Universities driving global innovation ecosystems

Learnings from Germany and the UK

Authors
Brad Davies, Vector Consulting
Reg Johnson, Cisco

Destinations

The format for the study tour took a number of different forms, including site visits to universities, guest speakers, networking receptions and technology demonstrations. A visit to the Australian High Commission in London – hosted by the Australian High Commissioner George Brandis QC – was a natural conclusion to the external-facing elements of the tour.

Other elements of the tour included:

1 Adlershof Technology Precinct.
The Technology Park is located in the former East Berlin and is home to more than 100 companies, including multinationals, SMEs and startups and has links to the Fraunhofer Institute network. The park is managed by WISTA and anchored by Humboldt University, where Albert Einstein lectured.
https://www.adlershof.de/en/

2 Hasso Plattner Institute.
The institute was privately funded by the founder of German technology company SAP. It was intended to create a combination of deep engineering programs and critical innovation capabilities such as design thinking. The Institute is ranked as the number one engineering program in Germany, Switzerland and Austria.
https://hpi.de/en.html

3 The Connected Places Catapult.
Funded by Innovate UK, the Catapult represents the merger between the Future Cities and Transport Systems Catapults. Its mission is to facilitate the development of cities and places that are more connected, smarter and more sustainable to create economic and social impacts. The London office of the Catapult was once owned by Pink Floyd who also recorded an album there.
https://ts.catapult.org.uk/news-events-gallery/news/connected-places-catapult-set-to-accelerate-smarter-living-and-travelling/

4 Cisco Open Berlin.
The innovation lab is part of the larger EU precinct and is a showcase facility and co-innovation space for a range of technologies, including the Internet of Things. The facility includes working demonstrations of a range of 'smart' applications including Smart Cities, Smart Transport and Digital Health.
https://www.cisco.com/c/m/de_de/innovationcenter/berlin-en.html

5 Cisco London.
The London office includes a range of demonstration spaces and most of Cisco UK's partnerships with universities and research institutes are coordinated out of the London HQ. The visit to Cisco London included a guest presentation from SAID Business School (Oxford University).
https://blogs.cisco.com/lifeatcisco/welcome-to-cisco-bedfont-lakes-the-uks-flagship-office

Context

Digital technologies are fundamentally changing all industries.

This has implications for business models, operating models and investment strategies. It is also creating significant implications for the skills profile of specific sectors. Universities are having to adapt to the future demands of work, changing business models and rising expectations of students.

Cisco undertook a seminal study with IMD (updated in 2018) that assessed the pace and intensity of change across industries. The Digital Vortex study (see Figure 1) put the media and technology sectors at the centre of the vortex, with education ranked eighth in terms of digital disruption.

Figure 1: Industry sector view of the Digital Vortex

Education differs from most other industry sectors in that it is an enabler across all industries, not just a sector in its own right. Universities play a critical role in helping to prepare companies for the adaptation required in a digital world. Their role extends to collaborative research, innovation, skills development and capacity building. This broad-based impact is also reflected in the different ways that Cisco partners with universities, as demonstrated in Figure 2.
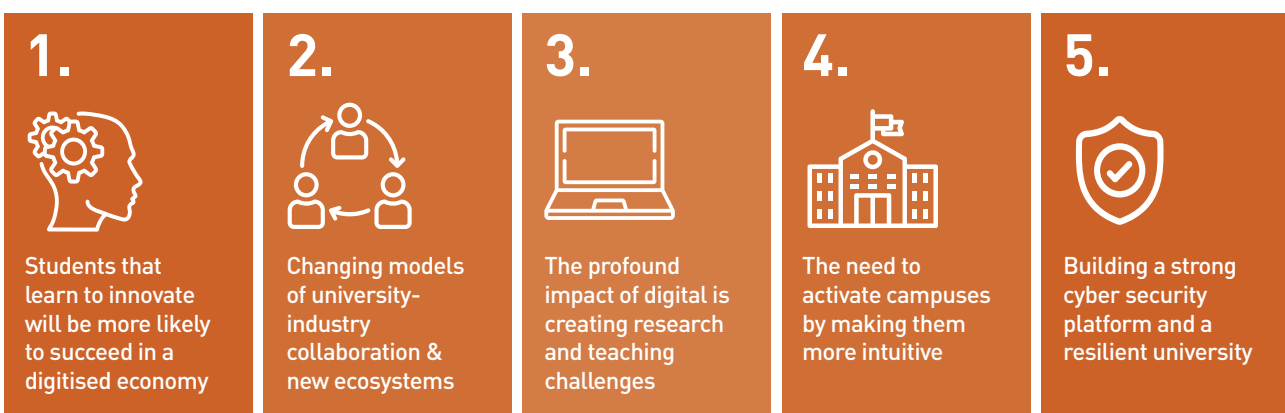
Figure 2: Different partnership strategies between Cisco and universities

