

Advancing manufacturing

EXPLORING THE HUMAN
ELEMENT OF THE JOURNEY



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Further enquiries

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Executive summary

To inform a review of progress against the priority action areas (PAAs) outlined in *Advancing Manufacturing Skills: A Skills, Training and Workforce Development Strategy for the Manufacturing Industry in Queensland*, Jobs Queensland engaged Queensland University of Technology (QUT) researchers from the newly established Australian Robotics Centre (ACC) to conduct research on the progress against key PAAs and illustrate that progress with two case studies.

This report presents the key findings from those two case studies and supporting data from a series of sector stakeholder consultations. The report illustrates the opportunities and challenges faced by manufacturing organisations in Queensland as they progress toward Industry 4.0. The case studies provide exemplars for addressing four key PAAs identified in the *Advancing Manufacturing Skills Strategy* (2018).



PAA 1

Positioning the manufacturing workforce as a key player in the journey towards Advanced Manufacturing



PAA 2

Strengthening business capability of manufacturers



PAA 7

Building a highly skilled, adaptable and capable existing workforce



PAA 8

Increasing the diversity of the manufacturing workforce

Key findings

Technology investment

Investment in robotics, automation and digitisation is essential to remain globally competitive. Companies that are investing are expanding into new markets, new product lines or becoming more competitive in existing niche markets.

Investing in re-skilling

Automation is changing jobs. Continued investment in skilling the current workforce, however, ensures workers can be re-deployed and maintain a career in manufacturing. Such investment must happen both at the level of the organisation and sector-wide. More research is required to better support re-skilling and to address future challenges of digitisation in the workforce.

Expanding skill sets

Workers with a combination of qualifications (e.g. engineering) and 'craft' skills (e.g. welding or boilermaking) are most in demand. By supplementing university qualifications with trade knowledge and craft skills, designers and engineers are better able to understand problems, innovate and produce more practical solutions.

Training partnerships

Partnerships with educational institutions (e.g. schools, TAFEs and universities) and professional associations are essential to building the skills required in the future workforce. These partnerships are also critical to addressing labour shortages and attracting more diverse workers into manufacturing.

Re-branding manufacturing work

A communication and attraction strategy is needed to promote emerging career opportunities, driven by robotics, automation and digitisation, and to re-frame negative perceptions in the labour market about manufacturing jobs.

Diversity strategies require research

The number of women in manufacturing appears to be growing and the workforce is becoming more diverse (as noted by those working within it); however, increasing diversity seems to have largely occurred organically. There are few formal strategies to increase diversity and limited research on the barriers to creating a more diverse workforce. More research is required to support organisations and inform their future strategies, including attraction and retention strategies for under-represented groups such as women, workers with a disability, First Nations people and older workers.

Leader-driven organisational change

Senior leaders play a pivotal role in shaping organisational cultures in which technology has been embraced as a means by which the organisation can innovate. The behaviour and commitment of leaders drives the 'mindset shift' that is required for workers to embrace automation and digitisation not as a threat but as an opportunity to improve the way work is done.

Capabilities for managing the external environment

Manufacturing capability can be further strengthened by developing skills in dealing with the external environment of the business. For example, managing cash flow, accessing finance and investment, making timely adoption of technology, managing digital threats such as cyber attacks, negotiating or adapting to supply chain opportunities.



Project context

1. Purpose

Following the release of the *Queensland Advanced Manufacturing 10-year Roadmap*¹ in 2018, Jobs Queensland published *Advancing Manufacturing Skills: A Skills, Training and Workforce Development Strategy for the Manufacturing Industry in Queensland*.² To enable Queensland manufacturing to transition to Advanced Manufacturing, this Strategy identified 10 priority action areas (PAAs) for industry and government. In 2020, the Queensland Government announced the establishment of Manufacturing Skills Queensland (MSQ), an independent, not-for-profit industry body, to support employers, workers, apprentices, and trainees in the manufacturing industry through identifying and developing critical skills in the manufacturing sector.³

In preparing for the establishment of MSQ, Jobs Queensland commenced a review of *Advancing Manufacturing Skills: A Skills, Training and Workforce Development Strategy for the Manufacturing Industry in Queensland*, and of progress against the PAAs. To inform this review, Jobs Queensland engaged a project team from the newly established Australian Cobotics Centre (ACC) to conduct research on the progress against key PAAs and illustrate that progress with two case studies.

The project commenced in November 2021 and has QUT Human Research Ethics Approval (Approval Number 5024).

