Industry driving the skills agenda in Asia

Perspectives from career and technical education (CTE) institutes and systems in Asia

2018

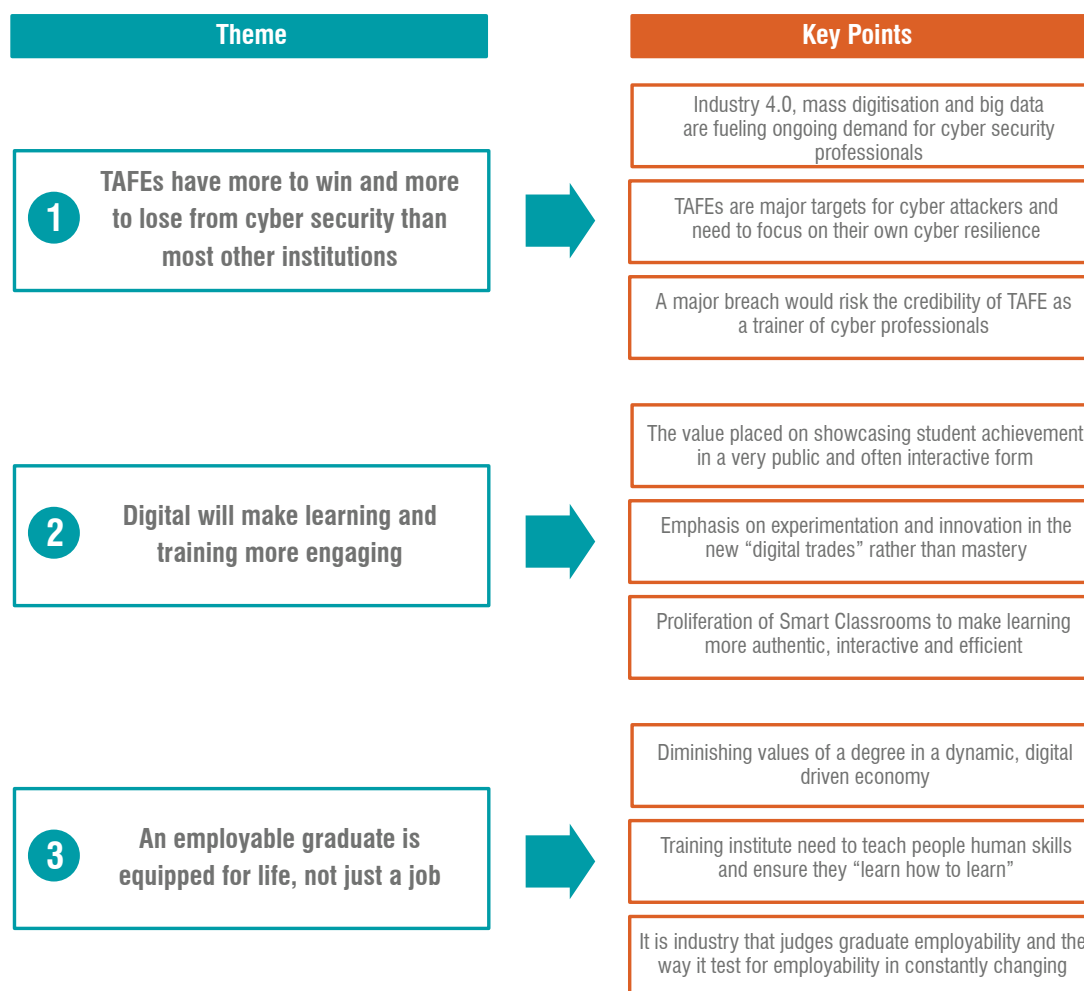Report Author: Brad Davies, Vector Consulting

Event Host:

Event Sponsors:

Executive Summary

Headlines

Where:	Singapore and Hong Kong
Themes:	Cyber security, smart classrooms, digital innovation, student employability
Event host:	TAFE Directors Australia
What:	Career and Technical Education Study Tour
Industry partners:	Cisco, SingTel Optus and Google
When:	9th – 11th April, 2018
Who:	12 CTE institutes from 4 countries (Australia, Singapore, Malaysia and Hong Kong)

Theme	Key Points
1 — **TAFEs have more to win and more to lose from cyber security than most other institutions**	Industry 4.0, mass digitisation and big data are fueling ongoing demand for cyber security professionals
	TAFEs are major targets for cyber attackers and need to focus on their own cyber resilience
	A major breach would risk the credibility of TAFE as a trainer of cyber professionals
2 — **Digital will make learning and training more engaging**	The value placed on showcasing student achievement in a very public and often interactive form
	Emphasis on experimentation and innovation in the new "digital trades" rather than mastery
	Proliferation of Smart Classrooms to make learning more authentic, interactive and efficient
3 — **An employable graduate is equipped for life, not just a job**	Diminishing values of a degree in a dynamic, digital driven economy
	Training institute need to teach people human skills and ensure they "learn how to learn"
	It is industry that judges graduate employability and the way it test for employability in constantly changing

