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**VC'S SPEAKING NOTES**

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I was delighted to be invited to say a few 'after-dinner' words at the ACDS Teaching and Learning Conference.

I would like to use the opportunity to give recognition to this Conference, and to the ACDS Teaching and Learning Centre which is its continuing presence, and focal point for the energy of the conference outside of the actual event.

Universities need innovation in teaching and learning, and they need leadership in teaching and learning. They need it in science perhaps more than in other areas, as we become increasingly aware of the significance of it for innovation, and the need to empower a broader range of our population in it.

While you might not agree with the recent CEDA report which stated that we are on the cusp of a Fourth Industrial Revolution, we are in an age of disruption and change driven by technology. We are undergoing change at a pace and magnitude not seen since the (last) industrial revolution. The centre of global economic activity is shifting towards Asia. The Australian economy is moving away from its dominant reliance on mining and resources towards an era where knowledge, skills and services are becoming our most precious commodity. The enormous scale, mobility and competitiveness of the international labour market is transforming the jobs and job security of Australians and reshaping workplace productivity, processes and culture.

Of these 'mega trends', technology is bringing about the most profound change.

Artificial intelligence and robotics are reinventing the workforce. Drones, driverless cars and the Internet of Things are transforming supply chains and logistics and disrupting industries across the globe. Changing preferences and expectations – most notably in the millennial generation – are altering consumption patterns and demand for everything from cars to real estate.

Some examples of digital/ technological innovation have already begun to shape/reshape industries, economies, governments and societies:

## **Digital technologies and agriculture**

One Indonesia startup is setting out to bring digital innovation to the rice paddy. Ci-Agriculture takes up a concept known in the agricultural industry as “precision farming” and adapts it to an Indonesian context. Precision farming means using high-end tech such as sensors, aerial imagery, and big data analytics to help farmers make smarter decisions about when, what, and how to farm.

In Nepal, an Android smartphone application offers a convenient way for Nepali farmers to link up to the market and to experts at agriculture extension agencies on a single platform.

Called IFA Krishi Nepal, the app provides information in the Nepali language to farmers about planting crops, livestock disease, weather forecast and market prices.

Importantly, farmers can now use this app to go beyond the existing network of middlemen and get the best price for their crops.

## **Food security and sustainability**

Innovation has always been important to chemical companies, but a recent Accenture report says it will be even more critical in the coming years. For example, the scarcity of some resources and a growing interest in sustainability will increase demand for renewable energy sources and electronic vehicles, creating opportunities for new chemical products. Growing populations and increasing affluence in emerging markets will drive a need for things such as longer shelf-life packaging and new food-preservation technologies.

## **Telehealth**

Population growth, ageing societies and changing disease patterns are expected to drive greater demand for well-trained health workers along with new digitally integrated health services in the next 15 years.

Melbourne-based IT integrator Neptune Managed Services' Trident Health unit, in partnership with Queensland-based Telehealth Networks, has launched a comprehensive telehealth platform that it says will help it capture at least 30 per cent of the market over the next 18 months. The platform, dubbed Connect2Care (C2C), facilitates patient evaluation diagnosis and treatment in remote locations by healthcare organisations and specialists. It comprises a user-friendly mobile client application, a web-based portal for healthcare professionals to securely access and integrate patient data and a one-touch video conferencing function

## **Bioprinting technology**

Scientists can now “print” human-size bones, cartilage and muscle, using a new device called a 3D bioprinter, according to a new study from the Wake Forest Institute of Regenerative Medicine (reported in the journal, Nature Biotechnology). The device prints cells together with polymer materials that help to form and mimic the shape of the original tissues. In experiments, the researchers were able to print rabbit cells

into human-size ear structures, and then implant these structures under the skin of mice. Two months later, the ear structures maintained their shapes; they had not broken down at all within the body. Moreover, cartilage tissue and blood vessels had formed around the structures, to support them. The aim is that bio-printing technology will eventually be used to create fully functional human organs for transplants and drug research.

## **Impact on the labour market**

The examples that I have just provided give you a real sense of the inherent possibilities that exist in innovation, science and technology.

However, the changes we are currently seeing in the spheres of digital technologies, connectivity, robotics and big data will have a broad impact on the labour market.

According to estimates from Oxford University's Carl Benedikt Frey and Michael Osborne, 40-50% of all jobs will be transformed or disappear in advanced economies.

The World Economic Forum has predicted that over five million jobs will be lost by 2020 as a result of artificial intelligence, robotics and other technologies. In many industries and countries, it argues, the most in-demand occupations or specialties did not exist 10 or even five years ago, and the pace of change is set to accelerate.

In the local context, a CEDA report on Australia's Future Workforce (2015) argued that, as a result of technological disruption, almost 5 million Australian jobs – approximately 40% of the workforce – face a high probability of being replaced by computers in the next 10 to 15 years.

This digital disruption is coinciding with a massive expansion of the global labour market with more than 84% of new workers being located in developing economies. In addition, with a rapidly expanding and increasingly educated Asian middle-class would result in a more competitive labour market.

To succeed in this new environment, workers will need to have a deep digital literacy.

Digital technology has become so pervasive that employees with the skills to take advantage of it will be needed well beyond the IT department, across all industries. Recruitment staff will increasingly look to fill functions such as operations, marketing and customer service with people who are comfortable with using the mobile, social and analytical tools that companies need for digital transformation.

