Automation:

Implications for Australian Skills, Employment Status and Job Security

Submission to the Select Committee on the Future of Work and Workers

January 2018

This Submission has been prepared by Michael Hartman, CEO of Skills Impact. It is based on information gained as part of his current and past roles involving work with industry stakeholders to determine future skills and training needs.

Skills Impact has recently carried out research, on behalf of the Australian Industry Skills Committee and contracted by the Commonwealth Department of Education and Training, into the effects of automation on the future of work and skills.

Skills Impact is a national Skills Service Organisation (SSO), funded by the Commonwealth Government. We are responsible for supporting Industry Reference Committees (IRCs) in the development of units of competency, skill sets and qualifications, for use by industry and the vocational training and education sector.

Skills Impact:

- Understands the importance of skills development.
- Has in depth knowledge about vocational education and training, skills standards and qualifications.
- Recognises the sustainable and economic value that grown and renewable resources, land-management based industries, and their value chains offer to the Australian economy
- Collects information about the industry sectors it works with that examines future industry development and change and the impact this will have on employment and skills. These insights are collated, on behalf of Industry Reference Committees into documents called Skills Forecasts. In order to forecast skills needs, it is necessary to understand drivers and influences on industry, work and the workforce.

Skills Impact is one of six SSOs who have received funding from the Commonwealth.

SSOs are accountable for providing technical, operational and secretariat services to enable their IRCs to undertake their industry engagement and training package development and review activities.

Some of the research and analysis for this submission, to the extent that it refers to automation, was conducted by a research team under the management of DeakinCo (a commercial entity backed by Deakin University) and the direction of Skills Impact.

Funding for the development of skills forecasts and for our insights on automation and the future of work is provided by the Commonwealth Government through the Department of Education and Training.

About: Skills Impact is a national Skills Service Organisation (SSO)
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Submission Summary

Advanced automation, empowered by new and developing technology, is having a large and exponentially increasing impact on industry and business.

This change offers opportunities and risks for Australia's workforce and our economy.

The opportunities are likely to be few, and the risks to employment high, unless Australia is able to be an effective manager and user of advanced, digitally enabled, automation.

Taking advantage of advanced automation to drive productivity and economic growth critically depends upon lifting and adapting the skill and knowledge of workers and managers.

Currently Australia is not well positioned to upskill the existing workforce in computerised/digitalised/advanced automation skills.

The Australian Industry Skills Committee (the AISC) and the Commonwealth Department of Education and Training have responded by initiating a process to bring skills training development into line with the shift in economic conditions.

This submission highlights work undertaken by Skills Impact and makes recommendations to support its continuation and extension. The recommendations are on p5.

Submission

Background

Skills Impact on behalf of the Australian Industry Skills Committee (AISC), Industry Reference Committees and the Commonwealth Department of Education and Training has recently conducted a Cross-sectoral Automation Project to examine the consequences of automation for future workforce skills.

The research supports national efforts to ensure the vocational education and training (VET) system provides workers with the skills required for future employment in an automation enabled economy.

Under the guidance of an industry project reference group the project examined what automation is and its effects on work across all Australian industries.

The project has provided a Case for Change report covering automation related qualifications, skill sets and units of competency, for consideration by the AISC.

Automation technologies, recent growth

The exponential increase in computer power driven by the developments in hardware and software technologies has extended the application of computer processing into areas previously occupied entirely by unaided human intelligence and creativity. These extensions include the application of artificial intelligence for causal, predictive and behavioural analysis, the use of virtual modelling and computer aided decision making, and natural language processing capturing sentiment analysis, speech recognition, language translation, parsing and topic modelling.

The application of the new capabilities has diverse economic manifestations at all levels — product, process, and system. There are new materials, composites and nanotechnologies; robotic automation and optimised industrial processes; new capabilities for design and proto-typing: supply chain optimisation and automation; the internet of things creating direct communication between objects and a new relationship between the business supplier and the customer; transformation of service and product delivery and a modern communications network that shifts the boundaries of the market.

These changes indicate we are entering a period of economy-wide automation and labour market transformation that is global in scale. Economically, it is disrupting established practice, replacing human workers in certain jobs, enhancing the capability of other workers, and creating new jobs. More generally, automation is a major factor contributing to the current and future transformation of work and employment.

While automation will be ubiquitous across industries, businesses and occupations, deployment will neither be consistent in extent nor speed. The deployment of advanced automation can be utilised by businesses in a narrow fashion to replace jobs with machines. However, it is important to recognise that a reduction in labour costs is seldom the driver for an increase in automaton; the main business objective is to enhance the performance of functions well beyond what is currently capable of by humans. This can be as simple as providing support for operations 24 hours per day, 7 days per week or performing work with exacting repeatability and huge volumes beyond the management of individuals or groups of people.

