Deloitte.

Mobile Nation 2019

The 5G future

Australian Mobile Telecommunications Association

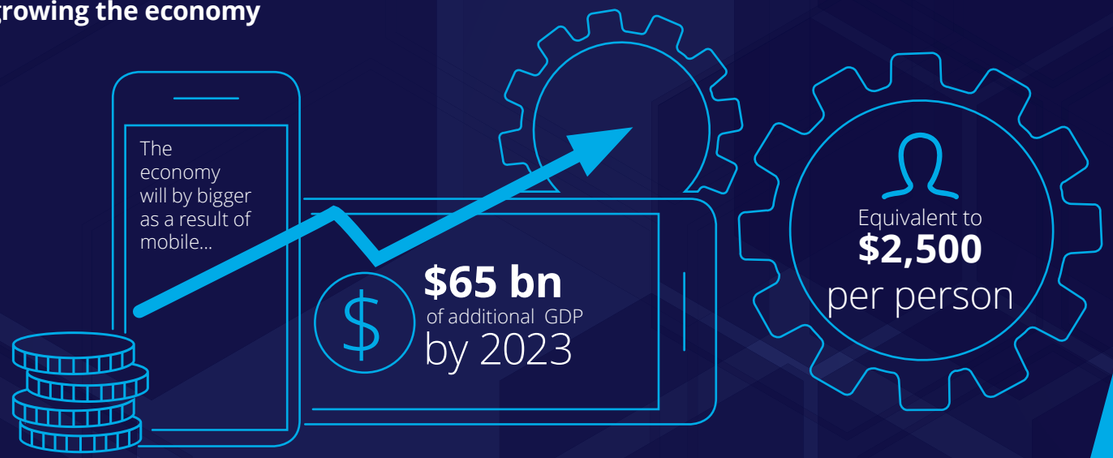
Deloitte Access Economics

Contents

Executive summary

Productivity

Mobile boosts productivity, growing the economy



Economy

The mobile telecommunications industry generates value added and supports employment

$23 bn
in value add

116,000
jobs
supported

Social

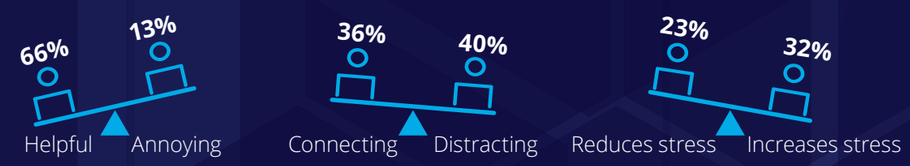
Mobile is an important tool in everyday life

94% take their devices when they leave the house

82% call their family & friends at least once a week

71% feel safer with their device

But attitudes are mixed...



Business

Mobile enables a range of technologies for businesses

Autonomous vehicles

Mobile payments

IoT

Drones

Executive summary

For many Australians, mobile devices are a necessity. It is the first thing we pick up when we leave the house; 94% of us take our mobile device when we go out, more than the proportion who take their wallet (92%) and house keys (88%).

Nearly nine out of every ten Australians own a smartphone (Deloitte, 2017). We spend on average three hours every day on our devices – connecting with family and friends, playing and working (Deloitte, 2018a).

Mobiles have become ubiquitous because of the value that they provide to us as individuals. They are key to how we communicate with loved ones, entertain ourselves, keep safe and manage our responsibilities. However, as with technologies before, mobile has also come with its own social challenges. How we choose to use – and not use – our devices is critical.

Beyond the social dimension, mobile supports a range of benefits for our economy. The industry itself makes a significant contribution to GDP and employment. However, the full benefits of mobile are much broader. It continues to provide new pathways for businesses to create value, supports productivity, and even helps people to join the labour force.

This year, we will see carriers starting to roll out 5G, the next wave of mobile technology. In this report, we look forward, rather than back, to consider the implications of our Mobile Nation – for our businesses, economy and society.

Economic benefits

The mobile industry itself makes a significant contribution to the economy. We estimate that the industry contributes **$22.9 billion to value added,** including $14.7 billion of indirect activity across the rest of the economy. It also supports over **116,000 employees,** with 3.7 full-time equivalent roles supported in the economy for every one person directly employed in the industry.

However, the most significant economic benefit of mobile is in how it contributes to productivity. For the first time, this report looks forward to what the economic benefits of mobile might be in the future. We estimate that by 2023 mobile will be worth **$65 billion to the Australian economy** (in 2016-17 dollars) – 3.1% of GDP. This is equivalent to approximately $2,500 for every Australian. By way of comparison, this is larger than the entire contribution of the agricultural industry to Australia (ABS, 2018a). It is also larger than the productivity impacts resulting from major economic reforms, like the National Competition Policy.

The productivity impacts of mobile have only increased over time. The previous Mobile Nation report found that the Australian economy was $34 billion larger as a result of productivity gains from mobile (Deloitte Access Economics, 2016). And recent research from the Bureau of Communications Research (2018) has suggested that the productivity impacts of 5G alone could be worth between $1,300 and $2,000 in additional GDP per person by 2030.

Mobile in business

Mobile devices enable a range of business benefits, from efficiency and the ability to work on-the-go to creating completely new products and markets.

5G, in particular, is likely to enable new opportunities for business. Greater reliability and capacity, coupled with lower latency, means that 5G networks will be the critical infrastructure supporting a range of emerging technologies, including broader rollouts of the internet of things, autonomous vehicles and augmented/virtual reality.

But businesses do not have to be on the frontier of technology to benefit. Mobile payments and video conferencing are two examples of low-cost mobile solutions that can support business growth and efficiency and are already provided by existing 4G networks.

Key social impacts of mobiles

- 60% of Australian households have replaced at least three other items with their phone – like phone books, home phones and cameras.
- But this has come with increasing use; 48% of Australians say they check their mobile at least once every 30 minutes. As a result, around half are concerned that they might be over-reliant on their devices.
- Yet the primary drivers of this behaviour are simply because people find their phone convenient (84%) and engaging (69%), rather than feeling pressured to be on their phone.

Implications for society

Mobiles are the modern day Swiss Army knife. They are an essential utility.

As Kranzberg's first law of technology states, "technology is neither good nor bad; nor is it neutral" (Kranzberg, 1986). Individuals and families face choices around how to use – and not use – their mobiles.

To understand these choices, we conducted a bespoke survey of more than 1,000 Australians aged 14 and over to understand our attitudes and behaviours when it comes to mobile.

Overall, most see mobile as a net benefit, helping to connect us with others. **Two-thirds of Australians say that their mobile is helpful, and 48% say that it provides freedom.**

Young Australians, however, are more concerned about their phone use. Over three-quarters of 14 to 17 year olds think they use their mobile too much. And while 61% of 18 to 24 year olds say they are trying to limit their phone use, only 24% are doing so successfully (Deloitte, 2018a).

Mobiles help us to feel safe. Just over 80% of survey respondents say that their mobile gives them peace of mind, knowing that they are accessible in case of an emergency. However, many Australians are also concerned about some of the safety risks posed by mobiles – in particular, data security (87%) and distracted driving (82%).

Ultimately, mobile is still primarily a tool that we use to connect. Around eight in every ten Australians use their phone to connect with friends and family at least once a week. Yet our most frequent means of communication is still in person. Just under half of Australians talk to friends and family face to face at least once a day. Ultimately, we can each decide how we interact, with our phones and with each other.

Introduction

75%

Fall in the price of data in phone plans between 2017 and 2019

21%

Increase in average download speeds between 2016 and 2017

5G

will be rolled out in 2019, complementing the 4G network and bringing faster speeds, better reliability and improved capacity

1 Introduction

Mobile technologies are embedded in everyday life. Today, 89% of Australians own a smartphone (Deloitte, 2018a), and the average Australian spends three hours every day using their smartphone - working, playing, connecting with family and friends (Deloitte, 2018a). Australians also increasingly use smartphones for entertainment. Almost a quarter of smartphone users watch live TV on their phones at least once a week, and 23% stream film/TV series weekly (Deloitte, 2018a).

Mobile devices are also a vital tool for businesses and government. More than half of businesses report that mobile internet is important "to a major extent" for their activities (ABS, 2017a).

The technology continues to evolve quickly. Today smartphones are able to recognise fingerprints and voices, monitor heart rates, and even project augmented reality. And with the development of exponential technologies such as the internet of things (IoT), driverless cars, drones and virtual reality, mobile is increasingly becoming an integral part of society.

The rapid adoption and evolution of mobile technologies comes with new challenges. There is ongoing debate about the possible overuse of mobile devices, particularly among young people, and the extent to which these devices connect us versus distract us. As a nation, we need to think carefully about how to manage these social issues.

In this context, the Australian Mobile and Telecommunications Association (AMTA) has commissioned Deloitte Access Economics to undertake research on the value of mobile to our economy, its use in business, and its social impacts.

Mobile

Throughout this report, we use 'mobile' not as an adjective, but as a noun to refer to devices such as smartphones, tablets and laptops that connect to the internet directly, through the mobile network, for example using a SIM card or dongle.

Many devices can seamlessly transition between mobile and fixed networks; from 4G to Wi-Fi. It can be difficult to disentangle when devices are using which network. As such, we look holistically at devices that connect to the mobile network, as well as the mobile networks themselves.

1.1 The mobile ecosystem

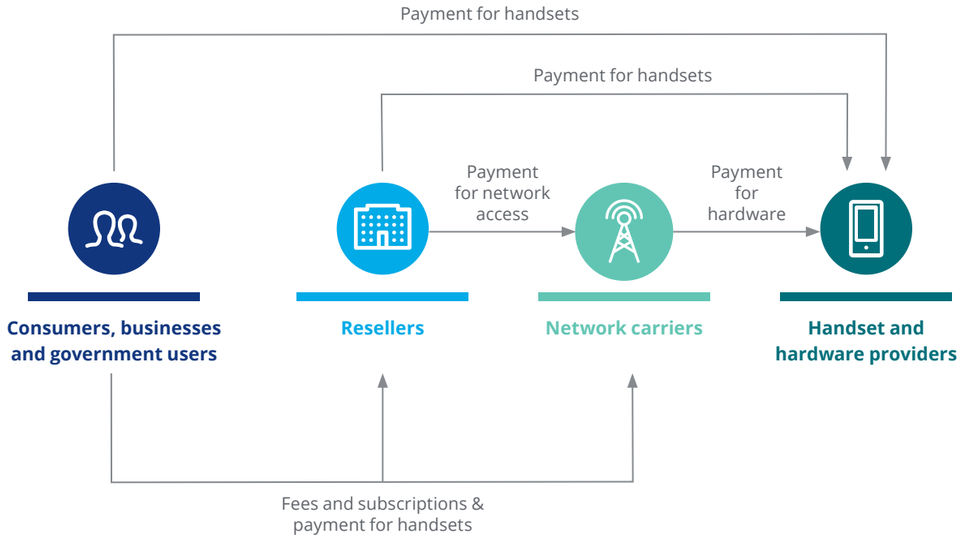
When most people hear 'mobile', they tend to think of smartphones and feature phones. These devices are common - there are an estimated 17.9 million smartphones in Australia (Statista, 2019). However, many other devices use the mobile telecommunications network including tablets and laptops, wearables and other (IoT) devices.

Mobile devices are connected by infrastructure and services. In Australia, a range of businesses provide this infrastructure and services, including:

- **Mobile network operators –** businesses that own, operate and maintain the wireless infrastructure that enables voice and data services
- **Mobile virtual network operators (MVNOs) –** businesses that provide mobile telecommunication services through networks owned by network carriers
- **Handset and hardware wholesalers and retailers –** businesses that sell physical mobile devices, and/or the infrastructure that is used to build the mobile network.

The connections between these parts of the industry are pictured in Figure 1.1.

Figure 1.1: Relationship between participants in the mobile telecommunications industry



Source: Deloitte Access Economics

Collectively, we refer to these businesses as the mobile industry.

Over time, the participants in the industry have been relatively stable, and recent government policy announcements have impacted the supply chain handset and hardware wholesalers.[1] Continued competitive pressure in the industry has seen improvements in customer outcomes such as falling prices and increasing coverage.

[1] See Australian Government press release 23 August 2018 'Government Provides 5G Security Guidance To Australian Carriers', https://www.minister.communications.gov.au/minister/mitch-fifield/news/government-provides-5g-security-guidance-australian-carriers

1.2 5G – the next step

We are now heading into the fifth decade of mobile technology, and 5G is the latest development (Figure 1.2). 5G networks will complement existing 4G networks to deliver faster speeds, better reliability and improved capacity. The mobile industry internationally is continuing to develop and agree on the technical specifications for these networks, and all major carriers have announced that they will begin deploying 5G networks in 2019.

As part of the 5G rollout, 'small cells' (low powered mobile base stations) will become increasingly common in suburbs around Australia. Small cells use less power, and produce less electromagnetic energy (EME). Even when they operate at maximum power, small cell emissions are within safe levels, in line with Australian Government requirements.[2]

The Australian Government has acknowledged the important role that mobile, and 5G specifically, will play in Australia's digital economy. To support this agenda, the Government has established a 5G working group, consisting of industry bodies and key industry players along with government departments to coordinate Australia's implementation of 5G networks (Department of Communications and the Arts, 2017).

In announcing the establishment of the working group, the Government (2017) noted, "5G is more than an incremental change for mobile communications. Rather, it will enable the next wave of productivity and innovation across different sectors of the Australian economy."

Given these expected benefits, 5G has fuelled a global race to be a first-adopter country and gain competitive advantage (Deloitte, 2018b). Investment in wireless telecommunications infrastructure in China and other countries has outpaced the US, but the US is now pushing hard in its 5G deployment plans.

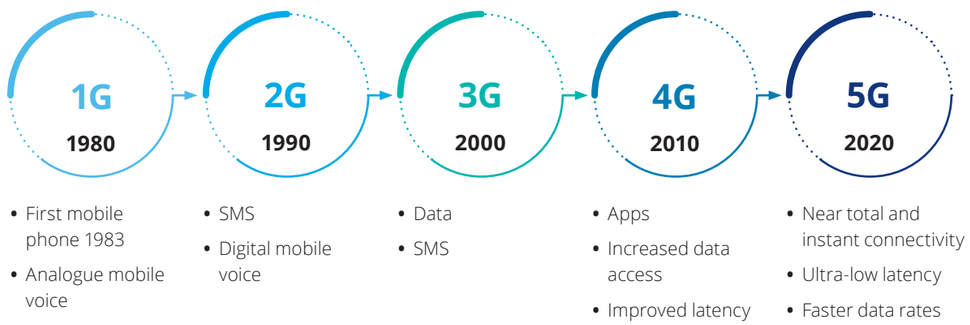
Technology, media and telecommunications predictions

Each year Deloitte conducts a global survey and produces predictions about the future of the technology, media and telecommunications ecosystem. The rollout of 5G in the coming years drives many of the predictions for 2019:

- Australia leads the way in 5G handset sales - Australia's infrastructure readiness means that we will see a disproportionate share of global 5G handset sales, possibly 50,000 units in 2019.
- MVNOs join the 5G race - mobile virtual network operators will join the race to win business through partnerships, acquisitions and mergers.
- Hotspots and 5G mobile hubs - commercial launches of 5G mobile hubs will help people connect. Telstra has already built the first hub, making it available for customers in 2019.
- Small cells become the norm - 5G will rely on small cells in high density areas. While the global small cell market was worth $2 billion in 2014, it will reach $10 billion in 2019.

Source: Deloitte (2019)

Figure 1.2: The evolution of mobile networks



Source: Deloitte Access Economics

[2] For more information on small cells and EME exposure, see the ACMA factsheet: https://www.acma.gov.au/theACMA/a-guide-to-small-cells

Businesses are also anticipating the efficiency and productivity improvements of the 5G network. A survey of 550 Australian business leaders in 2018 found that over two-thirds (69%) of employing businesses expect to be using 5G before the end of 2020 (Deloitte, 2018c).

As the next generation of mobile networks, 5G will more than upgrade existing systems. It will complement the broader network ecosystem and work with the latest mobile networks and broadband infrastructure to create more seamless connectivity (Deloitte Access Economics, 2017a).

1.3 Telecommunications regulation

The telecommunications sector is co-regulated by government and industry. Legislation such as the Telecommunications Act 1997 (Australian Government, 1997), the Radiocommunications Act 1992 (Australian Government, 1992) and the Australian Consumer Law[3] form the regulatory base for the industry. In addition, telecommunications providers comply with a range of co-regulatory instruments and codes.

A number of regulators and non-government bodies are responsible for developing, setting, enforcing and administering these codes, including:

- Australian Competition and Consumer Commission
- Australian Communications and Media Authority
- Telecommunications Industry Ombudsman
- Communications Alliance
- Australian Mobile Telecommunications Association.

Regulation of telecommunications seeks to support innovation and new technology, as well as protect consumers. This is reflected in the varying goals of regulatory bodies; for example:

- The Telecommunications Industry Ombudsman has a mandate to independently resolve disputes for telephone and internet complaints (Telecommunications Industry Ombudsman, 2019)
- The Australian Communications and Media Authority's charter is to protect customers, promote competition, and manage spectrum in broadcasting, the internet and telecommunications (Australian Communications and Media Authority, 2012)
- The eSafety Commissioner fosters online safety across government, industry and the not-for-profit community (Office of the eSafety Commissioner, 2019).

Government has been working closely with the industry to achieve a better telecommunications regulatory landscape. For example, the 5G Working Group brings together government and industry representatives to foster the deployment of 5G in Australia (Department of Communications and the Arts, 2017).