Universities as Cisco Ecosystem partners

Cisco's partnership strategies to tackle global challenges

Co-development of new digital solutions serve as foundation for student start-ups

Increasing the cybersecurity talent pool and co-development of curriculum

Co-creating industry-specific IoT solutions and capability

Skilling students so they can be immediately productive in the digital economy

The 2019 Higher Education Study tour to Germany and the UK focused on better understanding how innovation ecosystems are organised and to explore digital technologies being applied across the economy, including within the university campus environment.

Themes from the 2019 Higher Education Study Tour

A diverse range of topics were explored as part of the study tour. Five major themes emerged.

1.

Students that learn to innovate will be more likely to succeed in a digitised economy

2.

Changing models of university-industry collaboration & new ecosystems

3.

The profound impact of digital is creating research and teaching challenges

4.

The need to activate campuses by making them more intuitive

5.

Building a strong cyber security platform and a resilient university

1.

Students that learn to innovate are more likely to succeed in a digitised economy

While the pace of change is causing challenges for industry, it is doing the same for students. Contemporary universities need to equip learners for a digitised labour market and are recognising that three elements are critical:

1. **Providing students with industry exposure early and often.** At Hasso Plattner Institute all master's degree projects involve industry so students' theses don't end up 'in a drawer'.

2. **Getting students to think in a multi-disciplinary way.** While deep subject matter experience is critical in areas such as cyber security and deep learning, students become far more employable when it's combined with design thinking and critical skills such as problem-solving and the ability to work in teams. A list of high growth job roles published by the World Economic Forum[1] provides an indication of the multi-disciplinary nature of many future jobs, as well as their technology focus.

Emerging Roles	Growth Roles	New Specialist Roles
• Data Analysts and Scientists • Software and Applications Developers • Ecommerce • Social Media Specialists, roles that are significantly based on and enhanced using technology Source: World Economic Forum, (2018) Future of Jobs	• Customer Service Workers • Sales and Marketing Professionals • Training and Development • People and Culture • Organisational Development Specialists • Innovation Managers	• Artificial Intelligence and Machine Learning • Big Data • Process Automation Experts • Information Security Analysts • User Experience and Human-Machine Interaction Designers • Robotics Engineers • Blockchain Specialists

3. **Exposing students to innovation and entrepreneurship so they 'learn how to learn'.** Learning agility makes new hires lower risk for industry and provides those students with capacity to transition within their new organisations, as well as preparing them for the growing freelance labour market.

Examples/case studies from the study tour:

	Example	What they did	Results
A	**Design Thinking Program**	• Established a project-based design thinking program. The approach is industry-led and is designed to provide students with asset of skills that complement their substantive studies in cyber security, AI, etc	• 240 students • Global recognition

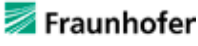|	Example	What they did	Results
B	**Country Digital Acceleration**	• Global investment vehicle to accelerate the digitisation of industries and countries • Universities are a critical element of projects	• $61M investment into Australia with prominent role for universities

2.

New models of university-industry collaboration and ecosystems

While traditional models for collaboration between academia and industry remain relevant, they are no longer sufficient. New models are emerging in response to a range of factors:

- New business and operating models in education and industry
- The rapid pace of change in industry, which is driving shorter business model cycles
- Industry's expectation that if projects fail, they will fail fast
- Changing risk appetite
- Use of digital to scale offerings, leverage new data sources and create network effects
- Technology platforms enable rapid scalability, reduce capital expenditure and create multi-sided markets where all parties benefit.