Action needed from government and TAFEs

| **A**	**B**	**C**
Training needs to be more reflective of industry needs and TAFEs need to be rewarded for teaching the skills industry values	Digitisation of the training process particularly classroom technology and cyber security	Re-framing the role and relevance of TAFE to arrest the current decline in enrolments and funding

Section 1:

Digital disruption and the role of career and technical education

Economies in Asia are digitising at a rate and scale that is creating major challenges, particularly for industries needing to predict and fulfil their talent needs. In this context the training sector has never been more important to economic success, and Australian needs to learn from jurisdictions at the front of the wave. Singapore and Hong Kong are two of the most progressive jurisdictions globally when it comes to revitalising and modernising their career and technical education sectors, having invested in adapting systems, curriculum, pedagogy, industry engagement and infrastructure to make students more job-ready. These were logical destinations for the 2018 CTE study tour hosted by TAFE Directors Australia (TDA).

Industry 4.0 anchors a new wave of jobs

Industry 4.0 is characterised by high levels of automation and decentralised decision-making based on data. It elevates the importance of data analytic and capacity to draw insights from data sources (including infrastructure, sensors, digital channels and social media). By aggregating new and current data sources TAFEs will be better placed to respond to student, community and industry needs and to equip the economy with new skills. Technology's role in industry is shown at Figure 1.

Figure 1: The evolution of industry
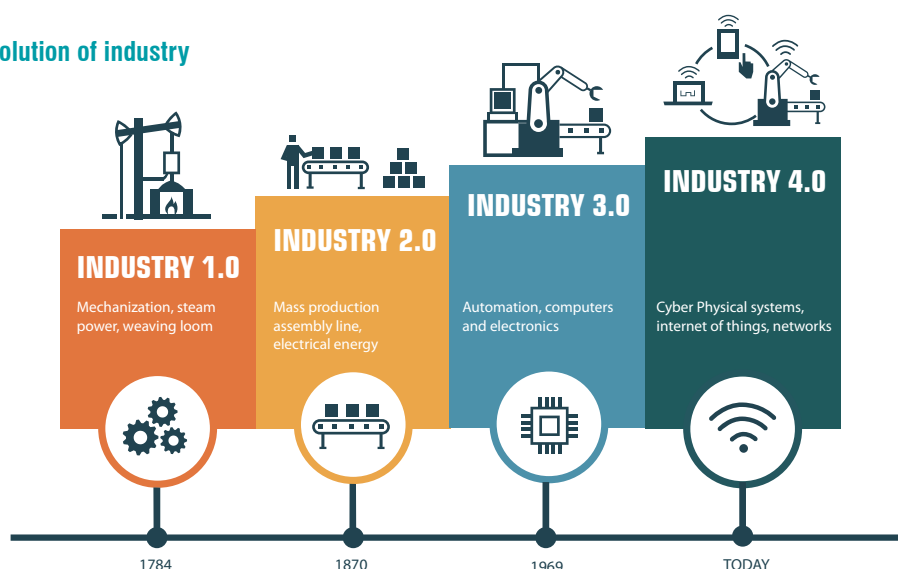
There are major skills implications associated with digital disruption for vocational providers
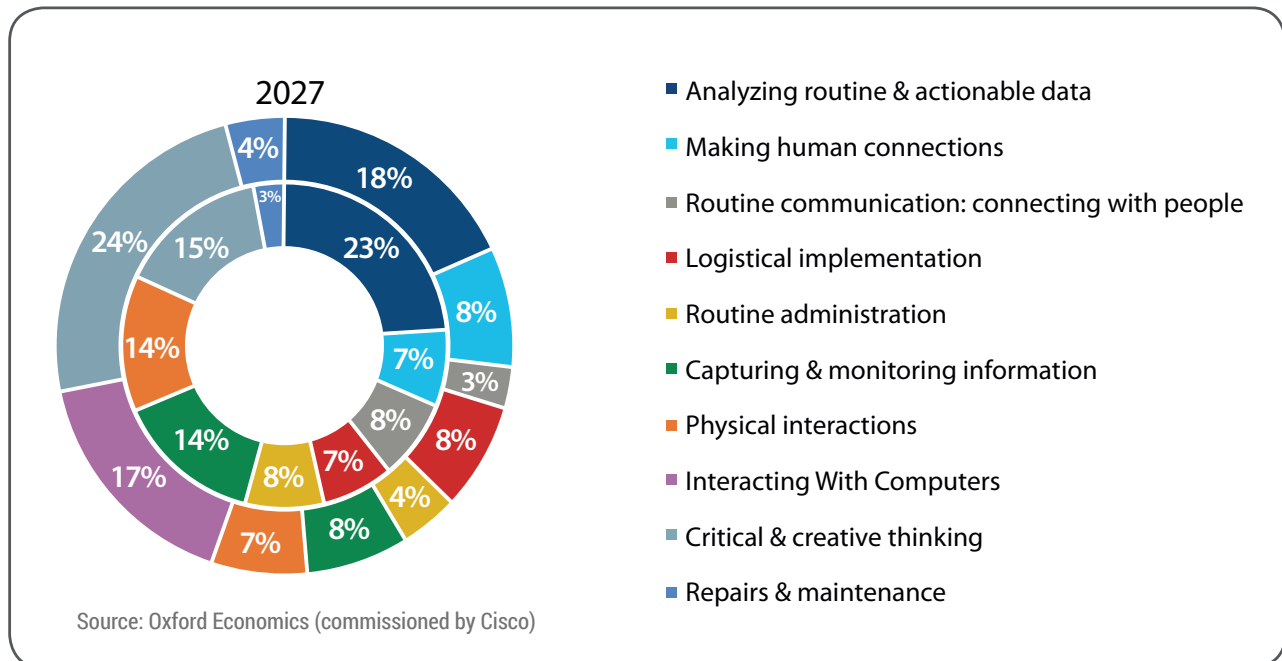
Digital disruption and Industry 4.0 are having profound implications for training institutes. First, it is changing the nature of the labour market as automation eliminates some roles, transforms others and creates new ones. Second, it elevates human skills such as problem-solving, critical thinking, collaboration and communication (skills more difficult to replace by machines). Third, value will be captured by early movers, including training providers that respond the skills shortfall captured in Figure 2.

