TELSTRA CORPORATION LIMITED

Submission on the National Digital Economy Strategy

30 November 2017

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INTRODUCTION

This submission is a response to the Australian Government's consultation paper *The digital economy: opening up the conversation.*[1] Consistent with the spirit of this paper, we present Telstra's view of the essential building blocks of the digital economy, the role for digital infrastructure providers such as Telstra, and the role government can play in bringing about the conditions for success in the digital age. Our submission is structured to broadly match the structure of the consultation paper.

In section 1 **The Digital Economy**, we set out what it means for Telstra to become a world class technology company that empowers people connect. Meeting this ambition first requires a focus on our core strength of delivering the connectivity that underpins almost all digital activity, and then curating digital experiences for our customers through the applications and services delivered over the top of our networks. We go on to list the most important consumer and enterprise digital technology trends.

In section 2 **Digital Infrastructure**, we explain in more detail how Telstra is constantly expanding its mobile network coverage and updating its mobile technology to facilitate new use cases, most notably the Internet of Things. We explain how digitisation will contribute to environmentally sustainable economic growth, call out the rapidly increasing focus on connected vehicles and cloud computing, and highlight the important new frontiers of big data, blockchain and artificial intelligence technology.

In section 3 **Standards and regulation**, we draw on work done by economists and policy makers in setting out the basic principles of best practice regulation, which is fundamental to realising the potential gains from digitisation by ensuring continued investment in infrastructure and facilitating innovation. We call out the importance of Australia participating in international standard making to ensure that as much as possible, we can make use of international standards to drive down the costs of products and services that are fit for the Australian market.

In section 4 **Trust, confidence and security**, we explain why data security is so important in a digital world, and that sound technical defences are critical but not sufficient when there is still a central human element in the way we interact digitally. Education is key, and government can help to embed a national culture of safe practices online. Telstra is contributing technically through the provision of cyber safe products for our customers and the establishment of world class security operations centres.

In section 5 **Building on our areas of competitive strength**, we highlight the importance of completing the NBN rollout efficiently, set out research on the digital-ready attributes cities need to compete globally, and explain the many initiatives Telstra is undertaking to help our company and our customers embrace digital transformation and new growth industries. We also call for frameworks that facilitate unimpeded cross border data transfer and storage, and note the important role for government in achieving that.

In section 6 **Empowering all Australians through digital skills and inclusion**, we focus on the importance of digital capability and STEM skills to the future workforce, and argue that we must not leave behind the three million Australians who are currently not online. Finally we set out the various ways in which Telstra is helping to ensure the positive social and cultural impact of digital technology, including through our ethical commitments and social investment principles.

Throughout this submission we suggest ways in which government can facilitate the development of our digital economy. In aggregate we see two broad roles for government: first, in targeting resources to help educate citizens about the benefits and risks of social and commercial online transactions; and second, by putting in place regulatory frameworks that enable rather than hinder the development and use of digital technology and facilitate sustainable growth of the digital economy.

[1] https://www.industry.gov.au/innovation/Digital-Economy/Documents/Digital-Economy-Strategy-Consultation-Paper.pdf

EXECUTIVE SUMMARY

This submission is a response to the Australian Government's consultation paper *The digital economy: opening up the conversation.*[2] It is structured to broadly match the structure of the consultation paper.

The digital economy

Telstra as a world class technology company that empowers people to connect

Telstra's vision is to become a world class technology company that empowers people to connect. In practice that means being obsessed with customer experience, continuously evolving our core strengths and differentiators, emphasising an agile and enabling culture, fully embracing the digital experience, and helping customers to find better ways to connect with technology. Driving this is the fact that virtually every technology innovation today is enabled by connectivity.

Key disruptive technologies

At Telstra we expect the key consumer technology trends in the coming year to be:

- Voice assistants such as Google Home and Apple's Siri
- eSports in which masses of spectators watch people playing digital games in stadia
- Augmented reality-enabled apps that deepen our digital engagement with the physical world
- Autonomous vehicles, more competition in ride sharing and the rise of e-bikes
- Programmable toys to help teach children the basics of coding.

We expect the key enterprise technology trends for the coming year to be:

- Cyber security solutions centred in the cloud rather than the device
- Real-time analytics to improve physical decision-making
- Containers and micro services, which render operating software more efficient
- Digital team collaboration software to complement email communications
- Digital twins, in which an operator uses a physical machine's digital twin as an interface.

Digital infrastructure

Networks for the future

Telstra has expanded its 4G mobile coverage to reach 99 per cent of the Australian population. Telstra's 3G and 4G coverage combined now reaches 99.4 per cent of the Australian population (up from 99.3 per cent) and covers 2.4 million square kilometres of the Australian landmass, including hundreds of thousands of square kilometres of regional and rural Australia not served by any other carrier. Telstra has also activated its Internet of Things (IoT) Cat M1 capability, enabling a Cat M1 footprint of around three million square kilometres – easily the largest in Australia and one of the largest in the world. In the future, 5G mobile technology will offer superfast speeds, ultra low latency, and support for IoT on a huge scale.

Contribution of digitisation to sustainable growth

[2] https://www.industry.gov.au/innovation/Digital-Economy/Documents/Digital-Economy-Strategy-Consultation-Paper.pdf

The digital transformation of the Australian and global economies opens up significant opportunities to achieve low-carbon economic growth. As more people become more connected, we are witnessing technology as a powerful enabler of low-carbon growth. It is helping reduce travel, energy consumption and greenhouse gas emissions. For businesses, it is creating new revenue opportunities, reducing operating costs and creating market differentiation.

Telstra's latest research (the SMARTer2030 report) details how Australia can use information and communications technology (ICT) to address a range of sustainability issues, particularly improving energy efficiency and transitioning to low-carbon economic growth.[3] The report finds that ICT has the potential to reduce carbon emissions in Australia by 188 million tonnes a year in 2030. This is a significant emissions reduction and accordingly, there is a strong case for increased use of ICT to help deliver Australia's Intended Nationally Determined Contributions (INDC) commitment.

Growth of connected and autonomous vehicles

Connected and Autonomous Vehicles (CAVs) offer the potential for many social and economic benefits for Australia including better safety, productivity and mobility. An improvement in safety for all road users will deliver the greatest social and economic impact through the reduction in the number of injuries and deaths (and the burden this places on families and the community), as well as a reduction in the $27 billion annual economic cost of road trauma and associated productivity loss.[4]

Properly introduced, CAVs may also bring new transport options to those unable to drive, making new levels of social equity possible, as well as allowing for mass-customisation of public transport to individual users' needs. A reduction in road congestion, along with increased efficiency and productivity will arise from increased ridesharing, reduction in car ownership, and better utilisation of the time that is currently required for driving. These will deliver gains to the Australian economy as well as environmental benefits.

Cloud computing

Cloud computing offers the agility needed to transform businesses, deliver better customer experiences, experiment with new offerings and operational models, and take value to market quicker, all with less risk. Public cloud platforms will also help propel business performance through the next wave of innovation such as big data, IoT and Artificial Intelligence (AI). At Telstra, our vision for cloud computing encompasses secure, low latency networking with an on-demand model and simplified data management, enabling governance and compliance at speed, without inhibiting agility.

Opportunities for development

Big data: Telstra helps enterprise customers harness data for big business opportunities with a cloud-based service that brings together world leading analytic software, infrastructure, enterprise security and service management in a ready-to-deploy solution. Effective access to, and use of Big Data presents a significant commercial advantage, with insights that can be used extensively to inform supply chain optimisation, customer churn analysis, fraud risk management and resource planning.

Blockchain: By making it easier to securely share data between institutions and individuals, blockchain has the potential to improve the efficiency of government operations and delivery of public services. In a

[3] Telstra & Fujitsu, 2016, *The Australian opportunity for ICT enabled emission reductions*, a report extending research from the Global e-Sustainability Initiative (GeSI), SMARTer2030 ICT Solutions for 21st Century Challenges - http://smarter2030.gesi.org/

[4] http://advi.org.au/2016/09/30/position-paper-economics-impacts-of-automated-vehicles-on-jobs-and-investment/

recent survey of 200 government leaders in 16 countries, around 90 per cent indicated a plan to invest in blockchain technology by 2018.[5] We believe the strongest near to medium term benefits from government utilisation of blockchain are within regulatory compliance, digital identity, asset registration and data security.

Artificial Intelligence (AI): AI systems that deploy Machine learning (ML) algorithms against huge data sets have been evolving rapidly. AI is now applied commercially in tasks such as automated assistance in natural-language speech enquires and identifying objects in images and videos. Telstra has already begun executing against AI/ML opportunities including customer experience initiatives and network analysis. Developing, building, and operating AI solutions will require additional skills and new talents in our workforce.

Standards and regulation

Best practice regulation

The ICT sector delivers services and technologies that are fundamental to the digital transformation underway in Australia and globally. The telecommunications sector's role as a key enabler of that transformation should be reflected in the design of the regulatory regime governing telecommunications infrastructure. A regime that provides incentives for investment in long-lived infrastructure and advanced services, as well as encouraging robust competition, will ensure Australia's ICT sector remains among the world's most advanced and continues to drive transformation of the economy.

The significance of telecommunications infrastructure and services as drivers of opportunity and change elsewhere in the economy should be taken into account by regulation. A best practice regulatory regime for telecommunications is one that generates predictable outcomes for all parties and successfully encourages both sustainable innovation and strong investment in infrastructure. There are high economic costs associated with regulations that are opaque, obsolete or overly intrusive; that provide for wide discretion for intervention; that fail to provide an equivalent balance of accountability; or that deter market-driven investment.

International standards framework

In the field of telecommunications, international standards provide a sound basis for the development and harmonisation of products and services. Wherever possible, Australia should leverage and align with these standards. Relative to comparable international counterparts, Australia is a small market by population size. This means that bespoke standards will come at significant incremental unit cost for devices, products and services, making Australia less competitive on the global stage.This is especially important in telecommunications areas such as radio spectrum for mobile, satellite and fixed-wireless services, international connectivity/interworking and cyber security, where bespoke standards could easily result in the need to customise devices, platforms or solutions for the Australian market.

Trust, confidence and security

The importance of data security

As digitisation has grown in scale and scope, the level of cyber risk around digital activities has increased, as has the incidence of cyber crime. Cyber security is a complex area and a matter Telstra places a high priority on, with a team dedicated to protecting our network and the data we hold. In practice cyber security can affect data security, meaning systems need to be implemented in a way which is consistent with the *Privacy Act 1988* and adheres to the Australian Privacy Principles.

[5] IBM, *Building trust in government: exploring the potential of blockchains*, January 2017, p 1-2. file:///C:/Users/d304417/Downloads/global-business-services-global-business-services-gb-executive-brief-gbe03801usen-20170926.pdf

Education is key to successful cyber security. In relation to privacy and security of data, there may be a role for government to develop further education campaigns targeted at both industry and consumers to raise the awareness each party plays in the role of cyber security. We have also noted our support for the mandatory data breach reporting obligations being introduced in Australia, and we see this measure as important in helping to build consumer confidence and trust in the holders of their data.

Supporting and progressing cyber security

The Federal Government has set the agenda with its cyber security strategy which we fully support. Telstra is collaborating with government, regulators, businesses, the community and our people to find solutions that help build resilience through readiness. From solutions to education, it is about knowing how to prepare and working together. Whether they are our employees, families, small businesses or enterprises, we have a responsibility to serve and protect our customers from cyber crime online.

Telstra has invested heavily in our cyber security capabilities. We have a team of more than 500 cyber security experts dedicated to protecting the data we hold and our network, and we have built a globally deployable managed security services platform and two security operation centres (SOCs). Telstra is also committed to cyber security for international customers and will be launching additional SOCs in the UK and Asia from 2018.

Being prepared means understanding that people play a critical part in cyber security. It is a person who clicks on a link, chooses a simplified password, and selects where their data is stored. The 'human firewall' is a powerful defence and must not be forgotten. To help educate our employees on being vigilant online at home and at work, we have implemented an active program to engage our employees with this topic and ensure they understand the role they play in protecting our data and networks.

Protection of consumer and business data

Telstra helps our customers address cyber security risks by providing core security products including Telstra Broadband Protect™, which blocks visits to more than 3.7 million websites hosting known malicious content, scams or viruses each month. It also includes parental controls, device protection, safe browsing and social network protection. In addition, Telstra Mobile Protect helps our customers tailor how their children access their mobile phone or tablet service to their needs and maturity.

Telstra offers Small and Medium Business (SMB) customers a range of flexible and affordable security products including: cloud security applications with data protection and automatic security software updates; virus protection with endpoint applications and around the clock technical support; and Telstra Business Protect which is a reliable tamper resistant security alarm monitoring service, built on the reach and security of Telstra's mobile network and the expertise of Telstra SNP Monitoring (TSM).

Building on our areas of competitive strength

Enabling and supporting NBN migration

For many businesses, transitioning to the nbn will require a refresh of the underlying technology and equipment used to support existing business applications. In addition to the added features and capabilities of replacement solutions, businesses may also benefit from cost efficiencies that the new solutions bring.

nbn co's development of replacement solutions for many of the Special Services used by businesses in Australia for connectivity, in addition to Telstra product exits, has triggered disconnection obligations which commence in November 2018. Special Service customers must therefore start thinking now about migrating these services to alternative solutions (including nbn) or they will be disconnected in accordance with Telstra's Migration Plan obligations and potentially left without a service.

Telstra (and other RSPs) are currently investing significant effort in encouraging customers to consider their options and plan to migrate early. This would be aided by a high profile government information campaign highlighting the need to migrate. Importantly, migration of business customers takes time in order to minimise the chances of outages along the way, so the earlier a campaign can be launched, the more effective it will be in maximising the number of successful migrations.

Facilitating startup development

A 2017 Telstra-commissioned Economist Intelligence Unit (EIU) global research report ranked 45 cities across five categories relevant to business performance. The report showed that many cities need to do more to deliver the key components to help businesses thrive in a connected world if they are to remain competitive and retain the startups that will help drive a flourishing digital economy. These key components are, in summary:

- A digitally literate workforce
- Adequate ICT infrastructure
- Access to open government data
- New sources of finance
- A vibrant technology ecosystem
- Active government consultation

Telstra's efforts in responding to digital transformation and new growth industries

Underpinning our growth ambitions is a clear strategy to identify, incubate and carefully acquire new capabilities we need for long-term success in a dynamic sector. Telstra is focused on ensuring we are ideally placed to leverage the next generation of technologies that are transforming the economy, including through the following initiatives:

- Investments in quantum computing
- Internal digitisation initiatives
- Development of telehealth services
- Technology solutions for growth industries
- Establishment of Telstra Labs for technology innovation
- Establishment of muru-D (Telstra's startup accelerator)

In addition, as at the end of FY17 Telstra has invested more than $300 million in 45 technology startups through Telstra Ventures since its inception.

Enabling Australian industry to participate in the global digital economy

Telstra supports open cross-border data transfer and storage. Australians should be free to make use of offshore providers where it is technically and commercially advantageous. Likewise, international customers should be free to store information in data centres regardless of the jurisdiction of the data centre location. So long as providers take responsibility for protecting their customers' data and comply with Australian privacy law, this approach will ensure a vibrant and competitive environment for customers in the supply of connectivity and e-commerce solutions.

For many Australian small producers, exporting into foreign markets can be risky and complex. Small producers also face issues in getting an end-to-end view of their operations due to a wide choice of order management, sales and inventory systems with limited integration and data sharing. Telstra is trialling an end-to-end digital solution to solve these challenges by facilitating access to the Chinese market, digitising and integrating their sales, order, and supply chain and reducing their logistics costs.

