

# INSIGHTS PAPER

## Information, Knowledge and Digital Disruption

### INTRODUCTION

#### Background

Advances in information, data and technology continue to gain momentum, shaping and shifting the way we operate. In the next 15 to 30 years new and emerging technologies such as the Internet of Things (IoT), big data, artificial intelligence, machine learning, robotics, automation and virtual reality are likely to transform many aspects of the way we live. In a warfighting context this rapid change results in disruption that presents both an opportunity and a threat. It is in this context that Emerging Disruptive Technologies Assessment Symposium One (EDTAS1) considers the future of Information, Knowledge and Digital Disruption (IKDD).

In realising and adopting the possibilities of the future, society will navigate many challenges. Such challenges will be varied and may include: continuous and rapid resetting of government policy required to guide the changes that will impact citizens; continued globalisation and increased influence from global corporations; a continued reduction in less skilled employment roles, coupled with higher demand for increasingly skilled employees; managing ageing infrastructure as an enabler of digitisation; the benefits of an increasingly connected digital world which in turn presents a rich tapestry for organised crime; and, potentially complex privacy issues.

As society grapples with these issues and seeks to maximise the benefit from future possibilities, so too will the Australian Government and the Department of Defence (Defence). The question of how Defence will raise, train and sustain future joint forces, while maintaining its capability position relative to other nations remains open. Many questions were raised during stakeholder engagement, including:

- What truly game changing technologies may appear in this timeframe and what effect will they have on the planned future force?
- How will IKDD change the way the ADF fights in a future conflict?
- While major land, sea and air capability platforms across the next 20-30 year time frame are largely known, what impact will IKDD have on how they are integrated, commanded, sustained and modernised?
- How will our adversaries adopt and use such technologies?
- Is Defence focused on necessary long term research and development and how robust are our methods to experiment with future capability inserts?
- Are Australian research institutions enabled to keep pace with ever increasing technological change?

The Symposium will explore IKDD opportunities and challenges with a view to identifying key themes for future research, industry focus and joint experimentation to inform Defence capability out to 2040.

#### This Project

As the agency responsible for leading the development of Defence technological capabilities, Defence Science and Technology (DST) has an active interest in IKDD and how to best understand the opportunities and the threats it presents.

This symposium will examine IKDD trends in the next 15-30 years. Particular attention will be given to technologies in 2040 and their application in a Hyper-Connected Mega City in 2040, internet knowledge capability opportunities and challenges, and the related social, legal and ethical considerations. DST Group and Noetic consulted with a range of stakeholders to inform the design of the Symposium which will include five facilitated workshop sessions, each preceded by a series of short expert presentations. A key output of the symposium will be a Big Picture Analysis Report that captures the contributions of symposium attendees. The primary audience for this symposium is academia, government, Defence and defence industry.

## Aim

The aim of this Insights Paper is to present key issues relating to IKDD in the next 15-30 years drawn from stakeholder interviews conducted in the lead up to the symposium.

Preparation included the conduct of 36 interviews in Australia and the United States, with scientists and academics from a range of relevant disciplines, industry leaders and Defence staff. Stakeholders provided a wide range of insights into IKDD, including advantages, challenges, limitations and risks.

## Technology in 2040

What technology will be capable of in 2040 and how society and Defence will leverage that technology remains open. Consideration of this will be central to the symposium. Such technologies are anticipated to include quantum computing, artificial intelligence (AI), human machine interfaces, biotechnology and open intellectual property. The technologies considered in this Insights Paper are all seen as emerging and potentially disruptive when realised, in the sense stakeholders consider they are expected to generate a disruptive effect in the way we currently consider IKDD.

## Hyper-Connected Mega City 2040

Since 2008 more than half the world's population has resided in towns and cities. This is expected to have increased to two in three people by 2040.<sup>1</sup> Increased urbanisation as a single issue presents us with a wealth of new opportunities and also enormous challenges. Such a demographic shift has the potential to further economic development and innovation, but also threatens to exacerbate key global problems, including resource depletion, climate change, and inequality.

