Mining and Automotive
Skills Alliance

Excerpts

The Missing Middle

Investigating the Potential of Vocational Degree Models in the Mining and Automotive Sectors

Phase One Final Report

June 2025

Mining and Automotive Skills Alliance

Abbreviated Contents

Acknowledgement of Country

In delivering this research, we acknowledge the Traditional Custodians of the lands on which we live and work.

We acknowledge Traditional Custodians of Country throughout Australia and their connections to land, sea, and community

Executive Summary

This report presents the outcomes of Phase One of the AUSMASA Vocational Degree project, led by the Australian Minerals and Automotive Skills Alliance (AUSMASA). The initiative was established to investigate the feasibility of introducing Australian Qualifications Framework (AQF) Level 7 vocational degrees to address persistent workforce challenges in the mining and automotive sectors. These challenges include shortages in mid-career technical and applied professional roles that fall between trade qualifications and university-level engineering programs. The project aligns with national skills priorities in clean energy, sovereign manufacturing, and industrial innovation, and responds to the need for qualifications that more effectively support workforce development in strategically significant sectors.

The project adopted a structured, multi-stage methodology. It commenced with a comprehensive literature review of Australian and international models for higher-level vocational education. This review identified critical gaps in the tertiary education architecture, particularly for applied professional roles that require both technical depth and workplace experience. Drawing on case studies and pilot initiatives from other jurisdictions, the review identified three potential models for delivering AQF 7 vocational qualifications: Dual Studies Programs, Professional Degree Programs, and Competency-Based Higher Vocational Programs.

The Dual Studies model integrates structured academic education with extended periods of workplace-based learning, delivered through strong partnerships between education providers and employers. It provides students with job readiness, financial accessibility through paid placements, and curricula co-designed with industry. While this model is well suited to sectors such as mining and automotive, it relies on significant employer participation to ensure placement consistency and quality.

The Professional Degree model prepares individuals for occupation-specific roles that require both academic learning and applied practice, often aligned with the standards of professional bodies. This model supports structured pathways into emerging roles, such as the reliability and testing engineer in mining, by blending academic rigour with practical oversight, enabling cross-sector mobility and supervisory capability development.

The Competency-Based Higher Vocational model, aligned with apprenticeship-style learning, focuses on demonstrating mastery of job-relevant skills. It provides flexible, personalised pathways supported by workplace integration and digital learning systems. While compatible with Australia’s Vocational Education and Training (VET) sector strengths, implementing this model at AQF Level 7 would require broader system reforms in regulation, funding, and quality assurance.

While these models offer potential, their relevance must be tested and refined in the Australian context. Australia's regulatory settings, industrial frameworks, and education systems differ markedly from those in Europe or the United Kingdom. For any model to succeed, it must preserve the VET sector’s strengths in applied learning while meeting the academic and quality standards required at AQF Level 7. It must also ensure policy alignment, recognition of qualifications, and equitable access for diverse learners. The literature review and consultation processes were therefore structured to inform future development, should the project progress to a qualification design phase.

Consultation was conducted through ten face-to-face workshops in three states, one national online workshop, and targeted interviews with employers, training providers, Jobs and Skills Councils, and professional associations. These engagements sought to determine whether existing qualifications adequately meet current and emerging workforce needs and where they do not, to understand the nature of the gaps, and to determine what types of solutions, including higher-level vocational qualifications, may be required.

The consultation revealed high coherence across stakeholder views despite the diversity of roles and industries. Several recurring themes emerged:

Workforce Development and Skills Requirements - Stakeholders emphasised the need for higher-level technical skills in automation, robotics, data analytics, and renewable energy systems. The focus was on developing applied capabilities in real-world problem-solving, with strong mathematical foundations and fine motor skills.

Industry and Educational Alignment - There was strong support for workplace-embedded training models and demand for modular, stackable pathways that support trade-to-degree transitions. Recognition of prior learning and flexibility were seen as essential for career progression and learner retention.

Digital Competency and Emerging Technologies - As workplaces adopt automation, AI, remote operations, and telemetry, digital fluency has become a core requirement for technical roles. Skills in cybersecurity, systems integration, and data interpretation are now critical for mid-career professionals.

Employer and Learner Investment - Employers sought training that delivers clear productivity outcomes, while learners valued flexible delivery, clear advancement pathways, and recognised credentials. Qualifications must balance academic credibility with practical relevance to attract and retain learners.

Qualification Structure and Relevance - Qualifications must be agile, with curriculum structures that can respond to rapid technological change. Stakeholders called for multidisciplinary content and cross-functional learning to meet evolving industry requirements.

Teaching, Learning, and Assessment - There was concern that overly academic models would not suit the learner cohort. Stakeholders advocated for authentic, workplace-aligned assessment strategies and investment in industry-experienced educators.

Inclusion and Cultural Responsiveness - Access and equity were viewed as critical. Any new qualification must be designed to accommodate Indigenous learners, neurodiverse individuals, and those in regional and remote areas through culturally safe and inclusive delivery.

Funding, Industrial Relations, and Regulation - Challenges were identified in relation to funding mechanisms, accreditation requirements, and licensing variability. Stakeholders called for coherent national frameworks that ensure industry recognition and qualification portability.