The importance of technologies for small business

Technology, particularly connected technology, is at the heart of business transformation. It is fundamentally changing the way businesses operate and opening up a growing range of opportunities. IoT is only one example of the growing application of technology in business. More broadly, business is making use of software and applications, cloud technology, high speed networks and unified communications.

Among the key benefits of these developments for small business has been the improvement in affordability of technology solutions. The long-held advantage of size and resources of large companies is now being supplanted by the advantage of nimble smaller companies that can now use inexpensive technologies to get to market and rapidly scale.

Helping small business embrace digital technologies

Telstra is helping small businesses to mobilise their workforce and be more productive through a suite of solutions such as lease plans for smartphones and tablets, providing cloud-based software such as Microsoft Office 365, as well as cloud storage options and a suite of curated business apps that we make available online through the Telstra Apps Marketplace.

We are helping businesses find new customers and reach new markets by getting online with Telstra Online Essentials, selling online with our e-commerce solution Neto and offering connectivity to their customers through our Wi-Fi network Telstra Air, which we will launch to SMBs in Q4 FY18. We are helping them secure their business operations and data through network security, mobile device management and cloud backup for leased devices.

Enabling SMBs to participate in the digital economy

Telstra analysis demonstrates that SMBs are becoming increasingly reliant on communications networks. For example:

- Traffic on Telstra's mobile network is set to increase five-fold by 2020
- The average person is predicted to have 19 connected devices
- The number of connected devices and streaming is forecast to double by 2020
- Reliance on cloud-focussed functionality will increase to allow this wealth of information to be continually uploaded and accessed by every linked gadget

Telstra offers a wealth of business technology solutions for digitally-focussed SMBs:

- Telstra Online Essentials including an entry-level website, domain name and directory listing
- Neto, an all-in-one omni-channel e-commerce platform
- Telstra apps marketplace offering some of the best cloud applications via a single portal
- Microsoft Office 365 providing access to office software and files while on the move
- BlueJeans, a simple videoconferencing application
- Box, which helps increase productivity by keeping content in one place online
- DocuSign to enable businesses to review, amend, sign and share important documents
- Deputy, a job rostering and workforce management solution
- Squirrel Street expense management system for recepts, invoices, and business contacts.
- Proquo, a joint initiative with NAB to support professional services connections

Empowering all Australians through digital skills and inclusion

Equipping Australians for the jobs of today and tomorrow

Telstra recognises the importance of helping future generations of digital innovators and problem solvers to build their digital capability. We believe young people now need more than just an understanding of how to use tech, create with tech and do it safely. Through the Telstra Foundation, Telstra supports and

invests in 21st century digital learning experiences in schools, public libraries and remote Indigenous and regional communities. Our program, *Telstra Digital Futures*, focuses on young people in low digital inclusion locations.

Bridging the 'digital divide'

The benefits of the digital economy cannot be shared equally when some groups and individuals are still facing real barriers to online participation. In recent years the digital divide has narrowed, but it has also deepened. The latest ABS data (2016) shows around three million Australians are not online. These Australians are at risk of missing out on the advantages and assistance digital technology can offer.

The Australian Digital Inclusion Index (ADII) provides a comprehensive picture of Australia's online participation to date.[6] It measures three vital dimensions of digital inclusion: Access, Affordability, and Digital Ability, showing how these dimensions change over time, according to people's social and economic circumstances, as well as across geographic locations. The most digitally excluded groups in 2017 were people in low income households, people aged 65+, people with a disability, people who did not complete secondary school, Indigenous Australians and people not in paid employment.

Collaboration and co-investment between government and business can be a cost-effective way of achieving scale in program delivery. Telstra's *Tech Savvy Seniors* program helps build the digital literacy of tens of thousands of older Australians, and we have also made significant co-investments with the Northern Territory Government to build out network connectivity to remote areas along with associated investments in digital literacy, cyber safety and telehealth.

Ensuring the positive social and cultural impact of digital technology

Technology has changed every aspect of our lives – how we work, learn, shop and connect with each other. At a time when climate change is accelerating, social inequity increasing, our ageing population is growing and there is persistent unemployment, there is an urgent opportunity to realise the potential of digital technologies to drive and scale solutions to tackle these challenges. That is why Telstra invests in a wide range of non-profit organisations to explore, build and scale technology solutions to improve the health and wellbeing of the community.

How we do business is important to us. We are committed to acting responsibly and being transparent and accountable, wherever we operate. A growing challenge is that the expectations – social, economic and environmental – that our employees, customers, investors, regulators and the community place on us continue to change. Our innovation agenda, like all that we do, is guided by our responsible business commitments.

[6] https://digitalinclusionindex.org.au/

01 The Digital Economy

1.1. Telstra as a world class technology company

[Reference discussion paper Question 1]

The traditional worlds of telecommunications and computing are converging. Technology is taking us into a world of rapid change, constant innovation and competition. We are seeing technology innovation transform industries, transform businesses and transform the way we live our lives. Driving this is the fact that virtually every technology innovation has to be connected. We see a future, where everything will be connected to everything.

The ability to create, to innovate, and to stay focussed on our customers is a critical enabler – technology is a way to make their lives easier, and businesses better. Telstra is becoming a world class technology company by:

- Being obsessive about the customer experience;
- Focussing on the continuous evolution of our business customers' core strengths and differentiators;
- Fostering an agile and enabling culture;
- Fully embracing the digital experience; and
- Helping customers find better ways to connect with technology.

For Telstra, the journey to becoming a world class technology company that empowers people to connect is centred around effectively curating technology and experiences into Australia and our target markets. We do this by bringing into reach technologies that might otherwise have been hard to access. For example, our multicloud environment brings the best of the world's cloud computing to Australia, integrated with Telstra connectivity, in a way that would otherwise be harder for customers to attain.

The applications and services that are sitting on top of the network are transforming the experience for our customers and delivering better ways for our customers to thrive in a connected world. We are building skills in software, data architecture and data science to a similar depth as the more traditional network, engineering and electrical skills that are our hallmark.

We are becoming a more innovative company through our muru-D accelerator (see 6.1.6), the Telstra Ventures division (see 6.1.7) and Telstra Labs (see 6.1.5). All of these activities drive innovation that permeates the organisation.

1.2. Key disruptive technologies

[Reference discussion paper question 4]

Telstra has identified the following key technology trends for FY18 divided into Consumer and Enterprise trends.

1.2.1. 2018 Consumer technology trends

1.2.1.1. Voice assistance

We have had voice assistants on our phones for years now thanks to Siri and Google Voice Search. Now, with Google Home, we are seeing this moving into our living spaces in a convenient form via a smart speaker. It brings speech activation and automation to the control of lights, locks, security, music and videos on demand. It's likely we'll see Amazon Echo smart speaker and Alexa smart agent officially

launched in Australia fairly soon, accelerating the proliferation of this technology into further mainstream use. From here you'll be able to shop, order Ubers and more, by simple voice command. We are still waiting for Apple's smart speaker and no doubt Samsung will continue to build around its Bixby Voice Assistant (recently revamped on the Note 8) leveraging its appliance business and recent acquisition of audio specialist Harman. How all these ecosystems will work together is a challenge worth solving.

1.2.1.2. eSports

eSports are where masses of spectators watch digital game players in action. eSports has been around for years, but it is about to be launched into the mainstream due to increased interest from 'traditional' sporting groups, content providers and broadcasters. The rise of eSports may have been unimaginable only a few years ago, however, eSports events such as the KeSPA CUP tournaments in South Korea already fill arenas with spectators. It's conceivable that major Australian sporting and entertainment venues in Australia could host eSports events on their big screens in the not too distant future.

1.2.1.3. Augmented Reality-enabled apps

The next product to be made obsolete by mobile phones could be the tape measure. While Pokémon Go was the Augmented Reality (AR) phenomenon of the past year, Apple's ARKit in iOS 11 and Google's ARCore will pave the way for the next wave of AR applications. This wave promises to be not only more advanced for entertainment purposes, but also enable more useful features such as accurate distance and area measurements.

1.2.1.4. Transport

The first trials of autonomous vehicles (AVs) – a shuttle service in Perth – took place in 2016. Next year we will likely see many more trials in most states of Australia as operators explore where these new AVs fit in the transport system, how people react to them, and how they connect from an efficiency and safety point of view. (See also 3.3)

Rideshare users will likely get more choice as incumbent Uber and local rideshare GoCatch will see Lyft (a major player in the US) enter the Australian market. We might also see services like UberPool, which offer lower fares by sharing rides, roll out here, which is good for traffic and facilitates the monetary incentives of the 'share economy'. On-demand public transport may start to become apparent as well – think luxury minibuses booked via an app and shared among four or more people.

Finally, crowd-share bikes are likely to become more popular. We've seen Singapore's oBike hit Australian shores with the ability to share them for one way trips anywhere, enabled by connectivity and location information. The next wave is electric bikes, which require some pedal power, augmented by an e-boost. Expect to see them in greater numbers. Already in Europe and China, these small, relatively low-cost, and increasingly ubiquitous vehicles are making it easier than ever for a wider group to access active transport, improving general health and wellbeing, while also improving traffic flow and reducing carbon emissions.

1.2.1.5. Programmable toys

Schools have begun to incorporate software development, or coding, into their curriculums. Teaching students to code is considered a good way to prepare the next generation of Australians for the jobs of the future. This same ethos is reflected in the broader availability of science, technology, engineering and maths (STEM) syllabus.

Recently, educational devices have appeared that are fun to use but also have an element of coding, and such devices might be used by kids at home just as easily as kids at school. BBC has released a cheap device called the micro:bit that, for just $20, allows kids to do simple coding on a smartphone and wirelessly program the micro:bit, without a traditional computer ever being involved. At the more premium end of the toy market, Sphero offers a range of toys from rolling balls to Star Wars characters

that can also be programmed from a smartphone or tablet. Kids have fun and learn valuable skills at the same time.

1.2.2. 2018 Enterprise technology trends

1.2.2.1. Cyber security

Demand for appliance-based security services should continue to decline as software-based, hosted cyber security solutions emerge. With users connecting to internet-based applications via a variety of mobiles, tablets and laptops, we can no longer simply ring-fence corporate systems from potential attack. The need for behavioral analytics-based systems is pulling security into the realm of Big Data-based solutions. Interconnected supply chains and industry ecosystems will drive Blockchain maturity for trust and verification. Security management will follow a deep learning approach throughout the application stack to improve both quality and speed of detection and response. (See also 5.2)

1.2.2.2. Real time analytics

Enterprises are increasingly looking to visualise and make physical world decisions based on information across its entire digital footprint. Multi-channel customer interactions will drive the need to access historical data for real time decision making, while adoption of IoT will increase real-time data flows. A visual representation of this ecosystem (in a dashboard or in a Virtual Reality (VR) representation) throughout the enterprise will enable real time decisions, beyond the network and application performance and across the enterprise supply chain (i.e a warehouse ERP system upgrade window is moved or changed due to weather or emergency services information in a given geography not directly connected to the enterprise). Integrated views will come due to consolidation of data environments, which will include third party information integration.

1.2.2.3. Containers and microservices

Modern webscale businesses are moving to microservices for compelling reasons. Microservices are small, useful functions with a cloud API that can be combined into bigger services that might run something like Uber or Amazon. Software using this approach scales better, is easier to adapt to new business needs and allows developers to pick the best frameworks or tools for writing each microservice.

Interest in microservices has coincided with the arrival of containers as an alternative to virtual machines for running multiple instances of software on a single physical server. While virtual machines each run a full image of an operating system, containers (a standardised contained unit of software) are more efficient and share the operating system so many more containers run on the same server. This suits microservices well, as each service can run in its own container and there will be many more of them than traditional applications. Enterprises are seeing the benefits of microservices and containers, and are working through the challenges of migrating to this model and adapting affected licence arrangements.

1.2.2.4. Digital team collaboration

Email originated in the 1970s. It doesn't cope well with dynamically changing teams, attachments are hard to find later and, when an employee leaves a company, the knowledge stored in their inbox often vanishes. Alternatives to email have been created by eager startups and are now becoming entrenched in enterprises. Some of the major brands are including similar experiences into their own collaboration suites. For example, Cisco has introduced a similar product called Spark, and Microsoft has their own offering called Teams. All of these enable teams within an enterprise to send messages to other team members in ways that overcome issues with email, and are particularly suited to desk-based workers like software developers.

1.2.2.5. Digital twin

Most enterprises have embarked on a digitisation journey to remove manual processes, connect sensors to key pieces of equipment, collect real-time data about their systems, and automate as much as possible. Full automation is still a little way off, as many existing processes cannot be replaced with simple computer-based rules, and machine learning approaches to addressing automation are still at an early stage.

The challenge is then to provide people with the optimal interface for dealing with digitised parts of the company, and the 'digital twin' has emerged as a useful pattern for enterprises. In this approach, the real-time data is displayed as a virtual instance of a real machine or process – its 'digital twin' – and the human operator monitors or manipulates this instance in a familiar way. This lowers the training effort, allows the operator to be located remotely, and provides a rapid path to value.

02 Digital infrastructure

2.1. Networks for the future

[Reference discussion paper Question 5]

Telstra has expanded its 4G mobile coverage to reach 99 per cent of the Australian population, offering 1.4 million square kilometres of 4G coverage. This expansion provides even more of regional and rural Australia with access to our world leading 4G service.

Telstra's 3G and 4G coverage combined now reaches 99.4 per cent of the Australian population (up from 99.3 per cent) and covers 2.4 million square kilometres of the Australian landmass, including hundreds of thousands of square kilometres of regional and rural Australia not served by any other carrier.

Telstra has invested in more than 9,000 mobile sites across metro, regional and rural Australia, with 7,300 of these sites 4G-enabled.

2.1.1. Internet of Things Cat M1 capability and 4GX coverage footprint

In relation to the IoT, Telstra has activated its Cat M1 capability across its entire 4GX coverage footprint, becoming the first telecommunications provider in Australia to offer the technology and accelerating the growth of Australia's IoT ecosystem.

The activation of Cat M1 enables a coverage footprint of around three million square kilometres for compatible Cat M1 devices – easily the largest in Australia and one of the largest in the world. Telstra's IoT capability is unmatched in Australia and is set up to support any IoT solution. This Cat M1 activation is an example of our readiness for the next phase of consumer and enterprise demands.

Industry in regional and rural Australia is likely to benefit most from this technology and extensive coverage. Telstra's Cat M1 technology offers coverage in densely populated cities and regional areas making mass deployment fast and asset tracking possible. It makes connection in even the most challenging locations, such as in-building and underground, more feasible with a Cat M1 device.

2.1.2. 5G technology improvements

5G mobile technology will take us from a world of connecting people to people and people to the internet, to a world that includes connecting machines to machines on a mass scale. This is a technology that will fundamentally change the way our world works.

While superfast speeds, ultra low latency, and supporting IoT on a huge scale are often called out as the key benefits of 5G, what really makes 5G interesting are the specific use cases and applications that will flow from it.

The increase in performance of 5G will bring will not only continue to benefit mobile broadband and smartphone experiences, but will also be essential to supporting the expected increase in IoT connected devices. It's a technology that will exist until beyond 2030, so it's important to think ahead about what wireless communications will mean in that time frame.

The first live 5G trial in Australia was conducted by Telstra in September 2016 in Melbourne in partnership with Ericsson, demonstrating 5G capabilities in a real world environment including speed and beam steering tests. Testing revealed total download speeds (to two mobiles) greater than 20 Gbps, which is very impressive in a real world, outdoor environment.

In a key step in the global development of 5G, the next wave in mobile network technology, in October 2017, Telstra and technology partner Ericsson completed the world's first 5G data call over 26GHz or 'mmWave' radiofrequency spectrum using Telstra's production core network. This is the first time the 26 GHz band has been used in the field, with this spectrum to play a critical role in 5G deployments globally.

