Australian Industry Group

The Fourth Industrial Revolution

Australian businesses in transition

August 2019

AiGROUP

About Ai Group

The Australian Industry Group (Ai Group) is a peak national industry association representing and connecting thousands of employers across Australia.

We represent the interests of more than 60,000 businesses employing more than 1 million staff and we promote industry development, jobs growth and stronger Australian communities.

Our members are private sector employers large and small, with common interests in more competitive businesses and a stronger economic environment.

Ai Group members have access to specialist workplace advice and services and to policy leaders and business networks.

We connect businesses and our members value Ai Group's expertise and ability to contribute to and influence government policy in areas such as industry policy, workplace relations, education and training, energy, trade, taxation and regulation.

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Foreword

Only a few years ago "digitalisation" seemed like a discussion by and for technology companies. That conversation now extends to businesses well beyond the technology sector.

More and more businesses are participating in the Fourth Industrial Revolution – a transformation of business models driven by connected devices, data analytics and other technologies, comparable in impact to the adoption of steam, electricity, telephony, railways, mass production, automobiles and computers. Business engagement with the current upheaval is growing, maturing and moving well beyond hype and theory.

Ai Group's new report, *The Fourth Industrial Revolution: Australian businesses in transition*, outlines the state of business digitalisation, drawing from a range of sources including Ai Group's recent surveys. It follows from our 2017 report *Business Beyond Broadband: Are Australian businesses ready for the Fourth Industrial Revolution?,* which reviewed business use of and investment in digital and associated technologies.

Implementation and change are spreading across sectors as diverse as manufacturing, electricity generation and transmission, construction, infrastructure, retail, the public sector and other institutions.

The changes underway present challenges and opportunities for all these organisations and the broader community. Organisations are grappling with this in different ways and with different levels of readiness and capability.

The very strong prospect of further rapid income growth in our region is a huge opportunity for Australia, particularly if we can lift innovation, productivity and quality in all sectors through the greater adoption of digital technologies.

At the same time, greater global engagement, the rise of new centres of economic success and growing digitalisation are disrupting existing businesses, industries and occupations.

Like many other developed economies, Australia faces currents of dissatisfaction and distrust associated with these transformations in the global economy, compounded by the failures that led to the Global Financial Crisis. The sense that "the system" is not working for ordinary people needs to be taken seriously in parliaments and boardrooms.

Debate is needed on how to navigate the wave of digitalisation: maximising participation, minimising the pain of change and disruption, and preventing disenfranchisement.

This debate is not just for businesses and other organisations: governments can provide strong visionary leadership. Following the recent Federal Election, and with more than a year before any State elections, the returned Coalition Government has the opportunity to work with businesses and the States to promote investment, job creation, community prosperity and social cohesion.

An immediate challenge is the current period of relatively low real wages growth which is evident across the world's developed economies and is widely perceived to be associated with globalisation and disruptive technological change.

People are right to demand solutions. Real solutions need substance and rigour. There is a growing risk worldwide that anger, distrust and the need to be seen to be doing something lead to populist or heavy-handed proposals on trade, regulation and technology. That would undermine the foundations both of global growth and Australia's strong performance over recent decades.

Australia needs to achieve inclusive growth. Making the most of the Fourth Industrial Revolution is essential to that goal.

Innes Willox
Chief Executive

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Executive summary

Australian businesses are currently transitioning to and within the Fourth Industrial Revolution (or Industry 4.0). It is fair to say that substantial progress in embracing Industry 4.0 has so far been confined to leading local and multinational firms. These companies are punching above their weight, doing amazing things with new technology and leading the way for others. The gap between these leaders and the majority of businesses is substantial.

This report assesses progress on digitalisation [1] and changes in the underlying technological landscape; highlights case studies from leading innovators; and sets out key policy priorities for work by government and businesses. It draws on Ai Group's surveys, interviews and wider data.

Business strategy and planning (Chapter 2)

A business's overall strategy and planning can determine the extent of its digital maturity. Top significant constraints for CEOs in 2019 included lack of customer demand, skill shortages, and competition from imports and online sources. Most popular business growth strategies included improving sales of current products and services to customers, new products to the market, downsizing or reducing operational costs, and increasing online presence or capability. The nature of investment is also changing, with a greater focus on IT and a shift towards increased investment in the services industries. These business challenges and opportunities suggest areas where digitalisation can play a useful role.

Business internet uses (Chapter 3)

There is considerable capacity for businesses to increase the proportion of revenue generated online, as well as boost their online presence. ABS data show innovative active businesses generally tend to make more internet use, while smaller businesses often lag in the take up of online technology. While Ai Group data indicate over 60% of businesses are making use of data storage and/or analysis and online applications, ABS data is less optimistic: nearly 60% of businesses do not use paid cloud computing and generally do not use automated links between their systems, and nearly 70% do not see any value in data analytics and intelligent software systems.

Digital infrastructure and IoT (Chapter 3)

A mix of good access to digital and communications infrastructure – including the National Broadband Network (nbn), non-nbn alternatives, 5G mobile networks and a mix of other Internet of Things (IoT) communications networks – is essential to do business in Industry 4.0.

The nbn is now available to more than 10 million homes and businesses, with less than twelve months of the build remaining. While accelerating uptake of service is expected to entail more frequent complaints, nbn-related complaints to the Telecommunications Industry Ombudsman have been falling as the rollout progresses and belies media perceptions of dissatisfaction with the nbn. However, there is much room for improvement in bringing down complaints, completing the rollout of the nbn, bridging the digital divide for underserved regions, lower barriers to global competitiveness, and communicating the real business benefits of the nbn.

The anticipated rollout of the 5G mobile network over the next year is expected to enhance access for advanced industry digital applications through significant higher data limits and faster data speeds compared to 4G.

Despite positive expectations for adoption of IoT through greater cost efficiency, challenges remain for promoting the business value of IoT. According to ABS data, more than 60% of businesses did not see any value in IoT. IoT was more likely to be valued by larger businesses and in industries such as mining, retail trade, transport, postal, warehousing, information media and telecommunications.

Cyber security and data breaches (Chapter 4)

Cyber security threats continue to be a growing and evolving risk management issue for many businesses. Akin to safety, cyber security is an ongoing risk management consideration for any business. 2018 saw the commencement of a range of significant data privacy legislation including the Australian Notifiable Data Breaches (NDB) Scheme and EU General Data Protection Regulation, as well as controversial Anti-Encryption Act.

Over 30% of businesses surveyed by Ai Group experienced a cyber security incident, with the most common arising from hacking, phishing, and malware. In contrast, ABS

[1] Sometimes digital transformation is used interchangeably with other terms like digital disruption, digitisation and digitalisation.

data reported less: over 10% of businesses experienced a cyber security incident, while less than 20% did not know.

Ai Group data found nearly 80% of businesses invested in cyber security measures. ABS data was less optimistic: almost half of businesses did not see any value at all.

Since the NDB Scheme commenced, over 1,000 data breaches were reported, almost 60% due to malicious or criminal attacks and over a third by human error. Despite improvements in cyber security investment, causes for these data breaches point to the need for improved cyber security and data management posture within organisations, where government support might assist.

Public policy priorities (Chapter 5)

In 2015, Ai Group set out key priority areas for private and government action to seize the opportunities of a digitally enabled economy. Those priorities remain relevant for Australian businesses in transition to and within the Fourth Industrial Revolution.

Nevertheless, discussions around take up and engagement in digitalisation are maturing as businesses transition to the Fourth Industrial Revolution. There is also an ongoing conversation in public policy about the role of government, regulators and other institutions in response to these changes, as well as the broader community impacts.

In this report, we identify nine public policy priorities for businesses in transition – areas that require private and government attention:

1. **Cyber secure, resilient and trusted businesses**: Strong cyber secure and resilient businesses are central to customer trust. This includes protecting data privacy, competitiveness, the strength of our economy and the reliability of our infrastructure. While in many ways diverse, business sectors have a common and collective interest to be cyber secure. It is a critical time for improved collaboration between governments and businesses.
2. **Business and technology investment**: Leadership in promoting investment in businesses, and enabling technology and infrastructure can help boost the economy. While businesses have the leading role in driving growth in the Fourth Industrial Revolution, governments can also contribute by improving business confidence and helping to create the conditions for more decisive improvements in business competitiveness.
3. **Innovation ecosystem**: Innovation is critical to improve outcomes for Australia's people, economy and environment, and it is essential to maintain and improve business competitiveness. We need to harness a wider range of capabilities through better collaboration between businesses, researchers and governments, and put this in service to a clear strategic agenda. Public policy support for innovation should be stable and informed by strategy, and should address all parts of the innovation system.
4. **Legal and regulatory framework**: Australia's legal and regulatory framework needs to be sufficiently flexible to accommodate rapid changes in technologies that lead to new types of business models and competition, maximising the benefits that flow from that, while also protecting broader community interests.
5. **Standards**: Standards are fundamental to promoting digitalisation because they can promote an ecosystem for technological innovation, competition, international trade and interoperability. Standards, when called up by regulation, offer a mechanism to quickly respond to changing markets.
6. **Sustainability**: Climate policy presents a particularly important business transition challenge, creating both economic opportunities for new products and industries, as well as vulnerabilities where existing industries may experience a challenging transition or risk exit. At the same time, waste reduction, materials efficiency and the circular economy present important opportunities over the long term.
7. **Trade**: The democratising nature of the internet has reduced the barriers that previously excluded SMEs from global markets, exposing them to greater opportunities and risks. Public policy can play a key role to boost the prospects of the vast majority of Australian exporters.
8. **Workforce skills**: Education and training play critical roles in the transitioning economy and the broader community, both in addressing workforce skill needs and improving social inclusion. The digitally enabled economy is leading to skill mismatches and shortages due to new tasks in existing jobs and to new jobs being created. While business and governments are making efforts to close the gaps, a range of measures is required to sufficiently meet business needs.
9. **Workplace relations**: Flexible workplace relations arrangements are fundamental to the improved productivity that is so important to Australia's national competitiveness and our capacity to further improve Australian living standards, especially as industries transition to and within the Fourth Industrial Revolution.

Key highlights

Business strategy and planning

A business's overall strategy and planning can determine the extent of its digital maturity. These business challenges and opportunities suggest areas where digitalisation can play a useful role.

According to Ai Group data:

- Just over 30% of CEOs identified a lack of customer demand as their most significant constraint, followed by skill shortages, and competition from imports and online sources.
- Improving sales of current products and services to their customers was the most popular strategy for business growth amongst 30% of CEOs, followed by introducing new products to the market, downsizing or reducing operational costs, and increasing online presence or capability.
- Turning to business investment priorities, strong focus on investing in technology is a long-term trend, with expectations of spending on new technologies rising at a faster pace than other forms of investment since 2013. This suggests the nature of investment in the Australian economy is changing, with a greater focus on IT and a shift towards increased investment in the services industries.

Business internet uses

Overall, the Ai Group and ABS data show that businesses are making inroads into embracing the opportunities offered through digital technologies and leveraging the internet for their business activities. However, there are still areas where businesses can increase their use of digital technologies to help achieve their overall business strategies and on their way to the Fourth Industrial Revolution. There is also considerable capacity for businesses to increase the proportion of revenue generated online, as well as boost their online presence.

ABS data show innovative active businesses generally tend to make more internet use, while smaller businesses often lag in the take up of online technologies.

Smaller businesses also often lag behind larger businesses in the take up of online technology, despite the low-cost entry barriers and efficiency gains that may result.

According to Ai Group data:

- Businesses in the services sector (87%) are more likely to use the internet for advertising and marketing than manufacturers (64%) or constructors (55%). Larger businesses are more likely to advertise online (77%) than medium (69%) or small (56%) firms. This demonstrates the large capacity for growth in online advertising and marketing that manufacturing or small to medium businesses have yet to utilise.
- Just over two-thirds (69%) of businesses use the internet to sell goods and services. There is little variation across the sectors (services 69%, manufacturing 66% and construction 67%) and sizes (small 71%, medium 65% and large 68%).
- Nearly two-thirds of businesses (65%) order online from suppliers. Three-quarters of construction firms (76%) are more likely to order online compared to two-thirds in manufacturing (65%) and services (64%). There are no notable differences between the size of a business and their likelihood to order online.
- Less than two-thirds of businesses make use of data storage and/or analysis (62%) and online applications (63%). Similar usage results appear across the surveyed sectors.

Digital infrastructure

A mix of good access to digital and communications infrastructure – including the National Broadband Network (nbn), non-nbn alternatives, 5G mobile networks and a mix of other Internet of Things (IoT) communications networks – is essential to do business in Industry 4.0.

The nbn is now available to more than 10 million homes and businesses, with less than twelve months of the build remaining. While accelerating uptake of a service is expected to entail more frequent complaints, nbn-related complaints to the Telecommunications Industry Ombudsman have been falling as the rollout progresses and belies media perceptions of dissatisfaction with the nbn. However, there is much room for improvement in bringing down complaints, completing the rollout of the nbn, bridge the digital divide for underserved regions, lower barriers to global competitiveness, and communicate the real business benefits of the nbn.

The anticipated rollout of the 5G mobile network over the next year is expected to enhance access for advanced industry digital applications through significant higher data limits and faster data speeds compared to 4G.

IoT

Despite positive expectations for adoption of IoT through greater cost efficiency, challenges still remain for promoting the business value of IoT.

- According to ABS data, more than 60% and 80% of businesses do not see any value in IoT and radio

frequency identification devices (RFID), respectively.

- IoT is more likely to be valued by larger businesses (major value at nearly 20%) and in industries such as mining, retail trade, transport, postal, warehousing, information media and telecommunications. However, just over 10% of these industries see major value in IoT.
- Similar to IoT, larger businesses are more likely to highly value RFID, however this was only for less than 10% of larger businesses. Transport, postal and warehousing valued RFID the most (major value at 10%).

Cyber security and data breaches

Cyber security threats continue to be a growing and evolving risk management issue for many businesses. Akin to safety, cyber security is an ongoing risk management consideration for any business. 2018 also saw the commencement of a range of significant data privacy legislations including the Australian Notifiable Data Breaches (NDB) Scheme and EU General Data Protection Regulation, as well as controversial Anti-Encryption Act.

According to Ai Group data:

- 32% of businesses report that they experienced a cyber security incident of some kind. This is a relatively high number, highlighting that businesses in Australia are susceptible to such incidents and are not isolated from an increasingly connected world. And given that there may be undetected incidents that are unknown and therefore not reported, the numbers could be higher.
- The most common incidents arise from hacking, phishing and malware. Compounded to this, some businesses experience multiple incidents including virus infections, hacking, malware, phishing, and denial of service.
- Businesses that specified their actions on a cyber security incident in our survey have varying responses. Some of the responses are not ideal and could be deeply disruptive, especially those that involved clean reinstalls and other actions that take a business offline for a period of time. Reinforcing this point, in the ABS survey, over half of the businesses that experienced a cyber security incident were affected the most by downtime of service.
- A very small number of businesses indicate they sought government assistance in 2018. Reasons for this low rate of engagement with the government is unclear. While we did not ask businesses why they did not seek government assistance, possible factors that might require further exploration include whether there is limited awareness about the government's role in such incidents; and whether other non-government organisations is seen to be already serving a similar function.
- 79% indicate that they invested in cyber security measures in 2018. Of those that did not experience an incident (or were unsure), 61% indicated that they proactively invested in measures.[2] The response in our latest survey show a stark contrast to the 78% of respondents in our previous survey who reported that they did not use cyber security technology, and only 13% saw cyber security as an inhibiting factor. The higher proportion of businesses proactively investing in cyber security (especially proactively) compared to our previous survey suggested a dramatic shift in business attitudes.

In contrast, ABS data reported less incidents: over 10% of businesses experienced a cyber security incident, while less than 20% did not know. In the same data, almost half of businesses did not see any value of cyber security measures at all.

Despite these differences, there was still a proportion of businesses that do not invest or value the importance of cyber security technology or other measure. Lack of business investment suggests that either more work could be done to improve cyber security posture, or that some businesses feel they already have adequate levels of protection.

Since the NDB Scheme commenced, over 1,000 data breaches were reported, almost 60% due to malicious or criminal attacks and over a third by human error. Despite improvements in cyber security investment, causes for these data breaches point to the need for improved cyber security and data management posture within organisations, where government support might assist.

In the meantime, Ai Group is making continued efforts to improve business awareness about the laws and mitigating data breaches. We would welcome the opportunity to work closely with government and key stakeholders to elevate industry awareness with useful information such as from the OAIC.

Businesses making inroads

We have received considerable feedback from businesses (particularly SMEs) over the last several years for reasons

[2] This proportion of responses was unweighted and therefore included more manufacturing responses than other sectors.

behind the gap in uptake of Industry 4.0 (see section 3.1).

Despite the challenges for some businesses in starting the Industry 4.0 journey and yet to take full advantage or see the value of certain transformative technologies, others are challenging themselves by taking the journey. As expected, such steps are often neither perfect nor easy and present successes along with their own practical challenges. Ai Group's Entrepreneurs' Programme Business Advisers and Facilitators have engaged with many SMEs who are progressing Industry 4.0 strategies without using this label. Instead, their primary objectives are to implement strategies or new approaches to enable them, for example, to manage their operations, become more efficient, improve productivity and improve bottom line performance. They also implement digital strategies to help drive demand strategies and build brand awareness (see section 3.1.2).

Delving deeper into how businesses are currently responding to the practical challenges and opportunities of Industry 4.0 and digitalisation, several innovative companies have taken the lead on investing in and implementing these technologies, leading to positive results for these businesses and their customers, as well as positive changes within their organisations including people and culture. Case studies of some of these companies and what they have been able to achieve through their investments are discussed in section 3.1.3 of this report. Below are some snapshots of these businesses and their investments taken from case studies presented in this report.