New models are context-specific. Cisco's own approach to innovation has also changed significantly; moving from a build, buy, partner model and now extended to an investment and co-development and collaboration with customer focus.

Examples/case studies:

C		Example	What they did	Results
	WISTA we get ideas done	**Adlershof Technology Park**	• Establishment of a technology and innovation precinct in the former East Berlin, anchored by Humboldt University. Houses multinationals, SMEs and increasing number of startups	• 1100 companies (50% tech-based); 85 market leaders, 16 scientific institutions, 18,000 employees and an outstanding 3% insolvency rate for startups

D		Example	What they did	Results
	CATAPULT Connected Places	**City of Manchester**	• Coalesced industry, government and community to improve the city amenity with applications ranging from street furniture to digital platforms	• Activation of the Manchester centre and positive citizen engagement

E		Example	What they did	Results
	Fraunhofer	**Industry-led research**	• Network of 72 institutes nationally • Projects aim to solve a critical industry need (not basic research) • Model is to have professors that are researcher, investor and entrepreneur	• Projects typically deliver a 20:1 ROI • In 2018 Fraunhofer voted one of the Top 100 Global Innovators (along with BASF, Bayer, Merck)

3.

The digitisation of industry is creating 'wicked' research and teaching challenges

Change presents opportunity for universities. The rate and gravity of digitisation mean that a status quo response is unlikely to work. Universities cannot afford to be complacent; a disruptor can come from any direction, including industry.

Universities need to increase the focus on delivering new forms of value for students beyond cost and experience. One concept that is now discussed is how universities can use their digital backbone to create platform value.

Industry has never needed universities more than it does now. From a research perspective, industry needs universities' intellectual property, deep expertise, networks, infrastructure and partnerships. Increasingly, the timelines will be contracted, with projects happening in sprints spanning months rather than years. From a teaching perspective, industry needs universities to provide specialist skills for in-demand roles such as data science, cyber security and artificial intelligence. It also needs universities to ensure students are well-rounded and equipped from an emotional intelligence perspective, not just technically.

"Borders cannot be fully understood by looking at them from one side only"

– CEO, IRIS Adlershof (Humboldt University)

One example of a specialist skill set requiring deeper research and teaching stocks is deep learning; a specialisation at Hasso Plattner Institute. Deep learning, and artificial intelligence more broadly, has a broad range of applications and focus areas (as depicted below).

Deep Learning Research Topics at the Hasso Plattner Institute

1 Binary Neural Networks: enable deep learning models on low power devices

2 Deep learning in medical image processing

3 Deep generative models for natural language generation

4 Multimodal representation learning for multimedia including image captioning, human action recognition and event detection in videos

Deep learning can also be applied to the creative sphere.

Figure 3: How AI allows the merging of photography and art
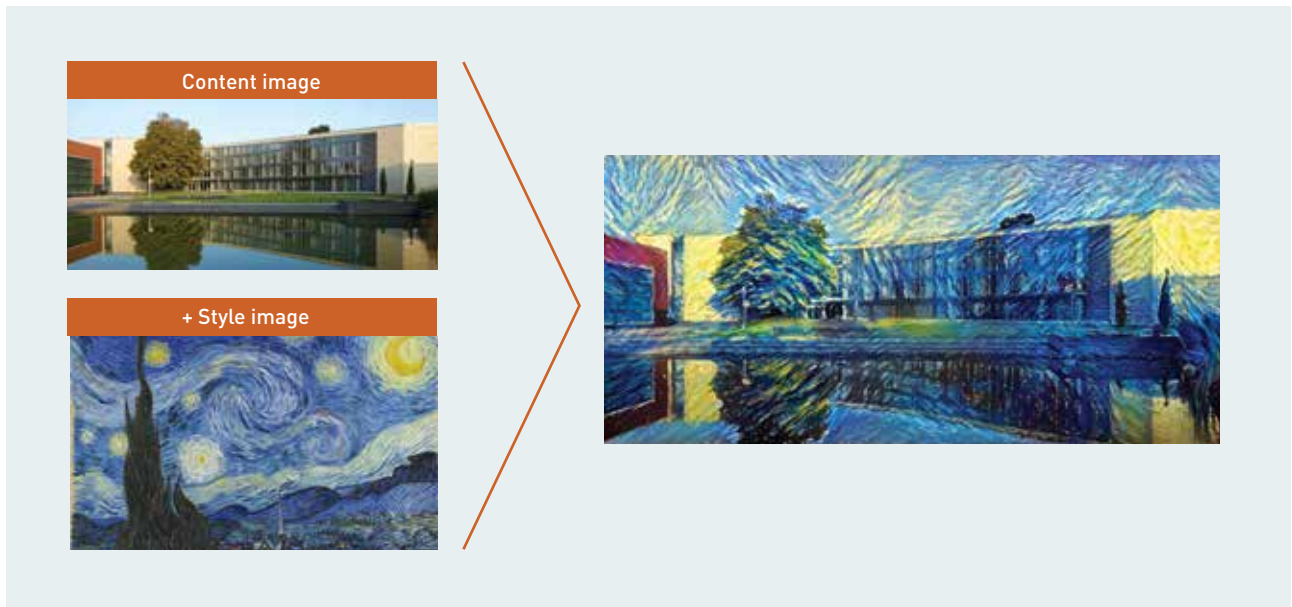
The rapid pace of digitisation is also creating opportunities and threats for industry.