This 5G data call demonstration was the first in what will be a series of trials at a new 5G testing centre Telstra is establishing on the Gold Coast. We have a unique opportunity to ensure Australia is at the forefront in the development of the next generation of mobile technology.

In addition to these demonstrations and trials, contributing to the international 5G industry standards is key to ensuring the technology will be best suited to Australia. Telstra has been using our experience to contribute to these standards, which means 5G should be the first technology that comes to us ready for Australian conditions. This preparation will be key to ensuring Australia is ready for 5G post 2020.

All industries are realising the benefits of mobile technology to increase productivity and/or customer experience. Many of the things that will be possible with 5G technology can be done already with one of the many variants of 4G that are now available, from Gigabit LTE down to Cat M1 and Narrow Band IoT. With the introduction of 5G these application will work even better, with lower latency and even higher efficiency.

Telstra's Chief Technology Office is exploring a range of emerging technologies that will form part of the 5G IoT ecosystem, including Unmanned Aerial Vehicles/drones, Virtual and Augmented Reality (VR/AR), and connected vehicles.

2.2. Contribution of digitisation to sustainable growth

The digital transformation of the Australian and global economies opens up significant opportunities to achieve low-carbon economic growth. As more people become more connected, we are witnessing technology as a powerful enabler of low-carbon growth. It is helping reduce travel, energy consumption and greenhouse gas emissions. For businesses, it is creating new revenue opportunities, reducing operating costs and creating market differentiation.

However, current economic and environmental policies and pathways do not fully take into account, or explicitly point to, the enabling role of information and communications technology (ICT) and how the sector can enable significant emissions reductions across the whole economy.

2.2.1. Importance of low-carbon economic growth

ICT has the potential to generate environmental and direct economic benefits for the Australian economy through ICT-enabled emissions reductions, cost savings and additional revenue opportunities.

For global climate change policy and action, the 21st Conference of the Parties (COP21) in Paris was a historic event to discuss and update the United Nations Framework Convention on Climate Change

(UNFCCC). The resulting Paris Agreement is significant in that it is the first global, legally-binding agreement for tackling climate change.

Before and during COP21, countries submitted individual Intended Nationally Determined Contributions (INDCs) which are country-specific action plans outlining how they will contribute to climate change mitigation and adaptation. As part of its INDC, the Australian Government took to Paris a commitment to reduce carbon emissions by 26-28% by 2030 from a 2005 baseline.

Following the events in Paris, attention must now turn to how we can achieve this reduction. A significant opportunity is through increased use of ICT and facilitating a digital economy.

2.2.2. Contribution of technology to low-carbon economic growth

Telstra's latest research, "*The Australian opportunity for ICT enabled emission reductions*" (herein referred to as SMARTer2030) details how Australia can use ICT to address a range of sustainability issues, particularly improving energy efficiency and transitioning to low-carbon economic growth.[7] It finds that ICT has the potential to reduce carbon emissions in Australia by 188 million tonnes a year in 2030. This is a significant emissions reduction and accordingly, there is a strong case for increased use of ICT to help deliver Australia's INDC commitment.

SMARTer2030 details the carbon reduction potential for 12 ICT use cases across eight Australian industry sectors. As an example, these include:

- Smart Agriculture – use of ICT to improve efficiency of food production by increasing crop yield, reducing waste and increasing access to markets (avoiding 60 $MtCO_2$-e);
- Smart Manufacturing – application of ICT to conventional manufacturing processes, increasing flexibility, efficiency and responsiveness (avoiding 30 $MtCO_2$-e);
- Smart Energy – using ICT to match energy demand to supply, integrate renewable energy into grid systems and enhance energy efficiency (avoiding 30 $MtCO_2$-e).

Although ICT enables carbon reduction across all of the sectors, the above ICT-enabled solutions present particularly significant benefits to Australia with Smart Agriculture, Smart Energy and Smart Manufacturing solutions offering about 75 per cent of total savings (188 million tonnes).

The benefits of ICT also extend beyond carbon abatement. ICT could offer significant economic benefits to both Australia's ICT sector as well as other industry sectors. Overall by 2030, SMARTer2030 finds that ICT could enable an additional $420 billion in sustainable economic benefits, comprising of $86 billion in additional ICT and cross-sector revenues and $334 billion in cost saving opportunities.[8]

ICT presents compelling opportunities for governments, businesses and consumers to be more innovative and connected as a means to ensure low-carbon economic growth and reduce carbon emissions. Opportunities abound, but will only be realised if decision makers unlock the potential of ICT.

Our research has shown that ICT can decouple economic growth from carbon intensity. Government and policy makers can make decisions to ensure ICT is deployed in a manner that meets underlying needs and improves quality of life, drives economic growth and addresses sustainability challenges. Creating incentives to further invest in connectivity infrastructure will expand and widen access to affordable ICT which will increase penetration and participation. There is also a need to adopt fair, balanced and consistent regulatory approaches to ICT services to speed up adoption globally.

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[7] Telstra & Fujitsu, 2016, *The Australian opportunity for ICT enabled emission reductions*, a report extending research from the Global e-Sustainability Initiative (GeSI), SMARTer2030 ICT Solutions for 21st Century Challenges - http://smarter2030.gesi.org/

[8] SMARTer2030 report, p.17.

2.3. Growth of Connected and Autonomous Vehicles

[Reference discussion paper Question 6]

2.3.1. Social benefits of Connected and Autonomous Vehicles

Connected and Autonomous vehicles (CAVs) offer the potential for numerous social and economic benefits for Australia including safety (reduced human error), productivity (time better spent on activity other than driving) and mobility (they can be used by unlicensed humans or for freight). An improvement in safety for all users of our roads will deliver the greatest social and economic impact through reduction in the number of injuries and deaths (and the burden this places on families and the community), as well as a reduction in the $27 billion annual economic cost of road trauma and associated productivity loss.[9]

During 2016, in the 11 months between 1 January and 30 November, 1,185 people died due to injuries sustained in motor vehicle accidents.[10] AIHW data covering the period 2001 to 2010 further suggests that each year around 35,000 Australians suffer serious injury in road accidents, which require hospitalisation.[11] Reducing deaths and serious injury caused by vehicle accidents will have positive and far-reaching economic benefits to Australian society as well as relieving thousands of individuals of the personal pain and grief associated with the death or injury of a loved one.

Properly introduced, CAVs may also bring new transport options to those unable to drive, making possible new levels of social equity, access and inclusion, as well as allowing for mass-customisation of public transport to individual users' needs. A reduction in road congestion, along with increased efficiency and productivity will arise from increased ridesharing, reduction in car ownership, and better utilisation of the time that is currently required for driving. These will deliver gains to the Australian economy as well as environmental benefits.

2.3.2. New business opportunities and ways of working

As existing transport industries are disrupted, the reality is that there will be job reductions in the transport and logistics industries. The important question becomes how we as a nation will address it. New job roles will emerge in technology industries and potentially in vehicle manufacture of CAVs and their components. For example, new jobs may emerge and be fostered by building on Australia's rich background in Intelligent Transport Systems (ITS) platforms and vehicle design. Australia is one of the world's leading providers of today's ITS systems having created two fundamental ITS technologies, SCATS and STREAMS.[12] Australia also has local companies such as Cohda Wireless who are world leaders in Cooperative and Connected ITS.

A long term roadmap, co-developed with the industry, can help ensure adequate provision of education and training required to transition affected employees to new, high growth industries and lines of work. Beyond the retraining of impacted individuals, there is also a role for government to

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[9] http://advi.org.au/2016/09/30/position-paper-economics-impacts-of-automated-vehicles-on-jobs-and-investment/

[10] https://bitre.gov.au/statistics/safety/fatal_road_crash_database.aspx

[11] Australian Institute of Health and Wellbeing (AIHW). Trends in serious injury due to road vehicle traffic crashes, Australia: 2001 to 2010. Published 11 February, 2016. http://www.aihw.gov.au/publication-detail/?id=60129554605. 146.4 seriously injured per 100,000 of population.

[12] Australia is one of the world's leading providers of today's Intelligent Traffic Management systems with NSW Roads & Maritime Services' SCATS traffic signal control system and Qld Transport & Main Roads' STREAMS managed motorway system. SCATS 'adapts' to real-time vehicle density to implement signal phasing to optimise urban arterial road traffic flow. STREAMS controls freeway ramp signalling and variable speed signs to enable world's best practice motorway traffic flow.

work with industry to tune startup and innovation ecosystems towards areas that will foster the creation of new jobs.

2.4. Cloud computing

[Reference discussion paper Question 6]

There is no longer any doubt that cloud, particularly public cloud such as Amazon Web Services (AWS) and Microsoft Azure, is now a major part of the mainstream IT infrastructure mix for business and enterprise organisations around the world.

Cloud computing offers the agility needed to transform businesses, deliver better customer experiences, experiment with new offerings and operational models, and take value to market quicker, all with less risk. Many also recognise the pivotal role that public cloud platforms will play in propelling business performance through the next wave of innovation such as big data, IoT and Artificial Intelligence (AI).

At Telstra, our vision for cloud computing encompasses secure, low latency networking with an on-demand model and simplified data management, enabling governance and compliance at speed, without inhibiting agility. The result is not only a hybrid IT environment delivering high performance, responsive and secure infrastructure for both legacy and cloud-native applications, but also a business technology platform for the future.

2.4.1. Cloud computing adoption

Hybrid Cloud is becoming the strategy of choice for enterprises that want the best of both public cloud and private cloud worlds. They want the flexibility and agility of multiple public clouds, the security and control of private infrastructure, and the ability to choose in which environment they place their legacy and cloud-native workloads.

Hybrid cloud in Australia is booming – more than two-thirds of companies in Australia are now implementing a hybrid cloud solution over a purely public or private play. The 2017 Rightscale State of the Cloud report finds that 92 per cent of businesses they interviewed in Australia and New Zealand are using the cloud, with 68 per cent preferring a hybrid cloud strategy compared to 58 per cent of enterprises worldwide.

Eighty five percent of Australian enterprises interviewed in this research are leveraging multiple clouds, and organisations using public clouds are running their applications in an average of 1.9 public clouds and experimenting with 1.6 more. In a world of digital disruption, the fact that Australian businesses are innovating at a faster rate than ever before and leading the world in hybrid cloud is a positive sign that businesses are taking up the challenge of digitising their operations and embracing serving their customers in a connected world.

2.5. Opportunities for development

[Reference discussion paper Question 6]

2.5.1. Big data

Telstra helps enterprise customers harness data for big business opportunities with a cloud-based service that brings together world leading analytic software, infrastructure, enterprise security and service management in a ready-to-deploy solution.

Effective access to, and use of, Big Data presents a significant commercial advantage, with insights that can be used extensively to inform supply chain optimisation, customer churn analysis, fraud risk management and resource planning.

Our customers can access advanced data gathering, storage and analytic features for fast and easy access to information that would otherwise elude analysis.

In recent years, Telstra has built analytics assets and a program of work to support revenue-driven business outcomes using our own customer insights to optimise our customer experience, products and services in market.

2.5.2. Blockchain / Distributed Ledger Technology

By making it easier to securely share data between institutions and individuals, blockchain technology has the potential to improve the efficiency of government operations and delivery of public services. In a recent survey of 200 government leaders in 16 countries, c.90 per cent indicated a plan to invest in blockchain technology by 2018.[13] We believe the strongest near to medium term benefits from government utilisation of blockchain technology are within the following areas:

- Regulatory compliance – Through the establishment of an immutable and transparent audit trail in the form of a distributed ledger, blockchain technology can improve the visibility, security and authenticity of compliance requirements and processes as well as reduce costs and time required to enforce regulations;
- Digital Identity - A blockchain-based ecosystem for digital identity would offer new ways to connect authoritative identity sources (government and private sector) and strong authentication options (such as biometrics on mobile phones) with services being accessed by individuals. It could give individuals more choice in how (and with who's help) their digital identity is verified and protected, and enable individuals to reuse identity validations across many services. This will provide incentives for businesses to offer stronger and simpler online identity solutions and more efficient and effective uses of identity validation;
- Asset registration – By securing a unique and non-corruptible proof of asset ownership (houses, cars etc.) and any subsequent changes in ownership on a blockchain, reliable ownerships records can be created that improve security and reduce costs compared to existing manual processes;
- Data Security – Blockchain enables new security capabilities that can minimise the impact of data tampering for highly sensitive data and records within governments and private enterprises.

While blockchain technology has significant potential applications across a broad spectrum of industries, it is a very early stage technology requiring co-ordination between regulatory bodies, industry groups and businesses in order to deliver on its potential. The Australian government can play a key role in bringing these parties together and accelerating the delivery of innovative blockchain based products and solutions for the benefit of citizens.

2.5.3. Artificial intelligence

In the last two years, Artificial Intelligence (AI) systems that deploy Machine learning (ML) algorithms against huge data sets have been evolving rapidly. AI is now applied commercially in tasks such as automated assistance in natural-language speech enquires and identifying objects in images and videos.

[13] IBM, *Building trust in government: exploring the potential of blockchains*, January 2017, p 1-2. file:///C:/Users/d304417/Downloads/global-business-services-global-business-services-gb-executive-brief-gbe03801usen-20170926.pdf

With the strong Big Data foundations that we have built in the last few years, Telstra has already begun executing against AI/ML opportunities including customer experience initiatives and network analysis. Our AI initiatives will continue to drive progress in delivering a world class product and network experience to our customers as well as serving our customers better in a more efficient way.

Developing, building, and operating AI solutions will require additional skills and new talents in our workforce. Telstra expects that many roles will be required onshore to work with AI/ML within three years, including software engineering, data science, and solution testing roles. It is clear that AI holds huge commercial appeal and potential for Telstra to serve the development of Australia.

03 Standards and regulation

3.1. Best practice regulation

[Reference discussion paper Question 7]

The ICT sector delivers services and technologies that are fundamental to the digital transformation underway in Australia and globally. The telecommunications sector's role as a key enabler of that transformation should be reflected in the design of the regulatory regime governing telecommunications infrastructure and services. A regime that provides incentives for investment in long-lived infrastructure and advanced services, as well as encouraging robust competition, will ensure Australia's ICT sector remains among the world's most advanced and continues to drive transformation of the economy.

3.1.1. Regulation for digital ecosystems

Technological and economic convergence within digital ecosystems presents fundamental challenges for regulation and regulatory systems. Digitisation drives rapid progress and change, for which traditional regulation is ill-suited. If regulatory frameworks are not adapted to digital ecosystems, they risk distorting digital markets and technological progress. A study by NERA Consulting for the GSM Association[14] identifies two ways in which outdated regulatory policies are harming the development of digital markets:

- Discriminatory regulation, in which converging sectors are regulated in different ways and to different degrees. For example, the communications sector is currently far more heavily regulated than other sectors within the digital ecosystem.

- Static regulation of dynamic markets, in which traditional *ex ante* regulation is applied unchangingly to markets which are rapidly evolving and hence more suited to *ex post* regulation in which problems are identified and addressed only once they emerge.

NERA suggests that policy makers address these problems by applying three basic principles to the regulation of digital markets:

1. Regulation should be based on function rather than structure or technology. It should seek to protect consumers and competition "without regard to technologies, industry structure or legacy regulatory regimes".

2. Regulation should be flexible, because the markets it applies to are flexible. It should instil rather than undermine confidence in risk-taking by taking a performance-based approach to regulation rather than a prescriptive approach.

[14] *A new regulatory framework for the digital ecosystem*, a study by NERA Economic Consulting for the GSM Association, 2016.

3. Regulation should be rethought from the ground up. Convergence within digital ecosystems has intensified competition to the point that regulation is no longer needed in many cases, while in others new cross-sectoral regulations can best address new threats and minimise distortions.