From stakeholder interviews, open source research and the case study that follows, it is anticipated that a future Hyper-Connected Mega City will incorporate and build on advancements such as:

- + open-data initiatives
- + interactive apps throughout the city
- + enhanced low cost wireless data connectivity throughout the city
- + Dynamic Kiosks that display real-time information and functionality
- + law enforcement agencies using real-time data to monitor, disrupt and prevent crime
- + digital surveillance in high-crime areas
- + high use of solar panels and SolaRoads
- + smart climate control
- + networked infrastructure including sensors on buildings enabling a digital landscape.

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<sup>1</sup> <https://esa.un.org/unpd/wup/publications/files/wup2014-highlights.Pdf> - UN World Urbanization Prospects Paper from 2014

## 2014 Case study

### **Tel Aviv Smart City Today**

In 2014 Tel Aviv won the World Smart City Award. The services included in the model are based around sanitation, security, education, community, transportation, water and energy. While these services and the responses to them are considered limited in terms of what may be possible in the future, it provides a clear snapshot of a city that is currently considered leading edge.

In Tel Aviv, using a 'resident and city club card' allows:

'A personalized digital communications network that is interest, site and life situation-based, whose focus is our residents. All Tel Aviv residents aged 13 and older can come to one of our many registration centers in the city, tell us a bit about themselves, and that's it! After that, they are sent a Smart City Card and become members of the Digi-Tel Club. Based on their unique profile, we are able to offer them information, a wide variety of special deals at cultural venues, sports arenas and other places, as well as customized digital services that enable them to carry out transactions with the Municipality - at any time and from any place. The information is delivered via different channels, including personal emails, text messages and a personal resident account. For example:

- We'll make sure that Shira receives a text message informing her that the bridge she normally travels on is closed, enabling her to take an alternative route and get to her game on time.
- We'll remind Danny that the deadline for registering his child for kindergarten is approaching, and we'll even help him register over the Internet.
- We'll keep Jonathan, who loves music, posted about discounted tickets for tonight's performance.'

In addition:

- Free Wi-Fi is provided to the public throughout most of Tel Aviv.
- Engagement of the community is made possible through community centres which make available online courses focused on the needs of residents.
- Tel Aviv has been connected to social media platforms such as Facebook and Twitter to spread messages as quickly as possible. The idea behind it is to offer 'simple and easy access to municipal services.'
- Open data has been part of Tel Aviv's 'policy to promote the accessibility and transparency of the information provided to the general public.'

*'As part of the city's policy to promote the accessibility and transparency of the information provided to the general public, the Municipality allows direct access to municipal databases that are not of a confidential nature. The environment enables the public and app developers to make use of information in municipal databases that deal with community affairs, culture, public health, budgets, statistical data and security. Among other things, the Municipality produced the Tel Aviv App2you contest, which encouraged the development of public benefit applications through use of municipal and government databases. About 70 new applications were created as a result of that contest'*

- Employment of security providers such as Check Point.

*'In Tel Aviv, Check Point provides a consolidated end-to-end cyber security infrastructure to the cameras that monitor the city transport routes, giving a real-time picture of the traffic. All*

*cameras around the city are connected to the main data centre servers, transmitting secured information which is also backed up on an encrypted cellular interface.<sup>2</sup>*

How will IKDD transform a Smart City to a Hyper-connected Mega City by 2040?

## Working and Living – a 2040 snapshot

As both technology and methods of communication continue to evolve into a digitised environment, so will the way we live and work.. The following descriptors describe a possible future environment in the 2040 timeframe:

- 'Hive' - This is your home and where your work journey will begin as you can already start to access much of the information you need to get your day started. Naturally the home will be "smart" and fully connected so that it comes to life before you even wake up. It also adjusts to your mood and what you need. For example your mood and nutrient levels will be detected to determine what kind of lighting will boost you up and what kind of food you should have for breakfast. Your home also knows when you're about to leave and calls for your pHive.
- 'pHive' (personal hive) - This could be a self-driving car that will transport you from your home to your place of work. While in the pHive you will be able to keep up your level of productivity while not having to worry about the details of your commute. You will be connected and can collaborate and communicate with your team while on the move. This is basically your office on wheels (or in the air). The pHive will take you to the Eco Campus.
- 'Eco Campus' - Instead of going to a building or a facility the Eco Campus can be thought of as a town within a broader city. It's a place where people can go to work and meet face-to-face and it's more of a co-working space than it is an office complex. It has a mix of spaces, "office" style, and amenities to cater to a variety of work preferences. Think of it a bit like Disneyland with the different "world's they have created, Tomorrow World, Fantasy World, etc. Robots roam the halls, 4D telepresence capabilities are everywhere, and virtual "smart assistants" help everyone get their work done. To take a break from work people head over to the Faraday.
- 'Faraday' - Robots might make and bring you your food but you won't get access to the internet as being "disconnected" will be considered a luxury. Faraday is a designed as a place to recharge before heading back into the busy connected world of work. After heading back to the Eco Campus to finish off the remaining work that needs to be done people then head to the Warp Workspace.
- 'Warp Workspace' - This is essentially next generation public transportation and includes ground and air transportation. Warp Workspace is essentially a subscription service with various options for upgrades for how you can be transported. For example, if you're prepared to pay more money you might access a more luxurious drone transport system instead of the basic model. Naturally all of these things are connected so you can catch up on any news, watch a movie, or just close your eyes and relax as you get transported back to the Hive.<sup>3</sup>

## FINDINGS

### What is Information, Knowledge and Digital Disruption (IKDD)?

Information, Knowledge and Digital Disruption is defined as the change that occurs when new digital technologies and operating models affect the viability of current ways of operating or delivering goods and services.

<sup>2</sup> <https://www.tel-aviv.gov.il/en/WorkAndStudy/Documents/SMART%20CITY%20TEL%20AVIV.pdf>

<sup>3</sup> [http://www.johnsoncontrols.com/content/dam/WWW/jci/be/global\\_workplace\\_solutions/global\\_workplace\\_innovation/SW2040/SW2040infographic.pdf](http://www.johnsoncontrols.com/content/dam/WWW/jci/be/global_workplace_solutions/global_workplace_innovation/SW2040/SW2040infographic.pdf)

In its most stark form IKDD is likely to create momentum for change that is mostly unseen until the impact is emerging. Such impact will present both government and society with questions and choices they may be ill prepared or unable to grapple with. Many interviewees commented on this aspect, believing education, training and awareness by citizens and businesses will be key to the population's ability to become early adopters of new technology rather than becoming disrupted by it.

IKDD will affect all people, facilities, things and systems digitally connected. Obvious adverse disruptions include a partial or complete power outage, events that cause loss of trust in data, and targeted cyber-attack. Some disruptions may have both a positive and negative impact e.g. the emergence of Uber, which on one hand has provided a cheaper more personalised transport service and on the other hand crippled the incumbent taxi industry.

For the purpose of EDTAS, IKDD is defined as the change that occurs when new digital technologies and operating models affect the viability of current ways of operating or delivering goods and services.

## Technology 2040

Industry continues to create faster and smarter computing systems and it is anticipated computers will in time move past circuits and begin dealing with more complex wireless communications such as cloud and quantum computing.<sup>4</sup> If the rapid change that is currently seen continues, more forms of IKDD are inevitable. At one end of a future spectrum this scenario presents immense advancement of civilisation, and at the other end, the settings for a potential Digital Pearl Harbour.<sup>5</sup>

## Artificial Intelligence (AI) and Machine Learning

Research and development of AI seeks to enable computer systems to perform tasks normally requiring human intelligence. Accordingly, AI is a critical component of autonomous systems, a priority research and development area for Defence.

Machine learning is a subfield of AI that focuses on developing algorithms that can learn and make predictions from data. Although machine learning is not new, the combination of big data with decreasing costs and increasing availability of computer storage and processing power have led to a renewed interest in this field.