System Reputation and Strategic Communication - There was strong support for positioning a vocational degree as a prestigious and practice-oriented alternative to university education, helping to elevate the status of the VET sector and attract high-calibre learners.

Workshop discussions confirmed widespread and increasing skills gaps across both sectors. In mining, roles such as reliability engineers, instrumentation technicians, geotechnical specialists, and planning personnel now demand capabilities well beyond trade-level qualifications. These include data analysis, systems diagnostics, and predictive maintenance. In automotive, skills gaps were reported in high-voltage safety, EV systems, battery diagnostics, and software-based troubleshooting. Roles such as EV specialists, diagnostic technicians, and workshop managers were cited as lacking clear training and progression pathways.

These gaps reflect not just changing technologies but systemic issues. Both sectors lack structured qualifications that support progression from trade into mid-career applied professional roles. Where upskilling occurs, it is typically unaccredited or employer-led, reducing career mobility and placing a training burden on individual businesses. Current Certificate III and IV qualifications, while foundational, are no longer sufficient to meet the full scope of workforce needs. Meanwhile, university degrees often do not provide the applied or workplace-integrated experience needed for field-based technical roles. As a result, industries face a bottleneck in talent development that threatens productivity and innovation.

Opportunity and Feasibility Analysis

Based on the findings from the national consultation process and the supporting analysis, this project identified a series of critical and growing skills gaps affecting mid-level technical roles in both the mining and automotive sectors. Across all workshop locations, stakeholders consistently reported a widening disconnect between existing training outcomes and the industry's evolving demands, particularly in areas influenced by electrification, automation, and digital diagnostics.

In the mining sector, capability shortfalls were most pronounced in reliability engineering, instrumentation, systems integration, and advanced diagnostics. Industry participants noted that roles including geotechnical technicians, metallurgical technologists, and mine planning personnel now demand competencies that extend significantly beyond the scope of traditional trade-level qualifications. These roles increasingly require applied analytical reasoning, systems thinking, and fluency in digital tools for monitoring, modelling, and optimisation of plant and operational performance.

The automotive sector has experienced a parallel shift in expectations, driven by the rapid emergence of electric vehicles, hydrogen fuel systems, and complex electronic platforms. As a result, technician roles now require advanced skills in high-voltage safety protocols, software-based diagnostics, battery management systems, and whole-of-vehicle systems integration. Employers and trainers highlighted a lack of structured pathways into advanced roles such as EV specialists, diagnostic engineers, and workshop managers. This gap has created persistent challenges in recruiting and progressing talent within the sector.

Importantly, the skills gaps identified are both technical and structural. Both sectors reported an absence of job-embedded, formally recognised pathways that allow experienced workers to transition into new applied professional roles. Existing Certificate III and IV programs remain foundational to entry-level workforce development but are no longer sufficient to meet the growing complexity of mid-career roles. At the same time, higher education offerings are often perceived as too theoretical or disconnected from these positions' practical, field-based requirements. The combined effect is a talent bottleneck; whereby even highly capable workers face significant barriers to progression without resorting to informal or employer-specific upskilling mechanisms.

This analysis reinforced the view that new solutions are required, particularly higher-level vocational qualifications that combine substantial technical depth with structured workplace integration. These qualifications would enable workers to acquire the applied knowledge, supervisory capability, and interdisciplinary skills needed in modern industrial environments.

The opportunity analysis undertaken through this project aimed to determine the extent to which current educational offerings address workforce requirements, and where they fall short, to define the nature of those gaps and identify appropriate qualification responses. Through consultation and supporting research, a range of mid-career roles were identified in both sectors where formal qualifications are absent, outdated, or poorly aligned with contemporary skill requirements. These included geotechnical and metallurgical technicians, reliability and testing engineers, master technicians, diagnostics experts, and EV technologists.

To evaluate these opportunities, the project applied a structured framework that considered factors such as current and projected workforce demand, the alignment of roles to national priorities (including critical minerals, clean energy, and sovereign manufacturing), and the feasibility of delivering new qualifications at AQF Level 7. Key data sources included the Jobs and Skills Australia Priority List, workforce plans, consultation findings, and the existing qualification ecosystem. The analysis focused on roles between trade-level training and university degrees, especially those requiring deep technical knowledge and a capacity for problem-solving, supervision, and integration of digital tools in operational contexts.

Findings confirmed that there is a persistent and widening training gap for these applied professional roles in both sectors. Particularly in fields affected by technological transformation, such as automation, digital systems, and electrification, industry increasingly relies on informal training or OEM-specific product courses. These arrangements may address short-term capability needs, but they do not provide recognised credentials or support long-term workforce mobility and retention. A higher-level vocational qualification, delivered as a standalone degree or as part of a nested or articulated model, could address this problem by providing a portable, credible, and scalable means of recognising and developing mid-career capability.

Of the roles assessed, the reliability and testing engineer in the mining sector emerged as the most viable candidate for targeted qualification development. This role cuts across traditional engineering and technical domains, encompassing asset reliability, performance analysis, risk management, and digital diagnostics. Despite its critical importance, it remains largely undefined within existing training structures and is not recognised as a discrete occupation within ANZSCO. Stakeholder feedback strongly supported the need for a qualification that could provide both technical depth and practical capability, tailored to the operational requirements of modern mining environments.