Telstra contributed to the commissioning of this study, supports its findings and policy prescriptions, and commends it to all regulatory practitioners and policy makers alike.

3.1.2. Regulation of the telecommunications sector

In Australia and across the OECD, telecommunications accounts for about 3 per cent of total economic output, a share which has been fairly stable since the 1990s.[15] However, since the early 1990s the economic value of technologically advanced, widely available, efficiently delivered and internationally price-competitive telecommunications services has increased. This is largely due to improvements in the capabilities of telecommunications networks, products and services, and as a result, they have emerged as key enablers of productivity, innovation, growth and structural change in other industries. Today, the telecommunications sector is fundamental to the digital transformation that is currently underway in homes, workplaces and industries around the world.

The significance of telecommunications infrastructure and services as drivers of opportunity and change elsewhere in the economy should be taken into account by regulation.

Historically, competition issues have been a focus of Australia's telecommunications regulatory regime. There is no question that vigorous, sustainable competition in the many markets that make up the telecommunications sector is a core objective, given its proven benefits for consumers and the incentives it creates for innovation.

It is equally important for regulation to provide a stable, predictable environment that encourages market-driven investment. Ongoing private investment in the long-lived, capital-intensive networks that underpin connectivity infrastructure and complex services will ensure Australian firms and households have access to cutting-edge communications capabilities into the future. These incentives for investment are just as important as competition in shaping a telecommunications sector that is technologically advanced, responsive to emerging demands from consumers, businesses and industries, and supportive of innovation-driven economic activity.

All of this speaks to the value of a regulatory regime in telecommunications that is aligned with best practice, that generates predictable outcomes for all parties, and that successfully encourages both sustainable competition and strong investment in infrastructure. Never before have the broader economic gains from achieving such a regime been as great as they are today. Conversely, there are high economic costs associated with regulations that are opaque, obsolete or overly intrusive; that provide for wide discretion for intervention; that fail to provide an equivalent balance of accountability; or that deter market-driven investment.

Regulation can be divided into economic, technical and consumer regulation. It is important that all of these subsets of regulation are conducted as efficiently as possible, but it is particularly important that economic regulation is efficient due to the large negative consequences for the economy and society if

[15] Australian Bureau of Statistics data indicates the information, media and telecommunications sector generated 2.9 per cent of Australia's GDP in 2014-15: ABS 5206.0 – 'Australian National Accounts: National Income, Expenditure & Product, September Qtr 2015' – Canberra, 2 Dec 2015, p.69. Similar data for all OECD members shows a similar share: Organization for Economic Cooperation & Development – 'OECD Communications Outlook 2013' – Paris 2013, p.65.

inefficiencies and miss-steps occur. To that end, Telstra supports the following principles for best practice economic regulation developed by Dr John Tamblyn:[16]

- Clear and focussed policy and regulatory objectives
- Clearly specified regulatory roles, responsibilities and functions
- Independence of regulation, free from undue influence
- Accountability of regulators for decisions, performance and outcomes
- Stability, predictability and adaptability of frameworks and decisions
- Efficiency and effectiveness of processes, methods and decisions
- Effective cross-sector coordination and cooperation among sectoral regulators

In addition, Telstra supports the Government's 10 principles for policy makers considering regulation as set out in the Australian Government Guide to Regulation.[17]

3.2. International standards frameworks

[Reference discussion paper Question 8]

International standards, especially in the field of telecommunications, provide a sound basis for the development and harmonisation of products and services. Wherever possible, Australia should leverage and align with these standards. Relative to comparable international counterparts, Australia is a small market by population size. This means that bespoke standards will come at significant incremental unit cost for devices, products and services, making Australia less competitive on the global stage. This is especially important in telecommunications in areas such as radio spectrum for mobile, satellite and fixed-wireless services, international connectivity/interworking and cybersecurity, where bespoke standards could easily result in the need to customise devices, platforms or solutions for the Australian market.

3.2.1. Appreciating the role of government in international forums

It is also important that where appropriate, Australia plays a strong lead in the development of standards to ensure that unique Australian attributes such as geography (large landmass) and low population density are included. Two relevant examples where Telstra has played a key role in shaping the development of international standards to facilitate services in Australia are: the *extreme long distance coverage in low density areas*[18] scenario which lifted the requirement for the maximum range of a 5G network cell from 100km to a maximum range up to 300km; and the *5 downlink / 1 uplink carrier aggregation combination*[19] to create a total aggregate bandwidth of 100 MHz for LTE Advanced services. It is important that Australian industry and government continue to play a key role in shaping the development of standards for the Australian environment.

04 Trust, confidence and security

4.1. The importance of data security

[16] *Best practice structures for regulation of access to telecommunications and energy network services*, Dr John Tamblyn, JCTamblyn and Assoc Pty Ltd, 6 July 2016.
[17] *Australian Government Guide to Regulation,* Commonwealth of Australia, Department of Prime Minister and Cabinet, 2014,
[18] 3GPP Release 14 Technical Report, section 6.1.6. https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=2996
[19] 3GPP TSG-RAN meeting #69, DocNumber: RP-151513. LTE Advanced 5 Band Carrier Aggregation (5DL/1UL). http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_69/Docs/RP-151513.zip

[Reference discussion paper Question 9]

4.1.1. Our commitment to data security

The privacy and security of our data is vitally important to us and to our customers. We are committed to protecting our customers' privacy and keeping their personal information safe and secure. As digitisation has grown in scale and scope, the level of cyber risk around digital activities has also increased, as has the incidence of cyber-crime. Each of these developments has created greater interest in the area of cyber security.

Cyber security is a complex area and a matter Telstra takes seriously, with an entire team of more than 500 cyber security experts dedicated to protecting the data we hold and our network. As a network operator Telstra is involved in cyber security activities at both the wholesale and retail levels of our operations, both internationally and domestically. In practice cyber security can affect data security (as well as broader security, such as network security), meaning systems need to be implemented in a way which is consistent with the *Privacy Act 1988* (including the protection of personal information) and adheres to the Australian Privacy Principles.

While cyber security is commonly perceived as a technical undertaking, maintaining security is not solely dependent on technical solutions. Anecdotally, for many cyber incidents which result in data breaches there is a human element such as an individual opening a phishing email and clicking a malicious link. This is not a failure of any technical element, and underscores the importance of having training and awareness programs for staff who access or maintain data, or use systems in which data is kept. Such programs must be provided in addition to having technical checks and balances (i.e. automated controls) in place and well-documented, well-maintained operational processes. Less obviously — and linked to the discussion in the preceding section — data breaches caused by human error can have a detrimental impact on consumer trust and confidence in cyber security frameworks because it is the systems, not the people operating them, that are perceived to be at fault.

Education is key to successful cyber security. In relation to privacy and security of data, there may be a role for government to develop further education campaigns targeted at both industry and consumers to raise the awareness each party plays in the role of cyber security.

We have also noted our support for the mandatory data breach reporting obligations being introduced in Australia, and we see this measure as important in helping to build consumer confidence and trust in the holders of their data.

4.1.2. Need for evolving policy/regulatory framework

Ultimately, the development of policy, and the regulatory framework need to keep pace with the rapid changes in technology and evolving societal expectations. In their research paper[20], the Productivity Commission noted that the pace of change of technology has implications for how governments undertake regulatory functions, noting that governments do not necessarily need to be involved in the development of standards, but where standards are mandated, there is a need to follow good regulatory principles to maximise the benefits while minimising regulatory overheads (finding 4.2),

The telecommunications industry has a good track record of developing codes and practices for good governance and compliance. One such example is the iCode[21] for cyber-security which aims to instil a cybersecurity culture within Australian ISPs that is sufficiently flexible to evolve with cyber-security

[20] Productivity Commission research paper, *Digital Disruption: What do governments need to do*? June 2016. Especially, Findings 4.1 to 4.9. https://www.pc.gov.au/research/completed/digital-disruption
[21] Communications Alliance. iCode, C650:2014. http://www.commsalliance.com.au/Documents/all/codes/icode

threats by encouraging and facilitating ISPs working and communicating together to respond to threats as they arise. A second good example is where work-stream 5 of the IoT Alliance of Australia (IoTAA-)[22] is developing an industry self-regulation code for IoT Security. The telecommunications industry should continue to develop and enhance self-regulation to meet new technology as it arises, such as the internet of things (IoT).

4.1.3. Data availability and access

As we outlined in our submission to the Productivity Commission's Draft Report on *Data Availability and Use*, and consistent with our strong customer focus, we are supportive of recommendations that promote consumer empowerment such as proposals for consumers to be able to transfer their consumer data in machine readable format.[23] However, we expressed concern that the proposed definition of consumer data is too broad, which will result in considerable uncertainty, both for businesses and consumers. Our concern was that an overly broad definition would provide incentives for businesses not to collect certain types of data, and/or to scale back analytics on certain types of data due to the high cost for curation and transfer of data at a consumer's request. In this light, we welcomed the Productivity Commission's final report which proposed to allow industry-agreed definitions for consumer data, which would be registered with the ACCC.

4.2. Supporting and progressing cyber security

Our world is rapidly changing with the proliferation of technology advancements and devices connected to the internet. It is estimated that by 2020, there will be more than 200 billion connected things, from cars and planes to homes and cities.[24] While this presents growth opportunities, it also presents threats to cyber security. The days when cyber security and cyber risk were isolated as an 'IT issue' are long gone.

Cyber security is a team sport and requires the investment of businesses, the community and the government to come together and find solutions that build cyber resilience. Cyber security and cyber risk are no longer on the periphery and are (or should be) occupying the minds of every company director as attacks increase in number and sophistication and the potential damage, when internal processes are not properly followed, can be catastrophic.

The cyber security environment is evolving rapidly in response to technology advancements and these widening set of threats. The traditional approach of securing the network perimeter by a firewall or the like is no longer sufficient protection.

The types of threats are also changing. Nation states and quasi-state entities, organised crime rings and hacktivist groups with the skill and resources to launch sophisticated attacks are growing. In fact, almost 60 per cent of organisations in Australia have detected a business-interrupting security incident on at least a monthly basis, which is more than twice as often compared to the year before.[25]

The objectives of attacks are also changing and now encompass espionage, disinformation, market manipulation and disruption of infrastructure in addition to data theft, extortion and vandalism.

Attacks in recent years have shown the potential impacts of cyber breaches. But behind the complexity cyber risk is just risk; cyber crime is just crime; cyber espionage is just espionage; and hacktivism is just

[22] IoTAA. See www.iot.org.au
[23] Telstra submission to Productivity Commission's Draft Report on Data Availability and Use, 15 Dec 2016. https://www.pc.gov.au/__data/assets/pdf_file/0018/211446/subdr312-data-access.pdf
[24] https://www.intel.com/content/www/us/en/internet-of-things/infographics/guide-to-iot.html
[25] https://www.telstra.com.au/content/dam/tcom/business-enterprise/campaigns/pdf/cyber-security-whitepaper.pdf

activism, all by another name. It is not a matter of risk eradication, but rather one of risk management that has evolved from just preventative measures to include monitoring and responding to the inevitable.

Telstra is working to help create a cyber secure Australia. We are collaborating with the government, regulators, businesses, the community and our people to find solutions that help build resilience through readiness. From solutions to education, it is about being in the know, knowing how to prepare and working together. Whether they are our employees, families, small businesses or enterprises, we have a responsibility and obligation to serve and protect our customers from cyber crime online.

4.2.1. The human firewall is a powerful defence

At Telstra we take cyber security very seriously in all that we do. It is a critical building block in our global growth and expansion. Being prepared means understanding that people play a critical part in cyber security. It is a person who clicks on a link, a person who chooses a simplified password, a person who selects where the data is stored. The 'human firewall' is a powerful defence and must not be forgotten.

Security savvy employees are a goldmine to organisations and their customers when they report security incidents and follow security guidelines. To help educate our employees on being vigilant online at home and at work, we have implemented an active program to engage our employees with this topic and ensure they understand the role they play in protecting our data and networks.

In 2016 we commenced regular cyber drills, designed to raise awareness about what our employees should do if they receive an unexpected email asking them to click on links or attachments. One of these phishing drills notified recipients they had a file titled 'Urgent Customer Complaint' in a program called 'OneBox'. When people clicked to view the file, they were directed to an education page.

To complement the cyber drills Telstra also developed a five part mini-series of videos to help generate discussion and build our understanding of cyber threats and what we can do about them. The videos concentrated on Phishing, Wi-Fi, Social Engineering, Malware and Information Disclosure and were made available to all staff.

The videos have been viewed by around 5000 employees and have been made available to the Telstra Digital Ambassadors program, which provided coaching sessions for 895 older Australians in FY17, and Our Tech Savvy Seniors programs, which provided face to face digital literacy training for more than 35,000 Australian seniors in local libraries and community colleges in FY17.

4.2.2. Security Operations Centres in Melbourne and Sydney

We live in a hyper-connected world as more people, organisations and businesses access information and communicate online. There are over five billion mobile subscribers in the world and nearly two billion active social network users. But alongside the benefits on connectivity – the information, education, health, and commercial opportunities and efficiencies – there are the cyber criminals, the hackers, the fraudsters who cause harm to communities and businesses. As we step into new grounds such as IoT, artificial intelligence and big data, our need for cyber security measures, experts and solutions increase.

As Australia's largest telecommunications provider, we understand our responsibility to deliver services that will protect the market domestically, and our customers globally. In response to the growing number of cyber attacks in business, we recently launched our Security Operations Centres (SOCs) in Sydney and Melbourne. Our state of the art Security Operations Centres provide 24/7, 365 priority access to our highly-skilled cyber security specialists and enable them to best monitor, detect and protect our Government and Enterprise customers.

The Security Operations Centres will bring on 42 new cyber talent across Sydney and Melbourne, adding to our global network of more than 500 cyber security experts that work to respond to security incidents for our customers. We are also committed to bringing our SOCs to international regions and have plans in place to build at least one additional SOC internationally, starting with London in FY18.

With the recent cyber attacks and the continued threat of cyber crime to businesses on a global scale, we understand the need to bring an end-to-end Managed Security Service to our customers with top cyber security talent to help protect Australia's business community. Our customers can not only see what we see, they can come in and work with us, learn with us, and influence how we develop our security products. Underpinning all of these activities is the powerful open source Managed Security Services platform that lets us tap into global innovation at will to help customers gain visibility of their security posture and react more effectively to threats.

While the rise in cyber criminality is regrettable, the establishment of Telstra's SOCs demonstrates that new jobs are being created in the economy in roles specifically designed to counter these attacks and protect Australian businesses and consumers.

The security environment continues to evolve rapidly, in line with technology advancements and new, organised threats. Telstra's Managed Security Services and centrally located SOCs build on our existing ASIO T4 certified SOC facility accreditation, and decades of experience protecting customers and our own networks. The SOCs revolutionise how we manage cyber risk for our customers. They are an important contribution from Telstra towards a more cyber secure Australia.

4.2.3. Support for the government's cyber security strategy development

As the operator of Australia's largest telecommunications network, we understand that the internet and connectivity are fundamental to the lives of all Australians and the ongoing prosperity of our economy, and that strong cyber security capabilities to protect this connectivity are critical.

The Government has set the agenda with the cyber security strategy which we fully support. The Government encourages the industry to be actively engaged in coming up with solutions because the more the industry actively innovates, participates, and integrates, the better the solutions will be – we need the industry to work together and manage cyber-crime as a united front.

Telstra is already collaborating with the government, regulators, businesses, the community and our people to find solutions that help build resilience through readiness. Our role now is to help turn this intent into action by providing our customers with the products and services that will deliver a more secure operating environment for all Australians.