One example is Cisco's investment in the circular economy, a term that describes the focus on keeping resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end of life. Cisco's investments are part of a wider global movement that focuses on operations, design, consumption, solutions and leadership (Figure 4).

Figure 4: Cisco's focus on the circular economy
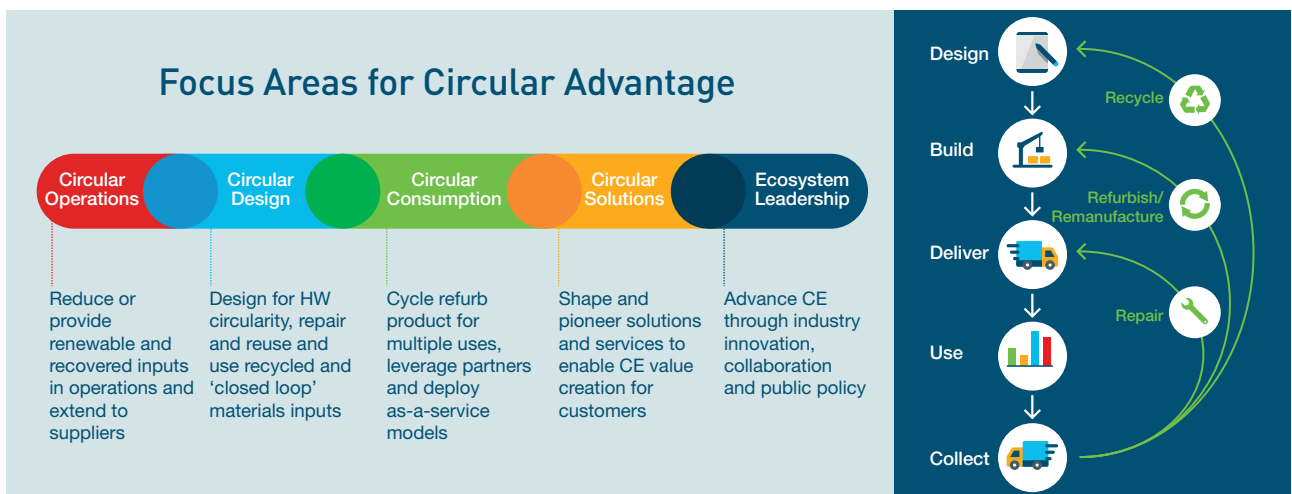
Examples/case studies:

F

Example	What they did	Results
Integrative Research Institute for the Sciences (IRIS)	• Cross-disciplinary research focused on how electronic functions are integrated into daily life and are adaptable, wearable, flexible and with low production costs	• Range of new applications for cutting edge technologies related to optics and electronics

G

Example	What they did	Results
SAID Business School	• Established 20 years ago to help to future-proof the institution • Has led Oxford's digitisation agenda (e.g. Oxford's first MOOC) to ensure students thrive in the digital economy	• Number one-ranked business school globally

H

Example	What they did	Results
Deep Learning	• Major focus on application of AI in areas as diverse as image and speech recognition, sensory neural network recognition, medical image processing	• Major breakthroughs contributing to HPI's standing as the number one engineering university in Germany

4.