AI is thought to be potentially obtainable within the next 20-30 years and is expected to be capable of rapid calculated decisions based on information that the AI will be able to monitor.<sup>6</sup> Stakeholders noted the introduction of AI has the potential to reshape the job market by reducing training needed for tasks that previously required substantial periods of training and years of experience to successfully complete. Stakeholders pointed to the race by commercial entities such as Google, Twitter, Intel and Apple to acquire AI start-ups as a strong indicator of its importance. It was further noted that increasing use of robotics with AI will benefit most industries and in turn create opportunities for Defence. The integration of AI into Defence capability has the potential to revolutionise all types of unmanned systems and increase force protection options by further removing humans from dangerous tasks.

What capability will AI provide to society?

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<sup>4</sup> <http://www.nature.com/news/quantum-computers-ready-to-leap-out-of-the-lab-in-2017-1.21239>

<sup>5</sup> <https://www.wsj.com/articles/adm-michael-rogers-on-the-prospect-of-a-digital-pearl-harbor-1445911336> - Digital Pearl Harbor refers to the sudden attack on critical infrastructure without a prepared force able to adapt to the sudden change.

<sup>6</sup> TOMIYAMA, TETSUO. 2007. Intelligent computer-aided design systems: Past 20 years and future 20 years. *Ai Edam* 21 (1): 27-9.

## Human Machine Interface (HMI) and Augmented/Virtual Reality

Human machine interfaces have historically been implemented in industries where human intervention with a machine or automated device is necessary. This could be in a machine, plant, building, or vehicle. The level of integration and sophistication may vary, but HMI can potentially be added to almost any application type. Stakeholders considered HMI as an essential path forward to increase the effectiveness and impact of Defence capability and as a means to update a range of legacy platforms. Advances in haptics, the science of applying touch (tactile) sensation and control to interaction with computer applications, opens new possibilities in the way we interact with computers and other machines.

Closely aligned with HMI will be the increased application of both virtual reality, to fully immerse users in an artificial environment, where they no longer perceive or interact with the real-world, or augmented reality, where the real-world is replaced by a simulated one. Stakeholders pointed to the F35 as an example of what is possible with the combination of HMI and augmented reality. The features include microphones for voice commands, a night vision system, and an advanced head-up display (HUD) that displays flight information and enables the pilot to see real-time in every direction via feeds from six infrared cameras mounted on the aircraft.

## Open Intellectual Property

Stakeholders identified that leading edge commercial entities are pursuing, and placing commercial pressure on vendors to provide, open innovation strategies. Typically these companies share some common traits, including:

- They are willing and wish to source and use external knowledge, ideas, intellectual assets, and technologies to complement their internal capabilities.
- They understand that such complements allow them to capitalise on opportunities, especially with the right IP structure and strategy in place.
- They wish to create new products and services.
- They improve their processes.
- They design new organisational systems and business models.

Facebook is a prime example. One of the innovative aspects of its model was Mark Zuckerberg's early insistence that Facebook had to be a platform with open application programming interface (API) in order to reach its potential.

What challenges and opportunities might advances in HMI present to society?

How do government, business and the community avoid a 'digital pearl harbour'?

## Internet of Things (IoT)

The Internet of Things (IoT) is a substantial extension of the current internet to a wide range of connected or smart physical devices that will be able to sense and interact with the environment, collect and exchange data, and cooperate with each other. The resulting distributed network will generate and facilitate the collection of big data, and may employ machine learning and other artificial intelligence methods to optimise and automate decision making.

Many stakeholders identified the expectation that the IoT will become widely available for government, industry and private use. Sharing of government, industry and personal data between applications will be common place, and society will be adept at being "in the internet" rather than "on the internet". The IoT in an advanced form will provide a level of connectivity and functionality that will enable access to and sharing of services and information in an unprecedented way. The IoT will progressively continue to personalise each user's experience with tailoring occurring without user prompting. Due to the low cost low powered nature of IoT hardware, security of systems is currently a fundamental flaw that will need to be resolved in a trusted way before widespread use in critical applications. Additionally, with increased personalisation and connectivity comes increased risk from cyber intrusive threats which in a relative sense are expected to remain as problematic as present day.

There was a widely-held view among stakeholders that government policy will at best struggle to keep abreast of this rapidly changing environment.