Figure 2: Where skills shortfalls exist
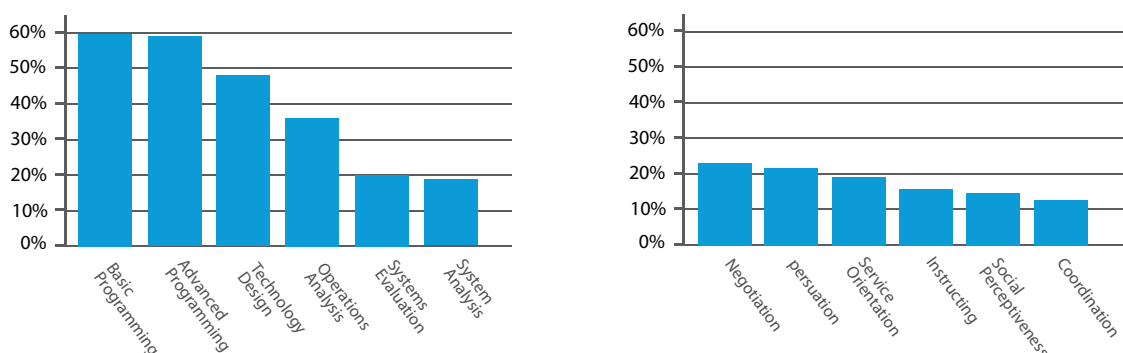
The changing skill demands also manifest at an occupation level. Truck driving is regularly cited as one of the occupations that will be most disrupted by digitisation; mostly the impact of autonomous vehicles. However, what's less understood is the fact that truck driving is already being transformed. The same research project revealed how responsibilities are changing for truck drivers beyond automation, showing truck driving will involve more time interacting with computers and less time capturing / monitoring data.

Figure 3: Changes in a truck driver's task profile from 2017 to 2027

2027

- Analyzing routine & actionable data
- Making human connections
- Routine communication: connecting with people
- Logistical implementation
- Routine administration
- Capturing & monitoring information
- Physical interactions
- Interacting With Computers
- Critical & creative thinking
- Repairs & maintenance

Source: Oxford Economics (commissioned by Cisco)

Digital: an economic growth engine not a threat to the economy

While there is a lot of focus on the replacement of jobs through technology, including the role of artificial intelligence / machine learning, it is also creating jobs. Job creation occurs in two areas:

1. Job creation from sustained economic growth. Labour-saving technologies and innovations are driving down the cost of goods and services but also growing consumer spending power. This 'AI paradox' has seen governments, particularly in countries such as Singapore and Hong Kong, embrace digital as an economic growth engine, not a threat to the economy.

2. New job in the fast growing digital economy. Employment growth in cyber security, data analytics and data forensics are examples of well-paid, sustainable and in-demand occupations fuelled by digital.

Singapore and Hong Kong have capitalised on growing demand for skills in robotics, AI and cyber security. To demonstrate, the Vocational Training Council (VTC) in Hong Kong focuses on experiential learning for students at its campuses, particularly in relation to digital technologies. Students run their own IoT experiments, classrooms are routinely fitted with augmented and virtual reality capability. The 'BIM iHub', which will be opened in late 2018, will offer Building Information Modelling to civil engineering, surveying, architecture and environmental engineering students.