Machines may replace routine physical and cognitive tasks, but it is where machines and humans form powerful combinations that future business and employment opportunities will reside.

The ability for Australia to take advantage of these opportunities will require a national skills strategy that supports the adoption and deployment of automation skills and knowledge

across Australia. This strategy will need a much richer and more accurate data set to properly inform the narratives that are currently growing around automation. Current narratives are often encumbered by current myths.

The Skills Impact Automation project has drawn on extensive research which highlights the insights needed to overcome these myths and develop an evidence based national skill strategy. These are outlined in Attachment 1.[1]

Automation Risks and Opportunities

The growth of computer enabled automation carries both risks and opportunities to Australia, Australian businesses and workers. If Australia does not successfully initiate a range of strategies to deal with automation and its effects on the workforce, the opportunities will be missed and the risks will multiply.

Automation can enhance Australia's competitive advantage and provide opportunities for employment growth; it can also create a substantial threat to employment and competitiveness if Australian businesses and employees are not able to understand, manage and use leading edge automation effectively.

It has been stated that developing nations have more to fear from digitally enhanced automation than developed nations. Developing nations have in recent decades relied upon cheap and low skilled labour as a pathway to industrial development, economic growth and a rise in living standards. Many of these types of jobs have now been, or are capable of being, automated and this automation will occur in economies that have the workforce skills and capital to manage its development. Therein lies the challenge and opportunity for Australia.

Clearly globalisation, when seen as a pathway for development of all nations, can act as a unifying and stabilising force across the world. Automation has the capacity to disrupt development pathways with very real risks that developing nations using automation to replace previously outsourced work will continue to grow their living standards and leave developing nations even further behind. The potential instability that could arise globally is featured as one of the concerns in articles on this issue. While this is not the focus of this submission, we include it to demonstrate the far ranging and the potential significance of the impact of advanced automation worldwide.

This submission highlights the need to adequately invest in skill development strategies to take advantage of the opportunities and to manage the risks that will arise with the rapid growth and deployment of automation technologies.

Investment in vocational skills to enable our workforce to effectively participate in and manage automated environments is critical to the success of strategies to develop advanced services and manufacturing in Australia.

The transition to an automation enabled economy will require both technical and more generic enterprise focussed skills, often referred to as "Future Work Skills". These will enable employees to move from existing work into the jobs of the future economy.

[1] Bowles, M. & Corrigan, F. (10 August 2017), *Automation Skills: Background report*, DeakinCo. & Skills Impact: Melbourne; and Bowles, M. (14 September 2017). *Automation survey response: Research report on findings from the 2017 study into automation and skills in Australia*, DeakinCo. & Skills Impact: Melbourne.

Other Implications for government

Skills development alone will not be enough to support the transition that the Australian workforce will need to make if we are not to be left behind as automation becomes a key determinate in the success of many businesses.

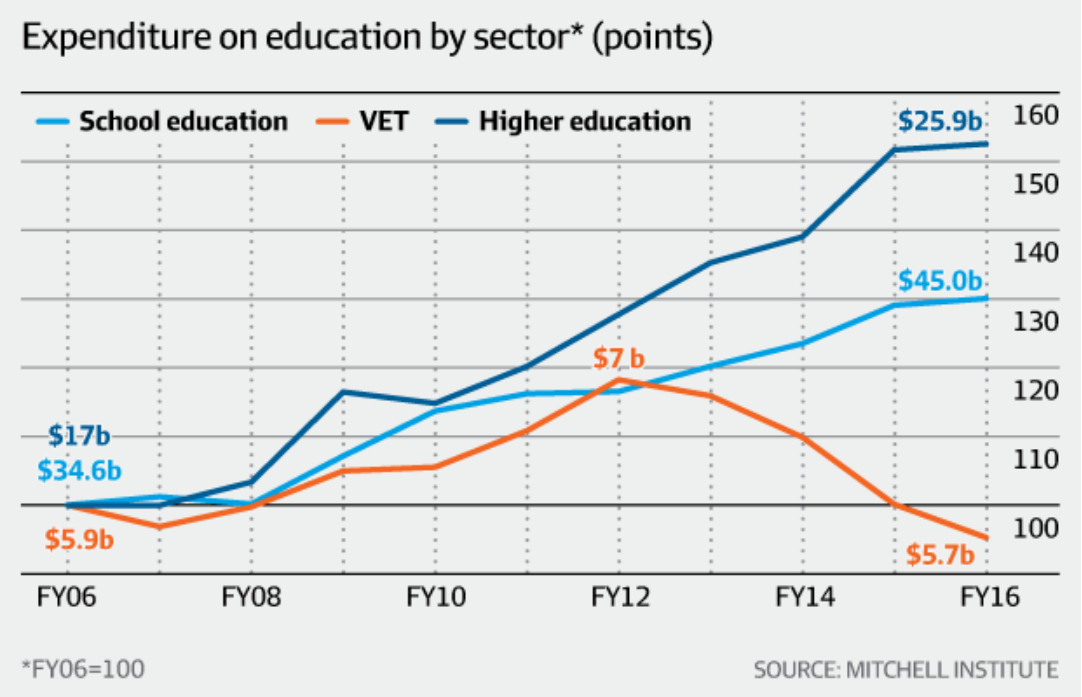
We will need to develop other mechanisms to support workers who are needing to make the transition as types of business and work disappear and new ones develop. Governments have traditionally had a piecemeal ad hoc approach to providing support for these types of transitions, usually as the result of the high profile closure of large manufacturing facilities affecting large numbers of employees.