An effective regulatory landscape will be important to supporting the industry investment required to promptly realise the full benefits of mobile technology, including comprehensive 5G, across Australia's economy and society. Specifically, having a flexible and robust framework to enable next generation infrastructure deployment, as well as flexibility and certainty in licensing, will be crucial.

These priorities are reflected in the Government's 5G Directions paper (2017) which identified "immediate actions" as:

- making spectrum available in a timely manner
- actively engaging in international standardisation
- streamlining arrangements to allow mobile carriers to deploy infrastructure more quickly and at lower cost
- reviewing existing telecommunications regulatory arrangements to ensure they are fit for the 5G era.

1.4 This report

When the Mobile Nation series began, it explored the implications of texting and discussed a small new opportunity to extend fixed line services.

Today, we are truly a mobile nation. As mobile technology has expanded and improved, from voice and text to 4G and beyond, we have examined the increasingly broad and wide-ranging benefits, from innovation and m-commerce to productivity and workforce participation.

This edition of Mobile Nation focuses on the significance of the telecommunications industry to the economy, the productivity benefits of mobile technology and the social effects of mobile.

The report uses econometric modelling to estimate how the mobile industry contributes to the economy, both through its own activity and by fostering productivity more broadly. It relies on case studies from businesses and a bespoke survey of 1,000 individuals to gauge the social impacts of mobile.

[3] The relevant legislation for the telecommunications industry is listed on the website of the Department of Communications and the Arts Law (2019), at: http://consumerlaw.gov.au/other-consumer-protections/national/

A significant sector

$22.9 bn

in value-added

$25.2 bn

in revenue

116,100

full time equivalent jobs supported

2 A significant sector

The mobile sector is an integral part of the broader telecommunications industry. It is a significant component of the critical infrastructure that facilitates our ability to connect, work and transact. It plays an increasingly important role in the broader telecommunications ecosystem.

Mobile services' share of the telecommunications industry has increased rapidly in the past five years in revenue terms. In fact, it is expected to account for 64% of telecommunications service providers' revenue in 2018-19 (IBISWorld, 2018).

The economic contribution of the mobile telecommunications industry includes its value added, as well as the employment the industry supports in the Australian economy.

Value added measures the value of goods and services produced by an industry's factors of production (i.e. labour and capital) measured by the income of those factors of production (wages and gross operating surplus). The sum of value added across all industries in the economy is equal to Gross Domestic Product (GDP).

The value added for the industry comprises two components:

- Direct value added captures the wages and gross operating surplus of the mobile telecommunications industry.
- Indirect value added captures the flow on economic activity associated with purchases of intermediate goods and services by the industry.

Further details on the methodology used to estimate the economic contribution are in Appendix B.

For the purposes of this economic contribution, the scope of the mobile industry includes network carriers and mobile resellers. The mobile handset industry is an important contributor to value added and employment in Australia for the mobile sector; however, a lack of data means that this industry segment has not been included in the economic contribution.

Key findings

The mobile telecommunications industry earned an estimated total revenue of $25.2 billion in 2017-18.

The total value added to Australia's GDP by the industry was $22.9 billion in 2017-18. This figure includes $8.2 billion supported through the mobile industry's direct activities, as well as $14.7 billion supported through indirect activity in related sectors and across the economy.

In total, the industry supported around 116,100 full time equivalent (FTE) employees, with almost 25,000 FTE staff directly employed. This means that for every FTE employed in mobile telecommunications, there were around 3.7 other FTE roles supported elsewhere in the economy.

We estimate that the mobile telecommunications industry supported **$22.9 billion of economic activity** in 2017-18, as shown in Table 2.1.

The mobile industry directly contributed $8.2 billion to the economy in 2017-18. Carriers have the largest share of direct contribution (98%) with the remainder made up from resellers.

The industry also directly employed almost 25,000 FTE people in 2017-18. The majority of those employed work for network carriers (89%).

The indirect contribution of the mobile telecommunications industry stems from purchases and flow-on activity generated in other sectors. For example, this includes spending on physical devices and construction services for telecommunications infrastructure.

The intermediate inputs purchased by network carriers and constitutes revenue and employment for these sectors in the economy. The sum of this additional economic activity is the indirect contribution.

In 2017-18, this indirect value added equated to $14.7 billion of economic activity in Australia.

Through its demand for services and production of goods, the industry supported 91,190 FTE jobs in other sectors of the economy in 2017-18. This means that **for every FTE role employed in the mobile telecommunications industry, there are 3.7 employed in flow-on industries.**

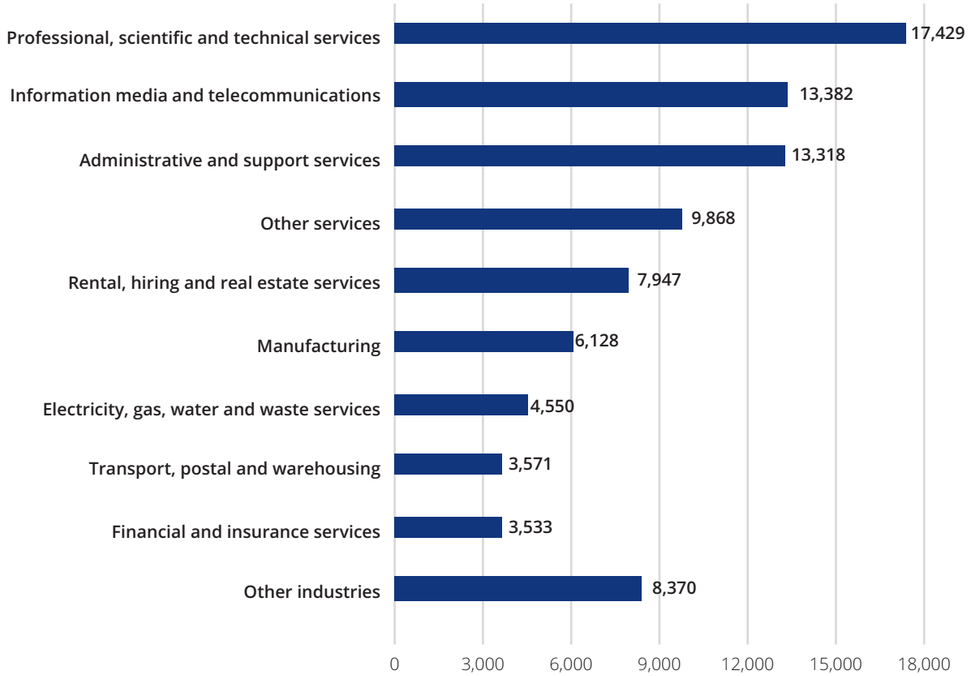
The high volume of jobs created showcases that while mobile telecommunications is capital intensive as an industry, it creates many more jobs in other sectors of the economy, such as in electrical equipment manufacturing and energy providers.

Chart 2.1 shows that mobile industry supports many FTE roles in high value added industries. For instance, it supports 17,000 roles in professional, scientific and technical services, and 6,000 in the manufacturing industry. Industry activity also generates over 13,000 FTE roles in administrative and support services industries.

Table 2.1: Total economic contribution, 2017-18

	Direct	Indirect	Total
Value added ($ million), Including:	8,221	14,713	**22,934**
Gross operating surplus ($ million)	6,192	11,087	**17,279**
Labour income ($ million)	2,029	3,626	**5,655**
Employment (full time equivalent)	24,924	91,190	**116,115**

Chart 2.1: FTE roles supported through mobile, by industry



Source: Deloitte Access Economics using industry and IBISWorld data

2.1 A bigger economic footprint

Previous economic contribution modelling undertaken by Deloitte Access Economics (2013) estimated that the total size of the mobile telecommunication industry was $14.1 billion in 2011-12. While some methodology changes prevent direct comparison with the latest estimate, for an indication of the magnitude, the value added of the mobile industry was $22.9 billion in 2017-18, 43% higher than six years earlier.

This significant growth is indicative of Australia's strong take-up of mobile. In fact, for the last four years Australia topped the global ranking for most mobile connected nation - scoring particularly highly on infrastructure and consumer readiness pillars (GSMA, 2018).

The industry's growth is a result of a mixture of three factors:

1. Mobile revenue is 15% higher since the last economic contribution was calculated five years ago.
2. The industry's structure is changing. A larger share of activities are subcontracted or purchased by the industry.[4] This indicates that the industry is having a relatively larger indirect effect on the Australian economy.
3. The 2011-12 economic contribution used the telecommunications input-output tables to estimate the expenses for the mobile sector. This year's economic contribution uses IBISWorld data because it has more information about network carriers and resellers expenses.

Another contributor to the growth in mobile has been high productivity in the telecommunications sector, which has enabled better outcomes for consumers.

One measure of productivity is labour productivity. Labour productivity is the volume of output produced per unit of labour used and measures the efficiency of labour. The telecommunications industry recorded an average annual growth rate of 4% in labour productivity between 2007 and 2015 – the second highest growth rate of all 16 Australian industries (Productivity Commission, 2017). During this period, the industry rate of growth in labour productivity was nearly three times greater than the increase in labour productivity in the Australian economy.

Another measure of productivity is multi-factor productivity: the output produced per unit of combined input from both labour and capital. This measures how efficiently both labour and capital inputs are used, rather than growth due to increasing the quantity of labour and capital. Multi-factor productivity in the telecommunication industry grew by 1.2% annually between 2007 to 2015, the fourth highest rate of increase of all 16 other Australian industries (Productivity Commission, 2017).

While the industry's contribution to the economy has grown, profitability in the telecommunications industry has been declining for the last five years (IBISWorld, 2018). Competition within the industry is driving investment and delivering value for customers. For instance, **the price of data has fallen 75% in phone plans over from 2017 to 2019** (Aitken, 2019), **and average download speeds increased by 21.2% from 2016 to 2017** (Speedtest, 2018).

[4] The ratio of the industry expenditure to wages in the sector has doubled since the previous economic contribution.

The mobile economy

$65 bn

in productivity value
to Australia's economy
by 2023

$2,500

of value for each
Australian

3 The mobile economy

The true economic benefits of mobile stretch far beyond the direct activities of the sector. Mobile has been integral to supporting productivity and participation in the economy, resulting in increased GDP. The benefits of mobile will continue to increase; 5G alone is estimated to be worth between $1,300 and $2,000 in additional GDP per person by 2030 (Bureau of Communications and Arts Research, 2018).

For the first time, this report looks forwards to what the economic benefits of mobile might be in the future.

3.1 The productivity impact of mobile on the Australia economy

Beyond the value added and employment contribution of the telecommunications sector, mobile technologies drive productivity throughout the economy.

Australia has experienced a decline in both labour and multi-factor productivity (MFP) over the last decade. Recent ABS data indicates that multi-factor productivity growth in 2017-18 was the lowest in five years, with annual MFP growth of 0.5% (ABS, 2018b).

One way to improve productivity is through technological enhancements. Mobile technology contributes to labour and capital productivity, by increasing the effectiveness or the efficiency of both inputs (Figure 3.1).

Of course, productivity is only one measure of economic welfare. It does not capture all the benefits of mobile. For example, it may not capture the social welfare benefits to consumers associated with the convenience and multi-purpose functionality of mobiles, or participation.

Key findings

We forecast that **by 2023 mobile will be worth $65 billion to the Australian economy** (in 2016-17 dollars) – 3.1% of GDP. This is equivalent to approximately **$2,500 for every Australian.** By way of comparison, this is larger than the entire contribution of the agricultural industry to Australia today (ABS, 2018a). It is also larger than the productivity impacts resulting from major economic reforms, like the National Competition Policy.

The productivity impacts of mobile have increased over time. The previous Mobile Nation report found that the Australian economy was $34 billion larger in 2014 as a result of productivity gains from mobile (Deloitte Access Economics, 2016) – meaning benefits will be almost twice as big in less than a decade.

Figure 3.1: Labour and capital productivity gains from mobile devices

Mobile technologies boost labour productivity through a number of mechanisms. For example, mobile:

- allows workers to access information quickly and easily, thereby increasing the effectiveness of workers
- increases efficiency by enabling workers to utilise mobile devices while commuting, as this translates to time savings (Section 5.4 further explores the flexibility benefits of using mobiles to work outside the main office)
- introduces more efficient corporate systems, such as enterprise apps, which can measure employee hours, promote collaboration, or synthesise information systems. Using data from over 35,000 users of its app building platform, Fliplet found that an average of 10.6 apps were created per business in 2016, up from 4.7 in 2015 (Fliplet, 2017).[5]

Mobile can also lead to improvements in capital productivity, for example by:

- enabling teleworking
- reducing the need for equipment and office space
- improving communication between managers, employees and customers.

Mobile technologies, and digital technologies more broadly, create spillover effects such as increased competition, which in turn boosts productivity (Qu, Simes, & O'Mahony, 2016). For example, the retail market has become more competitive with the increased popularity of online shopping (Sims, 2016). Greater competition leads to higher productivity, by stimulating innovation and driving more efficient use of resources (New Zealand Productivity Commission, 2014).

CASE STUDY

WISE Employment

WISE Employment is a non-profit company that delivers employment services to disadvantaged people.

After finding its manual systems and processes time consuming and unreliable, WISE Employment made the decision to move to mobile devices and digital technologies. They equipped staff with mobile phones and laptops and started using mobile connected routers and office equipment.

The fully mobile solution provided staff with a consistent user experience, regardless of whether they were in the office or out with a client. Mobile connected office equipment allowed WISE to establish new offices or relocate very quickly, without the need for on-site technical support. Overall, staff productivity increased 25 per cent, staff morale lifted and clients were happier.

CIO Michael Havill says "we've gone from being 95 per cent available to our clients to 99.9 per cent, while reducing costs and improving services."

Source: Telstra (2019)

[5] Fliplet (2017) also found that a company's labour force contributes an extra 240 hours per year when using enterprise mobile apps.

3.2 Translating mobile advances into productivity growth

In the past, the economic benefits of technological advancements have not been easy to measure.

However, as digital technologies become more widely adopted across firms and industries, the visibility of technology-related productivity enhancements also increases (Weir, 2018). The advancement of digital technologies throughout the economy, not just in ICT intensive sectors, has made it easier to measure the impact of technology on productivity (Qu, Simes, & O'Mahony, 2016).

The productivity benefits of mobile (and other technologies) are now well established. Successive generations of Mobile Nation have illustrated the continued contribution of mobile technologies to the economy, indicating that as the technology evolves, so too does its economic impact.

In the lead-up to the deployment of 5G technology in Australia, other government and industry bodies have focused their attention on its expected impact on productivity. For example, the Bureau of Communications and Arts Research (2018) anticipates a boost in income per capita of between $1,300 to $2,000 after the first decade of the 5G rollout.

The last edition of Mobile Nation focused on the holistic impact of mobile technology on productivity, rather than the impact of one generation of mobile technology, by estimating the effect of mobile penetration on GDP per capita. It found that the take-up of mobile technology boosted the Australian economy in 2015 by 2.04%, or $34 billion, as a result of long-term productivity impacts (Deloitte Access Economics, 2016).

"You can see the computer age everywhere but in the productivity statistics"

– Robert Solow (1987)

3.3 Econometric modelling and forecast

With 5G set to complement existing networks, and the adoption and benefits continuing to grow, the economic and productivity benefits of mobile are continuing to emerge.

What can we expect from the coming years?

For the first time, this report looks forward to forecast the total benefits of mobile.

We find that, between 2005 and 2023, mobile will increase Australia's steady state GDP per capita by 3.1%. This means that the adoption of **mobile technology will add an additional $65 billion (real GDP, in 2016-17 dollars) in 2023 to the Australian economy,** and this will continue to grow. By way of comparison, the agricultural industry contributes 2.8% of GDP (as measured by gross value added) to Australia today (ABS, 2018c).

Of course, this is only one part of the broader digital story. But our estimate of the productivity impact of mobile is separate from the estimated impacts of fixed telecommunications.

To forecast the productivity impacts of mobile, we combined updates of our previous econometric modelling with digital industry forecasts to estimate the effect of the take-up of digital technology on GDP per capita. This, combined with IBISWorld industry revenue data, Cisco's VNI index forecasts and Nielson's digital screen time forecast data, is used to predict the current and future contribution of mobile technology to GDP per capita.

The contribution of mobile technology is computed indirectly as a share of forecast total digital contribution, based on a composite measure of the share of digital revenue, traffic and use attributable to mobile. A more in-depth discussion of model specification, choice of variables and forecast methodology is available in Appendix C.

It is important to note the limitations of this modelling when interpreting these results. Chiefly, the approach relies on proxies for the entire contribution of digital technologies to GDP per capita, namely mobile cellular penetration, fixed broadband penetration and percentage of the population with internet access. It also relies on proxies for the contribution of mobile technology to the digital economy.

We also cannot explicitly include growth areas of mobile technology, such as IoT, in our index, due to data limitations. However, the proxies are intended to capture all elements of the digital economy, and the results reflect mobile's share of digital technology driving productivity across the economy.