The need to activate campuses by making them more intuitive

Universities are being forced to reconfigure their campuses so that they can respond to emerging demands of industry and students. This includes making campuses more intuitive and automated by capitalising on the possibilities offered by the Internet of Things.

The drivers of this change are neatly captured by ARUP[2] and include:

- Increasingly diverse student demographics
- Rising demand for lifelong learning
- Interest in on-campus experience
- Lifecycle-driven demand and automation to drive sustainability
- Greater understanding of user needs
- Internal and external needs driving innovation.

The response to these factors varies significantly between universities, as is appropriate. The importance of human-centred design has strengthened in recent years and the tools and methodologies used to design and deploy digital campuses have also evolved. In some cases universities create a digital twin of their campus so that they can experiment and model impacts on students before having to turn a single sod.
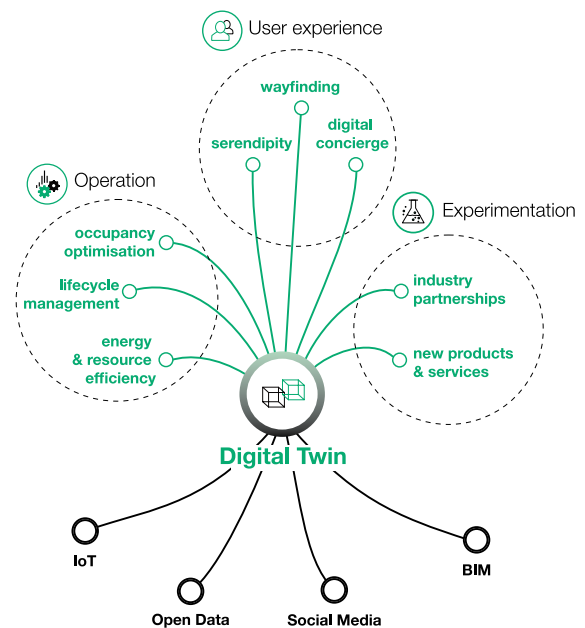
A major focus of digital campus redevelopments relates to the classroom experience.

Student engagement has become a major differentiator for universities, as well as being a predictor of overall student success and employability. Cisco's immersive collaboration technology is helping to transform the way students learn and teachers teach. In addition to the commonly used collaboration platforms and high-resolution video endpoints (Webex Teams and Webex Boards as examples), Cisco has expanded its collaboration suite to include full green screen capability, which gives teachers studio functionality (see right).

Figure 5: Augmented reality using Cisco Webex's Green Room capability

Examples/case studies:

I ARUP

Example	What they did		Results
Lifecycle-driven flexibility	• Created methodology that approaches campus redevelopment from inside out		• Methodology applied to a range of Australian university developments including Monash, Melbourne, RMIT universities

J catAPULT Connected Places

Example	What they did	Results
User-centred design	• Capture user feedback using mix of IoT sensors and tactile objects • Example: sensors capture temperature of a room but students use simple slide scales or turn an object a certain way to illustrate how they feel / what they're experiencing	• Strong demand for consulting services

K UNIVERSITY OF OXFORD

Example	What they did	Results
Employment of Digital Technologists	• Employed people in the specialist `digital technologist' role which has an IT underpinning but is customer oriented	• Repositioned the Office of the CIO from being a cost centre to a respected internal service

L catAPULT Connected Places

Example	What they did	Results
Technology Totems: Citizen Engagement	• Sensor-rich infrastructure deployed in universities and cities capturing a range of data • Used by businesses to test solutions and for communities / industry use as an engagement platform	• Demand from a range of public institutions including universities to support growing list of data-driven functions

5.

Building a strong cyber security platform and a resilient university

The education sector is more exposed than most when it comes to opportunities and risks presented by cyber security.

Led by CIO Lev Gonick the ASU team demonstrated a comprehensive, sophisticated and integrated approach to digital that impacted on every university function. Gonick saw part of his job was to embed digital in the ASU culture at all levels of the organisation. While the office of the CIO was absolutely focused on keeping core systems running and secure, it saw experimentation and pushing boundaries as core to its role. The university, in this way, operated like enterprise and managed its digital investments as a portfolio. Investments in adaptive courseware (see below) are an example of digital truly transforming the learning experience.