The VTC also recognises its key role in up-skilling trainees and has established new facilities and innovation centres on a number of its campuses including the Big Data Studio and Media Lab to build professional expertise in digital, including data management. This forms part of a broader push by the Hong Kong Government to nurture the city's digital workforce and build capability for capture, analysis and visualisation of data.

Section 2:

Major themes from the study tour

Theme 1: TAFEs have more to win (and lose) from cyber security

More to win because ….Industry 4.0, digitisation and big data are fuelling demand for cyber security professionals. As processes, roles and infrastructures become digitised, these also become prone to attack and need to be defended. While higher degree qualifications are required for some roles, industry sees major opportunities for people with vocational certification and for providers of vocational training. The advantage offered by TAFE is 'speed to market', given employers can't afford to wait four years to train a cyber graduate when they are engaged in a cyber 'arms race'.

Box Hill Institute in Melbourne has taken a broad-base approach to cyber security and established a comprehensive cyber security program with a strong focus on vocational qualifications, as well as a Master's Degree. Given cyber security jobs are growing at three times the rate of other ICT skills, the potential pipeline for institutes is enormous. Temasek Polytechnic in Singapore is another institute that has invested in cyber security training. Temasek reported significant growth in continued education and training – mainly mature-age learners, but also from school leavers. The demand for young and mature age learners was echoed by the Director of SingTel's Security Operations Centre in Singapore, David McLinton reported 30 to 40 ongoing job vacancies in his team of 200 staff.

More to lose because …. TAFEs are increasingly attractive targets for cyber attackers. Like in the corporate world, TAFEs face challenges that come with operating in the digital age. One of these challenges is ensuring they are both secure and compliant with relevant legislation. There are three reasons why TAFEs might be a bigger target than many other institutions:

1. TAFEs hold sensitive commercial and personal data (both students and industry).

2. TAFEs are investing less in cyber security than commercial institutions of the same scale.

3. Government ownership of TAFEs makes them a high-profile target.

A single cyber breach could potentially compromise the credibility of a TAFE's cyber security program and course offerings.

The study tour identified three priorities for TAFEs in cyber security:

A.   The need to improve institutes' own cyber resilience

The threat landscape is changing. There are more attackers, and more sophisticated and dangerous tools – many of which can be bought from online marketplaces and are easy to use. In the thriving marketplace for attack tools, if you buy four botnets you get the fifth free.

As the Internet of Things (IoT) proliferates – connecting more devices, sensors, vehicles and appliances – the attack surface is increasing. The need to do things fast encourages organisations to make compromises and occasionally provides a way in for attackers. The risk posed to TAFEs is real and requires investment in preventative measures including processes, systems and technology.

B.   Need to treat cyber security as a broad organisational responsibility – including at board level

In TAFEs, as with many similar organisations, carriage of cyber security tends to sit with a single, technology-focused individual buried deep in the organisation structure. In most cases information security is treated as a technology issue, consistent with its functional position in the organisation, rather than a business continuity issue.

The Singtel Cyber Security Institute (CSI) in Singapore has a very different perspective and strategic cyber security as a whole of organisation responsibility. One of the major areas of focus has been on senior leadership teams and Boards. CSI runs role-playing sessions with executives to rehearse responses to incidents and test processes and procedures. Delegates took part in a condensed role play activity that demonstrated the need to have data at hand and well-defined procedures in place before an attack happens. Often organisations don't plan adequately from an operational perspective or access sound advice when they need it, including the right industry partners with direct experience of working through an attack.

C.   Rethinking the cyber security training opportunity

Study tour delegates were exposed to Singaporean institutes that have been delivering cyber security training for many years, as well as training institutes in Hong Kong pushing the boundaries of experiential learning. TAFE representatives commented on a number of learnings that had implications for their own approaches to cyber training:

- The value of simulation in teaching, as demonstrated by the Cyber Range platform.

- The importance of understanding how automation is also impacting on cyber security. TAFEs, in particular, need to be acutely aware of how automation is transforming entry-level cyber jobs to ensure they are training cyber professionals for roles in demand and that will continue to exist.

- The need for ongoing teacher capability building. Including up-to-date baseline knowledge to ensure all tech-intensive courses appropriately deal with cyber security as a core competency.

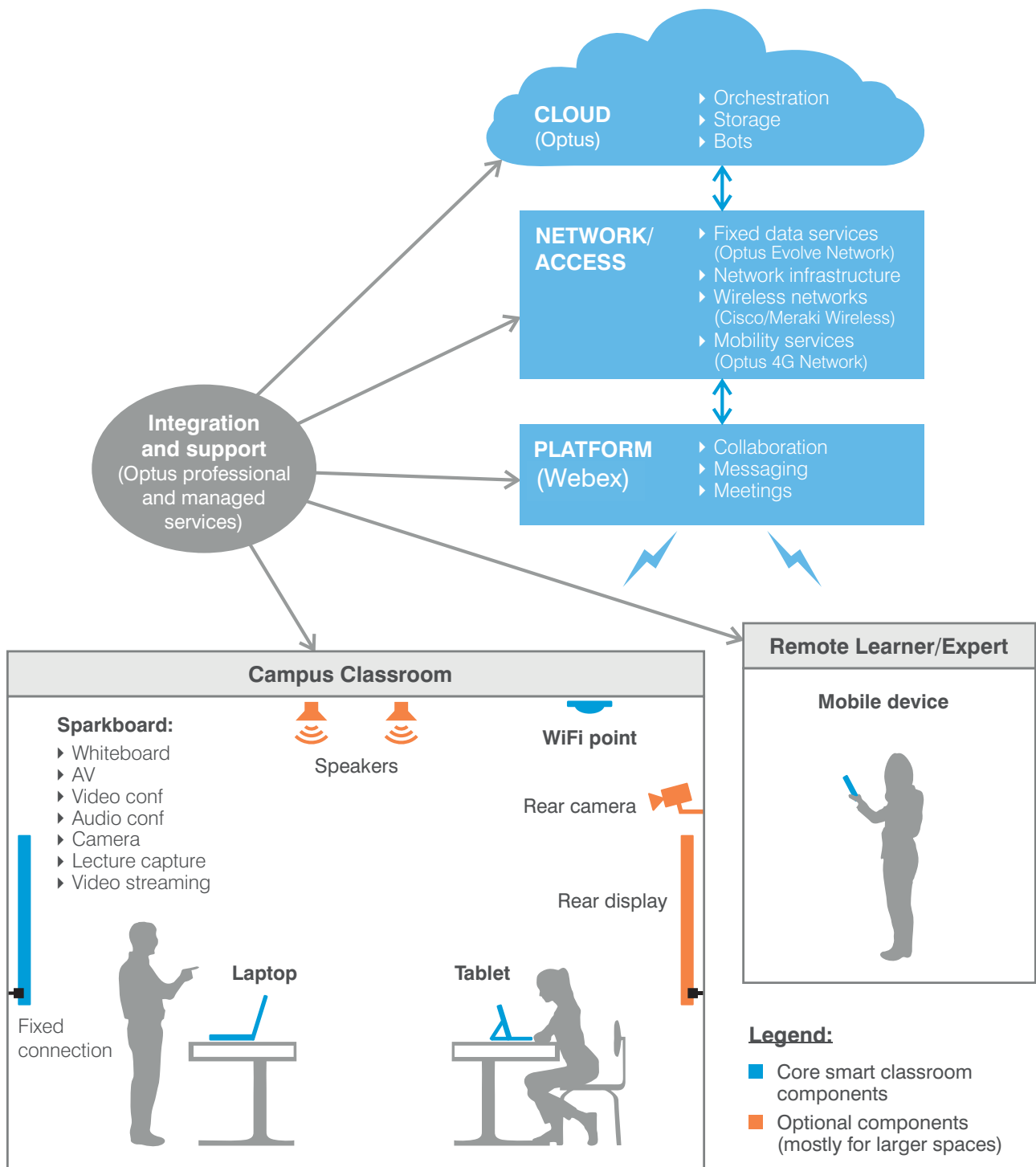## Theme 2: Digital will make training more engaging and high impact

The study tour created an ideal forum to share and test ideas, practice and perspectives. This includes highlighting some of the initiatives in delegates' institutes, as well as site visits. The opportunity to physically visit institutes and observe the learning process was particularly revealing in Hong Kong. The Vocational Training Council in Hong Kong has recently invested in a major campus modernisation program to ensure students have access to technology-rich, well-designed and heavily-utilised facilities to drive collaboration between learners.

A number of themes emerged from the visits in Singapore and Hong Kong in relation to learning:

- The value placed on showcasing student achievement in a very public form. In every Hong Kong institute there were visible displays of students' work. This included fashion exhibits at the Technological and Higher Education Institute of Hong Kong, an operational fine dining restaurant (Chinese Culinary Institute) and a focus on digital exhibitions at the Hong Kong Design Institute. Highlights included working prototypes of IoT projects in lab environments Hong Kong Institute of Vocational Education and creation of interactive designs that allow people to manipulate rather than passively view displays.

- The high value placed on experimentation and innovation. The dynamism of new 'digital trades' means that practice continually evolves quickly. The curriculum and teaching approach in both Singapore and Hong Kong is designed so students constantly push their own boundaries rather than focusing on simple mastery. In Hong Kong students programmed a drone to respond to hand signals rather than a traditional remote control, testing their technical and general problem-solving skills.

One of the most prominent examples of emerging technology is the Smart Classroom, which was demonstrated by Holmesglen Institute and ITE in Singapore. Holmesglen is one of the first large TAFEs to commit to Smart Classrooms built on the Cisco/Optus blueprint (Figure 4).

Figure 4: How Smart Classrooms are incorporated into teaching

CLOUD (Optus)
- Orchestration
- Storage
- Bots

NETWORK/ACCESS
- Fixed data services (Optus Evolve Network)
- Network infrastructure
- Wireless networks (Cisco/Meraki Wireless)
- Mobility services (Optus 4G Network)

PLATFORM (Webex)
- Collaboration
- Messaging
- Meetings

Integration and support (Optus professional and managed services)

Campus Classroom

Sparkboard:
- Whiteboard
- AV
- Video conf
- Audio conf
- Camera
- Lecture capture
- Video streaming

Speakers

WiFi point

Rear camera

Rear display

Fixed connection

Laptop

Tablet

Remote Learner/Expert

Mobile device

Legend:
- Core smart classroom components
- Optional components (mostly for larger spaces)

Optus provide a single point of contact for all managed services and delivery options. Specific services include:
- Project and transition management
- Systems Integration and engineering for designing, building and deploying technology
- Enterprise mobility and business applications
- End-to-end integrated ICT solutions such as Smart Classroom
- Change management

The demonstration showcased Holmesglen's integration of Smart Classrooms into the `hands on' discipline of sport, fitness and wellbeing. In a live cross to ITE a trainer from Holmesglen explained how they interacted with the technology and its impact on the learning process, including:

- More effective sharing and collaboration inside and outside formal classes

- More efficient access to course materials and recording for students

- Capacity for the trainer to reflect more critically on their own practice and approach

Smart Classroom uptake is reasonably widespread, particularly in Victorian TAFEs and Singapore polytechnics. The tour also focused on the next generation of Smart Classrooms, which offer:

- Capture and delivery of advanced analytics: The underlying Smart Classroom platform uses wireless sensors, tracking cameras and WebexBoards (formerly SparkBoards), which are able to track interactions with learning materials, recognise faces, count people, track movement and even monitor students' reactions to content.

- Access to artificial intelligence (AI): SparkBoards have the same AI platform used in autonomous cars, and which is currently used for voice recognition and noise suppression but will soon be capable of automatically authenticating anyone who attends a class or meeting.

- Virtual reality capability: Collaboration spaces and teams can be delivered in virtual or augmented reality where people interact with each other as 'avatars'.

- Integration into learning management systems (LMS): The current generation of Smart Classroomsenable native integration between collaboration software and LMS such as Moodle, Canvas, Blackboard and others. Holmesglen showcased API integration with Cisco and Brightspace to ensure integration with broader campus systems

Theme 3: An employable graduate is equipped for life, not just a job

The value of an industry-oriented study tour program is the insight it provides into industry's challenges, priorities and talent needs. Institutions spoke at length about the fact that graduate employability needed to be their singular focus if they wanted to remain relevant and compete effectively with other providers and universities.

Singtel, Cisco and Google profiled their own talent needs and how these had changed over time. One of the most important observations was that industry no longer just assesses a candidate's capacity to do a specific job but rather their resilience, agility and flexibility in navigating their career. A number of common threads emerged from the discussion:

A degree is no longer a sufficient proxy for employability in industry's eyes

While a degree qualification is still a prerequisite for some roles, its utility and value has diminished in recent years. Singtel, Cisco and Google spoke openly about the fact that other types of learning – including actual experience in start-ups or more applied vocational pathways – often prepared students better for the workforce than a university course. This was particularly true in disciplines experiencing high demand such as cyber security and data science. Industry's focus is increasingly on the acquisition of relevant skills and competencies outside of formal learning/training. The ability to leverage external courseware/ experts that are aligned to industry needs are attracting greater focus from schools and training institutions.

Training institutes need to teach people how to 'learn to learn' and to develop human skills

Singtel's Director of Talent Seiyi Goh was asked what she looked for in a prospective employee. She nominated two competencies – neither of them written into the curriculum:

1. Proven ability to learn. A candidate who has shown a willingness and aptitude for learning sends a strong signal that they will be able to take some control of their own development.

2.   Capacity to embrace change. In some situations employers hire graduates for roles that won't necessarily exist in five years. Employees who embrace change actively seek opportunities to move into new roles, teams and functions and take more ownership of their development.

Google and Cisco spoke at length about their recruitment and interview process. While technical skills underpin many roles, it's not universal. The focus of candidate interviews is moving towards evaluation of personal attributes and capabilities more than the technical mastery, including:

- Capacity to demonstrate empathy and work with people who are different from themselves

- The ability to synthesise information and exercise judgment

- Contemporary industry values and behaviours

- Global awareness and cultural understanding

Singtel, Cisco and Google noted that teaching these qualities were often seen as second order priorities compared with technical skills. The notion of training for a global world is a major focus of the VTC in Hong Kong, which is implementing its new vocational baccalaureate (VB). This will provide students with a credential that's globally recognised, allowing flexibility to enter the workplace or articulate to degree studies.

Section 3:

Action needed by government and TAFEs

Australia's Training model risks being unfit for digital economy jobs

Approaches to training in Singapore and Hong Kong highlight that Australia's accreditation of training content and the approach to delivery through the Training Package model does not fit the needs of industry for adaptable digitally capable workers.

Within Training Packages, the tightly prescribed assessment requirements against specific job functions for job roles focuses training on tasks. Most employers, including those in new industries and or those adopting new technologies, recognise that graduates need knowledge and capabilities that make them open to learning new technologies and adapting in the workplace. Hong Kong has changed its approach to training and learning and VTC has achieved an average of 90% graduate employment rate.

There are a number of opportunities available to institutes to more effectively serve industry, including changing how students learn and think, not just what they learn. The approach in Hong Kong is to deliver highly personalised learning, deliver flexibly with extensive use of simulations and 'hackathons' to make the learning more hands-on and engaging (as set out below).

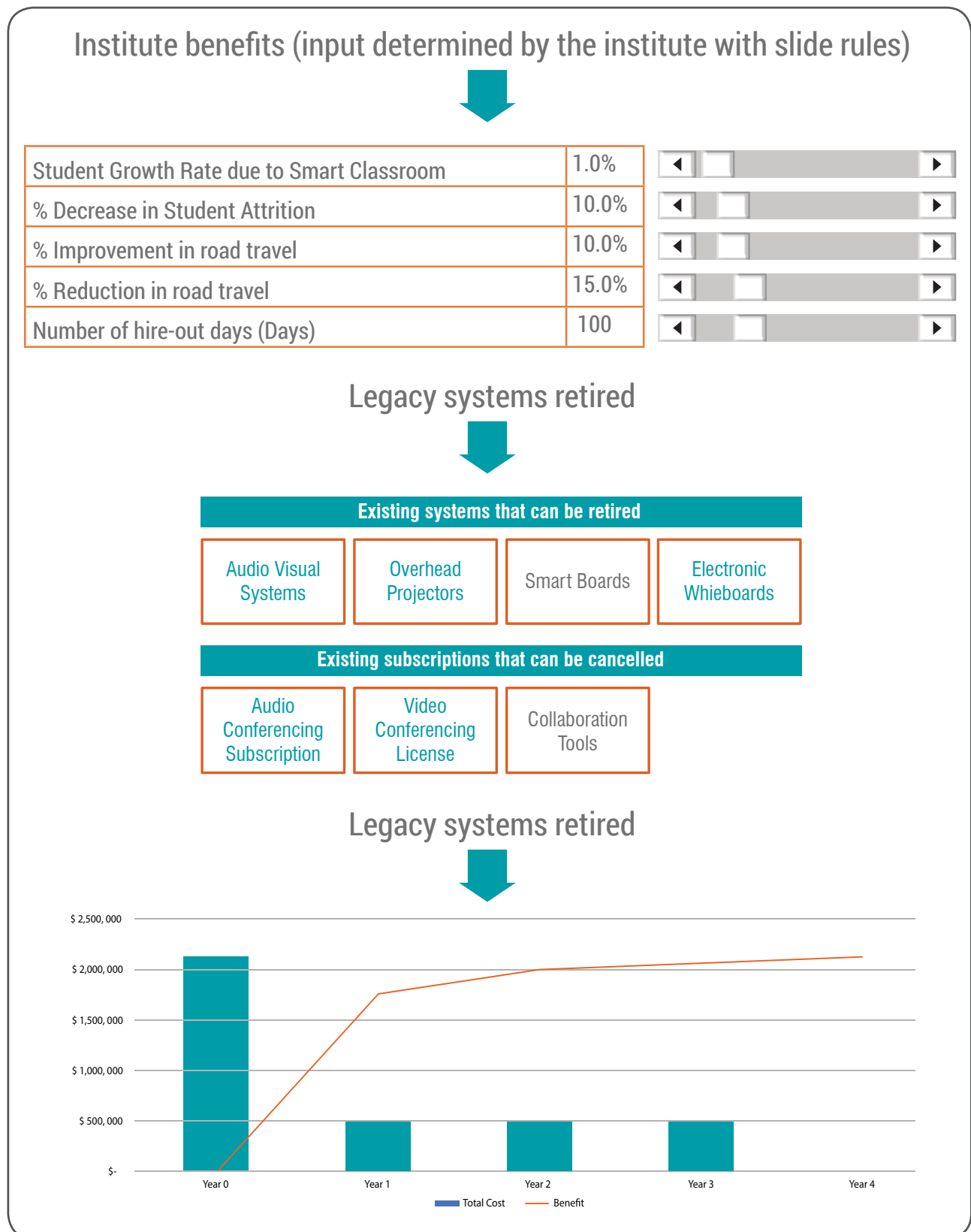| What Students Learn	How Students Learn	How Students Think
• Networking • Security and Cybersecurity • IoT • Programming • Linux and General IT	• Learning by doing • Problem-solving • Project-based learning • Initiative and leadership • Real-world experiences	• Customer-centric mindset • Critical thinking • Personal and social responsibility • Business context

Courses in 20+ Languages	Hands-On	Flexible Delivery	Supports Personalized Instruction	Simulations	Hackathons

Government needs to urgently respond to industry's call for students with more rounded personal capabilities by enshrining them into the curriculum more formally. The Australian training packages system, as an example, does not adequately reflect these new attributes industry is seeking. Cisco and Optus are willing to play their part in helping redefine what an employable graduate looks like.