What are the key enabling technologies and infrastructure required to maximise the benefits of the IoT for society?

## Quantum Computing

Research in the field of quantum computing seeks to develop computer technology based on the principles of quantum theory, which explains the nature and behaviour of energy and matter on the quantum (atomic and subatomic) level.

A quantum computer works fundamentally differently to a traditional Von-Neuman based computer. A quantum computer functions in a much more complex method capitalising on quantum physics laws in order to perform calculations. Quantum computing is highly efficient for particular algorithms including data search, materials design and machine learning.

How Defence would use such a capability will emerge but is likely to be centred on the rapid processing and exploitation of big data.

## Data

### Security

Data continues to become an increasingly valuable and sought after commodity. As the digital environment develops, providing enhanced connectivity and the ability to both collect and mine increasing amounts of personal and commercial information will increase exponentially. Cyber subject matter experts interviewed anticipate the development of increasingly effective cyber intrusion and disruption methods that will leverage off increased digitisation and data connectivity to enhance impact. The scale of information theft and frequency of attacks has continued to increase. As an example of both scale and duration, most recently Yahoo users became aware that some 32 million Yahoo accounts had been compromised.<sup>7</sup> Of interest was the publication of lists of domain names which included various government employees who had auto forwarded individual government email accounts to a personal Yahoo account. While such actions were likely intended to aid easy access to emails, it highlights a very low level of cyber awareness among the community. Such actions serve to increase damage from cyber intrusion and highlight the need for enhanced cyber awareness. The pervasiveness in present times of cyber related information theft, disruption and attacks must give rise to greater effort to protect future systems through both technical and human factors methods.

In recent times there have been a number of high profile and publically reported events relating to interference with services such as critical utilities, government services and elections attributed to cyber-attack. Where such capability can be used to disrupt national services it is also expected those capabilities can be employed against digitised military forces.

### Integrity and Trust

As society benefits from increasing levels of connectivity and living in a digitised environment, citizens, governments and commercial entities will become ever more reliant on personal devices to access information and services to assist with routine and complex daily tasks. As the digitised environment offers more and more to users, those users will become increasingly dependent on it. Without that access, basic functions will be difficult or impossible to perform.

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<sup>7</sup> <https://www.cnet.com/news/yahoo-says-forged-cookie-attack-accessed-about-32m-accounts/>

Growing reliance on access to the digitised environment implicitly requires increasing levels of trust in the systems that process our information and the repositories that store that information. Stakeholders engaged identified that societies' expectation is that information retrieved from those sources is provided instantaneously, is up to date and, most importantly, is correct. This expectation will increase over time. It was noted that while buyers may abandon software products and devices that perform poorly or which are reported to be "dangerous" (easily exploitable), there remains an underlying trust in the internet as a "system". The basis of this trust is unknown and it could be argued it is more borne out of reliance on digital services than any reasoned understanding of trust.

Regardless of the reasons for user trust, there is an expectation that trust will be honoured. Stakeholders pointed to the speed with which users gain trust in new technology applications but noted the implications of that trust not being delivered on reliably. They pointed to circumstances where unavailability of services caused either by system related failure or cyber-attack could erode users trust in system integrity. Further, a scenario in which data or data output was deliberately interfered with by nation states or organised crime groups to produce incorrect or misleading results would seriously undermine confidence in the digitised environment and cause major disruption to everyday life.

## Big Data

Big data refers to exceptionally large data sets comprising structured and unstructured data that are unable to be processed to the fullest potential with existing technologies. Novel architectures, technologies and analytical methods may uncover further hidden patterns, correlations, and insights that will lead to increasingly informed decision making for governments, businesses, academia and individuals. It is expected the work of law enforcement and national security agencies will be further enhanced through big data exploitation.

Having access to big data and the ability to understand what the data is showing are very different capabilities. Australian governments have access to big data but not the means to understand the data across different departments or the tools to leverage that data to enable the planning and provision of services across the three levels of government. Further, there are key policy choices to be made and enacted through enabling legislation to make best use of available data as new tools become available. Such choices must be balanced against privacy and the rights of individuals and are likely to be widely contested.

