



# Capitalising on the 'Blue Tech' opportunity

The vital role TAFE plays in equipping the Australian workforce for a digitised world

TAFE Directors Australia 2019 Study Tour Report  
Niagara Falls, Toronto and Washington DC



# Foreword

Australia has a strong TAFE sector with a global reputation in vocational education and technical training excellence. A crucial part of the TAFE sector's success is its willingness to engage with employers, with training systems globally, with global industry partners, and to constantly evolve.

The need to look outwardly is even more important given TAFEs now operate in a globalised economy and in the world's largest growth market of Asia. By understanding what's happening in other jurisdictions, Australian TAFEs can better anticipate the massive labour market shifts that are occurring, and gain insights into how they can respond.

The 2019 TAFE Study Tour to North America was organised by TAFE Directors Australia (TDA), and supported by its global industry partners Cisco and Optus, to better understand the Canadian and US contexts. The tour focused on the Niagara, Toronto and Washington DC markets and included visits to institutions, quality assurance bodies, government and industry. The latter was spearheaded by Cisco and Optus, who provided backing for the study tour and access to its global network and expertise.

This report provides a tangible record of what was an extremely successful event, and provides a platform for future advocacy efforts with government. The report will be disseminated to leaders among the sector and to governments, and forms part of a broader conversation between TDA, industry and government.

The study tour participants welcomed the hospitality of the Australian Embassy in Washington DC. In particular we thank the Honourable Joe Hockey.

– **Mary Faraone**, TDA Chair & **Craig Robertson**, TDA CEO

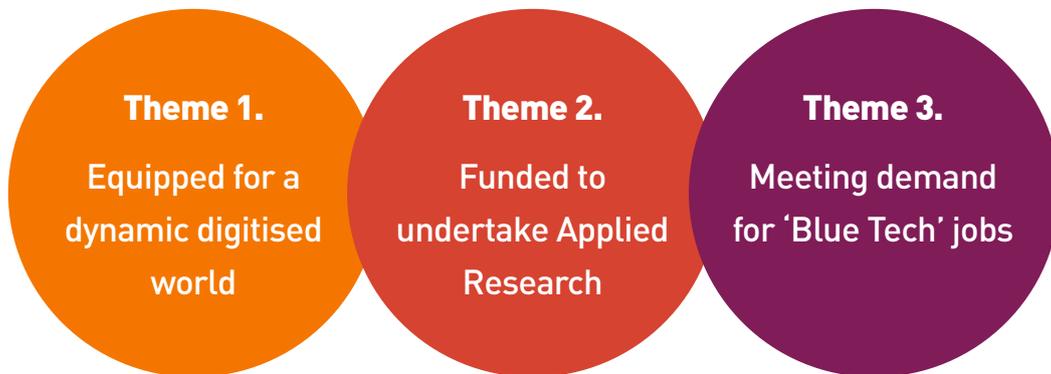
Organisations visited:



Participating TAFEs and industry:



## Summary of themes from the tour



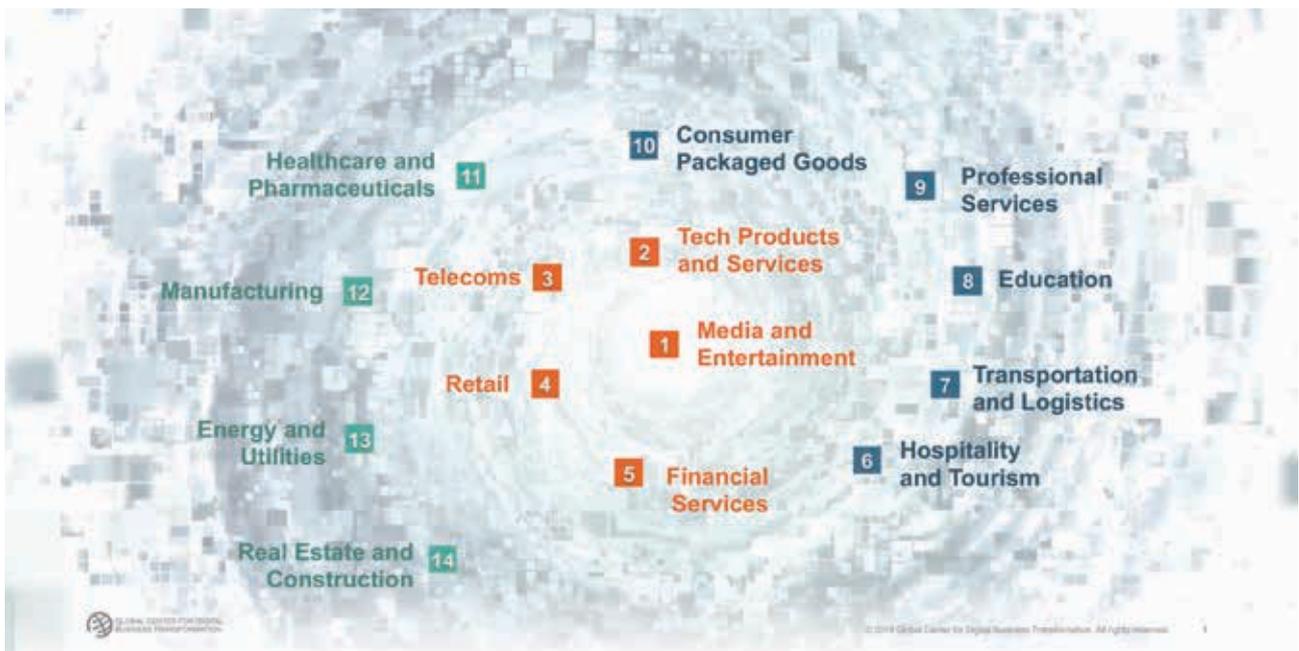
### Theme 1.

## Industry needs people equipped for a dynamic, digitised world

The future of work has never been less certain or more exciting for the cohort of young people nearing the end of compulsory schooling. Automation, artificial intelligence and machine learning are displacing jobs in sectors that have been traditionally large employers. The Digital Vortex was a term coined by Cisco to describe the degree of volatility across industries. Figure 1 captures how different industry sectors are being impacted by digital technologies, with media and entertainment, and communication technologies (ICT) most affected.

Those industries are characterised by chaotic conditions, converging technologies and an unbundling of their services. Education was ranked seventh on the list; ahead of professional services, and hospitality and tourism. One industry sector that presents significant opportunity for Australian TAFEs is manufacturing. Australia's decision to reduce tariffs in the 1980s and 1990s caused short-term pain for many but also accelerated the adoption of advanced technology in manufacturing.

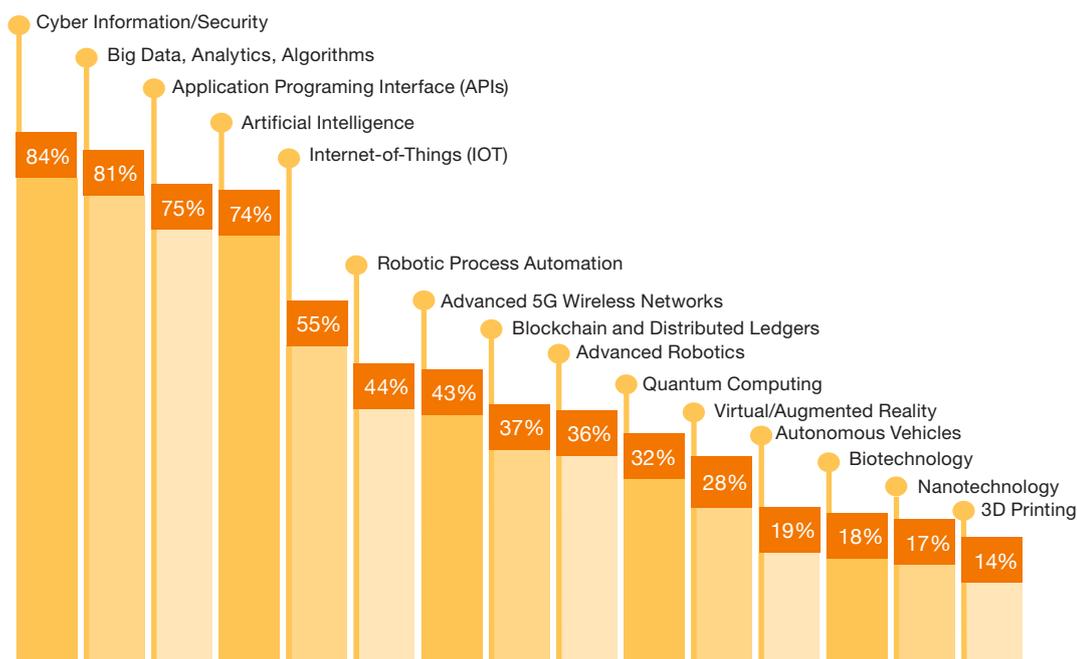
Figure 1: Industry sector view of the Digital Vortex



Given the state of flux within industries, and the promise of more to come, managing talent pipelines has never been more challenging. Industry needs to acquire the skills required for today but also hire people who are capable of adapting to their needs in the future. What's becoming clear is that technical competencies are important, but not sufficient. TAFEs will need to continue to adapt to demands for the future of work, constantly review business models and respond to rising expectations of students.

Another lens through which to look at disruption was explored as part of an Optus study focused on industry 4.0. As part of the study, industry was asked which technologies would have the most profound impact on their industries, with the list topped by cyber security and big data.

**Figure 2: Technologies with the most profound impact on industries**



The disruption caused by technology will be so profound that new employees are unlikely to have all of the deep technical skills required. Instead, industry's focus will be on ensuring graduates have 'learned how to learn', are coachable and have the skills required to work in teams and collaborate.

In an ironic twist, rapid advances in technology are causing firms to value human skills more than ever before. This requires a fundamentally different approach to developing people, whether they are in the training sector or the workplace. The training sector will need to incorporate greater educational aspects to the services it offers the individual and industry partners. Because the pace of change is accelerating, people need to pursue lifelong learning to remain current, employable and relevant.

“At Cisco Canada we have had to re-think how we approach human resources and talent management. We have moved away from annual assessments to more regular, constructive and practical feedback. Our employee training tends to be delivered as bite-sized events and is less about formal, elongated programs that take people out of the workforce for an extended period of time.”

**- Alex Johnson, HR Director, Canada**

Figure 3: Examples of how other leading systems are responding to disruption caused by technology

George Brown Community College		
<p><b>What we learned</b></p> <ul style="list-style-type: none"> <li>Structured approach to developing the whole student, including major focus on industry-based project work</li> <li>Entrepreneurship as a core competency, not a nice to have</li> </ul>	<p><b>What they're known for</b></p> <ul style="list-style-type: none"> <li>Connections to industry</li> <li>Applied research</li> <li>Hands-on learning</li> </ul>	<p><b>Potential opportunities</b></p> <ul style="list-style-type: none"> <li>Collaboration in relation to enterprise/ entrepreneurship</li> </ul>
Niagara College		
<p><b>What we learned</b></p> <ul style="list-style-type: none"> <li>Targeted focus on student engagement and specifically providing students with exposure to cross-disciplinary learning that helps to provide a rounded offering. For example, as part of the microbrewing program students are exposed to everything from the chemistry to marketing of craft beer</li> </ul>	<p><b>What they're known for</b></p> <ul style="list-style-type: none"> <li>Program specialisations in food and beverage</li> </ul>	<p><b>Potential opportunities</b></p> <ul style="list-style-type: none"> <li>Collaboration in relation to applied research case study</li> </ul>
Ontario College Quality Assurance Service (OCQAS)		
<p><b>What we learned</b></p> <p>The OCQAS assures program proposals adhere to:</p> <ul style="list-style-type: none"> <li>Program title</li> <li>Credential level</li> <li>Vocational learning outcomes (depth)</li> <li>Essential employability skills</li> <li>General education (breadth)</li> <li>Occupational need (labour market analysis)</li> <li>Laddering opportunities</li> <li>Regulatory requirements</li> </ul>	<p><b>What they're known for</b></p> <ul style="list-style-type: none"> <li>A global leader in post-secondary education quality assurance</li> <li>OCQAS is operated by and for colleges to drive quality</li> <li>Collaborative working relationships with colleges, based on trust</li> </ul>	<p><b>Potential opportunities</b></p> <p>Consider the key elements of Ontario's success, based on KPIs of:</p> <ul style="list-style-type: none"> <li>Ontario qualifications framework</li> <li>Minister's binding policy directive</li> <li>Shared quality assurance mechanisms</li> </ul>
Ontario Ministry of Training, Colleges and Universities (MTCU)		
<p><b>What we learned</b></p> <p>In Ontario the institution (college), the OCQAS and the MTCU work closely together:</p> <ul style="list-style-type: none"> <li>Institutes design and develop programs and the delivery approach, approval provided by their Board of Governors</li> <li>OCQAS validates proposed credentials against qualifications framework</li> <li>MTCU established Provincial Program Standards and fund programs when in public policy interest</li> </ul>	<p><b>What they're known for</b></p> <ul style="list-style-type: none"> <li>Providing policy direction, including on basic and applied research for the sector</li> <li>Employment Ontario</li> <li>High rate of employment participation particularly in new industries</li> </ul>	<p><b>Potential opportunities</b></p> <ul style="list-style-type: none"> <li>Consider the OCQAS model by which Colleges work together to assure quality on behalf of government</li> </ul>

**Figure 4: Implications for Australian TAFEs**

Implication	Description	Impact
 <p>Policy makers and industry need to re-think Australian training packages</p>	<p>The current suite of Australian training packages approach is useful in that it maps technical skills and competencies, but it is less effective in delivering on some of the high-priority capabilities that individuals and industry need.</p>	High
 <p>Must better understand the characteristics of future workers including the importance of 'human' skills</p>	<p>This includes understanding what technical skills workers will require as well as human skills including entrepreneurship. An accurate profile of future workers' educational and training requirements will help to inform changes to the system.</p>	High
 <p>Must provide students with business enterprise training and skills</p>	<p>The reality for many workers will be employment in the gig economy where graduates will need to be able to market and sell their services, not just perform their work duties. Delivering business enterprise skills, at scale, and ensuring they are available on an equal-access basis, will become increasingly challenging.</p>	High

## Theme 2.

### TAFEs must be funded to do applied research to remain relevant to industry

In a hyper-competitive and globalised economy, industry needs to be open to new and different innovation partners, or risk disruption. Cisco, for example, has evolved its innovation strategy to focus less on buying and building capability to more co-innovation with partners (including universities and their customers). Industry wants its education partners to be more than a source of skills; it wants them to offer their tools, practical experience and industry insights to help solve real problems. This is an acknowledged strength of the TAFE vocational education and training network in Australia, which may be built on to meet current and future industry needs.

While vocational education and training providers may never have the research depth of leading research universities, and nor should that be a driver, TAFEs should be given the capacity and resources to undertake contained and industry-driven innovation projects that are best aligned to the applied nature of the education and training sector. The Canadian Government provides approximately \$100M p.a. in competitive funds for applied research to TAFE equivalents. This funding generates an order of magnitude return to the participating industry partners and the economy more broadly.

There are a number of aspects of the Canadian model that help to ensure success:

- The projects are industry-led, with industry as a natural partner for the sector
- Commercial agreements are heavily weighted to industry, which retains full rights to intellectual capital to encourage participation
- Proper resourcing of project management and oversight to ensure dealings with partners are streamlined
- Higher success rate of development of talent and workforce participation.

While some TAFEs in Australia undertake research, it tends to be small-scale and barely visible outside the institution. These projects are often heavily subsidised by TAFE given there are no formal mechanisms to fund applied research at either State or Federal level.

Figure 5: Examples of successful applied research projects

## Precision Agriculture (Niagara College)



### Approach and results

- Precision Agriculture applications: Synthesise agricultural yield, elevation data, and other data to determine linkages and practices to reduce fertiliser inputs
- Variable Rate Prescription algorithms and protocols for use on farms
- Early-warning remote sensing technologies to protect tender fruit crops
- Digital terrain analysis tools
- Geographic Information Systems (GIS) and data analysis applied to the agricultural industry
- Sustainable food production: Aid local growers to increase their production and improve food quality.

### Problem being solved

- Improving crop yields, establishing early warning system for potential threats to crops.

### Partners

- More than 20 industry partners.

## Clear Blue Technologies (George Brown College)



### Approach and results

- Toronto-based Clear Blue Technologies has developed a solution that weds the power of clean energy – through solar panels and a wind turbine – with cloud software technology to wirelessly deliver highly reliable off-grid power and independence to devices like streetlights, traffic cameras and mobile signage. The company's software provides real-time monitoring and control from the web, significantly reducing maintenance costs.
- George Brown was engaged to develop a prototype and conduct in-field testing. OCE then stepped in with a First Job award followed by Market Readiness support to conduct market research and establish distributor relationships.
- 50 customers in Canada, US, Germany, Dubai and Australia. The company has just released a new patented version of its technology.

### Problem being solved

- Reducing capital costs for installing devices like street lighting, security cameras and pipeline sensors.

### Partners

- Clear Blue Technologies, Centennial College and George Brown College.

**Figure 6: Implications for Australian TAFEs**

Implication	Description	Impact
 <p>Need to understand the sweet spot for TAFEs in innovation and applied research</p>	TAFEs have the deep subject matter expertise, specialist tools and industry networks required to successfully engage in applied research. More work is required to understand where TAFEs can add most value and fill holes in the current innovation ecosystem in Australia.	High
 <p>Need to build the applied research evidence base and prove its value to the Australian economy</p>	TAFEs need to create a deeper evidence base about what it takes to deliver a successful applied research project, and the benefits that accrue to government, TAFEs and, most importantly, industry. This work should also draw on examples that show how exposure to applied research makes students more work-ready.	High
 <p>Realising the full potential of the TAFE brand with industry</p>	The role of TAFE in Applied Research would help reinvigorate the TAFE brand and provide it a level of differentiation from other post-secondary providers. This would also assist in helping TAFEs offer a fuller range of services to industry (not limited to supply of skills) and better equip students outside the gig economy.	High

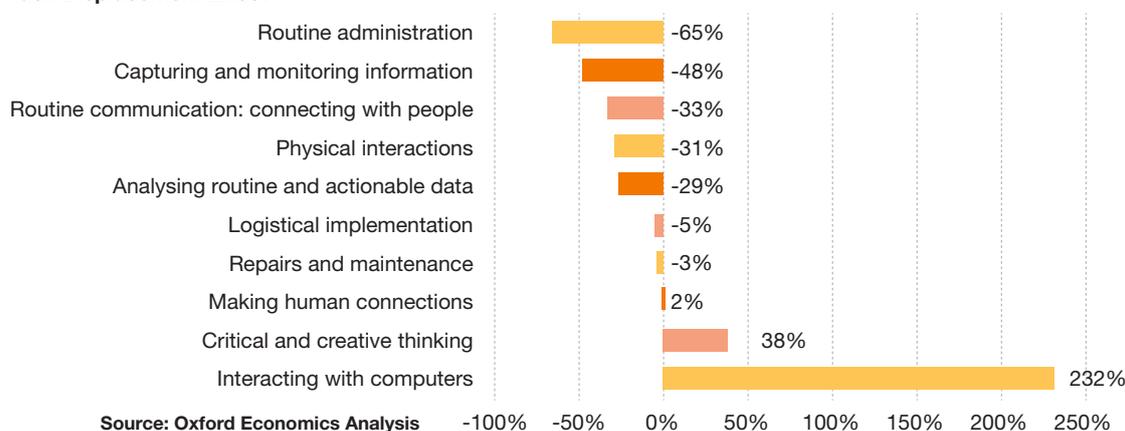
### Theme 3.

## There is a rising tide of ‘Blue Tech’ or Digital Trades, which are the natural market for TAFE

While economic commentary tends to focus on how many jobs will be lost to digitisation and automation, and that the rise of artificial intelligence and machine learning is quickly replacing standardised, process-oriented tasks, the digitisation of the economy is also creating new jobs and recasting old jobs. Oxford Economics<sup>1</sup> was commissioned by Cisco to assess the impact of digitisation on Asia. The report focused on the implications for specific industry sectors and job types. The analysis revealed that technology will be a net creator of jobs, and will push incomes higher.

There is particularly strong demand in areas such as cyber security, data and analytics, augmented and virtual reality, software engineering, the Internet of Things and artificial intelligence, all with the potential for non-gig economy jobs. Many of these jobs require sub-degree qualifications, including technical and project management skills. These jobs are increasingly referred to as ‘Blue Tech’ or ‘Digital Trades’ and TAFEs are well placed to respond. TAFE is the natural partner for students in these occupations, given they can respond more quickly than universities and with an applied learning focus.

**Figure 7: Task Displacement Effect**



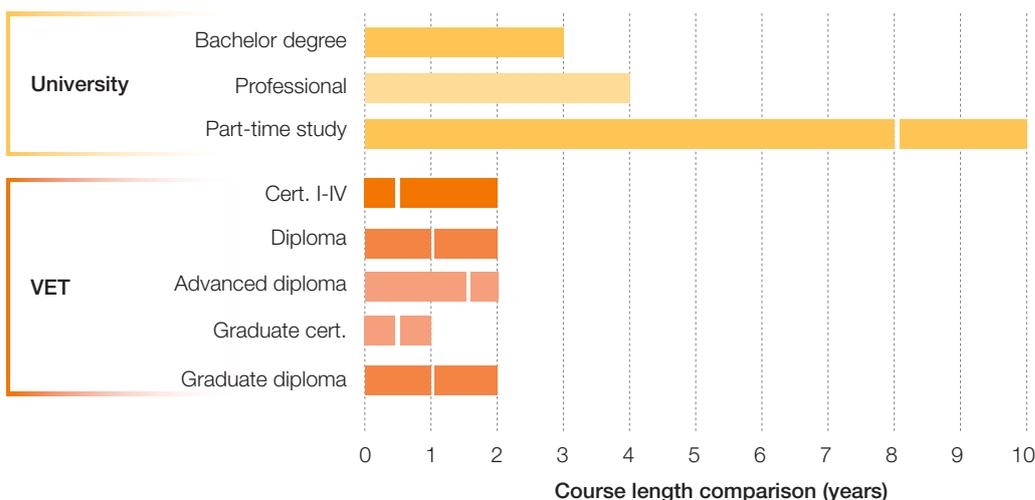
“Technological innovations are leveraged by businesses to improve their productivity. This alters the demands on their workforce, often displacing some workers from their jobs. Such change, however, also leads to a growth in prosperity, generating additional demand, which, in turn, creates new and different jobs. Employment in agriculture is a famous example. In the year 1900, roughly half of all U.S. workers were employed on farms. Today, that ratio stands at less than two per cent.”

– Oxford Economics Report

Australia needs 200,000 technology workers by 2023 if it's going to be a world leader in Industry 4.0<sup>2</sup>, yet in Australia there are fewer than 5,000 ICT degree graduates each year. Furthermore, Australian CEOs are not prioritising the re-skilling of existing staff as much as their global counterparts<sup>3</sup>. Consequently, Australian enterprises will not be able to fully realise the benefits from technology investments or have access to a workforce with the skills required, thereby putting their business and the wider economy at risk

An important question is ‘who is best placed to respond to this demand?’ According to the Australian Government Department of Employment, the VET sector provides training courses for 9 out of 10 occupations predicted to have the greatest growth of new jobs over the next five years. This shows that VET is more relevant than ever when it comes to preparing Australia to be more globally competitive. Part of the reason for this is that TAFEs are more responsive. This is demonstrated by Figure 8, which shows TAFE has a clear advantage over universities in terms of time required to complete – a differentiator that is critical in areas such as cyber security which is evolving rapidly and where there are immediate labour shortages.

Figure 8: Course length comparison



The World Economic Forum recently published its latest list of occupations in demand<sup>4</sup>. The list is dominated by roles that are grounded in technology and in many cases vocational qualifications will be sufficient, and in some cases preferred.

**Figure 9: Roles that are emerging or growing in demand**

Stable Roles	New Roles	Redundant Roles
<ul style="list-style-type: none"> <li>Managing Directors and Chief Executives</li> <li>General and Operations Managers*</li> <li>Software and Applications Developers and Analysts*</li> <li>Data Analysts and Scientists*</li> <li>Sales and Marketing Professionals*</li> <li>Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products</li> <li>Human Resources Specialists</li> <li>Financial and Investment Advisers</li> <li>Database and Network Professionals</li> <li>Supply Chain and Logistics Specialists</li> <li>Risk Management Specialists</li> <li>Information Security Analysts*</li> <li>Management and Organization Analysts</li> <li>Electrotechnology Engineers</li> <li>Organizational Development Specialists*</li> <li>Chemical Processing Plant Operators</li> <li>University and Higher Education Teachers</li> <li>Energy and Petroleum Engineers</li> <li>Robotics Specialists and Engineers</li> </ul>	<ul style="list-style-type: none"> <li>Data Analysts and Scientists*</li> <li>AI and Machine Learning Specialists</li> <li>General and Operations Managers*</li> <li>Big Data Specialists</li> <li>Digital Transformation Specialists</li> <li>Sales and Marketing Professionals*</li> <li>New Technology Specialists</li> <li>Organizational Development Specialists*</li> <li>Software and Applications Developers</li> <li>Information Technology Services</li> <li>Process Automation Specialists</li> <li>Innovation Professionals</li> <li>Information Security Analysts*</li> <li>Ecommerce and Social Media Specialists</li> <li>User Experience and Human-Machine Interaction Designers</li> <li>Training and Development Specialists</li> <li>Robotics Specialists and Engineers</li> <li>People and Culture Specialists</li> <li>Customer Service Workers*</li> <li>Service and Solutions Designers</li> <li>Digital Marketing and Strategy Specialists</li> </ul>	<ul style="list-style-type: none"> <li>Data Entry Clerks</li> <li>Accounting, Bookkeeping and Payroll Clerks</li> <li>Administrative and Executive Secretaries</li> <li>Assembly and Factory Workers</li> <li>Client Information and Customer Service Workers*</li> <li>Accountants and Auditors</li> <li>Material-Recording and Stock-Keeping Clerks</li> <li>General and Operations Managers*</li> <li>Postal Service Clerks</li> <li>Financial Analysts</li> <li>Cashiers and Ticket Clerks</li> <li>Mechanics and Machinery Repairers</li> <li>Telemarketers</li> <li>Bank Tellers and Related Clerks</li> <li>Car, Van and Motorcycle Drivers</li> <li>Sales and Purchasing Agents and Brokers</li> <li>Door-To-Door Sales Workers, News and Street Vendors, and Related Workers</li> <li>Statistical, Finance and Insurance Clerks</li> <li>Lawyers</li> </ul>

Source: Future of Jobs Survey 2018, World Economic Forum. Note: Roles marked with \* appear across multiple columns. This reflects the fact that they might be seeing stable or declining demand across one industry but be in demand in another.

Victoria Polytechnic is an example of the important role TAFE is playing in meeting demand for information and cyber security. It has established a Cyber Security Operations Centre (SOC) located in Melbourne’s western suburbs in partnership with Cisco. A recent report from *AustCyber*<sup>5</sup> and research firm Cybersecurity Ventures reveals that Australian employers will need at least 11,000 more cyber security workers over the next decade, while global demand in 2019 is expected to reach six million. The Cyber SOC will target re-training of long-term unemployed and disengaged youth as well as career changers and the general public. It will also feature a wide-range of training and professional development programs related to cyber security, to ensure students get the skills, knowledge and credentials they need to meet emerging industry need for cyber-savvy employees.

**Figure 10: Implications for Australian TAFEs**

Implication	Description	Impact
 <p>TAFEs are the natural lead for the ‘Blue Tech’ market, which remains ill-defined</p>	<p>‘Blue Tech’ is a natural space for TAFE given the vocational nature of the roles and alignment to technical skills. More work is required to size the Blue Tech market and identify the demand curve for specific role types. TAFE is also best placed to respond to industry demands from a curriculum development perspective.</p>	High
 <p>TAFEs need to broker industry-generated learning content as well as creating their own</p>	<p>The only way TAFEs can be responsive enough to industry demand in the high-tech sphere is by working closely with industry and utilising their own frameworks, curricula and materials. Cisco’s Networking Academy is a good example of industry content which can be easily integrated by TAFEs.</p>	High
 <p>TAFEs need to adopt new technologies to position their student experience as a contemporary one</p>	<p>The Blue Tech market will be more focused on visible technology than TAFEs’ traditional cohort. It is critical TAFEs lead in areas such as teaching and learning and campus efficiency. By teaching cyber security TAFEs are also making themselves a bigger target for hackers and their operations need to be secure.</p>	High

# Recommendations

As noted, Australia has a strong TAFE sector with a global reputation in vocational education and technical training excellence.

A crucial part of the TAFE sector's success is its willingness to engage with employers, training systems globally and with global industry partners to constantly evolve.

The following recommendations, if fully implemented, will further enable Australian TAFEs to better anticipate the massive labour market shifts that are occurring and, with employers and global industry partners, gain the necessary insights to respond appropriately and effectively for the benefit of the individual, communities, firms and industries, and for the betterment of the national economy.

Reflecting on the findings of the TDA 2019 Study Tour to Niagara Falls, Toronto and Washington DC, as set out in this report, the recommendations are for TDA to explore with its industry partners (including Cisco and Optus) and government to:

- 1 Analyse applied research projects in Canada and to develop principles for an Australian model.
- 2 Initiate two projects (with support from Cisco / Optus): George Brown (blockchain) and Niagara College (traditional industries).
- 3 Size the Blue Tech market as part of an independent study; potentially linked to an Oxford Economics report currently being commissioned by Cisco.
- 4 Conduct Future of Work state roundtables involving industry, culminating in a Future of Work and Blue Tech symposium at the World Congress in San Sebastian in October 2020, with the potential for an optional program the preceding day in Singapore.
- 5 Profile the future worker, focusing on what skills and competencies they need (soft and hard).
- 6 Establish a Cyber TAFE advisory board (TDA, Optus, Cisco, plus other industry partners).
- 7 Co-develop an enterprise credential for TAFEs – online, self-paced, MOOC.

## References

- 1 <https://www.oxfordeconomics.com/recent-releases/the-AI-paradox>
- 2 CS & Deloitte, Australian Computer Society Australia's Digital Pulse 2018 (June 2018). At <https://www.acs.org.au/content/dam/acs/acs-publications/aadp2018.pdf>
- 3 PwC, 21st CEO Survey (Feb 2018). At <https://www.pwc.com.au/ceo-agenda/ceo-survey/2018.html>
- 4 World Economic Forum, The Future of Jobs Report (September 2018). At [http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2018.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf)
- 5 <https://www.austcyber.com/resources/sector-competitiveness-plan/chapter3>



Australian TAFE and industry delegation at the residence of the Australian Ambassador in Washington DC