4.3. Protection of consumer and business data

[Reference discussion paper Question 11]

4.3.1. Enabling consumers to protect their data

Digital technology provides access to a world of information and communication but it can also leave our customers exposed to new risks in areas such as cyberbullying, privacy, data security and fraud. Through our programs and those of our partners through the Telstra Foundation such as PROJECT ROCKIT Online and eSmart Libraries in partnership with Alannah & Madeline Foundation, we work to build the skills and confidence needed to help understand these risks and promote safe and positive digital experiences.

Online safety is about more than protecting us from online danger and personal risk. It's also about creating a sense of belonging and standards of behaviour that enable us all to have a positive experience online. At Telstra we want to empower people to participate safely in the online world and provide the infrastructure and support that make it easy to do so. Telstra also provides customers with tips on how to manage security online through our website.

4.3.1.1. Telstra Broadband Protect™

Telstra Broadband Protect™ helps protect devices connected to more than 1.5 million Telstra home broadband services – blocking visits to more than 3.7 million websites hosting known malicious content, scams or viruses each month. It does so by blocking those website at the Telstra network before they reach you. It is automatically activated on Home Internet Bundles purchased after 23 August 2016 and can be accessed through Telstra 24x7® My Account or the Telstra 24x7 App.

Telstra Broadband Protect also includes:

- Parental controls – which allows users to choose which types of websites they're comfortable with family members visiting – helping protect children from known inappropriate sites and content on any device in the home.
- Parents can also set internet access times to help manage when kids can go online, and use Homework Time to restrict social networking and online gaming while they study.
- Device protection – the Anti-Virus Plus Security helps keep devices free from known viruses, spyware and other threats.
- The Safe Browser function can help protect your personal and financial data when shopping and banking online.
- Social network protection – which helps detect cyberbullying, unwanted attention and bad behaviour by monitoring children's activity on their social networks. It allows parents to receive notifications on their child's Facebook page, and see what they view on YouTube and Twitter to better manage their online experience.

4.3.1.2. Telstra Mobile Protect

For our Telstra mobile customers on a contract we offer free access to Telstra Mobile Protect – a service that helps you tailor how your children access their mobile phone or tablet service to their needs and maturity.

With Telstra Mobile Protect, you can set time-of-day limits on calls and mobile web use, block unwanted calls and texts, choose the mobile web content that can be accessed and manage outgoing calls to specific contacts, over the Telstra Mobile Network. Mobile Protect is managed through an easy-to-use web portal where customers can:

- Block unwanted calls or callers, texts or texters made over the Telstra Mobile Network – manage a list of numbers kids can call, text or be called and text by on their phone.
- Set up a safe list of numbers and websites – choose numbers that can always be accessed.
- Manage the time kids can spend online and making calls – place time-of-day limits on web browsing and phone calls so they have distraction-free homework periods and internet-free bedtimes.
- Choose the mobile web content which can be accessed – Mobile Protect allows parents to select internet browsing profiles that are tailored for young children and teens that permit some sites, while blocking adult-oriented content.

Additionally many of the newer smartphones now have the ability for customers to block unwanted calls or SMS.

4.3.2. Barriers for SMBs in adopting cyber security measures

[Reference discussion paper Question 12]

Often small to medium businesses (SMBs) do not have the resources to implement a comprehensive cyber security program and don't have the more formalised risk management structures in place to mitigate cyber security risks and drive comprehensive privacy practices. Additionally, SMBs do not have the means when presented with the choice of reinvesting revenue to continue to do business versus covering off on risk. In many cases preventing privacy breaches and cyber security attacks are not even on the radar.

Telstra offers Small Business customers a range of security products as detailed below.

4.3.2.1. Cloud security applications for a secure business

Telstra's cloud security applications can provide end-to-end security against spyware and hackers for laptops, desktops and file servers. The range of security applications provides:

- Data protection: Helps protect laptops, desktops and servers from viruses, spyware, hackers and data thieves, keeping the business secure.
- Stay up-to-date: Our cloud-based services are simple to order, simple to activate and simple to manage. Where software is required, installation occurs over the web with updates applied automatically, even when out of the office.
- Flexibility and affordability: Scale up or down to suit the demands of your business, and there's no need to pay upfront for software that may not be needed later on.

4.3.2.2. Virus protection with endpoint applications

McAfee Endpoint Protection Essential or Symantec Endpoint Protection services can provide advanced protection against the threat of viruses and malware, including:

- Superior security: advanced security to download files, access email and upload files from portable storage devices, helping to protect against viruses, spyware, adware, hackers and data/identify thieves.
- A simple, scalable solution: our anti-virus solutions are simple to set up, easily updateable and, thanks to a convenient web-based management system, the business can adapt the solution to suit them at any time.
- Business continuity: Your business will always have virus protection and it will always be up-to-date, even when staff members are working remotely.
- Affordable protection: No need to invest in dedicated security equipment and no large, upfront costs thanks to our convenient pay-as-you-go, per-user pricing model.
- Around the clock support: Any of our endpoint protection solutions receive our technical support, 24x7.

4.3.2.3. Telstra's Business Protect

Telstra's Business Protect is a reliable, tamper resistant security alarm monitoring service, built on the reach and security of Telstra's mobile network and the expertise of Telstra SNP Monitoring (TSM). TSM is a joint venture between Telstra and SNP Security Pty Ltd, an Australian enterprise with over 90 years' experience.

05 Building on our areas of competitive strength

5.1. Enabling and supporting nbn migration

[Reference discussion paper Question 14]

5.1.1. Benefits of high speed nbn network

High speed nbn access will allow business customers to explore the use of existing modern technologies like video conferencing, IP telephony, big data, and cloud infrastructure, while also opening up the opportunity to develop innovative new uses of the technology that are specific to their individual needs.

For many businesses, transitioning to the nbn will require a refresh of the underlying technology and equipment used to support existing business applications. In addition to the added features and

capabilities of replacement solutions, businesses may also benefit from cost efficiencies that the new solutions bring.

5.1.2. Communication with business to understand benefits of migration

It is important in ensuring Australian businesses are not held back from the benefits of digital technologies offered by the nbn, that they fully understand both the need to and benefits of migrating their legacy services to the nbn.

nbn co's development of replacement solutions for many Special Services (which are the main services used by businesses in Australia for connectivity), in addition to Telstra announcing some product exits, has triggered disconnection obligations which commence in November 2018. Special Service customers must therefore start thinking now about migrating these services to alternative solutions (including nbn, mobile or fibre based options) to avoid potentially being left without a service as a result of mandatory disconnections as required by Telstra's Migration Plan obligations.

Telstra (and other RSPs) are currently investing significant effort in encouraging customers to consider their options and plan to migrate early, and has been pleased to note that some industry peak bodies (such as the Pharmacy Guild of Australia) have begun reinforcing this message with their members, but this would be aided by a high profile government information campaign highlighting the need to migrate. Importantly, migration of business customers takes time in order to minimise the chances of outages along the way, so the earlier a campaign can be launched, the more effective it will be in maximising successful migrations.

5.2. Facilitating startup development

[Reference discussion paper Question 15]

In 2017 Telstra commissioned a global research project from the Economist Intelligence Unit (EIU) to assess the confidence of business executives in their city's environment and its conduciveness to supporting the digital ambitions of companies.

The EIU surveyed 2,620 executives in 45 cities (including Adelaide, Brisbane, Melbourne, Perth and Sydney) to develop the 'Connecting Commerce' report.[26] This report includes the first ever Digital Cities Barometer, which ranks the 45 cities across five key categories relevant to business performance: innovation and entrepreneurship; the financial environment; people and skills; development of new technologies; and ICT infrastructure.

The report found that although business leaders are relatively confident that their city environments can provide the support they need, many cities are coming up short in areas such as the supply of digital talent and the sharing of government data. Nonetheless, the report shows cities can play a pivotal role to facilitate the talent, ideas, financial resources or simply the inspiration to achieve digital initiatives. This is relevant to businesses of all sizes, including startups.

Some of the key components needed to help businesses thrive in a connected world include:

- A digitally literate workforce. Skills gaps are amongst the toughest challenges for companies, with 40 per cent of respondents rating their city's education institutions as ineffective at turning out the talent firms need to drive digitisation. Digital security and advanced data analytics are identified as the two most critical skills needed. Encouragingly, the majority of executives in each of the Australian cities said their local educational institutions are effective at equipping their

[26] 'Connecting Commerce: Business confidence in the digital environment.' A report from the Economist Intelligence Unit, commissioned by Telstra. November 2017, http://connectedfuture.economist.com/ http://connectedfuture.economist.com/

students with the right digital skills. Less populous cities like Adelaide were, anecdotally, found to be at a disadvantage in that digital talent, especially from overseas, is often attracted to the larger hubs of Sydney and Melbourne.

- Adequate ICT infrastructure. Fifteen percent of respondents cite shortcomings in their city's communication networks as a serious obstacle to achieving their digital ambitions. It is a concern, then, that 48 per cent of the survey sample believe their city is ineffective in providing ICT infrastructure that meets their digital transformation needs.

- Access to open government data. A large majority of executives in the survey (69 per cent) consider open data to be important to their business, and 30 per cent deem it 'very important.' However, 57 per cent of Australian executives surveyed said their city governments make poor use of the data they collect. The primary value of this data lies in leveraging it to provide new or improved services to customers, or identify new business opportunities. Startups in San Francisco, for example, have based their entire business models on the use of this data. One such example is BuildZoom, an online platform that matches homeowners looking to renovate their homes with local contractors. The platform catalogues licensing and building permit data made available by city governments across the US.

- New sources of finance. Components of the local innovation ecosystem are important sources of funding. The report found that 32 per cent of businesses have tapped into government programs in the past three years. Another one-fifth have received financial support from incubators or accelerators.

- A vibrant technology ecosystem. There is growing demand for formal and informal networks, communities, forums and other support structures, designed to help firms address their digital challenges. Companies are making active use of them. For instance, 29 per cent of firms in several Asian cities turn to innovation labs to obtain ideas and advice, and another 18 per cent work with incubators and accelerators. In European and US cities, innovation labs and centres are used by almost one quarter of firms. Interestingly, survey respondents in four of the five Australian cities – the exception being Adelaide which cited innovation labs – point to more traditional structures, such as business associations, as the most helpful external sources of support for their digital initiatives. This suggests Australian cities might benefit from less traditional external resources, such as innovation labs.

- Active government consultation. In many countries, national governments take the lead in co-ordinating interaction with the private sector on topical issues such as cyber-security. However, the role of city governments is becoming increasingly important – 63 per cent of respondents say local authorities have consulted them on cyber-security issues at least occasionally in the past two years. This is likely to continue as smart city programs and the proliferation of networked sensors create new vulnerabilities at local levels. Nearly two-thirds of executives across all five Australian cities look for the city authority's role to become more prominent in the coming years.

Nearly half of surveyed executives in Australian cities said their firm has considered relocating their operations to a city with a more favourable external environment. Organisations today have numerous options – both domestically and internationally – as to where they base their business operations. It's important that government creates the right environment to help startups succeed and build a thriving digital economy.

5.3. Telstra's efforts in responding to digital transformation and new growth industries

[Reference discussion paper Question 16]

Underpinning our growth ambitions is a clear strategy to identify, incubate and carefully acquire new capabilities we need for long-term success in a dynamic sector. The efforts of the Chief Technology Office, our Telstra Ventures investment arm and muru-D startup accelerator are focused on ensuring we are ideally placed to leverage the next generation of technologies that are transforming the economy.

5.3.1. Investments in quantum computing

In late August 2017, the Australian Federal Minister of Industry launched a new company called Silicon Quantum Computing (SQC) Pty Ltd. SQC is a joint venture between the University of New South Wales (UNSW), the Commonwealth Government, Telstra, and the Commonwealth Bank to commercialise the world-leading quantum computing research that has been conducted at UNSW for nearly 20 years.

Quantum computing has the potential to go beyond the limits of today's computers in solving certain key problems such as the ability to simulate molecules (for medical research or chemical production), optimisation of complex mathematical systems (routing of paths through a telecommunications network) and setting the parameters in machine learning algorithms.

Telstra is committed to becoming a world class technology company that empowers people to connect and if quantum computers do represent the next generation of computers, we will be well-placed through our investment in SQC Pty Ltd to be a globally leading provider of quantum computing cloud services.

5.3.2. Internal digitisation initiatives

Digitisation is increasingly central for every business – Telstra sponsored research found 75 per cent of companies are exposed to digital disruption and 97 per cent have a formal digitisation strategy in place.[27] Telstra has a strategy and plan in place, and Telstra's digitisation program is part of a $3 billion strategic investment between FY17-19.

There are multiple drivers behind this including customers' expectations - they increasingly expect to be able to interact with companies using digital channels and tools. The customer experience bar is being set ever higher by tech savvy companies. Companies can gain huge advantage by modernising and simplifying how work gets done - process efficiencies, modern user experiences for its own workers and the advent of artificial intelligence and machine learning mean even greater opportunities to better serve customers and personalise experiences. Data also means the experiences and patterns of previous customer interactions can help a company better deliver on future expectations.

Telstra's digitisation focus will include:

- Customer experiences – for example, helping customers better serve themselves where transactions are digitised, self-service tools 24/7.
- Digital platforms – simplifying and consolidating our IT systems –outdated legacy systems decommissioned; half of all applications retired, contained or moved to the cloud; and reduced delivery times.
- Employees – helping our people better serve our customers via manual hours saved through automation; improved speed to market; and increased digital service transactions.
- Ways of working – changing the way we work to empower our people by scaling Agile teams across the company and building out DevOps capability.

[27] "Disrupted or Disrupting? Fast track your future." Telstra commissioned research conducted by Tech Research Asia, mid 2016. https://www.telstraglobal.com/images/Disruption,%20digital%20transformation%20and%20effective%20technology%20strategy%20report.pdf.

Telstra has more than 200 initiatives to improve customer experience, simplify operations and deliver efficiencies – an example of delivered initiatives include:

- New tablets for field technicians plus a workforce planning system delivering improved scheduling, work optimisation and dispatch. Currently in trial across Tasmania and will be rolled out nationally in Q2FY18, the system reduces rescheduling, optimises resources, provides better service through improved appointment time performance and a 'Where is my Tech' online map. Saves around half an hour per day per technician.
- Suite of new tools and automation for fault assurance contact centres complemented by better self-help online tools. Currently active with 400 agents and to be scaled to 1,000 by end of calendar year. Automates processes and reduces screens for agents from 9 to 1, resulting in a significant reduction in call handling times, and 70 per cent fewer truck rolls.
- New operating support system providing big data capability to analyse the 8 terabytes of data generated by our network every day. Anomaly detection identifies rural 'hot spots' and potential issues in our network before they affect customers, and reduces the time to identify the impact of a service reduction by 80 per cent.

5.3.3. Telehealth

Telstra's telehealth service platforms enable GPs, specialists and allied health providers to connect remotely with their patients. We have recently partnered with the Royal Flying Doctors in regional Victoria to provide a telehealth platform that enables local residents in Kerang (300km North of Victoria) with diabetes to have consultations with specialists via video. What that means for patients is that instead of having to drive more than three hours to Melbourne to see a specialist they can travel a short distance to their local community health centre and have a consultation via video.

Telstra Health has enabled Mackay Health and Hospital Service in Queensland to improve access to specialist outpatient care through specialist videoconferencing. The solution has reduced patient waiting times to three weeks and reduced Failure to Attend rates to 4 per cent.

5.3.4. Growth industries

Telstra has increased our focus on high potential industry specific growth opportunities in FY18. We have identified a number of industries where we believe we can accelerate growth by taking an active role in the development of innovative technology solutions for specific customer segments. The growth industries identified include Broadcast Production Services, Mining Operations Communications, Managed Payment Services, QoS over Public Networks for Public Safety, Retail Performance Solutions, Smart Transport Solutions, Digital Government, and Asset Inspection using drone technology.