Business impacts

Collaborative apps

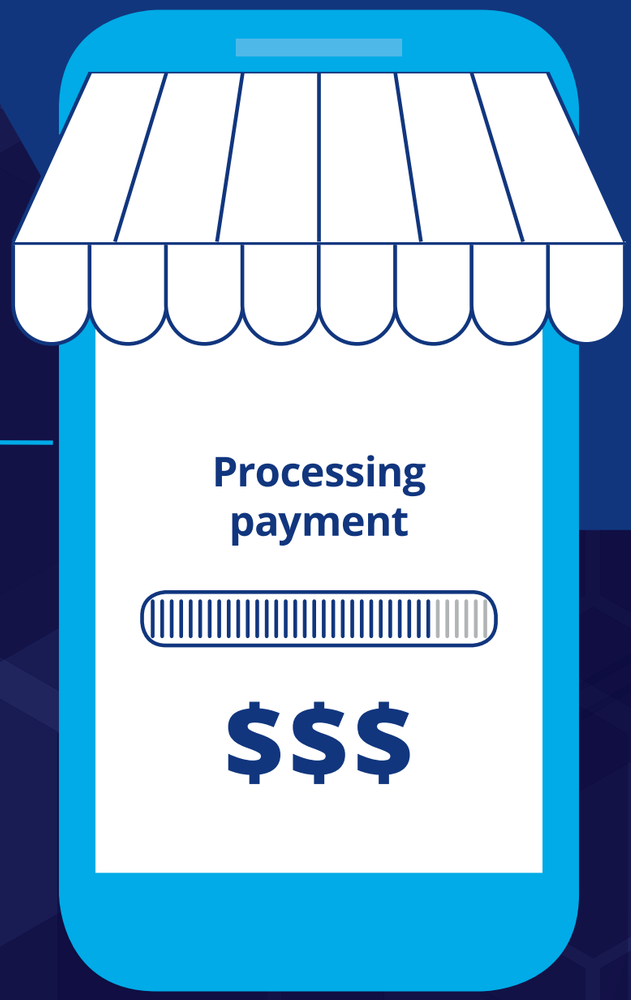
allow agribusinesses to share up to date information about climate conditions and prepare for weather

Mobile payments

make transactions easier for small businesses

IoT smart trackers

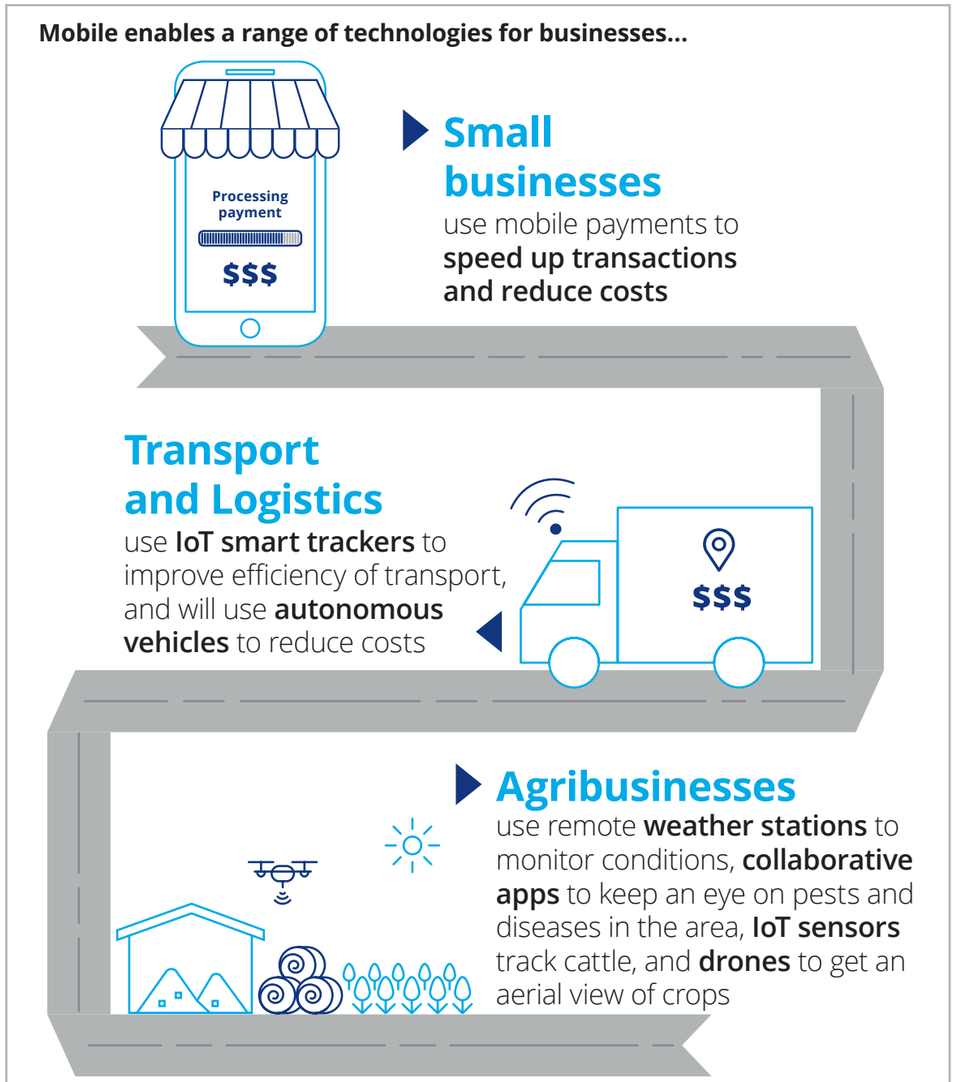
allow businesses insight into supply chains



4 Business impacts

Mobile technology is at the forefront of the current technological revolution. It is a driving force behind Industry 4.0 - the current trend towards increasing automation and data intensity - and vital to developments within the IoT technology sphere. As discussed in Chapter 3, mobile drives productivity growth, and businesses are able to harness the benefits. They are increasingly using mobile to drive innovation, develop new revenue streams, and streamline operations. With improving network infrastructure, the role of mobile in business will only grow.

Figure 4.1: Mobile enabled innovations for businesses

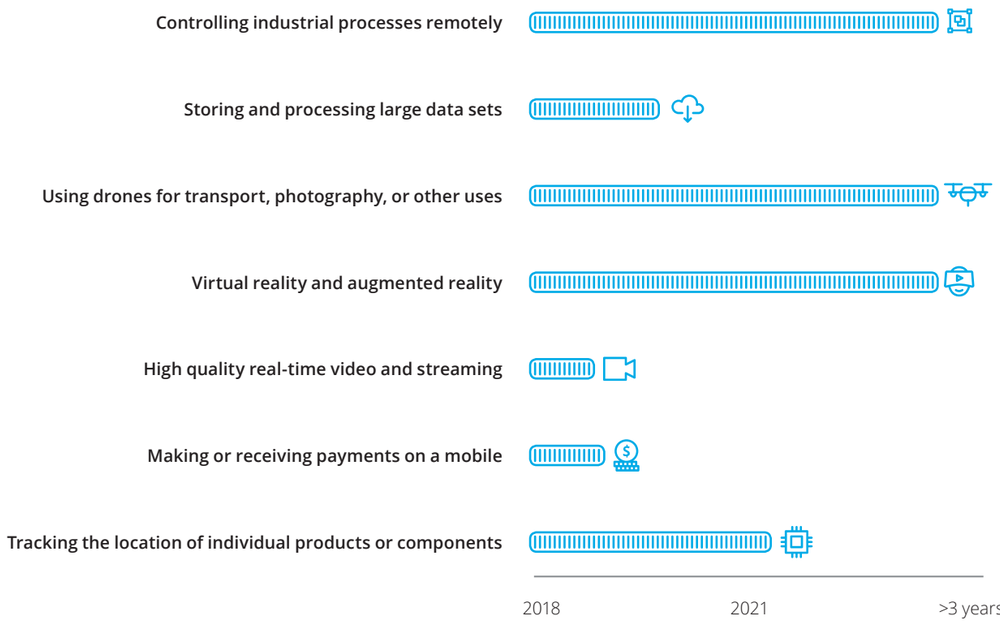


Source: Deloitte Access Economics

Amongst other benefits, the next generation network ecosystem will facilitate both existing and emerging technologies – such as driverless cars, mobile payments, and remote monitoring and control. In a survey of 550 businesses, around 80% reported that they have already implemented at least one emerging technology in their business, or that they expect to in the next three years (Deloitte, 2018c).

Clearly, businesses expect to implement some applications faster than others. For example, mobile payments are already in use in many businesses, as pictured in Figure 4.2, whereas few expect to be using virtual and augmented reality in the medium term.

Figure 4.2: Median timeframe for adoption of 5G enabled technologies by business



Source: Deloitte (2018c)

4.1 Small business

Small businesses operate in a competitive environment, and are constantly looking for ways to improve efficiency and generate new value for customers. For many small businesses, mobile technologies are one way of doing this. For instance, 50% of small and medium businesses in Australia use mobile-responsive websites to drive customer engagement (Deloitte Access Economics, 2017b).

One development that is reducing transaction costs for small businesses is mobile payment technology using near field communication (NFC).

NFC technology has created opportunities for new, innovative providers, such as Square, and device manufacturers, such as Apple (ApplePay) to enter the payments industry. The increased competition generated by new entrants has reduced card merchant fees and operating costs for small business (Lowe, 2018; RBA, 2018).

Mobile payment devices also allow small businesses to offer tap and go payments to customers. Mobile card readers, such as those offered by Square and PayPal, can be purchased for little or no upfront cost and are compatible for use with most modern smart devices (Square, 2019). With funds directly deposited within a day or two, even micro businesses can now offer a variety of payment options to customers.

These smart mobile payment devices enable small businesses to collect customer-spending data and make smarter sales, pricing and production decisions. For example, the Commonwealth Bank's mobile payment device, 'Albert', provides detailed customer spending data including sales trends, average daily transactions, and customer suburb (CommBank, 2018). Small businesses can use this data to increase incentives on slower trading days, identify key customer segments and better target advertising campaigns.

This also means that businesses can spend less time chasing outstanding customer invoices. Given that the average small business in Australia spends eight hours of work per week chasing unpaid invoices (Westpac, 2018), the benefits from this can be substantial.

Mobile technology can also increase productivity and allow even the smallest vendors to optimise their operations. Previous research has found that mobile adoption can increase productive time by 45% for workers who spend a significant amount of time in field (Deloitte Access Economics, 2016).

Figure 4.3: Square mobile card reader

Source: Square, (2019)

4.2 Transport and logistics

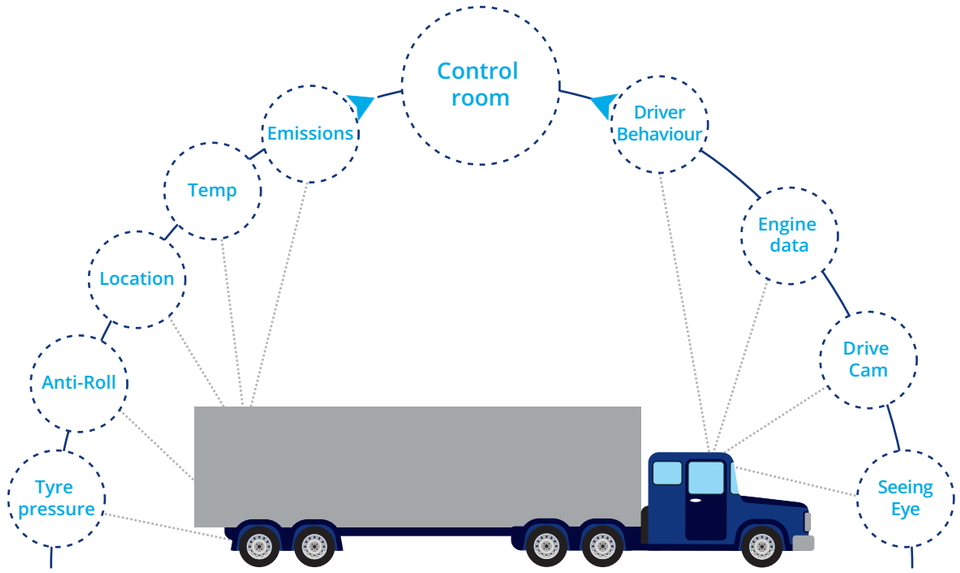
The transport and logistics industry is using mobile to improve tracking, cut costs, and deliver a more transparent, reliable service for customers. Mobile enabled IoT systems are used to track and monitor goods in real-time from any location.

For service providers in the logistics industry, IoT is a way of providing further value for customers across the value chain. For example, DHL's SmartSensor technology monitors temperature and humidity, while also indicating shock and light events that help ensure goods are not damaged during transportation (DHL and Cisco, 2015).

Logistics company Linfox's advanced fleet monitoring system, FoxTrax, uses precise GPS tracking and real-time communication between drivers and control room staff to improve safety, security and operational efficiency (Linfox, 2018). Transport for NSW tracking data provides customers using the TripView app with live timetabling and capacity data to ensure a comfortable commute.

Emerging technologies such as autonomous vehicles will further transform the industry. Unmanned vehicles (be they drones, trucks or trains) will reduce the cost and increase the operational efficiency of the delivery and transportation of goods. According to some estimates, trucking logistics costs will fall by 47% by 2030 as a result of autonomous trucks (Bowden, 2018). They will also have wider benefits for society. For example, autonomous vehicles that can drive through the night will help to ease congestion in overcrowded cities.

Figure 4.4: Examples of monitoring system features



Source: Linfox (2018)

CASE STUDY

Binary beer

Binary Beer uses IoT technology to improve the quality of beer. Established in 2016, the business was originally limited to niche home brewing, but has since begun to work with brewers across the world.

"The core of the problem is that when a brewer fills and ships a keg of beer they immediately lose control of it. Not only do many of their kegs go missing each year, if they're not refrigerated and consumed in good time the beer goes bad and gives the brewer a bad reputation as well", says co-founder Michael Burton.

Burton, along with his partner Brooke, found a way to utilise IoT technology to track these kegs. "Basically, we create trackers that monitor the quality and location of the keg in real time. By enabling kegs to transmit live information about the location, age and storage conditions of the beer, the brewer can make informed decisions to optimise their supply chain, protect their reputation and sell better beer."

This isn't the first time that Burton has experimented with IoT technology; "I first fell in love with IoT back in 2003 while developing a robot for a university project. Throughout my professional career in software development I used to build IoT devices as a hobby in my spare time, so it's very fitting that when we left our day jobs to found a start-up it would be in the IoT space."

He notes that timing was a critical factor in the business's success. "New IoT technologies like Vodafone's NB-IoT network have allowed Binary Beer's smart kegs to assist brewers in ways that weren't possible until now. By developing an innovative IoT solution with global potential we've opened up international opportunities before even launching locally. IoT is a global phenomenon and it's amazing how most of our contacts and enquiries have come from overseas. As our clients in Africa say 'Trust the Aussies to come up with a technology to track beer kegs'!"

And tracking beer is just the beginning: "I've always believed that if you can track beer kegs, you can track just about anything so from the outset we designed our sensors to be robust and modular so they could serve new applications as they arose. By having a working IoT platform with a demonstrated use case, we're already being pulled in many directions at once that we never expected and we've recently begun POC trials outside of beer keg tracking."

Burton believes that IoT technology represents a big opportunity for Australian businesses; "Just envision a future where almost everything is connected, where connectivity and data are practically free, and where collecting information from devices is trivial. Find ways to enable that future and the world is your oyster."

Source: Vodafone (2019)

4.3 Agriculture

Agricultural businesses are using a range of mobile technologies to transform traditional practices and improve efficiency of operations, from the time that crops are planted to when they are sold at market.

Commercial success in agribusiness requires understanding of weather patterns to optimise crop yields. Mobile technology is allowing businesses to be better prepared for weather events, with remote weather stations and specifically designed apps allowing them to monitor weather patterns in real time and plan accordingly. One example is the Western Australian Government's 'Weather stations app', which provides farmers with local data on temperature, humidity, rainfall, wind speed, and even solar radiation levels every 10 minutes (WA Government, 2018). This allows farmers to better prepare for weather events, and protect crops and livestock.

Use of mobile technology in agriculture also extends to technology that monitors crops and livestock themselves. A number of apps have been designed to assist agribusinesses to identify weeds, pests and diseases and provide advice. When a photo of a weed is taken, visual recognition software is used to match it to another in the database (WA Government, 2018). Some farms are also beginning to use IoT technology to monitor pH levels of crops in real time to maximise yield (Microsoft, 2016).

IoT technology is also being used for livestock management. Moocall, for example, sells IoT sensors for cattle that alert farmers when a cow is going in to labour. Farmers receive a text message when the cow is approximately two hours from giving birth, providing time to find and assist the cow. The sensors reduce calving mortality by up to 7% (Moocall, 2019).

Agricultural drones are another technology helping farmers. Drones allow farmers a view of their crops or livestock from above, and can be equipped with sensors that measure everything from sunlight absorption and transpiration rates to thermal imaging (National Drones, 2019). These features allow agribusinesses to map the health and vitality of crops, and pin point problem areas before they spread meaning that businesses can reduce the chances of loss, cut costs and improve efficiency.

Figure 4.5: Moocall sensor

Source: Moocall (2019)

CASE STUDY

AI increasing student engagement

Increasing student engagement and delivering better learning outcomes is a key priority for many universities. The University of Western Australia is working with Cisco and Optus to achieve this goal through digitalisation.

The organisations are deploying an app-based software solution that combines mobile applications, artificial intelligence and communication capabilities to enhance the student experience. UWA is the first Australian university to use this technology.

The platform will provide a personalised, one-stop-shop where they can access all the information they need from what is happening on campus to resources that assist them with their studies.

According to UWA Chief Digital and Information Officer Warwick Calkin, "Student feedback has indicated the need for an app that houses a suite of information and UWA is pleased to be putting this feedback into practice to support students."

"Students will be able to use the app for information on campus events, timetabling, and maps to get to classes, engage in co-curricular activities, participate in discussion forums, enrol in units and plan assignments. The app will digitally connect students to all the information they need."