- In a first in using technology to reach out to vulnerable customers, Australian energy retailer AGL has leveraged both predictive and response data and analytics to identify customers who may be showing early signs of hardship, and to orchestrate customised communications to raise awareness of the various support options available, including access to AGL's hardship programs. At a more macro level, the role of technology at AGL continues to evolve – automating outcomes where possible in order to create efficiencies in delivery and learning as well as allowing humans to focus more often on value-add tasks.
- Brisbane-based manufacturer B&R Enclosures has been proactively investing in a strategy of Industry 4.0. B&R's first digital transformational project focuses on improving the factory floor by making information transparent throughout the production process to improve decision making, lower costs and increase service. B&R's second project applies Industry 4.0 principles and technologies to product design and development to achieve digital continuity, reuse of information and real-time collaboration. Both projects represent a shift from large production-centric manufacturing of commodity products towards a more customised, smart and competitive manufacturing model.
- Construction and engineering firm Laing O'Rourke has developed and implemented a wide range of transformative technologies throughout its business, with two of the most prominent being the implementation of the LORAR+ augmented reality platform and the development of the Toolbox Spotter, a modular safety system powered by artificial intelligence. The development of these technologies and others stem from the desire of Laing O'Rourke to be a leading engineering organisation in the emerging Fourth Industrial Revolution.
- Adelaide-based manufacturer REDARC recently finalised a $22 million factory expansion project, including investment in its advanced manufacturing capabilities as part of its Industry 4.0 digitalisation strategy. The major investment in the company has been directed towards new state-of-the-art surface mount technology, new advanced testing and validation equipment, the latest in universal robotic technology, and the implementation of a new enterprise resource planning system.
- Traditional steel fabrication company Watkins Steel in Brisbane has embraced advanced processing robotics and emerging technologies to transform the company. They have recently introduced virtual reality (VR) as a new feature. Whilst VR is not new to industry, they have paired VR to point clouds generated from their laser scanning to enable users to walk through existing buildings and overlay design models.
- 150-year old engineering company Weir began investigating digital and data analytics several years ago, and has gone from being a manufacturer of stand-alone mechanical equipment to a supplier of advanced smart products, systems and services. From simple site-based detection systems to advanced remote monitoring, predictive maintenance, automation and control, Weir has developed a range of Industrial Internet of Things (IIoT), edge and Big Data-enabled smart products and services.

1 Introduction

Australian businesses are currently in a state of transition to and within the Fourth Industrial Revolution (or Industry 4.0) – the convergence between the virtual and physical worlds. And the fusion of technologies across the digital, physical and biological worlds are fuelling this new era.[3]

Founder and Executive Chairman of the World Economic Forum (WEF), Professor Klaus Schwab, suggests businesses are now being asked to re-examine the way they do business, understanding their changing environment, how they operate, and how they can be more innovative.[4]

Professor Schwab identifies three reasons for this revolutionary change in technology: the velocity of change is exponential; the breadth and depth of change is leading to paradigm shifts across the economy and society; and systems are transforming across countries and societies.[5]

This is an evolution of digitalisation, which began during the Third Industrial Revolution, ushering in the computer and information age. Now, businesses are being digitally transformed and disrupted, and becoming more globally connected.[6] Some refer to this as the Second Machine Age, with digital technologies becoming more sophisticated and integrated in the Fourth Industrial Revolution, leading to the transformation of societies and the global economy.[7]

Ai Group understands these impacts in our engagement with businesses and broader community.

In 2017, we published the *Business Beyond Broadband* report. An aspect of that report focused on business use and investment in digital technologies.

Our latest report reflects on how businesses have progressed in their digitalisation journey, as well as the underlying technological landscape, drawing from a range of sources including Ai Group's recent research.

There is more to digitalisation than technology. In our engagement with businesses, discussions have matured around the other issues that businesses need to consider as they transition to and within the Fourth Industrial Revolution.

In addition to our CEO survey of business prospects, we have also drawn from other sources on digitalisation to provide a more holistic picture.

Chapter 2 outlines current business challenges, drivers, plans and strategies.

Chapter 3 reviews the current technological environment that is enabling digitalisation in Australian businesses and advancement towards the Fourth Industrial Revolution.

Chapter 4 summarises our findings on Australian business responses to cyber security threats, as well as current cyber security trends.

Chapter 5 highlights priority areas in public policy for businesses in transition to and within the Fourth Industrial Revolution.

Appendices A and B provide further information about Ai Group's *CEO Survey of Business Prospects 2019*.

[3] Klaus Schwab, *The Fourth Industrial Revolution* (WEF Forum, January 2016), p. 8.

[4] Klaus Schwab, "The Fourth Industrial Revolution: What it means, how to respond" (WEF website, January 2016).

[5] Klaus Schwab, above n 1, p. 3.

[6] Sometimes digital transformation is used interchangeably with other terms like digital disruption, digitisation and digitalisation.

[7] Klaus Schwab, above n 1, p. 7.

2 Current business context

Speaking at an Ai Group function in 2018, the Governor of the Reserve Bank of Australia, Philip Lowe, commented on the nature of recent technological progress, noting that it has been heavily focused on software and information technology (IT) and that there was a wide dispersion of take up of these technologies between leading and lagging firms. Mr Lowe also expressed confidence that over time there would be a greater diffusion of these technologies beyond the leading firms thus boosting aggregate productivity and incomes.[8]

"One explanation for the widening gap between leading and laggard firms is the difficulty of employing new technologies. Successfully using these technologies requires both the right management capability and technical skills. Both of these can be difficult to acquire."
– RBA (2018)

These observations provide a useful point of reference on both the current status of the Fourth Industrial Revolution (or Industry 4.0) in Australia and what the future holds.

It is fair to say that substantial progress has been made in embracing Industry 4.0, whether under that name or others. And embracing Industry 4.0 has stretched the gap between these leaders and the majority of businesses.

We have received anecdotal feedback from businesses over the last several years for reasons behind the gap in uptake of Industry 4.0 (see section 3.1). Despite the challenges for some businesses in starting the Industry 4.0 journey and yet to take full advantage or see the value of certain transformative technologies, others are challenging themselves by taking the journey. As expected, such steps are neither perfect nor easy and present their own practical challenges, along with some success from the anecdotal feedback that we have heard over the last year (see section 3.1.2).

Delving deeper into how businesses are currently responding to the practical challenges and opportunities of Industry 4.0 and digitalisation, several innovative companies have taken the lead on investing in and implementing these technologies, leading to significant results (see section 3.1.3).

In this chapter, we explore current businesses' overall strategy and planning for 2019, based from Ai Group's *National CEO Survey: Business Prospects for 2019* report.

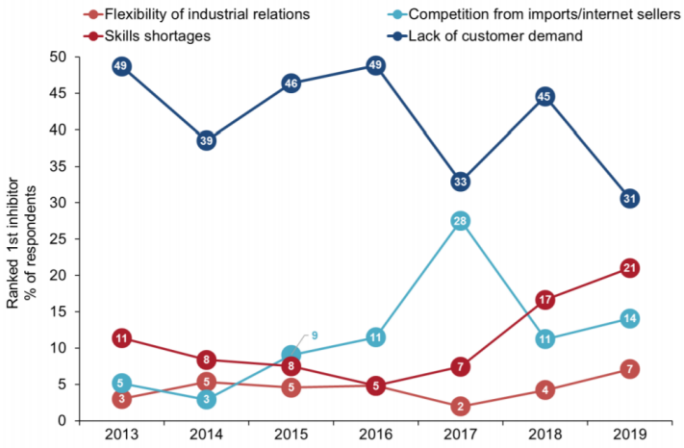
These strategies and plans can influence the digital maturity of businesses and therefore the gap between leading and lagging firms. They are shaped by a range of drivers and inhibitors, where digitalisation has the potential to play an important role.

2.1 Business drivers and inhibitors

31% of CEOs identified a "lack of customer demand" as their most significant constraint, followed by skill shortages (21% of businesses).

In Ai Group's *National CEO Survey: Business Prospects for 2019* report, we asked which factors would provide the biggest challenge to business in 2019. 31% of CEOs identified a "lack of customer demand" as their most significant constraint, down from 45% of CEOs who said the same in 2018 (and down from most previous years since 2013 (see Chart 1)).

Chart 1: Expected inhibitors to business growth*, 2013-2019



*Note: * Percentage of respondents who ranked each factor first in each year, out of a list of possible inhibitors.*
Source: Ai Group.

Labour market concerns featured prominently for businesses in 2019. The second most pressing concern for CEOs in 2019 was skill shortages with 21% of businesses nominating this as their top concern. This was up from 17% of leaders that identified skill shortages as an impediment in 2018 and triple the 2017 proportion (7%). These concerns reflected rising demand for labour seen in 2017 and 2018, as was indicated across a range of data sources including the monthly ABS Labour Force surveys and Ai

[8] RBA Governor, Philip Lowe, "Productivity, Wages and Prosperity" (Address to Ai Group, June 2018).

Group's Australian PMI®, PSI® and PCI®.

2018 Survey on workforce development needs

Ai Group's 2018 *Skilling: A national imperative* survey report also gauged employer sentiment around skill needs and training practices. Major pressure points identified in that survey included:

- **Skills shortages**: It was apparent that skills for both current and future-oriented occupations were not meeting demand. 75% of respondents report skills shortages, most often in the technician and trades worker category. Difficulties remained with the recruitment of employees with Science, Technology, Engineering and Mathematics (STEM) skills. For the first time in our survey, skills shortages were reported for those with skills in business automation, Big Data and artificial intelligence (AI) solutions.
- **Digital skills**: The rapid changes through digitalisation are requiring a number of occupational categories to be prioritised for digital technology training and changes anticipated or caused by its rollout. Managers required significant capability improvements in technology or digitalisation, with employers prioritising them (33%), over technicians or trades workers and administration staff (both 18%), followed by professionals (16%). In the age of digitalisation all workers will need digital skills at various levels.
- **Literacy and numeracy**: With the workforce increasingly requiring foundation skills that include not only literacy and numeracy but digital literacy and advanced soft skills, it was disturbing that 99% of employers were affected in some way by low levels of literacy and numeracy in their workforce. They were dissatisfied with the basic numeracy and literacy levels of over one-fifth of school leaver entrants. It was also a concern that dissatisfaction levels were high for the self-management, planning and organising, problem solving, initiative and enterprise skills of school leavers.
- **Leadership and management**: The digitally enabled economy requires a major change in the way work is completed and managed as entire business processes and organisational cultures are upended. Being aware of the activities that are most likely to change from a technical perspective allows managers to rethink how workers engage with their jobs and how digital platforms can better connect workplaces. The survey found that 62% of employers believed a lack of leadership and management skills was having a high impact on the business, an increase on 2016. They reported the most significant capability improvements required by managers were in technology or digitalisation, resulting in managers being prioritised for this training. Reflecting the need for managers to navigate constant change, employers said their capabilities must also improve for problem solving, initiative and enterprise.
- **Employer actions**: Employers were active in implementing strategies to alleviate some of these skills pressures. A greater percentage of employers intended to increase expenditure on training in 2018: the highest level since we began the survey in 2012. There was an increase in the percentage of employers engaging apprentices or trainees, with a substantial proportion being of mature age (43%). Employers reported a significant increase in their internal company training and support from supervisors and mentors to boost literacy and numeracy skills. Companies have steadily increased their links with education and training sectors since 2014 – a vital strategy in the faster moving economy.

In Ai Group's *National CEO Survey: Business Prospects for 2019* report, almost half of businesses (42%) planned to increase employment in their business in 2019, so concerns about skill shortages are expected to worsen as recruitment activity steps up during 2019. A further 7.5% of CEOs said the flexibility of industrial relations was their top concern in 2019, up from 4% in 2018. Despite these widespread (and growing) concerns about skill shortages and industrial relations flexibilities, only 5% of CEOs ranked wage pressures as their greatest inhibitor in 2019, similar to 2018, but well down from 12% of CEOs in 2017.

Competition from imports and online sources (14%) increased as a constraint for 2019 compared to 2018 (11%); but was well down from the recent peak in 2017 when it was a primary inhibitor for 28% of responding businesses.

Flexibility of industrial relations was a primary inhibitor for 7% of CEOs, up from 4% in 2018 and 2% in 2017. Government regulations were also a primary constraint for around 7% of CEOs, down slightly from the past couple of years.

Following the recent peak of the Australian dollar in January 2018, concerns about high and/or variable exchange rates were the main issue for 4% of businesses, which was slightly up from 2018 (3%). This was much lower than the 10% of businesses that had nominated this in 2015, when the trading range for the Australian dollar had been much higher.

Other constraining factors for business in 2019 included: rising input costs due to higher energy prices (the most commonly listed "other" factor); uncertainty about international trade; drought conditions; and access to

funding for operational and/or investment purposes.

Table 1: Factors that changed business use of ICT and/or the internet in 2017-18 by business size

Factor	Employment size				Total
	Micro	Small	Medium	Large	
	0–4 persons	5–19 persons	20–199 persons	200+ persons	
Loss/reduction of digital skills or capability	2.7	3	1.7	1.8	2.7
Enhanced digital skills or capability	6.7	8.7	11.1	16.9	7.7
Cyber attacks	2.5	4.7	6.7	8.2	3.6
Spam	6.1	9.7	9.5	9.3	7.6
Lack of access to digital infrastructure	7.3	8.1	9.5	2.5	7.7
Improved access to digital infrastructure	4.3	4.8	8.7	11	4.8
Increased cost of digital technology or services	5.2	7.3	6.9	6.9	6
Decreased cost of digital technology or services	1.3	0.7	2.4	5.2	1.2
Competition from new market entrants	4.9	5	3.9	5.2	4.8
Access to global markets	2.3	2.2	1.8	3.9	2.2
Creation of new markets from online communities	3	3.7	3.1	4.1	3.2
Other factors	0.7	0.2	0.3	0.1	0.5
No factors	75.1	68.8	67	67.7	72.3

Note: Factors are shaded depending on prevalence of factor within each employment size subset. 'No factors' are not included in the shading.
Source: ABS

Table 2: Top three management practices implemented by businesses for use of ICT and/or the internet in 2017-18 by business size

Rank	Employment size				Total
	Micro	Small	Medium	Large	
	0–4 persons	5–19 persons	20–199 persons	200+ persons	
1	None (76%)	None (64%)	None (43%)	Upgraded cyber software, standards or protocols (52%)	None (69%)
2	Upgraded cyber software, standards or protocols (10%)	Contracted external consultant (15%)	Upgraded cyber software, standards or protocols (28%)	Investment in new digital technologies or infrastructure (43%)	Upgraded cyber software, standards or protocols (14%)
3	Contracted external consultant (8%)	Upgraded cyber software, standards or protocols (15%)	Contracted external consultant (25%)	Upskilling staff (41%)	Contracted external consultant (12%)

Source: ABS

ABS survey of businesses in 2017-18

The ABS surveyed businesses' use of IT in 2017-18.[9] The survey considered factors that changed business use of ICT and/or the internet in 2017-18 (see Table 1).

Most businesses (72%) indicated no factors contributed to a change of ICT and/or internet use.

Setting that aside, enhanced digital skills or capability played an important role across business sizes – especially for large businesses (17%) and in the information media and telecommunications sector (16%).

Spam and lack of digital infrastructure access appeared to be more of an issue for small to medium size businesses (10%).

Where digital infrastructure access improved, large businesses benefited the most (11%), as well as in information media and telecommunications (8%).

[9] ABS, 8167.0 – Characteristics of Australian Business, 2017-18.

The ABS also asked what management practices were implemented by businesses for use of ICT and/or the internet in 2017-18 (see Table 2).

A high proportion of businesses indicated none (69%). When they did do something, micro to medium size businesses were more likely to contract an external consultant, or upgrade cyber security software, standards or protocols. For large businesses, the top responses were to have protocols in place, invest in the technology and train their staff to use that technology.

Upgrading cyber security software, standards or protocols was the most popular in the financial and insurance services sector (23%).

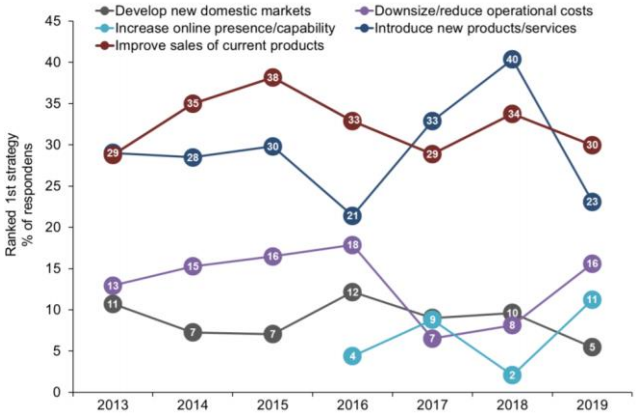
Contracting external IT consultants was most popular in information media and telecommunications, and financial and insurance services sectors (19%).

2.2 Business planning and strategy

Increasing online presence or capability was the primary growth strategy for 11% of Australian businesses in 2019.

In Ai Group's *National CEO Survey: Business Prospects for 2019* report, Australian CEOs planned in 2019 to concentrate on improving sales of current products and services to their customers. This strategy was the most popular priority for 2019 with 30% of CEOs ranking it their first choice, but the proportion of respondents listing this as their primary strategy has fallen from 2018 (34%) and is around similar levels to 2017 (see Chart 2).

Chart 2: Top strategies for business growth, 2013 to 2019



*Note: * Percentage of respondents who ranked each factor first in each year, out of a list of possible strategies.*
Source: Ai Group.

Introducing new products to the market was a primary strategy for growth in 2019 for 23% of businesses. It was the principal approach for more respondents in the 2018 (40%) and 2017 (33%) cycle but has since dropped back as the main approach for business improvement. We may be starting to see a cyclical process emerging across the time series as businesses alternate their focus from developing to consolidating sales of existing products and services.

Downsizing or reducing operational costs is a priority for more businesses in 2019 than it has been in the past two years (16%). After a decline in cost reduction as a primary growth strategy in 2018 (8%) and 2017 (7%), it has crept back up to similar levels as 2016 (18%) and 2015 (16%).

Increasing online presence or capability is the primary growth strategy for 11% of Australian businesses in 2019.

This factor has only been one of the most common strategies since 2016, where 4% of respondents considered it their priority, it rose in 2017, before falling back in 2018.

Although there was substantial growth in online presence (all responding large businesses have a website for example), there is room for further growth in small to medium enterprises and some business sectors have more capacity to increase their online capabilities in the future.

The same proportion of businesses planned to develop new markets within Australia, as they planned to work on developing new export markets (5% each of responding CEOs).

Few CEOs ranked advertising and marketing as their top business strategy in 2019 (4%, although this was slightly higher than in previous years) with most choosing to focus their efforts on selling existing products and services instead.

2.3 Business investment priorities

The strong focus on investing in technology is a long-term trend, with expectations of spending on new technologies rising at a faster pace than other forms of investment since 2013.

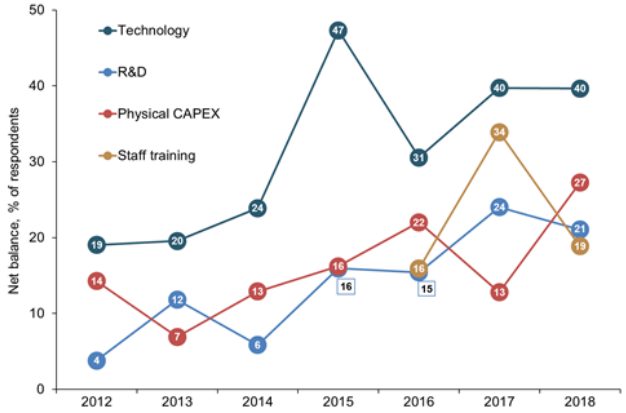
Looking back at 2018, almost half of respondents increased their spending on new technology (47%). In other areas of business investment, most businesses did not alter their spending on staff training, physical capital expenditure (CAPEX) or research and development (R&D) in 2018, relative to one year earlier.

Ai Group's annual CEO survey has indicated an upward trend in annual spending on technology, R&D and physical CAPEX since at least 2012 (see Chart 3).

A greater proportion of CEOs have reported growth in spending on technology than other investment options consistently since 2012. Looking back at previous surveys, it is clear that this focus on investing in technology has increased over time. This suggests the nature of investment in the Australian economy is changing, with a

greater focus on IT and a shift towards increased investment in the services industries.

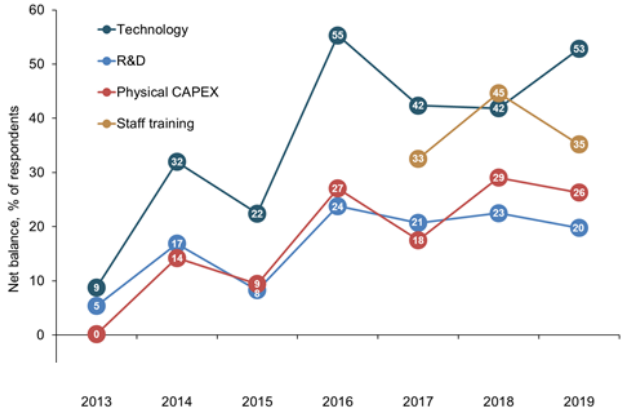
Chart 3: Business investment indicators, 2012-2018



Note: "Net balance" is the proportion of all survey respondents that reported an improvement minus the proportion that reported a deterioration in each indicator. Aggregate results include respondents from all surveyed industries and are weighted by ABS estimates of output from each sector. Here, the net balance increase is due to less respondents reporting negative spending i.e. less firms reporting falling investments rather than more firms reporting increasing investments. Firms reporting increasing investments has been remarkably steady.
Source: Ai Group.

Net spending on R&D was only slightly weaker than in 2017 (+24% in 2017 vs +21% in 2018), however like previous years, more than two-thirds of businesses indicated they would not change their level of R&D investment. Spending on staff training has only been included as a question since 2016 but this indicator appeared to have pulled back in 2018 after jumping in 2017.

Chart 4: Expected business investment indicators*, 2013-2019



*Note: * "Net balance" is the proportion of all survey respondents that improved minus the proportion that deteriorated. Aggregate results include respondents from all surveyed industries and are weighted by ABS estimates of output from each sector.*
Source: Ai Group

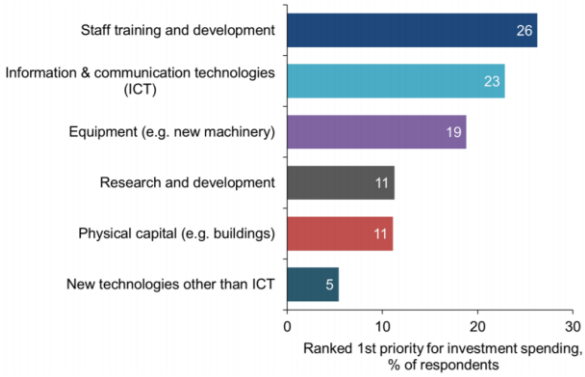
Moving from past actions to future intentions, the survey results indicated that most CEOs planned to maintain or increase their spending on various types of business investment in 2019. The proportions of businesses planning to reduce various types of investment were similar to results seen in 2018 but much lower than from 2013 to 2017 (see Chart 4).

The majority of Australian CEOs planned to maintain the same level of spending on staff training, physical CAPEX and R&D in 2019 as they did in 2018. Under half (39%) planned to increase spending on staff training, 33% expected to spend more on physical CAPEX and 23% foresaw increased expenditure on R&D. Very few CEOs planned to reduce business investment in 2019.

Expectations of spending on new technologies rose at a faster pace than other forms of investment since 2013. This suggests that the nature of Australia's investment environment will continue to change in 2019; with a greater focus on investment in new technologies. In "net" terms, new technologies investment spending was the only rising investment indicator (+42% in 2018 vs +53% in 2019).

In 2019, half of businesses (49%) planned to concentrate their investment spending on either staff training and development, or information and communications technology (ICT) (see Chart 5).

Chart 5: Investment priorities for business*, 2019



*Note: * Percentage of respondents who ranked each category first, out of a list of possible types of business investment spending.*
Source: Ai Group.

When asked what their highest priorities were for business investment spending in 2019, just over a quarter (26%) of CEOs stated that improving employee capability was their focus for investment. Just under a quarter (23%) of respondents said their first priority was ICT. These two factors are likely linked as the introduction of new technology generally necessitates an upgrade of employee skills.

The third most important area for investment spending for Australian CEOs was new equipment with 19% of respondents planning to prioritise this area of investment in 2019. R&D and physical CAPEX were each important to 11% of CEOs reporting on their investment intentions, while just 5% of businesses planned to focus on new technologies other than ICT.

3 Evolving technology landscape

The pace of technological change continues to increase across the globe creating digitally enabled environments that will affect every company. Rapidly advancing technologies are producing waves of wider innovation across the economy as businesses and individuals build new social practices and business models upon them.

Like previous advances, new technology is enabling improvements in speed to market, quality and cost effectiveness. But the Fourth Industrial Revolution also signals more flexibility and individualisation – a customer-oriented approach that provides a social value.

This chapter explores the current developments in the technology landscape relevant to Australian businesses.

3.1 Business end use

In Ai Group's 2017 *Business Beyond Broadband* report, we asked businesses about their use of, investment in, and plans for digital technologies. We found a positive correlation between use of digital technology and improved gross profit margins. Conversely, businesses that did not use any digital technology tended to have lower gross profit margins. Despite this, we found that businesses were yet to fully invest in and maximise the use of digital technologies (including the Internet of Things (IoT)) and recommended more support to increase business capability in this space.

Since that report, there continues to be a wide dispersion in take up of technologies between leading and lagging firms.

Anecdotal feedback from businesses (particularly SMEs) over the last several years has offered reasons for this gap including:

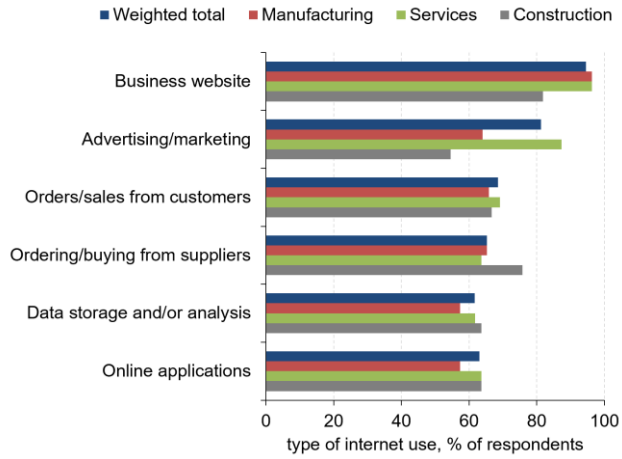
- Not knowing where to start.
- The speed of change makes it hard to keep up and adapt, even for innovative companies.
- Wanting to understand what others are doing to determine the industry benchmark.
- Not having the time to assess digital technologies to know what is relevant to them and what the benefits may be.
- While there may be interest from businesses in digital technologies, development and implementation of a business case is the real challenge. (This may also be partly due to the lack of skills, knowledge or capability within the organisation.)

Reflecting on the above, the following sections explore activities that Australian businesses are currently leveraging through the internet, and examples where innovative businesses are beginning to embrace the possibilities enabled by digital technologies.

3.1.1 Business internet activities

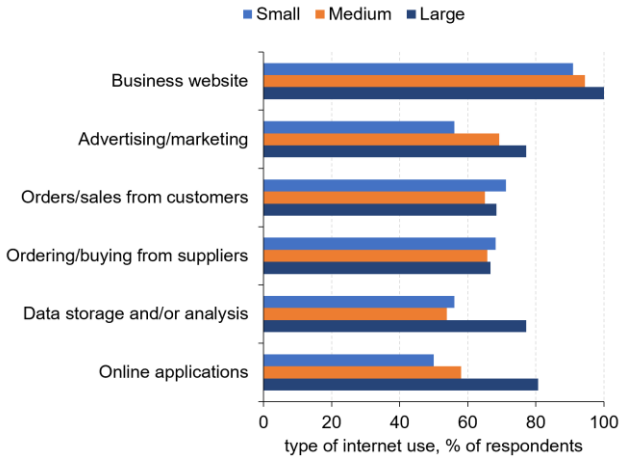
In Ai Group's *CEO Survey of Business Prospects 2019*, we asked businesses how they used the internet in 2018. Charts 6 and 7 summarise these responses.

Chart 6: Business internet use in 2018 by sector



Source: Ai Group

Chart 7: Business internet use in 2018 by business size



Source: Ai Group

Web presence

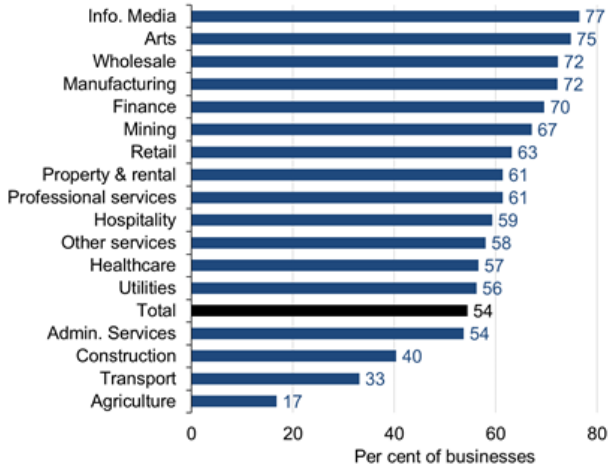
All respondents said they used the internet in some form. Almost all of the participating businesses had a website (95%) however it was more common in manufacturing and services businesses (both 96%) than in construction (82%).

All large businesses had websites, however it was less common in medium (94%) and smaller businesses (91%) to have an online presence.

ABS data suggested a much smaller proportion, reporting

54% of businesses with a web presence (see Chart 8).[10] This data included a larger proportion of smaller businesses (with less than 19 employees) with between 44%-67% having a web presence, compared to larger businesses (200+ employees) at 96%. The ABS also found a higher proportion of innovation-active businesses (71%) had a web presence compared to non innovation-active businesses (38%). Web presence also varied according to sector with the highest in information media and telecommunications (77%).

Chart 8: Business web presence in 2017-18 (proportion (%), by sector)



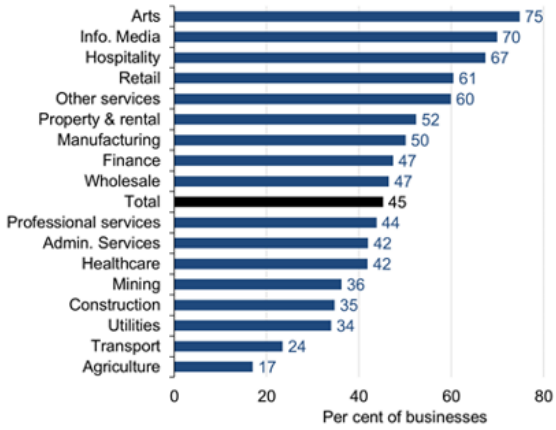
Source: ABS

It is unclear why some businesses opted not to have websites, but websites are an important part of attracting, informing and serving customers. The rise of other digital platforms and services atop the web makes websites necessary but not sufficient.

Advertising and marketing

Ai Group research found that businesses in the services sector (87%) were more likely to use the internet for advertising and marketing than manufacturers (64%) or constructors (55%). Larger businesses were more likely to advertise online (77%) than medium (69%) or small (56%) firms. This demonstrates the large capacity for growth in online advertising and marketing that manufacturing or small to medium businesses have yet to utilise.

Chart 9: Business social media presence in 2017-18 (proportion (%), by sector)



Source: ABS

For instance, although not explored in Ai Group's survey, social media marketing could be an avenue to improve branding or increase online revenue.

Table 3: Type of social media activities in 2017-18 (proportion (%), by business size)

Factor	Employment size				Total
	Micro	Small	Medium	Large	
	0–4 persons	5–19 persons	20–199 persons	200+ persons	
Develop company image or market products	80.2	81.1	88.3	84.7	81.5
Communicate with customers	67.7	74.9	76.7	76.9	71.7
Involve customers in development or innovation of products	19.5	19.9	19.8	27.6	19.8
Collaborate with partners or other organisations	13.8	13.3	18.9	32.6	14.4
Recruit employees	14.3	35.2	52.4	72.3	27.6
Exchange views, opinions or knowledge within the business	26.4	20.8	30.4	38.1	24.8
Other	2.6	2.8	0.9	1.4	2.5

Note: Factors are shaded depending on prevalence of factor within each employment size subset.
Source: ABS

[10] Ibid. Note: Differences in results between Ai Group and ABS survey data may reflect differences in sampling and data definitions. The ABS sample for *Business Use of IT* includes micro, sole trader and non-employing businesses. Ai Group survey samples exclude these very small and non-employing businesses.

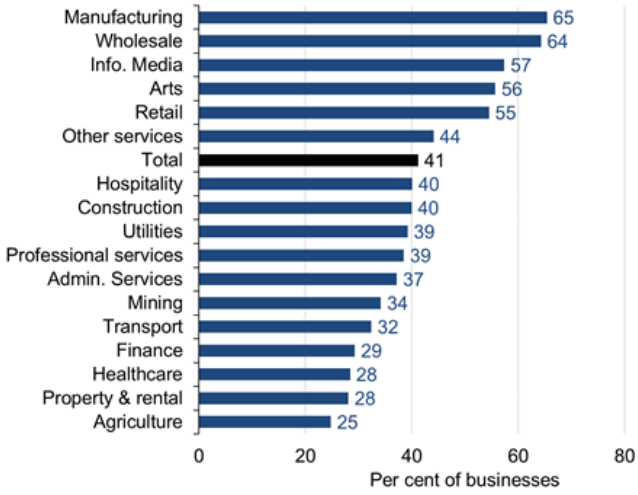
Nearly half of all businesses used social media according to the ABS (see Chart 9).[11] A higher proportion of innovation-active businesses (63%) had a social media presence. Larger businesses (200+ employees) were also more likely to have a social media presence at 86%. The sector with the highest social media presence was in arts and recreation services (75%). The most common uses for social media were marketing (82%) and customer communication (72%) (see Table 3).

Online sales and purchases

Just over two-thirds (69%) of businesses used the internet to sell goods and services, according to Ai Group data. There was little variation across the sectors (services 69%, manufacturing 66% and construction 67%) and sizes (small 71%, medium 65% and large 68%).

In contrast, ABS data reported over a third (41%) of businesses received orders online (see Chart 10).[12] As with web and social media presence, a higher proportion of innovation-active businesses (53%) received orders online compared to non innovation-active businesses (30%). This also varied according to business size with larger businesses of 200+ employees (65%) compared to smaller businesses of less than 4 employees (37%). The sector most likely to receive online orders was in manufacturing (65%).

Chart 10: Business received orders online in 2017-18 (proportion (%), by sector)

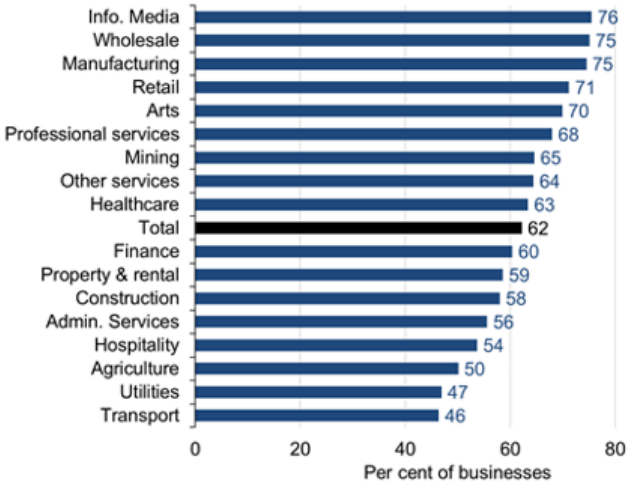


Source: ABS

Ai Group data suggested that nearly two-thirds of businesses (65%) ordered online from suppliers. Three-quarters of construction firms (76%) were more likely to order online compared to two-thirds in manufacturing (65%) and services (64%). There were no notable differences between the size of a business and their likelihood to order online.

Similarly, ABS data reported nearly two-thirds of businesses (62%) placed orders online (see Chart 11).[13] However, the ABS found greater variance between business sizes, with 56% for small business (less than 4 employees) compared to 86% of larger businesses (200+ employees).

Chart 11: Business placed orders online in 2017-18 (proportion (%), by sector)



Source: ABS

Similar to responses on web and social media presence, and orders received online, a higher proportion of innovation-active businesses (75%) placed orders online compared to non innovation-active businesses (50%).[14] The sector with the highest propensity to place online orders was in information media and telecommunications (76%).

A higher proportion of businesses (57%) also did not see any value in e-commerce capability.[15] On the other hand, larger businesses were most likely to express greatest value (23%) compared to smaller businesses (9%).

As Ai Group found in previous research, there is considerable capacity for businesses to increase the proportion of revenue generated online.

Data storage, analysis and online applications

Less than two-thirds of businesses made use of data storage and/or analysis (62%) and online applications (63%), according to Ai Group data. Similar usage results appeared across the surveyed sectors.

More than three-quarters (77%) of large businesses used

[11] Ibid.
[12] Ibid.
[13] Ibid.
[14] Ibid.
[15] Ibid.

Table 4: Type of business use of paid cloud computing/services in 2017-18 (proportion (%), by business size)

Factor	Employment size				Total
	Micro	Small	Medium	Large	
	0–4 persons	5–19 persons	20–199 persons	200+ persons	
Used paid cloud computing	35.5	50.1	65.7	76.4	42.4
Did not use paid cloud computing	64.5	49.9	34.3	23.6	57.6
Used for software	87.3	89.1	92.8	84	88.6
Used for processing power to run own software	9.5	7.5	11	18.4	9
Used for storage capacity	60	61.5	63.8	72.3*	61.1
Used for other services	1.3	2.6	1.9	1.2	1.8

*Note: Factors are shaded depending on prevalence of factor within each employment size subset. * This table includes an estimate that has a relative standard error of 10% to less than 25% and should be used with caution.*
Source: ABS

Table 5: Inhibitors to business use of paid cloud computing and services in 2017-18 (proportion (%), by business size)

Factor	Employment size				Total
	Micro	Small	Medium	Large	
	0–4 persons	5–19 persons	20–199 persons	200+ persons	
Risk of security breach	12.5	13.2	18.9	27.8	13.3
Problems accessing data or software	6.8	8.9	12.5	12.5	7.9
Difficulties unsubscribing/changing cloud computing service provider	4.1	2.9	4.7	3.7	3.8
Uncertainty about the location of data	9.8	8.3	11.5	12.3	9.5
Uncertainty about legal, jurisdictional or dispute resolution mechanisms	5.1	5.2	6.8	8.7	5.3
High cost of cloud computing services	9.7	13.3	14.1	12.2	11.1
Insufficient knowledge of cloud computing services	16.8	18.5	15.5	11	17.2
Other factors	1.1	2.4	2.5	7	1.7
No factors	67.2	64.6	59.2	53.9	65.7

Note: Factors are shaded depending on prevalence of factor within each employment size subset. 'No factors' are not included in the shading.
Source: ABS

data storage and analysis compared to over half of small (56%) and medium (54%) enterprises. Less than two-thirds in construction (64%) used these applications, followed by services (62%) and manufacturing (57%) businesses.

Large businesses were more likely to use online applications (81%) than medium and small businesses (58% and 50%, respectively). Nearly two-thirds of services and construction businesses (64%) accessed online software, with a slightly lower proportion in manufacturing (57%).

In addition to Ai Group's findings, the ABS explored whether businesses used paid cloud computing and cloud services, as well as the types of applications (see Table 4).[16]

The ABS found 42% of total businesses used paid cloud computing.[17] Medium and large businesses were more likely to use cloud computing (66% and 76%, respectively) than micro and small businesses (36% and 50%, respectively). Paid cloud computing use also varied by sector, with the highest users in information media and telecommunications (64%).

Where paid cloud computing was used, most businesses used it for software (89%) including email, office software, finance or accounting software and CRM software.[18] The next highest use was for storage capacity (61%) such as hosting of databases and storage of files.

The ABS also explored factors for why businesses were limited or prevented from using paid cloud computing (see

[16] Ibid.
[17] Ibid.
[18] Ibid.

Table 5).[19] A large proportion (66%) had no reason, which suggests a lack of perceived business value or purpose for paid cloud computing.

The next reason that inhibited business use of paid cloud computing varied.[20] Medium and large businesses highly rated risk of a security breach as a factor (19% and 28%, respectively). On the other hand, micro and small businesses were more likely to identify insufficient knowledge of cloud computing services (17% and 19%, respectively) as an inhibitor.

High cost of cloud computing services was a highly rated barrier in the information media and telecommunications sector (17%).[21]

The ABS data also showed similar patterns of business responses with data analytics and intelligent software systems.[22]

More businesses did not see any value in data analytics (68%) and intelligent software systems (67%).[23] These responses changed for large businesses who found more value (major value at 28% for data analytics, and 44% for intelligent software systems) compared to micro businesses (major value at 5% for both data analytics and intelligent software systems).

Overall, smaller businesses often lagged behind larger businesses in the take up of online technology, despite the low-cost entry barriers and efficiency gains that may result.

Other business activities

In addition to Ai Group data, the ABS also examined other business internet activities.[24] These are summarised in Table 6.

The primary internet activity for most businesses (89%) was financial related i.e. online banking, invoicing and making payments.[25] The information media and telecommunications sector used the internet the most for these activities (93%).

Associated with financial related applications, the ABS data

Table 6: Business internet activities in 2017-18 (proportion (%), by business size)

Factor	Employment size				Total
	Micro	Small	Medium	Large	
	0–4 persons	5–19 persons	20–199 persons	200+ persons	
Financial	87.9	90.6	94.7	90.6	89.3
Communication excluding email	45.5	50.2	57.1	71.3	48
Work from home	47.3	43.4	59.5	87.9	47.3
Work from other locations	40	40.2	60.9	88.5	42
Assess/modify business products/services	32.2	39	43.4	55.5	35.2
Develop new/improved products/services	19.6	27.6	33.8	48.8	23.3
Monitoring competitors	23.9	32.8	41	51.1	28.1
Identifying future market trends	20.6	26.7	31.9	53.4	23.5
Online training/learning	35.6	45.8	64.6	79.3	41.2
Info/data sharing with customers	24.5	26.9	37.3	53.1	26.4
Info/data sharing with non-customers	16.6	18.1	29	46.3	18.2

Note: Factors are shaded depending on prevalence of factor within each employment size subset.
Source: ABS

[19] Ibid.
[20] Ibid.
[21] Ibid.
[22] Ibid.
[23] Ibid.
[24] Ibid.
[25] Ibid.

Table 7: Automated links between business systems in 2017-18 (proportion (%), by business size)

Factor	Employment size				Total
	Micro	Small	Medium	Large	
	0–4 persons	5–19 persons	20–199 persons	200+ persons	
Suppliers' business systems	15.3	18.3	22	21.6	17
Customers' business systems	10.9	12.9	22.3	28	12.8
Reordering replacement supplies	5.4	10.4	17.9	23.5	8.5
Invoicing and payment	24.1	27.5	33.9	43.8	26.3
Production or service operations	7.3	8.5	17	22.8	8.7
Logistics	5.9	7.3	11.2	26.5	7
Marketing operations	7.8	11.2	14.7	20.6	9.7
No automated links	60.8	58	47.6	39	58.5

Note: Factors are shaded depending on prevalence of factor within each employment size subset.
Source: ABS

showed that 26% of businesses implemented automated links between systems for invoicing and payments (see Table 7).[26] This was especially popular in the arts and recreation services sector (39%).

Despite this, 59% of businesses did not have automated links between business systems more generally.[27] Other applications that showed low uptake by businesses through automation included suppliers' business systems (17%), customers' business systems (13%), reordering replacement supplies (9%), production or service operations (9%), logistics (7%), and marketing operations (10%).[28]

These automated links can be delivered through various means for the purposes of improving business productivity such as Business Process Management (BPM), Robotic Process Automation (RPA), Enterprise Resource Planning (ERP), Electronic Data Interchange (EDI), or a combination of these and other tools. While these concepts are not entirely new, tools that enable business systems to be integrated and automated are continually evolving, and are critical to an Industry 4.0 environment.

Overall, the Ai Group and ABS data showed that businesses are making inroads into embracing the opportunities offered through digital technologies and leveraging the internet for their business activities. However, there are still areas where businesses can increase their use of digital technologies to help achieve their overall business strategies and on their way to the Fourth Industrial Revolution.

3.1.2 Anecdotal business feedback

Despite the challenges for some businesses in starting the Industry 4.0 journey and yet to take full advantage or see the value of certain transformative technologies, others are challenging themselves by taking the journey.

As expected, such steps are often neither perfect nor easy and present successes along with their own practical challenges. The following are some anecdotal feedback that Ai Group has come across over the last year:

- Changing organisational mindsets: getting the organisation to appreciate the impact of digitalization; and overcoming fear of failure.
- Leadership: technology helps leaders focus on leading yet also highlights where they do not; need for people managers and critical thinkers, not traditional process leaders; and capability required in change management.
- Justifying expenditure: Some businesses with digitalisation strategies had difficulties justifying expenditure on particular Industry 4.0 initiatives.
- Incremental success: Some businesses started small – rather than changing everything at once – to demonstrate success and sought approval afterwards.
- Trusting and adapting to technology: getting traditional workers to trust data more than their experience and intuition; getting people used to AI and chatbots; need for a technology adaptive culture; and a dilemma for some companies is whether it is easier to hire a new generation of workers with new skills or retrain a senior workforce that may be resistant to change.
- Perceptions: no matter how much businesses were doing and how big they were, they all thought they were beginners on Industry 4.0; and for some manufacturers,

[26] Ibid.
[27] Ibid.
[28] Ibid.

difficulty in attracting people to work in manufacturing was more of a challenge than skill shortages – while concepts like gamification might make jobs more interesting, many factory processes were still largely pre-digital and the work itself not as easily attractive.

- Data use: lots of data were being collected already but some businesses were not sure what to do with it all; finding the right people to turn the collected data into insights; people have technical ability but not the mindset to maximise the use of data; and uncertainty as to who controls or owns the data.
- Interoperability issues: system integration was a challenge; and middleware was used to overcome different standards and proprietary systems.
- Supplier capability: a major constraint was matching suppliers with the capability required by the company; and if digitalisation enables companies to increase just-in-time production, especially globally, a model will be required for addressing delays in physical delivery.
- Digital innovation: one company wrote its own software because it saw it as a business opportunity; and another company used digital collaboration along its supply chain to allow for global problem solving and live design.

Ai Group's Entrepreneurs' Programme Business Advisers and Facilitators have engaged with many SMEs who are progressing Industry 4.0 strategies without using this label. The following are examples that we have come across:

- Fuel supplier to heavy transport and industry: Over recent years, the company developed a range of systems which allow it to offer full, end-to-end fuel management systems to its clients. (The business was a pioneer in the provision of remote, real-time tank monitoring and fuel management systems, although these have now been replicated by a number of competitors.) The monitoring systems offer customers transparency, visibility and control over fuel usage in their businesses. Through the use of remote monitoring systems and individually coded equipment tags with secure PINs used at the time of refuelling, the system enables full fuel use tracking and reporting, saving significant time and cost in reconciliation and internal reporting. Metrics tracked include user information, distances covered, equipment hours and consumption rates. If they choose, customers can also manage their own fuel stocks via back-end access to the monitoring software and mobile apps.
- Metal fabricator: The firm was implementing digital technologies through the acquisition of new laser cutting equipment and capturing new market opportunities. The new laser cutting machine features automated material handling and direct numerical control linked to the firm's CAD software. Representatives of the business visited overseas manufacturers of the automated laser equipment where they were very impressed with the fully automated loading and unloading capabilities available at an attractive price point.
- Manufacturer of vehicle safety testing equipment: The business owner worked with a road safety agency to develop a workshop based vehicle roadworthiness tester and sourced the electronics from an overseas supplier. This technology combines the technical requirements for European vehicle safety and the specific demands of the Australian environment for passenger cars and heavy road transport vehicles. The firm is now looking to connect the units it has in the field to send the test data back to a central database. The data has potentially major impact in understanding safety risks present in vehicles at their annual roadworthiness inspection.
- Plastic injection manufacturer: The business has been using sensoring devices on all of their equipment to monitor and manage machine performance. They are using the data generated, primarily for internal operating purposes, mainly for predictive and programmed management. More importantly though, the data generated is providing greater accuracy on machine utilisation rates, allowing them to become more accurate with their costings. This is having a flow on effect to pricing discussions that they are having with clients, allowing them to win more business. The business is looking at this whole process as an efficiency and business improvement process.

Some SME manufacturers do not focus on the Industry 4.0 label because their primary objectives are to implement strategies or new approaches to enable them, for example, to manage their operations and become more efficient, improve productivity and improve bottom line performance. They also implement digital strategies to help drive demand strategies and build brand awareness (as discussed in Chapter 2). On this basis, the following are examples of tools that they look for:

- The operational software programs including Enterprise Resource Planning (ERP), Project Lifecycle Management (PLM), Bill of Materials (BOM) and Customer Resource management (CRM) that provide interface with customers and auto updates on product manufacturing process.
- Automation of workflows using Electronic Data Interchange (EDI) and better communication around supply chain management, invoicing and payments.
- Bar coding and labelling including product traceability, warehousing and stock management.
- The implementation of lean methodologies.
- Robotics are being implemented as part of their

manufacturing processes.

3.1.3 Business case studies

Delving deeper into how businesses are currently responding to the practical challenges and opportunities of Industry 4.0 and digitalisation, Ai Group recently interviewed several innovative companies who have taken the lead on investing in and implementing these technologies.

These companies shared their experiences in adopting these technologies.[29]

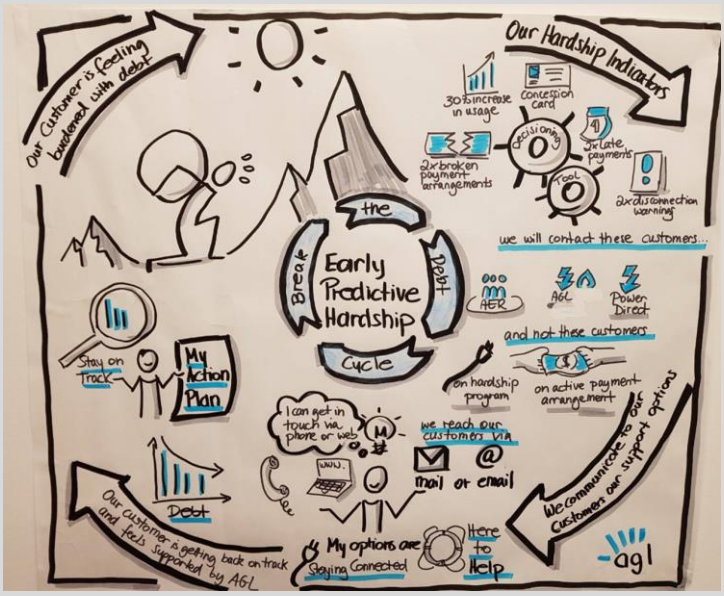
[29] Acknowledgement: Ai Group would like to thank AGL, B&R Enclosures, Laing O'Rourke, REDARC, Watkins Steel and Weir Minerals for sharing their case studies.

AGL

AGL is one of Australia's largest energy retailers. At a time when rising power and gas prices are a pressing issue, AGL recognises that financial vulnerability is an unfortunate reality for many Australians.

In response to AGL's commitment to address customer concerns on financial vulnerability, underpinned by their strategic objectives of Social Licence, Growth & Transformation, they have been able to leverage recent investments made in their world class Data & Decisioning platforms.

The Decisioning technology can leverage both predictive and response data and analytics to identify customers who may be showing early signs of hardship, then orchestrate customised communications to raise awareness of the various support options available, including access to AGL's hardship programs. Additionally, AGL worked collaboratively with the Australian Energy Regulator (AER) to ensure the system design of the tool targeted customers who may be experiencing financial difficulty.



It is the first time this technology has been used to reach vulnerable customers, using both data and automation technology to ensure their customers receive support they need earlier.

The platform was introduced as part of AGL's multi-year Digital Customer Experience Transformation Program, where significant investments were made in technology and data (including Big Data) to provide analytical insight to better inform business decisions.

By using a Decisioning Platform & Predictive Analytics it will over time allow a shift towards responsive modelling, machine learning and even real time contextual information in making the best and automated customer decisions. The goal is to create targeted and personalised options for customers as well as greater speed and efficiency to market, which helps balance both customer and business outcomes.

At a more macro level, the role of technology at AGL continues to evolve – automating outcomes where possible in order to create efficiencies in delivery and learning as well as allowing humans to focus more often on value-add tasks.

To support this mission, their Decisioning, Analytics and Data team have even made changes to their recruitment processes and capability mix as a result of the implantation of this new technology. Beyond the core competencies, they have recognised the need to have people who are able to self-learn and adapt to the ever-increasing pace of change as technology advances.

Since launching in January 2019, AGL have sent over 100,000 Early Hardship Communications to customers. This has exceeded their expectations in raising awareness of the support options available to customers and they have also been able to measure an increase in usage of their "Here to Help Online Tool".[30] Insights gained already from the initiative are being used to inform the next phase of delivery, where they will further leverage technology and personalisation options to increase the quality of their customer engagement model.

[30] https://www.agl.com.au/heretohelp.

B&R Enclosures

B&R Enclosures is achieving some surprising wins from their Industry 4.0 strategy.

Australian manufacturers have had to evolve to remain competitive in a marketplace that is now truly global.

B&R Enclosures are no different, having experienced a great deal of change over 65 years as Australia's largest manufacturer of enclosures, racks, cabinets, switchboard building systems and hazardous area equipment.

To deal with these challenges the organisation has chosen to provide a wide range of standard, off-the-shelf products as well as custom solutions to suit specific application needs for businesses and Government entities within Australia.

They are now using this expertise to successfully service requirements throughout the world.

"Competing against overseas suppliers, who have an advantage of high volumes and low labour costs, is something that we have been tackling for decades," states Chris Bridges-Taylor, General Manager at B&R. "We focus on delivering value and recognised early on that we had to learn and adapt to be competitive."

Learning to evolve and change quickly, has allowed the company to focus on taking an 'overall value' approach in solving customer problems.

"B&R have a strong heritage of producing high quality products that our customers can rely on," says Bridges-Taylor. "By learning how to be 'agile' we not only retained our position in our traditional markets, we have taken advantage of significant new opportunities that have supported our growth."

As part of this direction, four years ago, B&R Enclosures started proactively investing in a strategy of Industry 4.0 and have been on the journey ever since.

B&R's first digital transformational project focuses on improving the factory floor by making information transparent throughout the production process to improve decision making, lower costs and increase service.

"The data that is communicated in real-time has allowed the manufacturing part of the business to become aware of log-jams on the production line. Prior to that we didn't understand why jobs were taking longer than expected," states Bridges-Taylor.

B&R attributes a 15% saving in manufacturing time across the board and reaching an achievable DIFOT (delivery in full, on time) of 100% to the focus on their Industry 4.0 strategy.

B&R's second project applies Industry 4.0 principles and technologies to product design and development to achieve digital continuity, reuse of information and real-time collaboration.

According to Bridges-Taylor, "Our largest contracts are being won through our 'agility' to deliver customised orders quickly and deal with 'variations'. Many large contract customers place orders regularly that in the past presented unreasonable time-frames, and whilst still challenging, we are now able to better manage our

processes and resources to still deliver as required."

Both projects represent a shift from large production-centric manufacturing of commodity products towards a more customised, smart and competitive manufacturing model.

According to Chris Bridges-Taylor, this company-wide strategy has provided some surprising and valuable paybacks. "As well as the customer-centric benefits of moving in an Industry 4.0 direction such as reduced lead times and operational efficiency, our internal culture has evolved as employees in both the office and workshop get on board. Most of our team has been with us for years. Instead of staying in one job, many are now proactively learning new skills and seeking more knowledge and involvement to drive continuous improvement and participate in better decision making. While individuals are gaining professional and personal growth, this situation is good for our customers and good for the business."

Laing O'Rourke

Laing O'Rourke has developed and implemented a wide range of transformative technologies throughout its business, with two of the most prominent being the implementation of the LORAR+ augmented reality platform and the development of the Toolbox Spotter, a modular safety system powered by artificial intelligence.

The LORAR+ platform allows anyone inside of Laing O'Rourke to create and curate their own augmented reality experiences through a publicly available mobile application and a secured backend platform. This has massively reduced the cost and complexity associated with using augmented reality at an organizational level, and has created a very broad application of the technology to all parts of the business. Every project now uses augmented reality in some aspect, with this use being guided by those involved on the project and their particular requirements. Common uses are for community engagement, stakeholder communication and the communication of complicated information to teams on site.

The Toolbox Spotter uses artificial intelligence to identify when a human is in the way of a potential hazard and then automatically takes actions to control that hazard. For example, the Toolbox Spotter can be configured to identify when people are in the blind spots of heavy equipment, and to not allow that equipment to be engaged until the people are within the safe working areas. Other uses of the Toolbox Spotter include sending personalised warning messages to devices worn by workers, tracking the movement of people in and out of hazardous areas, and to create highly noticeable warnings that only appear when they are required.

The development of these technologies and others stem from the desire of Laing O'Rourke to be a leading engineering organisation in the emerging Fourth Industrial Revolution. Laing O'Rourke has a deep understanding that surviving and thriving in this new era of technology and culture requires a proactive approach to continue to create the best solutions for their clients, community and workforce.

Both of these technologies have been recognised as being transformative in their respective domains, and have been the recipients of a number of awards. The LORAR+ platform has streamlined communications and the delivery of augmented reality to such a degree that it is now a standard component of all Laing O'Rourke projects. Augmented reality, previously considered a potentially highly disruptive technology, has been so embedded into organisational practice that it is now business as usual.

The ideation, development and delivery of these technologies was facilitated by the Laing O'Rourke Engineering Excellence Group (EnExG). The EnExG is an internal team of experienced technologists, change agents and business development specialists, most of whom do not have a background in the construction industry. The EnExG provides a space for skilled and passionate people to apply their skills in an industry that they traditionally would not work in, and has been instrumental in driving the innovation agenda of Laing O'Rourke. The work of the EnExG is backed up by a deep commitment to innovation and improvement across all levels of Laing O'Rourke, and innovation practice is a core component of Laing O'Rourke

development programs.

The greatest challenge found when implementing these innovations is rarely the technology itself, but the people around the technology. All technology, from development to utilisation, exists in a human landscape, and successfully traversing this landscape can be fraught. Fear of change, the development of new skills, self-perception and identity all need to be carefully and respectfully considered. Laing O'Rourke has successfully navigated this terrain by creating novel and supportive environments, such as the EnExG, where new ways of thinking and doing can flourish outside of the existing confines of the business, and by a broader organisational recognition of the importance of our people. Understanding that innovation, at its core, it is a human centred process will ensure that Laing O'Rourke will be driving the development of construction and engineering technologies as the Fourth Industrial Revolution continues.

REDARC

Servicing recreational and heavy vehicle users including local and international defence, mining and marine industries, REDARC's success over the past four decades has been founded on providing premium quality, locally manufactured solutions.

REDARC recently finalised a $22 million factory expansion project, including investment in its advanced manufacturing capabilities as part of its Industry 4.0 digitalisation strategy. The major investment in the company has been directed towards new state-of-the-art surface mount technology, new advanced testing and validation equipment, the latest in universal robotic technology, and the implementation of a new enterprise resource planning system.

The ERP system has been integrated with the new and existing automation to provide a full view of component traceability from supplier batch through to finished good delivered to the customer. There is also an additional 3,000 sqm of advanced manufacturing space in REDARC's Lonsdale factory, including sustainable new power infrastructure, while new jobs have been created to build on the company's highly skilled workforce.

Owner and Managing Director of REDARC, Anthony Kittel, says the expansion – which was completed in November last year – has already seen key areas of the business grow, while simultaneously improving processes and efficiencies, as well as the quality and durability of the company's products.

"Expanding the business has given us more flexibility leading into the future as we enter new export markets and defence industries, making us more agile to deal with our customers' ever-changing needs," he said.

"Our technological expertise was already extremely high, but my business mantra has always been that no matter how well you do something, you can always do it better, so that's essentially what drives us to invest and grow.

"For example, our new surface mount technology line is now specified so highly that it's one of only a few in the world of its type, giving us the ability to increase our production capacity by 250%.

"Our new advanced testing and validation equipment has also significantly improved our manufacturing techniques, productivity and overall quality, while at the same time decreasing logistical burden and reducing our new product development cycle costs and schedules.

"Our investment in universal robots, otherwise known as cobots, are designed to accurately conduct difficult or repetitive work in tight confines and work safely and collaboratively next to our people within the factory."

Mr Kittel pays tribute to his staff for turning REDARC into a world class electronics manufacturer over recent years.[31]

[31] Photo: Anthony Kittel Managing Director of REDARC (right) and Heinz Zimmermann Managing Director of Suba Engineering (left).

Watkins Steel

Watkins Steel is a traditional steel fabrication company that has embraced advanced processing robotics and emerging technologies to transform the company.

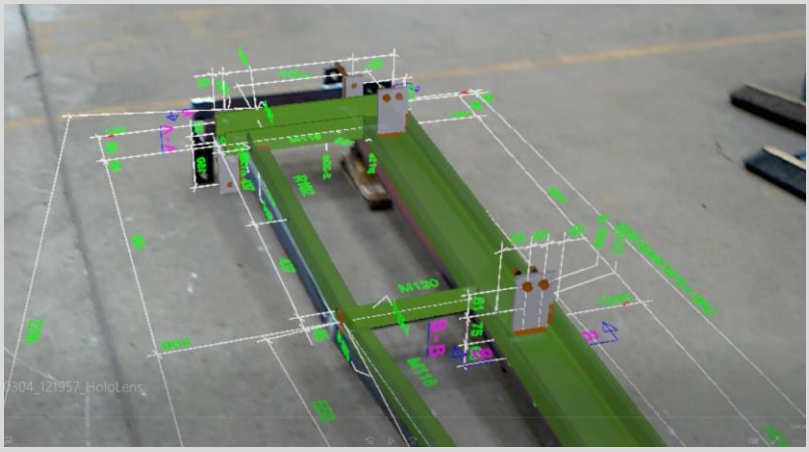
They have recently introduced virtual reality (VR) as a new feature. Whilst VR is not new to industry, they have paired VR to point clouds generated from their laser scanning to enable the user to walk through existing buildings and overlay design models.[32]

After seeing the massive impact digital innovation has had on their business, they encourage all their staff to learn and try new things. This is enhanced by overseas study tours, in house workshops and training courses.

This has now created momentum and their staff have embraced a culture of change.

The tangible improvements include:

- Taking 3000 person-hours per month out of their factory. As the company grows, the number of hours being saved continues to increase.
- Doubling in revenue size within a 3-year period.
- Expanding their geographical footprint with operations in Darwin, North Queensland and Melbourne.
- Doubling their physical factory size.
- They are using their technology and partnering with like-minded companies for the mutual benefit of all the supply chain partners. It allows them to differentiate the value proposition from others where they "sell" risk management and speed to market versus the traditional offering of tonnes of steel and person hours.



As they were a traditional steel company, they have created a new company – Holovision, to capture the offering the technology provides.

They are now offering different services such as "as built drawings", animation and scans for tender submissions, modelling through augmented reality, photogrammetry from drones, engineering, stress analysis using engineer software, data storage, model sharing, rendering and steel detailing using Tekla® software.

One of the welcome challenges that they had to overcome is the growth in Watkins Steel that Holovision has driven. As Watkins Steel gets busier, it is difficult to allocate sufficient resources to Holovision to continue its growth.

[32] In technical terms, a "point cloud" is a collection of data points that can be produced by 3D scanners, which can be used for example to model the shape of a physical system.

Weir Minerals

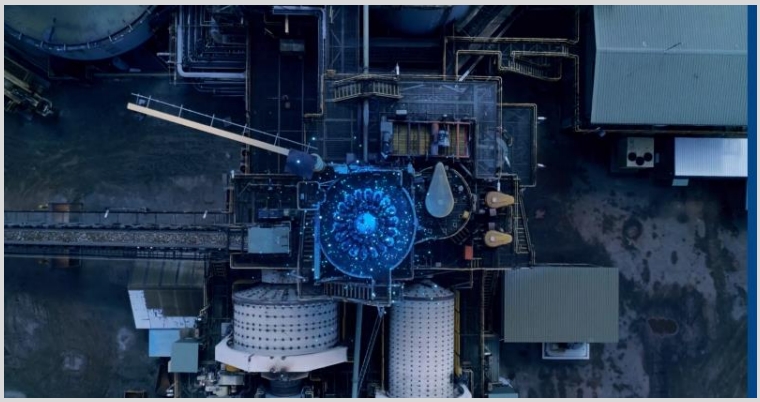
Digital Transformation

In a rapidly changing world we are seeing the emergence of new technologies such as autonomous vehicles, predictive analytics, blockchain, augmented reality, AI and many more. Technologies that Weir is adapting to, building upon nearly 150 years of engineering expertise. As a longstanding market leader, supplying processing solutions to the resources industry, Weir began investigating digital and data analytics several years ago.

Fast forward to today and a digital revolution has been quietly transforming Weir into a new kind of industry expert, developing disruptive digital platforms and technologies that are set to lift the resource industry to new levels. From simple site-based detection systems to advanced remote monitoring, predictive maintenance, automation and control, Weir has developed a range of Industrial Internet of Things (IIoT), edge and Big Data enabled smart products and services.

With the use of Synertrex® advanced technologies, Weir has advanced its reach, responsiveness and understanding of critical customer issues and opportunities. The digital platform provides fact-based insights, allowing operators around the globe to optimise the performance of Weir equipment and increase throughput. Weir products that can be Synertrex® enabled include: Warman® centrifugal pumps, Enduron® HPGR, screens and cone crushers, Cavex® hydrocyclones and GEHO® PD pumps.

The Journey



Despite making significant progress, developing this technology has not been easy. Building and introducing a leading technology platform was always going to have its challenges. To accelerate this journey, Weir's strategy has been to partner with the very best technology companies.

The main drivers for executing an advanced digital strategy is the fast-changing world around us, from both a macro and micro-economic perspective. In response to customer needs, new technologies are rapidly being developed, introduced and consumed by the mining and minerals market.

Challenges

The digital transformation process requires significant cultural change, necessitating new ways of listening to the market, developing products and services, organising internal processes, providing holistic solutions and delivering long term customer value. This required Weir to develop new IIoT technology and process expertise and recruit employees with relevant technological skill sets obtained from leading universities across the globe.

Additionally, Weir's newly founded Group Technology Team selects and works with some of the world's leading brands and emerging start-ups to establish cutting edge technologies. The team was also assigned to drive Weir's digital strategy and validate new developments. The result? Weir has gone from being a manufacturer of stand-alone mechanical equipment to a supplier of advanced smart products, systems and services.

Partnerships

Working closely with Dell, Microsoft and Australian technology firm LX Group has enabled Weir to develop some of the most advanced IIoT Edge technologies in the industry. The ruggedised 5100 series Edge Gateway integrates the best of computing, advanced communication and data acquisition into a standardised industrialised package

for the toughest environments imaginable.

And it does not stop there. The business continues to innovate, advancing both the simple and complex and recognising the need to build the technologies that will redefine Weir tomorrow alongside those that will enhance its core offerings today. From simple digital tools to enhanced onsite services and next generation AI, Weir is developing a digital thread that connects its entire value chain from front to back office. In short, Weir is advancing a vision of a frictionless enterprise, offering its customers a seamless digital experience.

Market Driven Development

Delivering that vision is Weir's driving force, building upon a longstanding belief that its customer and market led philosophy underpins its true value, with agile operations and product management the cornerstone of its development. With in-depth understanding of user experience driving continuous development, Weir has built a pipeline of applications and innovations enabling giant leaps through on-going small steps.

Leveraging Technology through its Core Business Model

This approach also enables Weir to bring its technology to market through existing service infrastructure rather than reinventing itself. This is an area that many businesses wrestle with as they try to invent ways to commercialise new technologies like IIoT. IIoT has become a natural extension of Weir's offering, enabling service teams to better support customers through remote and continuous monitoring, asset tracking for enhanced equipment management and product automation that reduces risk to equipment operators and optimises plant productivity.

It does not stop there for Weir. The company will continue to evolve with a pipeline of hundreds of ideas driven by a collaborative effort between its newly formed Group Technology Team, the businesses' technology and engineering teams, market leading technology partners and its core businesses advancing and applying the very latest technologies to sustain Weir's vision and mission.[33]

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3.2 Digital infrastructure and technology trends

Good access to digital and communications infrastructure is essential to do business in the Fourth Industrial Revolution.

Since our 2017 *Business Beyond Broadband* report, the technology mix for infrastructure access – and emerging technologies that rely on this infrastructure – continue to change, enabling faster internet speeds and greater volumes of data downloads.

The following sections provide a cursory glance at the current and emerging trends around this infrastructure and technology.

3.2.1 Internet access type, speed and data download volume

The Australian Communications and Media Authority's (ACMA) latest report found that there were 41.7 million internet subscriptions in Australia in June 2018, which was an increase of 4% over the year.[34]

According to the latest ABS data, 89% of all users with broadband reported advertised speeds of more than 8 Mbps in June 2018.[35] 66% of broadband users reported advertised speeds of more than 24 Mbps in June 2018.

The most common types of broadband services were delivered to consumers via mobile wireless (45% in June 2018) and fibre (25%), which surpassed DSL (22%) for the first time.[36] As the ABS predicted in 2016, fibre continues to be the fastest growing type of internet connection. For the 2017-18 financial year, fibre growth was 70%; in contrast to DSL which declined by 24%.

ABS data relating to business consumers in 2017-18 reported the main type of broadband connection was DSL (46%), followed by fibre (17%), fixed wireless (14%), mobile wireless (13%), cable (8%) and satellite (3%).[37]

The data also indicated that these proportions remained relatively the same whether businesses were "innovation-active" or "non innovation-active".[38]

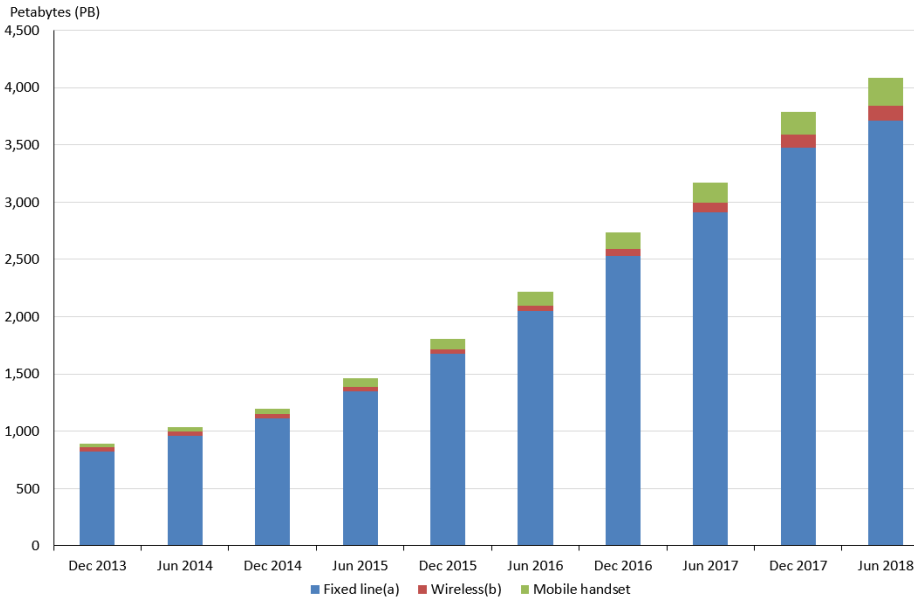
Notably, these proportions varied according to business size, with more large businesses having access to fibre (35% fibre for 200+ employees) compared to micro companies (14% for less than 4 employees).[39]

Proportions also varied according to sector.[40] Most industries had access to DSL followed by fibre; but if not fibre, then either fixed wireless or mobile wireless.

On the other hand, the agriculture, forestry and fishing sector had evenly divided access to wireless (20%-24% between fixed wireless, satellite and mobile wireless) and DSL (23%) – this is not surprising given the mobile nature of the sector.[41]

The ABS also asked about the importance of mobile internet to businesses, with 58% indicating that it was of major value, followed by 23% of moderate value.[42] The

Chart 12: Data downloads by connection type through Australian ISPs with 1,000+ subscribers



Notes:
(a) Fixed line includes DSL, cable, fibre and other fixed line broadband.
(b) Wireless includes satellite, fixed wireless, mobile wireless via a datacard, dongle, USB modem or tablet SIM card and other wireless broadband. Excludes data downloaded via mobile handsets.
Source: ABS

[34] ACMA, "Communications Report 2017-18" (Report, February 2019), p. 35.
[35] ABS, 8153.0 - Internet Activity, Australia, December 2016 and June 2018.
[36] Ibid.
[37] ABS, above n 9.
[38] Ibid.
[39] Ibid.
[40] Ibid.
[41] Ibid.
[42] Ibid.

construction sector valued this the most (70%).

Similarly, 50% of businesses rated access to high speed broadband of major value, and 26% of moderate value.[43] This was highly valued more in the information media and telecommunications sector (71%).

Supported by high speed broadband, the volume of data downloaded by Australians continued to increase rapidly, more than tripling in June 2018 since Ai Group's 2013 *Business End of Broadband* report, according to ABS data (see Chart 12).[44]

"The size and complexity of the internet continues to grow in ways that many could not have imagined."
– Cisco (2018)

Similarly, global IP traffic or the flow of data across the internet continues to exponentially increase, according to Cisco. [45] Cisco identifies key digital transformers that are driving global internet growth: more internet users; more devices and connections; faster broadband speeds; and more video viewing.[46]

3.2.2 Connected devices and other connections

Mobile penetration continues to saturate the Australian market.

The ABS estimated that there were almost 27 million mobile handset subscribers in Australia by June 2018.[47]

As a proportion of the population, ACMA reported that 96% of Australian adults used mobile phones to make calls, with 83% using smartphones.[48]

Diverse ways in which mobile phones were used to communicate are shown in Chart 13.[49]

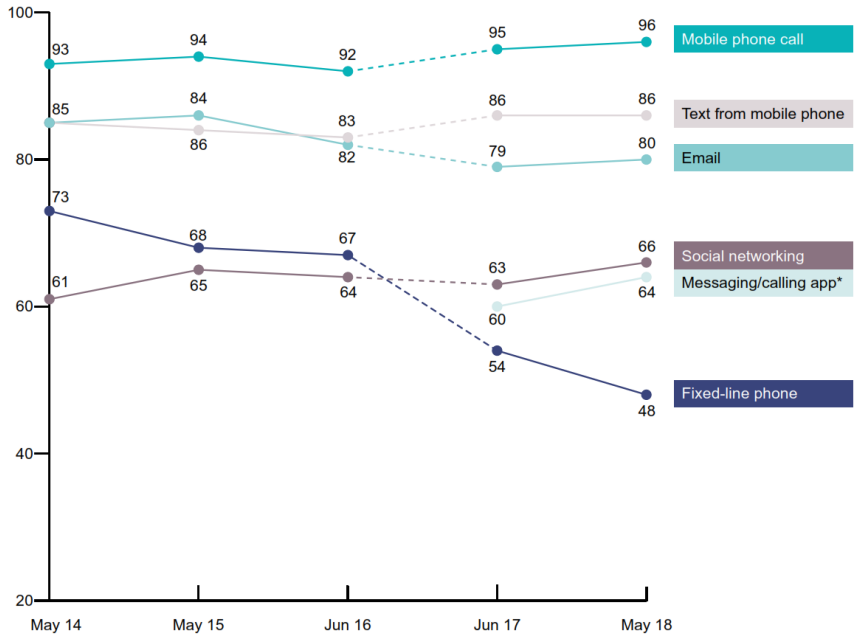
As at May 2018, 87% of Australian internet users also used their mobile phone to access the internet, followed by laptop (72%), and tablets (61%).[50] 40% of online Australians used five or more devices to access the internet, which almost doubled over the year.[51]

The most popular combination of devices for Australian adults for online access as at May 2018 were mobile phone, laptop computer, tablet, desktop computer and TV.[52]

47% of Australian adults used smart devices to connect to the internet, with smart TVs the most popular choice (36%), and growth in wearable devices (14%) and security cameras (5%).[53]

5% of Australian adults also owned a voice-enabled device, as well as voice-controlled speakers and GPS tracking tags or devices.[54]

Chart 13: How Australians communicate for personal purposes, by service (%)



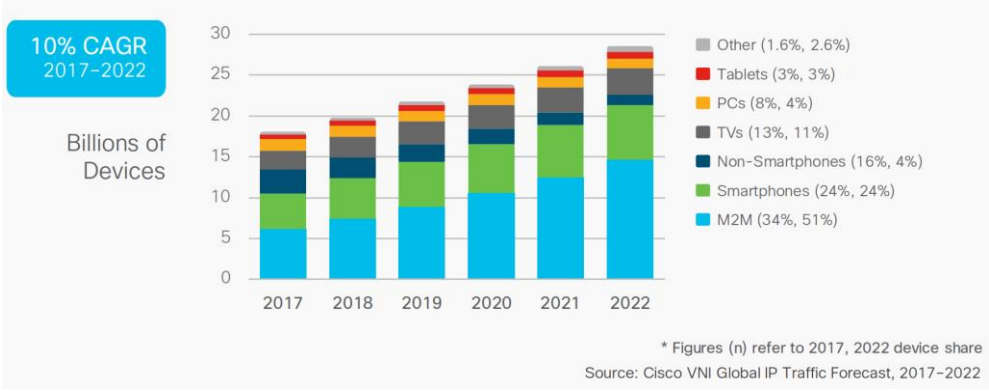
**Data not available prior to June 2017.*
Note: The changes in methodology in 2016 and 2017 mean that some differences between these years and in years prior may be explained by the methodology rather than any significant difference.
Base: Australians aged 18 and over.
Source: ACMA

Other smart home products were used by no more than 2%.[55]

[43] Ibid.
[44] ABS, above n 35, December 2013 to June 2018.
[45] Cisco, "Visual Networking Index: Forecast and Trends, 2017–2022 White Paper" (Cisco website, February 2019).
[46] Cisco, "Cisco Predicts More IP Traffic in the Next Five Years Than in the History of the Internet" (Cisco website, November 2018).
[47] ABS, above n 35, December 2016 and June 2018, June 2018.
[48] ACMA, above n 34, p. 33.
[49] Ibid, p. 54.
[50] Ibid, p. 58.
[51] Ibid, p. 59.
[52] Ibid, p. 60.
[53] Ibid.
[54] Ibid.
[55] Ibid.

Cisco predicted this trend in connectivity will accelerate with Machine-to-Machine (M2M) connections being the fastest growing, followed by smartphones, smart TVs, PCs and tablets (see Chart 14).[56]

Chart 14: Global devices and connections growth forecast



Source: Cisco

3.2.3 Broadband network

A mix of communication infrastructure is critical to enable the growth of the digitally enabled economy. However, some of these technologies are growing fast. Accommodating these, present a challenge for slower moving government and regulators, as do business calls for lower regulatory barriers and increased regulatory flexibility.

The nbn

Since the establishment of the nbn by the Federal Government in 2009, much has changed in both its design and mandate, as well as the competitive landscape and technologies in which it operates.

NBN Co is responsible for building and operating the nbn. Its "key objective is to ensure all Australians have access to fast broadband as soon as possible, at affordable prices, and at least cost".[57] And it "has a mandate to supply wholesale-only high-speed broadband access services to reach all Australians using a mix of access technologies and based on uniform national prices".[58]

We observed in our 2017 *Business Beyond Broadband* report that the acceleration in the nbn deployment in recent years was positive. More recently, NBN Co reported that "more than 10 million homes and businesses are now able to connect to the nbn™ access network … with less than twelve months of the build remaining".[59] By the end of Q2 2019, 5.532 million premises were activated, a 37% increase over the previous year, with the majority using technology other than fixed wireless and satellite.[60]

With the rise in connections of services over the nbn, there is likely to be a corresponding increase in customer complaints as a proportion of all internet and landline complaints, according to the Telecommunications Industry Ombudsman (TIO).[61] In its latest report for the period of July to December 2018, there were "60,998 total complaints received, a decrease of 27.7 per cent against the same period in 2017".[62] Of these complaints:

- *4,217 complaints were recorded about connections or changing providers for a service delivered over the National Broadband Network. Complaints about connections or changing providers per 1,000 premises added to the Network decreased from 9.2 to 6.7 compared to the July to December 2017 period.*
- *9,666 complaints were recorded between July and December 2018 about service quality on the National Broadband Network. Complaints about service quality per 1,000 premises on the Network decreased from 4.1 to 2.1 [compared to the] July to December 2017 period.*[63]

With respect to these complaints, the TIO points out:

The experience of consumers and small businesses when connecting to or receiving a service delivered over the National Broadband Network is influenced by a range of factors. This can include the actions of the internet service provider, wholesaler, NBN Co, and also factors within consumers' premises.[64]

Additionally, ACMA highlighted the following key findings with respect to telecommunications complaints handling data provided directly by telecommunications companies

[56] Cisco, above n 45.
[57] NBN Co, "About NBN Co" (NBN Co website).
[58] ACCC, "Communications Sector Market Study" (Final Report, April 2018), p. 18.
[59] NBN Co, "10 million homes and businesses can now connect to the nbn™ access network" (Media statement, July 2019).
[60] NBN Co, "Weekly Progress Report" (NBN Co website, 18 July 2019).
[61] TIO, "Six Month Update: July to December 2018" (Report, April 2019), p. 17.
[62] TIO, "Phone and internet complaints down between July and December 2018" (Media statement, April 2019).
[63] Ibid.
[64] TIO, above n 61.

for the period July to December 2018:

- *Voice only services delivered by telcos over the NBN (using VoIP technology) had the lowest number of services in operation (275,753) but the highest rate of complaints.*
- *The rate of complaints about broadband services delivered by telcos over the NBN is 40 per cent lower than for services delivered over non-NBN networks.*
- *The highest rate of complaints about broadband services delivered by telcos over the NBN involved the new fibre-to-the-curb technology – however this high rate of complaints was attributable to only a few of the telcos that provided data to the ACMA.*[65]

By way of contrast, ACMA reported that "mobile services had the highest number of services in operation (30.1 million) yet the lowest rate of complaints".[66]

And compared to the TIO data, ACMA noted that the "total complaints to telcos increased in the December quarter, while the proportion of complaints referred to telcos for resolution by the Telecommunications Industry Ombudsman (TIO) is down".[67]

ACMA suggested that high rate of complaints relating to FTTC may be due to the relative newness of this technology, given that first connections with FTTC were completed in March 2018.[68]

Overall, it is positive that complaints to the TIO, especially about the nbn, have decreased over 12 months.

While we would expect accelerating take-up of a service to entail proportionately more frequent complaints to the TIO, in fact nbn-related complaints fell as the rollout progressed. While improvements to awareness, access and quality remain important, complaints data belies media perceptions of dissatisfaction with the nbn.

However, there is much room for improvement in bringing down complaints to the TIO and ACMA. ACMA flagged of specific concern high level of complaints associated with voice-only services over the nbn that are critical to the most vulnerable users.[69] This will be important for the remainder of the rollout and ongoing delivery of the nbn services.

Therefore, completing the rollout of the nbn in a timely and effective manner are integral to meet customer expectations, bridge the digital divide for underserved regions, and bring down barriers to global competitiveness.

As recommended in our 2017 report, it remains important for businesses to be clearly aware of the nbn rollout, as well as the real business benefits of the nbn to encourage business uptake. To this end, in an NBN Co commissioned report, Ovum Research examined a range of business sectors and suggested how the nbn could help to deliver benefits from business investments in digital innovation.[70]

In addition to the nbn, there are a range of other non-nbn alternatives based on different network technologies including non-nbn fibre broadband services, fixed wireless services, as well as mobile networks.[71]

5G and IoT

With respect to mobile networks, improvements to this type of infrastructure continue to support the growth of mobile phones and other connections, with combined 3G and 4G mobile network coverage reaching 99.4% of the Australian population.[72]

Changes to mobile network technology is also seeing the closure of the legacy 2G networks, phase-out of 3G networks in the next few years, and expansion of advanced 4G networks.[73]

And with the anticipated rollout of the 5G mobile network over the next year, this is expected to enhance access for advanced industry digital applications through significant higher data limits and faster data speeds compared to 4G, theoretically delivering between 1 and 10 Gbps.[74]

The ACCC considered that 5G has the potential to substitute fixed broadband technology, given its ability to provide comparable speeds to fixed broadband services and portability advantage.[75] It noted, however, 5G's competitiveness may depend on price, service performance, service offerings including data quotas, and access to key inputs such as spectrum, small cell

[65] ACMA, "ACMA reveals telco complaints" (Media statement, July 2019).
[66] Ibid.
[67] Ibid.
[68] ACMA, "Telecommunication complaints handling July to December 2018" (Report, July 2019).
[69] ACMA, above n 65.
[70] Ovum Research, "The nbn™ broadband access network for business – a foundation of digital transformation" (Report for NBN Co, April 2019).
[71] It should be acknowledged that the communications sector market comprises several layers of which we are only considering a subset for the purposes of this report. For a more comprehensive analysis see: ACCC, above n 58, p. 28-30, 45-50.
[72] ACMA, above n 34, p. 17.
[73] Ibid, pp. 17-18.
[74] Ibid, p. 38; ACCC, above n 58, p. 142.
[75] ACCC, above n 58, p. 141.

infrastructure and transmission network.[76]

While there may be diverse views as to whether 5G will be a true substitute and therefore competitor to the nbn, it is important to note that the nbn and advances in broadband technology has the potential for it to both compete and complement with 5G (as it currently does with 4G).[77] For example, advances are already being made in broadband technology with deployment of G.fast capability for FTTC and trials of DOCSIS 3.1 technology for HFC, delivering potential speeds of up to and over 1Gbps.[78] Others have suggested that with technological advances in the nbn, it could also provide mobile backhaul infrastructure to support 5G networks which rely on fibre technology.[79]

Interwoven with 5G are developments in IoT infrastructure. ACMA considered IoT is now mainstream with greater cost efficiency that is likely to drive IoT adoption.[80] As part of these developments, multiple IoT networks are being rolled out in Australia based on different technology standards including LTE Cat-M1 (Cat-M1), Narrowband IoT (NB-IoT), Sigfox and LoRaWAN.[81]

Despite positive expectations for adoption of IoT, challenges still remain for promoting the business value of IoT. The ABS asked business about the importance of IoT, as well as the interrelated value of radio frequency identification devices (RFID). [82] Most businesses did not see any value in IoT (62%) and RFID (83%). Larger businesses (200+ employees) saw greatest value (major value in IoT and RFID at 18% and 6%, respectively, and moderate at 31% in IoT and 18% for RFID). However, there was still a significant proportion of large businesses that saw no value in IoT (24%) and RFID (51%). Smaller businesses (less than 4 employees) also mostly saw no value in IoT and RFID (67% and 85%, respectively). That being said, industries where IoT were valued the most (major value at 11%) were in: mining; retail trade; transport, postal and warehousing; and information media and telecommunications. Transport, postal and warehousing valued RFID the most (major value at 10%).

Global broadband comparisons

According to the monthly Ookla Speedtest Global Index, Australia lagged behind other advanced economies in terms of average connection speeds for fixed broadband.

Table 8: Top 10 countries for fixed broadband by download speed, June 2019

Rank	Country	Download speed (Mbps)	Upload speed (Mbps)
1.	Singapore	195.88	202.31
2.	Hong Kong	173.54	159.08
3.	South Korea	144.99	95.91
4.	Romania	128.88	95.03
5.	Andorra	128.48	132.12
6.	Monaco	123.12	72.93
7.	United States	119.09	43.66
8.	Switzerland	116.98	70.91
9.	Liechtenstein	113.49	85.12
10.	Hungary	112.37	53.19

Source: Ookla Speedtest

As of June 2019, Australia ranked 57th in the world for fixed broadband download speed, with an average download speed of 38.54 Mbps and upload speed of 15.7 Mbps.[83] This ranking has deteriorated since June 2018 where Australia was ranked 50th with an average download speed of 30.82 Mbps and upload speed of 11.23 Mbps.

In contrast, Australia ranked 4th in the world for mobile broadband, with an average download speed of 63.2 Mbps and upload speed of 16.56 Mbps.[84] This ranking has slightly improved over the past year (previously ranked 7th in June 2018). Australia's high performance is consistent with other sources such as the GSM Association's Mobile Connectivity Index, where Australia was ranked in first place out of 163 countries.[85]

While download and upload speeds for fixed broadband improved in Australia over this period, it was still relatively slow, compared to other countries. By way of contrast, the top 10 countries as of June 2019 are listed in Table 8. Australia's closest neighbour New Zealand ranked relatively higher at 23rd with an average download rate of 93.46 Mbps and upload rate of 56.5 Mbps.[86]

In interpreting global comparisons such as the above rankings, it is important to acknowledge the following:

- There is a distinction between retail broadband speeds delivered across a range of different service

[76] Ibid, pp. 4, 142.
[77] Canstar Blue, "5G Vs NBN: What's the best internet?" (Canstar Blue website, March 2019).
[78] NBN Co, "NBN Co plugs in first G.fast units across Australia" (Blog, November 2018); NBN Co, "Ultrafast trial highlights potential upgrade path" (Media statement, July 2019).
[79] Corinne Reichert, "5G will complement NBN, not replace it: Nokia" (ZDNet website, February 2018).
[80] ACMA, above n 34, p. 40.
[81] Ibid.
[82] ABS, above n 9.
[83] Ookla Speedtest, Global Index (Ookla Speedtest website, July 2019).
[84] Ibid.
[85] GSMA, "State of Mobile Internet Connectivity 2018" (Report, September 2018), p. 23.
[86] Ookla Speedtest, above n 83.

providers (comprising of different speed tier packages) versus wholesale broadband speeds, especially in the case of the nbn.[87]

- Access to different access networks depend on the geographical region. Some Australian users may still be on legacy DSL and were yet to be connected to the nbn. Others may have the nbn but access different types of access technology and therefore speeds may vary.
- While Australia has a national broadband policy, some other countries with a higher ranking may not have a national broadband policy or a large proportion of their population may not have access to the recorded ranking speeds.
- The quality of the ISP's edge network and quality of equipment at the end user side such as slower router or Wi-Fi set up.[88] This was confirmed in a recent ACMA study on the impact of modems on the performance of internet services delivered over the nbn.[89] It found that Wi-Fi performance of the modems tested ranged from mediocre to excellent, with performance seriously affected by interference, obstacles and the frequency that it operated on.

3.2.4 Emerging technologies

Technologies in the age of the Fourth Industrial Revolution are continually evolving – some at an exponential rate which makes it difficult to predict too far over the medium to long term horizon.

"Business and technology leaders will continue to face rapidly accelerating technology innovation that will profoundly impact the way they engage with their workforce, collaborate with their partners, and create products and services for their customers … CIOs and technology leaders should always be scanning the market along with assessing and piloting emerging technologies to identify new business opportunities with high impact potential and strategic relevance for their business."
– Gartner (2018)

Each year, the WEF releases its list of ten emerging technologies. These technologies are based on the following criteria: potential to provide major benefits to societies and economies; alter established ways of doing things; still in early stages of development but attract a lot of interest from research labs, companies and investors; and likely to make significant inroads in the next several years.[90]

The WEF's latest report identified the following top ten emerging technologies:

1. *Bioplastics for a circular economy: advanced solvents and enzymes are transforming woody wastes into better biodegradable plastics;*
2. *Social robots: droid friends and assistants are penetrating deeper into our lives;*
3. *Tiny lenses for miniature devices: thin, flat metalenses could replace bulky glass for manipulating light;*
4. *Disordered proteins as drug targets: new possibilities for treating cancer and other ills;*
5. *Smarter fertilizers can reduce environmental contamination: new formulations deliver nourishment on demand;*
6. *Collaborative telepresence: soon participants in virtual gatherings will feel like they are physically together;*
7. *Advanced food tracking and packaging: a combination of two technologies could vastly improve food safety;*
8. *Safer nuclear reactors: resilient fuels and innovative reactors could enable a resurgence of nuclear power;*
9. *DNA data storage: life's information-storage system is being adapted to handle massive amounts of information; and*
10. *Utility-scale storage of renewable energy: a roadblock to sustainable energy solutions is coming unstuck.*[91]

Each year, Gartner publishes its Hype Cycle, which depicts the maturity, adoption, evolution and lifecycle phases of emerging technologies and applications over time.