5.3.4.1. Focus industry: Mining

Telstra's powerful ICT resources can help mining companies navigate challenges, enhance productivity, automate processes, streamline operations and achieve greater visibility, control and collaboration. Miners that adopt ICT to enable "pit-to-port" supply chain management will not only gain competitive advantage, but also position their companies for a more agile future. Telstra is actively pursuing a number of network deals, which include private LTE (4G) network capabilities.

5.3.5. Telstra Labs

Telstra Labs – launched in 2017 – represent the next phase in Telstra's innovation journey, bringing together our innovation and tech capability in a unique environment that allows for rapid experimentation, validation and the implementation of new ideas with partners and customers.

Australia's first publicly-accessible GSMA Open IoT Lab is now open within Telstra's Gurrowa innovation space in Melbourne. A public space where anyone – from university students, to startups or multinational

companies – can work with some of the best equipment and minds in the business to create, test and prototype IoT solutions. The Lab provides all of the software and hardware needed to create and develop new products and solutions, including the ability to test on the Telstra network within a controlled environment.

5.3.6. muru-D

muru-D is Telstra's startup accelerator that empowers ambitious entrepreneurs to solve challenging global problems using technology, by providing financial support, co-working space, mentors, education and access to a global community to help scale businesses and make a positive change in the world.

Since 2013, muru-D has expanded to five locations in Sydney, Melbourne, Singapore, plus partner programs in Brisbane and Perth. In that time, 77 start ups were accelerated through the program, creating more than 300 jobs and global alliances with 500 Startups, HAX, Chinaccelerator, The Junction and The Icehouse.

In August 2017, we recruited the first cohort of IoT-focused startups into the Melbourne branch of muru-D. The four successful startups were offered $75,000 upfront in seed capital investment, in addition to access to Telstra's extensive network of mentors and industry professionals.

The four startups are innovating IoT solutions for a range of industrial and community needs, including:

- Smart Paddock: a farm management tool that hopes to modernise the global livestock industry through intelligent data analysis, using IoT data "straight from the pasture";
- Alpha Centauri: an organisation geared towards producing cheap and sustainable food production;
- Moduware which creates phone cases and power banks to extend the hardware and software capabilities of smartphones; and
- Sofihub, a hardware and AI platform using IoT sensors to learn and monitor 'normal' patterns of activity in elderly residents' homes.

5.3.7. Telstra Ventures

Since inception, as at the end of FY17 Telstra ventures has invested more than $300 million in 45 technology startups.

In the year ended 30 June 2017, we made a number of strategic investments in cutting-edge US-based technology companies. VeloCloud™ Networks is a Cloud-Delivered SD-WAN™ (software defined wide area networks) company that enhances our ability to offer enterprise customers greater network flexibility. Our priority is to offer this technology to our international customers including those in mainland China through our joint venture Telstra PBS.

Our investment in US-based cloud-delivered endpoint protection company Crowdstrike further strengthened our cyber security capabilities and the Crowdstrike package has already been adopted by some of our business customers.

5.4. Enabling Australian industry to participate in the global digital economy

[Reference discussion paper Question 17]

Telstra supports open cross-border data transfer and storage. Australians should be free to make use of offshore providers where that is technically and commercially advantageous. Likewise, international customers should be free to store information in data centres regardless of the jurisdiction the data

centre is located. This approach ensures a vibrant and competitive environment for customers in the supply of connectivity and e-commerce solutions.

We are cognisant the importance of meeting our legal obligations and the trust of our customers. As long as the information is handled in compliance with domestic privacy law and applicable national security, government official information, and lawful enforcement needs, the starting principle of open cross border data transfer and storage should apply to all information regardless of whether the information is generated by the private sector or government. We would also caution against assumptions that storing data locally necessarily equates to higher security than data stored in another jurisdiction.

There may be commercial advantages for choosing to store data locally, e.g. less latency and caching for local distribution. The trade-off may be in the form of higher costs. However, it should be left to the customer to make this decision in a competitive marketplace, rather than one made by regulatory mandate unrelated to privacy and law enforcement needs. Otherwise this will result in artificially driving customers to local data centres, and higher costs for customers.

It is for this reason that Telstra will continue to encourage the Australian Government's trade negotiations to start from positions that promote the free flow and storage of data within and across state boundaries.

5.4.1. Role of government in enabling managed flow of cross-border information

The role of government in enabling Australian industry to participate in the global digital economy centres on facilitating frameworks that enable the flow of cross-border information. As data volumes from businesses and IoT grow exponentially, and as the global economy makes our world closer and more connected, there is a need to facilitate cross-border flow of information to enable Australia to participate in, and benefit from global opportunities. This will allow Australia to remain a leader in innovation globally, and will enable the creation of new jobs for Australians in the global digital economy.

Data security and individual privacy are areas of concerns for consumers and businesses, and cross-border flow of information needs ensure that the privacy of Australian's is maintained, and that data flowing out of (and into) Australia is managed in a transparent way that allows Australians to understand and control how and where their data is used.

Data sharing frameworks need to be developed that facilitate managed sharing of data in accordance with Australia's Privacy Principles, and in a manner that is transparent and understood by Australians, and there is a key role for government in facilitating and participating in their creation. Frameworks need to encompass both business data and government data. A good example of work in this area is the NSW Government, in collaboration with the IoTAA, the ACS and others in developing a Data Sharing Framework[28] that offers an approach to guide the creation of a Government Data Sharing Policy to inform the development of a Risk Analysis assessment of open data.

Data sharing comes with a range of challenges such as privacy, data security and concerns about unintended consequences of data sharing. There is also a role for government, in collaboration with industry associations such as IoTAA, to develop educational campaigns that increase consumer and business awareness on how data collected about them may be used, and the importance of managing individual digital and online privacy to provide security and to minimise the risk of unlawful activity such as ransomware, phishing scams and identity theft.

5.4.2. Case study: Austrade – export markets in China

[28] Australian Computer Society (ACS). Data Sharing Framework – Technical White Paper. Sept 2017. https://www.acs.org.au/content/dam/acs/acs-publications/ACS_Data-Sharing-Frameworks_FINAL_FA_SINGLE_LR.pdf

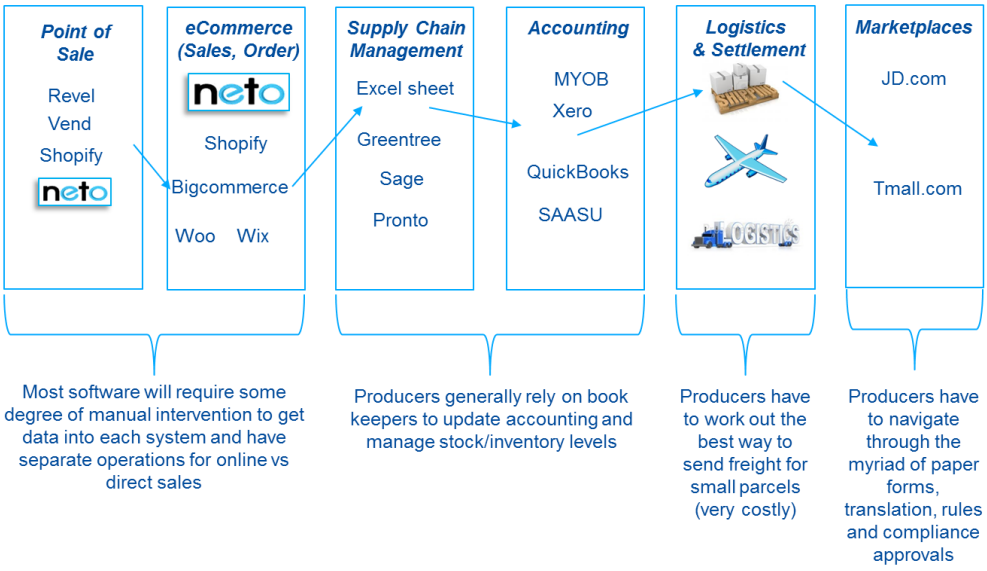
Telstra also recognises the opportunity that digitisation and collaboration can deliver for Australian small businesses seeking to access a global marketplace.

For many Australian small producers, exporting into foreign markets can be a risky and complex proposition. There are a myriad of paper forms, translations, rules and compliance approvals they must navigate to get their products to market.

Small producers also face issues in getting an end-to-end view of their operations due to a wide choice of order management, sales and inventory systems (some digital, some paper based) that have limited integration and data sharing. This necessitates manual intervention to get data into each system.

Finally, for a smaller single producer with initially low volumes, exporting raises challenges in efficient freighting because they will not have the scale to enjoy low freight costs.

Today: Export producers are confronted with a wide choice of software platforms with limited integration of data and workflows between them



Collectively these challenges have created a barrier to entry for many Australian small businesses and producers that has resulted in them missing out on potential export opportunities despite the benefits. We saw an opportunity to design and trial an end-to-end solution to solve these challenges by:

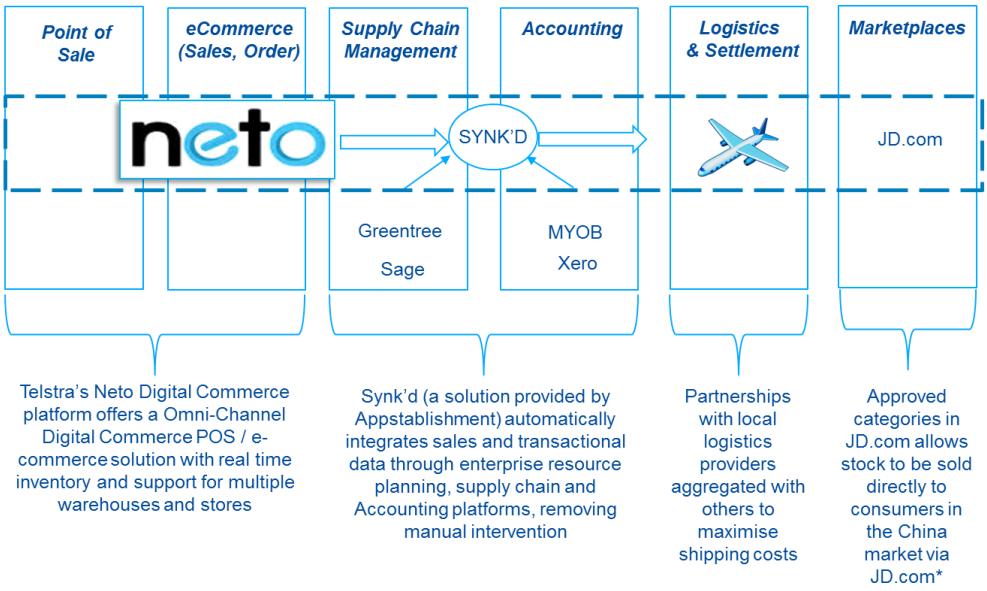
- Facilitating access to the Chinese market;
- Digitising and integrating their sales, order, supply chain; and
- Reducing their logistics costs.

This will in turn create new market opportunities for small producers to deliver premium products, at competitive costs and with unparalleled speed, from their door to the Chinese consumer in days.Our solution has three elements:

- The first focusses on identification and facilitation of market entry. This includes an assessment of the products marketability, set up of supply agreements, import approval and local marketing. This first element is supported by Austrade's Export Market Delivery Grants (EMDG) programme.

- The second uses NETO and SYNK'd (a solution provided by Appstablishment) to provision a digitally integrated Sales, Logistics, Real-Time Inventory and Supply Chain Management, that simplifies and integrates the local producers existing systems.
- The third is a logistics solution that partners with local logistics providers to aggregate the volumes of a number of users within a region reducing the cost to the local producer.

Tomorrow : Our solution is a fully integrated with marketing support via AUSTRADE's EMDG



We have been trialling this solution with a group of regional producers in the South West region of Western Australia. Our goal is to drive productivity and efficiency by digitising the end-to-end export chain and aggregating logistics across a number of producers.

Our South West WA trial shows how through digitisation, collaboration with local producers and support of the EMDG, Telstra is supporting regional producers obtain efficient access to export markets.

5.5. The importance of technologies for small business

[Reference discussion paper Question 18]

Technology, particularly connected technology, is at the heart of business transformation. It is fundamentally changing the way businesses operate and opening up a growing range of opportunities.

For example the IoT, where more and more smart, connected devices running on smart 4G networks are connected to the internet and able to talk to each other, is available today and is being adopted by a growing number of business in Australia and around the world.

These connected devices collect information about patterns and processes in the way people, machines, equipment and instruments move through and interact with the world. Through the collection, aggregation and analysis of information, they enable smarter decisions and improvements to be made to things as varied as processes, procedures, customer experience and quality of life.

IoT and the associated technology is helping make almost everything more connected and as a result a lot smarter. It's helping do everything from tracking the location and movements of valuable tools and equipment, to managing and synchronising entire transport systems with the real time movement of

passengers, to managing crops and livestock and linking their needs to local weather patterns, soil moisture and nutrients.

IoT is only one example of the growing application of technology in business. More broadly, the rapid rise of technology for business has been built on the following things:

- Software and applications – easy to use, intuitive, accessible, subscription based software and applications that can be integrated with other systems, improving business productivity and mobilising workforces.
- The cloud – technology that is enabling businesses to capture, store and access information from any location with a suitable internet connection.
- Networks – high-speed fixed, mobile and satellite networks that provide secure, reliable and accessible connectivity.
- Unified communications – the convergence of voice, mobility and video that enables better business communication, collaboration and productivity.

Among the key benefits of these developments for small business has been the improvement in affordability of technology solutions. The long-held advantage of size and resources of large companies is now being supplanted by the advantage of nimble smaller companies that can now use inexpensive technologies to get to market and rapidly scale.

For example, the rise of subscription based software as a service, distributed via the cloud, that can be easily scaled as a business needs, means there is no longer a need to tie up large amounts of capital on the outright purchasing of software and hardware, as well as operational capital on in-house IT teams to operate and maintain IT systems and infrastructure.

With greater availability and affordability, technology is a growing source of competitive advantage for small businesses. In a 2017 survey of Telstra Business Awards Alumni, 82 per cent of businesses said technology had been critical or very important in helping them achieve business success.

Having the right digital technology is also becoming an expectation of customers and people entering the workforce. The seamless experiences delivered by digital based businesses such as Uber and Netflix are increasingly raising the service expectations of customers, as are digital self-service or always-on customer service channels provided by companies.

Generational change in the workplace is seeing a growing number of Millennials born between 1980 – 2000 enter the workforce. These are the last generation of people to have experienced some of their life pre-internet. They are being followed by Digital Natives or people who have only experienced life with the internet and associated digital technology. This is making technology used within a small business a consideration when it comes to the recruitment and retention of staff.

5.5.1. Key barriers and needs for small business

Research commissioned by Telstra into Business ICT needs in the small (1-19 employees) and medium (20+ employees) sized businesses identified that while there is a clear appetite among SMBs to embrace digital innovation, there are clear factors that are stopping them from doing so. [29]

The research found two in three businesses were considering adopting at least one new information and communication technology (ICT) product in the next two years.

- 65 per cent of SMBs with 1-19 employees

29 Telstra commissioned market research by FityFive5, Business ICT needs, March 2017.

- 70 per cent of SMBs with 20+ employees

The investment in technology was considered an important way to help address the key challenges common to most SMBs, including recruiting the right people, managing people, managing cash flow, being time poor and having poor work/life balance.