Students submit their schedules and interests to the platform, which then sends curated information, news and events to the student's smart device. Using analytics, such as attendance at certain events, the software further customises the information that students receive.

In addition, artificial intelligence will deliver valuable insights to UWA's administrators and teachers. The software can flag students whose engagement patterns indicate a need for intervention, decreasing the likelihood that a student will 'fall off the radar'.

Source: Optus (2019)

Social impacts

40%

of mobile users find their device distracting, while 36% say it helps them connect to others

94%

of mobile users take their phone with them when they leave the house

71%

of mobile users say they feel safer in dangerous situations when they have their mobile device, and 75% of triple 0 calls come from a mobile

66%

of mobile users say their device is helpful, compared to just 13% who find it annoying

5 Social impacts

Mobile clearly has significant benefits for businesses and our economy. However, its impacts and ubiquity are most visible in society. It has become our most common – and necessary – accessory. We find that, **94% take their mobile device when they go out;** more than the proportion who take their wallet (92%), house keys (88%) or car keys (77%).

This is testament to how important our mobiles are. They are key to how we communicate with family and friends, entertain ourselves, keep safe and manage our responsibilities. However, we are also coming across mobile-related social issues – such as cyber safety and overuse.

These issues do not have simple solutions. An extreme suggestion is to ban use of mobile in situations such as at work or school. But this would mean losing significant benefits that mobile offers. Instead, more nuanced and innovative responses will be required. Ensuring responsible use of mobile technology is something that will require joint effort between individuals, businesses, government and society more broadly.

Deloitte Access Economics surveyed 1,000 Australians aged 14 and over to better understand how people use, and feel about, their mobiles – the good and the bad.

About the survey

This report draws on a bespoke survey fielded by Dynata in January 2019. The survey sample is made up of over 1,000 individuals from around Australia.

Participants were asked about their use of, and attitudes to, mobile technology, as well as their behaviour while online.

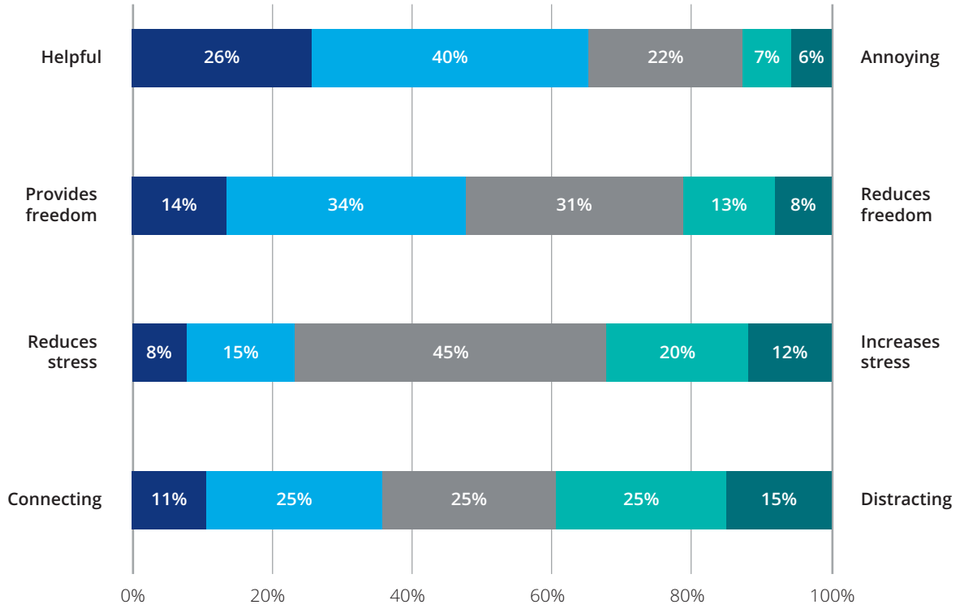
Around one-quarter of respondents were from NSW, another 21% were from Victoria, and the rest were distributed across the rest of Australia. The distribution is largely representative of the population.

Almost 90% of respondents were mobile users, and cover a range of ages. For more detail about the survey sample, see Appendix A.

Overall, Australians view their mobiles more as a help than a hindrance. For instance, two-thirds of respondents said that their device was helpful compared to 13% who said it was annoying (Chart 5.1). Similarly, 48% say their device provides freedom while just 21% say it reduces it.

Results are more divided when it comes to stress, with 32% of respondents saying that mobile devices increase stress compared to 23% who say they reduce it. Similarly, there are mixed views about whether mobiles are connecting (36%) or distracting (40%).

Chart 5.1: Social impacts of mobile devices



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

This chapter looks at the importance of mobile from a social perspective:

- **Mobile as a utility –** as their name suggests, smartphones do more than simply call and text. Modern devices have replaced everything from street directories and calendars to torches and cameras.
- **Social connection –** while there is no denying the power of mobile to connect people across the globe, some argue that we risk being distracted from the present moment.
- **Mobile cities –** transport and navigation apps make traversing crowded cities easier than every before, but if not managed carefully, the digital divide between regions and cities could continue to grow.
- **Work and study anywhere, anytime –** mobile enables people to work and study flexibly, and promotes participation in the workforce.
- **Safety and security –** mobile means that help is in your pocket, but there are also new risks associated with cyber security that need to be monitored.
- **Physical and mental health –** wearable mobile devices are helping people to better track their health and reach fitness goals, but the ability to be 'always on' can also have detrimental health effects.
- **Young Australians' use of mobile –** being digital natives, young Australians interact with mobile technology differently, meaning they get different benefits but also face different challenges.

Top survey findings

1. 94% of mobile users take their phone with them when they leave the house - more than the proportion who take their wallet
2. 66% of mobile users say their device is helpful, compared to just 13% who find it annoying
3. 40% of mobile users say they find their device distracting, while 36% say it helps them connect to others
4. 60% of mobile users have replaced at least three other items with their device (most commonly their road directory, phone book, home phone or camera)
5. Almost half (48%) of mobile users check their device at least once every 30 minutes
6. Face-to-face is still the most common way that people interact every day - but 82% of respondents call their family and friends at least once a week
7. 71% of respondents say they feel safer in dangerous situations when they have their mobile device
8. 53% are worried about over-reliance/ addiction to their devices
9. 33% of respondents say that their mobile devices have improved their work/life balance – this is higher than the 24% who feel the opposite
10. Just over 90% of mobile users take at least one active step for online security.

5.1 Mobile as a utility

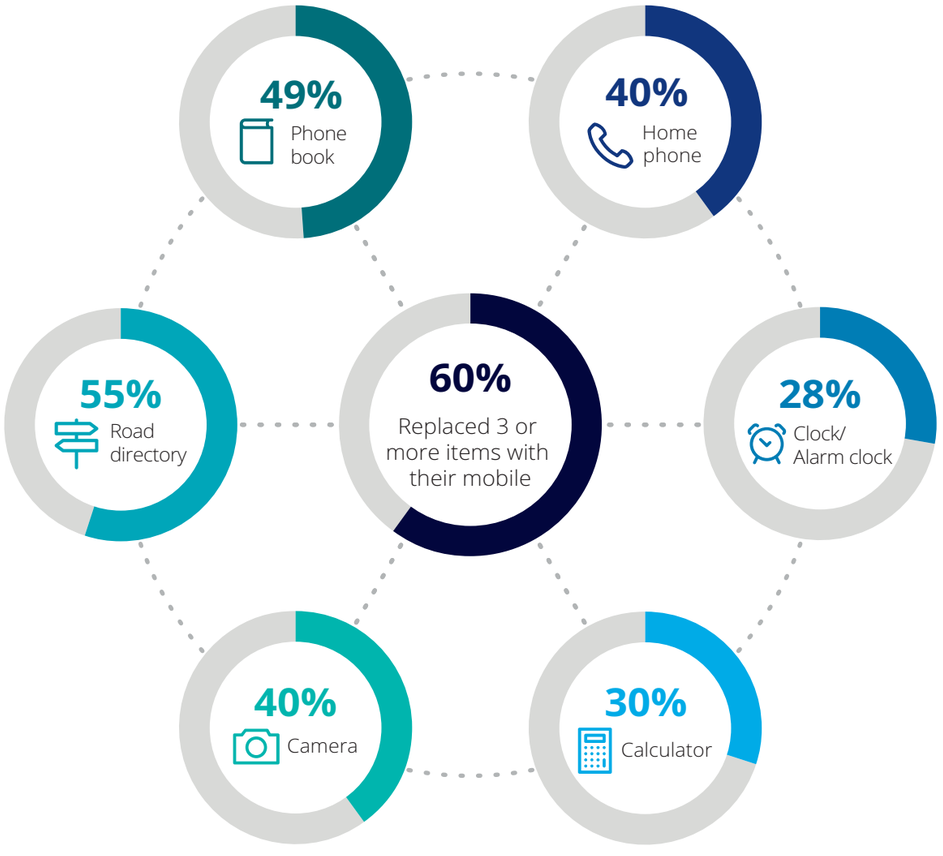
Mobile devices have become multi-purpose utility tools, used for a range of tasks. Of course, they continue to be used for their original purpose – making and receiving phone calls. But increasingly, their value is in the broader range of functions they serve.

For example, beyond calls and texts, most Australians use their smartphone as an alarm clock, calendar, map, torch and more. Similarly, many use tablets to read books and newspapers, edit videos and watch television.

In fact, the vast majority of Australians use their mobile for purposes other than calls. More than nine in ten mobile users in our survey said they use their mobile device to take photos, 85% check news and weather, and 78% manage personal finances (e.g. mobile banking, paying bills).

In some instances, mobiles are replacing other items entirely. In our survey, 78% of Australians said that their mobile devices had replaced at least one other item in their household, and for 60%, mobile devices had replaced at least three. The most commonly replaced items were road directories, phone books, home phones and cameras (see Chart 5.2).

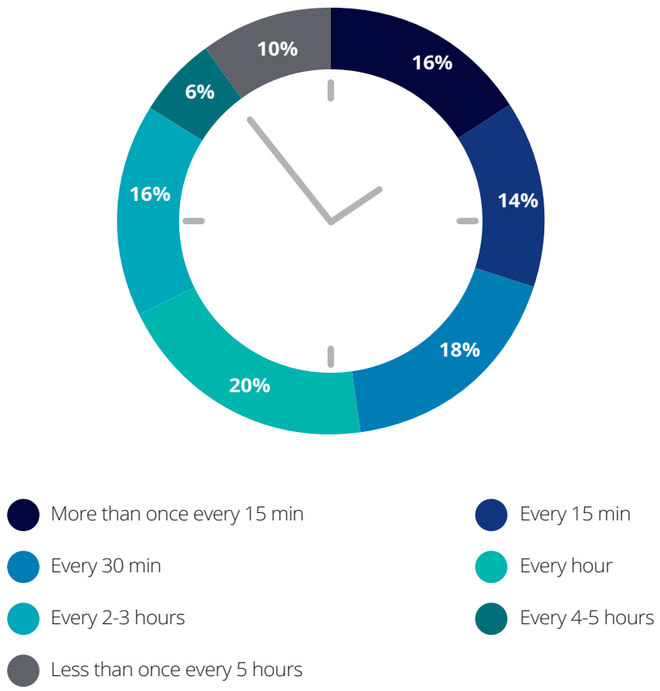
Chart 5.2: Mobile devices replace the need for other household items



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

Statements about overuse of, and over reliance on, mobile devices are commonly features of the national debate. Indeed, as Chart 5.3 shows, almost half of survey respondents check their mobile device at least once every 30 minutes. But considering the number of functions it offers, and the tools it can replace, this is hardly surprising.

Chart 5.3: Frequency of mobile device use



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

5.2 Social connection

Mobiles help connect people regardless of distance. It is now possible to communicate instantly across the world at the press of a button. Apps such as Skype, Whatsapp and WeChat mean that families and friends can stay in touch instantly around the world, whether it be through personal messages, group conversations or video.

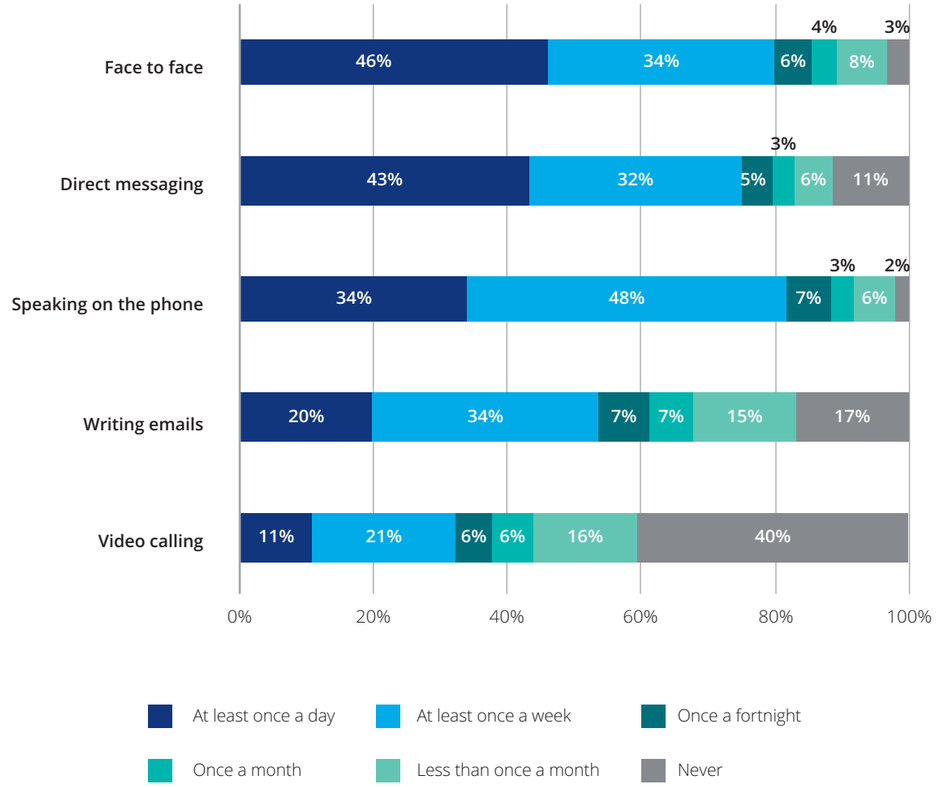
By connecting us, mobile plays an important part in Australia's social fabric. More than one-quarter (26%) of Australians were born overseas (ABS, 2017b), and mobile apps make it cheaper and easier to communicate with people overseas. Older Australians use their devices to stay connected, even when they are less mobile - Skype is the most popular communications app among Australians aged 65 and over (ACMA, 2016). Thousands of parents share advice and stay in touch on virtual mothers groups, for example through Facebook (Winston, 2018).

Two-thirds of survey respondents use direct messaging to stay in touch with family and friends at least once a week - in line with the number who see them face to face (Chart 5.4).

Of course, while people may be connecting more frequently, there is no guarantee that they are connecting in a meaningful way. Two in five survey respondents say that mobile is more distracting than it is connecting, and around half of Australians report feeling ignored by friends who use their mobile devices while in social situations (Murdoch University, 2018).

Many people have instituted rules to curb this trend. For instance, 36% of Australians say they are trying to limit their mobile use. Socially, 40% of people trying to limit their mobile use keep their phones in their pockets when they meet people, 29% turn their phones off at night, and 24% don't take their phone out of their bag when they are alone (Deloitte, 2018d).

Chart 5.4: Frequency of communication with friends and family, by method of communication



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

5.3 Mobile cities

Mobile devices help to improve efficiency, navigation and connectivity in cities. The high density of city living means that monitoring and directing traffic to avoid congestion is increasingly important.

Through apps that track public transport in real time, the government is able to improve the efficiency of travel and enable people to minimise time lost in congestion. Likewise, Google Maps shows traffic congestion in real time, recalculating routes and travel times as required to help people be as informed as possible when navigating. And sharing economy businesses such as Uber rely on mobile technology to match supply and demand for rides, leading to a better connected and more efficient city.

But these advances can also mean that those who do not have a mobile device, or strong digital skills, may miss out. The Australian Digital Inclusion Index 2018 shows that digital inclusion is still low for some groups such as those with low household income, those with disabilities, and Indigenous Australians (Thomas, et al., 2018). However, it is improving on average and across most groups. Even so, barriers such as income and geography that prevent people accessing quality mobile services, and the implications of this, should be considered.

CASE STUDY

Pedestrian safety technology

As the number of travellers increase and population density in our cities increases, road safety is becoming increasingly important. In 2016 there were 212 pedestrian deaths on Australia's roads. To address this, Telstra is helping to develop technology that will enable communication between cars and the surrounding components. Vehicle-to-Pedestrian (V2P) technology aims to reduce the number of accidents by alerting road users to imminent danger in real-time.

The premise of its function is that the technology can chart out the locations of the vehicles around and send an alert prediction based on data interactions that are hard to judge or even perceive by humans. A simple example of this is around corners, where pedestrians may not see an oncoming vehicle until it is too late.

In a trial of this technology in South Australia, in partnership with Cohda Wireless and the South Australian Government, Telstra demonstrated how vehicles can interact directly with pedestrians' and cyclists' mobile phones, providing early-warning collision detection and alerts via an application installed on their mobiles.

V2P also has important implications for driverless cars, which will become a feature of Australian roads in the future. Much is required for the safe coexistence of autonomous vehicles and humans on the roads, but V2P technology will be a big step forward.

Source: Telstra (2019)

5.4 Work and study anywhere, anytime

Mobile has eroded the barriers posed by location. People can increasingly work and study in a location, and at a time, that suits them.

This increased flexibility allows more people to work and study. For example, it can enable people who live in rural or regional areas to work remotely, avoiding restrictively long commutes. Individuals with caring responsibilities (for instance, those with young children) can stay in contact whilst out of the office.

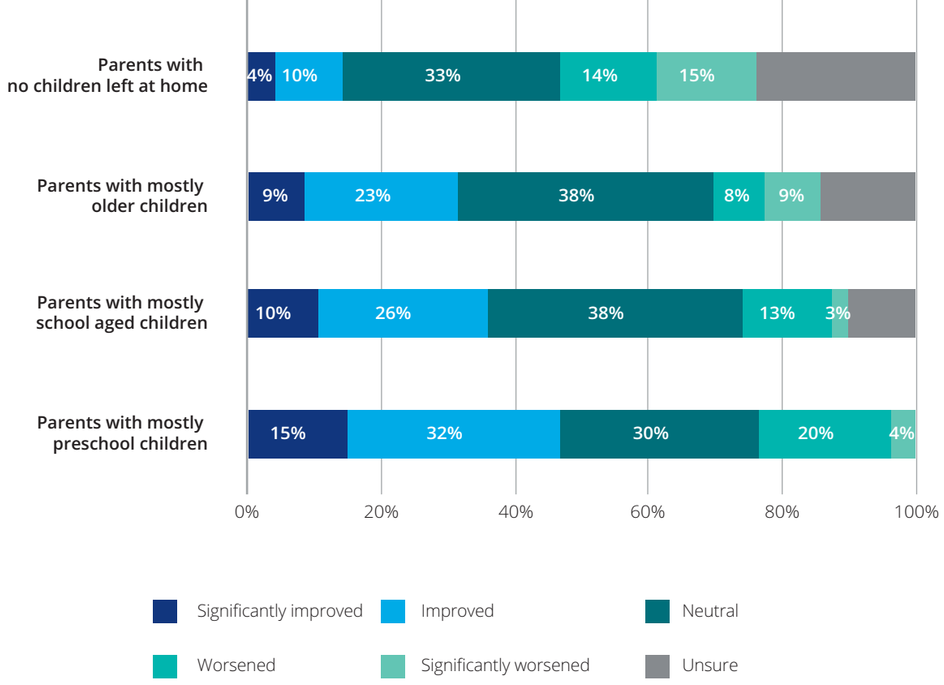
Previous Mobile Nation research has shown that vulnerable workers would work, on average, 36 minutes less per week if they did not have access to mobile devices. That additional work time translates to an $8.9 billion GDP boost each year (Deloitte Access Economics, 2016).

This is having an impact on who works, and how. Already, 25% of Australians work at least one hour per week in a location outside their main office (McCrindle, 2018), and part-time workers make up one-third of the Australian workforce (Cassidy & Parsons, 2017).

With the ability to work and study anywhere, anytime, there are risks that people feel the need to be 'always on'.

On balance, Australians tend to think that their mobile helps, rather than hurts, their work/life balance. **One-third (33%) of respondents say that their mobile devices have improved their work/life balance;** and while almost half are neutral on the question, this is higher than the 24% who feel the opposite. For parents with young children, almost half say work/life balance has improved, and less than one-quarter say it has worsened.

Chart 5.5: Effect of mobile device on work/life balance, by type of family



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

This is because life can spill in to work as much as the opposite; previous research has shown that 77% of office employees check personal emails while at work, 69% make calls or schedule appointments, and 57% shop online (Office Pulse, 2017).

Ultimately, it is important that both employees and employers set boundaries about how mobiles are used – both in the workplace, and for work purposes after hours.

Of Australians who say they use their device too much, 42% nominate the need to 'be available to work' as a key reason for overuse. In response, some businesses are implementing policies to encourage workers to 'switch off' such as silencing email services after hours, or intentionally providing desktop computers instead of laptops so that workers cannot take work home with them. One study suggests that 25% of companies have either a formal or an informal rule regarding email use out of hours (Kang, 2012).

On the other hand, the use of mobiles for personal purposes while at work can create risks. The Fair Work Commission (FWC) has highlighted the importance of policies that regulate use of mobile technologies in the workplace, and has upheld decisions of employers to dismiss employees for breaching mobile use policy, for example whilst operating machinery (Workplace Law, 2018).

5.5 Safety and security

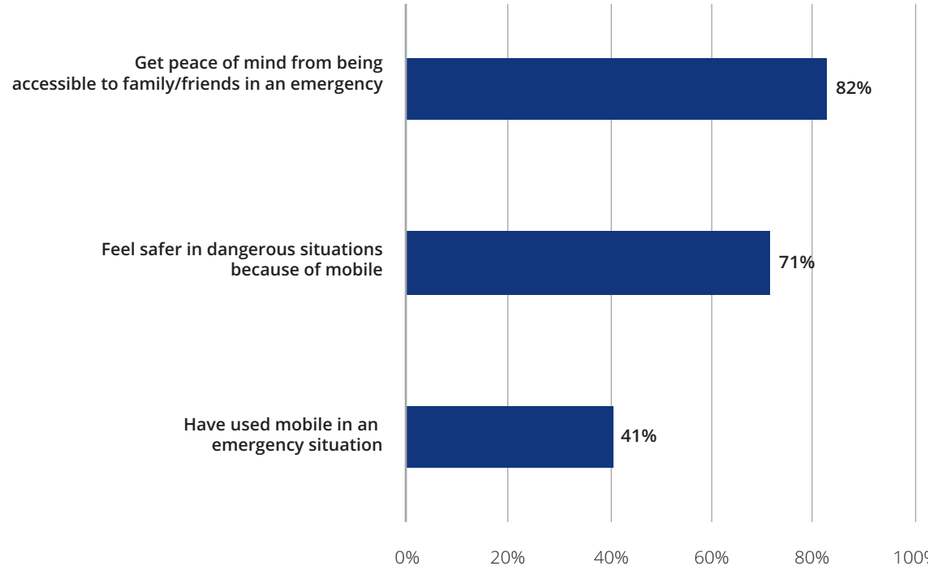
Mobile plays an increasing role in ensuring the safety and security of people and possessions. In fact, today around three in four emergency calls to 000 are made from a mobile phone (Telstra, 2019). Police advise members of the community to "make sure people know where you are, and if you've got a mobile phone carry it" (Cunningham & Pearson, 2018).

Having a mobile device adds to people's sense of safety. As Chart 5.6 shows, 82% of survey respondents say that having their mobile device brings them peace of mind because they know they are contactable by family and friends in an emergency. Further, 71% say it makes them feel safer in dangerous situations, and 41% have actually used their device in an emergency.

Mobile devices are also increasingly used for monitoring possessions. Telsyte estimates that there are 165 million internet connected devices in Australian homes (Telsyte, 2018), and this includes an increasing number of 'smart security' devices, such as security cameras which can be monitored remotely on a home-owner's phone.

However, many Australians are also concerned about some of the safety risks posed by mobiles – in particular, data security and distracted driving.

Chart 5.6: Proportion of survey respondents that feel safer with a mobile device



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

The industry's approach to mobiles and driving

Ordinarily, interacting with a mobile – or any electronic device – requires physical, visual and cognitive attention. While driving, this can be dangerous.

Existing technologies, like hands-free and Bluetooth, can allow people to use their phones without physical interaction or needing to look at the screen. However, education is required to address cognitive factors, to make sure that people keep their eyes, and attention, on the road.

The industry recognises the dangers of distracted driving. In 2015, AMTA worked closely with the National Road Safety Partnership Program to develop a mobile phone use policy to assist in identifying the key research results in the area of driver distraction as a basis for proposing key driving behaviours regarding in-vehicle phone use based on safety and the prevailing law.

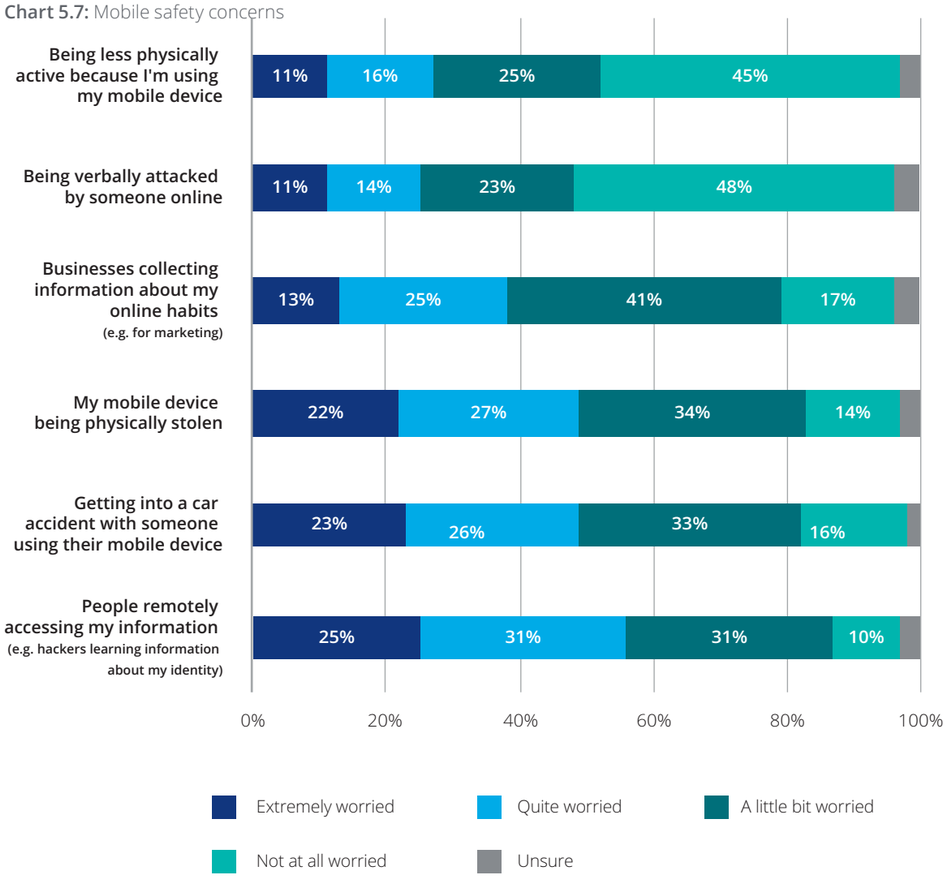
As increasingly connected vehicles make technology more embedded in the driving task, making drivers aware of in-car distractions and their implications will become even more vital.

Source: Based on consultation with the Australian Mobile Telecommunications Association

Survey respondents were most worried about the potential of a data breach. Cyber security is a concern for 87% of survey respondents, 25% of whom are "extremely worried", as shown in Chart 5.7. Between January and September 2018 alone, close to 550 data breaches were identified by the Australian Government, 63 of which affected over 1,000 people each (OAIC, 2018). Despite this, only 12% of respondents say they have been the victim of a data breach, and a further 14% say they are unsure whether they have been.

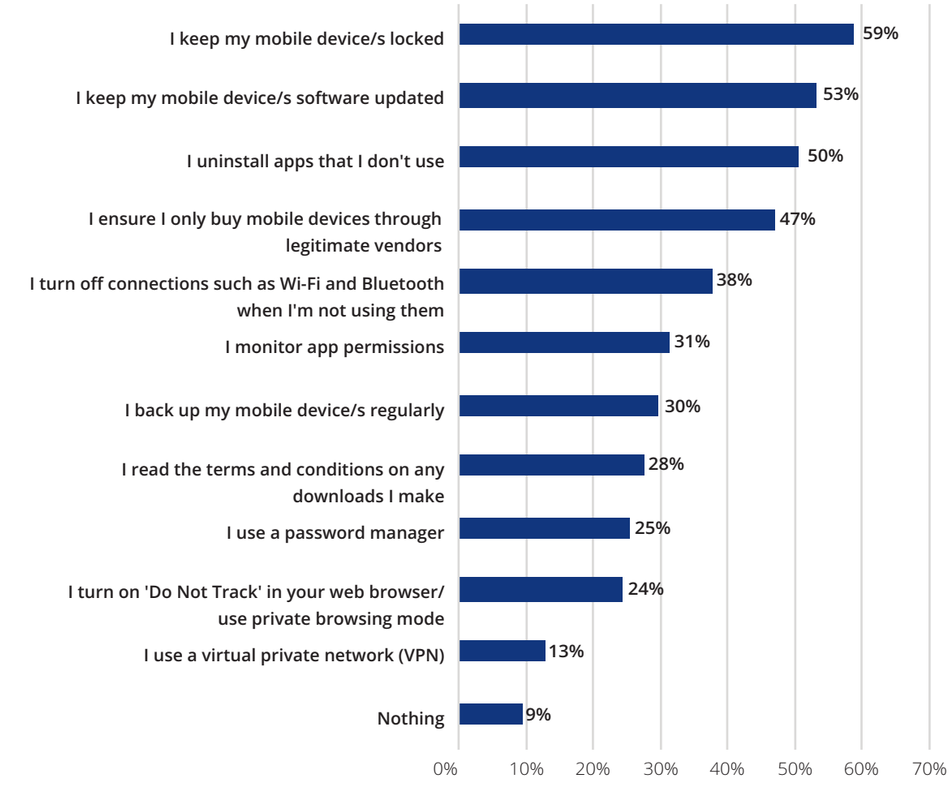
There are many ways to protect private data from a security breach, and our survey results show that Australians are actively working to protect their data. As Chart 5.8 shows, the most common actions taken are locking mobile devices (done by 59% of mobile users), updating software (53%) and uninstalling unused apps (50%). **Just over 90% of mobile users take at least one precaution, and more than half do at least four.**

Chart 5.7: Mobile safety concerns



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

Chart 5.8: Most commonly adopted security measures



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

The second most common concern was around car accidents. Mobile-related distracted driving has been the cause of an increasing number of traffic accidents. Between 2012 and 2017, distracted driving caused 184 accidents in NSW alone. And many more people are using their phones while driving – more than 40,000 infringement notices were issued by NSW police in 2016-17 (Knaus, 2018). Similarly, pedestrians distracted by mobile devices create a more dangerous road environment.

In response to these dangers, governments across Australia are taking action. In January 2019, the NSW Government began trialling high-definition cameras that utilise artificial intelligence to detect (and eventually penalise) drivers illegally using a mobile phone (NSW Government, 2018a). At the same time, the Council of Australian Government's Transport Infrastructure Council ordered a review of the use of mobile phone and smart watches while driving in 2018, with results expected in 2020 (Jacks, 2019).

5.6 Physical and mental health

We are increasingly using mobile devices – particularly wearables – to monitor and measure our health. Today, around 19% of Australians own a fitness band, and 9% own a smart watch (Deloitte, 2018a).

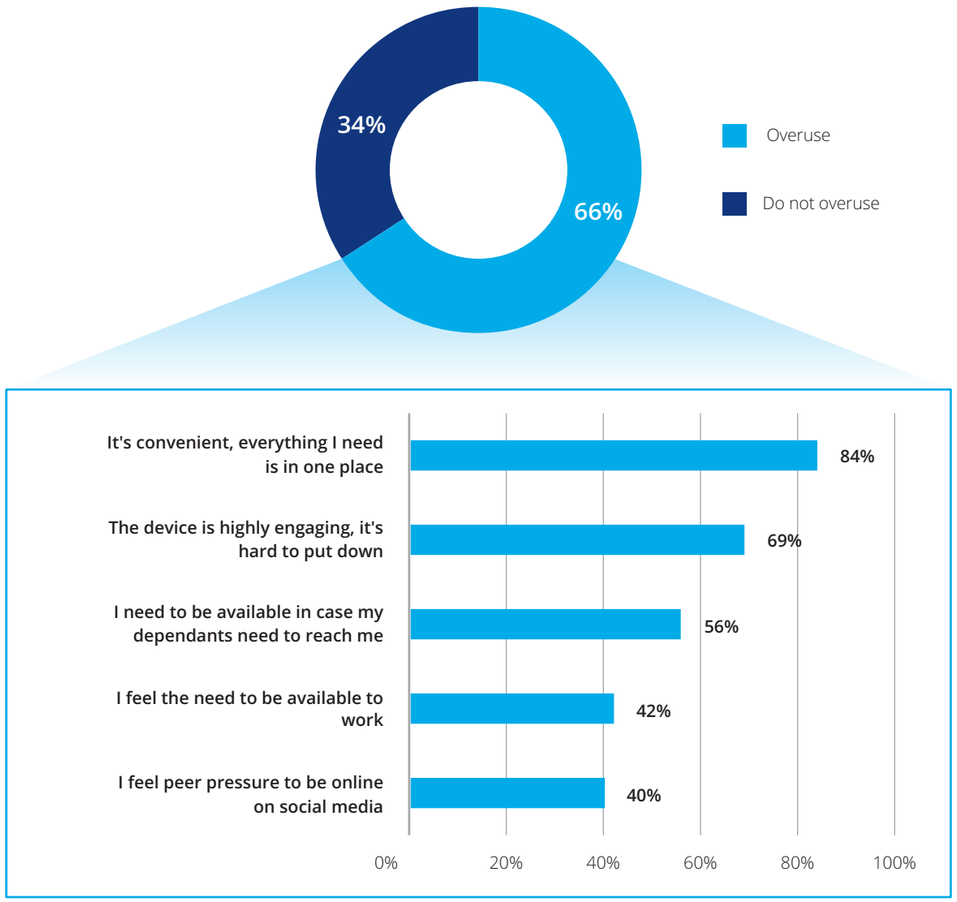
These devices contain features that monitor health, including heart-rate monitors and sleep trackers. When integrated with apps, they can be a powerful tool to help people track trends and adjust their behaviours over time.

More is yet to come – Deloitte forecasts suggest that the next generation of wearables will not just be about tracking, but about sensing patterns and helping users to manage lifestyle diseases (Deloitte, 2018a).

It's also helping medical professionals and patients. For instance, CSIRO has developed home monitoring systems that allow patients to check-in virtually with a doctor. The monitoring devices collect data on the patient's vital signs, and connect a video call to a doctor as required. In a national trial, patients with home monitoring devices were 53% less likely to be admitted to hospital and had a significantly reduced length of stay when they were admitted (CSIRO, 2018).

However, how we choose to use our devices can also affect our mental health.

Chart 5.9: Top reason for over-use of mobile



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

CASE STUDY

Live surgery

Many of the benefits that come from mobile are not captured in GDP figures. One example of this is in the health sector. Mobile is improving the quality and availability of healthcare, but the value of avoiding medical costs and saving lives does not show up in GDP figures.

In February 2019 doctors at the Hospital Clinic de Barcelona used mobile technology to direct a live surgery. They were able to interact in real time with surgeons at a remote hospital to guide a tumour removal surgery, drawing directions on the video footage of the tumour in real time.

This was made possible because of the reduced latency offered by 5G meaning virtually no lag in the video broadcast.

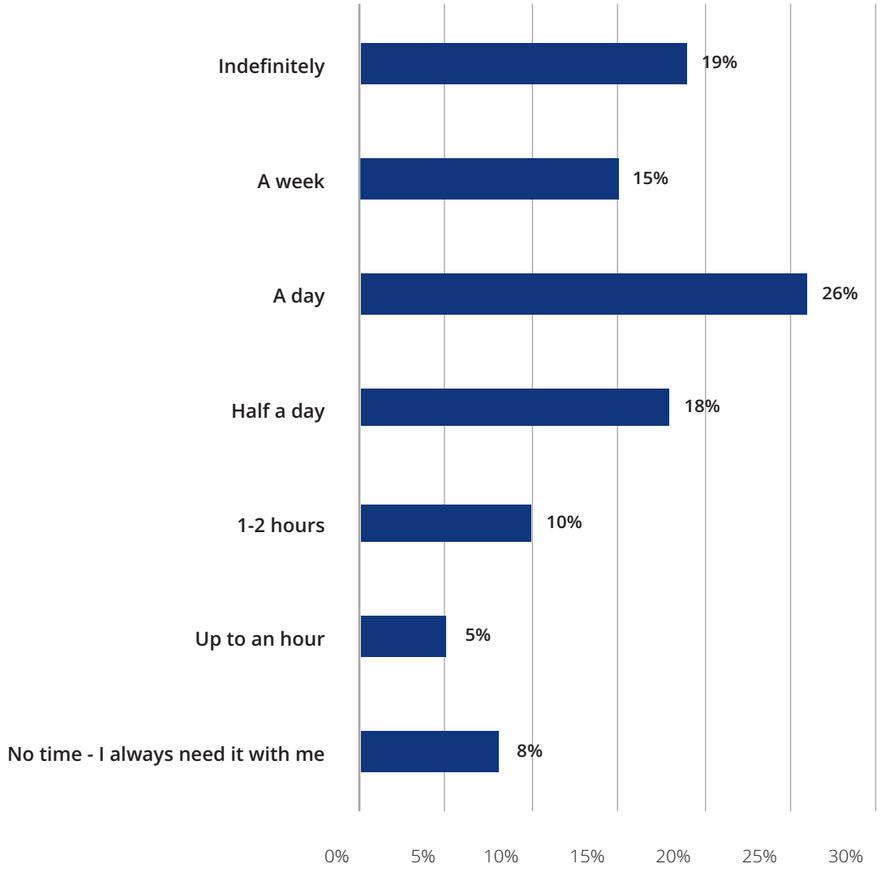
At the moment, there are an estimated 143 million surgeries annually that are not performed around the world because of a lack of local medical knowledge, but virtual guidance means that surgeons around the world can be mentored in real time.

Source: Mobile World Congress (2019)

Two-thirds of survey respondents say they use their device too much, but only 53% are worried about over-reliance/addiction to their devices. Similar research has found that although 39% of Australians think they use their phone too much, only 26% are successfully limiting their use in response (Deloitte, 2018a). For most people, over-use is not out of obligation; the vast majority of those who think that they use their phone too much say that this is simply because it is convenient and engaging.

For most people, their mobile is ultimately a critical tool to facilitate daily life. In fact, when asked how long they could last without their device, 41% said that less than half a day would be the maximum (see Chart 5.10).

Chart 5.10: Length of time respondents could last without their mobile devices



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

5.7 Young Australians' use of mobile

The use of mobile by Australia's youth is perhaps one of the most commonly discussed social impacts. Today's young people are 'digital natives', and as such have a different relationship with technology to older users.

For instance, Chart 5.11 shows that almost half of 14-17 year olds use their mobile devices to check social media more than five times per day, and two-thirds use their device whilst doing other activities. Other recent data shows that 90.3% of 5-14 year old Australians participated in screen-based activities in 2017-18 (ABS, 2019).

Mobile offers many benefits for young people. For instance, 79% of 14-17 year olds say that having their mobile device makes them feel safer in dangerous situations, and 80% use them to get directions when they go out.

But there can also be drawbacks to how integral mobile is to young people.

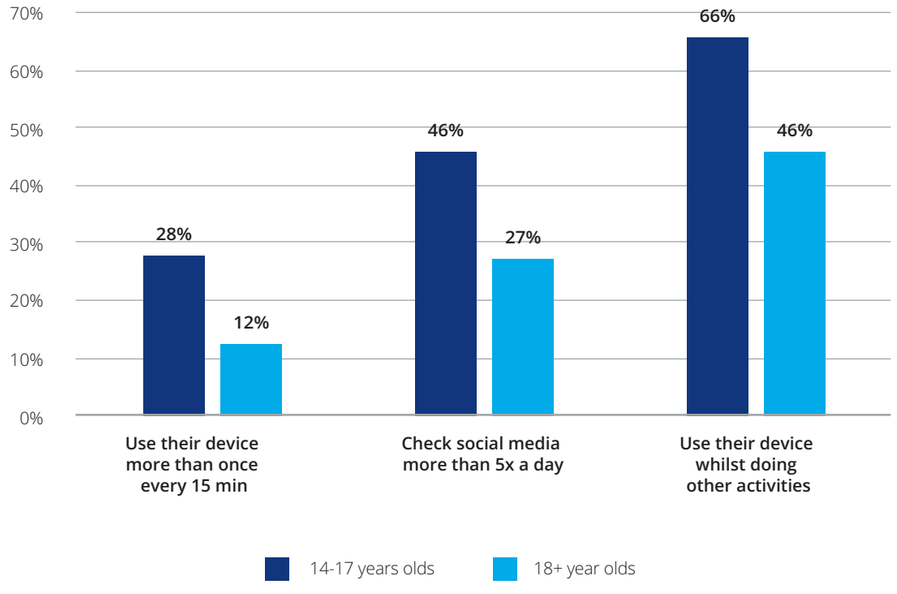
Around three in four (78%) young people surveyed say they use their mobile device too much, compared to only 56% of adults (Chart 5.12). The major reasons for this are convenience (34% say they use their mobile too much because it is so convenient having everything in one place), and engagement (31% say they find it hard to put down because it's highly engaging).

Young people are also moderately more worried about cyber bullying than people in older age groups (Chart 5.12). Still, parental concern about children being bullied online far outweighs the concern of young people themselves; two-thirds of surveyed parents are worried about their children being bullied online, compared to 52% who are worried about being bullied themselves.

Finding ways to minimise these negative impacts is challenging, and requires a coordinated effort between young people, parents, government, and the broader community.

As a result, many young people are trying to limit their use of their phones. But while 61% of 18 to 24 year olds say they are trying to limit their phone use, only 24% are doing so successfully (Deloitte, 2018d). The literature is yet to reach a consensus on 'how much is too much'. UK children's health experts say that there is no set amount that is correct; families need to set rules according to individual circumstances (RCPCH, 2018), rather than setting hard limits on daily screen use.

Chart 5.11: Frequency of mobile device use, by age



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

Use in schools is another area of ongoing debate. Mobiles can be distracting, but they also create significant learning opportunities.

The NSW Government recently completed an independent review into the non-educational use of mobile devices in NSW schools (NSW Government, 2018b). In response, it has announced a decision to restrict use of mobile phones in primary schools, and has given secondary schools the option to do so as well.

Yet more and more schools require students to have a laptop or tablet for learning purposes, and 47% of 14-17 year olds in our survey said they use their mobile device for learning at least once a week.

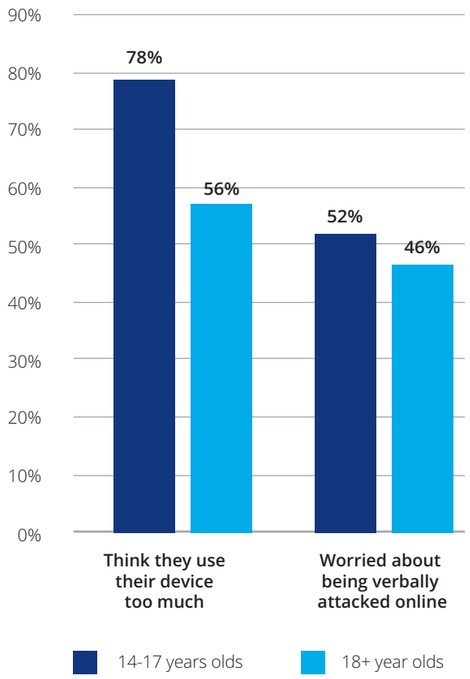
Cyber bullying is a serious problem, and a difficult one to address. The government has established the Office of the eSafety Commissioner, charged with finding ways to improve online safety. The Office has a broad remit which includes providing:

- a complaints service for young Australians who experience serious cyber bullying
- identifying and removing illegal content
- tackling image-based abuse.

The government is also considering a 'digital licence' for children. The licence would teach children about cyber bullying with a view to protecting them when they are online (Varghese, 2019).

In addition, the government is considering revamping laws aimed at reducing online bullying, image-based abuse and child sexual abuse material, following a review of existing safety legislation. Proposed changes include the introduction of a single piece of legislation to regulate social media companies, establishing a new, much higher benchmark, and a more interventionist enforcement regime (Loussikian, 2019).

Chart 5.12: Drawbacks to mobile, by age



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

"When things go wrong try to resist immediately taking away their device. Removing your child's phone or computer could be really unhelpful. Cutting off their online access does not teach them about online safety or help build resilience. It could alienate them from their peers, and it also removes an essential tool for them to communicate and connect with friends.

– Office of the eSafety Commissioner (2019)

5.8 Summary

As the modern Swiss Army knife, it is no surprise that mobile devices are ubiquitous, and widely seen as a necessity. This comes with both challenges and opportunities. Like any technology, how we choose to use our devices is an individual choice. It is important that people are educated, empowered and equipped to use their devices responsibly.

Looking forward, the opportunities offered by mobile are significant. Improvements in productivity could see Australians $2,500 better off on average every year. New mobile-enabled technologies will offer more choice and convenience, as well as new opportunities for business. Our ability to connect whenever and wherever we choose will continue to improve. With 5G networks set to complement existing 4G+ technology, the economic and business benefits of being a mobile nation will continue to grow.

References

ABS. (2017a). Business use of information technology statistics. Retrieved from http://www.abs.gov.au/ausstats/abs@.nsf/mf/8129.0

ABS. (2017b). 2071.0 - Census of Population and Housing: Reflecting Australia - Stories from the Census, 2016. Retrieved from http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/2071.0Main%20Features602016?opendocument&tabname=Summary&prodno=2071.0&issue=2016&num=&view=

ABS. (2018a). 5206.0 - Australian National Accounts: National Income, Expenditure and Product, Sep 2018. Retrieved from https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/5206.0Main+Features1Sep%202018?OpenDocument

ABS. (2018b). 5260.0.55.002 - Estimates of Industry Multifactor Productivity, 2017-18 . Retrieved from http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/5260.0.55.002Main%20Features12017-18?opendocument&tabname=Summary&prodno=5260.0.55.002&issue=2017-18&num=&view=

ABS. (2018c). 5204 - Australian System of Natonal Accounts, 2017-18. Retrieved from https://www.abs.gov.au/ausstats/abs@.nsf/mf/5204.0

ABS. (2019, March 29). 4921.0 - Participation in Selected Cultural Activities, Australia, 2017-18. Retrieved from ABS: http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4921.0Main+Features12017-18?OpenDocument

ACMA. (2016). Digital lives of older Australians. Retrieved from https://www.acma.gov.au/theACMA/engage-blogs/engage-blogs/Research-snapshots/Digital-lives-of-older-Australians

ACMA. (2018). Australia's 5G auction concludes. Retrieved from https://www.acma.gov.au/theACMA/australias-5g-auction-concludes

Aitken, N. (2019). Look at how fast the cost of mobile phone data is falling in Australia. Retrieved from https://whatphone.com.au/sim-only-byo-plans/top-data-plans-in-australia/look-at-how-fast-the-cost-of-mobile-phone-data-is-falling-in-australia/

Australian Communications and Media Authority. (2012). Regulatory responsibility. Retrieved from https://www.acma.gov.au/theACMA/About/Corporate/Responsibilities/regulation-responsibilities-acma

Australian Government. (1992). Radiocommunications Act 1992.

Australian Government. (1997). Telecommunications Act 1997.

Bajkowski, J. (2018). Westpac, NAB prepare to open doors to Apply Pay. Retrieved from https://www.itnews.com.au/news/westpac-nab-prepare-to-open-doors-to-apple-pay-516998

Biscoe, C. (2018). Australia ranked fifth in worldwide data breaches so far in 2018. Retrieved from https://www.itgovernance.asia/blog/australia-ranked-fifth-in-worldwide-data-breaches-so-far-in-2018

Blöckner, Danti, Forrai, & Broll. (2009). Please Touch the Exhibits! using NFC-based interaction for exploring a museum. 11th International conference on Human-Computer Interaction with Mobile Devices and Services (p. Article 71). Bonn, Germany: ACM.

Bowden, D. (2018). Digitisation and autonomous driving to halve costs by 2030, finds PxC Truck Study. Retrieved from https://press.pwc.com/News-releases/digitisation-and-autonomous-driving-to-halve-costs-by-2030--finds-pwc-truck-study/s/430cbddc-e025-4573-ab82-7fe53bb272a4

Brooks, C., & Pomerantz, J. (2017). ECAR Study of Undergraduate Students and Information Technology, 2017.

Bureau of Communications and Arts Research. (2018). Impacts of 5G on productivity and economic growth. Australian Government, Department of Communications and the Arts.

Campfens, V., & Dekker, C. (2018). Turning Rotterdam into the "World's Smartest Port" with IBM Cloud and IoT. Retrieved from https://www.ibm.com/blogs/think/2018/01/smart-port-rotterdam/

CareerBuilder. (2016). Maority of US Workers Think Traditional 9 to 5 is a Thing of the Past. Retrieved from http://www.careerbuilder.com/share/aboutus/pressreleasesdetail.aspx?ed=12%2F31%2F2016&id=pr959&sd=7%2F21%2F2016

Cassidy, N., & Parsons, S. (2017). The rising share of part time employment. Reserve Bank of Australia.

Catalonia, G. o. (2016). The smart city sector rakes root in Catalonia. Retrieved from http://catalonia.com/trade-with-catalonia/smart-city.jsp

Cisco. (2018). VNI Complete Forecast Highlights. Cisco.

CommBank. (2018). Daily IQ User Guide.

Commission, P. (2017). Productivity and Income - The Australian Story. Sydney.

Commonwealth Bank. (2017). Commbank's Albert: two years shaping the future of business.

Cowling, D. (2019). Social Media Statistics Australia - January 2019. Retrieved from https://www.socialmedianews.com.au/social-media-statistics-australia-january-2019/

CSIRO. (2018). Home monitoring of chronic diseases. Retrieved from https://www.csiro.au/en/Research/BF/Areas/Digital-health/Improving-access/Home-monitoring

Cunningham, M., & Pearson, E. (2018). Police weight link between woman's death in Princes Park and sex attack. Retrieved from https://www.theage.com.au/national/victoria/police-weigh-link-between-woman-s-death-in-princes-park-and-sex-attack-20180613-p4zl5f.html?platform=hootsuite

Deloitte. (2017). Mobile consumer survey.

Deloitte. (2018a). Mobile Consumer Survey.

Deloitte. (2018b). 5G: The chance to lead for a decade.

Deloitte. (2018c). 5G mobile technology: Are businesses ready to seize the opportunity? Telstra.

Deloitte. (2018d). Media consumer survey.

Deloitte. (2019). TMT predictions 2019.

Deloitte Access Economics. (2013). Mobile Nation: the economic and social impacts of mobile technology.

Deloitte Access Economics. (2016). Mobile Nation: Driving workforce participation and producitvity.

Deloitte Access Economics. (2017a). 5G mobile - enabling businesses and economic growth.

Deloitte Access Economics. (2017b). Connected Small Businesses.

Deloitte Digital. (2016). Failure to Launch: 7 Steps to developing mobile apps your employees will actually use. Deloitte Digital.

Department of Communications and the Arts. (2017). 5G—Enabling the future economy. Retrieved from https://www.communications.gov.au/departmental-news/5g-enabling-future-economy

Department of Communications and the Arts. (2019). Policy listing.