2. Project scope: PAAs reviewed

Of the 10 PAAs in the Strategy, this project investigated how the manufacturing industry has progressed and taken action against the following four of them:

- PAA 1: Positioning the manufacturing workforce as a key player in the journey towards Advanced Manufacturing
- PAA 2: Strengthening the business capability of manufacturers

- PAA 7: Building a highly skilled, adaptable and capable existing workforce
- PAA 8: Increasing the diversity of the manufacturing workforce.

The project describes progress against these PAAs through case studies of two exemplar organisations, B&R Enclosures and Watkins Steel-Holovision. The purpose of the case studies is to exemplify and communicate the Advanced Manufacturing Strategy to government and other stakeholders. The project also included consultation with eight manufacturing industry stakeholders to ensure that the case studies aligned with broader industry perceptions and experiences in relation to the four PAAs.

3. Method

Case studies

The project team selected the two case studies to represent diversity in manufacturing subsectors and organisational size and to show variance in the degree of progress toward Advanced Manufacturing processes. Importantly, the organisations had to be willing to participate in the project and have their organisation profiled as part of the Strategy Review, including being willing to openly share their experiences for the benefit of other Advanced Manufacturing organisations. Both organisations had previously provided input to the 2018 *Advancing Manufacturing Skills: A Skills, Training and Workforce Development Strategy for the Manufacturing Industry in Queensland*⁴ (referred to here as the *Advancing Manufacturing Skills Strategy*) and/or the *Queensland Advanced Manufacturing 10-year Roadmap*⁵ (referred to here as the *Roadmap*).

In consultation with Jobs Queensland, the team selected B&R Enclosures and Watkins Steel-Holovision as notable examples of innovative manufacturing companies. B&R Enclosures is also an industry member of the ACC.

1 State of Queensland. (2018). *Queensland Advanced Manufacturing 10-Year Roadmap and Action Plan: Invested in Queensland Manufacturing. Edition 2*. Department of State Development Manufacturing, Infrastructure and Planning, November 2018. https://www.rdmw.qld.gov.au/__data/assets/pdf_file/0016/1531024/advanced-manufacturing-roadmap-full.pdf

2 Jobs Queensland. (2018). *Advancing Manufacturing Skills: A Skills, Training and Workforce Development Strategy for the Manufacturing Industry in Queensland*. Ipswich: Queensland Government.

3 Minister for Employment and Small Business and Minister for Training and Skills. (2020). \$200 million to be invested in future training. *Media statement*, 01 December. Brisbane: Queensland Government. <https://statements.qld.gov.au/statements/91079>

4 Jobs Queensland. (2018). *Advancing Manufacturing Skills: A Skills, Training and Workforce Development Strategy for the Manufacturing Industry in Queensland*. Ipswich: Queensland Government.

5 State of Queensland. (2018). *Queensland Advanced Manufacturing 10-Year Roadmap and Action Plan: Invested in Queensland Manufacturing. Edition 2*. Department of State Development Manufacturing, Infrastructure and Planning, November 2018.

Data collection

The case studies were developed by analysing data gathered through worksite visits, observations, analysis of publicly available organisational information and through semi-structured interviews with senior managers, supervisors, and key stakeholders. The team conducted two site visits to the Heathwood, Queensland location of B&R Enclosures, and one visit to the Banyo, Queensland location of Watkins Steel-Holovision. Site visits provided context for the interviews and confirmed information provided in them.

The interview sample in each case organisation included, where available:

- The Chief Executive Officer
- The human resource manager
- Production managers
- Other members of the senior leadership team
- Managers and supervisors.

Six interviews were conducted with B&R Enclosures, and eight interviews with Watkins Steel-Holovision. Interviewees who gave consent to be identified have been named where context requires it.

To establish context for the case studies and identify common issues faced by Queensland manufacturers, the research team also interviewed key stakeholders in the Queensland manufacturing sector or sought their participation in focus group discussions. The data gathered through these consultations enabled the research team to assess the applicability of the issues arising in the case organisations to other organisations in the sector.

Stakeholders were identified through existing networks, and with a focus on regional locations and representatives from organisations that had contributed to the 2018 Advancing Manufacturing Skills Strategy. The stakeholder organisations included unions, education providers and industry associations such as Queensland Regional Manufacturing Hubs, Advanced Robotics for Manufacturing (ARM) Hub, METS Ignited, Resource Industry Network (RIN), Gateway to Industry Schools Program (GISP) (Advanced Manufacturing) and the Australian Manufacturing Workers Union (AMWU).

The team conducted six stakeholder interviews and two focus groups. A total of eight individuals representing six organisations participated. Three represented the perspectives of stakeholders in regional locations. Only stakeholders who have given their consent have been named in the case studies in this report.

Two separate case study reports have been developed, each featuring a specific organisation – B&R Enclosures and Watkins Steel-Holovision. The case studies provide exemplars of the advanced manufacturing journey.

Impact of COVID-19 on data collection

Interviews were conducted between late November 2021 and February 2022. The project team had initially intended to include workers in the interview sample, undertake interviews onsite and take images or video of the case organisation workplaces to support the case examples. Following the rise of COVID-19 cases in Queensland during this time, however, the project team, in discussion with the case organisations, agreed to limit site visits and undertake interviews online (using Zoom technology) to minimise the health risks to researchers, interviewees and their workplaces. Both case organisations also experienced staff shortages and supply chain pressures during this period. Worker interviews could not be conducted without placing further unnecessary pressure on manufacturing processes in each organisation. Regardless, the inclusion of supervisors and production team leaders in the sample provided insight into the perspectives of ‘shop floor’ employees.

Analysis and interpretation

For each case organisation, interviews were transcribed and analysed to identify common issues and themes relating to the four PAAs of interest. The Advancing Manufacturing Skills Strategy outlines a series of ‘actions’⁶ to be taken under each PAA. These actions formed sub-themes (action themes) under each PAA investigated during the interviews. The research team sought to identify issues, challenges, opportunities and examples relating to the following action themes under each PAA.

⁶ Jobs Queensland. (2018). *Advancing Manufacturing Skills: A Skills, Training and Workforce Development Strategy for the Manufacturing Industry in Queensland*. Ipswich: Queensland Government, pp. 68–74.



PAA 1 | Positioning the manufacturing workforce as a key player in the journey towards Advanced Manufacturing

- Sectoral communication about Industry 4.0
- Organisational culture - enablers and barriers to transition to Advanced Manufacturing
- Skills of leaders, change management and communication about transition
- Consultation between employers and employees
- Worker concerns and experiences of technology implementation



PAA 2 | Strengthening business capability of manufacturers

- Training and development available to owners and leadership teams
- University and executive programs for managing transition
- Short and focused skills development pathways (university and vocational education and training (VET))
- Funding options for upskilling and capability development
- Access to mentoring



PAA 7 | Building a highly skilled, adaptable and capable existing workforce

- Transparency and promotion of upskilling and re-skilling pathways
- Skill and qualification pathways outside VET and universities
- Nationally recognised qualifications and impacts of structural adjustment
- Foundational skills and 'soft skills' for transition to Advanced Manufacturing



PAA 8 | Increasing the diversity of the manufacturing workforce

- Active promotion and support of women in Advanced Manufacturing
- Information and support for manufacturers employing people with a disability
- Retention of older workers and/or retention and productivity of injured workers

While the research team explored all four PAAs during the interview process, not all action themes appear in each case study. All organisations are unique, and thus different issues were expected to emerge in each case organisation. Each case study is designed to illustrate the most notable technological developments, opportunities, challenges and illustrative examples of the PAAs that emerged most strongly in the case. Case studies are presented separate to this report.

In addition to analysis of the case organisation data, the research team analysed data gathered during consultations with sector stakeholders. The perspectives of these stakeholders were analysed and summarised using a similar approach to the case studies. The issues that emerged within each case were compared between cases and with emergent themes in the stakeholder consultations. Through this iterative approach to analysis, sector-wide findings emerged. These key findings are summarised in Section 4.

4. Conclusion and key findings

Despite being very different manufacturing businesses that have undergone quite different changes, B&R Enclosures and Watkins Steel-Holovision share some similar characteristics. Through technology implementation, including automation and digitisation, both organisations have expanded their products and markets. For both, competition, even in the local market, has been strongest from international companies. Innovation, whether it be in product lines, markets or processes, is considered by both companies to be essential if they are to be (or remain) globally competitive. To this end, both organisations have strategically invested in both technology and people. Such investment has included strong partnerships with educational institutions, coupled with a commitment to providing in-house skills development and on-the-job training. Both organisations seek to provide their employees with career opportunities, even as automation changes jobs.

A commitment to re-skilling and re-deployment is a notable characteristic of both organisations.

The two case studies are illustrative of the opportunities and challenges faced by manufacturing organisations in Queensland as they progress toward Industry 4.0. The case studies provide exemplars for addressing four key PAAs identified in the Advancing Manufacturing Skills Strategy (2018):

- PAA 1** Positioning the manufacturing workforce as a key player in the journey towards Advanced Manufacturing
- PAA 2** Strengthening business capability of manufacturers
- PAA 7** Building a highly skilled, adaptable and capable existing workforce
- PAA 8** Increasing the diversity of the manufacturing workforce

While each case organisation is unique, when viewed together they present some common themes, echoed in the views of key stakeholders from organisations that support and work across the sector (see below). From the collective data, some key findings emerge that can be summarised to inform the three focus areas of building the talent pipeline, managing change and growing the industry, that were identified in Jobs Queensland's recent review of the Advancing Manufacturing Skills Strategy⁷.

