VOCATIONAL TRAINING FOR THE GLOBAL ECONOMY

A focus on major trends in vocational education and training in the Asian region

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Contents

About this report

dandolopartners was commissioned by Cisco and Optus to investigate emerging trends in vocational education and training, with a focus on Asia. This work is intended to stimulate debate, generate ideas and potentially inform, but not dictate, future directions for decision-makers within the Australian VET system. This report is not intended to provide direct comparison between countries that are clearly operating in different contexts. Inputs into this report included desktop research, consultation with Australian and Asian institutions and a study tour to Singapore involving five Australian TAFEs from three states.

Executive Summary

The global economy is orienting towards Asia, and Asian countries are looking towards VET to meet demand

We are witnessing astonishing shifts in global economic power to emerging markets, particularly in Asia. As the ability of some countries to simply manufacture more products or mine more resources rapidly diminishes, a premium is now placed on innovation and new industry. Economic growth is driven by the capacity of economies to continually renew themselves, drawing together the right skills, talent and technology at the right time. In the case where retraining and upskilling form a necessary part of transitioning our economy into high-value sectors, VET is vital to economic competiveness. We know many of the skills of the future won't be taught at university. Across Asia, developing VET capacity and capability is a major priority.

Technology change is also disrupting the supply and demand sides of the VET market

The pace of technology change is accelerating. Successful training institutions demonstrate a capacity to understand what's happening at a technology level, the impact this is having on VET providers and markets, and see leveraging technology as an opportunity to create competitive advantage. Training institutes are exploring how these technologies can help them achieve the vision of becoming 'Smart Campuses'. Key emerging technologies include:

- **Mass connectivity, mobility and the consumerisation of IT:** Raising learner expectations about the proportion of training that is available online or through rich formats (e.g. gaming).
- **The Internet of Things (IoT):** Creating opportunities to automate functions / improve productivity, generate new sources of data and inform decisions about learner engagement, experience and outcomes.
- **Big data, analytics and visualisation:** Data is the new oil, and when accompanied by visualisation it offers institutions the potential to achieve the 'holy grail' of VET: personalised training.
- **Cloud:** Driving complexity out of the institutional environment, increasing agility and exploiting new.
- **Cyber security:** A major source of risk for institutions, but also opportunity (as a growing industry in its own right).

The convergence of these technologies underpins what is being referred to as the Internet of Everything (IoE).[1]

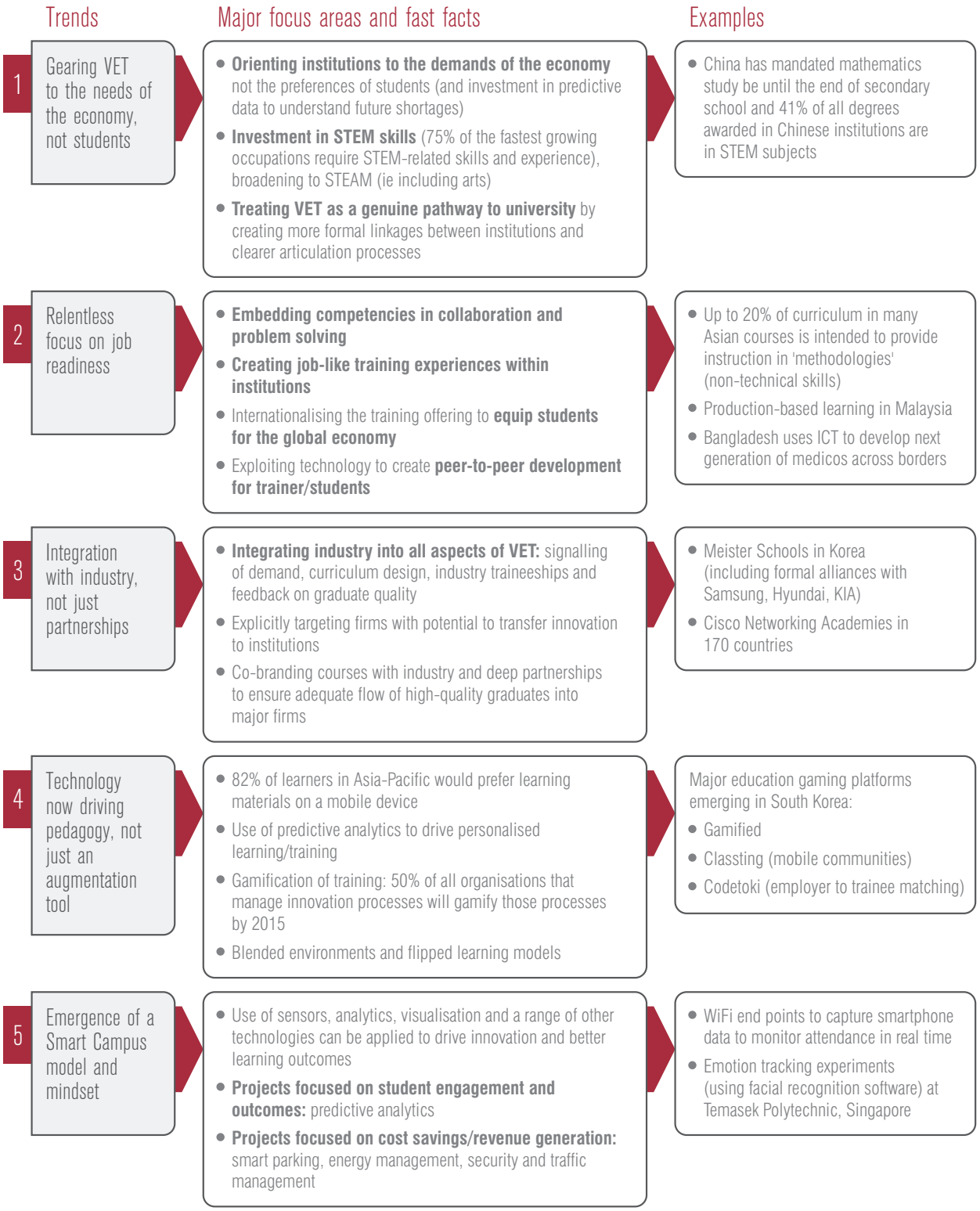
The Value at Stake for IoE for the next decade globally is estimated at $19 trillion ($4.6 trillion public sector). This is equivalent to about one-third of the expected labour productivity growth over the next 10 years. In the Australian VET sector alone the Value at Stake is estimated at $1.7 billion over the next decade[2]. Major areas of potential value include the application of the IoE to learning, parking, lighting, security, transport, payments and buildings/facilities. That number is likely to be even larger when factoring in the expected explosion in the use of predictive analytics to improve student retention rates.

1 IoE can be thought of as a four-stage process: 1) The capture of new data from machines and people (including smart devices); 2) Analysis of this data to deliver insight; 3) Application of insight to make process changes; and 4) Resulting human response or reaction. Quite simply, IoE represents a genuine platform for institutions and people to make evidence-based decisions.

2 Cisco has established a codified approach to assess Value at Stake based on 40 use cases for the public sector, understanding of industry dynamics, pain points and core value drivers. The approach is robust, data-driven and enables clients to target key pools of value.