DHL and Cisco. (2015). Internet of things in logistics.

Fliplet. (2017). 2017 Enterprise Mobile App Report. Fliplet. Retrieved from https://fliplet.com/wp-content/uploads/2017/02/2017-Enterprise-Mobile-Apps-Report-Fliplet.pdf

GSMA. (2018). Connected Society: State of Mobile Internet Connectivity 2018.

Hardy, & Rukzio. (2008). Touch & Interact: Touch-based interaction with a tourist application. 10th Conference on Human-Computer Interaction with Mobile Devices and Services, (pp. 531-534). Amsterdam.

IBISWorld. (2018). J5800 - Telecommunications Services in Australia.

International Telecommunications Union. (2019). The ICT Development Index (IDI): conceptual framework and methodology. Retrieved from https://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2017/methodology.aspx

Jacks, T. (2019). Drivers may face tougher ban on phone use. Retrieved from https://www.theage.com.au/national/victoria/drivers-may-face-tougher-ban-on-phone-use-20190121-p50sly.html

Kang, C. (2012). After-hours e-mail, companies are telling employees to avoid it. Retrieved from https://www.washingtonpost.com/business/economy/after-hours-e-mail-companies-are-telling-employees-to-avoid-it/2012/09/21/a95f53b2-fdba-11e1-a31e-804fccb658f9_story.html?utm_term=.c880349dda8c

Kim, E. (2016). Amazon's $775 million deal for robotics company Kiva is starting to look really smart. Retrieved from https://www.businessinsider.com.au/kiva-robots-save-money-for-amazon-2016-6?r=US&IR=T

Klick, MacDonald, & Stratmann. (2012). Mobile phones and crime deterrence: an unprecedented link. Research Handbook on the Economics of Criminal Law.

Knaus, C. (2018). New cameras will catch drivers using mobile phones on NSW roads. Retrieved from https://www.theguardian.com/australia-news/2018/may/03/new-cameras-catch-drivers-mobile-phones

Kranzberg, M. (1986). Technology and History: "Kranzberg's Laws". Technology and Culture, 27(3), 544-560.

Linfox. (2018). Transport management systems. Retrieved from https://www.linfox.com/supply-chain-solutions/logistics-it/transport-management-systems/

Loussikian, K. (2019). Social media giants face child safety law overhaul. Retrieved from https://www.smh.com.au/politics/federal/social-media-giants-face-child-safety-law-overhaul-20190215-p50y5j.html

Lowe, P. (2018). A journey towards a near cashless payments system.

Maskey, N., Horsmanheimo, S., & Tuomimaki, L. (2015). Latency analysis of LTE network for M2M applications.

McCrindle. (2018). Teleworking in Australia: Latest Trends and Perceptions.

Microsoft. (2016). Technical case studies. Retrieved from https://microsoft.github.io/techcasestudies/iot/2016/11/03/CostaCorp.html

Miller, C. (2018). ApplePay has over 252M users globally, more popular internationally than US. Retrieved from https://9to5mac.com/2018/08/09/apple-pay-adoption-loup/

Moocall. (2019). The Moocall Product Family. Retrieved from https://moocall.com/

Murdoch University. (2018). What are Australians' smartphone habits? Retrieved from https://www.modernlifestudy.com/abc-survey-results

Mobile World Congress. (2019). First 5G tele-mentored live surgery. Retrieved from https://www.mwcbarcelona.com/session/first-5g-tele-mentored-live-surgery/

National Drones. (2019). Agriculture. Retrieved from https://nationaldrones.com.au/industries/agriculture/

New Zealand Productivity Commission. (2014). Boosting productivity in the services sector. New Zealand Productivity Commission.

Nielson. (2018). Nielson Digital Ratings. The Nielson Company.

NSW Government. (2018a). Cameras to catch drivers using their phones. Retrieved from https://www.nsw.gov.au/news-and-events/news/cameras-to-catch-drivers-using-their-phones/

NSW Government. (2018b). Review into the non-educational use of mobile devices in NSW schools. Retrieved from https://education.nsw.gov.au/about-us/strategies-and-reports/our-reports-and-reviews/mobile-devices-in-schools

OAIC. (2018). Notifiable Data Breaches Quarterly Statistics Report. Retrieved from https://www.oaic.gov.au/privacy-law/privacy-act/notifiable-data-breaches-scheme/quarterly-statistics-reports/notifiable-data-breaches-quarterly-statistics-report-1-july-30-september-2018

Office of the eSafety Commissioner. (2016). Cyberbullying? Top 5 tips for parents. Retrieved from https://www.esafety.gov.au/about-the-office/newsroom/blog/cyberbullying-top-five-tips-for-parents

Office of the eSafety Commissioner. (2019). About the Office. Retrieved from https://www.esafety.gov.au/about-the-office

Office Pulse. (2017). Brining Life to Work.

Pearce, R. (2018). Australia's telcos prepare for 5G era, spending $834 million on key spectrum. Retrieved from https://www.computerworld.com.au/article/650613/australia-telcos-prepare-5g-era-spending-834-million-key-spectrum/

Productivity Commission. (2017). Productivity and Income - the Australian Story.

Qu, J., Simes, R., & O'Mahony, J. (2016). How Do Digital Technologies Drive Economic Growth?

RBA. (2018). Average merchant fees for debit, credit and charge cards.

RCPCH. (2018). The health impacts of screen time - a guide for clinicians and parents. Retrieved from https://www.rcpch.ac.uk/resources/health-impacts-screen-time-guide-clinicians-parents

Roberts, Yaya, & Manolis. (2014). The invisible addiction: cell-phone activities and addiction among male and female college students. Journal of behavioural addictions, 11.

Roy Morgan. (2018). Mobile betting drives growth in online wagering. Retrieved from http://www.roymorgan.com/findings/7624-mobile-betting-users-march-2018-201806172313

Sims, R. (2016). Enhancing competition in retail. AFR Retail Summit. Melbourne: ACCC.

Singtel. (2018). Singtel posts record full-year earnings on NetLink Trust divestment and strong core business.

Solow, R. (1987). We'd better watch out. New York Times Book Review, p. 36.

Speedtest. (2018). Australia. Retrieved from https://www.speedtest.net/reports/australia/

Square. (2019). Square Up. Retrieved from https://squareup.com/us/en/payments

Statista. (2019). Number of smartphone users in Australia from 2015 to 2022 (in millions). Retrieved from https://www.statista.com/statistics/467753/forecast-of-smartphone-users-in-australia/

swisslog. (2016). Catch of the Day, Australia: E-commerce intralogistics. Retrieved from https://www.swisslog.com/en-au/logistics-automation/case-studies-and-resources/case-studies/2016/07/catch-of-the-day

Telecommunications Industry Ombudsman. (2019). About us. Retrieved from https://www.tio.com.au/about-us

Telstra. (2018). Telstra annual report.

Telstra. (2019). Mobile calls to 000. (AMTA, Interviewer)

Telsyte. (2018). Smart speakers help send Australian IoT@home market skyward. Retrieved from https://www.telsyte.com.au/announcements/2018/5/15/smart-speakers-help-send-australian-iothome-market-skyward

Thomas, Barraket, Wilson, Cook, Louie, Halcombe-James, . . . MacDonald. (2018). Measuring Australia's Digital Divide: The Australian Digital Inclusion Index 2018. Melbourne: RMIT University.

Triggs, A. (2018). Unlocking Australia's productivity paradox. Why things aren't that super. Retrieved from https://theconversation.com/unlocking-australias-productivity-paradox-why-things-arent-that-super-106350

Tucker, R. (2017). 5G vs NBN: Next-gen mobile network will be a convenient but expensive alternative. Retrieved from https://www.abc.net.au/news/2017-10-25/5g-vs-nbn-mobile-network-convenient-but-expensive-alternative/9083746

Varghese, S. (2019). Labor plans to issue digital licences for children. Retrieved from https://www.itwire.com/government-tech-policy/85992-labor-plans-to-issue-digital-licences-for-children.html

WA Government. (2018). Weather stations app. Retrieved from https://www.agric.wa.gov.au/apps/weather-stations-app

Weir, G. (2018). Wage Growth Puzzles and Technology. Reserve Bank of Australia.

Westpac. (2018). Westpac Small Business Report.

Winston, N. (2018). New mums Nikki and Haley didn't have a 'village' to join. So they made their own. Retrieved from https://www.mamamia.com.au/facebook-mothers-groups-australia/

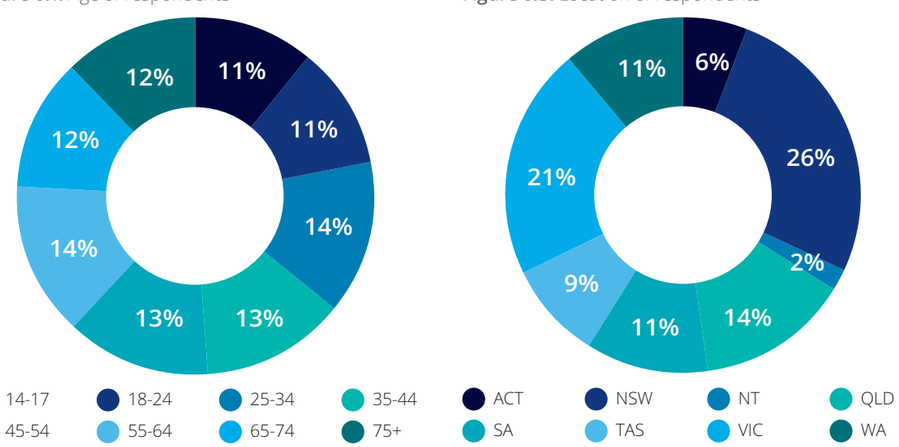
Workplace Law. (2018). Getting your mobile phone policies right. Retrieved from https://www.workplacelaw.com.au/getting-your-mobile-phone-policies-right/

Appendices

Appendix A
Survey respondents

This research is based, in part, on a bespoke survey of over 1,000 Australians. The survey was fielded in January 2019. The charts below show the demographic makeup of the sample.

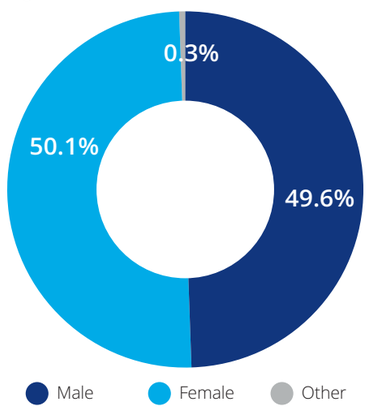
Figure 6.1: Age of respondents



N=1,004

Source: Deloitte Access Economics analysis based on data from Dynata (2019)

Figure 6.2: Gender of respondents



N=1,004

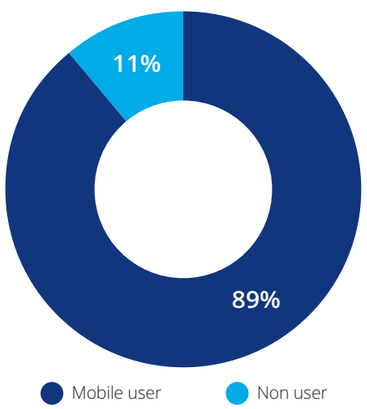
Source: Deloitte Access Economics analysis based on data from Dynata (2019)

Figure 6.3: Location of respondents

N=1,004

Source: Deloitte Access Economics analysis based on data from Dynata (2019)

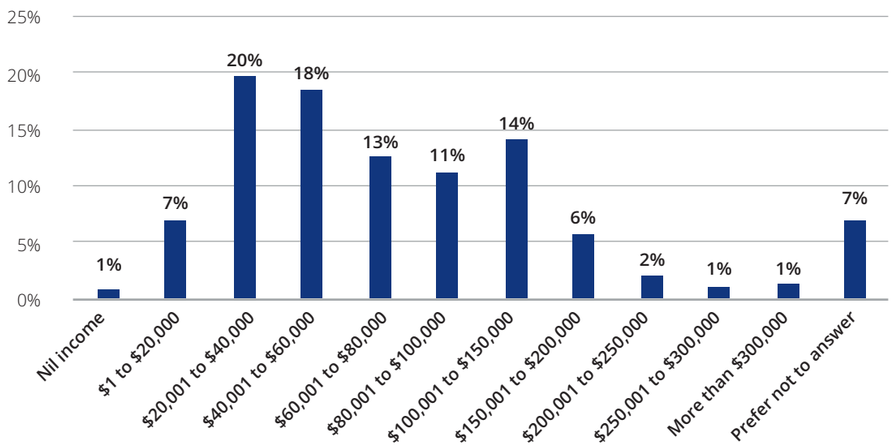
Figure 6.4: Respondents' use of mobile



N=1,004

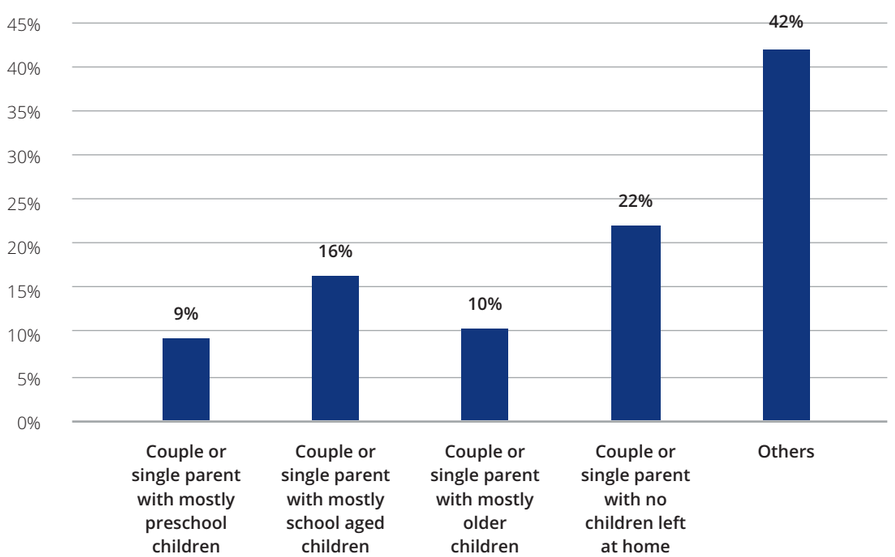
Source: Deloitte Access Economics analysis based on data from Dynata (2019)

Figure 6.5: Household income of respondents



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

Figure 6.6: Household composition of respondents



Source: Deloitte Access Economics analysis based on data from Dynata (2019)

Appendix B
Economic contribution

Economic contribution studies are intended to quantify measures such as value added, exports, imports and employment associated with a given industry or firm, in a historical reference year. The economic contribution is a measure of the value of production by a firm or industry.

B.1. Value added

Value added is the most appropriate measure of an industry's economic contribution to gross domestic product (GDP) at the national level, or gross state product (GSP) at the state level.

Other measures, such as total revenue or total exports, may be easier to estimate than value added but they 'double count'. That is, they overstate the contribution of a company to economic activity because they include, for example, the value added by external firms supplying inputs or the value added by other industries.

B.2. Measuring the economic contribution

There are several commonly used measures of economic activity, each of which describes a different aspect of an industry's economic contribution:

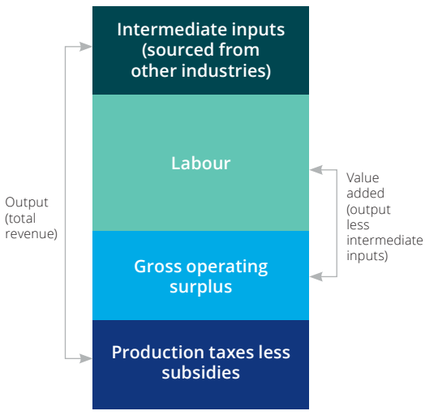
- Value added measures the value of output (i.e. goods and services) generated by the entity's factors of production (i.e. labour and capital) as measured in the income to those factors of production. The sum of value added across all entities in the economy equals gross domestic product. Given the relationship to GDP, the value added measure can be thought of as the increased contribution to welfare.

  Value added is the sum of:

  - Gross operating surplus (GOS). GOS represents the value of income generated by the entity's direct capital inputs, generally measured as the earnings before interest, tax, depreciation and amortisation (EBITDA).
  - Labour income. It represents the value of output generated by the entity's direct labour inputs, as measured by the income to labour.
  - Tax on production less subsidy provided for production. This generally includes company taxes and taxes on employment. Note: given the returns to capital before tax (EBITDA) are calculated, company tax is not included or this would double count that tax.
- Gross output measures the total value of the goods and services supplied by the entity. This is a broader measure than value added because it is an addition to the value added generated by the entity. It also includes the value of intermediate inputs used by the entity that flow from value added generated by other entities.
- Employment is a fundamentally different measure of activity to those above. It measures the number of workers that are employed by the entity, rather than the value of the workers' output.

Figure B.1 shows the accounting framework used to evaluate economic activity, along with the components that make up gross output. Gross output is the sum of value added and the value of intermediate inputs. Value added can be calculated directly by summing the payments to the primary factors of production, labour (i.e. salaries) and capital (i.e. GOS, or profit), as well as production taxes less subsidies. The value of intermediate inputs can also be calculated directly by summing up expenses related to non-primary factor inputs.

Figure B.1: Economic activity accounting framework



Source: Deloitte Access Economics

B.3. Direct and indirect contributions

The **direct economic contribution** is a representation of the flow from labour and capital within the sector of the economy in question.