## **STEM to STEAM**

Science and innovation are recognised internationally as key for boosting productivity, creating more and better jobs, enhancing competitiveness and growing an economy.

In Australia, 65% of economic growth per capita from 1964 to 2005 can be ascribed to improvements in our use of capital, labour and technological innovation – made possible in large part by STEM.

A 2015 PWC Report found:

- 44 per cent or 5.1 million current Australian jobs are at risk from digital disruption over the next 20 years
- 75 per cent of the fast growing occupations require STEM skills
- The top three occupations least at risk in the workforce of the future are doctors, nurses and teachers
- The top three occupations most at risk are accountants, cashiers and administration workers.

As educators, however, we will need to prepare our students for this STEM-fuelled future. To do this successfully, however, I think will require a shift in thinking from STEM to STEAM.

As I argued in my speech to the National Press Club last year, American writer, Walter Isaacson captures this imperative particularly well with his account of how the success of some of the world's greatest thinkers - a group in which he includes Steve Jobs alongside Einstein - relied on what he calls the "intersection" of the humanities and the sciences.

"Human creativity", he argues, "involves values, aesthetic judgments, social emotions, personal consciousness, and yes, a moral sense. These are what the arts and humanities teach us, and why those realms are as valuable to our education as science, technology, engineering, and mathematics."

He goes on to state that it used to be common for creative people to stand at this intersection. Leonardo da Vinci was the exemplar, and his famous drawing of the Vitruvian Man became the symbol, of the connection between the humanities and the sciences. "Leonardo was both artist and scientist, because in his day there was no distinction."

### **Preparing graduates for the future**

Our graduates, our students, will need to be instilled with a broad set of competencies preparing them for multiple careers (some of which don't currently exist), for global careers, and to be creative and entrepreneurial.

In preparing our students to address the grand challenges of our time; to engage with the world as citizen scholars; to think creatively and across disciplinary boundaries.

We should be preparing our students to stand at the intersection of the humanities and the sciences.

This will require some rethinking, at an institutional-level and at an individual level, of traditional pedagogical frameworks. Opportunities for professional development and work-integrated and service-based learning will need to be extended. Greater collaboration between universities, business, industry and the arts will be vital.

Most importantly, however, in our teaching, we should not neglect to encourage our students to be imaginative, creative, have an intuitive feel for beauty, and to “Think Different,” as Steve Jobs would say.

We should be providing greater opportunities for students to think outside the silos of disciplines; and there should be room in our teaching and learning for experimentation where uncertainty (and even, failure) is acceptable.

### **Sydney School of Entrepreneurship**

One such example of such a space for interdisciplinary collaboration and experimentation is the Sydney School of Entrepreneurship (SSE).

In June this year, the NSW State Government announced a \$25 million investment towards establishing the SSE, due to commence operations in 2017.

As a joint venture between NSW universities and TAFE NSW, the SSE will bring together high performing students from all disciplines to learn, collaborate and experiment as part of their undergraduate degree or TAFE course. They will also receive the practical training, support and mentoring they need to kick start innovative businesses.

The SSE is modelled on the Stockholm School of Entrepreneurship in Sweden – a country that has consistently outperformed almost every other on global innovation indices.

More than one-in-three graduates of the Swedish school have successfully launched startups, including two high-profile ‘unicorns’ (start-ups valued at more than \$US 1 billion) such as Klarna, as well as the highly successful SoundCloud, ClocalNet, Jaycut, Readmill, Tasteline and Videoplaza.

### **Learning and Teaching – the challenge ahead**

We are living an age of disruption driven by rapid technological change; the impacts of which are changing the narratives of global economies, labour markets, and societies more broadly.

They are also, I think, changing the narrative of higher education as I’ve just discussed.

But more than that, as teachers, we (you) will all to imagine new ways of learning and teaching; old pedagogical approaches – be it in curriculum, program design or the design of learning and teaching spaces - will have no place in universities as we prepare our students for the future.

Currently the adoption of innovations and improvements – for example, the flipped classroom or the incorporation of blended learning – tend to be preserve of enthusiastic staff. There needs, however, to be a more wholesale change to the way in which science/STEM/STEAM is taught.

Technology will be key; both as a tool for learning and teaching and to develop a depth of digital literacy in our students.

The use of technology in learning and teaching is important but it should be viewed as a means to an end, not an end in itself.

It's the way that technology is used that is crucial; the way in which it is infused into the design of a teaching space as much as it is as a means of communicating content. To improve student engagement and to foster active learning, it needs to be used in meaningful and creative ways.

For example, Western Sydney University's IPSQ campus....

## **Conclusion**

Ladies and gentlemen, thank you.

I hope I have provided you with some food for thought about the challenges for our universities (and academics at the coalface of the classroom) and some broad brush-stroke responses to prepare a generation described as 'Generation Flux' for a future that might be described as exciting, uncertain and constantly shifting, all at the same time.

Most importantly, in preparing our graduates for an age of innovation, I will end with some words from Walter Isaacson's 2014 lecture to the National Endowment of the Humanities: 'Innovation will come from being able to link beauty to technology, human emotions to networks, and poetry to processors.' It is this that should lie at the core of our future learning and teaching endeavours.