At one level cyber security represents a growth market for universities, given the forecast 3.5 million cyber security job vacancies that will be unfilled globally by 2021[3]. It's also creating opportunities in relation to research collaboration with industry, with the Cyber Security Cooperative Research Centre (CSCRC), of which Cisco is a foundation member, one example.

At another level it also presents major risks. Education providers and systems must protect personal student data, employee records, commercial in confidence data and research IP, as well as data from industry partners and governments. The fact universities and training institutions offer cyber security courses and research IP – thereby positioning them as experts – makes them a major target.

The state of universities' cyber resilience was the subject of a recent study commissioned by Cisco in Australia. In terms of the attack surface, organisations view their legacy applications as the primary vulnerability, while legacy infrastructure also presented major risks. Challenges accessing and retaining internal cyber capability was the second-biggest risk, along with low levels of cyber literacy among executives and getting an accurate picture of the organisation's vulnerabilities to an attack.

Figure 6: Sources of cyber security risk[4]

What creates the biggest risk to your organisation from a cyber security perspective?

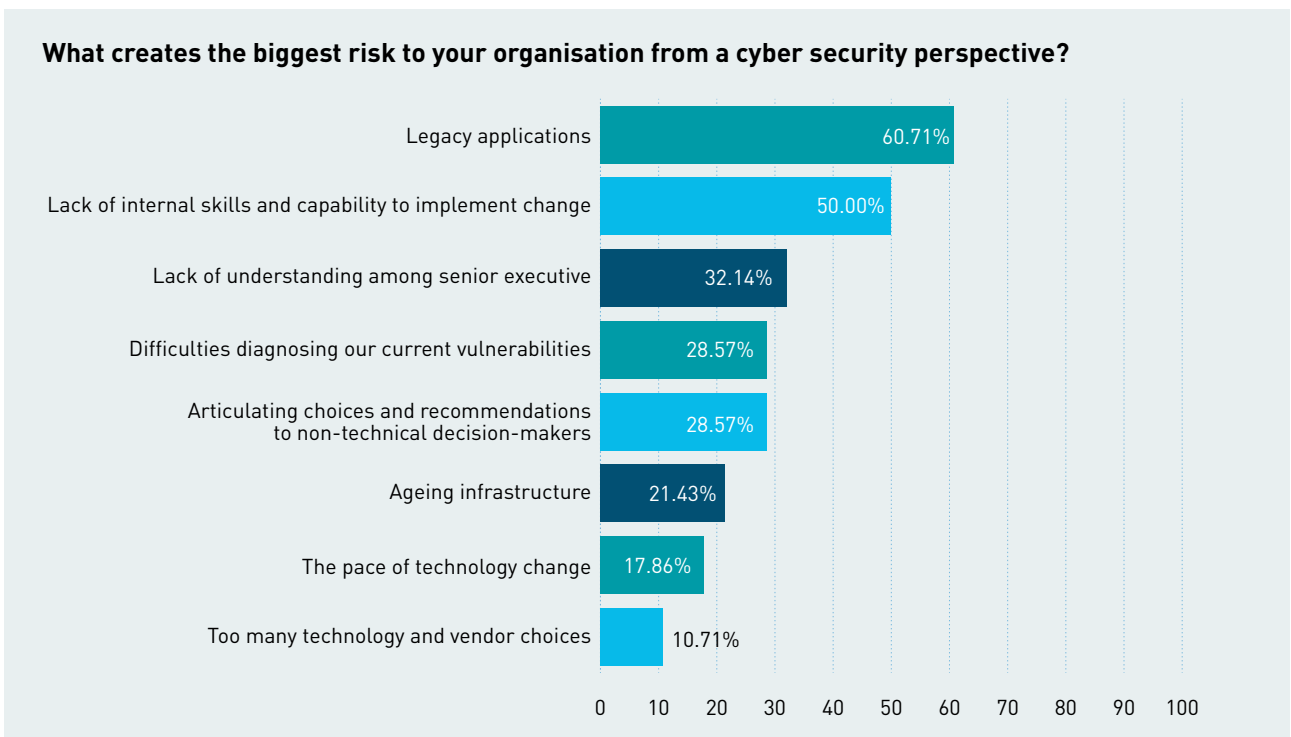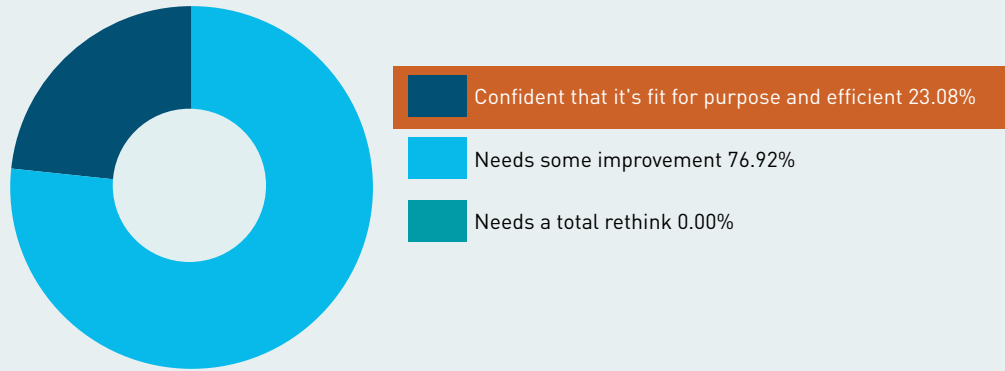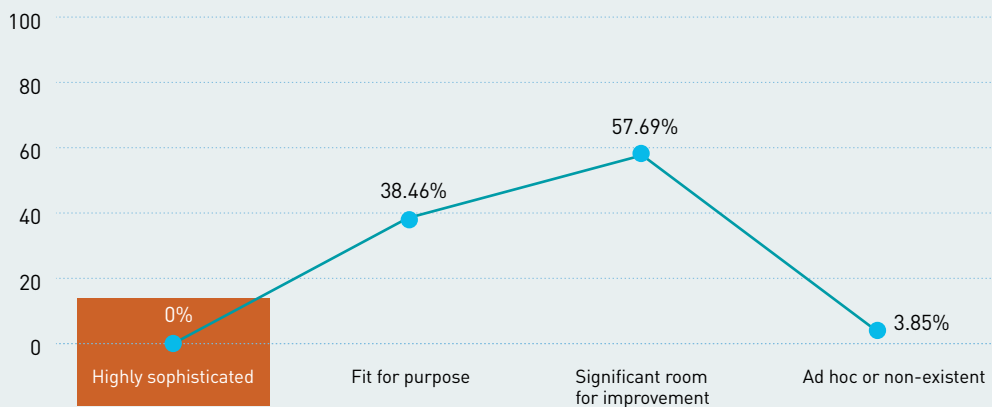| Category	Percentage
Legacy applications	60.71%
Lack of internal skills and capability to implement change	50.00%
Lack of understanding among senior executive	32.14%
Difficulties diagnosing our current vulnerabilities	28.57%
Articulating choices and recommendations to non-technical decision-makers	28.57%
Ageing infrastructure	21.43%
The pace of technology change	17.86%
Too many technology and vendor choices	10.71%

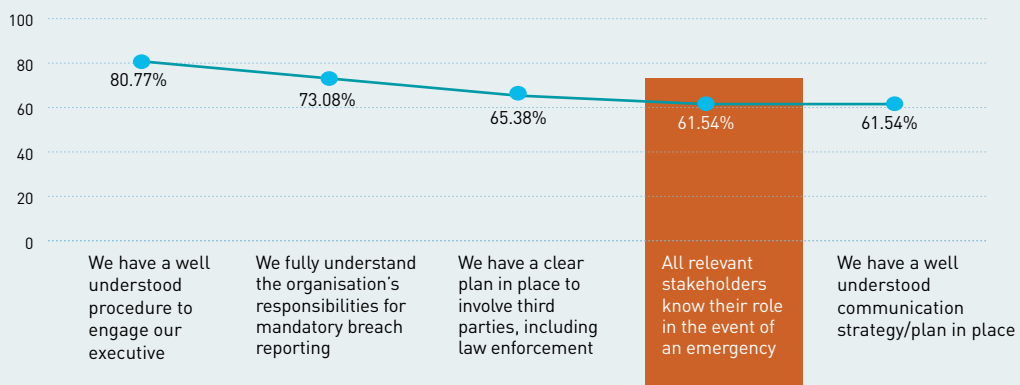**Figure 7: University confidence level and preparedness for a cyber attack[5]**

What is the level of confidence in your institution's current approach to cyber security?

