manufacturing Industry Insight

October 2022



VICTORIA State Government | Education and Training

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Introduction

This report on the Manufacturing industry forms part of the 2022 Victorian Skills Plan and outlines demand for occupations, education and training directed to meeting this demand and current workforce issues facing the industry.

This report has been prepared by the Victorian Skills Authority (VSA). The VSA was formed in July 2021 in response to the review *Future Skills for Victoria: Driving collaboration and innovation in post-secondary education and training* (known as the Macklin Review). The VSA is charged with preparing an annual Victorian Skills Plan (the Skills Plan) to guide decision-making on skills and training, by the Government, education and training providers, industry and communities.

The Victorian Skills Plan

The annual Skills Plan sets out Victoria's skills needs for 2022 to 2025 by drawing on data, evidence and insights from a range of system-wide and local sources.

The Government in conjunction with industry, communities and education and training partners brings collaborative action through the Skills Plan which:

- **defines skill needs** with clear statements of required skills and capabilities (current and emerging)
- **sets priorities** for post-school education and training in Victoria
- **communicates to the community** the opportunities education and training can provide to offer careers for individuals that also meet the workforce needs of industry
- **aligns action** across industry and government to support improved outcomes for all Victorians.

The Skills Plan consists of:

- a summary report – the Victorian Skills Plan
- the industry needs of the Victorian economy segmented into 13 insight reports, each comprising like industries – of which this report is one
- profiles of industry and occupations in the regional areas of Victoria which outline priorities for skills development – either as snapshots or Regional Skills Demand Profiles
- current employment and forecast demand to 2025 across Victoria – a user-driven dashboard.

About Industry Insight Reports

Each industry insight is based on robust research, qualitative and quantitative data collection and analysis and extensive consultation with the Government's Industry Advisory Groups, partners and stakeholders over a period of six months. Each report sets out to:

- profile the **industry outlook**, taking into account sector trends and key drivers of demand
- detail the **workforce and skilling implications** of the industry based on forecasting
- set **industry priorities** in responding to current and future workforce challenges
- provide initial guidance for an **education and training response** to these challenges.

The industries reflected in each report are defined according to their classification within *1292.0 - Australian and New Zealand Standard Industrial Classification (ANZSIC) 2006*, prepared by the Australian Bureau of Statistics. Occupations within industries have been defined using the *Australian and New Zealand Standard Classification of Occupations (ANZSCO)*.

Each industry insight contributes to the conclusions and recommendations of the Skills Plan, focusing on actions for implementation over a three-year period.

The VSA acknowledges and extends sincere thanks to the individuals and organisations that participated in the consultations and contributed to these materials.

Using this report

This is a point-in-time report on the Manufacturing industry in Victoria and the associated skills and workforce issues.

This report, along with the Skills Plan, has been prepared for industry and provider partners as a summary of demand for occupations and current workforce issues. It is intended to provide Victorian government, industry and education and training partners the basis for ongoing work on skills demand and responses, including by the VSA and through the Industry Advisory Groups.

Feedback

Feedback on this report, and others, is welcome and can be provided to SkillsPlan@education.vic.gov.au. Feedback will contribute to developing insights and actions.

Report Coverage

This report focuses on the manufacturing industry as defined under ANZSIC and the occupations relevant to the industry, classified according to ANZSCO. It covers food product manufacturing, wood product manufacturing and machinery and equipment manufacturing among many others.

Statistics about an industry and its sub-sectors are collated by the Australian Bureau of Statistics (ABS) from the activity of businesses. Each business is classified to an industry based on their primary activities. Where an individual works for multiple businesses, their main job is used.

Industry classifications rarely encompass the full nature of the work (and therefore skills) associated with a given industry. ABS definitions of industries or sectors may not align with the definitions used by an industry association, while the allocation of businesses on primary activity can result in businesses that perform similar services but with a different emphasis being classified across different industries.

Coverage in the report is limited to employment in the industry and sectors as defined by ABS, noting some occupations are almost exclusively associated with an industry, such as production managers in manufacturing, while others, such as accountants and electricians, are associated with many industries. Note, however, that occupational demand for Victoria is the total of occupational demand for all industries.

Table 1 sets out related activities and the industry report that captures those activities. Where relevant this report should be read alongside those identified.

Table 1 | Scope of related industry activities and insights related industries

Activities	Industry insight
Logging and production of crops or livestock	Agriculture, Forestry and Fishing
Construction of buildings (including those with timber trussing and other prefabricated materials or products) and infrastructure	Construction
Trade services including the installation of carpentry and cabinetry	Construction
Use of hydrogen and other energy in production	Electricity, Gas, Water and Waste Services
Beneficiation, where minerals and ore are purified to form higher grade products	Mining
Publishing and printing as a combined activity	Professional, Financial and Information Services
Consulting services (including in relation to waste and water management)	Professional, Financial and Information Services
Sales of manufactured products	Services
Repair and maintenance of automotives, machinery and equipment (including domestic appliances)	Services

Executive summary

Industry outlook

The manufacturing industry in Victoria is essential for producing products and materials used by every other industry and personal consumers. Over 261,300 workers are employed across food and beverage, pharmaceuticals, metal and equipment, wood products and paper and other manufacturing products.[1]

The COVID-19 pandemic highlighted the importance of local manufacturing to the Victorian economy, due to the impact of disrupted global supply chains and rising input prices. Despite these challenges being likely to continue, the industry outlook remains strong. Government investment in infrastructure and related materials and growing consumer demand for local products in recent years are key drivers of demand. This is accompanied by increasing investment in advanced manufacturing, set to drive growth and efficiency into the future.

Workforce and skilling implications

On average, across all industries total employment is expected to grow by an additional 211,900 workers to 2025, from 3,538,900 workers in 2022, an annual growth rate of 1.97 per cent[a].[2,3] In comparison between 2017 and 2020 employment grew by 2.68 per cent[b] annually.[4]

In the manufacturing industry, employment is expected to grow by an additional 2,100 workers to 2025, from 261,300 workers in 2022, an annual growth rate of 0.26 per cent[c] which is below the overall Victorian average across all industries.[5,6] In comparison between 2017 and 2020 employment across this industry grew by 1.38 per cent[d] annually.[7]

The manufacturing workforce will need to grow by an estimated 15,500 new workers by 2025 to meet expected demand.[8] This includes 2,100 in employment growth and replacement of 13,400 retirees.[9,10]

Table 2 identifies the top ten occupations in demand across the industry by 2025.[11] Of these, five occupations (highlighted in table) are expected to experience employment growth at a rate above the overall Victorian average between 2022 and 2025.

Table 2 | Occupations in demand in the manufacturing industry by 2025[e,12,13]

Occupation	Current employment	Employment growth (2022–25)		Retirements (2022–25)	New workers needed (2022–25)
		Number	**Per cent**		
Production managers	12,500	800	2.0%	950	1,750
Manufacturers	12,400	400	1.4%	850	1,250
Food and drink factory workers	7,450	450	3.0%	250	750
Meat, poultry and seafood process workers	2,250	400	2.6%	250	600
Packers	9,450	100	0.4%	500	600

[a] 3-year compound annual growth rate
[b] Computed for 2017 to 2020 employment growth for pre-COVID comparison
[c] 3-year compound annual growth rate
[d] Computed for 2017 to 2020 employment growth for pre-COVID comparison
[e] Due to rounding, some totals may not correspond with the sum of the separate figures

Structural steel and welding trades workers	13,150	-50	-0.2%	450	400
Storepersons	5,900	-50	-0.2%	400	350
Cabinetmakers	4,700	100	0.6%	250	350
Other specialist managers	3,700	200	2.3%	150	350
Meat boners and slicers, and slaughters	3,150	200	3.3%	100	300

Legend

Above Victorian employment growth average between 2022 and 2025

The increasing use of robotics and artificial intelligence are driving demand for new job roles which require a higher skill level, including digital manufacturing engineers, data architects and robot operators.

Industry has also identified changing skill needs. Workers will need to keep pace with technologies including 3D printing, digital twinning, advanced robotics and automated machines. Technical skills in artisan food and drink manufacturing will also be needed at a sector level.

Meeting this demand will be challenging. A number of occupations were identified as in shortage. However, there are many other occupations identified as in shortage reported in other Industry Insight reports, that also service the manufacturing sector (e.g., electricians, accountants, ICT managers).

The industry reports an ageing workforce, limited awareness of the opportunities available in manufacturing and low numbers of workers from diverse backgrounds choosing to enter the industry as all contributing to this challenge.

Workforce priorities

Three priorities are identified to address workforce and skilling needs for the manufacturing industry:

1. Upskill workers to move into more technical roles – enhanced professional development opportunities can support a more digitally capable workforce that attracts international investment
2. Attract, retain and locate workers in manufacturing hubs across Victoria – attention is required to encourage workers into the industry from local communities
3. Build the pipeline of new workers to meet immediate and emerging workforce needs – responding to the industry's ageing workforce can help meet demand

Education and training pipeline and workforce response

Pathways to employment in the education and training industry are split across Higher Education and Vocational Education and Training (VET) with 21 per cent of workers holding a degree or above as their highest level of education and 38 per cent of workers holding a VET level qualification as their highest level of education.[14] There were 26,030 enrolments in relevant VET qualifications in 2020 and 7,770 equivalent full-time study load (EFSTL) in higher education in 2019.[15,16] This should present a significant opportunity to meet projected demand.

Popular VET pathways into this industry include the Certificate IV in Process Manufacturing, the Certificate III in Engineering, the Certificate II in Engineering Studies, and the Certificate II in Furniture Making Pathways.[17] While activity is high in some courses, many courses have low enrolments and opportunities exist to better respond to identified priorities. Further, activity does not always map to demand.