Major trends in Asian VET

This report identified five major trends in VET in Asia, with implications for Australia.



Conclusion

Australia is well placed (strong economic fundamentals, stable institutions and a highly educated workforce), but there is potential room for improvement if Australia's training sector is to position Australia for the global economy. A high-performing TAFE system will not only allow our institutions to compete, but for Australia to realise the potential economic opportunities more generally.

1. The need for a focus on Asian vocational education and training

The global economy is orienting towards Asia

Based on current trends, the so-called 'E7' emerging powers (Brazil, China, India, Indonesia, Mexico, Russia and Turkey) will overtake the G7 in purchasing power terms by 2030.[3] By then, the middle class of Asia-Pacific will be double that of Europe and North America combined.[4] These economic shifts are resulting in a rebalancing in terms of consumption patterns and infrastructure spending, creating an entirely new global economic landscape.[5] Part of this is due to the primacy of manufacturing in the global economy (70% of total global trade) and the ability of countries such as China, India and South Korea to capitalise on technology breakthroughs to drive economic activity and productivity.[6]

These rapid changes in global economic power have forced developed countries in particular to re-evaluate their own economic futures. As the ability of some countries to simply manufacture more products or mine more resources rapidly diminishes, a real premium is now placed on innovation and new industry. China has developed emerging industries in areas such as energy and environmental technologies, next generation IT, biotech and high-end manufacturing, all of which it considers strategic for its economic future.[7] And while financial services have always been a strength of places such as Singapore, there is also a substantial increase in focus on innovative health and education services.[8]

One of the greatest predictors of future economic growth is economic complexity, which is the capacity of countries to diversify their economies and transition to high-value industries that are creating the demand for the jobs of the future.[9] Furthermore, we are seeing the extreme impact advances in digital technology are having on business models, supply chains and customer behaviour. In Australia, we know that up to 44% of jobs – or 5.1 million positions – are at risk from digital disruption.[10] These pressures are placing a major strain on the economy as a whole, but particularly on the workforce that supports it. If Australia is to remain globally competitive, it must innovate and diversify. That will require a highly skilled workforce aligned to new industry demands in the digital economy and a thriving VET sector.

A high-performing VET sector is critical to a nation's economic competitiveness

Governments and companies need to be proactive in evaluating where future sources of economic advantage will come from in a global economy with greater flows of capital, people and information. Economic growth is driven by the capacity of economies to continually renew themselves, by drawing together the right skills, talent and technology at the right time. Where retraining and upskilling form a necessary part of transitioning our economy into high-value sectors, VET becomes vital to economic competiveness. Around 21% of school leavers go directly into VET. In 2013, more than 3 million Australians had participated in some form of VET.[11]

In responding to an ageing population, governments will need to manage the demands of reskilling and training to keep people working longer. Across government-funded VET Australia-wide in 2014, there were more students in the 45-64 age bracket than the 20-24 age bracket.[12] This change in the demographic profile will add to complexity for TAFEs, which are more accustomed to servicing younger learners. The importance of VET is also recognised by competing economies:

- Nearly two-thirds of forecast employment growth in the European Union will be in the 'technicians and associate professionals' category.
- Nearly a third of job vacancies by 2018 will require some post-secondary qualification but less than a four-year degree.[13]

The value of degrees is being challenged globally for reasons such as the length of time to complete courses, perceived issues with job readiness and their vocational relevance (according to research released in 2013, 48% of employed college graduates in the U.S. are in jobs that require less than a four-year college education).[14]

3 Yang S, PwC *Global Annual Review* (2014), p. 7
4 King S, Hine D, Brea E, Cook H (CSIRO Australia), *Make for Asia – The emerging Asian middle class and opportunities for Australian manufacturing (2014)*, p. 10
5 Yang S, PwC *Global Annual Review* (2014), p. 7
6 McKinsey Global Institute, *Manufacturing the future: The next era of global growth and innovation* (2012)
7 US-China Business Council, *China's Strategic Emerging Industries: Policy, Implementation, Challenges & Recommendations* (2013), p. 2
8 Deloitte, Competitiveness: *Catching the next wave (China)* (2014), pp. 23-24
9 StartupAUS, Crossroads: *An action plan to develop a vibrant tech startup ecosystem in Australia* (2014), p. 10
10 PwC, *A smart move* (2015), p. 1
11 Birmingham S (Assistant Minister for Education and Training), *Transcript 5 February 2015*
12 NCVER, *Government-funded students and courses 2014: Australia* (2015)
13 OECD, *Skills Beyond School: Synthesis Report* (2014), p. 11
14 Vedder R et al., *Why are Recent College Graduates Underemployed?* (2013), available at: http://centerforcollegeaffordability.org/uploads/Underemployed%20Report%202.pdf

While innovation and skills are becoming the currency of the global economy, individuals remain at the centre of this broader change. If we continue to equip the disadvantaged and disenfranchised with the skills that allow them to contribute productively to the economy of the future, both the individual and the broader community benefit. VET forms a major part of this equation; we know that many of the vital skills of the future won't necessarily be taught through a three or four-year university degree.

Over time there has been a significant increase in workforce participation by traditionally disadvantaged groups, including women, mature-age workers and people with disabilities. Improved participation achieves greater incomes and living standards for the individuals and produces economy-wide benefits, including a contribution to national income. A 2.7% increase to overall national income by 2024 is predicted as a result of mature-age workers alone.[15]

Case study: Valuing high-end technology

iPhone component manufacturing demonstrates how economic value is transferring to Asia. Japan and South Korea account for 34% and 13% of the total value of the iPhone components, compared with just 6% for the US.[16] China produces only 3.6% of iPhone components, but this has supported the development of industry and infrastructure that now produces a wider range of high-value products. As industry and expertise develop, Asian production of high-end technologies is likely to increase.

Australia tends to focus on Asia as a VET market but needs to broaden that perspective

Education exports are of huge value to Australia and were its fourth-largest export in 2013.[17] Around 19% of this total, or $2.6 billion, can be attributed to VET. The vast majority of international students studying in Australia are from Asia, which also accounts for the top nine nationalities.[18] Asia as a market should, and will, continue to be a focus. However, given the increased importance of VET and Asia's successful economic growth, particularly in new industries, it can also be instructive for Australia. This paper, while picking up the macro trends happening throughout Asia in the VET sector, is focused on what is happening on the ground in some of the leading institutions to distil ideas and lessons that can be applied by Australian VET institutions and governments.

Fact base: A profile of VET delivery in Asia

Scale and focus of VET delivery in Asia

Developing VET capacity and capability is a national priority across Asia. This manifests in different ways in different circumstances. India and China are grappling with how to rapidly scale their VET infrastructure and make it more accessible. But though they have relatively similar populations and are both considered developing, China[19] has nearly seven times the number of VET students of India.[20] Highly advanced economies such as South Korea and Singapore have different priorities. They are increasingly sophisticated in the way they design and implement VET strategies and respond to the frequent – if unjustified – criticism that employment outcomes from VET are inferior compared with academic pathways. To demonstrate, around a third of all South Korean high schools are considered vocational and seen as a pathway into vocational junior colleges, universities or directly into employment.[21] Singapore has also championed VET from secondary school level since 1964. Now, technical/polytechnic education is seen as a viable alternative to junior college and graduates have consistently strong employment outcomes.