At the same time, the research showed among those considering adopting at least one new information and communication technology (ICT) product in the next two years, the top five things that were stopping SMBs from embracing digital innovation were:

- Cost – 46 per cent
- Identified as a future need, but not a current priority – 34 per cent
- Implementation (time, effort, resources) – 27 per cent
- Concerns about integration with existing systems – 21 per cent (stronger among businesses with 20+ employees)
- Don't understand ICT products/ services – 18 per cent (stronger among businesses with 1-19 employees).

5.5.2. Key benefits for small business

Telstra market research of SMBs identified three key areas in which Telstra can assist them to embrace digital innovation. These are as follows:

1. Efficiency

Businesses can be more mobile, more efficient and ultimately more productive by using technology to improve systems, processes and enabling their workforce to work from more places. Specific ways technology can help to benefit SMBs include:

- Seamless sharing of information through the use of cloud software and storage and mobile devices and applications.
- Enhanced operations between multiple sites through the use of managed IT networks and services, video conferencing, voice-over-internet-protocol (VOIP) services and unified communications.
- Greater workforce mobility through the use of cloud software and storage, fixed and mobile broadband, mobile devices and applications.
- Enhanced external communications through the use of video conferencing and VOIP services.
- Greater automation through the use of machine-to-machine connectivity and cloud software and storage.

2. Growth

Digital technology can help businesses to find new customers, reach new markets, create and retain rich relationships and ultimately help grow their business. Specific ways technology can help do this include establishing a digital and e-commerce enabled presence. This can be achieved through the use of a mobile optimised website, online store, online payment offering and an active social media presence.

3. Security and protection

Due to their limited resources, SMBs are often the least prepared when it comes to electronic and cyber security. As a result they are often the most vulnerable and hardest hit by threats to their operations. With the right technology solutions, businesses can increase the safety and security of their operations and data and minimise their risks. Specific ways technology can help to benefit SMBs include:

- Enhanced physical security through CCTV, intelligent electronic access and monitoring systems and alarms
- Enhanced security of tools, equipment and assets through IoT
- Enhanced data security through the use of cloud software and storage, secure networks and firewalls and backup systems.

5.6. Helping small business embrace digital technologies

[Reference discussion paper Question 18]

As of 30 June 2017, Telstra had almost 1 million SMB customers. This represents around 65 per cent of Australia's SMB sector.

Telstra's aim is to become the trusted ICT partner for Australian SMBs. As part of our vision to be a world class technology company, we want to help bring businesses the best technology, the best advice, the best solutions and the best support to help them reach their goals.

We are helping small businesses to mobilise their workforce and be more productive through a suite of solutions such as lease plans for smartphones and tablets, providing cloud-based software such as Microsoft Office 365, as well as cloud storage options and a suite of curated business apps that we make available online through the Telstra Apps Marketplace. We are building capability across all our sales and service channels to advise customers on the right business apps to support business productivity, efficiency and growth.

We are helping businesses find new customers and reach new markets by getting online with Telstra Online Essentials, selling online with our e-commerce solution Neto and offering connectivity to their customers through our Wi-Fi network Telstra Air, which we will launch to SMBs in Q4 FY18.

With electronic and cyber security being major concerns for business customers, we're helping them secure their business operations and data through network security, mobile device management and cloud backup for leased devices.

In H2 FY18, we will also be including an additional layer of network security in Telstra broadband bundles for business.

5.7. Enabling SMBs to participate in the digital economy

5.7.1. Increasing reliance on networks by SMBs

As availability and affordability of technology continue to grow and the appetite of Australian SMBs to adopt technology in their business strengthens, businesses and their customers are becoming increasingly reliant on networks.

This is supported by Telstra analysis, which found:

- Over the next five years, we're expecting traffic on our mobile network to grow by five times
- The average person is predicted to have at least 19 connected devices;
- The growth is being driven by an unprecedented surge in connected devices and streaming, forecast to double by 2020; and
- Telstra anticipates an even greater reliance on cloud-focused functionality to allow this wealth of information to be continually uploaded and accessed by every linked gadget.

In our 2017 survey of Telstra Business Awards Alumni, high speed broadband was in the top three technological developments identified to have made the greatest difference to business in the last five years.

This growing reliance on networks to deliver important productivity, growth and security benefits for Australian SMBs is among the key drivers of Telstra's additional investment of more than $1.0 billion in building the Networks of the Future.

5.7.2. Telstra's service and support for SMBs

From our own research, Telstra recognises SMBs want expert advice on technology solutions for their business from someone they can trust. This a key reason behind the significant investment we make in our strong physical presence in cities and communities around the country.

In early 2017, we boosted our support for small businesses by putting 1,000 dedicated small business specialists in our network of 350 Telstra stores in local communities across Australia. That's in addition to the support we provide SMBs in our business contact centres, online and the 80 Telstra Business Centres and 200 business and enterprise partners we have around the country.

5.7.3. Telstra's support for SMBs via ICT infrastructure

From our research, we know delivering a superior network experience continues to be the most important consideration for our customers. Our network leadership in mobile, fixed, IoT and received experience remain an incredibly important part of what we deliver to our customers.

Complementing our network leadership position, Telstra is committed to providing our SMB customers with business grade connectivity. This includes providing a secure and seamless internet connection via a modem with mobile backup as standard, unlimited data uploads, secure cloud services and data back-ups, static IP addresses and a range of other features.

5.7.4. Telstra's support for SMBs via technology solutions

In our aim to become the trusted ICT partner for Australian SMBs, Telstra is seeing strong demand for business technology solutions, particularly in our more ICT-based digital offerings. The sections below outline of some of the key solutions we provide SMBs.

5.7.4.1. Telstra Online Essentials

Telstra Online Essentials provides SMBs with an entry-level website and support to help them establish an online presence at an affordable price within 10 days. Telstra supports SMBs through the process by providing services such as copywriting, design, search and mobile optimisation, web hosting, basic analytics and email and phone support. Further information is available at www.telstra.com.

5.7.4.2. Neto

Neto is an all-in-one omni-channel commerce platform, enabling SMBs to sell online, in-store, on mobile and through marketplaces and manage their inventory, orders, shipping and customer interactions from a single, integrated back-office. Neto includes:

- Integration with all key payment, shipping, marketplace and accounting platforms
- Enables SMBs to automate otherwise manual daily processes through various enterprise level productivity features, saving on labour costs.
- Provides local support with a team of over 120 e-commerce experts based in Australia.

5.7.4.3. Telstra Apps Marketplace

Telstra Apps Marketplace brings together some of the best cloud-based applications and services for business in a simple to use online portal. Among the most popular apps are:

Microsoft Office 365:

- Provides businesses with access to their office software and files when their out of the office, on the road, with customers, from home or when travelling.
- Provides access to core applications (Word, Excel, PowerPoint etc.), files (storage on OneDrive) and communications tools (email, Skype for Business, instant messaging etc.).
- Also integrates well with other software e.g. Docusign.

BlueJeans

- A simple and intuitive video conferencing application that can be used across compatible devices and platforms.
- Enables high-definition video meetings anywhere with internet connectivity.
- Helps save travel costs, while also providing the flexibility to work from home or on the go.

Box

- Helps increase productivity by keeping content in one place online.
- It enables businesses to access the latest document versions anywhere with connectivity, helping manage reviews and feedback.
- Particularly useful for sharing large files such as videos, images, plans etc. without having to courier, post or try and send via email.

DocuSign

- Enables businesses to review, amend, sign and share important documents from their smartphone, tablet, laptop or PC.
- Provides complete visibility of documents throughout the signing process and can send out automatic reminders to save on following up.
- DocuSign adheres to some of the most stringent security standards in the industry.

Deputy

- Provides a job rostering and workforce management solution, enabling businesses to create and modify rosters, monitor hours, approve timesheets and communicate with teams via a simple, easy-to-use interface.
- Integrates with Xero™, MYOB®, QuickBooks®, NetSuite® and many more.

Squirrel Street

- An expense management system to manage receipts, invoices, business cards and email contacts from any compatible mobile device.
- Takes photos of receipts and business cards, securely scans and extracts information for sorting and preparing for tax compliance.

5.7.4.4. Proquo

Proquo is a joint initiative between Telstra and NAB to provide Australian small businesses a new way to connect, share and trade professional services in the market. Proquo is aimed at small and micro businesses who either can offer or are in need of marketing, accounting, legal, design or technology services or other services.

The platform allows users to swap or exchange their skills or services in addition to traditional monetary payments. For example, if a web designer needs the services of a brand expert or copywriter, they'll be able to source a range of services from such providers, create briefs for the work they need, exchange quotes, manage payments and publish reviews all on the one simple platform.

Proquo is also playing a growing role connecting and facilitating trade between small and big businesses.

5.7.4.5. Supporting tradespeople

In partnership with Master Builders, Telstra is developing a digital technology platform for small business tradespeople that will enable them to manage jobs, order parts and materials, service customers as well as conduct safety checks to help with safety and compliance in the field. The platform is scheduled for release in 2018.

06 Empowering all Australians through digital skills and inclusion

6.1. Equipping Australians for the jobs of today and tomorrow

[Reference discussion paper Question 20]

A report by the World Economic Forum reveals that almost 65 percent of the jobs elementary school students will be doing in the future do not even exist yet. In addition, according to Foundation for Young Australians' (FYA) report *The New Work Smarts*, in an average working week, the time spent on tasks requiring advanced technology skills is set to increase by 75 per cent from 4 hours today to 7 hours in 2030.

Now more than ever, technology is an integral part of the lives of young people in Australia. However, as our world becomes increasingly shaped by smart technology, it seems many young people are further from being able to shape it.

Telstra recognises the importance of helping future generations of digital innovators and problem solvers to build their digital capability. We believe young people now need more than just an understanding of how to use tech, they need to understand how to create with tech, do it safely and to thrive through this connection.

Through the Telstra Foundation, Telstra supports and invests in 21st century digital learning experiences in schools, public libraries and remote Indigenous and regional communities. Our program, *Telstra Digital Futures*, focuses on young people in low digital inclusion locations.

6.1.1. The skills and jobs of the future

Technology will be central, critical and ever evolving but young peoples' ability to harness it will be the critical factor to handle the digital disruptions to come and the jobs of the future. Telstra has focussed its community investment on developing youth focussed programs to equip young people with skills and behaviours we believe are essential to the future of work, including:

- Positive online behaviours;
- Hands on learning re coding, robotics and 3D printing;
- Critical thinking and problem solving skills;
- Information and data analysis;
- Entrepreneurship, agility and adaptability;
- Curiosity, imagination and creativity; and
- Influencing, communication and collaboration skills.

In terms of our program delivery, we work with tech education partners and focus on young people living in low digital inclusion areas as identified in Telstra's Australian Digital Inclusion Index.[30] Our programs leverage coding, robotics, 3D printing, entrepreneurship and cyber safety to teach the building blocks of digital citizenship and tech innovation.

6.1.2. Telstra's contribution to preparing Australians for the digital economy

For many young Australians digital technology is an everyday part of life. However, despite this connection, there is a lack of understanding about how tech works, "under the hood". In a world where almost everything has a digital component or is somehow digitally mediated, being able to understand the basics of how this all works is more important than ever.

In addition to our broader Digital Inclusion work, our philanthropic investments via the Telstra Foundation focus on collaborations to help young people create with technology as opposed to just consuming it. We invest in digital learning experiences focussed on coding, 3D printing, robotics, cyber safety and digital creativity skills.

In FY17 our investment program extended across Australia and empowered more than:

- 70,000 young people to create rather than just consume technology, safely;
- 3,000 groups (non-profits, libraries, schools and community groups) to provide learning opportunities in digital citizenship, STEAM and digital making; and
- 6,000 digital guides for young people (Telstra employees, librarians, teachers and community leaders).

There is an opportunity to scale this community investment program in collaboration with government, schools, libraries and community groups. For example:

Learning to code – As the founding funder of Code Club Australia, we are providing Australian children with the opportunity to learn to code through afterschool coding clubs, online resources and teacher training workshops. We support 2,000 Code Clubs across Australia, the Moonhack campaign and we fund the operations of the Code Club team and their teacher training workshops. We have also delivered online and face to face teacher training resources to communities and schools as part of this partnership. Co-investment would scale this work further.

Indigenous Digital Excellence (IDX) – As the co-founder of the IDX Initiative with the National Centre of Indigenous Excellence we deliver programs to strengthen Indigenous participation, practice and entrepreneurship in the digital economy. This work includes:

- research, national summits and online conversations with young Indigenous people to develop a strategic IDX roadmap for the nation;
- a free, train-the-trainer program, IDX Flint, that works with Indigenous communities to deliver engaging STEAM-based learning experiences for Indigenous youth (coding, robotics, 3D printing, drone technology and enterprise skills) – local Indigenous Elders and community groups are leading our program in remote and regional locations; and
- the IDX Awards, a high profile black carpet event to showcase the digital achievements of Indigenous digital leaders and help scale Indigenous-led tech innovation.

Telstra Kids – Though our grassroots employee grants program we support our employees to drive STEM based learning experiences in the communities they live and work. The program invests $1

[30] *Measuring Australia's Digital Divide: The Australian Digital Inclusion Index 2017.* https://digitalinclusionindex.org.au/wp-content/uploads/2016/08/Australian-Digital-Inclusion-Index-2017.pdf.

million via employees into schools, libraries and community groups with 70 per cent of the program funding coding, robotics and digital making activities for children (K-12).

These programs provide hands on, engaging learning experiences to spark and inspire young people to take a deeper interest in technology and hone a set of transferrable skills in preparation for the jobs of the future.

6.1.3. Importance of STEM skills

Participation in Science, Technology, Engineering and Maths (STEM) subjects in Australia is declining with enrolments in these subjects the lowest in twenty years.

STEM education has an important role to play in building our pipeline of problem solvers and future innovators. New technologies are creating emerging sectors and transforming existing ones. In order for Australian businesses to compete, our workforce will require STEM skills that are core to business innovation and economic growth.

STEM skills underpin emerging knowledge-based industries such as biotechnology, ICT, education and advanced manufacturing, and can provide competitive advantage to industries such as agriculture, resources and healthcare. STEM skills are also a gateway to transferable skills essential for future jobs - skills such as computational thinking, problem solving, and collaboration, the foundations of a nimble and adaptive workforce.

By 2020, approximately 190 million people will come online in Southeast Asia, presenting a phenomenal opportunity for growth.[31] We need to address Australia's STEM challenge and opportunity now, so that Australia is better placed to take advantage of this growth potential.

The Telstra Foundation believes that the brightest future is a future that builds on technology, innovation, ideas and imagination to drive positive outcomes; and this is a future with STEM. We also believe that technology is key to great STEM teaching and our *Digital Futures* program puts this into practice.

6.2. Bridging the 'digital divide'

[Reference discussion paper Question 21]

The benefits of the digital economy cannot be shared equally when some groups and individuals are still facing real barriers to online participation. In recent years the digital divide has narrowed, but it has also deepened. The latest ABS data (2016) shows around three million Australians are not online. These Australians are at risk of missing out on the advantages and assistance digital technology can offer. As the internet becomes the default medium for almost everything we do, the disadvantages of being offline grow greater and being connected becomes a necessity rather than a luxury.

Digital inclusion is about bridging this 'digital divide'. It's based on the premise that all Australians should be able to make full use of digital technologies – to manage their health and wellbeing, access education and services, organise their finances, and connect with friends, family, and the world beyond. The goal of digital inclusion is to enable everyone to access and use digital technologies effectively. It goes beyond simply owning a computer or having access to a smartphone. At its heart, digital inclusion is about social and economic participation, using online and mobile technologies to improve skills, enhance quality of life, educate, and promote wellbeing across the whole of society.

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[31] Ardent Capital, *Southeast Asia, Why you should pay attention **NOW***, Adrian Vanzyl, CEO, October 2013. https://static1.squarespace.com/static/55152ec3e4b0ce927f081cf6/t/558d0d9de4b0750606e35dca/1435307421732/southeast_asia_-_why_you_should_pay_attention_now.pdf.