Immediate investment in technology to equip institutes for the training needs of digital economy

Two areas where urgent investment is required are classroom technology and cyber security. The case for investment in Smart Classroom technology is compelling but commercial business cases have tended to be weak or non-existent. Too often business cases focus on technology features rather than benefits to student engagement and outcomes. As part of the study, Cisco and Optus showcased their Smart Classroom business case tool,which is available to Australian TAFEs. The business case tool allows institutes to calculate the commercial value of Smart Classroom infrastructure on student acquisition/retention, trainer productivity, travel expenditure and retiring of legacy systems. TAFEs can now precisely calculate the costs and benefits and produce a rigorous return on investment profile for Smart Classroom deployments. A mock-up of how the tool is presented is captured in Figure 5.

Institute benefits (input determined by the institute with slide rules)

Student Growth Rate due to Smart Classroom	1.0%
% Decrease in Student Attrition	10.0%
% Improvement in road travel	10.0%
% Reduction in road travel	15.0%
Number of hire-out days (Days)	100

Legacy systems retired

Existing systems that can be retired

Audio Visual Systems	Overhead Projectors	Smart Boards	Electronic Whieboards

Existing subscriptions that can be cancelled

Audio Conferencing Subscription	Video Conferencing License	Collaboration Tools

Legacy systems retired

Total Cost — Benefit

(Chart: Year 0, Year 1, Year 2, Year 3, Year 4; $- to $2,500,000)

In cyber security, chronic under-investment by government and institutes risks both being vulnerable to attack. Responsibility for cyber resilience needs to be at CEO and Board level. Organisations need to practise and plan for worst-case scenarios, and investment in cyber needs to be based on what's at stake, not whether TAFEs have been compromised in the past. State Governments and Ministers – as owners of Australian TAFEs – are particularly exposed in the event of a successful cyber-attack.

Re-framing the role and relevance of CTE

Enrolments in training are declining at the precise moment Australia should be elevating the importance of this sector. As the pace of change accelerates, Australia will depend more than ever on its capacity to produce graduates who are employable from day one (in the eyes of industry) and able to fill major skills shortages quickly before these impede economic growth.

As the local economy pivots to digita lit is hard to rationalise why student participation and funding for vocational education and training is declining. This is not the case in advanced economies such as Singapore and Hong Kong and shouldn't be so in Australia.

"The most urgent priority is to address declining levels of public investment in VET and associated cost shifting to students, and other factors that appear to be contributing to the ongoing fall in VET student enrolments. This issue should be considered as a matter of priority by the heads of Australian governments if the real risk of declining participation in tertiary education in Australia, and declining levels of qualification attainment in the workforce, is to be averted."–Mitchell Institute

Re-framing the role and relevance of vocational education and training should start with the Commonwealth Government in conjunction with states and territories and trickle down to those currently employed in roles that will be fundamentally changed by technology and globalisation, to parents, school leavers and schools.

And what's next…

Cisco and Optus are committed to working closely with TDA to play their part in elevating the role of TAFE and improving outcomes for industry, learners and the economy more broadly. Cisco and Optus are proposing the following next steps:

- Curation of a vocational training showcase at the upcoming World Congress. Cisco and Optus propose to use their technology to allow individual institutes and systems to demonstrate or showcase innovative uses of technology in TAFE.

- Staging a cyber security simulation activity for TAFE Boards and senior executives. Singtel CSI runs similar sessions with global banks, manufacturers and service providers and propose a one-off event for TAFE executives.

- Live demonstrations of Smart Classroom technology and the future technology roadmap. The demonstrations are TAFE-specific and will draw on evidence of what works in other institutes. A high-level business case demonstration is proposed as part of the session using the Cisco/Optus Smart Classroom ROI tool.

- A one-day cyber security audit for TAFE's. The audit assesses TAFE's current cyber security resilience and provide recommendations for quick wins and other potential responses.

- Digital Business Roadmap (DBR): offers a simple and practical approach that enables institutions to develop a digital roadmap and make informed decisions about technology and broader issues. The Cisco business architecture approach maps digital solutions to specific institute needs, culminating in a multi-year strategic roadmap.

Expressions of interest for any of the above can be registered with Jason Bamert at Optus (Jason.Bamert@optus.com.au) and Reg Johnson at Cisco (regjohns@cisco.com).

For further information you can also contact TAFE Directors Australia at memberservices@tda.edu.au or (02) 6153 3458