Social media has changed how the world interacts and provides a good example of the scale of change IKDD can initiate. From changes in human interaction caused by the prevalence of online social media platforms, comes the opportunity for those platforms to capture vast amounts of data. Stakeholders pointed to Google, Facebook, Uber and Airbnb as examples of companies who collect and store data on an unprecedented scale. The commercial application of big data based on user habits and preferences at such scale is significant. However, a more significant aspect of data holdings on this scale is that they provide the data needed to undertake research and development into techniques to further exploit this data. Stakeholders noted that academia and governments do not have access to equivalent quantities of data needed to support enabling research in this field.

How can digital disruption be used to improve data security?

How will digital providers gain and retain the trust of users in an environment of data theft and intrusion?

## Enablers

### Infrastructure

Infrastructure built in 2040 is expected to be significantly different than that of today in a digital sense. However, stakeholders noted that cities will carry substantial amounts of legacy infrastructure through to 2040 and beyond. Stakeholders reinforced the need to plan and act in the near term to maximise the benefits possible by 2040.

In a planning sense, federal and state governments need to establish and regularly refresh the strategy that guides public and private investment in digitally smart infrastructure. But stakeholders identified that realising digital potential cannot wait for new infrastructure. More than one stakeholder referred to combining "smart sensors with



dumb infrastructure” to start this journey, coupled with the need to leverage existing public and private sensor suites already deployed.

Commencing this journey now will aid in the design of future digitally enabled infrastructure and assist in reducing the impact of legacy infrastructure into the future.

How do federal and state governments best guide public and private investment in digitally smart infrastructure?

## Innovation in Procurement

Defence procurement processes were widely seen as both an inhibitor of innovation and unresponsive to advances in technology. There was an accompanying view that this is likely to get worse as technology continues to evolve more rapidly, with the result being an ever widening gap. There were few solutions offered to resolve this potential dilemma but many anecdotal examples were offered as evidence to support views.

It was observed that Defence is aware of most of the major land, sea and air platforms that will be in service in 2040, so future decisions will generally not be about major platforms. Rather, key to capability success in the future are sustainment programs that provide an enhanced ability for ongoing modernisation of those platforms through upgrades and enhancements from new technology. IKDD will require procurement procedures to be revisited to allow for more frequent and rapid capability upgrades.

How do government and industry procurement processes adapt to the pace of technology change so that competitive advantage is not lost?

## Government Policy

The majority of stakeholders raised serious concerns as to governments’ ability to create effective policy ahead of the emergence of new technologies. Some commented that despite current government in house innovation efforts, technological innovation is the antithesis of policy development, and there is an absence of forward thinking policy that will foster technology innovation and uptake. Others stated that government policy making is already disrupted by innovation, and the situation looks only to get worse.

Most stakeholders who discussed future policy development were unsure as to how this situation might be corrected. Some suggested citizens wanted a bigger role in the shaping of policy in the future and if not satisfied may seek to do this through consumer action. Others suggested policy frameworks move to providing guiding principles rather than detailed policy. This approach may provide a framework for commercial entities to operate within while enabling innovation.

How do governments generate policy that will foster technology development and uptake in Australia?

## Social

### Citizen Centred

There is an increasing expectation from citizens in developed countries that governments become more responsive to their thoughts and expectations. Stakeholders identified that citizens want access to effective mechanisms that allow citizen centred design of both policy and services, both of which are becoming increasingly accessible from commercial entities. An interesting recent phenomena pointed to by stakeholders has been the power of consumer action to adjust the behaviour of commercial entities.

There have been recent examples of this in Australia, with companies making very public stands on matters that would normally be expected to be led by government. The future digital environment and the enablement of increased online social networking are likely to both facilitate and increase this expectation. How will governments respond to the concept of user centred design and how will Defence respond to social priorities that may compete for funding earmarked for Defence capability?

How do governments effectively engage citizens and how will that be impacted in a digitised environment?