15 Deloitte Access Economics, Increasing participation among older workers: The grey army advances (2012), p. 11
16 Rassweiler A, *iSuppli Teardown Analysis* (2009), available at: https://technology.ihs.com/389273/iphone-3g-s-carries-17896-bom-and-manufacturing-cost-isuppli-teardown-reveals
17 Connelly S and Olsen A, *Education as an Export for Australia: Green Shoots, First Swallows, but Not Quite Out of the Woods Yet* (2013), p. 2
18 UNESCO Institute for Statistics, *Global Flow of Tertiary-Level Students*, available at: www.uis.unesco.org/Education/Pages/international-student-flow-viz.aspx
19 World Bank, China: *Improving Technical and Vocational Education* (2013), available at: http://www.worldbank.org/en/news/feature/2013/05/06/china-improving-technical-and-vocational-education
20 Nandakumar I and Sabharwal S (The Economic Times), *Number of tech graduates swells; salaries at IT firms stay stagnant* (2011), available at: http://articles.economictimes.indiatimes.com/2011-11-24/news/30437637_1_engineering-colleges-engineering-and-technology-graduates
21 Agrawal T (Indira Gandhi Institute of Development Research), *Vocational education and training programs (VET): An Asian perspective* (2013) in Asia-Pacific Journal of Cooperative Education, p. 22

Tertiary level vocational education and training in Asia

India

4600+ institutions (public/private)
1.6m+ students

Key priorities include:

- Scaling to meet growing skills demands
- Standardising VET curriculum
- Entrepreneurship: creating additional jobs for graduates

China

1200+ institutions (public/private)
10m+ students

Key priorities include:

- Scale (converting 600 public universities into polytechnic institutions)
- Focusing on skills needed in new industries to fuel economic growth
- Equipping students will technical and soft skills

South Korea

180+ institutions (public/private)
1.1m+ students

Key priorities include:

- Increasing adult participation in VET
- Strengthening basic skills, numeracy and literacy
- Increasing pathways from VET into university

Japan

3,500+ institutions (public/private)
550,000+ students

Key priorities include:

- Expanding the role of universities in VET
- Creating qualifications recognised by firms
- Enhancing career guidance for students

Taiwan

90+ institutions (public/private)
650,000+ students

Vietnam

700+ institutions (public/private)
1m+ students

Thailand

2000+ institutions (public/private)
1.5m+ students

Australia

5000+ institutions (public/private)
1.8m+ students

Singapore

6 institutions (public)
100,000+ students

Key priorities include:

- Job-ready focus, including internship opportunities for students
- Accessibility: expanding online VET
- Improving linkages between VET and university

Malaysia

30+ institutions (public)
165,000+ students

Key priorities include:

- Involving firms in curriculum design
- Incentivising firms to offer VET to workforce
- Improving public perception and awareness of VET

Indonesia

1200+ institutions (public)
2m+ students

Key priorities include:

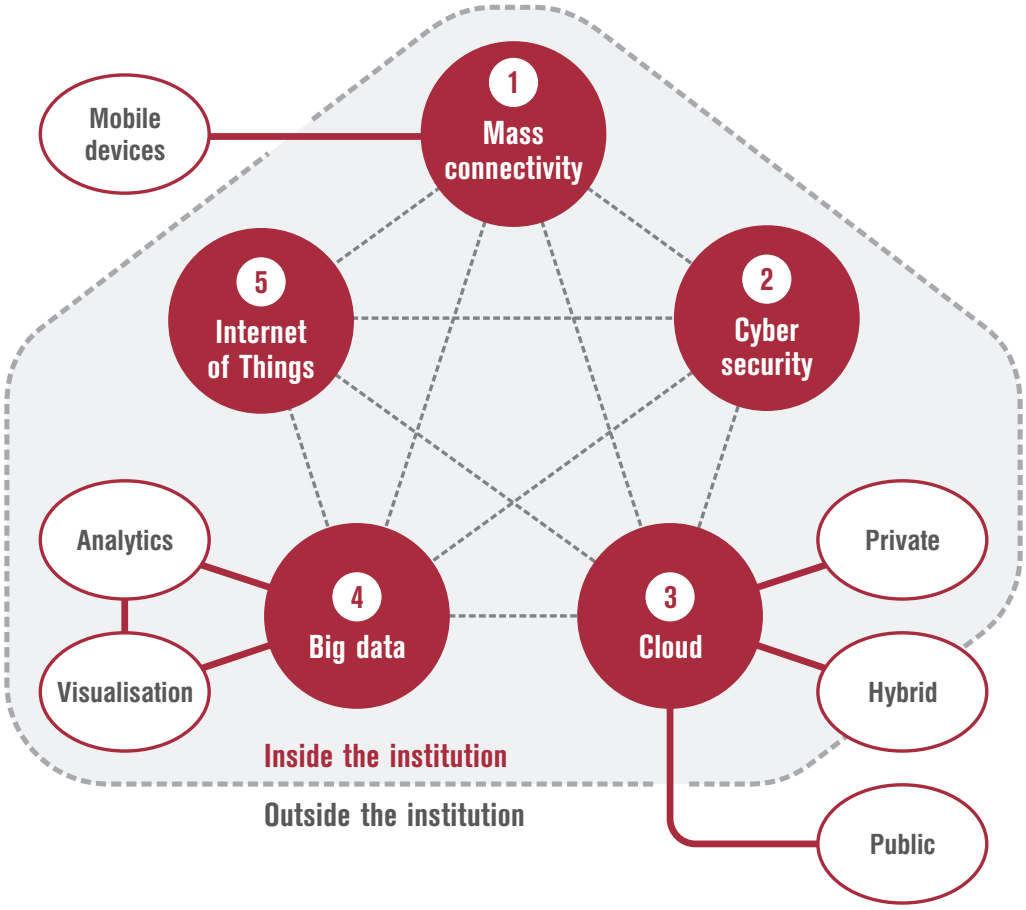
- VET system driven by labour market signals
- Flexibility: multiple entry points into study

2. Technology with the potential to disrupt VET delivery and business models

The pace of technology change is accelerating. Successful training institutions demonstrate a capacity to understand what's happening at a technology level and the implications for them and the markets they serve. This section describes five interconnected technologies that VET needs to appreciate, and some of the implications for VET.

Five interconnected technologies are disrupting the training sector

The purpose of this section is not to provide an in-depth analysis of specific technologies, but to describe the technology context in which VET is operating. The five technologies described below represent potential for major disruption to the way that VET operates and the markets that it serves.



Mass connectivity, mobility and the consumerisation of IT

Mass connectivity describes the increasing and widespread connection of individuals and objects to each other through technology. Increases in the mobility of technology make connectivity even more ubiquitous. VET institutions – perhaps more than any other – face the stark reality of 'mass connectivity' on a daily basis. The traditional cohort of VET – those aged 18-25 – have never been more connected to information and people. This is particularly true socially, where the Internet's 'killer app' has been as an engagement platform (social media). The consumerisation of IT describes what this 'mass connectivity' does to a person's perspective about other aspects of their life.[22] In short, evidence shows that users' experiences with technology as consumers (and socially) directly impacts on their expectations regarding their technology experiences at work and in education. If they are connected socially, they expect to be connected while learning.