Transitional support needs to become part of the skilling and reskilling infrastructure to support all Australians who need to carry out work and career transition, not just those in politically sensitive high profile situations.

The displacement of employees with machines poses a threat to the government revenue flowing from personal income taxation. If businesses are able to grow, produce more, be more profitable, and do so with dramatically less employees, there will be fewer employees paying tax. It is therefore essential to ensure productivity gains and business growth in individual sectors lead to overall economic growth and employment.

Recommendations:

1. That the Australian Government continue to explore the cross industry skill needs that need to be developed due to the growth in digital enhanced automation.
2. Governments work collaboratively to arrest the decline in investment in VET (see chart below). This decline in investment is putting at risk the ability for Australia's workforce to support industries that are becoming more dependent upon automation technologies. Industry will migrate to countries able to support automation and the economic growth that follows.
3. That government, as part of its investment in vocational training, explore how to build transitional support services to displaced workers into the normal VET programs, rather than as a piecemeal reaction to plant closure. Addressing transitional issues on an ongoing basis will be far more cost effective than the potential for long term unemployment that often results from a lack of imbedded transitional support.
4. The Commonwealth continue to support the current "VET Training Product Reform" process and the processes instigated by the Australian Industry Skills Committee to look at approaches to support the development of cross industry skill development and the development of "future work skills".



Attachment 1

Research Insights (based on the research team under the management of DeakinCo, a commercial entity backed by Deakin University, amended by Skills Impact for the purpose of this submission)

Three Myths and Three Insights

The current public narrative surrounding automation is being driven by three myths. Insights are offered to counter each myth. This consolidated wisdom should inform national effort and actions to consider initiatives to prepare Australia to deal with this development in a positive manner.

Myth One:
Automation drives economic growth and improves human productivity, but at the cost of jobs.

Investigation of automation and the role of VET in this project occurs against a contemporary backdrop of often dire predictions as to the job losses automation will trigger in Australia and across the globe. When the well-respected Committee for Economic Development of Australia (CEDA) reported in 2015 that 40 percent of Australia's workforce, or more than five million people, could be replaced by automation within the next 10–20 years, the topic attracted attention[2]. Unfortunately, both the context for such statistics, the assumptions used to guide the possible scenarios and the wider research derived from the Frey and Osborne predictions were ignored.

The effect has been automation is a 'bad news story' that few stakeholders wish to discuss while the public perception and prevailing data is so negative. To address automation with a skilling strategy and reform to training packages all level of government need more accurate messages that confirm exactly how automation will affect existing workers and those entering the workforce.

Our research and commissioned analysis by the most sophisticated platform available today suggest the data on job losses and gains need greater resolution. More recently the CEDA 40% of job losses was later challenged by the OECD that argued while over 60% of jobs may be affected by automation only 9% of jobs in the existing workforce will actually be fully automated in the next decade.[3] Given 5% of job disappear from the Australian labour market every 5 years the suggested quantum aligns with natural attrition.

The world-leading Tandem model, developed by Australian R&D firm Faethm, predicts the risk of automation using a job's underlying skills. Tandem's machine learning algorithm identifies the skills that are most at risk to automation and those skills that are more important in a new world where humans and machines work together. Their analysis of Australian companies has shown that 49% of jobs are at risk of automation or augmentation over the next 15 years. But 27% of job roles are at risk of having more than 85% - the threshold for 'job replacement' – of tasks and activities automated[4]. While much higher than the OECD and Productivity Commission projections, it is not as high as the CEDA scenario. Given the more refined insight the real issue is not the loss of jobs but the fact they will be concentrated in specific occupations and will occur across all regions and industries in Australia. Nor do we have accurate data on the 'good news' of: (a) the cost will be to Australia of not automating in terms of loss of competitiveness and GDP stagnation, and (b) the number of additional jobs created through automation.

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[2] This is the number reported by CEDA. It was reported in the public press without wider reference to the context nor the global data models and studies being used as a foundation: see Committee for Economic Development of Australia. (2015). *Australia's future workforce?,* Canberra: CEDA using data models and set from Frey, C. B., & Osborne, M. A. (2013, September 17). *The future of employment: How susceptible are jobs to computerisation?* Retrieved from http://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf

[3] Arntz, M., Gregory, T., & Zierahn, U. (2016). The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis. OECD Social, Employment and Migration Working Papers, No. 189, OECD Publishing, Paris. Retrieved from http://dx.doi.org/10.1787/5jlz9h56dvq7-en; and Productivity Commission. (2016). Digital disruption: What do governments need to do? Retrieved from http://www.pc.gov.au/research/completed/digital-disruption/digital-disruption-research-paper.pdf.

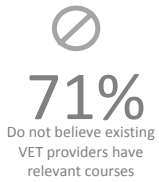
[4] Analysis by Faethm using the Tandem platform, September 2017.

Insight One:
A successful VET strategy must promote training packages and competencies that alleviates public anxiety by encouraging constructive thinking about the future workforce skills Australia must develop to remain competitive in a global economy. The focus has to include how to support workers to transition to future employability and to support growing industry competitiveness, not just ensuring a person is competent to perform in a current job role.

To support deployment of VET and reskilling the workforce to automate, we need data that more accurately predicts where jobs will be created and the socio-economic cost if Australian industries lag behind other nations that are automating to improve their global competitiveness.

Myth Two:
Automation is reshaping and changing the skills required to work.

There seems to be a prevailing belief that requirements for future jobs that are reshaped by automation will cause a more significant discontinuity between the supply and demand for skills. The survey of industry stakeholders'[5] in particular uncovered doubt that Australia's existing skilling capacity could respond with the flexibility required to play a significant role in satisfying skill demand caused by automation.



Respondents outside the government and education sector seem to be very strongly in agreement that publicly funded qualifications and the accredited tertiary providers (registered training organisations (RTOs) and universities), are not ready to support the skills transformation being driven by automation. More than 3 out of every 4 people surveyed were not convinced existing accredited VET providers have the courses required to help them develop the skills to automate processes and activities. While discussions had occurred with existing providers regarding automation training, respondents indicated that the larger the organisation the more likely they were to use expensive vendor or commercial providers to source the training they need.

Our research indicates no matter the industry, the number of employees, or the type of automation being considered or implemented, skills development remains a major challenge. While important to skill existing workers to use automated technologies or work with new technologies, the priority skilling task isn't all about developing the technical skills.

Research in this project tends to support the emphasis being on competencies that enable the workforce and employers to prepare for automation. The ability to discover, analyse and select the best options; optimise existing processes and performance; engage the workforce in the associated change process; and continually review trends and seek opportunities to improve existing processes and activities (automated or non-automated).

The future workforce shifts demand beyond a sole focus on skills to do a job (technical competencies) to encompass the soft skills, emotions and mindsets required to continually learn and adapt. It is about preparing a person for the future, not a job role. It is about skills that go beyond the vertical movement within an occupational stream. As automation disrupts our sense of a vocation and the associated career pathways, employability will be determined more by competencies that enable an individual to undertake horizontal movement and transfer their skills into new jobs or converged jobs where technology is augmenting existing practice.

[5] A separate report is available that covers the survey results, Bowles, M. (September 2017). *Automation survey results*, DeakinCo., Skills Impact: Melbourne.

Insight Two:
Ongoing analysis of emerging and new job profiles and advertisements confirm 70% of the job profiles for future workers are composed of non-technical skills. Irrespective of the degree of automation, some competencies will be essential for future employability[6].

A cross-sector training package with common competencies and resulting skills sets and qualifications can be developed to prepare all Australian industry to better adopt automation technologies and to automate processes. This requires a focus on developing common competencies potentially required by all industries, organisations and most occupations.

Myth Three:
Automation is occurring at a speed and breadth that is too fast for the existing training package development cycles.

There is a perception, validated by the research undertaken in this project, that employers in all industries lack confidence in the ability of industry-specific training packages and competency development and revision cycles to keep pace with specific automation technologies and how they will be used in specific vocations.

Two different skillsets are required: skills to develop automation; skills to apply automation [sic].

Data collected from the industry survey confirms what the initial review of global research has suggested it is not possible for a national skilling strategy to use available data to accurately predict- even five years ahead - which specific automation technologies will reshape specific future job roles and the associated technical skills[7]. Deployment of even known automation technologies will vary across each industry and even by organisation in an industry. Furthermore, technologies will continue to evolve rapidly. New options will emerge as technologies listed under automation converge (e.g. cloud with computerisation, AI with robotics) and on a wider scale as these specific automation technologies converge with developments in other fields such as Internet of Things, big data (probably more correctly titled as data science and advanced analytics), augmented and virtual reality, intelligent apps, and blockchain and distributed ledgers.

While the above findings strongly mitigate against any national skilling strategy or competency development agenda trying to focus on a specific automation technology or a specific job impacted by the automation technology, it does not mean a strategy cannot usefully target competencies relating to the deploying automation in an industry. Effort is required to more accurately determine how prioritise the development of the competencies required to use certain types of automation technologies, or to work with automated activities and processes.

To facilitate the pro-active development and review of training packages it is possible to prioritise effort to where existing automation technology developments will impact future clusters of work. This means we could predict where specific automation technologies will be more likely to impact certain clusters of related job roles. It also means we can prioritise effort to where most of a job role can be fully automated. For instance, we can already predict with a high degree of reliability that in the next 5 years voice automation technologies could replace most of a contact call centre service role; or machine learning and cognitive computing could replace the financial planning role associated with preparing statements of advice. Many other examples also exist.

Insight Three:
Existing training packages, competencies and qualifications should be revisited to remove overlap, edit out prescriptive approaches tied to a manual activity or task sequences, and address obsolete practices that ignore technology enablement. This will enable all SSOs and training package owners to be more responsive when configuring the skills required to support improved responses to digital disruption within their jurisdiction.

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[6] World Economic Forum. (2016). The future of jobs: Employment, skills and workforce strategy for the Fourth Industrial Revolution. Retrieved from http://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf
[7] A separate report is available that covers the survey results, Bowles, M. (September 2017). *Automation survey results*, DeakinCo., Skills Impact: Melbourne.

To be more effective at the national level, owners of training packages must also become users of data and automated processes. To respond in a timely manner the training system – and indeed all levels of government– need to know how jobs will be reshaped through three activities:

1. Automation;
2. Augmentation (merging, grafting or converging activities and job roles); and
3. Addition (emerging and new jobs).

Businesses and governments need to better prioritise those jobs that are at high risk and invest in the skills to improve the future employability of a workforce. Through algorithms and analysis based on job clusters[8] or a job-neighbourhoods[9], decision makers can obtain the data that show the skill needs for a future cluster and then prioritise gaps. This will inform an industry or national view on the competencies required to use automation technologies, work in automated processes, or secure work in the new jobs created by automation. All join to improve the targeting of investment in skills that will raise the future employability of individuals and accelerate business adoption of automation.

With effort, the national system could also use predicative analysis to generate the data necessary to anticipate, prioritise and proactively respond to competencies required when certain types or automation technologies affect a future job cluster in an industry. This means we could, for instance, anticipate where existing workers will be displaced from specific job roles and act pre-emptively to augment their existing skills with new competencies that prepare them for roles that will endure. For instance, moving contact call centre staff to a service role assisting customers adopt digital technologies (a digital service cluster).

1.1 What are the skill sets or qualifications required to support automation?

The research and direct consultation with industry confirms the importance of any future competency development or changes to training packages promote flexibility. This is measurable in terms of:

- Allowing packaging to meet contextual industry and business needs;
- Accelerate the cycle time to competency attainment by workers adopting and using new technologies; and
- Enabling specific organisations, in particular smaller firms, improve their ability to assess and adopt automation.

Overwhelmingly, the research supports the critical importance of skill sets. Skill sets that can rapidly upskill an existing workforce as they respond to automation, augmentation (work enabled with addition of technology) and addition of new jobs.

[8] Work such as DeakinCo professional capabilities of the future analysis with IBM Watson, or Foundation for Young Australians. (2016). The new work mindset: 7 new job clusters to help young people navigate the new work order. Retrieved from https://www.fya.org.au/wp-content/uploads/2016/11/The-New-Work-Mindset.pdf
[9] The Tandem platform developed by the Australian company Faethm

1.2 Skill sets

The logical skill sets emerging from the common automation competencies would be in areas such as follows.

Skill Set title	Possible competency inclusions
A. Work with automated technologies or processes (AQF 3)	*Identify the role and impact of automation on work* *Use automation technology and equipment* *Maintain automation equipment, tools and systems* *Use automation processes and technologies in a safe and compliant manner*
B. Enable business adoption of automation (AQF 4)	*Identify future trends and likely role and impact of automation on existing processes and technologies* *Identify major application areas for automation technology and calculate the business benefit for specific automation options* *Assess and collaborate with others to proactively identify ways to automate and improve operational efficiency and processes*
C. Robotic process automation (AQF 4)	*Analyse and assess ways to optimise processes using RPA tools* *Identify appropriate RPA software* *Map processes for software to automate* *Set up an RPA build, test and deployment environment*
D. Robotic process automation (AQF 5/6)	*Identify and quantify opportunities to use RPA to optimise performance or revenues* *Test and assess proposed RPA improvements* *Assist others automate established processes using RPA*
E. Lead business adoption of automation (AQF 8)	*Manage automation plans and projects within specific operational, process or areas of business practice* *BSBLDR805 Lead and influence change*

1.3 Qualifications

The following represents the initial considerations as to how units of competency could be packaged into qualifications. As with the unit of competencies, it is expected the titles for all qualifications must be refined through validation and applied research.

Qualification	Possible competency inclusions
Certificate 3 in Automation	1. *Use automation processes and technologies in a safe and compliant manner* (C) 2. *Use automation technology and equipment* (C) 3. *Maintain automation equipment, tools and systems* (C) Plus seven electives from other new competencies or another nominated source 4. *MSS402010 Manage the impact of change on own work* 5. *Select suitable processes for RPA use* 6. *Engage effectively in change processes* 7. *Cooperate with others to clarify and address change issues or facilitate change initiatives* 8. *Identify factors within a work area that are a constraint to work efficiency, customer outcomes or productivity* 9. *Present and visualise data supporting an automation initiative* 10. *Identify, diagnose, and/or repair automation equipment and technologies* 11. *Complete routine set up or calibration of automation equipment or technologies*
Certificate 4 in Automation	1. *Identify future trends and likely role and impact of automation on existing processes and technologies* (C) 2. *Identify major application areas for automation technology and calculate the business benefit for specific automation options* (C) 3. *Identify relevant data sources required to measure the effectiveness of an automation project* (C) 4. *Analyse and determine the need for additional infrastructure or training to support automated processes or activities* (C) Plus eight electives from other new competencies or another nominated source 5. *Assemble, set up and prepare prototype or simulation for specific automation technologies or tools under supervision* 6. *Complete routine testing of sensing, communication, measurement or actuation devices* 7. *Assure automation data accuracy, reliability, validity and integrity* 8. *Develop predictable, stable and consistent operational targets* 9. *Analyse and assess ways to optimise processes using RPA tools* 10. *Assess and collaborate with others to proactively identify ways to automate and improve operational efficiency and processes* (C) 11. *Manage automated material handling and distribution systems* 12. *Facilitate execution and measurement of automation improvements across a value chain partners* 13. *Facilitate and monitor progress against the change goals* 14. *Identify and influence stakeholders' expectations for a well-defined change initiative* 15. *MSS407001 Prepare for and implement change* 16. *Organise and document maintenance and repair of automation equipment and technologies* 17. *Maintain and optimise equipment and technology reliability* 18. *Assure adherence to safety requirements and specification*

Qualification	Possible competency inclusions
Certificate 4 in Robotic Process Automation	1. *Analyse and assess ways to optimise processes using RPA tools* (C) 2. *Identify appropriate RPA software* (C) 3. *Map processes for software to automate* (C) 4. *Set up an RPA build, test and deployment environment* (C) 5. *Use RPA to automate routine, well defined activities* (C) Plus eight electives from other new competencies at this level of one from another level or TP
Diploma of Automation	1. *Plan and integrate automation in various manufacturing, process, supply chain or technical applications* (C) 2. *Research and analyse the benefit of adopting emerging and future automation technologies* (C) 3. *Design, specify and support the integration of automation systems with other systems* (C) 4. *Communicate and build stakeholder commitment to an automation project* (C) 5. *Monitor, control and improve automation processes, technology and devices to meet customer and operational requirements* (C) Plus seven electives from other new competencies or another nominated source 6. *Analyse, design and develop solutions to automate and control the production and delivery of goods and services* 7. *Calibrate, troubleshoot, and test sensing, communication, measurement and actuation devices* 8. *Design measurement control systems (e.g. accuracy, repeatability, linearity, turndown and speed of response)* 9. *Develop continuous data reporting and process controls* 10. *Identify and quantify opportunities to use RPA to optimise performance or revenues* 11. *Identify alternative RPA tools or methods for analysing and visualising process improvements* 12. *Coordinate implementation of an automation improvement project plan against agreed targets* 13. *Communicate and effectively engage with others to execute an improvement project* 14. *Integrate supply chain information and data sharing and reporting* 15. *Use technology to optimise stock or freight control, movement and inventory management* 16. *Translate change strategies and objectives into an operational reality* 17. *Assess the workforce capability and readiness to execute required changes* 18. *Influence and engage critical stakeholders to support a change initiative* 19. *Champion change and establish the means to resolve or escalate change issues* 20. *Assure automated systems and infrastructure adhere to established standards, procedures and requirements* 21. *Collaborate with others to ensure maintenance, repairs and related documentation meets operational needs* 22. *Establish documentation and procedures to install and support the integration of automation systems with other systems* 23. *Assure the safe and reliable installation and operation of automation processes and technologies*
Diploma of Robotic Process	1. *Identify and quantify opportunities to use RPA to optimise*

Qualification	Possible competency inclusions
Automation	*performance or revenues* (C) 2. *Build and rewrite scripts for the RPA tool* (C) 3. *Test and assess proposed RPA improvements* (C) 4. *Identify alternative RPA tools or methods for analysing and visualising process improvements* (C) 5. *Assist others automate established processes using RPA* (C) Plus seven electives from other new competencies or another nominated sources.
Graduate Certificate in Leading business automation (AQF 8)	1. *Manage automation plans and projects within specific operational, process or areas of business practice* (C) 2. *Develop metrics and means to accurately report organisational benefits from automation* (C) Plus two electives from other new competencies or another nominated sources. 3. *BSBLDR805 Lead and influence change* 4. *Design systems and infrastructure to support automation projects and requirements* 5. *Design and sponsor technology improvements that optimise business processes or customer outcomes* 6. *Specify and design the installation and testing of sensing, communication, measurement and actuation devices necessary for automation* 7. *Manage the testing and outcomes reporting of major automation projects* 8. *Analyse, document and collect data to assure automated processes and technologies meet all operational requirements* 9. *Establish control monitoring and reporting systems* 10. *Evaluate and advocate for prioritises needs and benefits that justify RPA investment* 11. *Oversee RPA activities* 12. *Foster a culture of continuous learning and improvement* 13. *Uses evidence based methods and statistical measurement to evaluate the impact of improvement projects* 14. *Map and quantify opportunities for automation to improve business outcomes across all partners in a supply chain* 15. *Drive and report strategic outcomes from change processes or projects* 16. *Assess organisational maturity and responsiveness to technological disruption* 17. *Maintain strong relationships with internal and external stakeholders throughout a change initiative* 18. *Sponsors change and supports others responding to emerging operational challenges and risks* 19. *Manages automated processes and technologies throughout their lifecycle* 20. *Review automation equipment, systems and infrastructure initiatives against strategic requirements* 21. *Review deployment of technology and devices throughout the automation project lifecycle*
Graduate Diploma in Automation (AQF 8)	1. *Manage automation plans and projects within specific operational, process or areas of business practice* (C) 2. *Develop metrics and means to accurately report organisational benefits from automation* (C) 3. *Design and sponsor technology improvements that optimise business processes or customer outcomes* (C) 4. *Design systems and infrastructure to support automation projects*

Qualification	Possible competency inclusions
	and requirements (C) Plus four electives from other new competencies or another nominated sources. 5. *Specify and design the installation and testing of sensing, communication, measurement and actuation devices necessary for automation* 6. *Manage the testing and outcomes reporting of major automation projects* 7. *Analyse, document and collect data to assure automated processes and technologies meet all operational requirements* 8. *Establish control monitoring and reporting systems* 9. *Evaluate and advocate for prioritises needs and benefits that justify RPA investment* 10. *Oversee RPA activities* 11. *Foster a culture of continuous learning and improvement* 12. *Uses evidence based methods and statistical measurement to evaluate the impact of improvement projects* 13. *Map and quantify opportunities for automation to improve business outcomes across all partners in a supply chain* 14. *Drive and report strategic outcomes from change processes or projects* 15. *Assess organisational maturity and responsiveness to technological disruption* 16. *Maintain strong relationships with internal and external stakeholders throughout a change initiative* 17. *BSBLDR805 Lead and influence change* 18. *Manages automated processes and technologies throughout their lifecycle* 19. *Review automation equipment, systems and infrastructure initiatives against strategic requirements* 20. *Review deployment of technology and devices throughout the automation project lifecycle*
Graduate Certificate in Leading Robotic Process Automation (AQF 8)	1. *Coordinate and manage the operationalisation of RPA* (C) 2. *Isolate priority processes for RPA* (C) Plus two other electives from new competencies or from nominated sources. 3. *Evaluate and advocate for prioritises needs and benefits that justify RPA investment* 4. *Oversee RPA activities* 5. *Align RPA deployment with business outcomes* 6. *Integrate RPA activities into the wider automation strategy*
Graduate Certificate in Leading Change (AQF 8)	1. *Drive and report strategic outcomes from change processes or projects* 2. *Assess organisational maturity and responsiveness to technological disruption* Plus two other electives from new competencies or from nominated sources. 3. *Maintain strong relationships with internal and external stakeholders throughout a change initiative* 4. *BSBLDR805 Lead and influence change*

Glossary

The following is a glossary of key automation technologies and techniques sourced from the McKinsey Global Institute.