The **indirect contribution** is a measure of the demand for goods and services produced in other sectors as a result of demand generated by the sector in question. Estimation of the indirect economic contribution is undertaken in an input-output (IO) framework using Australian Bureau of Statistics input-output tables, which report the inputs and outputs of specific sectors of the economy.

The total economic contribution to the economy is the sum of the direct and indirect economic contributions.

B.4. Limitations of economic contribution studies

While describing the geographic origin of production inputs may be a guide to a firm's linkages with the local economy, it should be recognised that these are the types of normal industry linkages that characterise all economic activities.

Unless there is significant unused capacity in the economy (such as unemployed labour) there is only a weak relationship between a firm's economic contribution as measured by value added (or other static aggregates) and the welfare or living standard of the community. Indeed, the use of labour and capital by demand created from the industry comes at an opportunity cost as it may reduce the amount of resources available to spend on other economic activities.

This is not to say that the economic contribution, including employment, is not important. As stated by the Productivity Commission in the context of Australia's gambling industries:

"Value added, trade and job creation arguments need to be considered in the context of the economy as a whole … income from trade uses real resources, which could have been employed to generate benefits elsewhere. These arguments do not mean that jobs, trade and activity are unimportant in an economy. To the contrary they are critical to people's well-being. However, any particular industry's contribution to these benefits is much smaller than might at first be thought, because substitute industries could produce similar, though not equal gains."

In a fundamental sense, economic contribution studies are simply historical accounting exercises. No 'what-if', or counterfactual inferences - such as 'what would happen to living standards if the firm disappeared?'- should be drawn from them.

The analysis - as discussed in the report - relies on a national input-output table modelling framework and there are some limitations to this modelling framework. The analysis assumes that goods and services provided to the sector are produced by factors of production that are located completely within the state or region defined and that income flows do not leak to other states.

The IO framework and the derivation of the multipliers also assume that the relevant economic activity takes place within an unconstrained environment. That is, an increase in economic activity in one area of the economy does not increase prices and subsequently crowd out economic activity in another area of the economy. As a result, the modelled total and indirect contribution can be regarded as an upper-bound estimate of the contribution made by the supply of intermediate inputs.

Similarly, the IO framework does not account for further flow-on benefits as captured in a more dynamic modelling environment like a Computable General Equilibrium model.

B.5. Input-output analysis

IO tables are required to account for the intermediate flows between sectors. These tables measure the direct economic activity of every sector in the economy at the national level. Importantly, these tables allow intermediate inputs to be further broken down by source. These detailed intermediate flows can be used to derive the total change in economic activity for a given sector.

A widely used measure of the spillover of activity from one sector to another is captured by the ratio of the total to direct change in economic activity. The resulting estimate is typically referred to as 'the multiplier'. A multiplier greater than one implies some indirect activity, with higher multipliers indicating relatively larger indirect and total activity flowing from a given level of direct activity.

The IO matrix used for Australia is derived from the ABS IO tables. The industry classification used for input-output tables is based on ANZSIC, with 111 sectors in the modelling framework.

Appendix C Productivity modelling and forecasting approach

C.1. Theoretical modelling framework

This report follows previous Deloitte Access Economics and OECD research in taking a panel approach to identify the growth effects of digital technology usage with consideration to policy and institutional influences. The econometric methods employed largely follow the approach of Qu, Simes and O'Mahony (2016), and Bassanini et. al. (2001).

The model adheres to previous research with the some changes in the main variable of interest. The underlying modelling framework is based on a standard neo-classical growth model derived from a constant returns to scale production function. Output at time t is given by:

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} \left(A(t)L(t)\right)^{1-\alpha-\beta}$$

Where Y,K,H and L are respectively output, physical capital, human capital and labour, α and β are the partial elasticity of output with respect to physical capital and human capital, and A(t) is a composite measure of technical progress Ω(t) and economic efficiency I(t):

$$A(t) = I(t)\Omega(t)$$

Economic efficiency can include a range of 'enabling services', such as the digital economy, trade, transport and logistics, professional and support services and innovation. These enabling services provide support to firms at all stages of production.

In addition to measures of ICT and the digital economy, this report controls for several other widely recognised policy and institutional variables V_j (t), which contribute to economic efficiency. These are urbanisation, total research and development (R&D) expenditure and exposure to trade.

$$\ln I(t) = p_0 + \sum_j p_j \ln V_j(t)$$

Other technological progress is assumed to be exogenous and to grow at rate g(t).

$$\dot{\Omega}(t) = g(t)\Omega(t)$$

The following equations can be used to describe the path of factors of production over time.

$$\dot{k}(t) = s_k(t)A(t)^{1-\alpha-\beta}k(t)^{\alpha}h(t)^{\beta} - \big(n(t) + d + g(t)\big)k(t)$$

$$\dot{h}(t) = s_h(t)A(t)^{1-\alpha-\beta}k(t)^{\alpha}h(t)^{\beta} - \big(n(t) + d + g(t)\big)k(t)$$

$$\dot{L}(t) = n(t)L(t)$$

These equations are used to derive the steady-state values of physical capital and human capital. In turn, the steady-state values of physical and human capital can then be used to express the steady state output per capita as:

$$\ln y^*(t) = \ln A(t) + \frac{\alpha}{1-\alpha}\ln s_k(t) + \frac{\beta}{1-\alpha}\left(\ln h(t) + \frac{1-\psi}{\psi}\Delta\ln\left(\frac{h(t)}{A(t)}\right)\right) - \frac{\alpha}{1-\alpha}\ln\big(g(t) + d + n(t)\big)$$

Adding convergence dynamics and expanding the productivity term A yields the transitional equation for output per capita.

$$\Delta\ln y(t) = \phi\left(-\ln y(t-1) + \frac{\alpha}{1-\alpha}\ln s_k(t) + \frac{\beta}{1-\alpha}\ln h(t) + \sum_j p_j \ln V_{j,t} - \frac{\alpha}{1-\alpha}\ln(g(t)+d)\ln n(t) + g(t)t + (p_0 - \ln\Omega(0))\right) + \frac{1-\psi}{\psi}\frac{\beta}{1-\alpha}\Delta\ln h(t) + \left(1 - \frac{\phi}{\psi}\right)g(t)$$

This last equation represents the functional form that was empirically estimated in this report. The coefficient estimate $\boldsymbol{\phi}$ represents the convergence parameter, which reflects the speed in which countries converge to their new steady-state output.

C.1.1 Limitations

It is important to recognise that under the conditional convergence model used in this paper, various forms of capital as well as policies and institutions are assumed to have a permanent impact on cross-country differences in GDP per capita levels but only temporary effects on growth rates. This means the observed growth in output in any given period, abstracting from cyclical fluctuations, can be seen as the combination of three different forces:

- exogenous growth in other technological progress
- a convergence process towards the country-specific steady-state path of output per capita
- shifts in the steady-state that can arise from changes in policy and institutions, digital technology adoption as well as investment rates and changes in population growth rates.

It should also be noted that the framework is derived under the assumption of equilibrium employment and hence that variations in the intensity of labour utilisation are not explicitly taken into account.

C.2. Empirical approach

The empirical work in this report employs a pooled mean group estimator (PMG). The PMG approach provides an effective middle ground between imposing homogeneity on all slope coefficients when using a dynamic fixed effect estimator (DFE), and the imposition of no restrictions when using a mean group approach (MG). Both DFE and MG estimators have significant drawbacks when dealing with samples similar to the one analysed in this report when compared with PMG (Qu, Simes & O'Mahony, 2016).

It is worth noting the PMG approach is not without its limitations. Chiefly, PMG requires the estimation of a large number of parameters, which can cause likelihood convergence issues and estimates sensitive to model specification changes (Qu, Simes & O'Mahony, 2016). In practice, this means considering more than three policy and institutional variables can be difficult.

C.2.1 Index motivation

We employed an index approach to capture the effect of multiple digital variables, for theoretical and empirical reasons. Firstly, it is difficult to separate fixed and mobile networks as there are increasing crossovers between the two. For example, dongles use the mobile network on PCs and other devices that are usually considered to be part of the fixed network, such as when using fixed broadband penetration as a proxy. Estimating the combined impact of mobile and fixed through an index allows us to partly capture this integration.

Empirically, an index of mobile and fixed variables also accounts for the limitations of the PMG estimator, through the ability to simultaneously control for, and measure, the impact of several digital variables. Including multiple explanatory variables of interest in the same model often resulted in convergence problems or estimates highly sensitive to model specification changes.

The index of digital variables measures the contribution of the entire digital industry. The individual contribution of each industry, fixed and mobile, is then calculated as a proportion of the total contribution based on each industry's share of revenue, traffic and use within the digital industry.

C.2.2 Index methodology

The methodology underlying the creation of the digital index in this report largely follows that of the ICT Development Index (IDI) developed by the International Telecommunications Union (ITU) (2019).

To capture the effect of digital technology on productivity growth, we use a combination of three digital variables; mobile phone penetration, percentage of individuals with access to the internet, and fixed broadband penetration. It is important to note that these variables do not provide a perfect measure of changes in the digital industry. However, in the absence of reliable data that could reflect these underlying changes in technology over a sufficient time period, these variables serve as a good starting point to measure the impact of fixed and mobile technologies in Australia.

In order to combine the three variables into a single index, each is first normalized following methods outlined by the ITU. The reference value for fixed broadband is defined as 60 connections per 100 inhabitants; for mobile penetration, 120 per 100 inhabitants; and for the percentage of individuals with internet access, 100% of the population. Following normalisation, the following weights are used to combine the three variables.

Table C.1: Index weights 2004-2017

Parameters	Direct
Fixed-broadband internet subscriptions per 100 inhabitants	0.3
Percentage of individuals using the internet	0.3
Mobile-cellular telephone subscriptions per 100 inhabitants	0.4

Source: Deloitte Access Economics and International Telecommunications Union (2019)

C.3. Data and modelling results

The modelling in this report uses a sample of 37 countries between 2005 and 2017. Where appropriate, data is converted to constant 2010 US dollars using constant Purchasing Power Parity, consistent with OECD standards.

Table C.3 outlines the parameters used in the econometric modelling. In addition to primary factors of production, including physical capital accumulation, human capital and labour, the model also takes into account the contribution of other productivity enhancing variables, such as openness to trade and urbanisation of the population.

Table C.2: Country list

Australia	France	Korea	Slovak Republic
Austria	Germany	Luxemburg	Slovenia
Belgium	Greece	Mexico	South Africa
Canada	Hungary	Netherlands	Spain
Chile	Iceland	New Zealand	Sweden
China	Ireland	Norway	Switzerland
Czech Republic	Israel	Poland	Turkey
Denmark	Italy	Portugal	United Kingdom
Estonia	Japan	Russia	United States
Finland			

Source: Deloitte Access Economics

The results presented here are consistent with the academic literature with respect to the estimated shares of capital and labour. Further, there are no estimated coefficients for the included controls are all statistically significant at the 5% level.

The coefficient on the digital index, V_3, can be interpreted as follows. If the index increases by x% and if y represents the resultant percentage change in long-run steady state GDP per capita then;

$$y=V_3x=0.127x$$

Put another way, a 1% increase in the digital index leads to an approximate 0.127% increase in steady state GDP per capita.

Table C.3: Data sources

Parameter	Variable	Source
$y(t)$	Gross domestic product per capita	OECD
$h(t)$	Tertiary education attainment (% of 15+ population)	Barro-Lee
$n(t)$	Total population growth	OECD
$s_k(t)$	Gross capital formation (% of GDP)	Worldbank
V_1	Urbanisation (% of population in urban areas)	Worldbank
V_2	Exports and imports of good and services (% of GDP)	Worldbank
V_3	Index of mobile and fixed variables (see above)	ITU & Worldbank

Source: Deloitte Access Economics

Table C.4: Model results

Parameter	Variable	Coefficient
Long-run coefficients		
$\ln h(t)$	Tertiary education attainment (% of 15+ population)	0.319*** (7.27)
$\ln n(t)$	Total population growth	-0.426 (-0.94)
$\ln s_k(t)$	Gross capital formation (% of GDP)	0.477*** (19.4)
$\ln V_1$	Urbanisation (% of population in urban areas)	0.933*** (4.69)
$\ln V_2$	Exports and imports of good and services (% of GDP)	0.080** (2.68)
$\ln V_3$	Index of digital variables	0.127*** (3.79)
Implied share of physical capital		**32.30%**
Implied share of human capital		**21.60%**
Implied share of labour		**46.11%**

Source: Deloitte Access Economics

Notes: t-statistics are reported in parenthesis.

C.4. Forecast

C.4.1 Index forecast methodology

To forecast the future contribution of digital technology, this report combines modelling estimates of the effect of changes in digital technology with individual variable forecasts from Cisco's (2018) VNI index.

First, digital index growth is estimated by aggregating predicted growth of the individual elements. To predict changes in the percentage of the population with internet access, this report utilises Cisco VNI index forecasts for the percentage of the Australian population with internet access in 2022.

Growth in mobile penetration forecasts is based on Cisco forecast growth of Networked Devices (excluding M2M) from 2017-2022. Finally, the growth of fixed broadband connections is estimated using Cisco forecasts for the increase in fixed internet users as a percentage of the population. The annual growth rate of the index from 2017-2022 is used to forecast the index in each year from 2018 to 2023.

Second, forecast index growth is combined with econometric modelling results to predict the effect on steady state GDP per capita.

Table C.5: Forecast results

Period	Index growth (forecast)	Contribution to steady state GDP per capita
2005-2017	47.05%	5.98%
2005-2023	59.85%	7.60%

Source: Deloitte Access Economics and Cisco (2018)

C.4.2 Mobile forecast methodology

To calculate the current and future proportion of the ICT contribution to GDP per capita that is attributable to mobile, we created a composite measure of the mobile share of the digital economy. This includes three components that each capture a different feature of mobile technology.

The first component of the composite mobile measure is mobile spend, as a proportion of total revenue (mobile + fixed) attributable to mobile telecommunications, based on IBISWorld (2018) forecasts of revenue in wired and wireless telecommunications.

Secondly, we use mobile traffic as a share of total internet traffic, from Cisco (2018) digital forecasts. The final part of the mobile measure is mobile use or screen time, calculated as the share of total screen time on PCs and smartphones attributable to smartphones (Nielson, 2018).

The composite mobile measure is an average of the mobile shares of revenue, traffic and use, from 2005 to 2017, and 2005 to 2023.

C.4.3 Mobile forecast results

To calculate the individual contributions of mobile and fixed technology, the total index contribution, y, is divided up proportionally based on the mobile composite measure from above. That is, if β represents the mobile composite measure, then the percentage contribution of mobile technology to GDP, z, is defined as;

$$z = \beta y$$

For this report, this corresponds to a contribution from mobile technology to GDP, between 2005 and 2017, of;

$$z = 0.362 \cdot 0.0598 \ = 2.17\%$$

And forecast contribution between 2005 and 2023 of;

$$z = 0.410 \cdot 0.0760 \ = 3.12\%$$

Note, in the second estimate, the mobile compostive share has been adjusted upwards to reflect growth in the mobile revenue, traffic and use forecasts up to 2023.

C.4.4 Limitations

It is important to note that the measures used for digital technology are not perfect. For example, the adoption rate of mobile devices cannot completely capture the sophistication of mobile usage, availability of services through mobile devices, or the interaction between mobile devices and other technology platforms.

Table C.6: Mobile share of digital industry, in spend, traffic and use

Period	Mobile share of spend (revenue)	Mobile share of traffic	Mobile share of use (screen time)
2005-2017	57%	2%	50%
2005-2023	61%	4%	58%

Source: IBIS (2018), Cisco (2018) and Nielson (2018)

However, in the absence of reliable data that could reflect these underlying changes in technology over a sufficient time period, these variables serve as a good starting point to measure the impact of fixed and mobile technologies in Australia.

C.5. Sensitivity analysis and robustness tests

To address any potential issues created by the construction of the digital index and assess the validity of the main results, we performed the following tests.

Firstly, we tested a number of alternate index specifications to determine whether the results are driven by index weighting decisions. Small adjustments of any of the three variable weights had a minimal effect on the results.

Alternate specifications including other digital variables were also run, but they encounter convergence problems or produce nonsensical estimates of control variables. This is could be due to many of these variables being available for only a limited time series and often with patchy data across all 37 countries.

As a final general test, alternate model specifications including different combinations of control variables were run. The main results are statistically and economically consistent across all tested specifications, with the estimated contribution larger and more significant in most.

Limitation of our work

General use restriction

This report is prepared solely for the use of the Australian Mobile Telecommunications Association. This report is not intended to and should not be used or relied upon by anyone else and we accept no duty of care to any other person or entity. The report has been prepared for the purpose of quantifying the economic and social impact of mobile in Australia. You should not refer to or use our name or the advice for any other purpose

Contacts

John O'Mahony

Partner, Deloitte Access Economics
+61 2 9322 7877
joomahony@deloitte.com.au

Nick Hull

Senior Analyst, Deloitte Access Economics
+61 2 8260 4222
nhull@deloitte.com.au

Ric Simes

Senior Advisor, Deloitte Access Economics
+61 2 9322 7772
rsimes@deloitte.com.au

Xanthe Smith

Senior Analyst, Deloitte Access Economics
+61 2 9322 3792
xsmith@deloitte.com.au

Jess Mizrahi

Associate Director, Deloitte Access Economics
+61 2 9322 3644
jmizrahi@deloitte.com.au

Evie Fox Koob

Graduate, Deloitte Access Economics
+61 2 8260 6707
efoxkoob@deloitte.com.au

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Deloitte.

Deloitte Access Economics
ACN: 149 633 116

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