Expanding interest and awareness of manufacturing pathways in school is needed. Attraction efforts should focus on the need for skills in advanced technologies. Pathways into careers should also be streamlined to assist students in better identifying appropriate career pathways. These pathways must be made more accessible for residents from regional and rural areas, particularly workers looking to reskill.

Attention should also focus on supporting the existing workforce to build their capability and undertake further training in specialised technical skills. Meanwhile, a more holistic approach that emphasises practical experience for vulnerable workers is needed.

Government and industry must target investment in manufacturing priority areas with growth potential and a proven record of success to ensure limited resources and capability are used appropriately. In addition, collaboration with the energy sector is needed to manage the transition to renewable sources and the subsequent infrastructure upgrades required.

Finally, managing the industries' transition will require robust workforce planning to align the efforts of employers and government. Efforts to grow and skill the workforce should be supported through mentoring, work experience and study leave along with a strong employer value proposition.

The Victorian Government has existing support mechanisms that can assist impacted workers. Jobs Victoria supports people looking for work and connects employers with the staff they need. The Victorian Government's Skills and Jobs Centres provide expert advice on training and employment opportunities, particularly on referrals and job matching to local employment opportunities and help with career and training plans to support a successful career transition.

Table 3 highlights actions that can be considered by education, industry and government to meet workforce demand.

Table 3 | Actions for consideration by education, industry, and government

- Industry needs to build the pipeline of workers by increasing awareness with school students, mature-aged workers and skilled migrants about careers in manufacturing.
- Streamline VET pathways to simplify course offerings while meeting industry needs. Through industry advice and the Manufacturing Industry Advisory Group, review key pathways to ensure they equip students for future as well as current skills needs.
- Support incremental upskilling to lift baseline workforce capability and enable workers to pursue specialised technical roles.
- Improve the attraction and retention of industry experts to deliver education and training, particularly for high growth and specialised qualifications.

Industry Outlook

The manufacturing industry transforms materials and products for business and personal use

The manufacturing industry plays a vital role in the Victorian economy. It increases the value of materials and products by transforming them for use by all other industries as well as personal consumers.

The manufacturing industry is engaged in the physical or chemical transformation of materials, substances, or components into new products.[18] In Victoria, manufacturers produce a wide range of products including metals and equipment, food and beverages, petroleum and chemicals, clothing, textiles and furniture, glass, plastics, minerals, paper and wood.[19]

The manufacturing industry directly employs 7.4 per cent of the total Victorian workforce (261,300 workers) and is one of the largest suppliers of full-time jobs.[20] Across the industry, approximately 71 per cent of workers are male, significantly higher than the Victorian average of 53 per cent.[21] Approximately 33.6 per cent of workers in this sector are aged over 50, which is slightly higher than the Australian average across all sectors of 29 per cent.[22]

Workers typically perform duties in plants, factories and mills, using power-driven machines and materials-handling equipment. Modern manufacturing also requires highly skilled workers to use technologies across the manufacturing value chain, from research and development to after-sales and services.[23]

Employment opportunities in the manufacturing industry are available at all skill and experience levels with many opportunities for entry-level workers. Workers across the industry have varied levels of qualifications. Approximately 41 per cent of workers do not have post-school qualifications, while 38 per cent of workers hold a VET qualification and 21 per cent have completed a Higher Education qualification.

Although most of the manufacturing industry was permitted to continue operating as an essential industry during the COVID-19 pandemic, it was affected by limits of supply from global supply chains. This highlighted the importance of local manufacturing to the economy. The industry also faced reduced sales and labour shortages. Despite this, most manufacturers are forecasting improved business conditions with strong demand for products, but will be inhibited by ongoing supply chain interruptions, skills shortages and rising input prices.[24]

The COVID-19 pandemic and the reshaping of production value chains globally is spurring the manufacturing industry to embrace digitisation with greater urgency, motivated by gains in efficiency and operational resilience.[25] This emphasis on operational streamlining and technology has generated significant growth opportunities in advanced and specialised manufacturing.[26] While this will continue to shape core industry activities, structures and processes in Victoria, many core manufacturing activities will continue to require a high number of production workers.

In addition to advanced manufacturing, emerging areas include gas-processing, niche and additive manufacturing.[27] These emerging areas span the two broad types of manufacturing – process manufacturing (high volume) and specialised manufacturing (low volume or bespoke).

In both process and specialised manufacturing, a product passes through various tiers before it is ready for sale. Manufacturers in each of these tiers are typically identified as follows:[28]

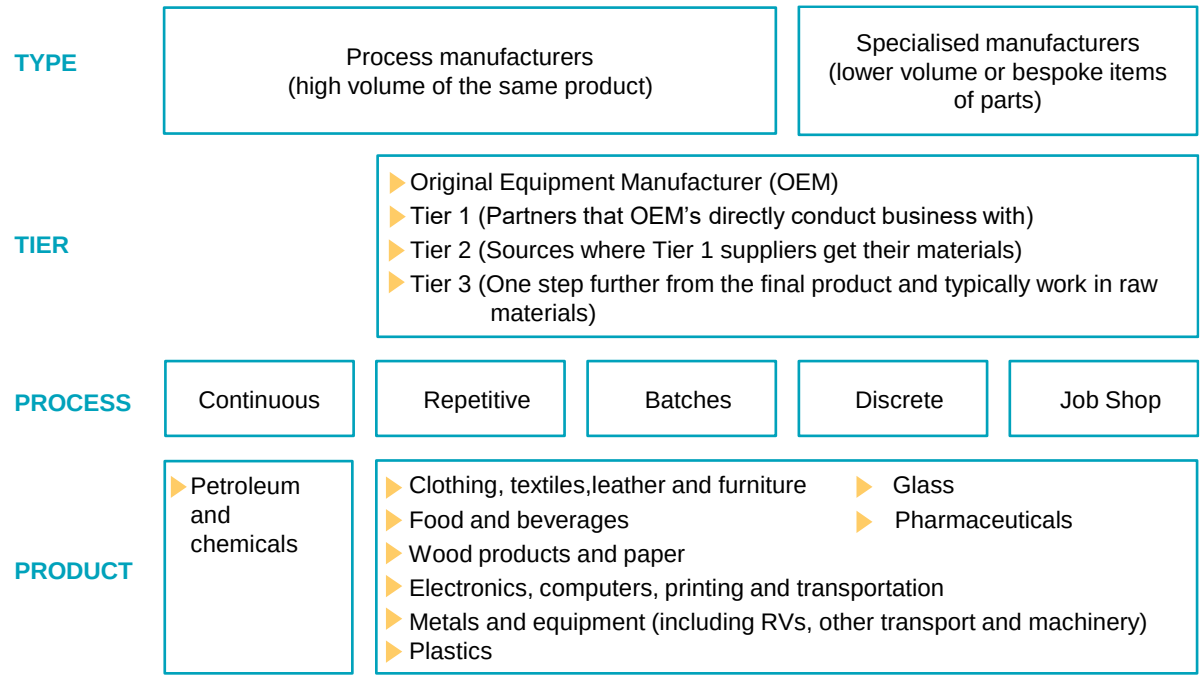
- Original equipment manufacturer (OEM) – a company whose name and brand are on a product's final package.
- Tier 1 manufacturer – often OEMs themselves, Tier 1 manufacturers otherwise provide primary and complex components to OEMs before they are transformed into a final product.

- Tier 2 manufacturer – for simple products, Tier 2 manufacturers take the place of a Tier 1 manufacturer in relation to an OEM. Otherwise, they provide parts to Tier 1 suppliers.
- Tier 3 manufacturer – while there may be other tiers below Tier 2, Tier 3 manufacturers work with raw materials in the first stage of production, refining them for use by other manufacturers.

Manufacturers in the above tiers use a wide variety of processes to generate products – continuous, repetitive, batch, discrete and job shop[f] manufacturing.

Key sectors within the manufacturing industry are shown in Figure 1.

Figure 1 | Key sectors within the manufacturing industry[29]



A well-functioning manufacturing industry is critical for the success and growth of other industries. For example, the wood products and paper sector provides essential goods for other industries – the construction industry uses timber products in building infrastructure, and arts and recreation services rely on paper to publish creative work.

The retail, food and accommodation sectors use cardboard, wooden and paper packaging, which will grow in line with increased demand for sustainable packaging. Finally, trucks, caravans and trains require parts that meet stringent safety and quality guidelines.

Selected sectors within the industry are described below.

Food and beverage

The food and beverage sector is responsible for employing more than 20,000 workers across Victoria.[30] Victorian manufacturers produce a wide range of food and beverages products, including baked goods, meat, alcoholic beverages (such as wine, gin and beer), confectionery and other groceries.[31] The food and beverage sector intersects with other sectors including plastics and glass, that manufactures and supplies a range of packaging options.

[f] A job shop is a type of manufacturing process in which small batches of a variety of custom products are made. In the job shop process flow, most of the products that are made require a unique set-up and sequencing of process steps.

Pharmaceuticals

The pharmaceuticals sector is a growth sector for innovative and advanced manufacturing.[32] It is concentrated in Melbourne and is responsible for employing more than 18,000 workers.[33] The sector produces a wide range of chemical products that are used as medicinal drugs, including prescription medication, vaccines, vitamins and off-the-shelf medicines (e.g., pain relief).