⁷ Jobs Queensland. (2022). *Advancing Manufacturing Skills Strategy Review*. Ipswich: Queensland Government.

Key findings



Technology investment

Investment in robotics, automation and digitisation is essential to remain globally competitive. Companies that are investing are expanding into new markets, new product lines or becoming more competitive in existing niche markets.

Investing in re-skilling

Automation is changing jobs. Continued investment in skilling the current workforce, however, ensures workers can be re-deployed and maintain a career in manufacturing. Such investment must happen at both the level of the organisation and sector-wide.



Expanding skill sets

Workers with a combination of qualifications (e.g. engineering) and 'craft' skills are most in demand. By supplementing university qualifications with trade knowledge and craft skills (e.g. welding or boilermaking), designers and engineers are better able to understand problems, innovate and produce more practical solutions.

Training partnerships

Partnerships with educational institutions (e.g. schools, TAFE and universities) and professional associations are essential to building the skills required in the future workforce. These partnerships are also critical to addressing labour shortages and attracting a more diverse workforce into manufacturing.



Re-branding manufacturing work

A communication and attraction strategy is needed to promote emerging career opportunities, driven by robotics, automation and digitisation, and to re-frame negative perceptions in the labour market about manufacturing jobs.

Diversity strategies require research

The number of women in manufacturing appears to be growing and the workforce appears to be ethnically diverse (as noted by those working within it); however, increasing diversity seems to have largely occurred organically. There are few formal strategies to increase diversity and limited research on the barriers to creating a more diverse workforce. More research is required to support organisations and inform their future strategies to attract and retain workers from under-represented groups such as women, older workers, First Nations people and workers with a disability.



Leader-driven organisational change

Senior leaders play a pivotal role in shaping organisational cultures in which technology has been embraced as a means by which the organisation can innovate. The behaviour and commitment of leaders drives the 'mindset shift' that is required for workers to embrace automation and digitisation not as a threat but as an opportunity to improve the way work is done.

Capabilities for managing the external environment

Manufacturing capability can be further strengthened, developing skills in dealing with the external environment of the business. For example, managing cash flow, accessing finance and investment, making timely adoption of technology, managing digital threats such as cyber attacks, negotiating or adapting to supply chain opportunities.



Sector-wide issues

In order to put the findings of the case studies in a broader Queensland context, additional stakeholder interviews were conducted. The stakeholder organisations included Queensland Regional Manufacturing Hubs (RM Hubs), Advanced Robotics for Manufacturing (ARM) Hub, METS Ignited, Resource Industry Network (RIN), Gateway to Industry Schools Program (GISP) (Advanced Manufacturing) and the Australian Manufacturing Workers Union (AMWU).

The following section presents a summary of common themes and examples emerging from the stakeholder interviews, organised around PAAs 1, 2, 7 and 8. These themes present issues for consideration at the sector level and include voices from regional manufacturing in Queensland.

The themes are synthesised from multiple respondents. Quotations or specific examples are attributed to individuals or organisations, as appropriate.





PAA 1

Positioning the manufacturing workforce as a key player in the journey towards Advanced Manufacturing

When speaking of the transition to Industry 4.0, two central themes emerged in stakeholder discussion. First, stakeholders suggest that a vision for the future is needed, in which workers can see a place for themselves and the future value and application of their skills. To achieve this vision, managers need a raft of strategic change management skills to engage workers. They also need to communicate, advocate and learn from other companies within the sector as a whole.

Workers central to Industry 4.0

Stakeholders suggest that workers in the current manufacturing workforce find it difficult to imagine a new role for themselves in the Industry 4.0 workforce. The perception that robots will result in unemployment is still widespread. Some suggested that the key to solving this problem is to recognise the cognitive abilities of workers in manufacturing trades. These skills and related knowledge may be transferrable to new technologies, new positions and new modes of working.

The ARM Hub representative suggests that the key to helping workers see their future work and to transition into it is through teaming traditional trade workers with engineers and other digital experts to tackle on-the-job challenges that can be solved by the application of advanced technology.

The GISP representative echoed these views, arguing that the future of Advanced Manufacturing lies not in technology but in the untapped potential of the human workforce.

To give workers the confidence that their skills will remain relevant, even as skills expand and develop, and that employment in the sector need not be threatened by automation and digitisation, leaders in manufacturing need to communicate a vision of Industry 4.0 where workers are central.

I think it's management and leadership, [that are key] because they're the ones that are going to drive where they think the business is going to go. At the end of the day, everything else is implementing that vision.

Representative, RM Hubs

Developing strategic change management skills in leaders

The need for change management skills in manufacturing leaders was a recurring theme in stakeholder interviews and the case studies. Change management skills are essential to help organisations cope with (sometimes rapid) growth, to effectively introduce different technologies and to support staff to adapt to new ways of working, which, in recent times, has included remote working. Leaders need to be aware that worker expectations and work styles are changing, and that this has implications for the recruitment and retention of workers.

Our biggest failure in leadership is the unused potential in our people. We have to put our people at the core of our business and make them happy. No longer is it about putting square pegs in square holes. [It's] understanding and loving your people enough to know what they need to get the best out of them.

**Customer Projects Manager,
B&R Enclosures**



Change management skills need to extend to strategic capabilities, such as design thinking and environmental scanning skills, that enable leaders to recognise and deal with new processes or issues that emerge as the environment and technology change. Risk management, contingency and scenario planning are critical.

... Understanding how to absorb information about trends and possible emerging futures is key for any business leader, especially in any competitive industry. [Leaders need the ability to do] a deliberate analysis of where they are, what the future holds and some of the trends that are applicable to them.

Representative, METS Ignited

Stakeholders observed that organisations that had considered risk scenarios and made contingency plans for their organisation to survive significant events were better prepared for, and able to respond to, the COVID-19 pandemic. Australian manufacturers, however, need more support to anticipate emergent challenges. There is, for example, a lack of awareness of the potential cyber security vulnerabilities organisations become exposed to as they digitise systems, and a lack of information about how to protect Advanced Manufacturing organisations from cyber attacks.

Communicating and leading across the sector as a whole

Business leader mentoring networks are considered very important to building capability across the sector. While mentoring programs for small businesses are offered in partnership with local government, most mentoring is informal, for example, when company leaders form relationships through participating in an accelerator or other industry group. The benefits of sharing experiences across organisations were acknowledged by stakeholders.

Organisations within clusters do perform better than those who are not, because there's opportunities for connection, informal conversations and formal mentor programs.

Representative, METS Ignited

Cross-organisational mentoring relationships also mean that companies become very familiar with each others' capabilities.

...When opportunities come across the door that may not necessarily be a fit for one company, that company knows another company can provide those, that service or product or can understand quickly how, if they partner with another company or several companies, they can provide the customer a combined solution.

Representative, METS Ignited

This benefits the customer and strengthens relationships between companies.

Having the ability to form partnerships and workable relationships is still very much a strength that any leader needs to have.

Representative, METS Ignited

New methods of providing mentorship are still needed, and these may involve further partnerships with educational institutions, for example, through embedding researchers in business or adopting cadet or internship models. Such partnerships facilitate reverse mentoring.

Reverse mentoring is where an organisation might be providing mentorship to a student or to another business that might be in a different area but they're actually getting equal benefit from the mentoring in both directions.

Representative, METS Ignited



PAA 2 | Strengthening business capability of manufacturers

Key themes that emerged in relation to strengthening the capabilities of Queensland manufacturers to transform to Advanced Manufacturing extended beyond the capability of the workforce or the skills of the leaders to highlight the challenges that have emerged as Queensland manufacturers grow and respond to environmental pressures, including the COVID-19 pandemic. Stakeholders discussed how technology has been used to expand manufacturing capabilities, but also how finding the right technology and accessing funding have posed challenges. The importance of 'business management' skills for growth, and the role that educational institutions and informal networks play in building the capability of manufacturing leaders were also discussed. The importance of sectoral level strategies to invest in new technology, emerging industries and research and development (R&D) was noted.

Rapid capability development

Capability to rapidly scale up manufacturing businesses has recently accelerated out of necessity during the COVID-19 pandemic. Vertical integration has increased and organisations, large and small, are leveraging digital technologies to both increase efficiencies within the business and pursue new opportunities. For example, mining equipment manufacturers previously provided equipment as a capital purchase. In recent years, they have moved to a new model of leasing equipment and providing value-added services, such as fleet management systems and integrated maintenance management systems, as part of the lease. Another example is a company that manufactures sensors which now also supplies the networking infrastructure, such as applications that the sensors can feed into, and analytical services. Rather than resulting in job losses, technology has supported the ability of manufacturing businesses to adapt to the challenges presented by the pandemic and to expand their capability.

In order to be competitive, [manufacturers] have developed capability in-house and extended their raft of products.

Representative, METS Ignited

Responding to the pandemic or other environmental pressures also presents specific challenges. Access to capital to make the necessary changes can be problematic, particularly if the organisation needs to move quickly. Government grants have been helpful for many manufacturers, but some are reluctant to apply for grants because of the time it takes, limited knowledge of the process or because of a lack of prior success.

Advanced technology adoption must 'fit' the unique needs of Australian manufacturers

Historically, manufacturing organisations' experience with technology has been to implement 'off-the-shelf' solutions that do not always address the unique needs or manufacturing conditions of Australian organisations, specifically small batch and micro-manufacturing. The technology is often not supported with concurrent training or re-training of the workforce and produces a reliance on the original technology supplier. Consequently, enthusiasm for robotic technology has been dampened, despite its possible benefits. Technology that 'fits' the varied needs of Australian manufacturers can be difficult to access, and poor fit can lead to hesitancy toward future technology investments.

Probably about 10 years [or 8 years] ago, there were a couple of fly-by-night salespeople that came into the region and actually got a few sales for robotic welders. But unfortunately, within a year and a half, those machines were sitting in the corner. They just weren't suited to the style of manufacturing that we do here.

General Manager, RIN

The ARM Hub and university-led organisations, such as the Australian Robotics Centre (ACC), provide one avenue for facilitating partnerships that address the bespoke needs of small batch manufacturers for the benefit of the whole sector.

Supporting manager skills development in business management

Regional manufacturers are mostly small (fewer than 20 staff), but many want to compete with big supply chain providers and to grow in scale. The training needs for Advanced Manufacturing are therefore not simply digital or technological but, rather, what could be called 'business management fundamentals'.

Many owners of small- to medium-sized enterprises (SMEs), particularly in regional areas, are tradespeople with limited formal business training. To move to Advanced Manufacturing, they need to develop business planning capabilities, learn ways to reduce waste and have access to knowledge of new processes and emerging technologies to produce specialised products and/or improve current production. In response to this gap in leadership capability, manufacturing hubs are introducing company director courses to the regions and offering accelerator programs designed to improve the business skills and knowledge of SME leaders. Development of business capabilities, such as lean manufacturing or strategic planning, is needed before building digital capabilities. Digital capabilities vary but could include anything from Enterprise Resource Planning systems to augmented reality (AR) and virtual reality (VR). There is also a growing recognition of the importance of data and data systems.

At the supervisor level, there is an identified need to improve generic management knowledge and develop process improvement capability.



We're linking with the manufacturing hub on programs around Advanced Manufacturing to link it with business skills and business improvement so that's the overall picture and how it all fits in together.

Representative, RM Hub

There is also a specific and growing need for manufacturing leaders of SMEs to have access to training and to develop skills in how to scale quickly, recruit skilled labour quickly and identify different funding options. Competition for qualified workers in robotics/mechatronics has been particularly strong in the robotics sector.

Working with universities and VET providers

Similarly, although university and vocational education and training (VET) target manufacturing competencies, having a combination of practical experience, deep knowledge and capability is also important. This is especially true in leadership education for Advanced Manufacturing, as well as for the need to build digital capabilities and prepare the current workforce and future graduates for emerging roles in Advanced Manufacturing. A digital translation/transformation/digitisation consultancy ecosystem has emerged to serve this need. At present, some of the leadership training needs are met by external management consultants who offer tailored training, but there are opportunities for online courses and masterclasses. This may be achieved by universities and/or VET providers partnering with industry experts to deliver joint training.

The transition to Advanced Manufacturing needs sectoral level strategies

To have a realistic strategy for transition to Advanced Manufacturing, there needs to be a real recognition that the manufacturing industry needs to survive and to grow into new supply chain opportunities. The AMWU representative argues that a holistic approach is needed that involves two key strategies:

- Stimulating investment of private capital in upgrading equipment and investing in machinery, research and development, and the advanced technologies of Industry 4.0
- Making more effective use of public resources such as TAFE and CSIRO to spur innovation, support startups and identify and create new industry opportunities.

Emerging industries provide an important context to understanding the trajectory and training needs of many regional manufacturers. For example, the hydrogen sector needs different kinds of trade skills, such as pressure welding.



PAA 7

Building a highly skilled, adaptable and capable existing workforce

Queensland manufacturers are facing challenges in accessing sufficient labour, and the required skills to address current needs, especially in regional areas. Manufacturers are concerned that these shortages will continue in the future. Automation and digitisation are not expected to significantly reduce these gaps, and trade or 'craft' skills will remain in demand. A sector-wide retention and attraction strategy is needed, supported by a dual approach to skill development that includes industry-led qualification and training partnerships, and organisation-specific development programs.

Labour and skills shortages

Skills shortages were identified by a range of stakeholders as a priority in Queensland regions. This skills gap has been further exacerbated by the closure of borders and cessation of international skilled migration throughout the COVID-19 pandemic. The increase in domestic migration to Queensland during the pandemic was not identified by stakeholders as having mitigated this gap.

A sector-wide retention and attraction strategy emerges as critically important. Such a strategy needs to consider how the sector can offer new models/approaches to work (such as a four-day working week or greater levels of flexibility) and support new entrants and those that wish to re-skill with new ways to provide rapid skill development and certification (such as micro-credentials or short courses).

Attraction and retention strategies need to address the perception that manufacturing jobs are 'dumb, dirty and dangerous' (representatives, RM Hub and GISP), with limited career progression and insecure or at risk of automation.

Despite a decline across Australia, employment in manufacturing in Queensland increased by 3.4% in the March 2021 quarter,⁸ possibly driven by R&D, diversifying into new markets, a focus on niche, customised products and bringing previously outsourced processes/components back in-house.

Most manufacturers that I've seen do this have tripled their payroll. They've put on three times more people. Their business is going gangbusters.

Representative, GISP

Although the long-term trends have been towards reduced employment in manufacturing, there is now a wide variety of careers and new roles emerging. For example, careers are available now for business development managers, digital marketing and social media specialists, roles in 3D printing, programming, technicians, electrical engineers, mechanical engineers, as well as for roles such as boilermakers, welders and fitters and turners. Digital skills are becoming increasingly important with automation and are driving new (or more) jobs in roles such as chief digital officer or chief data officer, dedicated software security, privacy officer, dedicated workforce health officer, smart contracting staff, supply chain positions, sales, aggregated supply roles and chief carbon officer.

Skills shortages remain, however, in many of the traditional roles. Specific skills shortages cited by sector stakeholders includes the need for better accreditation, particularly in welding, ISO 9606 (important to some Defence contracts), skills in boilermaking, detailed technical drawing, fabrication and fitting and turning.

⁸ Queensland Government Statisticians Office. (2021, March). *Employment by Industry, March quarter 2021*. Brisbane: Queensland Government. <https://www.qgso.qld.gov.au/issues/3401/employment-industry-202203.pdf>



'Craft' skills will remain in demand

In contrast to the view that automation will kill off traditional trade skills, combining trade or 'craft' skills with formal higher education qualifications is considered critical to building the problem-solving and innovation capabilities required for Industry 4.0. For example, one company:

...Hired a graduate engineer with excellent technical skills, but found he wasn't able to troubleshoot because he wasn't aware of the practical implications. They supported him to complete a welder certificate so he could understand practical knowledge.

Representative, RIN

Development of the workforce will require building on existing qualifications with trade skills or, conversely, building on trade skills with higher qualifications in areas such as programming. One example is the Diploma of Applied Technology offered through a North Queensland hub.

It was very much designed to provide current tradespeople in manufacturing with some extra skills around high-level technology skills, understanding programmable logical controllers (PLCs), understanding a lot more computer-aided design (CAD) / computer-aided manufacturing (CAM), high-end stuff, and that's been very effective, to the point where it looks like being put on - hopefully on the skills priority list and being funded to take to [the] wider market in the next 18 months.

Representative, RM Hub

Industry-educator partnerships are essential for future skills

Addressing skills shortages and developing future skills must be driven by industry in partnership with education providers and professional associations. Innovative approaches and new modes of formal education coupled with on-the-job training experiences are needed. Such programs are beginning to emerge. For example, the Ai Group in partnership with TAFE Queensland have formed a platform to develop training programs relevant to the future of manufacturing. These are, however, usually targeted at specific segments of workers with specific needs and funding support, such as former Australian Defence Force employees or First Nations trainees. Regional hubs are working with local university engineering schools and TAFE colleges to develop micro-credentials, in an effort to provide local workers with an enhanced skillset. Opportunities for professional associations are emerging to extend existing accreditation programs or memberships within the sector.

Schools play a critical role in the provision of future labour; however, stakeholders believe a lack of communication on the variety of careers and the type of work now available in manufacturing is contributing to declining interest in a career in manufacturing. More investment in working with school counsellors, teachers and students is needed to educate the future workforce on career opportunities and reframe the sector, highlighting the diversity of the workforce and of interesting, technology-driven jobs available now and in the future.

If we don't start letting these schoolkids understand there is a future of manufacturing, there will be no people coming through to work in manufacturing. You can have a building full of robots but if you don't have someone to program them, maintain them, link them, understand what they do and actually understand the quality of what needs to be produced, then you/the technology is dead.

Representative, RM Hub



Partnerships and ongoing engagement between industry, TAFE, schools, universities and professional associations are essential for future labour supply and to form the infrastructure for training that will address rapidly changing skill requirements in the sector. Such partnerships will require a variety of delivery modes and hybrid training models that combine both onsite and offsite experiences.

Company investment in skills

The issue of skills development needs to be considered as a part of each organisation's business strategy and workforce plan. Without that holistic perspective of the interactions between technology adoption, skills and labour shortages, investment in training and skills may not be a high priority.