The feasibility analysis conducted during this project evaluated the strategic fit and implementation potential of AQF Level 7 vocational degrees across both sectors. The analysis applied consistent criteria to assess demand drivers, skills needs, workforce readiness, and the potential for delivery through current institutional frameworks. It also considered new programs' sustainability, the required policy alignment, and the scalability of proposed models across industry.

The reliability and testing engineer role in the mining sector was confirmed as the strongest candidate for immediate development. It is currently undersupplied, highly relevant to future industry capability, and represents a clear occupational gap not served by either vocational or higher education pathways.

The role supports strategic industry goals in critical minerals and asset performance optimisation, and aligns with national imperatives in energy transition, safety, and productivity. The analysis found that the skills required by the role map well to the competencies and outcomes expected at AQF Level 7, and that a vocational degree could provide the structure and rigour needed to support professional development and cross-sector recognition.

In contrast, the automotive sector presented evidence of significant skill shortages and transformation needs, but did not identify a single role with the same degree of demand clarity or qualification gap as in mining. Rather, the analysis revealed a cluster of roles, particularly in electric vehicle systems, diagnostics, and workshop management, where mid-career upskilling is urgently required. However, more work is needed to define the structure, scope, and delivery model for a qualification that could serve this broader occupational group. While the development of a vocational degree remains a viable option, the sector is not yet ready for immediate progression to program design. Instead, the findings in automotive will inform future planning and targeted engagement with key stakeholders.

In summary, the feasibility analysis confirmed that while both sectors face significant workforce challenges, the mining sector presents a more clearly defined and strategically aligned opportunity to pilot a vocational degree. The reliability and testing engineer role is operationally critical, structurally underserved, and strongly supported by industry. It provides an appropriate and high-potential focus for Phase Two of this initiative. For these reasons, the reliability and testing engineer has been selected as the focus of Phase Two of this project where further development, validation, and co-design of a fit-for-purpose AQF Level 7 qualification will occur.

Recommendations

The report concludes with 13 detailed recommendations to guide the next phase of work, specifically:

Recommendation 1 - Proceed to Phase 2, Focused on the Reliability and Testing Engineer Role

Based on the findings of Phase 1, AUSMASA should proceed to Phase 2 of the project, with a specific focus on the development of an AQF Level 7 vocational degree for the reliability and testing engineer role in the mining sector. This role has been identified as a critical applied professional occupation that sits between trade-qualified technicians and degree-qualified engineers, and it presents strong potential for a new qualification pathway aligned to workforce needs.

Recommendation 2 - Confirm Industry Need and Role Definition

Build on the initial findings to refine and validate the occupational definition of the reliability and testing engineer. Clarify its core functions, scope, and positioning within the mining workforce. This should be supported by structured consultation with Tier 1 and Tier 2 mining companies, OEMs, and contractors to ensure relevance across operational contexts. Stakeholder Maps have been provided in Appendix 2.

Recommendation 3 - Address the Lack of ANZSCO Recognition

AUSMASA should lead the process to seek formal recognition of the reliability and testing engineer occupation within the ANZSCO framework. The absence of an ANZSCO code has made data collection and workforce planning difficult. AUSMASA should compile an evidence base to support a submission to Jobs and Skills Australia and the ABS for recognition of this role as a distinct occupation.

Recommendation 4 - Engage Engineers Australia to Establish Discipline Recognition

Continue engagement with Engineers Australia to explore formal recognition of reliability and testing engineering as an emerging or subdiscipline. Phase 2 should aim to define practice standards, assess alignment with existing engineering categories, and clarify how the proposed vocational degree complements or intersects with traditional engineering education.

Recommendation 5 - Refine the Sample Product Through Stakeholder Input

Use the sample product developed in Phase 1 in Appendix 6 as a consultation tool to refine the structure, content, and outcomes of the vocational degree. This includes validation of core technical areas, work-integrated learning design, and assessment approaches. The refined framework should guide Phase 3 development.

Recommendation 6 - Formalise Delivery Partnerships

Secure formal commitments from identified delivery partners, including WA and QLD based TAFE Centres of Excellence / RTOs and a Tier 1 mining company, to support co-design, piloting, and delivery. These partnerships will provide critical platforms for applied learning, access to workplace settings, and long-term program sustainability.

Recommendation 7 - Test and Validate Delivery and Work-Integrated Learning Models

Design a flexible delivery model that includes structured work-based learning, block release options, online components, and project-based assessment suited to mid-career professionals. Pilot delivery mechanisms with partner organisations to test feasibility, learner experience, and employer outcomes.

Recommendation 8 - Establish Entry Pathways and Recognition of Prior Learning

Develop articulation and credit arrangements from existing VET qualifications such as the Diploma of Engineering - Technical. Recognise prior learning and experience to enable trades-qualified technicians to access the program without restarting their learning journey.

Recommendation 9 - Engage with Peak Bodies and Policy Stakeholders

Maintain active engagement with Jobs and Skills Australia, the Department of Education, Engineers Australia, and state training authorities to ensure policy alignment, support for funding mechanisms, and recognition of the qualification within tertiary and professional frameworks.

Recommendation 10 - Strengthen Data and Evidence for Program Justification

Undertake further data collection to substantiate the demand for the reliability and testing engineer role, including targeted analysis of job postings, industry vacancy data, and projected demand. This evidence will support formal accreditation, recognition, and resource allocation.