6.2.1. Insights from the Australian Digital Inclusion Index

The Australian Digital Inclusion Index (ADII) provides a comprehensive picture of Australia's online participation to date.[32] It measures three vital dimensions of digital inclusion: Access, Affordability, and Digital Ability, showing how these dimensions change over time, according to people's social and economic circumstances, as well as across geographic locations.

In 2017, the ADII shows that overall, digital inclusion is growing in Australia, with people spending more time – and doing more – online. Since 2014 Australia's overall digital inclusion score has improved by 3.8 points, from 52.7 to 56.5. In 2016–2017 alone, Australia's score rose by 2.0 points, from 54.5 to 56.5. Scores for every state and territory also increased over this period.

However, the gaps between digitally included and excluded Australians are substantial and widening. Digital inclusion follows some clear economic and social contours. In general, Australians with low levels of income, education, and employment are significantly less digitally included. The gap between people in low and high income households has widened over the past four years, as has the gap between older and younger Australians. Particular geographic communities are also experiencing digital exclusion, with Tasmania and South Australia well below the national average.

Nationally, Digital Access has improved steadily over the past four years, with Australians accessing the internet more often, using an increasingly diverse range of technologies, and with larger data plans than ever before. However, Digital Ability remains a key area for further improvement. Nationally, all three components of Digital Ability - Attitudes, Basic Skills and Activities – have improved over time, but it is important to note that all three components have risen from a low base. Digital Ability remains an important area for attention for policy makers, business, education, and community groups.

Affordability is the only sub-index to have declined since 2014, despite a slight recovery in the preceding 12 months. While the value of internet services has improved, households are spending a growing proportion of their income on them (from 1 per cent in 2014 to 1.19 per cent in 2017). Thus, despite increasing value, Australia's overall Affordability score has fallen. This trend is reason for concern, particularly for people on low incomes.

The ADII points to several sociodemographic groups that are Australia's most digitally excluded in 2017, with scores well below the national average (56.5). In ascending order, these groups are: people in low income households (41.1), people aged 65+ (42.9), people with a disability (47.0), people who did not complete secondary school (47.4), Indigenous Australians (49.5), and people not in paid employment (50.2). Also worth noting:

- The 'age gap' is substantial and has been steadily widening since 2015 - people aged 65+ are Australia's least digitally included age group (13.6 points below the national average).
- Overall, Australian women have an ADII score 2.0 points below the score for men, the gap here widens with age and is a particularly significant for women aged 65+.
- There are substantial differences between rural and urban areas. In 2017 digital inclusion is 7.9 points higher in capital cities (58.6) than in country areas (50.7).
- The overall 'Capital–Country gap' has narrowed slightly since 2015. However, this is not reflected in all states and territories. While South Australia, Western Australia and Queensland narrowed the gap between capital city and country residents, the gap widened in Victoria, New South Wales, and Tasmania.

Further investment to improve the digital inclusion of these excluded groups is critical.

6.2.2. The government's seniors connect investment

[32] https://digitalinclusionindex.org.au/

One of the challenges in delivering digital inclusion initiatives is how to reach excluded communities and individuals who are not already online. At Telstra we partner with on-the-ground community organisations to build on existing programs to access these communities and extend our reach. Where relevance and confidence are barriers, a more individually responsive approach is often needed – a "just in time" not "just in case" approach to education.

The Federal Government's *Be Connected – Every Australian Online*, an Australia-wide initiative aimed at empowering all Australians to thrive in a digital world, is to be commended. The combination of online learning resources along with a Network of community partners to help excluded community members to take the first steps to internet use is a positive step. We encourage the Government to continue this work and consider supporting further initiatives targeting particularly excluded community members.

6.2.3. Importance of government/industry co-investment and collaboration with community

Collaboration and co-investment between government and business can be a cost-effective way of achieving scale in program delivery. For example, since 2014 Telstra has partnered with state governments to deliver the Tech Savvy Seniors program to help build the digital literacy of tens of thousands of older Australians in Victoria, New South Wales, Queensland and South Australia. Another example is a partnership between Telstra and the State Library of Queensland to help build the digital skills and capability of Indigenous communities in 26 regional and remote locations in Queensland through Indigenous Knowledge Centres.

Telstra also has a $30 million infrastructure co-investment agreement with the Northern Territory government which will provide new mobile network access to 12 remote communities, and enable a further three to upgrade from 3G to fixed broadband. Telstra has also committed a further investment of $5.5 million over three years to deliver digital literacy initiatives, cyber safety programs and expanded remote telehealth services.

6.2.4. Telstra's co-investment framework

Telstra has a long-history of network co-investment. In late 2017 CEO Andy Penn announced the establishment of a $25 million per annum co-investment fund to operate in FY18-21, subject to maintenance of the current regulatory settings. This is part of a long term commitment to regional Australia to enhance and extend mobile coverage and stimulate infrastructure co-investment with stakeholders that is otherwise difficult to justify.

6.3. Ensuring the positive social and cultural impact of digital technology

[Reference discussion paper Question 22]

Technology has changed every aspect of our lives – how we work, learn, shop and connect with each other. At a time when climate change is accelerating, social inequity increasing, our ageing population is growing and there is persistent unemployment, there is an urgent opportunity to realise the potential of digital technologies to drive and scale solutions to tackle these challenges.

Emerging technologies such as blockchain, augmented and virtual reality, AI, robotics and the IoT, are offering exciting opportunities. Typically, when we talk about these trends, we talk to the exciting ways tech is transforming "us". However, technology itself is not destiny – humans shape their destiny. We believe Telstra plays a leadership role to ensure everyone has an opportunity to drive positive social and environmental outcomes through digital innovation. To do this, we are helping to build an innovation ecosystem that proactively supports Australians to "do digital better".

Telstra is a tech for good investor, we support purpose driven enterprises creating market ready solutions and non-profits using technology to drive positive social and environmental impacts.

In addition to our commercial technology investments supported through Telstra's muru-D accelerator and Gurrowa Labs, Telstra also invests in non-profit organisations wanting to explore, build and scale technology solutions to improve the health and wellbeing of young people. This unique investment program selects the best features of the accelerator model, and embeds them in a non-profit funding program. This is a first of its kind, custom designed for non-profits and free to all non-profit participants.

Central to the design of this work is the belief that unleashing creativity, experimentation and digital innovation in the non-profit sector will enable us to find solutions to some of our most pressing social challenges. Non-profits have the expertise and established relationships with the people they support. They also own a depth of data and insights to deliver the right solution.

This work has driven positive social outcomes to young people at high risk of ill mental health, living with disability, living in regional, rural and remote communities and young Indigenous Australians. We provide a mix of funding and in-kind support to scope, develop and scale digital products and services.

Our current social innovation projects include:

- ReachOut Australia and Orygen (National Centre of Excellence for Youth Mental Health) – we are investing in new ways to leverage technology to treat youth mental health, from awareness and prevention through to e-health tools for clinicians.
- Assistive Technology Australia – our funding is connecting people living with complex communication needs to life changing tech solutions.
- Remarkable (Cerebral Palsy Alliance) Foundation - we're backing new technologies to improve the wellbeing of people living with disability, including gamified wearable tech, robotics, the IoT, virtual and augmented reality.
- Technology solutions co-designed with remote Indigenous people living with terminal disabilities.
- Inclusion Rebooted Challenge – a Tech4Good accelerator and seed fund customised for non-profits partnership with Australia leading tech education campus.
- Imaginarium boot camps – innovation workshops for non-profits.
- An e-learning platform developed by the Fitzroy Academy.

In addition, we also recognise that as a tech leader, we have a role to be a trusted guide when it comes to supporting positive online behaviours. In addition to the work outlined in section 7.2.3, we also invest via the Telstra Foundation in digital citizenship programs designed to reinforce positive online behaviours in young people.

Our 2017 'Schoolyard to Screen' study found more than one in three (36 per cent) Australian teenagers have personally experienced cyberbullying. The study asked Australian parents to rank their biggest worries for their school-aged children. One in 10 parents told us they worried about their child smoking and drinking alcohol – while 15 per cent were concerned their child would take drugs. But 40 per cent said cyberbullying and bullying were their biggest worries.

We have funded PROJECT ROCKIT Online, a youth-designed digital classroom to tackle cyberbullying, designed for students living in regional and remote areas that may not be able to access face to face cyber safety workshops. An Australian first, the online program developed by PROJECT ROCKIT targets school students in years 7 to 9 to take action on cyberbullying and online safety. This youth-led and designed program comprises three 20-minute digital workshops and was launched in February 2017. 98 per cent of young people who completed the digital program said they were more confident they could stand up to bullying. Scaling the program into schools is the next area of opportunity.

Our eSmart Libraries partnership with Alannah & Madeline Foundation also tackles cyber safety, equipping public libraries and connecting library users with the skills they need for smart, safe and responsible use of technology. Sixty-seven per cent of public libraries across Australia (49 per cent in regional locations) have taken up our offer of free training and signed on to be an eSmart Library. An

external evaluation survey found that 100 per cent of library managers said eSmart had made a difference to cyber safety and the management of cyberbullying in their library.

6.3.1. Responsible innovation

How we do business is important to us. We are committed to acting responsibly and being transparent and accountable, wherever we operate. A growing challenge is that the expectations – social, economic and environmental – that our employees, customers, investors, regulators and the community place on us continue to change. This is partly driven by an unprecedented world of technology innovation and digital disruption, but also by pressing social issues and growing environmental challenges. We recognise that the long-term performance and sustainability of our company depends on how we respond to these changing expectations, not just within our own operations but into our supply chain and relationships with our business partners.

Our innovation agenda, like all that we do, is guided by our responsible business commitments including:

- Ethics, values and governance;
- Protecting our customers' data and privacy;
- Managing our supply chain;
- Human rights;
- Product responsibility; and
- Social and environmental innovation.

6.3.2. Principles of universal design

Telstra's Tech4Good program is guided by a set of principles that also reflect Telstra's commitment to universal design, diversity, inclusion and accessibility commitments, and our agile approach.

We believe that true diversity can be achieved if we give everyone a voice in a connected future, so they can be part of shaping our future with technology. To guide this work, all Telstra's social innovation investment is developed using the following eight principles:

1. We design with and for the user(s)

- Understand user(s) needs. Research to develop a deep knowledge of who the service users are, their context, and what that means for the design of the service, including gender and cultural bias).
- Consider and include all user groups in planning, development, implementation and assessment (e.g. teachers and students in an education setting).
- Create a service that is simple and intuitive enough that users succeed first time, ensuring solutions are sensitive to, and useful for, often marginalised user groups (e.g. people with a disability and English as a second language).

2. We remember it's not just about technology

- Tech4Good initiatives recognise that digital technology is a means not a strategy, so have a clear purpose and vision for your initiative that aligns with your organisational objective.
- Build the initiative around a multidisciplinary group of motivated people, who are given the support they need.

3.We build incrementally and test often

- Build iteratively, being informed by ongoing user research and usability testing to continuously seek feedback from users to improve the service.

- Respond to change, rather than follow a plan by developing in modular ways, favouring approaches that are interoperable over those that are monolithic by design.
- Test often and test early, starting with low fidelity prototypes.
- Be able to test the end-to-end service in an environment identical to that of the live version, including on all common browsers and devices, and using dummy accounts and a representative sample of users.

4. We collaborate, reuse and improve

- Engage diverse expertise across disciplines and industries at all stages, and work across sector silos to create coordinated and more holistic approaches.
- Go where your users are. Where possible use, modify and extend existing tools, platforms and frameworks.
- Document work, results, processes and best practices and share them widely.
- Participate in networks and communities of like-minded practitioners.
- Use and expand open standards and common platforms where available, and publish materials under a Creative Commons license (or have a strong rationale if another licensing approach is taken).
- Invest in software as a public good.
- Ensure equity and fairness in co-creation, and protect the best interests of the end-users.

5. We design for scale

- Design for scale from the start, and assess and mitigate dependencies that might limit ability to scale.
- Demonstrate impact before scaling a solution.
- Be replicable and customisable in other locations or contexts.
- Analyse all technology choices through the lens of national and regional scale.
- Factor in partnerships for scale from the beginning and start early negotiations.

6. We build for sustainability

- Design solutions that learn from and enhance existing services and plan for organisational adaptation.
- Put in place a sustainable multidisciplinary team that can design, (potentially) build, operate, monitor and support the service.
- Build a service that can be iterated and improved on a frequent basis and make sure that you have the capacity, resources and technical flexibility to do so.
- Evaluate what tools and systems will be used to build, host, operate and measure the service, and how to procure them.
- Utilise and invest in partnerships for support and help catalyse their growth.

7. We are data driven

- Design projects so that impact can be measured at discrete milestones with a focus on outcomes rather than outputs.
- Identify performance indicators for the service and establish a benchmark or goal for each metric. Use this data to analyse the success of the service and to translate this into features and tasks for the next phase of development.

8. We address privacy and security

- Evaluate what user data and information the digital service will be providing or storing, and address the security level, legal responsibilities, privacy issues and risks associated with the service (consulting with experts where appropriate).
- Assess and mitigate risks to the security of users and their data.

6.3.3. Government investment into e-safety

Telstra is deeply invested in helping communities to be safe, smart and responsible with technology, an investment that extends beyond our cyber safety/parental controls products, services and campaigns.

Through the Telstra Foundation, we make significant investments to equip communities and schools with the skills they need to be smart safe and responsible online hubs. We also invest in digital tools and workshops to assist young people to stand up to bullying.

We are keen to explore how we could collaborate with government to help scale the work of PROJECT ROCKIT ONLINE across the secondary education system.

PROJECT ROCKIT has developed an innovative and cost effective digital product for schools to access curriculum aligned lessons designed to encourage positive online behaviours. Youth-led and co-designed, this digital classroom was developed for students living in regional and remote areas that may not be able to access face to face cyber safety workshops.

Given the increased rate of bullying in remote and regional areas, there is great demand for quality, evidence-led and effective ways to tackle this social challenge. We believe technology based solutions like PROJECT ROCKIT ONLINE could play a greater role in filling this gap. We would be keen to explore co-investment strategies to expand the digital classroom in addition to support that could help PROJECT ROCKIT lift their visibility across Australia.

PROJECT ROCKIT is a social enterprise co-founded by thought leaders Lucy and Rosie Thomas. The team currently receives valuable mentoring and support from the eSafety Commissioner who sits on their Board of Advisors.

6.3.4. Embedding sustainable development goals

The UN Sustainable Development Goals (SDGs) outline critical ambitions, at a critical time. They offer business a common framework for considering and addressing the world's most significant development challenges. Now launched, the SDG compass will assist businesses to identify the role they can play in driving the innovative change required to turn these goals into reality.

It is clear that technology, as a key enabler, will have a central role to play in the achievement of the SDGs. It has been pleasing to discover the close alignment between the SDGs and some of Telstra's core sustainability programs, including our Reconciliation Action Plan (RAP).

The centrepiece of our RAP is a $30 million co-investment with the Northern Territory Government to deliver new mobile and broadband services for remote communities. This investment will help to achieve Goal 9: build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation; and by keeping people connected will also help to achieve many others, such as ensuring inclusive and equitable quality education (Goal 4).

Telstra has also partnered with the Northern Territory Government to build a National Telehealth Connection Service, including quality and secure video conferencing to bring specialist medical care to some of Australia's most remote communities. This initiative will help to achieve Goal 3: promote healthy lives and promote well-being for all at all ages.

Through inclusive, proactive recruitment, such as our aim to double the number of Aboriginal and Torres Strait Islander employees at Telstra, over a three year period, we'll help to achieve Goal 8: to promote

sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.