## Digital Adaptation

Stakeholders were quick to point out that companies and organisations that have a strong digital presence will almost always have a stronger support base than offline counterparts. Companies such as Virgin, Qantas, Domain and Dominos have been able to energise their digital transition while their competitors have been slow or unable to see the benefit of the online world. Dominos has been able to overtake Pizza Hut through digital adaptation and trialling new technology that increases the experience value of a transaction.<sup>8</sup> There is an underlying commercial imperative that drives businesses that does not exist in government or government agencies.

Notwithstanding game changing business innovations such as Uber and Airbnb, stakeholders suggested that most business innovation is incremental rather than transformative. And that internally driven incremental change ensures that when a game changing innovation is realised, the new gap to be breached is of less magnitude. Some stakeholders suggested this approach should be mantra within Defence capability projects.

There was an almost unanimous view that citizens and governments are not well positioned to adapt quickly to technological change. There was an equally strong view that an increased appetite for digital adaption could be created through education and development of different ways of thinking about the future.

How does Australia foster a society more capable of rapid uptake of new technology?

## Education

Between 2003-2010 IT degrees fell by 52%, and 70% of students enrolled in IT degrees withdrew from the degree.<sup>9</sup> Formal education provided in university is decreasing and understanding of emerging technology and its potential to create disruption is also decreasing. In terms of innovation, in 2016 Australia fell from 17<sup>th</sup> to 19<sup>th</sup> on the global innovation index.<sup>10</sup>

There was a very strong view from stakeholders across academia, government agencies, industry and Defence regarding the need to improve the education base of Australians broadly and more specifically to develop an enhanced understanding of the impact of technological developments among policy makers and Defence staff. For Defence staff this should include both formal and informal qualifications, with technological elements becoming standard on Defence courses.

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<sup>8</sup> Bauer, Christine, and Peter Lasinger. 2014. Adaptation strategies to increase advertisement effectiveness in digital media. *Management Review Quarterly* 64 (2): 101-24.

<sup>9</sup> <https://www.itnews.com.au/news/why-are-aussie-students-dropping-out-of-it-courses-372101>

<sup>10</sup> <http://www.afr.com/technology/australia-drops-in-global-innovation-index-20160815-gqsiou>

How can Australia develop a suitably skilled digital workforce to take maximum advantage of technological advancement?

## Global Corporations

Global corporations have a commercial imperative to be client focused. Citizens as clients are increasingly basing purchasing decisions on the policies and behaviours of global corporations offering goods and services. As discussed earlier in this Insight Paper, there are recent examples in Australia of companies or groups of companies making very public stands on matters that would normally be expected to be led by government. Equally, global corporations may increasingly seek to operate across nation borders to maximise revenue, in an effort to reduce the impacts of so-called “google-tax”. Some stakeholders suggested that in the absence of relevant policy or law, this is the beginning of a period in which consumer behaviour will drive the landscape of what is acceptable change and what is not, as they will either embrace or reject opportunities provided through innovative technology.

The potential impacts on nation states are wide-ranging. Nations may choose to establish boundaries to protect the national interest and its citizens from certain risks and threat such as radicalisation, but equally to safeguard critical national revenue streams. Should this consumer effect continue or increase, what moral or ethical obligations do global corporations have and what nation’s policy or law do they consider to make those judgements? These questions reflect the rise of a digital global commons which crosses borders and has a membership with potentially divergent ethical norms. While there are many potential benefits in a digital global commons, it provides new avenues for unethical and criminal behaviour. How do nation states protect citizens in such an environment?

## Conclusion

In preparing this Insights Paper some 36 interviews were conducted drawing on representatives from academia, government, industry and Defence in Australia and the United States and were engaged to identify a range of factors that would influence IKDD in the next 15-30 years. Their input has resulted in the findings of this paper with the intention of informing discussion at EDTAS1. The Insights Paper is not intended to be a final product or a standalone publication.

Stakeholders’ support that information and technology innovation will continue to gain momentum and that the way we will live in 2040 may be significantly different from today. A range of opportunities and challenges have been identified that will be further examined at EDTAS1 with the aim of identifying key themes for future research, industry focus and joint experimentation to inform Defence capability out to 2040.