- Confident that it's fit for purpose and efficient 23.08%
- Needs some improvement 76.92%
- Needs a total rethink 0.00%

Which statement best describes your data protection policy and approach?

	Value
Highly sophisticated	0%
Fit for purpose	38.46%
Significant room for improvement	57.69%
Ad hoc or non-existent	3.85%

Which of these statements are true of your organisation in the event of a cyber security incident?

	Value
We have a well understood procedure to engage our executive	80.77%
We fully understand the organisation's responsibilities for mandatory breach reporting	73.08%
We have a clear plan in place to involve third parties, including law enforcement	65.38%
All relevant stakeholders know their role in the event of an emergency	61.54%
We have a well understood communication strategy/plan in place	61.54%

There were a number of themes emerging from the study tour in relation to cyber security:

- The response to cyber threats needs to be driven by business priorities, including the individual cultures of universities
- Accountability for cyber security needs to be owned at board level, not IT
- Securing university campuses will be made more complex with the growth of IoT.

Examples/case studies:

M — HPI Hasso Plattner Institut — IT Systems Engineering | Universität Potsdam

Example	What they did	Results
Open HPI: Cyber for Beginners	• Teaches the basics of internet security to help individuals and small businesses protect against cyber threats (delivered on the Open HPI online platform)	• Heavily subscribed delivering brand halo

N — CISCO

Example	What they did	Results
Business driven information security approach	• Cisco has undertaken a range of assignments, including Brunel University (London), to ensure specific business requirements are mapped to the security posture avoiding a one-size-fits-all approach	• Creates a platform for continuous trust verification and 'enforcement everywhere'

References

[1] http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf

[2] Source: ARUP Campus of the Future

[3] https://www.cnbc.com/2018/08/09/cybersecurity-jobs-non-technical-workers.html

[4] Cyber Security Study performed by Vector Consulting, 2019

[5] Cyber Security Study performed by Vector Consulting, 2019

Conclusions and Execution

The 2019 Higher Education Study Tour resulted in a number of conclusions and potential next steps:

- Digitisation is fundamentally changing the global jobs market. Without exposure to digital skills and tools students risk being excluded from the fastest-growing areas of the economy.
- University-industry collaboration has become more important, not less, but requires different models and mindsets to deliver results. Industry needs to be clearer about the problems that need to be solved and willing to invest, while universities need to be agile and responsive.
- The focus on innovation-driven differentiation is not unique to Australia. Some of the largest companies and universities globally are not just seeing innovation as part of their strategy, it's driving their strategy.
- Universities need to be confident their underlying infrastructure platform will scale to meet future demands, is highly automated and secure. This is particularly true of its own campus assets, which will need to scale and evolve to meet changing student and industry demands.

Next steps

1. Rollout of Cisco's CDA program in Australia. Education, skills, research and innovation are a centrepiece of Cisco's program and expansion of Cisco's co-innovation model is a core element, along with partnerships with universities.

2. Identification of new innovation projects involving Cisco, university partners and other industry players (including startups).

3. Major campus investments among universities that blend the physical and digital worlds, with Cisco as the infrastructure backbone.

4. Release of the Australian higher education cyber security assessment commissioned by Cisco.

5. Registration of interest for next year's study tour program, which will be held on June 15 and travel to Phoenix, US, and Vancouver, Canada.

About the Cisco Higher Education Study Tour program

The annual Higher Education Study Tour has been operating for nine years and in this time the majority of Australian universities have participated in the program. Destinations have included the US, Canada, UK, Israel, Sweden, Denmark and Germany. In this time the study tours have visited more than 30 universities.

For further information please contact:

Brad Davies
Managing Director
Vector Consulting
brad@vector-consulting.com.au

Reg Johnson
GM, Education and Industry Development
Cisco
regjohns@cisco.com

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Focus   Innovation, industry-university collaboration and digitisation of universities

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Australian universities on the study tour: