29 November 2017

Senator the Hon Arthur Sinodinos AO
Minister for Industry, Innovation and Science
By email <minister@industry.gov.au>
Copy <digitaleconomy@industry.gov.au>

Dear Minister

Deakin University is very pleased that the important task of developing a Digital Economy Strategy for Australia is being undertaken under your leadership.

Please find attached **Four Big Disruptors** as Deakin University's contribution to *The Digital Economy: Opening up the Conversation.* We have chosen to focus on four sectors of the digital economy where our intensive research expertise enables us to offer government an insightful understanding of the opportunities and challenges ahead. These are:

1. **Digital delivery of higher education**: global access is the next wave of international education
2. **The fourth industrial revolution** and how digital technologies will transform manufacturing
3. **Investment in cybersecurity** to position Australia as a global leader
4. **Digital enhanced living** – enabling Australia's population to live and age well

We have structured our advice in accordance with the aims stated in your Preface to, and the broad themes outlined in, the public consultation document, as follows:

- the opportunity
- productivity and change to deliver growth
- competing and winning globally
- instilling confidence and skilling up

At Deakin University, we are well placed to contribute to Australia's Digital Economy Strategy. The University's strategic plan *Live the Future 2020* is a plan for a bold and exciting future that focusses on harnessing the power, opportunity and reach of the digital world in all that we do.

Yours sincerely

Jane den Hollander

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FOUR BIG DISRUPTORS

Deakin University Submission to

The Digital Economy: Opening up the Conversation

29 November 2017

Disruptor 1. Digital delivery of higher education: *Global Access is the Next Wave of International Education*

THE OPPORTUNITY:

New credentials in and for the global digital economy

Australia has the opportunity – and Deakin University has the ambition – to reimagine degrees and credentials that are fit for purpose, considered value for time, money and effort, and which equip learners with appropriate warrants of their skills and capabilities at all stages of their working lives, bearing in mind that the nature of work is forecast to undergo significant change.

While degrees continue to appeal to certain cohorts, and may do so for some time, working professionals who are career advancers and switchers increasingly engage in lower-cost, short, skills-based courses which attract 'micro-credentials.' The attraction of such micro-credentials has been evidenced through the millions of enrolments in these short online courses, particularly offered by well-known universities on global MOOC platforms such as edX, Coursera and FutureLearn. For example, working professionals may take short online courses in skills such as coding in Python, risk assessment, or leading complex teams. When such courses were all free, the attrition rates were very high. Now that learners have to pay modest fees (to complete the course and the assessments for a certificate or micro-credential), retention and completion are improving. Employers are paying greater attention to these
micro-credentials as evidence of achievement and engagement. Increasingly, institutions need to know how to respond when prospective students bring them as evidence for credit for prior learning.

The more attractive of these new micro-credentials are 'stackable' – that is, they have cachet as stand-alone skills warrants, or if desired they can be stacked with similar cognate credentials to form part or all of a macro-credential (such as a Master degree).

Modern education is now digital:

- Learning resources can be accessed in digital format. This includes text books, readings and library resources; video, multimedia and augmented reality resources.
- Increasingly, learning is 'chunked' into micro bites rather than semesters or trimesters, and is blended or fully online. Blended means students access digital resources before, during or after more interactive face-to-face classes. Fully online means those classes, as well as the resources, are experienced via screens.
- A great deal of digital learning can be unhooked from time zones – many short digital credentials can be done 'just-in-time.' Even exams are invigilated via webcam.
- Challenges of digital learning include knowing how and when learners truly engage as remote learners. This can be a challenge for academics used to seeing their students in classrooms.
- Fully online learning is a global offer and MOOCs have changed attitudes to its effectiveness. For many who have not yet experienced quality digital learning, there remains suspicion regarding the quality of engagement, traceability and academic integrity compared to classroom delivery.

PRODUCTIVITY AND CHANGE TO DELIVER GROWTH:

What needs changing for Australian providers to scale their educational expertise to global markets?

Many higher education providers and businesses already work effectively in onshore digital learning. However, there are several barriers to offshore expansion:

1. The Australian Qualifications Framework:
    a. Beyond the terms 'bachelor' or 'master', the AQF presents a confusing array of degree titles which are not necessarily well-understood overseas.
    b. The volume of learning associated with the AQF is open to interpretation, and was devised in an era when most learning was done in standard semesters with weekly drip-fed content in lectures. It is even more confounding when trimesters are more common, or indeed digital learning can be accessed in smaller bites, and at the time and pace that suits the learner.
    c. Other jurisdictions have different requirements. In the UK, for example, a Master is generally a year. Longer time requirements for Australian masters are therefore not competitive on time required (which also means more cost to the learner).
2. Cost and price:
    a. Digital learning, done properly, is expensive. Pricing for other jurisdictions requires us to be able to lower the cost of production and delivery and this requires scale.
    b. Under the *Higher Education Support Act (2003)* (HESA), providers have limited scope to set prices for courses even when the course is offered only online, to offshore international students and attracts no direct subsidy from the Government. This reduces the opportunity for competitive or incentive pricing (e.g. discounting as the learner successfully progresses through the course).
    c. Scholarships are a mechanism for discounting price but add complexity to the value proposition to students and increase administration costs.
3. Brand recognition: Australia is well known for its educational expertise, and particularly its legacy of teaching students at distance. Yet brand recognition of our HEPs offshore is often aligned to research strength which is not necessarily coupled with expertise in online/Cloud teaching.

COMPETING AND WINNING GLOBALLY

Australia attracts many international students but could be attractive to a much larger global market by:

1. streamlining the AQF to reduce the number of degrees and expressing the out-dated and confusing volume of learning requirements in a simpler fashion
2. recognising micro-credentials in the AQF by creating a framework to make them translatable before their proliferation makes this task impossible
3. where discipline appropriate, encouraging professional bodies to work with providers and thoroughly consider digital delivery as an alternative to requirements for on-site attendance
4. amending HESA so that providers have more flexibility in pricing wholly online courses for international offshore students. This includes varying pricing to suit different jurisdictions
5. amending TEQSA's powers as necessary to ensure proper implementation.

INSTILLING CONFIDENCE AND SKILLING UP

We know from the Productivity Commission's *Upskilling and Retraining, Shifting the Dial: 5-year Productivity Review* (particularly Supporting Paper No. 8, key points) that:

- technological advances will create new job opportunities but will also displace some jobs, including occupations previously considered 'irreplaceable'. If the education system, and those in or entering the

workforce, are not responsive to changing skills needs, there is a risk of higher unemployment, underemployment and lower earnings prospects, which in turn are likely to reduce engagement in the labour market

- improving the employability of workers through upskilling and retraining is a necessary response to the combined effect of an ageing workforce and technological change. There are no easy ways of ensuring that the current workforce has the relevant skills for the jobs of the future, particularly given the uncertainty about the effect of technology on the usefulness of existing skills and occupations. Reforms that will reduce barriers and assist people to upskill and retrain, include: establishing an independent system that enables recognition of, and trust in, new ways of acquiring knowledge and skills that may stimulate further upskilling and retraining. The lower costs and greater flexibility of these new approaches may be particularly relevant for people who have existing job and family commitments.

Deakin University has made significant investment and progress in forging new ways of offering digital learning and credentials for the jobs and skills of the future:

- Deakin University has a substantial presence on FutureLearn, the global social learning platform with nearly seven million enrolled learners from over 200 countries. Deakin University is the first university in the world to offer full postgraduate degrees on FutureLearn, in diabetes education, cyber security, information technology, leadership, property and real estate, and development and humanitarian action.
- Deakin University also offers short courses on FutureLearn in many fields, including infant nutrition, professional resilience and cyber security for small to medium enterprises. These courses are aimed at learners with an interest in the subject area, who may or may not have some knowledge of the topic.
- Starting in early 2018, Deakin University will partner with Australia Post to offer short courses on digital skills, for learners who are skilling up in the elementary use of technology.
- On robust assessment of learner achievement, Deakin University confers AQF-aligned credentials in professional practice. They can be stand-alone, relate to companies' Continuing Professional Development arrangements or be integrated by third-party learning providers into their learning programs; and can lead to credit in certain Deakin University degrees.

Disruptor 2. The fourth industrial revolution
How digital technologies will transform manufacturing

THE OPPORTUNITY

Geelong's Local Investment Plan (LIP) highlights the loss of 2500 manufacturing jobs in recent years and forecasts an additional 800 jobs will be lost between now and 2020. This trend is seen across all of Australia's historic manufacturing centres.

However, backed by the advanced manufacturing expertise at Deakin University, Geelong has an opportunity to buck the trend and generate net growth in manufacturing jobs in the coming years.

This has not been achieved by redefining existing business models to manufacture existing products, but by a focus on the future of manufacturing. For manufactured products whose economics are not driven purely by the input cost of labour, how can new materials, industrial design and new processes change the competitiveness of manufacturing locally?

Deakin University has existing leadership in this space. ASX-listed Quickstep Holdings has chosen to consolidate all of its global R&D capabilities to its facility on Deakin University's Waurn Ponds Campus and is joined by leading carbon fibre car wheel manufacturer, Carbon Revolution and the soon-to-be-opened Manufutures facility for accelerating and scaling up small manufacturing businesses.

PRODUCTIVITY AND CHANGE TO DELIVER GROWTH

The time-honoured method of Design of Experiment (DoE) needs a step change to accelerate scientific innovation. This iterative method quickly hits limits as soon as the number of control variables or target goals are increased. For example, since the Bronze Age, fewer than 12 elements have been combined to make alloys. But the periodic table contains 97 naturally occurring elements. Only a tiny fraction of the target space has been explored because of the underlying complexity - by increasing the number of elements to just 15 in order to find a high-strength alloy with three mixing levels per element, the search space escalates to more than 14 million choices. We are almost always forced to compromise at a non-optimal result.

By interweaving statistical and computer theories, Deakin University has formulated patent-protected pattern recognition methods to solve diverse problems. The Economist forecasts that ‘the use of AI (machine learning) to speed up scientific breakthroughs’ will be one of three major drivers to transform the world (June 2016). Deakin University supports this and believes that AI will establish Australia as a leader in innovation-led productivity in the fourth industrial revolution.

Deakin University's new Adaptive Experimental Optimisation (AEO) framework can iteratively recommend future experimental settings. It will be based on Bayesian optimization, an area combining statistical and computational theory to optimise outcomes in minimal iterations. This has the potential to disrupt a large swathe of current material design, such as optimising an aluminum alloy for weight and strength. It can also be applied to the management of industrial processes themselves. A good example is the University’s work with the chemical engineering firm, HeiQ. We have been able to help HeiQ tune its manufacturing process to create short polymer fibres with pre-defined properties, optimised for a specific industrial use such as a treatment to minimise pilling in a woolen fabric

COMPETING AND WINNING GLOBALLY – LEMOND COMPOSITES AND DEAKIN UNIVERSITY

In May 2017, US-based material technology company, LeMond Composites signed a worldwide licence for a manufacturing invention (the 'Reactor') from Deakin University to produce industrial and aerospace grade fibres. The licensed technologies will reduce the capital expenditures for fabricating a production line by an estimated 40%, while nearly tripling the annual production output. The newly engineered reactor technology reduces the production line length by 60% while consuming 75% less energy than the industry's standard carbon fibre production line.

The new methodology of processing carbon fibre, which is integral and key to this new technology, is highly innovative in its approach. Deakin University completely stripped down the current process to understand the link between process and reaction and in doing so was able to develop a methodology along with an engineered Reactor that will completely disrupt the industry.

As well as developing innovative technology, LeMond is planning to build Australia's first industrial-scale carbon fibre manufacturing plant on Deakin University's Geelong Waurn Ponds Campus. With an investment in excess of $40m, it is expected the project will create 100 Full Time Equivalent (FTE) jobs during the plant construction phase and 110 FTE positions once operational. An economic impact report KPMG estimates that 'almost 340 jobs' would be created by the facility across the Geelong economy.

The strategic opportunity for LeMond to build the facility at Deakin University's Waurn Ponds Campus is based on key inputs available for sustainable carbon fibre manufacturing including access and proximity to:

- a highly skilled workforce, familiar with automotive supply-chain practices
- industrial scale power supplies and land
- world-class research and development capabilities
- competitive logistics
- significant customer demand
- agglomerated service providers and SMEs
- supportive government policy settings for regional advanced manufacturing.

INSTILLING CONFIDENCE AND SKILLING UP

Due to the advanced processes and technology utilised in the production of carbon fibre, employees will be highly trained and skilled. Training and further development will be undertaken by Deakin University and the Gordon Institute of TAFE and will include up-skilling for Ford and Alcoa employees recently made redundant.

This will be the first commercial scale advanced carbon manufacturing plant built in Australia with major supply chain opportunities during the construction and throughout the commercialisation phase. LeMond is committed to supporting new SMEs to build new markets and products using the carbon fibre that will be manufactured locally.

The LeMond plant will also provide additional momentum to maximise opportunities that may flow to the region as a result of renewed government commitment to local content in defence contracts and procurement programs and is a great example of how well-managed University intellectual property can not only drive economic growth but be a globally significant disruptor.

Disruptor 3. Cybersecurity
Positioning Australia as a Global Leader

THE OPPORTUNITY:

We have an opportunity to build trust and community confidence in digital platforms and systems by uplifting Australia's cyber security maturity and capability. Deakin University is working in the following areas:

1. Education. Deakin University has been leading the way since 2003 with cyber security courses for undergraduates, postgraduates and business executives. These courses teach practical skills and knowledge, helping to prepare students to be job ready. The business executive security sessions run by Deakin University, educate Australian industry leaders on the risks associated with digital business; provide an understanding and awareness of the threat actors targeting business; and, mechanisms that can be used to help improve the risk culture within organisations to minimise cyber security risks.

   Deakin University's capability in cyber security education is also being exported to other international universities under license.

   Deakin University provides Australian businesses with the opportunity for undergraduates to participate in the workforce as a way of ensuring students are job ready and to deal with the skills shortage in cyber security. There are two engagement models:
   a. industry based projects which are undertaken by a collaborative cohort of students over a 26-week period with the aim of delivering a business outcome at no financial cost to business
   b. industry based full time placements for 3, 6 and 12 months providing organisations with a low risk mechanism to take on students at the end of their study.
2. Innovation and Research. Deakin University's Cyber Security Research and Innovation centre (CSRI) provides innovative products, technology and solutions to help advance the cyber capability and safety of Australian organisations. CSRI sits within a cutting-edge technology ecosystem created by Deakin University's world-class capabilities in cloud and mobile computing, software development, pattern recognition and data analytics, smart environments, robotic, haptics and human/machine interfaces.
3. The CyRise cyber security start-up incubation and accelerator partnership between Dimension Data and Deakin University educates, mentors and links new Australian entrepreneurial talent with Australian businesses to road test and pilot new cyber security solutions. The program is highly practical and focused on ensuring Australia becomes a global leader in innovation and technology.

PRODUCTIVITY AND CHANGE TO DELIVER GROWTH

The Australian Government needs to better coordinate and fund cyber security research, both blue sky thinking and industry outcome based activities to ensure duplication is reduced and foster cross collaboration between Australian Universities. The field of cyber security is diverse and varied which also allows for the establishment of centres of excellence around the country. Currently this occurs in Victoria across eight universities via the Oceania Cyber Security Centre, however this should be replicated on a national level.

Australia's current structural and cultural environment inhibits innovation and entrepreneurial programs from reaching their full potential. Australia could learn from Israel's start-up nation culture by establishing and encouraging:

- Improved networking and exchange of ideas between entrepreneurs.
- Conversion of University research into products and services.
- Australian organisations to pilot or trial Australian products or services.
- A venture capital sector similar in culture to Israel (JVC Cyber Labs) where funding can be obtained and matched by government at early stage incubation.

Removal of duplication and better coordination between state and federal cyber activities. Each state and territory is ramping up cyber security capabilities and developing policies. A coordinated national approach is needed with better industry engagement from a balanced cross section of Australian business. In the past, strategies at both state and federal level have been based on the needs and feedback from the larger end of town (e.g. banking and telecommunications). While this is beneficial, it also neglects the small to medium sized businesses (SMB) and critical infrastructure utility providers (e.g. water, power, gas) who will have a different perspective. This different perspective is critical as SMBs often have no dedicated security teams and low budgets to spend on cyber security solutions while utility providers are dealing with legacy systems and the IoT cyber security challenge. Other areas such as health should be consulted as cyber security for this sector is about speed to information as lives depend on it, open access to information between a varied workforce and system resilience. This contrasts the financial sector where the cyber security focus is on access restriction and defence from cyber criminals.

The Baker McKenzie Chart of Australian Cyber Security Infrastructure highlights the complexity and potential for duplication. When state based and other cyber programs are included it clearly becomes evident that a better coordinated approach to cyber security is required[1]. The Australian government does need to objectively assess the value that is being delivered to Australian businesses and the community for the current approach and identify areas which may benefit from improved collaboration, coordination and oversight.

COMPETING AND WINNING GLOBALLY

Barriers for business in adopting cyber security and privacy practices stem from:

- lack of awareness of the risks and impacts
- inability to clearly and quickly identify effective low cost products and services in a crowded complex market which uses jargon
- inability to attract skilled resources, or skilled resources are too costly
- no perceived financial impact or tangible value investing in cyber security.

Adopting an Australian cyber security rating scale with two dimensions (cyber security capability and maturity) would create incentive for business to invest in cyber security. Such a rating would operate on a scale of 1 to 5 in both cyber security capability and also cyber security maturity, in a similar fashion to food or energy ratings, to drive and stimulate cyber security investment as a consumer advantage. Under the Australian Prudential Regulation Authority (APRA) the financial sector must conduct third party assessments on their material suppliers. Currently the four major banks each assess material suppliers rather than a single agency performing the assessment, rating the supplier once and sharing the data with the banks. A cyber security rating system that operates along similar lines to a credit rating agency could be operated by government or an independent not-for-profit organisation. Businesses with higher cyber ratings will naturally secure greater trust and more profitable business with their customers, thereby encouraging market forces to drive the capability and maturity of Australian business in the right direction.

It should be noted that at least 14% of breaches are a result of vendors or the supply chain. As businesses outsource more and depend on third parties for services, the result of a single data breach by a third party could result in a catastrophic impact to many organisations. An Australian cyber rating system would provide a global competitive advantage driver for cloud-based Australian businesses.

INSTILLING CONFIDENCE AND SKILLING UP

A National Approach

Business at all levels, from large enterprises to small to medium-sized businesses (SMBs), need to assess their cyber security risks and establish incident recovery plans. While the banking and telecommunication sector is very mature and has in-house cyber security capabilities, SMBs often lack both an awareness and

[1] http://www.bakermckenzie.com/-/media/files/insight/publications/2015/11/al_australia_cybersecurity_jan17.pdf?la=en

understanding of the cyber security risks. The other challenge SMBs have is identifying and retaining skilled people to address the risks within their organisations.

The commencement of the Mandatory Data Breach Notification (MDBN) in 2018 and existing Australian Privacy Principles (APPs) provides a good starting point to ensure the protection of consumer data. However, the effectiveness of MDBN to shift the needle in the minds of Australian businesses and board directors to take cyber security seriously is yet to be determined and will be subject to the interpretation and implementation of the legislation.

The integrity of Australian business-consumer transactions can be improved by:

- enhanced coordination between state and federal governments on Cyber Security programs
- closely linking the Joint Cyber Security Centres currently to Australian businesses with well-defined processes and integrations
- the introduction of a business rating scheme (cyber security capability and maturity) as detailed above.

Another upskilling initiative would be the development of a cyber security app in plain English with no jargon that business will find easy to navigate and use. The application could also receive notifications to alert business operators and company directors of changes in the cyber security landscape – almost like a tsunami warning system if CERT or another government agency identifies a new threat to Australian businesses. A well-designed application would categorise businesses in different verticals and provide targeted warnings and advice. Consumers could have a similar version to help keep them engaged and educated on cyber security through gamification and online safety guidelines.

Disruptor 4. Digital Enhanced Living
Enabling Australians to Live and Age Well

THE OPPORTUNITY

The rapid growth in our ageing population is a major emerging societal challenge in Australia and around the world. As people live longer, the need to provide aged-care facilities and in-home support increases, but existing facilities and resources struggle to keep up with ever-increasing demands for care and support. By 2050, it is estimated that the proportion of people over the age of 80 will have risen from 3.9% to 9.1% of the population of OECD countries[2]. The majority of these people will need help to manage chronic diseases such as dementia, heart disease, diabetes as well as mobility issues and support for their daily living tasks. Hospitals and current health systems typically focus on acute episodes of illness and are not well equipped to provide adequate support for daily living.

Similarly, over 460,000 Australians will be provided with support from the National Disability Insurance Scheme by 2020; many needing in-home and in-care digital assisted support. A critical need exists for practical, affordable, scalable and safe in-home and in-residential care solutions leveraging a range of current and emerging sensor, interaction and integration technologies – a 'smart home' focused on assisted living.

Deakin University is disrupting the Digital Enhanced Living space on three fronts:

1. To serve Australia's ageing population and position Australia as a leader in digitally enhanced living, Deakin University has won funding to establish the Australian Research Council (ARC) Industrial Transformation Research Hub for Digital Enhanced Living[3] (the ARC Research Hub or the Hub). This is jointly funded by the ARC, industry, and local and overseas university partners.
2. Deakin University has also spun-off a company called Unisono[4] to commercialise the behavioural learning platform with artificial intelligence methods, which were developed at Deakin University's Software & Technology Innovation Laboratory. The platform uses multiple non-invasive sensors to learn and recognise the behaviours and activities of the residents who are living independently, and interact with them in various subtle and explicitly human-centric ways. For example, if a resident spent more time than usual in the bathroom, the system is able to detect this anomaly and request the resident to respond to an event (e.g. make a movement). If the resident fails to respond to this request the system alerts a carer. The system can also remind the residents to take their medications or remind their appointments. The aim of Deakin University's research in partnership with Unisono is to empower elderly people to live independently and safely in their own homes for as long as possible.
3. Deakin University is investigating further areas for use of such technologies to underpin other digital health and welfare improvement opportunities. These include healthcare transformation via the improved deployment and use of digital solutions, personalised support apps and devices for health, ageing, chronic condition management, disability and rehabilitation, and improved support for a wide variety of mental health challenges.

PRODUCTIVITY AND CHANGE TO DELIVER GROWTH

Deakin University's vision is to create a new research and development ecosystem of digital enhanced living with devices, software, integration and the deployment of novel medical technologies. The ARC Research Hub will focus on generating new knowledge in this area using an innovative approach with a multi-disciplinary team to leverage diverse expertise.

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[2] OECD, A good life in old age? Monitoring and Improving Quality in Long Term Care.
[3] Digital Enhanced Living website, http://www.deakin.edu.au/sebe/delh, accessed on 16th Nov 2017.
[4] Unisono (trading as SofiHub) website, http://sofihub.com, accessed on 16th Nov 2017.

The Hub is expected to provide significant benefits including revenues from new and repurposed devices, conversational agents, data analytics and integration platforms for individuals to manage their own health care. In addition, new jobs in these areas will be created for enhanced care and physical well-being together with cost reductions. The Hub will build or adapt technologies and support infrastructure for 'intelligent sensed spaces' in residences to realise the related, but different needs of both high-quality ageing in place, disability and rehabilitation support. Costs for community care will be reduced by leveraging affordable technologies and reducing mundane human carer task demands. This will increase the productivity of the carers so they can focus on more strategical tasks and reduce carer fatigue.

Deakin University's artificial intelligence solutions for health are built as 'human on the loop' systems to allow health and aged-care professionals to focus on the people they look after and more strategic tasks rather than mundane and repetitive activities.

Deakin University is also utilising digital technology to enhance the lives of children with disabilities. The Deakin University AllPlay program has partnered with AFL, Moose Toys and the National Disability Insurance Agency to develop an online portal (All Play) and companion app to support children of all abilities be part of the AFL's Auskick program. Children with developmental challenges, such as autism, ADHD, cerebral palsy, language disorders and intellectual disabilities, often feel their disabilities are a barrier to participating in team sport and yet sport is a cornerstone of Australian culture. AllPlay is about opening up the opportunity to engage in sport to all children, because we can see that it has such a positive impact on not just their physical development, but their social development and inclusion too.

COMPETING AND WINNING GLOBALLY

Australia is well positioned to be the R&D launch pad for digital enhanced living technologies in other countries, especially those in the Asia-Pacific region[5] due to our diverse and rich cultural background, an ageing population and our understanding of the cultural, regulatory and demographic differences of the region.

Deakin University is working to provide three major industry transformative opportunities:

1. The first is for non-health technology companies (e.g. companies producing devices, software, integration and analysis services) to move into this rapidly growing area to support enhanced living. One of such examples is TOBY Autism Therapy app, which is an early intervention application for children with autism spectrum disorder from two years of age. Machine learning algorithms are constantly working in the background and 'grow' with each individual child. This empowers parents to start therapy at home and help their children to learn over 300 real world activities.
2. The second is the transformation of community-based aged, disability and rehabilitation care service industries to leverage these technologies to significantly improve operational effectiveness, efficiency and business models. At present, Deakin University is working with the Royal Melbourne Hospital to train deep neural networks to identify the occurrence of epileptic seizures. We hope to train machines to predict a seizure minutes before it occurs, and to assess whether such a prediction can be made from consumer-grade wearable devices. This would be a life-changer for the 250,000 people in Australia and 65 million globally affected by epilepsy, since early warning would provide sufficient time to call for help, and/or stopping any dangerous activities (e.g. driving) that place their life at risk.
3. The third is to educate and future-proof not just Deakin University's students, but all of Australia's population about the technologies and minimise any barriers for adoption. One example is Educational Dementia Immersive Experience (EDIE) developed by Alzheimer's Australia and Deakin University. This virtual reality experience was developed to instil empathy towards people living with dementia. This complete sensory experience plays out through the eyes and ears of EDIE (a person living with dementia). The experience aims to communicate how compassion and changes around the home can significantly increase the quality of life of someone living with dementia. Currently in Australia there

[5] Where 60% of the world's population lives, according to UN World Population World Population Prospects 2017

are over 413,106 people with dementia[6] living in the community and there are over 46.8 million people[7] Worldwide. It is important to support and educate family and community members.

Deakin University works in partnership with industry, government, and not-for-profit organisations and is always striving to be a transparent, agile, progressive and engaging organisation, which empowers the communities we serve. Deakin University has a number of Australian and international research partners with whom work together in the digitally enhanced living space. One such example is our long-term collaboration with the University of Copenhagen. Together we are working on a chronic conditions management platform. This platform will connect trained healthcare educators with people living with chronic conditions to provide a life-long motivation in managing their conditions.

Deakin University and our partners are well positioned to combine our expertise in Artificial Intelligence, healthcare, Internet of Things, robotics and engineering to establish a new industry in this space, and increase the competitiveness and productivity of Australian industry.

INSTILLING CONFIDENCE AND SKILLING UP

Not all Australians are digital-confident in their personal and professional lives. There is already a myriad of digital technologies that do not talk to each other, or lack a sustainable platform to support themselves.

Deakin University is very conscious of the fact that some aged care and healthcare professionals need to look after a number of technologies and systems, thus taking their time away from the people they are caring for. We also empathise with carers and the time poor children of elderly people who do not have the time to work out how a gadget works or charge multiple devices.

Our overall goal is to produce systems that will blend into a person's normal life, monitoring and supporting activities of varying complexity without compromising the autonomy and competence needs of their normal lifestyle. This will enable people to live and be cared for safely in their own homes or in limited care residential facilities and optimise their level of independence and lifestyle. This technology and infrastructure to achieve this will range from passive monitoring of key indicators, advisory systems for detecting hazardous situations and alerting the user or carer, through to detecting subtle deviations from complex, normal activities over significant periods of time. Through these personalised medical technologies, various exercises to support a wide range of physical and cognitive deficits will be provided, and social connectedness will be enhanced using in-situ devices. The residence, therefore, becomes an intelligent, caring and autonomous supportive advisor.

The roll out of the NBN across Australia offers opportunities for improved connectivity and use of digital enhanced living solutions in a wide variety of ways, including telemedicine, smart homes and residential care, improved family and community connectedness via communication and immersive reality, improved monitoring and service delivery, and new business models in the aged care, disability, rehabilitation and mental health spaces. Deakin University's Digital enhanced living research seeks to leverage this opportunity to the full.

[6] The National Centre for Social and Economic Modelling NATSEM (2016) *Economic Cost of Dementia in Australia 2016-2056*

[7] Alzheimer's Disease International (2015) *World Alzheimer Report 2015: The Global Impact of Dementia - an Analysis of Prevalence, Incidence, Cost and Trends*