22 Columbus L (Forbes), *How Enterprises Are Capitalizing On The Consumerisation of IT* (2014), available at: www.forbes.com/sites/louiscolumbus/2014/03/24/how-enterprises-are-capitalizing-on-the-consumerization-of-it/

"It is estimated that by the end of 2014 there were 7 billion mobile phone subscriptions (representing 96% of the global population). In contrast, only 4.5 billion of the world population had access to a toilet facility at the same time.[22] For the first time, more than one-quarter of the global population will use smartphones in 2015, which will become one-third of the population by 2018."

The Internet of Things

The Internet of Things (IoT) describes the mass connectivity of objects. If the Internet is about connecting people, IoT is about connecting people to 'machines', and machines to machines. Consider that only 2 per cent of all machines or objects that will be connected to the Internet are currently connected.[24] Connected objects will be as diverse as vehicles, street lights, irrigation sensors and wearable technology detecting everything from blood sugar levels to heart rate. The potential value and impact of the IoT is immense; the worldwide market for IoT 'solutions' will grow from $1.9 trillion in 2013 to $7.1 trillion in 2020.[25] Consumer 'machine to machine' connections will top 7 billion in 2023, generating $700 billion in annual revenue.[26]

Big data, analytics and visualisation

It is no longer possible to talk about the IoT without contemplating big data and visualisation. It has been described as 'the new oil'. Successful VET institutions will increasingly need to be capable of capturing and responding to diverse information flows and social networks.[27] Institutions can now leverage data to understand how long it took a student to access content after the course started, the time of day they did so, how long they spent looking at specific content, whether they collaborated with others or logged on to forums, and whether they asked questions and what type of questions. This information can now be processed quickly, and patterns established.

Another emergent technology field is data visualisation. As more data is analysed, decision-makers need to find ways to more easily interpret results and predict the future. The human brain processes information faster visually, and the science of data visualisation has evolved quickly. Data collected through South Korea's National Education Information System (NEIS) via surveys and transactions is being harnessed to improve VET. NEIS uses big data to identify specific trends in the market (anything from a shortage of technical skills in the electronics industry to a lack of 'soft skills' in the food processing industry).

Cloud

Cloud is often dismissed as a technology disrupter because it forms part of the 'plumbing'. Despite this, the impact of cloud on business and operating models – and internal cost structures – is profound. Cloud initially came to attention for its cost benefits, but increasingly VET institutions are attracted to its flexibility and agility and the capacity to take complexity out of ICT. Cloud infrastructure works especially well in 'bring your own device' environments, which is typical for TAFEs. It also tends to be more secure – and less dependent on end users' security compliance – and allows services to scale up and down quickly. As VET institutions have become more comfortable with cloud the question is not whether to use cloud but what type – private, hybrid and public – and in what circumstances.

23 UNESCO, *Fostering Digital Citizenship through Safe and Responsible Use of ICT* (2014)
24 Evans D (Cisco), *The Internet of Things: How the Next Evolution of the Internet is Changing Everything* (2011)
25 IDC, *Market in a Minute: Internet of Things* (2014), available at: www.idc.com/downloads/idc_market_in_a_minute_iot_infographic.pdf
26 Machina Research, *Consumer Electronics M2M Connections Will Top 7 Billion in 2023, Generating USD700 Billion in Annual Revenue* (2014), available at: https://machinaresearch.com/news/press-release-consumer-electronics-m2m-connections-will-top-7-billion-in-2023-generating-usd700-billion-in-annual-revenue/
27 Schleicher A (OECD Education Today), *Big data and PISA* (2013), available at: http://oecdeducationtoday.blogspot.com.au/2013/07/big-data-and-pisa.html

Cyber security

Training institutions must now be capable of operating in a digital world where security breaches are a constant threat. The challenge for institutions is to maintain security in a borderless and porous environment – and to keep it simple. A recent survey of Australian university Chief Information Officers cited, for the first time, cyber security as their number one priority.[28] The bulk theft of intellectual property – including personal, financial and competitive information – is now a genuine threat. In 2013 more than 500 million personal data records were stolen, with an average $145 cost per record and the average cost of a single breach hitting $3.5 million, according to IBM.[29] At last count there were 10 million known virus signatures. Educational institutions need to assess their own vulnerability to attack, but think laterally when doing so. The threat is not just of losing data, but of compromising someone else's private information: students, staff or industry collaborators.

The human dimension to vulnerability is particularly interesting, with up to 80% of banking trojans deemed preventable. It is estimated 95% of security incidents involve human error.[30] Not surprisingly, a major focus of cyber security is behaviour and attitude change management to ensure system users comply with policies.[31]

Supply and demand side implications of major technology shifts

Technology is reforming VET institutions' internal operations

The new global knowledge economy – one powered by ICT – is creating new, unexpected competitors to VET institutions. One understated aspect of the Internet's impact has been the erosion of education and training institutions' 'monopoly' on knowledge creation and dissemination. Contemporary sources of knowledge are broader and more open than ever. Corporations and professional service firms, along with insightful individuals with access to knowledge, can and do produce content that is engaging and often freely available. This creates potential competitors for VET institutions, but also opportunities for new partnerships and approaches.

New learners who have grown up with technology have especially high expectations for its use. The 'millennial' cohort is characterised by early adoption of technology and consequently high expectations the institutions with which they interact will harness the potential of technology to personalise and enrich its services.[32] While technology has created high expectations, it is also critical to meeting those expectations, including in vocational training.

The impact of technology on VET markets and customers

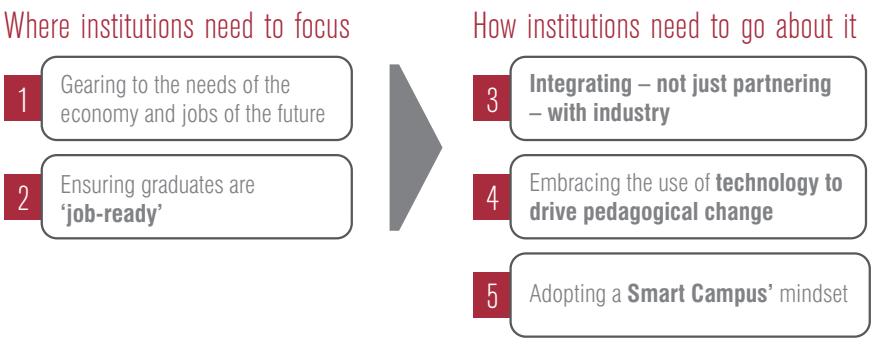
Technology is driving massive change in almost every facet of the economy and certainly among companies that are the 'consumers' of skills produced by VET institutions. Many of the industries that VET has traditionally serviced are in flux. For example, online platforms such as Airbnb create threats and opportunities to the way hospitality is taught by TAFEs. As industries evolve, so does the capability set.

Consider the five-year employment growth rates for the following jobs: ICT business and systems analysts (19.1%), software and applications programmers (17.2%), and database and systems administrations and ICT security (21.1%).[33] These projections don't even account for jobs not yet invented.

28 Computer Daily News, *Cyber attacks now No 1 issue in Aust boardroom chatter* (26 Jun 2015)
29 IBM, *IBM Security Services: Cyber Security Intelligence Index* (2014), p. 2
30 IBM, *Cyber Security Intelligence Index*
31 Barbier J, Bradley J and Handler D (Cisco), *Embracing the Internet of Everything To Capture Your Share of $14.4 Trillion* (2013)
32 CEDA, *Australia's future workforce?* (2015), p. 45
33 Australian Government Department of Employment, 2015 Employment Projections, available at: http://lmip.gov.au/default.aspx?LMIP/EmploymentProjections

3. VET trends in Asia

Five broad trends have been observed in Asia with clear implications for Australian VET providers. The trends are in two categories: where institutions need to focus, and how to begin implementing change.



Trend 1: Gearing VET to the needs of the economy and jobs of the future

What's driving the focus on jobs of the future?

It is estimated that 47% of today's jobs will be automated in the next 10-20 years.[34] In Australia, traditionally strong industries such as agriculture and manufacturing will continue to be sources of employment, but the nature of the jobs available in those industries is likely to change in fundamental ways. On the flip side, McKinsey estimates that by 2020 employers worldwide could face a shortage of 85 million high- and medium-skilled workers, particularly in emerging fields such as cyber security.[35]

While it is difficult to know what jobs will exist in the future, we know that STEM skills are likely to be an important part of the equation, whether it's in reconfiguring jobs in existing industries or having the capacity to fill the jobs of the future – even the ones we have never thought about. It is estimated that 75% of the fastest-growing occupations require STEM-related skills and experience.[36] But further to that, it is becoming more important that everyone in society has a good grasp of STEM, as even traditionally non-STEM industries become disrupted by new technologies. As Alan Finkel AO, the Chancellor of Monash University, stated, there are "no occupations, careers or professions that are not reliant on understanding of STEM skills".[37]

Asia's approach

Prioritising the needs of the economy over student preferences

In Australia, we frequently express pride in the way we maximise choice for students. Australia's demand-driven system gives students the freedom to 'follow their dreams'. While the notion of a demand-driven system is sound in principle, there is a question about how well placed students are to assess what's in their best interests in the medium and long term, let alone the needs of the broader economy. Australian jurisdictions increasingly provide students with qualifications for which there are few or no practical job outcomes, which in turn ends up restricting their choices in the job market. A recent report revealed that VET enrolments for storeperson training in one state reached 19,000, despite average annual employment needs of just 1,728. Other jobs that were heavily oversubscribed included truck driving and carpentry.[38]

Improving the reputation of VET to drive student uptake and change industry perceptions

Several Asian countries – particularly Singapore – use the needs of the economy, rather than the needs of the student, as the anchor of their VET system. One major area of focus is on the repositioning of VET institutes – and their course offerings – as highly progressive and responsive. At Temasek Polytechnic, economically important courses are also branded creatively to attract students ('Big Data Management and Governance' or 'Digital and Cyber Security').

34 Frey C B and Osborne M A, *The future of employment: how susceptible are jobs to computerization?* (2013).
35 BHEF, *The National Higher Education and Workforce Initiative* (2013), p. 3
36 *Ibid*
37 Finkel A (The STEM Pipeline for the Digital Economy Round Table), *Attracting and Retaining STEM Talent* (2014), available at: www.bhert.com
38 Preiss B (The Age), *Victorian training costs blow out in professions with under-supply of jobs* (2015), available at: www.theage.com.au/victoria/victorian-training-costs-blow-out-in-professions-with-undersupply-of-jobs-20150716-gidzua.html

Case study: Improving perceptions of VET for the benefit of the economy

In Singapore 65% of the entire post-secondary cohort attend a vocational institution. Singapore has also taken an innovative approach in tackling poor perception of VET, through campaigns such as the 'Top of the Trade' television competition and 'Apprenticeship of the Year' awards. Now, the Institute of Technical Education and a handful of institutions like it are considered world-class education institutions (even when considered against universities) and excel particularly in STEM.

Translating priorities into action on the ground, including a focus on STEM

In order to truly serve the economy, it's not enough for governments to simply outline general priorities and hope that industry and the education sector respond. After the global financial crisis of 2008, Chinese leaders decided it was necessary to restructure the economy from an export-oriented model to a domestic one, requiring a diversification in the form of huge investment into science and technology. As a result, ICT has been a core part of its five-year plans for decades, and is identified as one of seven strategic emerging industries, alongside energy-efficient and environmental tech, biotech, high-end equipment manufacturing, new energy, new materials and new energy vehicles.[39] China has also mandated that mathematics be compulsory until the end of secondary school. These actions ensured 41% of all degrees awarded in Chinese education institutions were in STEM subjects.[40] Taiwan not only has technical schools, but also technical universities. South Korea is notable here too, for the inclusion of Arts as part of its 'STEAM' program in order to encourage bright students to stay with science and mathematics.[41]

Recognition of VET as an effective pathway into university

The benefits of treating VET students as good candidates for university degrees have long been realised in Asia. In Australia, the two pathways are seen as reasonably distinct: after high school you either begin further academic study at a university or pursue a trade. In Singapore, technical and polytechnic education is not just an industry-ready exit qualification but also a pathway into university. Parents recognise that a mix of academic and practice-oriented education builds important and mutually useful skills in their children.[42] In South Korea, Meister schools are producing students who are attractive to both employers and universities.

Trend 2: A relentless focus on job readiness

What's driving the 'job readiness' focus?

Employers want graduates who are work-ready and can grow into whatever role they are given.[43] Ensuring that graduates are job-ready is critical to ensure that firms and industries remain dynamic, adaptable and efficient. Job readiness encapsulates the 'soft' skills needed in the workplace and the technical skills to be able to add value quickly. Australia is considered to be lagging behind Asia on the former, and at least comparable regarding the latter.

Asia's approach

Embedding competencies around collaboration and problem solving

The top two skills that employers seek in contemporary graduates are the ability to work within a team and the ability to solve problems.[44] Asian countries are ahead of Australia based on creative problem-solving PISA (Programme for International Student Assessment) rankings. Singapore, South Korea, Japan and China are the top four performers in the OECD.[45] In Singapore, a huge part of the job readiness movement is the principle of 'productive failure': the idea that part of the process of learning is accepting failure then persevering. This method of teaching has proven results in improving learning outcomes, even in technical subjects such as mathematics.[46] This type of resilience is particularly valued in new and emerging industries such as tech start-ups.

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39 US-China Business Council, *China's Strategic Emerging Industries*.
40 Chan P and Lutgen P (XL Group), *The Age of Innovation in China and India* (2014), available at: http://xlgroup.com/fast-fast-forward/articles/the-age-of-innovation-in-china-and-india
41 ACOLA, STEM: *Country Comparisons* (2013), pp. 54-55
42 Agrawal T, *Vocational education and training programs*, p. 23
43 Callaghan R (Australian Financial Review), *Employers want graduates with more than just good marks* (2015), available at: www.afr.com/news/policy/education/employers-want-graduates-with-more-than-just-good-marks-20150215-13d15h
44 Adams S (Forbes), *The 10 Skills Employers Most Want In 2015 Graduates* (2014), available at: www.forbes.com/sites/susanadams/2014/11/12/the-10-skills-employers-most-want-in-2015-graduates/
45 OECD, *Snapshot of Performance in Problem Solving* (2012), available at: www.oecd.org/pisa/keyfindings/PISA-2012-PS-snapshot-performance.pdf
46 Kapur M et al., *Productive failure in Mathematical Problem Solving* (2015), available at: www.manukapur.com/wp40/wp-content/uploads/2015/05/CogSci08_PF_Kapur_etal.pdf

Creating 'job-like' training experiences

Vocationally focused institutions increasingly measure their success on their students' capacity to secure sustainable employment. One of the challenges for institutions is finding sufficient work placement opportunities for students. The Meister schools of South Korea have provided training for 11,500 students since 2010, despite operating in only 28 schools. Work placements have been created in 1,611 companies and are delivering strong employment outcomes, improved industry collaboration and increasing the status of VET generally.[47] Even when an appropriate work placement cannot be found there are opportunities to create compelling experiences. For example, students at Temasek Polytechnic in Singapore operate the institution's IT support centre, providing work experience and saving it money.

Case study: Job-like environments beginning in high school

Twenty-one Meister high schools opened in 2010, with 28 in operation in 2013. The objective was to reposition vocational education as a high-status alternative to university. The label 'meister' is German for master craftsman. Meister schools account for less than 7% of all vocational high schools in South Korea, yet the early results are promising. 90.8% of the first generation of young 'Meisters' have job offers before graduating. Graduates finish with the equivalent of two years' work experience/community college experience, an attractive blend to employers and a point of difference if the student applies to university.

Case study: Responding to the shortage of job placements

A challenge for VET institutions is finding genuine, high-quality industry placements for the large number of students they serve. In many situations, especially in areas experiencing rapid economic growth, it is impossible to provide workplace training to the required scale. In Malaysia, polytechnics are implementing production-based learning. At Batam State Polytechnic, for example, goods are produced by students for industry within a learning framework, with profits returned to the institution. Students work through the product value chain, from product identification and analysis to business case planning and manufacturing in a factory.[48] The Shipbuilding Institute of Polytechnic Surabaya is also implementing a similar approach to create an industrial culture among students and all profits are reinvested in the institution.

Internationalising training to equip students for the global (and digital) economy

Asia has long recognised the importance of a global education, and as such, is home to the world's most mobile student population.[49] It is becoming increasingly common for their domestic education programs to include a compulsory overseas study component. Internationalisation has been embraced by institutions across Asia, and Australia should follow suit. Initiatives such as the New Colombo Plan, which supports study and internships in the Indo-Pacific region, are a good start.[50]

Exploiting technology to create peer-to-peer development opportunities for trainers and students

Technology is increasingly playing a role in helping students better prepare for workforce conditions. In Bangladesh the Department of Pharmacology of BSMMU established a virtual classroom system for students across the country to increase the number and capability of medical professionals. This allows professionals from Dhaka and elsewhere to deliver lectures to students in different regions and students can listen and ask questions in real time.[51] The interest in these technologies is partly driven by lower costs of these technologies, as well as the fact they have become more immersive and effective.

47 McKinsey, *Meister High Schools*, available at: http://mckinseyonsociety.com/e2e_casestudy/meister-high-schools-south-korea/1/
48 Hidayat G and H (Padang State University), *Production Based Learning: An Instructional Design Model in the Context of Vocational Education and Training* (2014), available at: journalofscience.org/index.php/GJSFR/article/download/1410/1272
49 UNESCO Institute for Statistics, *Global Flow of Tertiary-Level Students*, available at: www.uis.unesco.org/Education/Pages/international-student-flow-viz.aspx
50 Australian Government (DFAT), *New Colombo Plan,* available at: http://dfat.gov.au/people-to-people/new-colombo-plan/pages/new-colombo-plan.aspx
51 Nakata S (World Bank), *Virtual Classrooms Foster Medical Education and Research in Bangladesh* (2015), available at: http://blogs.worldbank.org/endpovertyinsouthasia/virtual-classrooms-foster-medical-education-and-research-bangladesh
52 Microsoft, *Coding fever hits a new high in Asia-Pacific* (2015), available at: https://news.microsoft.com/apac/2015/06/18/coding-fever-hits-a-new-high-in-asia-pacific/

Case study: Coding for kids

Learning coding is a priority for students in Asia, even in places where it does not already form part of the curriculum. A recent study found that 91% of respondents thought coding was a good career option, and 74% of students would even take coding classes outside school if given the opportunity. Institutions – in collaboration with firms – have been conducting coding events for people under 24 in places such as Japan in order to dispel the notion that only certain people can code due to perceptions of difficulty/exclusion in the field. This message is strongly aimed at parents, schools and governments.[52]

Trend 3: Integration with industry, not just partnerships

What's driving the focus on integration with industry?

There is a high degree of dependence between industry and the institutions that supply human capital. The model of industry as a passive 'receiver' of skilled people is a historical artefact. In a contemporary economy, industries increasingly expect to be involved in the design of curriculum and pedagogy, and expect to provide feedback on the extent to which needs are met.

VET institutions expect clarity on future skills needs, formal and informal channels of engagement and a contribution towards the learning experience (e.g. work placements). The cost of failing to effectively deal with reciprocity is significant: it leaves students with obsolete or irrelevant skills and firms without the human capital they depend on to contribute economically.

Asia's approach

Integrating industry in all aspects of VET

Asia is taking the lead when it comes to involving industry in all aspects of VET, from helping direct course design to providing feedback on graduates when they eventually enter the workforce. In many ways, this approach seems obvious, but it is not done well in Australia. Another important role for industry is improving the quality of VET instructors by creating more effective and efficient exchanges between industry and training institutions.

Case study: Approaches to securing industry involvement

The Malaysian Human Resources Development Fund was created through imposing a levy on employers in the services and manufacturing industry sectors, in order to create a central pool of resources for training. All employers that contribute to the levy are eligible to apply for training grants or financial assistance for employee training. Human resource development costs are allowable expenses for tax purposes, creating incentives for industry to invest in the ongoing development of employees.

Case study: Teaching teachers

A German engineering company, GIZ, has a 30-year relationship with China as a sustainable development partner. One of the core competencies is around VET. The GIZ VET Platform for Wind Power Operation and Maintenance Staff is intended to enhance the practical skills of operations and maintenance teaching staff. This project involves 14 VET institutions partnering with three wind power companies and three turbine manufacturers. Modelled on German education models, it encourages teachers and trainers to be 'agents of change'. German experts conduct in-country training over several weeks to ensure the competency of instructors from China, and the scheme is being expanded into Indonesia and Myanmar.[53] Participating Chinese teachers are also required to spend one month in industry each year.[54]

Explicitly targeting firms with potential to transfer innovation to institutions

Firms are a critical source of innovation in the training sector. Asian institutions have recognised that not all industry partnerships are equal. There is a preference for relationships with companies that have high innovation quotients, not just high turnovers. This recognises that a relationship with a knowledge and innovation-rich firm offers two clear advantages in VET: the opportunity to work with companies that will thrive in the global economy and those with the potential to transfer innovation to the institution.

Asian institutions are increasingly co-branding courses with major companies, recognising it is good for students (skills have greater currency and pathways) and the institution (knowledge transfer). The collection of Cisco Networking Academies (which exist in 9000 separate institutions and 170 countries), accredit students to work with a particular type of technology. The same is true for Meister schools in South Korea, which act as feeders for large companies. To demonstrate the second point – i.e. innovation transfer – it is interesting to note that Asian institutions are increasingly branching into strategic procurement relationships with suppliers. The objective here is not just to deepen relationships with a strategic supplier, but to ensure the supplier facilitates access to its ecosystem of partners, knowledge and technology so that the institution may benefit directly.

Trend 4: Technology driving pedagogy

What's driving the focus on technology in teaching and learning?

Advances in teaching and learning ICT have reached a tipping point. No longer are technologies simply an augmentation tool – they are fundamentally changing how training is provided. There are several factors contributing to this phenomenon including the rise of the millennial cohort, who are characterised by their early adoption and intensive use of technology (82% of learners in Asia-Pacific would prefer learning materials to be made available on a mobile device).[55] As they have grown up with broadband, smartphones and social media, they expect instant access to information and will often have a better grasp of ICT tools than senior workers.[56] This is particularly important when you consider over half of the current population in India fall into this cohort.[57]

There is a widespread recognition that some traditional training and teaching pedagogies are becoming less effective. The move towards flipped classrooms is occurring in higher and K-12 education, not just training. Traditional lecturing techniques ('sage on a stage') could increase the failure rate by a factor of 1.5 as compared with more active, progressive learning techniques.[58]

While many institutions are embracing new pedagogies, pockets of intense resistance remain. One of the major sources of resistance is the training workforce itself. Integration of technology into the training process often involves significant change to processes, attitudes, course materials and even the fundamental role of trainers. Take, for example, the introduction of flipped classrooms where students view the 'lecture' before class and spend class time applying and testing their knowledge. The trainer moves from being a subject matter expert to a facilitator and knowledge broker. This resistance is likely compounded by an ageing workforce (National Centre for Vocational Education Research reported in 2009 that teachers in TAFEs are likely to be older than the broader VET population).[59] The receptiveness of faculty is particularly important when you consider that the next generation of learners will consider technology 'situation normal', not a value-added pedagogical feature.

53 Fosa N D, *Moving beyond talk-and-chalk-teaching – a holistic didactical approach to teacher training through trilateral cooperation between Germany, Indonesia and Myanmar* (2015), available at: www.tvet-online.asia/issue5/dwi-fosa_etal_tvet5.pdf

54 OECD, *Vocational Education and Training in China: Strengths, Challenges and Policy Options* (2013), available at: www.oecd.org/education/skills-beyond-school/45494135.pdf

55 Hill J (Skillsoft Asia), *Learning and Development Trends in Asia-Pacific* (2014), available at: http://elearningindustry.com/asia-pacific-learning-development-trends

56 PwC, Millennials at work: *Reshaping the workplace in financial services in Asia* (2012), p. 6

57 *Ibid*

58 Freeman S et al., *Active learning increases student performance in science, engineering, and mathematics* (2014), available at: www.pnas.org/content/111/23/8410

59 NCVER, *Careers in vocational education and training: what are they really like?* (2009), p. 19

Asia's approach

Analytics driving personalised learning[60]

Predictive analytics are offering – perhaps for the first time – access to the 'holy grail' of training: personalised learning. Institutions are now able to capture significant stores of data about learners' backgrounds, attitudes, behaviours and outcomes. Asian institutions are at the forefront of learning analytics. Singaporean institutions are beginning to experiment with facial recognition technology that can provide lecturers with real-time information about whether a student is feeling positive, neutral or negative, or engaged/disengaged. Other examples of how learning analytics are currently being used to tailor learning to student needs include survey-based analytics to establish learning dispositions, providing personalised feedback and assess suitability for specific courses, data collected through online learning platforms and visualisation of text chat to monitor students' learning experience.[61]

Gamification of training

Globally, people spend three billion hours a week playing video and computer games.[62] Gamification as a concept is not new, though its uptake and quality has increased exponentially in recent years. Gartner, for example, estimates that 50% of all organisations that manage innovation processes will gamify those processes by 2015.[63] It also is beginning to have widespread application beyond the business world and in education, as evidenced by the success of Duolingo as a language-learning platform. Gamification's benefits include better learning experiences and environments that prompt behavioural change, instant feedback, application across a broad range of learning needs and a positive impact on the bottom-line of most institutions.[64]

Case study: The unexpected impact of gamification

Uptake of gamification as a trend has played into Asia specifically, in part due to the high saturation of smartphones (and other devices) across countries such as Japan, China and South Korea. Gamified education is becoming one of South Korea's most exciting exports, with a variety of apps being developed. Classting, for example, creates a mobile community for the classroom that is accessible by students, teachers and parents, allowing them to send out news, updates and homework tasks.[65] Codetoki is an app that matches employers and applicants through a gamified platform, and is aimed at reducing unemployment in the Philippines.[66] The value of gamification is also starting to gain some acceptance in Australia: TAFE SA is working with a partner to use tactile and visual 3D-simulated environments to deliver more skills online and less via text and audio.[67]

Technology changing the way training is done

It is no longer sufficient to simply provide access to knowledge and assume students are equipped to apply them. Digital technologies are driving two pedagogical changes:

- **Increasingly blended environments:** While there has been, and continues to be, a significant focus on Massive Online Open Courses (MOOCs), most training institutions are settling on a blended approach (a combination of online and face-to-face methods). This incorporates a range of emerging digital tools, including lab simulations, games, online tutorials and podcasts, which complement face-to-face instruction.

60 http://blog.hobsonsapac.com/2015/04/leveraging-analytics-to-drive-personalised-learning/
61 University of Queensland, *Personalised learning: an overview* (2015), p. 7, available at: http://itali.uq.edu.au/filething/get/1865/Personalised_learning_overview_Final_16_Mar_15.pdf
62 Knewton, *Gamification of Education* (2012), available at: www.knewton.com/gamification-education/
63 Gartner, *Industry research* (2011), available at: http://elearningindustry.com/top-6-benefits-of-gamification-in-elearning
64 *Ibid*
65 Southern L (12ahead), *Gamified education is South Korea's hottest export* (2012), available at: www.12ahead.com/gamified-education-south-korea%E2%80%99s-hottest-export
66 Asian Development Bank, *ICT and Skills Development in Asia and the Pacific: 12 Things to Know* (2013), available at: www.adb.org/features/ict-and-skills-development-asia-and-pacific-12-things-know
67 TAFE Directors Australia, *TAFE to pilot interactive training technology* (2015), available at: www.tda.edu.au/cb_pages/newsletter_2_february_2015.php

Flipped learning: The notion of flipped classrooms is not new, but its uptake has increased as digital technologies have become more immersive, richer and more accessible. In a flipped environment, students are provided with the 'lecture' ahead of class (generally accessible online), and class time is spent applying knowledge. Flipped classes represent a starkly different pedagogy, and radically change the role of the trainer from 'content expert' to 'expert and facilitator'.

Trend 5: The emergence of a Smart Campus mindset

What's driving the focus on Smart Campus?

The term 'Smart Campus' is relatively new. Initially its meaning was reasonably narrow and referred to an education campus that was exploiting opportunities related to the Internet of Things.

Increasingly, a broader meaning has been attached to Smart Campus and it has come to encapsulate a range of digital technologies, including those applied to teaching and learning, administration and operations. It has become clear that 'Smart Campus' is a mindset, not a solution set that can be purchased from a catalogue. Smart Campus incorporates all of the five emerging technologies described in this report.

Training institutions – including many in Asia – are increasingly looking at how sensors, analytics, visualisation and a range of other technologies can be applied to drive better learning outcomes[68] and improve student experience/engagement, capture new sources of revenue and generate efficiencies/productivity savings, and increase an institution's capacity for innovation and community relevance.

Asia's approach

A strategic approach to Smart Campus investments

The most active institutions tend to make decisions and invest for the longer term. The benefits of Smart Campus are divided into three categories: student-centred, operationally-centred and long-term strategic objectives.

68 Explored in more detail in *Trend 4: Technology Driving Pedagogy*

The short-term quantifiable benefits tend to be what encourage institutions into discussions about Smart Campus. These include benefits relating to student operational efficiencies and student outcomes and engagement. However, discussions with institutions that are committing more fully to the establishment of Smart Campuses revealed that the motivation behind their investments is broader, and longer term. They focus on how a Smart Campus mindset can align their institution to the jobs of the future, create platforms for new industry partnerships and drive wider community and societal benefits.

What Smart Campus projects are starting to look like

The best projects to start with tend to leverage mostly existing infrastructure, pose low implementation risks and offer clear benefits.

Student engagement/student outcome-focused projects

New applications of IoE centred on students are starting to emerge. The use of big data analytics is increasingly used as a predictive tool to identify students at risk of not graduating. Sophisticated analytics identify specific variables and risk factors from a broad range of data including demographic information, assessment data, attendance and interaction with learning materials.

WiFi end points are being used to capture data from smartphones to monitor student attendance in real time. For privacy reasons the application has focused on capturing anonymous student data, which is useful for being able to track attendance at an aggregate rather than individual level. This type of data helps to provide insight into class engagement (i.e. if the total number of students is far less than are enrolled) and room utilisation.

Emotion tracking (based on facial recognition software) is being experimented with at Temasek Polytechnic in Singapore. Sensors will be used to capture students' facial expression that can be treated as a proxy for student engagement. Once proven, the technology may be able to provide a trainer with real-time information about whether students are concentrating, distracted or anxious, allowing them to modify the instruction accordingly. Digital beacons are being used extensively in Asia to track and identify students to a specific geographic location. The beacons can recognise an individual student's smart device and customise digital signage messages to the student.

Efficiency/revenue-generating projects

Much of the initial focus of IoE has centred on applications to increase efficiency and generate revenue. Smart parking applications are being rolled out broadly, with a focus on how to use sensors to determine (in real time) where carparks are available and providing this information to drivers in search of a space. Given that carparking is a major issue for VET institutions – particularly in metropolitan areas – much of the early interest in IoE has focused on this application. Other IoE applications with high potential include smart security (leveraging IP surveillance technology), smart waste (enabling garbage bins to alert collectors when they are full, reducing the need for pick-ups) and smart lighting. Smart lighting offers significant potential value to institutions from a safety and energy management perspective. New technologies being developed and tested in Copenhagen, among other places, suggest that energy savings from smart lighting could be as high as 75%. In cases where lighting infrastructure is used for other purposes (e.g. the wireless points on light poles being used as sensors for smart parking applications) the benefits are even greater.

Overview of the Potential IoE Value at Stake for VET in Australia

The IoE is driving unprecedented disruption to the public and private sector. The Value at Stake for IoE for the next decade globally is estimated at $19 trillion ($4.6 trillion public sector). This is equivalent to about one-third of the expected labour productivity growth over the next 10 years. In the Australian VET sector alone the Value at Stake is estimated at $1.7 billion over the next decade[69]. Major areas of potential value include the application of the IoE to learning, parking, lighting, security, transport, payments and buildings/facilities. That number is likely to be even larger when factoring in the expected explosion in the use of predictive analytics to improve student retention rates.

69 Cisco has established a codified approach to assess Value at Stake based on 40 use cases for the public sector, understanding of industry dynamics, pain points and core value drivers. The approach is robust, data-driven and enables clients to target key pools of value.

4. Implications for Australian TAFEs and system

Technology is seen through a narrow lens in Australia. Technology is seen as an augmentation tool for learning rather than a force for genuine change in the way training is designed, delivered and evaluated. Institutions in Asia are increasingly recognising that there are benefits to investing in technology beyond the core functionality of the systems, applications and hardware itself. As an example, institutions are realising that technology not only addresses specific functional requirements but exposes institutions to a new breed of industry partners, gives students schools that are highly valued and acts as a force for renewal in communities. The right technology, implemented well, can also be a catalyst for new research activity, testing, prototyping, implementation, new product development and training that is truly integrated with industry.

The five trends present clear challenges and implications for Australian TAFEs and education systems

- **Preparation for the jobs of the future:**
  It is worth questioning whether Australia's demand-driven system is serving students well, particularly considering instances where places significantly exceed demand. Governments – and TAFEs to a lesser extent - need to consider whether funding and other levers are being used most effectively. Government also needs to guard against just solving for immediate shortages: the nation's economy needs a supply of skills that will be in demand in the medium term.

- **Ensuring graduates are 'job-ready':**
  People pursue training to get a job, and we know technical competency is only part of the answer. Australian institutions need to think creatively about how to a) increase the number and quality of job placements and b) more effectively mimic industry demands within institutions. Teaching people to problem-solve and collaborate are obvious first steps.

- **Integrating – not just partnering – with industry:**
  This notion of integration with industry should sit comfortably with institutions given TAFEs' mission, but is made more complex by issues relating to the customer-supplier relationship. In a contemporary institution the needs of both the TAFE and firms will increasingly need to be treated as two sides of the same coin rather than absolutely separate.

- **Embracing the use of technology to drive pedagogical change:**
  Technology is no longer 'just' an augmentation tool for teaching and learning. Resistance to change – particularly from trainers – needs to be overcome if institutions are to fully exploit the power of new technology.

- **Adopting a 'Smart Campus' mindset:**
  TAFEs need to be honest about the state of infrastructure, systems, process and culture before commencing. It is important to understand the underlying infrastructure, systems, processes and cultures. A simple audit of equipment is not sufficient, unless it's accompanied by an assessment of other relevant considerations including commitment to innovation and organisational arrangements. The IoE – which encapsulates physical connections, systems, processes and people – represents a macrocosm of what needs to be in place or developed within an institution.

The performance of Australia's VET system is strong, but challenges exist as Australia transforms from low to high value-added industries.

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