Recommendation 11 - Position the Qualification for Cross-Sector Mobility

Design the qualification to enable graduates to transition between sectors such as mining, defence, advanced manufacturing, and clean energy. Emphasise portable competencies in systems reliability, diagnostics, data interpretation, and digital tools that apply broadly across high-tech industries.

Recommendation 12 - Define Graduate Outcomes and Professional Capabilities

Finalise a comprehensive graduate profile that articulates the technical, supervisory, and analytical capabilities expected of vocational degree holders. This profile should guide curriculum development, industry expectations, and quality assurance processes.

Recommendation 13 - Prepare for Phase 3 Development and Piloting

Document the outcomes of Phase 2 in a form that enables transition to Phase 3. This includes a validated qualification structure, delivery model, stakeholder agreements, and a proposed accreditation pathway. These deliverables should support pilot delivery with selected partners and broader implementation.

Conclusion

This report confirms both the opportunity and the necessity for developing higher-level vocational pathways that address the widening skills gaps in Australia's mining and automotive sectors. Phase One of the AUSMASA Vocational Degree project has demonstrated clear demand, sector alignment, and structural gaps in the current training ecosystem, particularly for mid-career technical roles that fall between trades and traditional university qualifications. Through rigorous consultation and analysis, the reliability and testing engineer in mining has emerged as a strong, high-potential candidate for piloting an AQF Level 7 vocational degree. The findings provide a sound foundation for advancing to Phase Two, where targeted co-design, validation, and engagement with partners will be critical. This next phase represents an important step towards a more agile, applied, and industry-aligned tertiary education model that supports workforce capability and national economic priorities.

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Introduction

The rapid advancement of technology is transforming industries worldwide, placing significant pressure on education and training systems to produce a workforce equipped for emerging challenges. Australia's automotive and mining sectors face critical skills shortages driven by innovations such as electric vehicles (EV), autonomous systems, and sustainable mining technologies. Traditional education pathways often fail to address these evolving needs, leaving industries without the expertise to maintain competitiveness and growth.

Technological and digital transformation are driving profound changes across Australia's economy and society. Technological advances continue to shape industries and boost productivity, supporting rising living standards and expanding job creation. Digital technologies have increased Australia's connectivity to the global economy, strengthened links between regions and cities, and fundamentally altered the nature of work. Emerging technologies such as artificial intelligence (AI) and advanced robotics improve workplace safety, enhance product quality, and create new markets. However, as has been the case in previous eras, technological advancements have uneven impacts across industries and occupations. Workers outside the technology sector must also develop core digital literacy skills to remain competitive. Governments, businesses, and the broader community are critical in enabling more people to benefit from these technological advances.

Climate change and the net-zero transformation similarly reshape the economic and industrial landscape. Governments worldwide have committed to achieving net-zero emissions by 2050, marking one of the most significant shifts in the global economy since the Industrial Revolution. Australia is well-positioned to benefit from this transformation, with its potential to generate abundant renewable energy and play a key role in global supply chains for net-zero technologies, such as batteries. However, the net-zero transition drives profound shifts in the skills demanded by industries, particularly in trades and engineering, while amplifying global competition for expertise.

Meeting these skill demands will be essential for delivering emissions reduction commitments and unlocking economic opportunities in renewable energy and critical mineral exports. Simultaneously, climate change introduces physical risks and productivity challenges requiring innovative solutions.

Addressing this challenge necessitates bridging the longstanding divide between vocational education and training (VET) and higher education (HE), an issue conceptualised by Peter Noonan and internationally as "the missing middle". The term "the missing middle" highlights the absence of well-defined, adequately supported educational pathways at mid-level qualifications that effectively integrate the strengths of VET and HE. Scholars and industry bodies alike emphasise that failing to provide these coherent, flexible pathways not only hampers individuals' opportunities for smooth progression but also constrains the responsiveness of the education and training system to industry needs. Addressing the missing middle, therefore, involves creating qualifications that better align with industry demands, offer robust technical training, and provide a platform for higher-level learning and workplace integration.

In this context, an Australian Qualifications Framework (AQF) Level 7 Vocational Degree emerges as a promising but not the only solution. By integrating advanced technical training, university-level learning, and embedded workplace experiences, such degrees could fill the gap, providing a more direct route to the high-level skills demanded by Industry 4.0

Methodology

Phase 1 of the project was designed as a foundational exploration and evidence-gathering phase to support the development of a new vocational qualification aligned to emerging industry needs. This phase adopted a structured, multi-step methodology to ensure that findings were comprehensive, evidence-based, and directly informed by research and stakeholder insight. Phase 1 comprised three interrelated steps: a literature review, a stakeholder consultation process, and an environmental scan.

Step 1: Literature Review

The first step involved an in-depth review of national and international literature to understand the opportunities and challenges associated with introducing a vocational degree within the AQF at Level 7. This included analysis of workforce trends, education policy frameworks, and the integration of vocational and HE systems in jurisdictions such as the United Kingdom (UK), Germany, and Canada. The review examined previous reform efforts within Australia, evaluated models such as Higher Apprenticeships and Dual Studies programs, and assessed the current capacity of the VET and HE sectors to support an integrated qualification model. Findings from the literature review provided a conceptual and policy framework to guide subsequent project stages.

Step 2: Industry Consultation

The second step focused on direct engagement with stakeholders across the mining and automotive sectors. The consultation process synthesised insights from more than ten sector-specific sessions, bringing together employers, registered training organisations (RTOs), education and training experts, and peak industry bodies. These sessions were complemented by targeted one-on-one interviews to gather nuanced feedback from union representatives, regulators, and professional associations. The consultations sought to validate the findings of the literature review, identify current workforce capability gaps, test the feasibility of proposed qualification concepts, and understand industrial relations (IR) and regulatory considerations. This step also served to identify key stakeholders for further engagement in the next phase of the project.

Step 3: Environmental Scan

The third step involved a comprehensive environmental scan of the mining and automotive sectors. This included an analysis of workforce size and composition, employment trends, critical occupations, skill gaps, regulatory developments, and demographic changes. Data sources comprised government labour force statistics, industry reports, training package utilisation data, and workforce demand projections. The environmental scans provided the evidence base for mapping current and future workforce needs and assessing the potential alignment of a vocational degree with industry requirements.

Step 4: Opportunity Analysis

The fourth step, built upon the findings from the literature review, industry consultation, and environmental scan, is to conduct a detailed opportunity analysis for both the automotive and mining sectors.

In the automotive industry, the analysis focused on acute shortages in mid-career technical roles, such as master technicians and diagnostics experts, and an emerging need for advanced skills in areas like EV’s, hydrogen systems, and digitalised platforms. In the mining industry, the analysis focused on the critical gaps in semi-professional and technologist roles, particularly in mine automation, advanced processing, and digital operations.

The opportunity analysis also examined the potential for an AQF Level 7 vocational degree to provide a new workforce development pathway that bridges practical workplace skills with advanced technical competencies, offering a strategic solution to current and future workforce demands, supporting national policy goals and enabling cross-sector talent mobility.

Step 5: Feasibility Analysis

The fifth step involved a feasibility analysis for developing an AQF Level 7 vocational degree for key mining or automotive roles. The analysis rated each role based on the workforce demand, existing training gaps, role complexities, and industrial award structures that shape feasibility. For each role, the analysis assesses alignment with the AQF 7 vocational degree descriptors, gauges the practicality of applied work-integrated learning, and considers both career progression and industrial fit. These assessments ensure that any proposed vocational degree pathways are evidence-based, operationally relevant, and supported by a clear rationale for investment.

Recommendations

The report concludes with recommendations for phase two of the project, supported by a sample product for the recommended role and a stakeholder map to inform further development.

A Vocational Degree - Definition

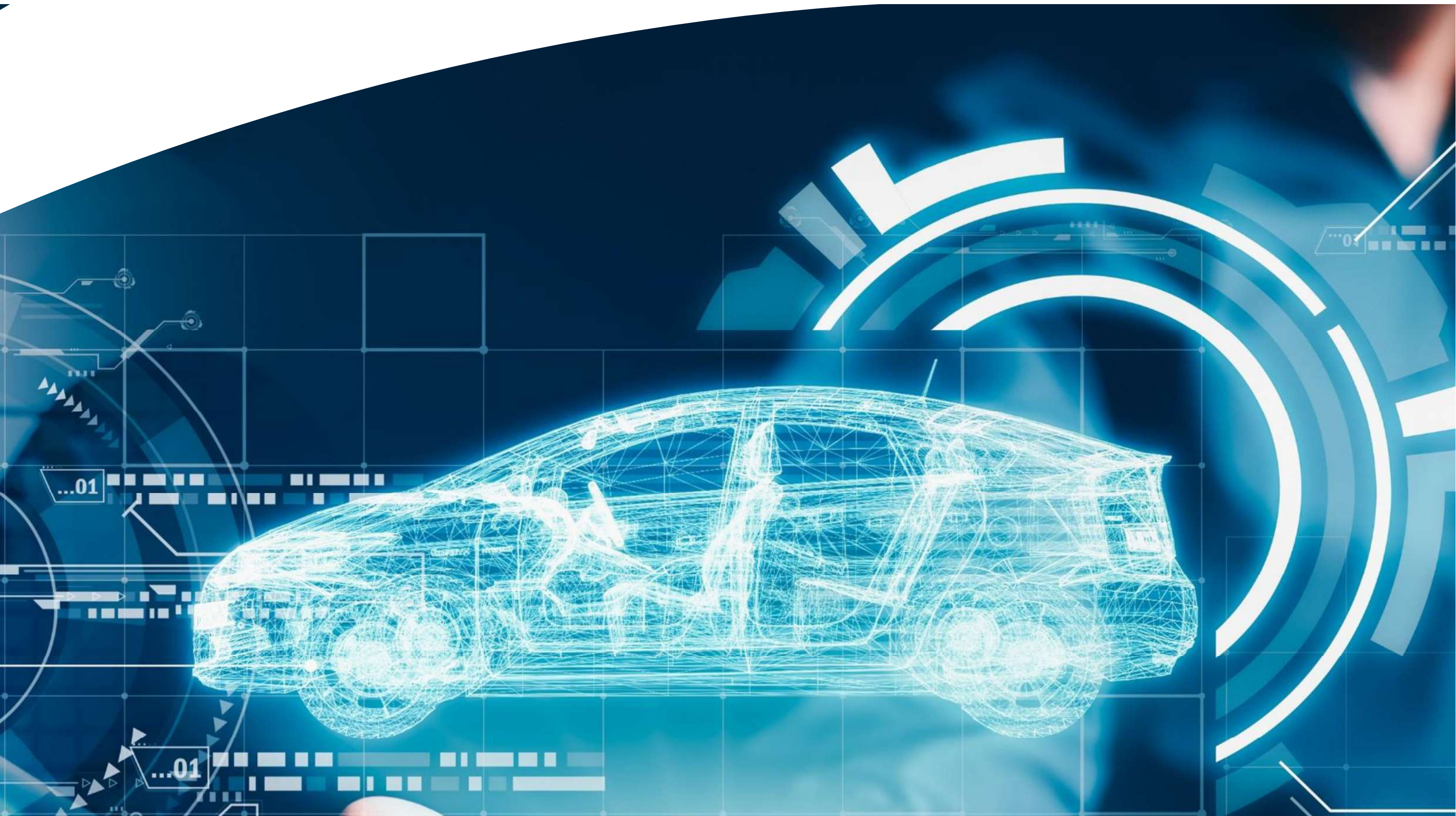
Depending on the context, many definitions exist for Vocational Degrees. These definitions refer to a qualification designed to prepare learners for specific careers, often focusing on hands-on training and applied learning. These degrees are typically aligned with the needs of industries and employers and aim to equip graduates with the practical skills and competencies required for employment. In contrast, academic degrees emphasise broader theoretical knowledge and critical thinking skills.

For this project phase, the following definition has been adopted:

"A technical qualification that provides learners with access to work-based learning opportunities at AQF Level 7, including learning that may be linked with a contract of training where the work-based learning component aligns with applicable standards for the associated industry".

Key facets of this definition include:

- A technical qualification implies a close relationship with the world of work and an outcome that is more specifically tied to an occupational outcome than a university degree.
- Work-based learning includes formal learning occurring in a workplace, which provides for the accumulation and demonstration of knowledge and skills.
- Can be linked to a contract of training between the employer and education and training provider, indicative of integrating the on and off-the-job learning components.
- An AQF Level 7 outcome that aligns with a Bachelor's Degree qualification outcome.
- Where applicable, close alignment with professional standards body requirements, e.g. law, medicine, and engineering.



Mining and Automotive Skills Alliance

AQF7 Vocational Degree Workshops – Theme Summaries and Knowledge or Skills Needs

Industry Focused Themes

Skills and Knowledge

The development and practical application of advanced technical skills, including automation, robotics, data analysis, and renewables, supported by strong mathematical foundations, fine motor skills, and integrated problem-solving. The emphasis is on technical expertise rather than administrative or leadership roles.

Qualifications and Pathways

Strong support for embedding qualifications within vocational training pathways such as Higher Apprenticeships and Dual Studies, with an emphasis on stackable qualifications, micro-credentials, and clearly defined entry and exit points, alongside strategies like dual trades and trade-to-degree transitions to enhance retention and recognise prior learning and experience.

Industry and Educational Alignment

Qualifications must keep pace with rapidly evolving job roles and industry needs, requiring industry-driven curriculum development, strong partnerships between RTOs and employers, flexible elective structures, and cross-functional, multidisciplinary training programs that respond to ongoing technological advancements.

Digital Competency and New Technology

There is an increasing need to develop digital competencies across areas such as cybersecurity, automation, AI, data analytics, telemetry, and machine learning, with a particular focus on the workforce impacts of generative AI and the growing importance of skills in remote control, autonomous operations, and digital integration.

Employer and Learner Motivation / Investment

Qualifications must be closely aligned with real workplace needs. Employers are questioning the return on investment for higher-level training, highlighting the importance of a clear and compelling value proposition for both employers and learners.

Workforce Development

Training must be clearly aligned with employment outcomes and workforce needs. It must recognise the importance of learner motivation and mindset, address current skills shortages, and support employer investment in training as a strategy for retention while also considering employment conditions and work-life balance during training and employment.

Training Provider and Policy Themes

Assessment Relevance and Rigour

There is concern about assessment practices, particularly the reliance on final exams and capstone models, which may disadvantage neurodiverse learners and practical thinkers, highlighting the need for rigorous assessment approaches that move beyond traditional academic-only methods.

Teaching and Learning Innovation

Strong emphasis on innovative teaching and assessment methods, the recruitment and retention of industry-experienced educators, and the development of pedagogical capability, with a clear need for continued investment in trainer and lecturer development to ensure the delivery of learner-centric, practical-oriented training that meets workplace requirements.

Reputation and Perception

Improving the reputation of Vocational Education and Training (VET) requires clear communication strategies, enhanced stakeholder engagement, and effective marketing approaches that attract learners and build strong buy-in from employers and industry.

IR, Regulation and Policy

There is a need to address industrial relations, licensing, and accreditation within a framework that ensures national and international consistency and portability of qualifications while also resolving funding inconsistencies and navigating legislative and jurisdictional differences that impact training delivery and standards.

Funding Considerations

Significant challenges exist around training funding and investment, including the economic viability of the programs, the need for clearer industry contributions, evaluation of return on investment, inconsistencies in funding across jurisdictions, and questions about who bears the cost of higher-level training.

Inclusion and Diversity

Increased awareness and focus on reducing the stigma surrounding neurodiversity, the development of inclusive pathways for Indigenous learners, and the need to address broader cultural inclusivity within training environments were identified as essential priorities. Ensuring accessible delivery and support structures was also identified as a priority.

Technical Knowledge and Skills

Area	Specifics
Diagnostics	Problem identification, root cause analysis, fault finding
Electrical & Electronics	Auto electrical, wiring diagrams, schematics, soldering
PLC and Programming	Programmable logic controllers, scripting languages
Advanced Hydraulics & Pneumatics	Fluid mechanics, system maintenance, schematic symbols
Instrumentation & Sensors	Telemetry, control systems, calibration
Data Analysis	Interpreting, analysing, visualising industrial data
Automation & Control Systems	Remote ops, HMI systems, robotics integration
Geoscience & Mine Planning	Surveying, mapping, geological interpretation
ADAS & EV Systems	Vehicle automation, electric drivetrains, safety protocols
Cybersecurity	Digital infrastructure safety, threat prevention
SAP & Digital Tools	Enterprise platforms, Excel, Power BI
Project Management	Scheduling, coordination, budget oversight

Future Focused or Emerging Knowledge and Skills

Area	Specifics
Artificial Intelligence (AI)	Basic concepts, coding foundations, applications in industry
Machine Learning	Basic logic, application in diagnostics and predictive maintenance
Generative AI	Use in automation and data generation
Digital Literacy	General comfort with software tools, systems, cloud data
Remote & Autonomous Operations	Working in digitally controlled or off-site environments
Sustainability / ESG	Environmental, social, and governance literacy in an operational context
Electrification	High-voltage safety, EV maintenance, power systems
Hydrogen Technologies	Safety, storage, and integration in mechanical systems
Advanced Manufacturing	Additive manufacturing, smart factories

Core and Transferable Knowledge and Skills

Area	Specifics
Problem Solving	Diagnostics, troubleshooting, scenario-based decisions
Critical Thinking	Independent judgment, complexity navigation
Communication	Technical language, workplace communication, clear reporting
Teamwork	Cross-disciplinary collaboration, shift-based coordination
Emotional Intelligence	Self-awareness, managing teams, understanding learners
Resilience & Adaptability	Working in changing environments, bouncing back from setbacks
Conflict Resolution	Workplace tensions, negotiation, mediation
Work Health and Safety	Especially mental health and wellbeing
Leadership & Supervision	Leading small teams, training apprentices, site coordination
Cultural Competence	Working across diverse teams, Indigenous engagement
Teaching Skills	Peer instruction, developing future trainers

Potential Target Roles

Master Technician, Instrumentation Technician, Mine Scheduler, Planning Engineer / Scheduler, Metallurgy Technician, Field Technician / Hydrologist, Reliability Engineer / Technician, Testing Technician / Test Engineer, Field Geo-technician, HSEC Advisor

Sample Product Reliability and Testing Engineer

The phrase *experience with* refers to tasks and functions that the individual must be capable of performing competently in order to be effective in the role. In contrast, *exposure to* denotes areas where a working understanding is required, even if the task is not a core responsibility. This knowledge supports broader role awareness and effective collaboration across related functions.

Area	**High-Level Skills and Knowledge Requirements**	**Exposure to and Experience with**
Mining	• Understanding the whole mining process flow, including crushing, screening, and unit operations. • Mining applications across sites and commodities. • Understanding of environmental challenges that exist in the mining environment and their effects on machine reliability (i.e.: extreme temperatures, dust contamination and accelerated wear and tear).	• Exposure to mining maintenance processes: Work order-based planning and planned maintenance shutdowns for heavy equipment and fixed plant production assets. • Experience responding and adapting to changes due to external factors such as environmental or process changes.
Applied Systems and Maintenance Knowledge	• Knowledge of strategies to optimise asset performance and reduce failure risks. • Awareness of maintenance strategies such as condition-based and reliability-focused maintenance. • Integration of mechanical, electrical, and control systems knowledge in diagnosing equipment failures. • Understanding asset lifecycle and degradation mechanisms. • Familiarity with condition monitoring technologies (e.g. vibration analysis, thermography, ultrasound) in an applied operational context. • Practically apply theoretical knowledge to real-world problems.	• Experience identifying asset inefficiency or bottlenecks through data analysis. • Experience with Instrumentation of equipment to facilitate data analysis. • Experience with data-driven asset or process improvement and fault-finding. • Experience using gathered data to influence maintenance planning and life cycle estimates. • Exposure to practical mechanical and electrical maintenance works.
Technical Analysis and Problem Solving	• Diagnosing equipment failures using data and field inspections. • Designing tests and trials to validate hypotheses. • Knowledge of common failure modes of components and	• Exposure to real-world failures and analysis of data leading up to and after the failure.

Area	High-Level Skills and Knowledge Requirements	Exposure to and Experience with
	sensors, and how to identify them. • Knowledge of control system functions and usage.	
Data Analysis and Digital Diagnostics	• Analysis of equipment performance trends using real-time data systems (e.g. OSIsoft PI, SCADA, historian databases). • Analysis of historical and aggregate data utilising SQL databases/ code-based methods to identify trends and anomalies. • Competence in using diagnostic tools and interpreting predictive maintenance outputs. • Intermediate to advanced use of analytics platforms (e.g. Power BI, Excel, SAP PM) to support reliability decisions. • Knowledge of where specific types of data can be most useful. • Knowledge of setting up data systems for specific applications/ tests.	• Exposure to real-world data systems. • Experience working with discrete, aggregate, and time series data sets. • Exposure to real-world failures and analysis of data leading up to and after the failure.
Root Cause Analysis and Investigation Techniques	• Structured application of RCA methodologies (e.g. fishbone diagrams, 5 Whys, fault tree analysis) in field environments. • Development of investigation reports that link technical findings with operational risk or production loss. • Ability to lead or contribute meaningfully to reliability investigations following asset failure. • Ability to differentiate causation and correlation in failure investigation.	• Exposure to root cause analysis case studies. • Exposure to real-world failures and analysis of data leading up to and after the failure.
Work Planning and Reliability Strategy	• Project Management and team leadership. • Ability to develop cost assessments, justify projects, and integrate risk, safety, and cost into decision-making. • Understanding preventive, predictive, and reliability-centered maintenance approaches and when to apply them.	• Experience with planning and scoping maintenance and rectification works within or relating to production environments/ assets. • Experience interpreting and adapting OEM maintenance procedures to suit operational conditions/ challenges. • Exposure to mining maintenance processes: Work order-based planning and planned

Area	High-Level Skills and Knowledge Requirements	Exposure to and Experience with
	• Ability to design and recommend testing or inspection regimes based on asset risk profiles. • Integration of reliability data into broader maintenance planning and work scheduling systems.	maintenance shutdowns for heavy equipment and fixed plant production assets.
Communication and Technical Reporting	• Production of clear, structured technical reports with analysis, justification, and recommendations. • Communicate complex diagnostic findings to operators, supervisors, and engineers. • Participation in cross-functional reviews (e.g. reliability meetings, defect elimination groups), translating data into practical actions. • Stakeholder engagement to ensure relevant data sharing in investigations and rectifications (RACI Matrices). • An ability to integrate feedback from maintainers and trades personnel into analysis in technical reporting. • Ability to contribute and communicate effectively with design teams regarding engineered solutions. • Soft skills: Ability to run effective meetings and make full use of tools such as MS Teams and meeting aids such as transcribing and scheduling tools	• Exposure to good technical writing and guidelines for authoring technical reports. • Experience authoring technical reports and test procedures. • Experience adapting technical writing to suit required metrics (standardised test procedures, failure, and test reports).
Safety, Compliance, and Asset Integrity Awareness	• Awareness of safety-critical asset functions and the regulatory consequences of equipment failure (e.g. process safety, critical control verification). • Understanding of standards and frameworks (e.g. ISO 55000, OEM maintenance guidelines, statutory inspections). • Capacity to assess asset risk and support compliance with safety case or licensing obligations. • Ability to test and verify a standard, particularly new technology or system integrations applications.	• Exposure to engineering failure mode and risk analysis discussions: FMEA, ALARP, HAZOP, HAZID and LOPA. • Experience with the interpretation and application of relevant standards. • Application of “Best Practice” where a standard does not cover specific actions. • Exposure to management of change processes.

Area	High-Level Skills and Knowledge Requirements	Exposure to and Experience with
Professional Judgement and Autonomous Practice	• Application of engineering judgement in selecting monitoring tools, interpreting trends, and recommending action. • Implementation and testing of Engineering requirements. • Confidence to act independently in remote or unsupervised roles while understanding escalation protocols. • Verification and Validation processes. • V-Model engineering. • Recognition of the limits of one's technical authority and the need for interdisciplinary collaboration (e.g. with engineering or OEM support).	• Exposure to fault identification and rectification process through an engineered solution. • Experience with the interpretation and application of relevant standards. • Application of "Best Practice" where a standard does not cover specific actions.
Mathematics and Data Interpretation	• Basic statistical analysis, performance trend analysis, root cause analysis, and interpreting data from mining operations. • Numerical literacy and comfort with interpreting data • Mathematical foundations required for advanced technical diagnostics, modelling, and automation systems. • Understanding of signals utilised in common sensor types for fault finding purposes and analysis (i.e., math filter functions to reduce signal noise)	• Experience utilising data from numerous sources to identify issues with systems where there may not be a dedicated sensor package.
Digital Competency and Automation	• Digital literacy, including comfort with tools such as Excel, Power BI, SAP Awareness of and capability in AI, machine learning, cybersecurity, and telemetry. • Skills related to remote operations, autonomous operations, and digital integration. • Basic coding knowledge for database usage and set-up of automated data systems.	• Experience integrating various data systems with visualisation and analytical tools.
Career Pathways and Transferability	• Pathways that recognise prior learning and workplace experience	• Exposure to system-level troubleshooting where multiple factors need to be considered. • Experience differentiating between correlation and

Area	High-Level Skills and Knowledge Requirements	Exposure to and Experience with
	• Integration of dual trades, trade-to-degree transitions, and micro-credentials • Clearly defined entry and exit points that support career mobility and long-term progression	causation in system-level troubleshooting activities.

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