Technologies and techniques	Description/examples	
Artificial intelligence	Field of computer science specializing in developing systems that exhibit "intelligence." Often abbreviated as AI, the term was coined by John McCarthy at the Dartmouth Conference in 1956, the first conference devoted to this topic	
	Machine learning	Subfield of artificial intelligence developing systems that "learn," i.e., practitioners "train" these systems rather than "programming" them
	Supervised learning	Machine learning techniques that train a system to respond appropriately to stimuli by providing a training set of sample input and desired output pairs. Supervised learning has been used for email spam detection by training systems on a large number of emails, each of which has been manually labelled as either being spam or not
	Transfer learning	Subfield of machine learning developing systems that store knowledge gained while solving one problem and applying it to a different but related problem. Often used when the training set for one problem is small, but the training data for a related problem is plentiful, e.g., repurposing a deep learning system trained on a large nonmedical image data set to recognize tumours in radiology scans
	Reinforcement learning	Subfield of machine learning developing systems that are trained by receiving virtual "rewards" or "punishments" for behaviours rather than supervised learning on correct input-output pairs. In February 2015, DeepMind described a reinforcement learning system that learned how to play a variety of Atari computer games. In March 2016, DeepMind's AlphaGo system defeated the world champion in the game of Go
	Cognitive computing	Synonym for artificial intelligence
Neural networks	**Artificial neural network**	AI systems based on simulating connected "neural units," loosely modelling the way that neurons interact in the brain. Computational models inspired by neural connections have been studied since the 1940s
	Deep learning	Use of neural networks that have many layers ("deep") of a large number (millions) of artificial neurons. Prior to deep learning, artificial neural networks often only had three layers and dozens of neurons; deep learning networks often have seven to ten or more layers. The term was first used in 2000
	Convolutional neural network	Artificial neural networks in which the connections between neural layers are inspired by the organization of the animal visual cortex, the portion of the brain that processes images, well suited for perceptual tasks. In 2012, the only entry using a convolutional neural network achieved an 84% correct score in the ImageNet visual recognition contest, vs. a winning score of 75% the year prior. Since then, convolutional neural networks have won all subsequent ImageNet contests, exceeding human performance in 2015, above 90%
	Recurrent neural network	Artificial neural networks whose connections between neurons include loops, well-suited for processing sequences of inputs. In November 2016, Oxford University researchers reported that a system based on recurrent neural networks (and convolutional neural networks) had achieved 95% accuracy in reading lips, outperforming experienced human lip readers, who tested at 52% accuracy.
Robotics	**Soft robotics**	Non-rigid robots constructed with soft and deformable materials that can manipulate items of varying size, shape and weight with a single device. Soft Robotics Inc. grippers can adaptively pick up soft foods (e.g., baked goods, tomatoes) without damaging them.
	Swarm robotics	Coordinated multi-robot systems, often involving large numbers of mostly physical robots
	Tactile/touch robotics	Robotic body parts (often biologically inspired hands) with capability to sense, touch, exhibit dexterity, and perform variety of tasks
	Serpentine robots	Serpentine looking robots with many internal degrees of freedom to thread through tightly packed spaces
	Humanoid robots	Robots physical similar to human beings (often bi-pedal) that integrate variety of AI and robotics technologies and are capable of performing variety of human tasks (including movement across terrains, object recognition, speech, emotion sensing, etc.). Aldebaran Robotics and Softbank's humanoid Pepper robot is being used to provide customer service in more than 140 Softbank Mobile stores in Japan
Automation product	**Autonomous**	Wheeled vehicles capable of operating without a human driver. In July 2016, Tesla reported that its cars had driven over 130 million miles while on "Autopilot." In

Technologies and techniques	Description/examples	
categories	**cars and trucks**	December 2016, Rio Tinto had a fleet of 73 driverless trucks hauling iron ore 24 hours/day in mines in Western Australia
	Unmanned aerial vehicles	Flying vehicles capable of operating without a human pilot. The unarmed General Atomics Predator XP UAV, with roughly half the wingspan of a Boeing 737, can fly autonomously for up to 35 hours from take-off to landing
	Chatbots	AI systems designed to simulate conversation with human users, particularly those integrated into messaging apps. In December 2015, the General Services Administration of the US Government described how it uses a chatbot named Mrs. Landingham (a character from the television show The West Wing) to help onboard new employees
	Robotic process automation	Class of software "robots" that replicates the actions of a human being interacting with the user interfaces of other software systems. Enables the automation of many "backoffice" (e.g., finance, human resources) workflows without requiring expensive IT integration. For example, many workflows simply require data to be transferred from one system to another

Source: Manyika et al. (2017, p. 24).