A lot of manufacturers for ... well, for a very long time, if ever, haven't invested in their workforce.

Representative, GISP

Others, however, provide significant investment in developing their existing workers and new entrants to grow the workforce of the future.

97% of my industry partners, if a young person commits to a trade pathway, they invest in the student returning to university to do ... engineering, mechatronics, robotics, etc. ... they make for better engineers, general managers, salespeople etc. ... they are better at whatever they decide to go on to with foundational learning.

Representative, GISP

Many manufacturing organisations are turning to in-house training solutions, including job rotation, on-the-job training and formalised 'buddy' or mentor systems.



PAA 8 | Increasing the diversity of the manufacturing workforce

Stakeholders acknowledged that diversity is healthy for any organisation and accessing a more diverse workforce will help address some of the labour and skills shortages identified earlier. While gender diversity in Queensland manufacturing appears to be improving, strategies are needed to provide a more targeted and sustainable approach to further diversifying the manufacturing workforce. Strategies that can improve the participation of other under-represented groups, such as First Nations people, people with a disability and older workers, are also needed.

Gender diversity

Stakeholders suggest that more women have been entering the manufacturing workforce, although there is a recognition that significantly more needs to be done to achieve gender parity. Women tend to be concentrated either in business roles or in unskilled work where a lack of trade qualifications is not a barrier to advancement. In these jobs, gender diversity is more balanced. There are far fewer women in management roles in manufacturing organisations than in other sectors. A detailed analysis of the gender diversity within each trade may be useful to understanding gender segregation in manufacturing. More research on the experiences of young women in apprenticeships and how that varies between trades or roles is also required.

Similarly, it is necessary to understand the barriers to women's progression into management in manufacturing. For instance, little is known about instances of sexual violence or sexual harassment in the sector, or other reasons why women might leave it. This research is necessary to inform strategies designed to attract and retain women in the manufacturing workforce and to ensure that manufacturing-related education and training programs support a more diverse future workforce.

There is recognition that promoting opportunities for women to see manufacturing as a real and rewarding career begins in schools. Programs that are already beginning to address this need include the Women Who Weld program. This program provides a one-day Metal Inert Gas (MIG) welding course for female school students, and seven out of nine females at the participating schools are now selecting engineering pathway subjects for their future study.

It was noted that while some of the larger companies have formal strategies to achieve gender parity in all parts of the company, most smaller companies do not formally pursue diversity but 'are open to anyone capable of doing the role.

Representative, METS Ignited

Diversity beyond gender

Much of the diversity emphasis in the sector is on gender; however, diversity extends to age, ethnicity, cultural diversity, (dis)ability and neurodiversity. Issues associated with an ageing workforce were not raised by many stakeholders. When discussing older workers, the most common (albeit still infrequently) mentioned strategy was transitioning to retirement through reduced hours or moving to part-time work. One stakeholder explained how this can be successful in unexpected ways, describing an employee considering retirement who instead moved into a part-time data science role and, because of their organisational and manufacturing knowledge, eventually set up a large and successful data science team whose organisational contribution was attributed to the diversity of the team.

Another example of an innovative diversity initiative was introduced by a manufacturing hub, targeted at the 700 to 800 people who leave their Australian Defence Force career each year.



Developed in conjunction with TAFE North - [the hub has] a Veterans program happening, which is very much entry level, supported by Weld Australia, which will be entry level because 700 or 800 exit Lavarack Barracks in North Queensland every year [yet] manufacturing has never been on their radar.

Representative, RM Hub

Some SME manufacturers have adapted processes to support diverse talent, including changing the work environment to attract talented people with a disability. One example includes a company that has hired people with a disability to undertake the voice and interpretive aspects of social robots in the suburban setting so the robot is the extension of the person with a disability (representative, GISP).

Neurodiverse workforces can also provide benefits to manufacturing companies, particularly by bringing in truly different ways of thinking that encourage innovation.

We have examples of high autism in high-precision machining. ...We need to look at the roles and the skills required, including 21st century transferable skills ... What one person could consider dull ...a neurodivergent person could be very suitable, in particular, for what we would consider repetitive roles. Robots are just taking the dirty and dangerous roles.

Representative, GISP

In summary, the issues presented in the two case study organisations are illustrative of many sector-wide issues that emerged in consultations (focus groups and interviews) with representatives from stakeholder organisations across the manufacturing sector. The stakeholder perspectives allow the case studies to be put in context and show that many of the themes in the case studies are common in the sector. That is, the issues and opportunities identified in the two case studies are evident in many Queensland manufacturers, as testified by key informants who interact with a broad range of companies.

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