A significant recent development in this sector is the approval of Moderna's vaccination facility. It is the first mRNA facility in the southern hemisphere and will create up to 500 ongoing jobs (in addition to 500 jobs in construction).[34]

Metals and equipment

The metals and equipment sector is responsible for 2.7 per cent of Victoria's entire workforce and almost half of the manufacturing workforce.[35] Within this sector, transport, machinery and equipment businesses manufacture defence equipment, recreational vehicles (including caravans and campervans), horse equipment and logistical equipment such as truck components and trailers.[36] Victoria manufactures 90 per cent of all recreational vehicles made in Australia, employing over 3,000 people.[37]

Primary metal and prefabricated metal product manufacturers in the sector produce cast iron, rail components, aluminium,[38] copper products, forged chains, pipe fittings, structural steel and metal containers such as tanks.[39] For example, Alcoa operates an aluminium smelter in Portland, responsible for 19 per cent of Australia's total aluminium production. For rail components, the High-Capacity Metro Trains project assembles trains using parts manufactured in Bendigo, Morwell, Hallam and other parts of Victoria (in part due to its 60 per cent local content target).[40] The Preston depot is revitalizing Melbourne's iconic trams while the Next Generation Trams project is drawing on workers in Dandenong and more broadly across the state to manufacture Victoria's most modern trams.[41]

Wood products and paper

The wood products and paper sector employs approximately 4,000 workers across the state.[42]. The wood products and paper sector transforms trees into a wide range of products including woodchips, building materials, pallets, cardboard, cellulose and (ultimately) paper. It also includes timber framing and trussing. This sector intersects with the furniture sector, which manufactures products such as wooden chairs and tables. There are also interdependences between this sector and critical and specialist workers in the forestry sector such as saw technicians.

Other manufacturing

Other manufacturing sectors in Victoria are smaller than those described above. They include glass, petroleum, plastics and clothing, textiles, footwear and furniture. In addition, leather (such as bike and horse saddles), prefabricated building products (including timber trussing), printing, reproduction of recorded media and chemicals form part of the industry.

The manufacturing workforce is expected to grow, driven by investment in advanced manufacturing

Investment in advanced manufacturing highlights the increasingly prominent role that technological development will have in shaping demand for more complex and bespoke manufacturing products in Victoria. The industry outlook is driven by a range of factors set out in Table 4.[43]

Table 4 | Drivers of demand in the manufacturing industry

	Driver	Food and beverages	Pharma-ceutical	Metals and equipment	Wood products and paper
Policy	Government investment announcements support local and advanced manufacturing.	High	High	High	Medium
	Partnerships between the public and private sector are increasing, including grants for innovation.	High	High	Medium	Medium
Economic	Global supply chain issues drive product shortages and local demand.	High	High	High	High
	Shortages in some raw materials as a result of COVID-19, supply chain issues and increased government investment in infrastructure developments.	Low	Low	Medium	High
Social	Consumer demand is increasing for ethically sourced and sustainable products.	Medium	Low	Medium	High
	Increased local travel will drive demand for recreational products such as caravans.	Low	Low	High	Low
Technological	Advancing technologies create opportunities to increase efficiency, safety and automation.	High	High	High	High

	Driver	Food and beverages	Pharma-ceutical	Metals and equipment	Wood products and paper
Environmental	Climate change is driving greater demand for low carbon and sustainable products and processes. Climate change is also driving greater efforts to preserve native forests and lower bushfire risk with reduced timber supply.	Medium	Medium	High	High

Drivers are impacting sectors differently across the industry. The $2 billion Breakthrough Victoria fund will have a significant impact on commercialising outcomes for research and development projects across all sectors over a 10-year period.[44] Priority sectors include health and life science, advanced manufacturing, digital technologies, agri-food and clean economies.[45]

Food and beverage

One of the food and beverage sector's main priorities is to improve efficiency and innovation in its products and processes. There is $1.3 billion in federal funding under the Modern Manufacturing Strategy to help manufacturers scale up, improve competitiveness and build more resilient supply chains. Food and beverage manufacturing is one of six priority areas.[46] Identified growth opportunities in the sector include automation processes such as continuous and batch control, palletising and control for temperature, humidity and pressure.[47] It also encourages the development of innovative foods and beverages including premium ready to eat meals and products that have been fortified for nutrition.[48]

There is opportunity for further growth of the sector in rural areas, where almost 40 per cent of all food and beverage manufacturing currently takes place. In consultation with 37 member councils, Rural Councils Victoria is coordinating approaches to 4,000 manufacturers to gauge their interest in relocating or expanding their operations into rural Victoria.[49]

Consumer demand and climate change will also drive increased demand for local food and beverages that is sustainably produced. This intersects with the glass and plastics sectors responsible for packaging.

Pharmaceuticals

The COVID-19 pandemic highlights the growth potential in locally manufactured vaccines and other pharmaceuticals. This is consistent with government's emphasis on infectious disease preparedness in the wake of COVID-19.

Medical products are also a priority area under the $1.3 billion Modern Manufacturing Strategy.[50] Opportunities in the sector come from the growing demand for healthcare driven by an ageing population, advances in customised and precision healthcare and digital technologies.[51] They include high-value pharmaceuticals, biologics, complementary medicines, digital technologies and platforms.

Metals and equipment

The metals and equipment sector is a critical and long-standing sector in Victoria's manufacturing industry. Increasing demand for automation and robotics across the industry will stimulate growth in the sector. In addition, industry noted strong demand for steel products will result from significant investment in transport infrastructure across Victoria, such as the Westgate Tunnel Project, Metro Rail, Road-Rail Separation Projects and the North East Link Program.[52]

The Victorian Government has committed to invest $3.6 billion in rolling stock manufacturing and maintenance between 2015 and 2025, supporting employment of up to 2,500 people.[53] Demand for recreational products such as caravans and camping equipment has increased and is driven by

increased local travel and household savings (built during COVID-19 and in lieu of overseas holidays). As noted above, consultation highlighted that 90 per cent of all recreational vehicles (including motor homes, pop tops, tent trailers and caravans) are manufactured in Victoria and that the sub-sector has experienced strong demand since 2019.

Wood products and paper

Significant government investment in infrastructure and bushfires have contributed towards a shortage in timber, exacerbated by global and domestic supply chain issues during COVID-19. Supply shortages will persist in the short to medium term while new plantations mature. It is anticipated that investment in the industry – including through *Advancing Victorian Manufacturing: A Blueprint for the Future* – will only continue to boost demand.[54] There is also increasing regulation around the use of timber in manufacturing, which intends to conserve natural resources and to improve compliance with existing laws.[55]

To enhance the capacity of domestic supply chains and manufacturing resilience, the government has created Victorian Supply Chain Directories. These Directories showcase capabilities in manufacturing sub-industries and promote the use of local suppliers. The sector will also need to navigate the phasing out of native timber harvesting by 2030 in favour of plantation-based supply under the Victorian Forestry Plan.[56] The sector has historically relied on locally grown supply above the availability of imported timber. The local sector will also need to boost supply to meet demand, supported by federal government grants available for new plantations.[57]

The Victorian Government has committed $30.5 million to support local (and attract new) manufacturers to make products using recycled materials through the Recycling Victoria Recycling Markets Acceleration package.[58] This demonstrates the value of research and innovation in manufacturing.

Other manufacturing

Demand for automation and efficiency is likely to affect all other sectors of the manufacturing industry.

Consumer demand for better quality, longer-lasting garments and ethically sourced products is creating opportunities for businesses in the textile, leather, clothing and footwear manufacturing industry.[59] This will require advanced production and repair, craftsmanship and sophisticated marketing.[60]

Hydrogen gas manufacturing is likely to be a significant area of growth as part of Australia's transition to renewable energies. This is analysed in greater detail in the Electricity, Gas, Waste and Water Services industry insight.

> *"We need to advocate for Industry 4.0, increasing productivity to create more high value jobs. We need forward thinking future workers."*
>
> Skills Plan Consultation, Industry forum, March 2022

Workforce and Skilling Implications

An estimated 15,500 new workers are needed to meet projected demand over the next 3 years

On average, across all industries total employment is expected to grow by an additional 211,900 workers to 2025, from 3,538,900 workers in 2022, an annual growth rate of 1.97 per cent[g].[61,62] In comparison between 2017 and 2020 employment grew by 2.68 per cent[h] annually.[63]

In the manufacturing industry, employment is expected to grow by an additional 2,100 workers to 2025, from 261,300 workers in 2022, an annual growth rate of 0.26 per cent[i] which is below the overall Victorian average across all industries.[64,65] In comparison between 2017 and 2020 employment across this industry grew by 1.38 per cent[j] annually.[66]

The 15,500 new workers needed between 2022 and 2025 comprises 2,100 employment growth and replacement of 13,400 retirees.[67] The number of retirements does not consider people leaving the industry for other reasons.

Although growth in the manufacturing industry is predicted to increase in the next five years overall, workforce demands within sub-industries will fluctuate. Regardless, consultation highlighted that the availability of the workforce would be a key determinant in attracting manufacturers to Victoria. A workforce pipeline that fuels further investment will require significantly more workers than currently forecast.

In all sectors, there is likely to be a decline in frontline roles resulting from process automation. This will shift workforce demand in favour of semi-skilled and skilled workers.

Construction growth (e.g., HomeBuilder) will drive demand in metal and wood products that are commonly used in houses and commercial buildings (e.g., $30 million investment to establish a high-tech plant in Wodonga that manufactures cross laminated timber (CLT) panels).[68] It will also drive demand for prefabricated and modular building products.

Similarly, the Victorian Government's investment in 400 electric vehicles and $3.6 billion in rolling stock will drive growth in transport equipment manufacturing (estimated +600 jobs).[69] There will also be increased demand for recreational vehicles such as caravans as consumers travel within Australia (estimated +300 jobs). By contrast, the Federal Government's instant asset write-off scheme for businesses to order new and replacement equipment such as trailers or trucks components will end in 2022, with a predicted downturn in machinery and equipment manufacturing as a consequence (estimated -800 jobs).[70]

Demand for artisan food and beverage products, such as baked goods and craft beer, provides an important opportunity to drive growth in food and beverage manufacturing (particularly considering the lack of maturity in this sub-industry globally).[71]

Along with growth in advanced manufacturing, each of the above forecasts demonstrates an increasing demand for complex and bespoke products. This will require workers in the manufacturing industry to hold specialised roles and to obtain more specialised skill sets. For example, meat inspectors and certifiers are a vital enabler of the meat processing sector – the operations of large manufacturing chains in this sector require products to pass through safety checkpoints. Consultation also highlighted that regionalisation increases competition for talent between industries (e.g., meat processing and renewable energy), which will shape the extent to which industry can meet demand.

[g] 3-year compound annual growth rate
[h] Computed for 2017 to 2020 employment growth for pre-COVID comparison
[i] 3-year compound annual growth rate
[j] Computed for 2017 to 2020 employment growth for pre-COVID comparison

Table 5 identifies the top ten occupations in demand based on employment growth and replacing retirees by 2025.[72] Of these, five occupations (highlighted in table) are expected to experience employment growth at a rate above the overall Victorian average between 2022 and 2025. There are also several occupations with predicted high rates of retirement, including production managers (950), manufacturers (850) and packers (500). These figures are estimates but it is important to note that they do not account of existing vacancies nor take account of changes in the rate of workers leaving the industry for other roles.

Table 5 | Occupations in demand in the Manufacturing industry to 2025[k,73,74]

Occupation	Current employment	Employment growth (2022–25)		Retirements (2022–25)	New workers needed (2022–25)
		Number	**Per cent**		
Production managers	12,500	800	2.0%	950	1,750
Manufacturers	12,400	400	1.4%	850	1,250
Food and drink factory workers	7,450	450	3.0%	250	750
Meat, poultry and seafood process workers	2,250	400	2.6%	250	600
Packers	9,450	100	0.4%	500	600
Structural steel and welding trades workers	13,150	-50	-0.2%	450	400
Storepersons	5,900	-50	-0.2%	400	350
Cabinetmakers	4,700	100	0.6%	250	350
Other specialist managers	3,700	200	2.3%	150	350
Meat boners and slicers, and slaughters	3,150	200	3.3%	100	300

Legend

Above Victorian employment growth average between 2022 and 2025

Significant technological advancements and changes in consumer demand across the manufacturing industry are driving demand for new and emerging jobs. Increasing use of automation and robotics in the industry will require workers with digital, artificial intelligence and data specialisations. Sustainability is driving demand for artisan products and disruption in the wood and paper products sector (given its reliance on timber).

Emerging occupations for the manufacturing industry are detailed in Table 6. Emerging occupations are defined as new, frequently advertised jobs which are substantially different to occupations already defined in the ANZSCO.[75]

[k] Due to rounding, some totals may not correspond with the sum of the separate figures

Table 6 | Emerging occupations in the manufacturing industry[76]

Emerging occupations	
• Artisan food and beverage producers	• Artificial intelligence and augmented reality system specialists
• Data architects	• DevOps engineers[77]
• Digital manufacturing engineers	• Electric vehicle assemblers
• Logistics analysts	• Robot operators
• Timber system designers	

Occupational and skill shortages will need to be addressed with a focus on core and technological capabilities

The industry will need to ensure that its workforce adapts to the increasing use of technology to achieve operational efficiencies and in designing new manufacturing processes.

The manufacturing industry currently faces shortages across all major sectors. Consultation highlighted that these shortages were chronic.[78] Production workers and traditional trades workers are required in a wide range of sectors. In addition, advanced manufacturing and the recreational vehicle subsector is driving demand for engineering and assembly workers.

A shortage exists when employers are unable to fill or have considerable difficulty filling vacancies for an occupation at current levels of remuneration and conditions of employment, and in reasonably accessible locations. In some instances, shortages in a specialisation within an occupation will show the occupation in shortage.

VSA consultations indicate that more occupations across Victoria will likely soon be in shortage, if they are not already at the moment. A list of occupational shortages in the manufacturing industry is shown in Table 7.

Table 7 | List of occupational shortages facing the manufacturing industry[79,80]

Occupational shortages	
• Brewers and distillers	• Estimators
• Fabricators	• Fitters
• Food and drink factory workers	• Industrial, mechanical and production engineers
• Recreational Vehicle product assemblers and engineers	• Sheetmetal trades workers
• Stainless steel fabricators	• Welders
• Wood and saw machinists	
Additional occupations as part of the National Skills Commission's updated Skills Priority List released on 06 October 2022[81]	
• Mechanical engineering technician	• Precision instrument maker and repairer

Occupational shortages	
• Engineering patternmaker	• Vehicle body builder
• Toolmaker	• Screen printer
• Picture framer	• Industrial spray painter
• Plastics technician	• Plastics production machine operator (general)
• Meat boner and slicer	• Slaughterer
• Motor vehicle parts and accessories fitter (general)	• Print finisher

Workers in the manufacturing industry will need to build general technological skills at all levels to adapt to increases in advanced manufacturing and productivity pressures. This will require workers to operate and maintain more complex machines and technologies including 3D printing, digital twinning, advanced robotics and automated machines. Specific technical skills will also be required to drive growth in artisan food and drink manufacturing.

In addition, workers will need to upskill in general management, literacy and numeracy. These general skills are required to support attainment of new skills associated with technological advancement and ensure that skills continue to match industry requirements. A highly skilled workforce will also make Victoria more attractive to manufacturing investors, given their high mobility. A list of specific skills shortages is shown in Table 8.

Table 8 | Skills shortages facing the manufacturing industry[82,83]

Skills shortages	
• Computer-Aided Manufacturing and Design	• Database user interface and query
• Digital capability	• Electrotechnology
• Enterprise resource planning	• General literacy and numeracy
• Leadership and management	• Mechatronics
• Medical and pharmaceutical technology	• Metallurgy
• Problem solving	• Robot operation
• STEM skills	• Welding
• Writing and interpreting hydraulics schematics	

Education and Training Pipeline

There were over 26,030 enrolments in manufacturing related VET qualifications in 2020 and 7,770 relevant enrolments in Higher Education in 2019.[84,85] This should translate to more than 14,940[I] students entering the workforce each year with relevant qualifications, presenting a significant opportunity to meet projected demand, although some will seek employment in other industries. For further detail, see the collaborative response toward the end of this report.

VET is a key pathway into manufacturing for specific roles

There are a high number of diverse VET pathways into the manufacturing industry. Many of these courses are in specialist areas such as meat quality inspection, custom-made footwear and sawmilling. VET will likely continue as an important channel of education supply to the manufacturing workforce, with 38 per cent of workers currently holding a VET level qualification as their highest level of education.[86] There are also a significant number of courses with low enrolments.

> In 2020, there were over 13,270 students in Victoria enrolled in manufacturing related Vocational Education and Training (VET) qualifications prior to commencing employment.

With 41 per cent of all workers having no post-school qualifications, on-the-job learning is critical for the success of the workforce.

Apprenticeships are an important part of the enrolment pipeline given their emphasis on skills acquisition in the workplace. They are government funded, consistent with the strong employment outcomes they generate.

The industry provides a diversity of opportunities, including for school leavers and mature-aged workers with no post-school qualifications, as well as higher skilled job opportunities. Enrolment activity is spread across different qualification levels. In 2020, there were a small number of enrolments in manufacturing related skill sets in Victoria.

VET Activity

People enrol in VET courses for one of three main reasons:

- to prepare for employment
- to support current employment
- to progress their careers within the industry.

This equates to training categorised as prior to employment; with employment (as an apprenticeship or traineeship) and upskilling once qualified as shown in Tables 9 to 13. The tables show the enrolments in 2020 VET courses on the Victorian Government's Funded Course List (FCL)[87] and the Victorian Funded Skill Set List (FSSL)[88] related to this industry and against each category. The enrolment numbers are drawn from Total VET activity (TVA) which comprises enrolments supported by public funding or by private contribution.

As part of preparing this report, industry representatives have provided their perspectives on the purpose of these qualifications, which is summarised in Figure 2 and helps to read Table 9 to Table 13.

[I] This number is determined by taking the total number of VET enrolments in courses undertaken prior to employment, combined with 1/3 of the total number of HE enrolments in AQF 5-8 courses (as these courses are traditionally undertaken prior to employment and the average bachelor degree is three years, so therefore only those in their final year of study will enter the workforce the following year).

Figure 2 | VET pipeline key

- 'AT' indicates a classroom-based course is also available as an apprenticeship or traineeship option
- 'Q' indicates industry values the course as a qualification
- 'SS' indicates industry values the course as a skill set
- 'EIR' indicates it is an Endorsed Industry Requirement as noted by industry
- 'OL' indicates the course leads to an Occupational License as noted by industry

Note: Industry has not provided feedback on all qualifications and where indicated; each value assignment can be reviewed in the future.

General manufacturing VET pipeline

There were 15,000 enrolments in general manufacturing related VET qualifications in Victoria in 2020. Table 9 sets out the VET pipeline for general qualifications that support entry into most manufacturing sectors.

Table 9 | VET pipeline for general manufacturing across all sectors in Victoria[m]

Prior to employment	
Qualifications (8,207 TVA enrolments 2020)	
Certificate II	**7,927**
Certificate II in Engineering (Q,AT,OL)	932
Certificate II in Engineering Pathways	207
Certificate II in Engineering Studies (Q,EIR)	6,788
Certificate III	**280**
Certificate III in Engineering - Electrical/Electronic Trade (Q,SS,AT,EIR)	122
Certificate III in Engineering - Fabrication Trade (Q,AT,EIR)	62
Certificate III in Engineering - Mechanical Trade (Q,AT,EIR)	93
Certificate III in Engineering - Production Systems (Q,AT,EIR)	<5
Certificate III in Engineering - Technical (Q,AT,EIR)	-
With employment (apprenticeship and traineeship)	
Qualifications (1,657 TVA enrolments 2020)	
Certificate II	**66**
Certificate II in Engineering (Q,OL)	66
Certificate III	**980**
Certificate III in Competitive Systems and Practices (Q,SS,EIR)	202
Certificate III in Engineering - Composites Trade (Q,EIR)	10
Certificate III in Engineering - Electrical/Electronic Trade (Q,SS,EIR)	<5
Certificate III in Engineering - Fabrication Trade (Q,EIR)	508
Certificate III in Engineering - Mechanical Trade (Q,EIR)	241
Certificate III in Engineering - Technical (Q,EIR)	8

[m] VET courses can support a range of occupations across a range of industries, and occupations can also support a range of industries. To present the likely VET trained employment pipeline by industry, enrolments for a course have been assigned to the most common industry in which people seek employment.

Certificate III in Process Plant Operations (Q,EIR)	8
Certificate IV	**586**
Certificate IV in Competitive Systems and Practices (Q,EIR)	169
Certificate IV in Engineering (Q,EIR)	12
Certificate IV in Engineering Drafting (Q)	<5
Certificate IV in Process Manufacturing (Q,SS,EIR)	403
Diploma	**25**
Diploma of Competitive Systems and Practices (Q,EIR)	25
Upskilling once qualified	
Qualifications (5,132 TVA enrolments 2020)	
Advanced Diploma	**676**
Advanced Diploma of Competitive Systems and Practices (Q,AT,EIR)	31
Advanced Diploma of Engineering (Q,EIR)	266
Advanced Diploma of Engineering Technology (Q,OL)	379
Certificate II	**47**
Certificate II in Competitive Systems and Practices (Q,AT,EIR)	44
Certificate II in Engineering - Production Technology (Q,AT,EIR)	<5
Certificate III	**829**
Certificate III in Competitive Systems and Practices (Q,SS,AT,EIR)	822
Certificate III in Engineering - Composites Trade (Q,AT,EIR)	<5
Certificate III in Process Plant Operations (Q,AT,EIR)	5
Certificate IV	**3,279**
Certificate IV in Competitive Systems and Practices (Q,AT,EIR)	935
Certificate IV in Engineering (Q,AT,EIR)	872
Certificate IV in Engineering Drafting (Q,AT)	122
Certificate IV in Process Manufacturing (Q,SS,AT,EIR)	1,268
Certificate IV in Process Plant Technology (Q,AT,EIR)	82
Diploma	**301**
Diploma of Competitive Systems and Practices (Q,AT,EIR)	124
Diploma of Engineering - Advanced Trade (Q,AT,EIR)	10
Diploma of Engineering - Technical (Q,EIR)	59
Diploma of Engineering Technology (Q,EIR)	45
Diploma of Product Design (Q,EIR)	63

Note: Enrolment figures in the table above are as reported by NCVER, Total VET student and courses 2020: program enrolment. There may be instances where program enrolments are not reported by providers to NCVER and therefore not included in the enrolment figures in the total VET training activity data. Total VET activity for 2021 is expected to be released in August 2022.

Food and beverage manufacturing

There were 5,780 enrolments in food and beverage manufacturing related VET qualifications in Victoria in 2020.

Table 10 sets out the VET pipeline for food and beverage manufacturing.

Table 10 | VET pipeline for food and beverage manufacturing in Victoria[n]

Prior to employment	
Qualifications (1,757 TVA enrolments 2020)	
Certificate I	**57**
Certificate I in Food Processing (Q)	57
Certificate II	**729**
Certificate II in Baking (Q,AT)	145
Certificate II in Food Processing (Q,AT)	431
Certificate II in Meat Processing (Abattoirs) (Q,AT)	10
Certificate II in Meat Processing (Food Services) (Q,AT)	133
Certificate II in Meat Processing (Meat Retailing) (Q,AT)	10
Certificate III	**929**
Certificate III in Baking (Q,SS,AT)	337
Certificate III in Bread Baking (Q,AT)	30
Certificate III in Cake and Pastry (Q,AT)	<5
Certificate III in Meat Processing (Boning Room) (Q,AT)	-
Certificate III in Meat Processing (Food Services) (Q,AT)	-
Certificate III in Meat Processing (General) (Q,AT,OL)	46
Certificate III in Meat Processing (Meat Safety) (Q,AT,OL)	10
Certificate III in Meat Processing (Retail Butcher) (Q,AT)	-
Certificate III in Meat Processing (Slaughtering) (Q,AT)	5
Certificate III in Meat Processing (Smallgoods - General) (Q,AT)	<5
Certificate III in Meat Processing (Smallgoods - Manufacture) (Q,AT)	<5
Certificate III in Patisserie (Q,SS,AT)	474
Certificate III in Wine Industry Operations (Q,SS,AT)	21
Certificate IV	**42**
Certificate IV in Meat Processing (Meat Safety) (Q,AT,OL)	42
With employment (apprenticeship and traineeship)	
Qualifications (3,039 TVA enrolments 2020)	
Certificate II	**726**
Certificate II in Baking (Q)	<5
Certificate II in Food Processing (Q)	311
Certificate II in Meat Processing (Abattoirs) (Q)	295
Certificate II in Meat Processing (Food Services) (Q)	96
Certificate II in Meat Processing (Meat Retailing) (Q)	22
Certificate III	**2,206**
Certificate III in Baking (Q,SS)	165
Certificate III in Bread Baking (Q)	396
Certificate III in Cake and Pastry (Q)	81
Certificate III in Food Processing (Q)	419
Certificate III in Meat Processing (Boning Room) (Q)	49
Certificate III in Meat Processing (Food Services) (Q)	194
Certificate III in Meat Processing (General) (Q,OL)	28

[n] VET courses can support a range of occupations across a range of industries, and occupations can also support a range of industries. To present the likely VET trained employment pipeline by industry, enrolments for a course have been assigned to the most common industry in which people seek employment.

Certificate III in Meat Processing (Meat Safety) (Q,OL)	<5
Certificate III in Meat Processing (Retail Butcher) (Q)	370
Certificate III in Meat Processing (Slaughtering) (Q)	72
Certificate III in Meat Processing (Smallgoods - General) (Q)	282
Certificate III in Meat Processing (Smallgoods - Manufacture) (Q)	96
Certificate III in Patisserie (Q,SS)	23
Certificate III in Wine Industry Operations (Q,SS)	28
Certificate IV	**107**
Certificate IV in Food Science and Technology (Q,OL)	<5
Certificate IV in Meat Processing (Leadership) (Q)	34
Certificate IV in Meat Processing (Meat Safety) (Q,OL)	34
Certificate IV in Meat Processing (Quality Assurance) (Q)	37
Upskilling once qualified	
Qualifications (983 TVA enrolments 2020)	
Certificate III	**567**
Certificate III in Food Processing (Q,AT)	567
Certificate IV	**349**
Certificate IV in Food Processing (Q,AT)	219
Certificate IV in Food Science and Technology (Q,AT,OL)	29
Certificate IV in Meat Processing (Leadership) (Q,AT)	71
Certificate IV in Meat Processing (Quality Assurance) (Q,AT)	30
Diploma	**67**
Diploma of Food Science and Technology (Q)	67

Note: Enrolment figures in the table above are as reported by NCVER, Total VET student and courses 2020: program enrolment. There may be instances where program enrolments are not reported by providers to NCVER and therefore not included in the enrolment figures in the total VET training activity data. Total VET activity for 2021 is expected to be released in August 2022.

Metals and equipment manufacturing

There were over 230 enrolments in metals and equipment manufacturing related VET qualifications in Victoria in 2020.

Table 11 sets out the VET pipeline for metals and equipment manufacturing.

Table 11 | VET pipeline for metals and equipment manufacturing in Victoria[o]

Prior to employment	
Qualifications (39 TVA enrolments 2020)	
Certificate III	**8**
Certificate III in Automotive and Marine Trimming Technology (Q,AT,EIR)	<5
Certificate III in Automotive Manufacturing Technical Operations - Bus, Truck and Trailer (Q,AT,EIR)	<5
Certificate III in Marine Craft Construction (Q,AT,EIR)	-
Certificate III in Surface Preparation and Coating Application (Q,AT,EIR)	-
Certificate IV	**9**
Certificate IV in Aeroskills (Avionics) (Q,AT,OL)	<5
Certificate IV in Aeroskills (Mechanical) (Q,AT,OL)	7

[o] VET courses can support a range of occupations across a range of industries, and occupations can also support a range of industries. To present the likely VET trained employment pipeline by industry, enrolments for a course have been assigned to the most common industry in which people seek employment.

Diploma	**22**
Diploma of Aeroskills (Mechanical) (Q,AT,OL)	22
With employment (apprenticeship and traineeship)	
Qualifications (184 TVA enrolments 2020)	
Certificate III	**158**
Certificate III in Automotive and Marine Trimming Technology (Q,EIR)	13
Certificate III in Automotive Manufacturing Technical Operations - Bus, Truck and Trailer (Q,EIR)	44
Certificate III in Marine Craft Construction (Q,EIR)	60
Certificate III in Recreational Vehicle Manufacturing (Q,EIR)	18
Certificate III in Surface Preparation and Coating Application (Q,EIR)	23
Certificate IV	**26**
Certificate IV in Aeroskills (Mechanical) (Q,OL)	26
Upskilling once qualified	
Qualifications (8 TVA enrolments 2020, <5 Skill Set enrolments 2020)	
Certificate III	**<5**
Certificate III in Recreational Vehicle Manufacturing (Q,AT,EIR)	<5
Diploma	**<5**
Diploma of Aeroskills (Avionics) (Q,AT,OL)	<5
Skill Set	**<5**
Course in the Use of Carbon Fibre in Composite Manufacturing (Q,EIR)	<5

Note: Enrolment figures in the table above are as reported by NCVER, Total VET student and courses 2020: program enrolment. There may be instances where program enrolments are not reported by providers to NCVER and therefore not included in the enrolment figures in the total VET training activity data. Total VET activity for 2021 is expected to be released in August 2022.

Wood and paper products manufacturing

There were around 60 enrolments in wood and paper products manufacturing related VET qualifications in Victoria in 2020.

Table 12 sets out the VET pipeline for wood and paper products manufacturing.

Table 12 | VET pipeline for wood and paper products manufacturing in Victoria[p]

Prior to employment	
Qualifications (7 TVA enrolments 2020)	
Certificate III	**7**
Certificate III in Sawmilling and Processing (Q,AT)	7
Certificate III in Timber and Composites Machining (Q,AT,EIR)	-
Certificate III in Timber Manufactured Products (Q,AT)	-
Certificate III in Timber Truss and Frame Design and Manufacture (Q,SS,AT)	-
With employment (apprenticeship and traineeship)	
Qualifications (47 TVA enrolments 2020)	
Certificate III	**38**
Certificate III in Timber and Composites Machining (Q,EIR)	12
Certificate III in Timber Truss and Frame Design and Manufacture (Q,SS)	26
Certificate IV	**9**

[p] VET courses can support a range of occupations across a range of industries, and occupations can also support a range of industries. To present the likely VET trained employment pipeline by industry, enrolments for a course have been assigned to the most common industry in which people seek employment.

Certificate IV in Timber Processing (Q)	9
Upskilling once qualified	
Qualifications (2 TVA enrolments 2020)	
Certificate IV	**<5**
Certificate IV in Timber Processing (Q,AT)	<5
Certificate IV in Timber Systems Design (Q,AT)	-
Note: Enrolment figures in the table above are as reported by NCVER, Total VET student and courses 2020: program enrolment. There may be instances where program enrolments are not reported by providers to NCVER and therefore not included in the enrolment figures in the total VET training activity data. Total VET activity for 2021 is expected to be released in August 2022.	

Table 13 captures the manufacturing pipeline for all other sectors. There were around 4,960 enrolments in VET qualifications that are related to other manufacturing sectors, not covered by the above manufacturing groups, in Victoria in 2020.

Table 13 | VET pipeline for other manufacturing sectors in Victoria[q]

Prior to employment	
Qualifications (3,249 TVA enrolments 2020, 11 Skill Set enrolments 2020)	
Advanced Diploma	**23**
Advanced Diploma of Jewellery and Object Design (Q,EIR)	23
Certificate II	**2,931**
Certificate II in Applied Fashion Design and Technology (Q,EIR)	931
Certificate II in Furniture Finishing (Q,SS,EIR)	<5
Certificate II in Furniture Making (Q,SS,AT,EIR)	329
Certificate II in Furniture Making Pathways (Q,EIR)	1,669
Certificate II in Glass and Glazing (Q,EIR)	-
Certificate III	**238**
Certificate III in Biomanufacturing Operations (SS)	11
Certificate III in Cabinet Making (Q,SS,AT,EIR)	45
Certificate III in Clothing and Textile Production (Q,AT,EIR)	132
Certificate III in Furniture Finishing (Q,AT,EIR)	-
Certificate III in Furniture Making (Q,AT,EIR)	-
Certificate III in Glass and Glazing (Q,AT,EIR)	34
Certificate III in Jewellery Manufacture (Q,AT,EIR)	-
Certificate III in Picture Framing (Q,AT,EIR)	-
Certificate III in Upholstery (Q,AT,EIR)	16
Certificate IV	**57**
Certificate IV in Textile Design, Development and Production (Q,AT,EIR)	57
Skill Set	**11**
Course in Biomanufacturing Pathways (Q)	11
With employment (apprenticeship and traineeship)	
Qualifications (1,503 TVA enrolments 2020)	
Certificate III	**1,467**
Certificate III in Cabinet Making (Q,SS,EIR)	1,219
Certificate III in Furniture Finishing (Q,EIR)	7

[q] VET courses can support a range of occupations across a range of industries, and occupations can also support a range of industries. To present the likely VET trained employment pipeline by industry, enrolments for a course have been assigned to the most common industry in which people seek employment.

Certificate III in Furniture Making (Q,EIR)	<5
Certificate III in Glass and Glazing (Q,EIR)	204
Certificate III in Jewellery Manufacture (Q,EIR)	13
Certificate III in Upholstery (Q,EIR)	20
Certificate IV	**36**
Certificate IV in Farriery (Q,EIR)	36
Upskilling once qualified	
Qualifications (201 TVA enrolments 2020)	
Certificate IV	**201**
Certificate IV in Clothing Production (Q,EIR)	70
Certificate IV in Custom-Made Footwear (Q,AT,EIR)	11
Certificate IV in Farriery (Q,AT,EIR)	<5
Certificate IV in Furniture Design and Technology (Q,EIR)	19
Certificate IV in Millinery (Q,EIR)	25
Certificate IV in Musical Instrument Making and Repair (Q,SS,EIR)	74

Note: Enrolment figures in the table above are as reported by NCVER, Total VET student and courses 2020: program enrolment. There may be instances where program enrolments are not reported by providers to NCVER and therefore not included in the enrolment figures in the total VET training activity data. Total VET activity for 2021 is expected to be released in August 2022.

Further, stakeholders identified 17 additional qualifications currently available that are also utilised to provide skill sets for the industry. Further consultation and review can determine appropriate changes moving forward.

Higher education related occupations will be in high demand but remain a comparatively small pathway to the industry

Higher education also supports pathways into the manufacturing industry, with 21 per cent of workers holding a degree or above as their highest level of education.[89] A higher education qualification is required in many engineering, supply chain and robotics roles.

Occupations in the industry that rely heavily on higher education qualifications are projected to grow over the next five years.[90] Due to the deep knowledge of (emerging) technologies and engineering that is required in these sectors, longer periods of study are required to enter the industry through higher education.

In 2019, there were over 7,770 enrolments across manufacturing related courses delivered by Victorian universities.[91] Noting that many of these courses serve multiple industries, the total Equivalent Full Time Student Load (EFTSL) numbers are reflective of this broader pipeline. The challenge faced by the manufacturing industry is to capture the required share of graduates as they compete with other industries.

The manufacturing industry pipeline in the higher education system is shown in Table 14. Only high enrolment courses with EFTSL over 100 are included.

Table 14 | Higher Education pipeline for manufacturing in Victoria, high enrolment courses with EFTSL over 100[92r]

Electrical and Electronic Engineering and Technology (3,086 EFTSL, Victoria, 2019)	
Australian Qualifications Framework (AQF) 9+ (e.g., Master and above) *(937 EFTSL)*	**AQF 5-8 (e.g., Diploma, Bachelor, Hons) *(2,149 EFTSL)***
Examples include: • Doctor of Philosophy (Electrical and Electronic Engineering) (129) • Master of Science (Network Systems) (109) • Master of Engineering (Electrical and Electronic Engineering) (109)	Examples include: • Bachelor of Engineering (Electrical and Electronic Engineering) (Hons) (1,000) • Bachelor of Engineering (Electrical Engineering) (Hons) (483) • Bachelor of Engineering (Computer and Network Engineering) (Hons) (115) • Bachelor of Engineering (Software Engineering) (Hons) (112)
Mechanical and Industrial Engineering and Technology (2,430 EFTSL, Victoria, 2019)	
AQF 9+ (e.g., Master and above) *(530 EFTSL)*	**AQF 5-8 (e.g., Diploma, Bachelor, Hons) *(1,900 EFTSL)***
Examples include: • Doctor of Philosophy (Mechanical and Manufacturing Engineering) (145)	Examples include: • Bachelor of Engineering (Mechanical Engineering) (Hons) (1,460)
Process and Resources Engineering (1,327 EFTSL, Victoria, 2019)	
AQF 9+ (e.g., Master and above) *(961 EFTSL)*	**AQF 5-8 (e.g., Diploma, Bachelor, Hons) *(366 EFTSL)***
Examples include: • Doctor of Philosophy (692)	Examples include: • Bachelor of Engineering (Chemical Engineering) (Honours) (172) • Bachelor Engineering (Chemical Engineering) (104)
Manufacturing Engineering and Technologies (925 EFTSL, Victoria, 2019)	
AQF 9+ (e.g., Master and above) *(325 EFTSL)*	**AQF 5-8 (e.g., Diploma, Bachelor, Hons) *(600 EFTSL)***
Examples include: • Master of Engineering (Manufacturing) (133)	Examples include: • Bachelor of Engineering (Advanced Manufacturing & Mechatronics) (Hons) (217) • Bachelor of Mechatronics Engineering (Hons) (204)

[r] A course may be allocated to different narrow field of educations by different higher education providers based on the primary purpose of the course. Higher education enrolments reported against a course under a specified narrow field of education reflect only the portion of enrolment allocated to the narrow field of education and are not reflective of the total enrolment for the course.

Workforce Priorities

Key workforce priorities centre on the attraction of workers and upskilling in technology

Key challenges exist to address the supply and skill of labour. Some challenges extend beyond the remit of the Skills Plan, such as industry awards and remuneration. Other challenges focus on fewer than required individuals choosing to enter the industry and difficulty retaining existing workers.

The manufacturing industry is undergoing a technological transformation, requiring the development of new skills and the establishment of new occupations. The occupational and skills shortages that follow this transformation are compounded by an ageing workforce, as well as poor public perception and awareness of the manufacturing industry.

The above challenges impact attraction of workers with diverse backgrounds to the industry, particularly young people and women. In an industry that faces high vacancies due to COVID-19, the attraction of new cohorts of workers to decrease staff workload and address production delays and withdrawals is imperative.

The Skills Plan identifies three key priorities for the manufacturing industry. Responsibility for delivering on this priority is shared across many stakeholders, however education and training has a key role to play (see next section for a proposed response to these priorities).

Upskill workers to move into more technical roles

The composition of the manufacturing workforce is shifting in favour of complex, bespoke and advanced manufacturing. The industry currently relies on a high volume of workers with no post-school qualifications who lack many of the skills required of advanced technology-driven activity.

The transition to advanced, technology-driven manufacturing necessitates new education and training pathways in emerging technologies and an increasing emphasis on data and digital skills. Preparing the existing workforce to transition into emerging occupations is essential to futureproof the industry. This should focus first on employees who do not have the ability to operate more complex machinery and computer processes.

The Victorian Government has existing support mechanisms that can assist impacted workers. Jobs Victoria supports people looking for work and connects employers with the staff they need. The Victorian Government's Skills and Jobs Centres provide expert advice on training and employment opportunities, particularly on referrals and job matching to local employment opportunities and help with career and training plans to support a successful career transition.

Finally, a digitally capable workforce is important in attracting investment from onshore manufacturers to achieve wider industry growth.

Table 15 | Areas of focus to upskill workers to move into more technical roles

- Manufacturing is shifting towards complex, bespoke and advanced manufacturing, increasing demand for higher order skills.
- The existing workforce lacks many of the skills demanded by new technologies and advanced manufacturing practices (specifically in relation to data and digital skills).
- Education and training responses lag industry demand for emerging and future skills.

Attract, retain and locate workers in manufacturing hubs across Victoria

The attraction and retention of workers to manufacturing hubs, particularly in regional locations, is a key priority for the industry. Manufacturing supports local economies and communities. Without a workforce, there is risk that existing manufactures will either shutdown or relocate at cost to community and businesses.

From a business perspective, operations in regional areas can be cheaper to run (e.g. rent, labour and other operating costs are lower than in metropolitan Melbourne), while offering greater proximity to supply chains and flexibility in operations (e.g. noise). The industry is challenged to build skills ahead of time to shape demand and attract manufacturing investment. The manufacturing industry is in a unique position where it can create value and scale globally – it is not limited to serving the local population. This growth potential highlights an important opportunity for the industry to build the workforce pipeline now to support the attraction of investors to Victoria.

Table 16 | Issues affecting the attraction, retention and locating of workers across Victoria

- There are very few student communities in regional and rural areas to provide a pipeline of future workers.
- Competition for workers from other industries such as construction impacts workforce supply.
- The industry is underpinned by specialist roles for which training is not always viable for providers to deliver.

Build the pipeline of new workers to meet immediate and emerging workforce needs

The challenge of meeting chronic workforce shortages remains and is acute in lower-level roles and specialised areas, compounded by strong competition from other industries (e.g., construction) for graduates with relevant skills. There is also a high need for emerging occupations in advanced manufacturing and robotics that is unlikely to be filled by the current training pipeline.

The manufacturing industry currently relies on an ageing workforce (estimated 13,600 retirements across Victoria by 2025) that is concentrated in ‘hubs’ across Greater Melbourne and regional Victoria, for example food hubs around Shepparton and Wodonga, equipment hubs in Kerang and timber and truss in Ovens Murray and Gippsland.

Impending retirements increases the risk of losing valuable knowledge from the industry. This expertise must be retained and passed on to the next generation of manufacturers.

There is also an imperative to attract new workers to address workforce shortages, particularly in these ‘hubs’. School leavers are an essential cohort who should be made aware of the wide range of opportunities across the industry, particularly in emerging areas. Mature-aged workers looking to re-skill and/or up-skill and skilled migrants should also be informed of opportunities across the industry, particularly in regional areas.

A larger pipeline will support the attraction of new manufacturing businesses to Victoria and achieve industry growth. It will also reduce competition for workers between sectors.

Table 17 | Areas of focus to build the pipeline of new workers

- There is low awareness of emerging areas of manufacturing, limiting the potential workforce to draw from.
- Pathways for new entrants do not fully support more diverse cohorts including women, mature aged workers and migrants.
- There are barriers to retaining the expertise of a specialised but ageing workforce for the purposes of education and training.

Collaborative response

The education and training response can support industry and attract the necessary pipeline to meet current and future needs

The education and training response has a key role to play in helping to address the three key workforce issues for the industry:

1. Upskill workers to move into more technical roles
2. Attract, retain and locate workers in manufacturing hubs across Victoria
3. Build the pipeline of new workers to meet immediate and emerging workforce needs

The education and training response should focus on building a pipeline of workers for entry-level roles that do not require specific qualifications. This should start by raising awareness and interest in the manufacturing industry at school.

A wide range of VET pathways are available to the manufacturing industry, with the number of courses available potentially causing confusion and fragmenting the potential pipeline of workers. Streamlined VET in school pathways should align with local industry need, which will assist students in identifying appropriate career pathways. This can position the industry to skill young workers for sustained careers in the industry, starting from when they are less likely to have significant personal or financial responsibilities.

To support industry growth, it will also be important to attract, retain and locate workers in hubs across Victoria. The education and training response should focus on building student communities in regional and rural areas. The response can also focus on making existing pathways more accessible for residents in these areas (either at entry-level or post-qualification), such as with remote learning or intensives, particularly for mature-aged workers looking to reskill and/or upskill, and skilled migrants.

> *"Building the pipeline needs to start in early secondary education… We need to capture the interest and awareness and get kids to consider manufacturing jobs of the future."*
>
> Skills Plan Consultation, Industry forum, March 2022

The education and training response should also support the existing workforce to upskill, particularly in digital and data capability. The industry requires workers to build baseline digital capability to support its growth ambition and prepare the workforce for transition. Workers with a higher baseline capability in data and digital skills are well-positioned for further training in specialised technical skills. An incremental approach allows workers to stretch in line with their capability and interest as they build over time. Short courses and micro-credentials could form an effective part of this response, along with on-the-job training. Close partnerships between industry and education providers (e.g., TAFE, Registered Training Organisations (RTOs) and universities) can support the development of a curriculum that keeps pace with the changes in technologies used by industry.

It will be important to consider how to support workers in entry-level roles to upskill when they may be reluctant to engage with and learn about digital technologies, often due to having limited exposure and thus, reduced capability. This will be very important in retaining workers that have spent their working lives in production or shop floor roles as these workers are vulnerable to redundancy, or they may pursue early retirement. A holistic approach to retraining that emphasises practical experience over a long period is likely to be more successful than a traditional classroom model.

As described above, there are sectors with high needs (e.g., robotics and advanced manufacturing) essential to achieving industry growth. Opportunities for growth and innovation would be well-

supported by universities with a strong research capability. This facilitates knowledge transfer between the research and business sectors.

There are also specialist pathways (e.g., metal casting, meat inspecting and certification, estimating, timber truss estimating and detailing and saw milling) that are vital to meet current industry needs. The education and training response needs to ensure continued availability and delivery of these courses. Central to this will be how to attract industry experts to deliver practical training in these sectors without compromising teaching quality. Industry experts are vital for bespoke manufacturing or in specialised roles where few trainers are available, which is most acute in key regional 'hubs'.

> *"The shortage of teachers needs to be reflected. How can you expect people to walk away from full-time well-paying jobs into something more marginal [like casual teaching employment]?"*
>
> Skills Plan Consultation, Industry forum, March 2022

Government and industry need to support industry growth

The education and training response alone cannot deliver on the three workforce priorities to improve how the manufacturing industry attracts and manages talent. It is critical that the response aligns with government and industry to support the training and skilling requirements necessary to meet future demand and deliver a coordinated response.

Consultation highlighted governments tend to invest in sectors with growth potential and a proven record of success. Chronic workforce shortages mean that the industry is limited in achieving overall growth. Sectors compete with each other for workers. Industry welcomes government support but cannot deliver outcomes without a strong pipeline of workers. It will, therefore, be important for government and industry to continue to target priority areas.

Consultation also highlighted the vital role of energy affordability in the manufacturing industry. As Victoria transitions to renewable energy, industry will face huge capital outlays to upgrade infrastructure and rising cost of fossil fuels in the interim. The industry is energy intensive and needs to work collaboratively with energy sectors to manage the transition.

Workforce planning initiatives to attract new workers and prospective students will also be important. Industry could improve mentoring and work experience to school aged students to connect them with career pathways and further study that aligns with industry needs. This will be vital in regional and rural hubs where communities are built around industry. Employers can also support upskilling through flexible work arrangements, formal recognition of on-the-job learning and study leave. This will assist in managing attrition and redundancy risks for the current workforce.

> *"The growth is there and if we can't support it… it will go offshore after we've spent all of this time bringing it onshore."*
>
> Skills Plan Consultation, Industry Forum, March 2022

Table 18 | Actions for consideration by education, industry, and government

- Industry needs to build the pipeline of workers by increasing awareness with school students, mature-aged workers and skilled migrants about careers in manufacturing.
- Streamline VET pathways to simplify course offerings while meeting industry needs. Through industry advice and the Manufacturing Industry Advisory Group, review key pathways to ensure they equip students for future as well as current skills needs.
- Support incremental upskilling to lift baseline workforce capability and enable workers to pursue specialised technical roles.
- Improve the attraction and retention of industry experts to deliver education and training, particularly for high growth and specialised qualifications.

Appendix A Data methodology

VSA Employment Model overview

The VSA Employment Model produces estimates of:

- projected employment growth between 2022 and 2025
- projected retirements between 2022 and 2025
- projected total new workers needed between 2022 and 2025.

Table 19 further defines the model outputs and identifies the primary source for each output.

Table 19 | Employment model outputs

	Employment growth 2022-25	Retirements 2022-25	New workers needed 2022-25
Definition	Change in the number of workers employed from 2022 to 2025	Workers expected to permanently leave the workforce from 2022 to 2025	Workers needed from 2022 to 2025 to meet demand from growing employment and to replace retirees
Primary source	Benchmarked to the NSC Employment Projections	Derived from retirement rates from Australian Census Longitudinal Dataset	The sum of employment growth and retirements

All outputs are modelled at the occupation, industry and region level:

- occupations are defined by 4-digit occupation unit groups in the Australian and New Zealand Standard Classification of Occupations (ANZSCO)
- industries are defined by 1-digit industry divisions in the Australian and New Zealand Standard Industrial Classification (ANZSIC)
- regions are defined by the nine Regional Partnerships of Victoria as outlined by the Victorian Department of Jobs, Precincts and Regions.

Benchmark data from the NSC give estimates of projected employment growth. Using an approach called iterative proportional fitting, the detailed occupation, industry and region breakdowns are generated by applying the distribution of employment in ABS Census and other data to the benchmark projections.

The model was developed by the VSA with the support of Nous and Deloitte Access Economics (DAE). The sections further below describe how the key outputs were modelled.

> The VSA Employment Model gives a best estimate of employment by industry, occupation and region. It provides an indication but does not, and cannot, tell the full story of the region's economy.

Employment growth, 2022-25

Source: *VSA and Nous (2022), modelling of NSC (2022) Employment Projections*

This modelling takes the NSC Employment Projections as the benchmark data for 2022-25 and breaks it down into occupation by industry by region tables.

The benchmark data sources provide 'control totals' for occupation, industry and region breakdowns independently. However, they do not provide the interaction between each of the variables. For example, they do not give the breakdown of occupations within industries.

Iterative proportion fitting uses a detailed 'seed' data table with the necessary breakdowns from a representative dataset and scales that distribution to control totals in the new dataset. Over many iterations, the seed data is transformed to sum up to the occupation, industry and region control totals.

The seed data comes from the ABS Census 2016. The control totals for occupation and industry come from the NSC's Employment Projections, and the control totals for region come from the NSC's Small Area Labour Markets data. Table 20 describes the inputs in detail.

The modelling results in:

- industry and occupation projections that align with the NSC Employment Projections
- regional data that matches the distribution across NSC Small Area Labour Markets
- industry by occupation by region data tables that approximate the distribution within the ABS Census 2016.

Table 20 | Data sources used to model employment growth from 2022 to 2025

Type	Data	Source
Seed	Employment x 3-digit industry (ANZSIC3) x 4-digit occupation (ANZSCO4) x Statistical Area Level 2 (SA2)	ABS, *Census of Population and Housing*, place of usual residence data
Control total	Employment x SA2	NSC, *Small Area Labour Markets*, 'SALM smoothed SA2 Datafiles (ASGS 2016) - March quarter 2022'.
Control total	Employment x ANZSIC1	NSC, *Employment Projections,* 2020-25
Control total	Employment x ANZSCO4	NSC, *Employment Projections,* 2021-26

Notes:

1. *Following the modelling, SA2 data is aggregated up to Regional Partnership region. Where an SA2 spans multiple regions, the estimates have been apportioned based on geographic area.*
2. *The NSC industry projection is often not available until some months after the occupation projections. As at May 2022, there were no 2021 to 2026 ANZSIC1 by state forecasts available. The previous release of 2020 to 2025 ANZSIC1 by state forecasts were used and scaled up to match the Australian total employment numbers in the ANZSCO4 forecasts.*

Retirements, 2022-25

Source: *VSA, Deloitte Access Economics (DAE) and Nous (2022), Retirement projections 2022-2025*

Retirements are estimated by applying occupation-specific retirement rates to the employment projections.

Using the Australian Census Longitudinal Dataset, an estimate of the size of the labour force aged 50 and over in 2016 was taken and compared to the size of the labour force aged 45 and over in 2011. After adjusting for migration, the gap is an estimate of retirements between 2011 and 2016. The relative age structures of occupations in the Census 2011 were then used to estimate retirements at the detailed occupation level (ANZSCO4).

The outputs were used to estimate an occupation-specific retirement rate, calculated as:

Retirement rate = retirements between periods t and t+1 / employment at t

The retirement rates were applied to the employment projections to estimate the number of retirements between 2022 and 2025 at the region (Regional Partnerships), industry (ANZSIC1) and occupation (ANZSCO4) level.

New workers needed, 2022-25

New workers needed is the simple sum of employment growth and retirements. It is calculated at the region (Regional Partnerships), industry (ANZSIC1) and occupation (ANZSCO4) level.

New workers needed is an estimate of demand for workers to join an industry, occupation or region. In this model, demand comes from growth in employment (as business, government and other employers expand their operations) and the need to replace retirees who leave the workforce.[s]

New workers needed is not an estimate of skills shortage. In the VSA Employment Model, demand is always met by supply of new workers who enter the work force from study, unemployment, migration, a change in industry or occupation, or other avenues.

This means that the VSA Employment Model is not suitable for identifying current or future skill shortages. The Victorian Skills Plan draws on the National Skills Commission's Skills Priority List and stakeholder feedback to identify skills shortages within industries and across Victoria.

[s] This will generally underestimate demand as it does not account for the need to replace workers who leave a job for other reasons, such as switching occupations or migrating out of Victoria.

Appendix B Victorian VET pipeline methodology

Enrolment numbers

Sources:
National Centre for Vocational Education Research (NCVER) (2021), Total VET students and courses 2020, available here.
Victorian Department of Education and Training (2022), Funded Course List, available here.
Victorian Department of Education and Training (2022), Funded Skill Set List, available here.

The Victorian VET pipeline table estimates the number of enrolments in each qualification and skill set for the 2020 academic year in Victoria. The NCVER total VET students and courses is used as the dataset. Only courses on the Victorian Funded Course List (FCL) and the Victorian Funded Skill Set List (FSSL) are included.

The following steps were taken to develop the table:

1. Each course was reviewed by IAG members and allocated to **only one** of three main reasons for studying: to prepare for employment; to support current employment (apprenticeship or traineeship); and to progress their career. Each course is then listed under their respective allocation.
2. The numbers of students who enrolled in that course in 2020 is then noted in the VET pipeline tables.
3. For courses that provide **an apprenticeship and traineeship option and a classroom-based option**, these courses are duplicated twice in the table, with enrolment numbers split across the other two options: the number of apprentice and trainee enrolments are reported under the header 'with employment (apprenticeship and traineeship); the number of classroom-based enrolments is shown under the purpose for completing the classroom-based option (either to prepare for enrolment or to progress their career). An ('AT') is noted next to these duplicated classroom-based courses to indicate they are also delivered as an apprenticeship or traineeship.
4. Where industry has provided feedback on the value of qualification or skill set, a ('Q') indicates it is valued as a qualification, while a ('SS') indicates it is valued as a skill set. A ('EIR') indicates it is an Endorsed Industry Requirement and ('OL') indicates it is an Occupational Licence. Industry has not provided feedback on all qualifications and where indicated; and each value assignment can be reviewed in the future.
5. Numbers are then totalled in their respective headers above. For the Skills Plan, the number of enrolments 'prior to employment' is a key focus for industry as it indicates how many students are being trained but are not yet employed.

The 2020 enrolment figures are a best estimate of the pipeline of workers for industry to draw on. The 2020 figures were the latest dataset available from the NCVER at the time of developing the Skills Plan and will be updated in future iterations of this document. They intend to provide an indication of the pipeline but do not and cannot tell the full story of workforce supply. Factors such as completion rates and the COVID-19 pandemic during 2020 are also likely to impact the availability of the future workforce.

Appendix C Stakeholder engagement process

Stakeholder engagements allowed VSA to test, update and validate the content of the Manufacturing industry insight report. Stakeholders from organisations in government, education and industry were engaged to provide input to the report and the Skills Plan more broadly. Specifically, stakeholders provided insight on economic outlook, workforce and skilling challenges and an education and training response across three rounds of consultations. Engagements guided initial thinking and research, as well as opportunities to test and revise the insights. We would like to thank the following organisations for their participation in the stakeholder engagement process. Table 21 lists the organisations involved.

Table 21 | Consultation participants

Organisation
Australian and New Zealand Pulp and Paper Industry
Australian Academy of Technological Science and Engineering
Australian Balustrade Association
Australian Cabinet and Furniture Association
Advanced Manufacturing Growth Centre
Australian Manufacturing Technology Institute Limited
Australian Foundry Institute
Australian Furniture Association
Australian Industry Group (Ai Group)
Australian Manufacturing Workers Union
Australian Steel Institute (ASI)
Australia Workers Union
Automotive & Transport Industry
Caravan Industry Association Victoria
Carpet Institute of Australia Limited
Department of Jobs, Precincts and Regions
Frame and Truss Manufacturers Association
Glaas Inc
GOTAFE
Jobs Victoria
Institute of Automotive Mechanical Engineers (IAME)
Manufacturing Industry Advisory Group
MGA/Timber Merchants Association
National Union of Workers
Specialised Textiles Association

Organisation
Swinburne University
United Workers Union
Victorian Automobile Chamber of Commerce
Weld Australia

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