Gartner's latest Hype Cycle considered five major emerging technology trends for leaders: [92]

1. *Democratised AI: AI will become more widely available due to cloud computing, open source and the "maker"*

[87] NBN Co, "Akamai report shows again the nbn™ network is critical to bridging the digital divide" (Media statement, December 2016).
[88] Ookla Speedtest, "Fixed Broadband Report for Australia" (Ookla Speedtest website, November 2017).
[89] ACMA, "Get the right modem for peak NBN performance" (Media statement, July 2019).
[90] WEF, "Top 10 Emerging Technologies 2019" (Report, July 2019).
[91] Ibid.
[92] Gartner, "Gartner Identifies Five Emerging Technology Trends That Will Blur the Lines Between Human and Machine" (Press release, August 2018); Gartner, "5 Trends Emerge in the Gartner Hype Cycle for Emerging Technologies, 2018" (Gartner website, August 2018).

community;

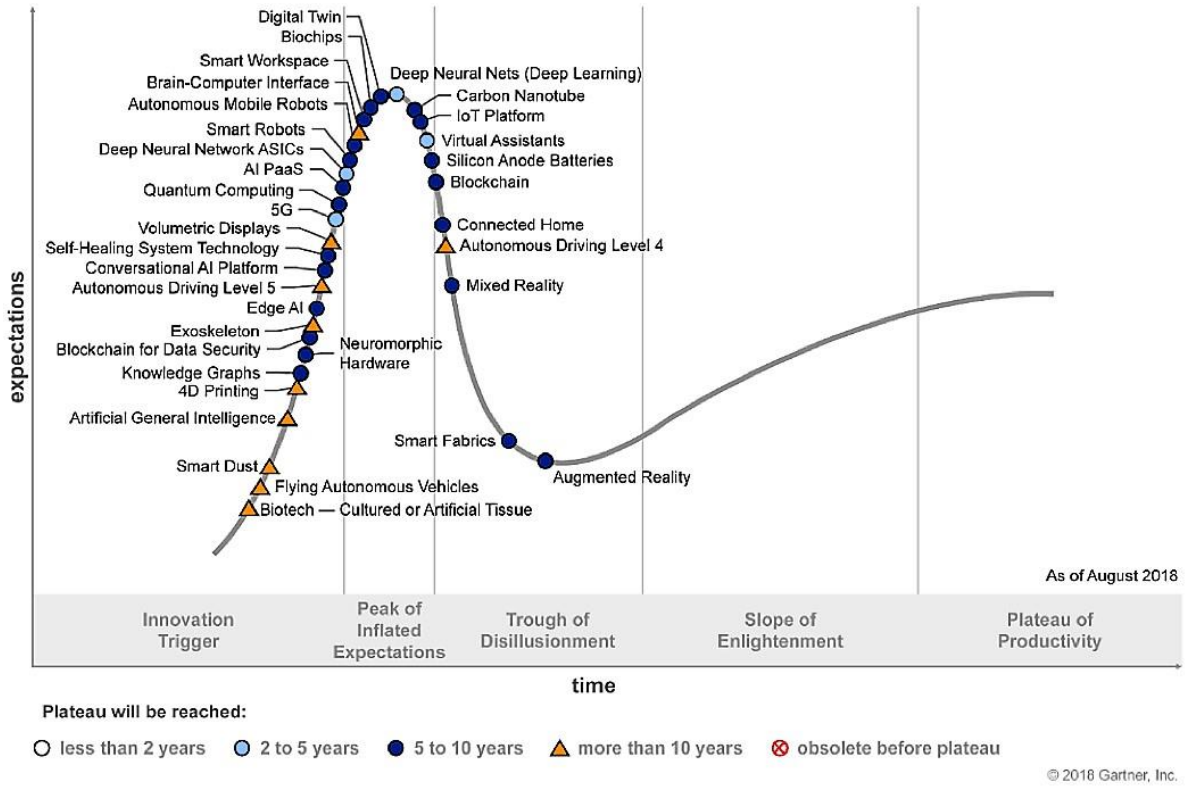
2. *Digitalised ecosystems: emerging technologies in general will require support from new technical foundations and more dynamic ecosystems, requiring new business strategies and a move to platform-based business models;*
3. *Do-It-Yourself biohacking: hacking biology and "extending" humans will increase in popularity and availability, ranging from simple diagnostics to neural implants and be subject to legal and societal questions about ethics and humanity;*
4. *Transparently immersive experiences: technology is increasingly human-centric, blurring the lines between people, businesses and things, and extending and enabling a smarter living, work and life experience; and*
5. *Ubiquitous infrastructure: The appearance and growing popularity of cloud computing and the always-on, always-available, limitless infrastructure environment have changed the infrastructure landscape. These technologies will enable a new future of business.*

A high-level breakdown of these technologies and applications mapped onto a timeline of maturity and adoption is shown in Chart 15.[93]

Amidst this jungle of technological jargon, it remains to be seen which if any of these trends and technologies will grow to fruition and be relevant to businesses.

The underlying conundrum in this discussion is dealing with change, emerging technologies and their impact on businesses.

Chart 15: Gartner's 2018 Hype Cycle for Emerging Technologies



Source: Gartner

[93] Ibid.

4 Growing cyber security threats

As businesses become more digitalised and connected through the internet, they will become more exposed to cyber security threats.

And cyber security threats continue to be a growing and evolving risk management issue for many businesses, with news about data breaches and ransomware attacks becoming more mainstream.

In light of growing public awareness and government scrutiny about data privacy and rights, it is important that businesses ensure that they are adequately meeting consumer and government expectations and level of trust.

4.1 Previous survey results

Ai Group's 2017 *Business Beyond Broadband* report surveyed businesses about their use of and investment in cyber security technology. At the time, we found that this was of relatively low priority for many businesses.

Our previous survey did not define the term "cyber security", though we can assume most businesses have access to basic cyber security protections such as off-the-shelf antivirus software or security features of standard operating systems. However, 78% of respondents reported that they did not use cyber security technology and just 13% saw cyber security as a barrier to new digital investments. This appeared to be in stark contrast to trends overseas.

Our report emphasised the need for businesses to increase their cyber security skills, capabilities and investment as a matter of urgency. This could entail elevating cyber security as a risk management issue for the boardroom and having proper cyber security management systems in place, including staff training, governance and technology.

We also identified areas in which businesses could benefit from Government and business support in increasing their cyber security skills and capabilities, and welcomed working with Government and businesses to raise business awareness and facilitate business access to appropriate experts and existing initiatives for cyber security.

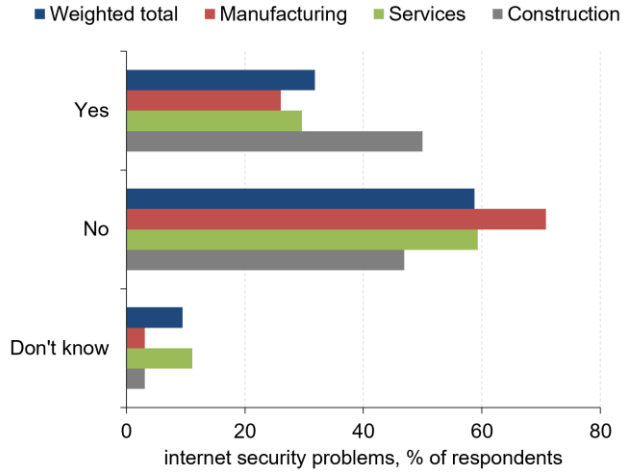
4.2 Latest survey results

In Ai Group's *CEO Survey of Business Prospects 2019*, we delved deeper into business experiences with cyber security incidents and measures.

4.2.1 Cyber security incidents

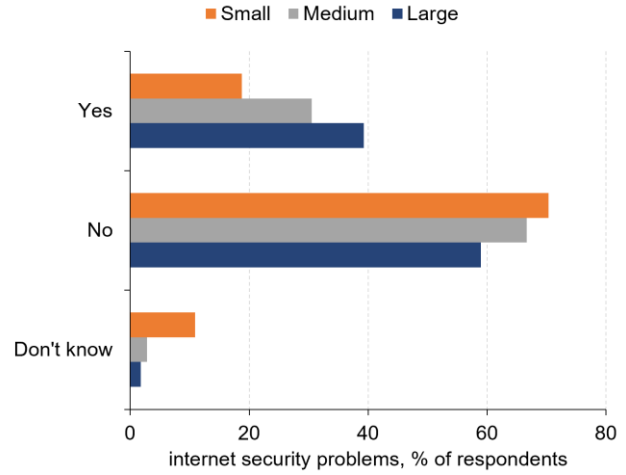
Our survey asked businesses whether they experienced any cyber security incidents in 2018. Charts 16 and 17 summarise these survey responses.

Chart 16: Businesses experiencing cyber security incidents in 2018 (proportion (%), by sector)



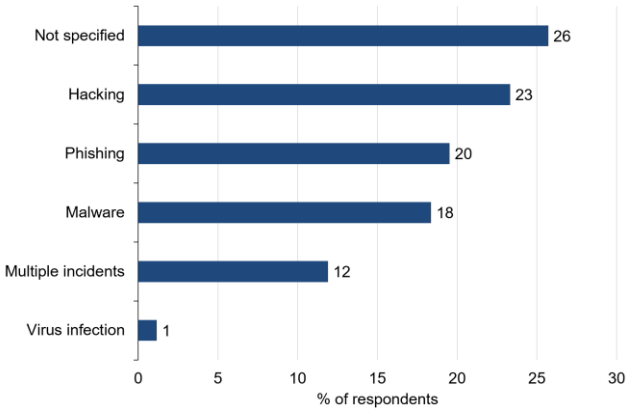
Source: Ai Group

Chart 17: Businesses experiencing cyber security incidents in 2018 (proportion (%), by business size)



Source: Ai Group

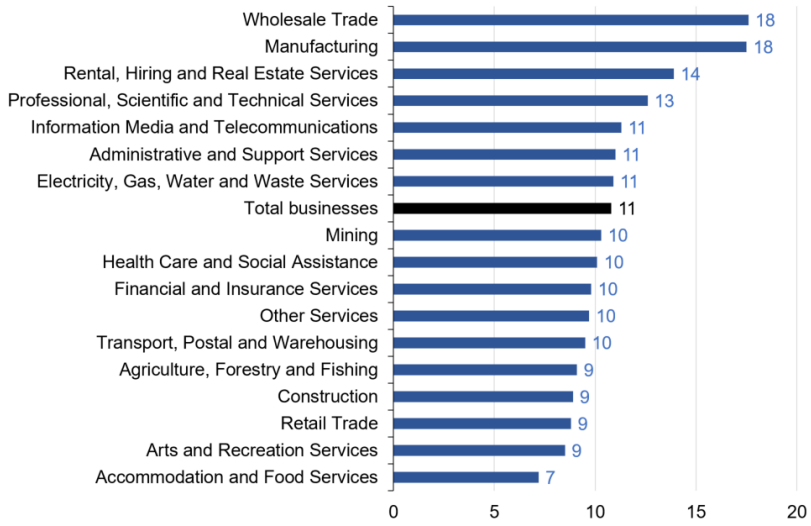
Chart 18: Types of cyber security incidents for businesses in 2018



Source: Ai Group

32% of businesses reported that they experienced a cyber

Chart 19: Businesses experiencing cyber security incidents in 2017-18 (proportion (%), by sector)



Source: ABS

security incident of some kind. This was a relatively high number, highlighting that businesses in Australia were susceptible to such incidents and were not isolated from an increasingly connected world. And given that there may be undetected incidents that are unknown and therefore not reported, the numbers could be higher.

Construction businesses reported a higher level of cyber security incidents, although manufacturing and services sectors were not immune either. Similarly, larger businesses reported a higher number of incidents than smaller businesses, though smaller businesses still reported incidents.

The survey respondents that experienced a cyber security incident were also asked to elaborate further about their experience.

As can be seen in the Chart 18, the top three most common incidents arose from hacking,[94] phishing and malware. Compounded to this, some businesses experienced multiple incidents including virus infections, hacking, malware, phishing, and denial of service.

By way of contrast, the ABS reported that 11% of businesses that it surveyed had experienced a cyber security incident in 2017-18, while 18% did not know.[95] A higher proportion of large businesses reported incidents (19%), followed by medium (17%), small (13%) and micro (9%). Compared to other sectors, wholesale trade and manufacturing reported higher incidents (18%) (see Chart 19).

Considering this in the global context, the top five most frequently cyber attacked industries around the globe in 2018 were (ranked by IBM in order from highest to lowest): finance and insurance; transportation; professional services; retail; and manufacturing.[96]

Notably, professional services and manufacturing also appeared in the ABS's top five industries that reported cyber security incidents.

According to a report by the Australian Cyber Security Centre (ACSC) in 2017, there was an 11% increase of reported incidents from sectors that were not traditionally targeted, including in accommodation, automotive and hospitality.[97] The ACSC suggested that the primary motivations for perpetrators in Australia included theft of intellectual property and other commercially sensitive information, and direct financial gain.

A 2019 cyber security report by Telstra also found the following:

- *89% of Australian businesses estimate that breaches went undetected – up 12% since 2018.*
- *65% of Australian businesses interrupted by a breach – up 5% since 2018.*
- *55% of Australian businesses said they received fines for being in breach of legislation enacted in the past two years.*[98]
- *48% of Australian businesses experienced a security*

[94] Note: "Hacking" was not defined by the respondents so could possibly fall under other types of cyber security incident categories.

[95] ABS, above n 9.

[96] IBM, "IBM X-Force Threat Intelligence Index 2019" (Report, February 2019), p. 16.

[97] ACSC, "2017 Threat Report" (Report, October 2017), pp. 55-56.

[98] According to Telstra's report: "While these are perhaps some of the most well-known regulations that have come into effect, there are many others coming into law across APAC, Europe and the United States (US). Some of the new regulations are sector specific, such as for the banking, energy, health care, and government sectors, which are highly regulated in most markets. There is evidence that the GDPR is getting the attention of other regulators looking at putting similar measures in place that protect individual privacy rights." See Telstra's Security Report 2019 (April 2019), p. 31.

Table 9: Impact of cyber security incidents for businesses in 2017-18 (proportion (%), by business size)

Factor	Employment size				Total
	Micro	Small	Medium	Large	
	0–4 persons	5–19 persons	20–199 persons	200+ persons	
Corruption of hardware or software	35.3	41.1	38.1	23.8	37.7
Corruption or loss of data	27.3	33	21.3	27.7*	28.7
Downtime of service	48.9	54.9	55.9*	54.5*	52
Website defacement	6	5.2	5.6	2.3	5.6
Theft of business, confidential or proprietary information	6	10	6.3	4.1	7.5
Loss of income	14.5	11.1	9.4	8.5	12.5
Loss of staff productivity	26.7	36.3	45.1	50.5*	32.7
Other impacts	1.6	3.7	6.3	6.5	3
None	17.1	15.9	14.3	18.2	16.3

*Note: Factors are shaded depending on prevalence of factor within each employment size subset. 'None' are not included in the shading. * This table includes an estimate that has a relative standard error of 10% to less than 25% and should be used with caution.*
Source: ABS

attack in the past 12 months.[99]

Of the businesses in the ABS survey that experienced a cyber security incident, the impact which affected most was downtime of service (52%) (see Table 9).[100] This was followed by corruption of hardware or software (38%), loss of staff productivity (33%), and corruption or loss of data (29%). These were common major impacts across different business sizes.[101]

Business email compromise

Business email compromise (BEC) is reportedly becoming more common.

Under the category of phishing, a number of businesses reported that their email was hijacked by a fraudulent party, whereby the scammer inserted themselves into correspondence around payments or transactions and fraudulently represented themselves as a legitimate supplier or decision maker within the organisation.

Unfortunately, in one case, a small manufacturer reported that they lost a significant amount for a business of their size.

Over the last several years, we have heard anecdotes from other SMEs who have lost even more significant amounts of money through more sophisticated and targeted cyber attacks arising from BECs.

While some types of phishing are random, BEC tends to be more targeted because it requires the fraudulent party to make some effort including researching known decision makers within the organisation either at a high level (a practice labelled as "whaling") or other individuals in the organisation (known as "spear-phishing"). Often, compromised businesses are not necessarily large, which highlights another important fact: cyber criminals target smaller businesses as well as larger ones, and the cost impact of such an incident is relatively significant for smaller businesses.

Ransomware

Over the last several years, ransomware attacks such as WannaCry and NotPetya have gained mainstream attention.

Under the category of malware, ten businesses stated that they experienced some form of ransomware attack with some being locked out from their own data. Other types of reported malware included malicious software infecting websites, and virus attachments in emails.

Spam attacks

While often understood to be unsolicited email received in bulk (e.g. junk email), spam can be used for nefarious purposes such as spreading computer viruses, worms, trojans and other malicious activities such as phishing scams.

Responses to our survey about spam attacks may be interrelated with other incidents, although it was unclear

[99] Telstra, "Cyber security remains a top business priority as the estimated number of undetected security breaches grows" (Media release, April 2019). Further information can be found in Telstra's Security Report 2019 (April 2019).

[100] ABS, above n 9.

[101] The ABS notes that some of the estimates have a relative standard error of 10% to less than 25% and should be used with caution.

as to the nature of the spam and therefore unspecified.

Hacking and virus infections

With respect to other types of incidents, a number of businesses indicated that they experienced hacking that targeted their servers or websites.

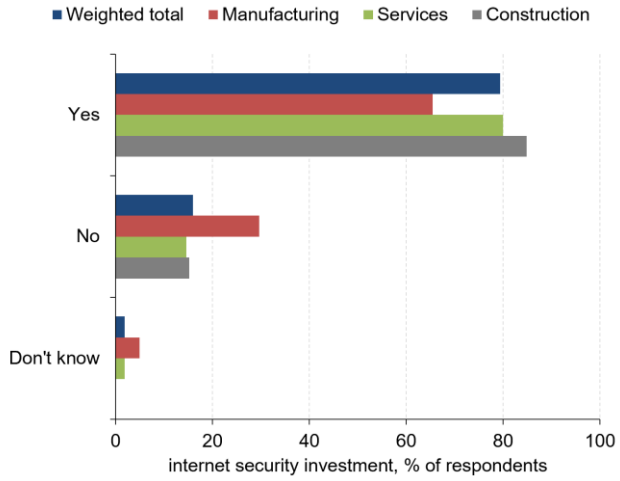
While relatively lower than other types of reported incidents, virus infections do still exist. Businesses need to be mindful of basic cyber security hygiene as well as alert to more advanced forms of attacks.

4.2.2 Business actions to cyber security incidents

The businesses surveyed by Ai Group that reported cyber security incidents were asked whether they took any action to resolve the problem (see Charts 20 and 21).

While a number of businesses indicated that they did respond to the reported cyber security incidents, there was a large proportion that did not specify what approach they took.

Chart 20: Business action to resolve cyber security incidents in 2018 (proportion (%), by sector)



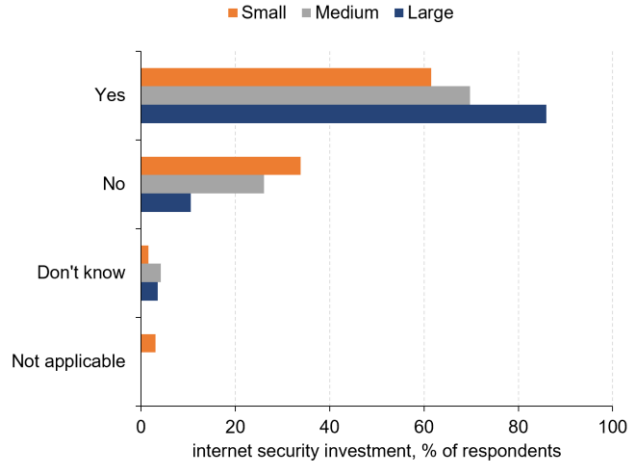
Source: Ai Group

Those that did specify a response had wide-ranging approaches, with a few taking several actions. Actions undertaken included implementing one or more of the following:

- Antivirus software
- Software upgrades
- Computer upgrades
- Firewalls
- Cyber security cloud platforms
- Changing software vendor
- Backups of the system or information
- Data integrity measures
- Multi-factor authentication
- Penetration testing
- Blocking websites
- Audit logging
- More sophisticated passwords
- Managed by IT service provider
- Reviewed internal process/systems
- Clean reinstall
- Deleted infected emails
- Restricted external user access
- Increased email screening
- Education/training of users

Each response varied according to the incident that occurred and the choices taken by the impacted business to help resolve the issue. Some of the responses were not ideal and could be deeply disruptive, especially those that involved clean reinstalls and other actions that would take a business offline for a period of time.

Chart 21: Business action to resolve cyber security incidents in 2018 (proportion (%), by business size)



Source: Ai Group

With the benefit of hindsight, some of the responses could have mitigated the impact of these incidents if businesses had measures in place prior to the incident. On the other hand, some might not have been avoidable in consideration of the business's circumstances, such as risk profile and budget to invest in more advanced solutions.

Ransoms

As noted above, a number of businesses reported ransomware attacks, where businesses were locked out from accessing their own data, leading to loss of data and restoration from backups. While it would seem sensible that businesses do not pay ransom, at least one respondent paid a ransom in bitcoin.

Unfortunately, this is not an isolated case and these stories are being reported more frequently. This highlights why critical information needs to be protected. In the event that such important data is locked out for ransom, some businesses are desperate enough to regain access that they feel they have no alternative but to pay the ransom.

Experts point out that there is no guarantee that the ransom once paid will give the owner access back to their locked information. It is giving money to an untrustworthy stranger who has acted nefariously with the expectation that they will behave in a trustworthy manner. Furthermore, paying for ransom encourages more crime.

It is therefore generally inadvisable to pay ransomware, though easy to understand why some businesses do. To avoid being in a situation where paying is perceived as essential to regain access, businesses should regularly back up their critical data and securely store it as a minimum standard.

IT vs Boardroom responsibility

Cyber security has often been treated as a narrow IT issue. Some of our survey responses suggested this issue continues to be pigeon holed into that area by delegating responsibility to either the internal IT department or outsourced IT service provider.

From a corporate risk management perspective, a breach can devastate a company's brand and reputation. As shown in our survey, breaches can also have enormous and costly impacts by disrupting or shutting down operations, or putting commercially sensitive information at risk. Once a company's security has been breached, repairing the trust between the business and its customers can be very difficult, if not impossible.

The need continues for cyber security to be elevated beyond the IT manager and moved into the boardroom as a major risk management issue. These threats are real, changing and evolving over time, and increasing in frequency and intensity. Businesses pursuing opportunities online will need to stay informed, learn from the lessons of their peers and take appropriate steps to manage these risks.

Government assistance

In our survey, a very small number of businesses indicated that they sought government assistance in 2018 (6%).

The limited assistance included: access to guides; government website to assist with cyber risk planning; advice on upgrading password strength; advice on regulatory reporting around payroll and superannuation; and subscribing to CERT, Joint Cyber Security Committee and Government Security Advisory Body.

Reasons for this low rate of engagement with the government is unclear. While we did not ask businesses why they did not seek government assistance, there could be possible factors that might require further exploration such as whether: there was limited awareness about the government's role in such incidents; and other non-government organisations were seen to be already serving a similar function.

Nevertheless, governments do play an important role. Existing initiatives such as AustCyber and the ACSC are positive, and should receive ongoing support. However, more can be done by governments to assist.

As mentioned above, we have heard anecdotally from SMEs about their experiences with Business Email Compromises. These incidents are becoming more frequent, partly enabled – ironically – by advances in technology, leading to innovative criminal business models like Ransomware-As-A-Service and use of cryptocurrency to enable payment to hackers. It has also been argued that cyber criminals are more responsive than enforcement bodies, who have limited resources to address these threats.

To highlight the scale of the issue, experts have suggested that global cyber crime is now more lucrative than the narcotics trade. [102] Unfortunately, law enforcement resources for tackling cyber security are significantly less than those directed against narcotics.

Given the rapidly evolving state of cyber threats and attacks, it is essential that our law enforcement bodies are sufficiently resourced, not only for protecting our national security, but also to protect business and the community against global cyber crime.

4.2.3 Investment in cyber security measures

Of businesses surveyed by Ai Group, 79% indicated that they invested in cyber security measures in 2018.

It was not surprising that most businesses that experienced cyber security incidents also invested in measures.

Of those that did not experience an incident (or were unsure), 61% indicated that they proactively invested in measures.[103]

A breakdown of the types of responses are shown in Chart 22.

The response in our latest survey showed a stark contrast to the 78% of respondents in our previous survey who reported that they did not use cyber security technology, and only 13% saw cyber security as an inhibiting factor.

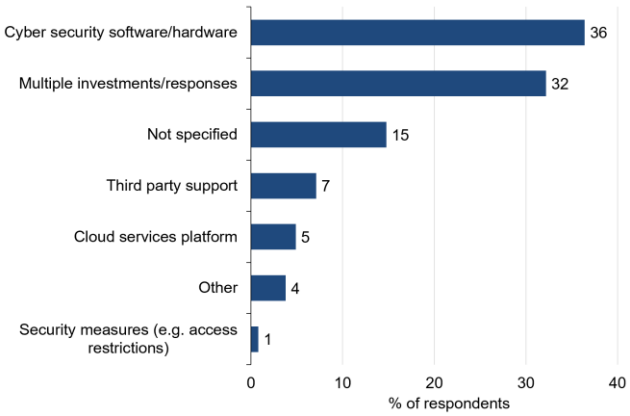
While our latest survey did not explore other drivers for

[102] Cybersecurity Ventures, "2017 Cybercrime Report" (Report, November 2017), p. 3.

[103] This proportion of responses was unweighted and therefore included more manufacturing responses than other sectors.

cyber security investment, the higher proportion of businesses proactively investing in cyber security (especially proactively) compared to our previous survey suggested a dramatic shift in business attitudes.

Chart 22: Business investment in cyber security measures in 2018



Note: "Other" includes penetration testing, employing new staff, IT responsibility, cyber insurance and updating website
Source: Ai Group

This may possibly be due to increasing awareness about cyber management hygiene, and compliance with new privacy and data breach legislations such as the Australian Notifiable Data Breaches (NDB) Scheme which commenced in February 2018 and European Union General Data Protection Regulation (EU GDPR) which commenced in May 2018. The NDB is discussed further in the next section.

Separately, the ABS asked businesses about the importance of cyber security technology in 2017-18 (see Chart 23).[104]

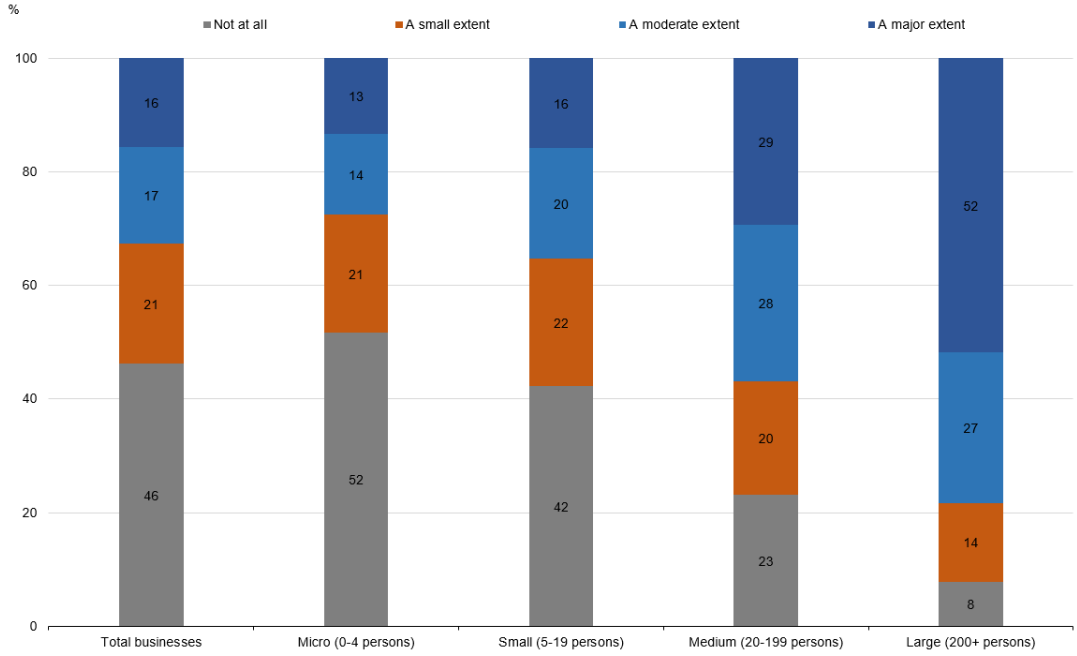
The ABS data was less optimistic than Ai Group's findings.[105] A high proportion of businesses (46%) did not see any value at all, closely aligned with micro and small businesses (52% and 42%, respectively), compared to medium (23%) and large (8%) businesses. The accommodation and food services sector valued cyber security the least (no importance at 59%).

Conversely, large businesses valued cyber security technology the most (major value at 52%), as well as the financial and insurance services sector (29%).[106]

Despite these differences, there was still a proportion of businesses that did not invest or value the importance of cyber security technology or other measure.

Akin to safety, cyber security is an ongoing risk management consideration for any business. Lack of business investment suggests that either more work could be done to improve cyber security posture, or that some businesses feel they already have adequate levels of protection.

Chart 23: Extent of business importance of cyber security technology in 2017-18 (proportion (%), by business size)



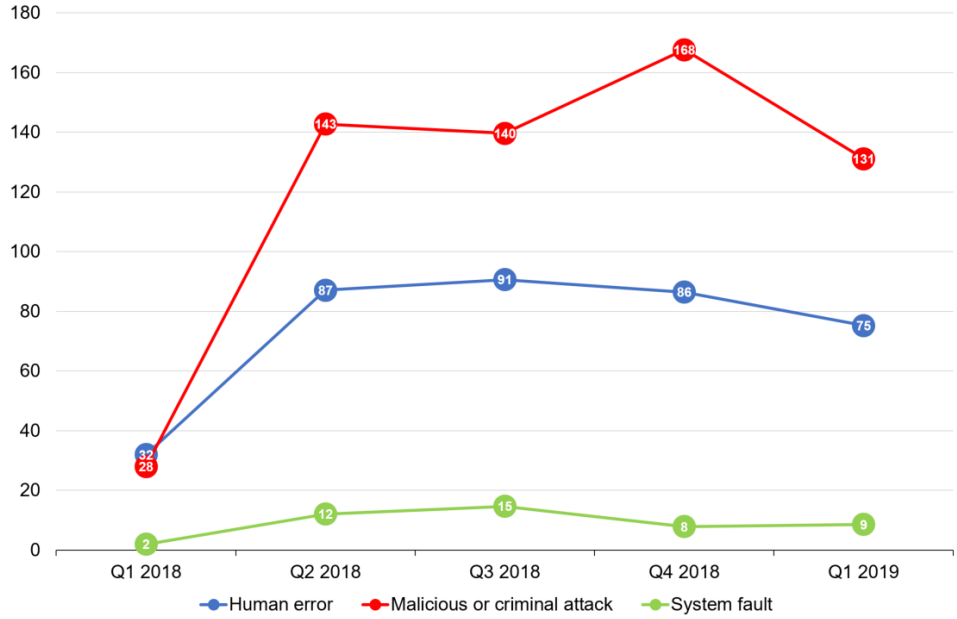
Source: ABS

[104] ABS, above n 9.
[105] Ibid.
[106] Ibid.

4.3 Data breaches

The Australian NDB Scheme commenced in February 2018. Chart 24 shows the number of data breaches reported to the Office of the Australian Information Commissioner (OAIC) since the commencement of the NDB Scheme.

Chart 24: Notifiable data breaches since NDB Scheme commenced (by breach category)



Source: OAIC

By the end of March 2019, there were over 1,000 data breaches reported to the OAIC since the NDB Scheme commenced.[107] Over this period, malicious or criminal attacks greatly contributed to these data breaches (59%), followed by human error (36%). System faults (4%) were rarely a factor.

"89% of Australian businesses estimate that breaches went undetected"
– Telstra (2019)

Delving deeper into the data, the OAIC provided a breakdown of the types of cyber security incidents that gave rise to data breaches from the period of 1 April 2018 to 31 March 2019 (see Chart 25).[108] For the same period, the OAIC also categorised the type of human errors and system faults that resulted in data breaches (see Chart 26).[109]

These causes for data breaches point to the need for cyber security hygiene within organisations, as well as more general improvements in internal management of personal data to minimise human errors.

According to Telstra, human errors were "often caused by inadequate business processes and employees not understanding their organisation's security policies".[110]

Of the breaches reported to the OAIC since the NDB Scheme commenced, industries that have regularly appeared included: health service providers (22%); finance (14%), professional services (legal, accounting and management) (11%); and education (8%) (see Chart 27).[111] Given how much personal data are handled in these respective industries, this should be no surprise. Of greater concern was that these sectors service other industries so others were not immune.

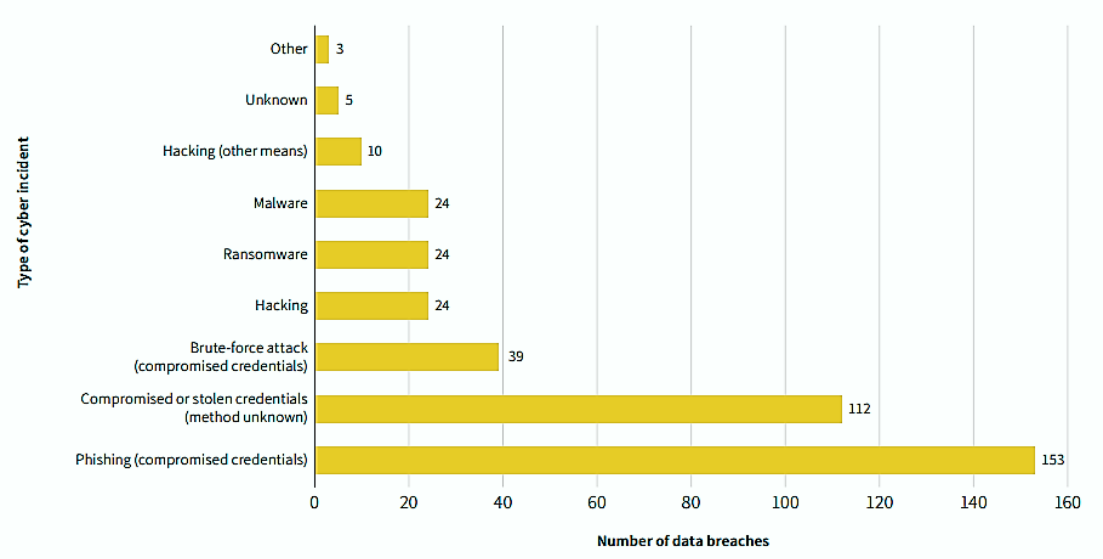
The fact that there was a steady rate of data breaches being reported from a diverse range of industries highlight the need for additional government support.

While not raised in our survey, we have also received anecdotal feedback from businesses, especially SMEs, about the costs arising from new legislations such as the NDB Scheme. Other data and privacy legislations such as the EU GDPR and Consumer Data Right (which is being developed for specific sectors), as well as the controversial Australian *Assistance and Access Act 2018* (Cth) (also known as the Encryption or Anti-Encryption Act), also present an additional regulatory burden and challenge for a range of businesses. Government support for businesses to meet these obligations may be required.

In this regard, a policy or regulatory response is only

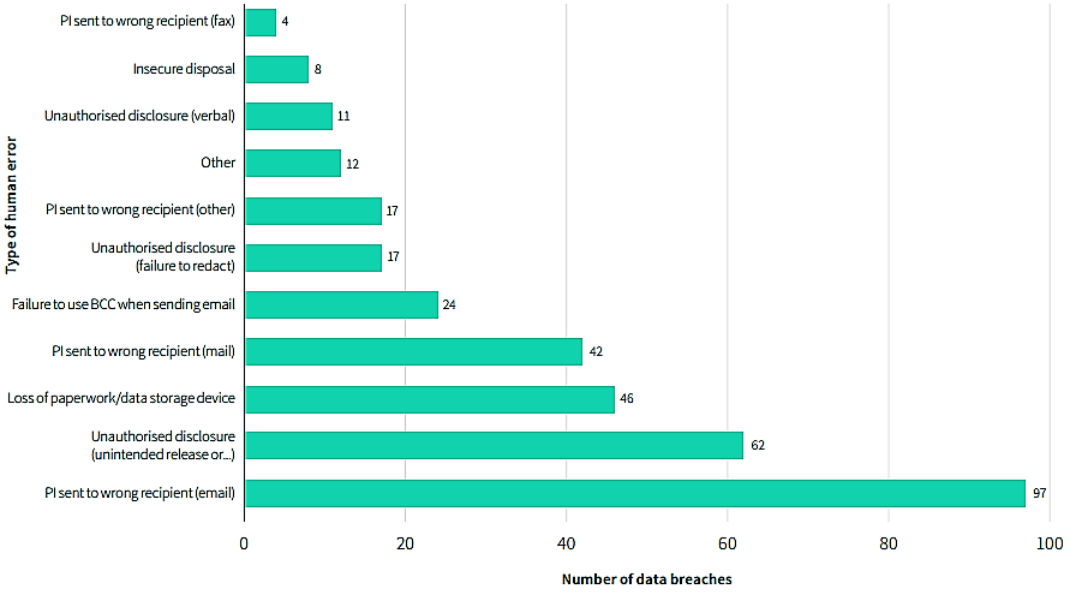
[107] OAIC, Notifiable Data Breaches Quarterly Statistics Reports (January 2018 – March 2018, 1 April – 30 June 2018, 1 July – 30 September 2018, 1 October – 31 December 2018, 1 January 2019 – 31 March 2019).
[108] OAIC, "Notifiable Data Breaches Scheme 12-month Insights Report" (Report, May 2019), p. 10.
[109] Ibid, p. 12.
[110] Telstra, "Breach expectation: the new mindset for cyber security success" (Article on Telstra website, April 2019).
[111] OAIC, above n 107.

Chart 25: Notifiable data breaches caused by cyber security incidents, 1 April 2018 – 31 March 2019



Source: OAIC

Chart 26: Notifiable data breaches caused by human error and system faults, 1 April 2018 – 31 March 2019



Source: OAIC

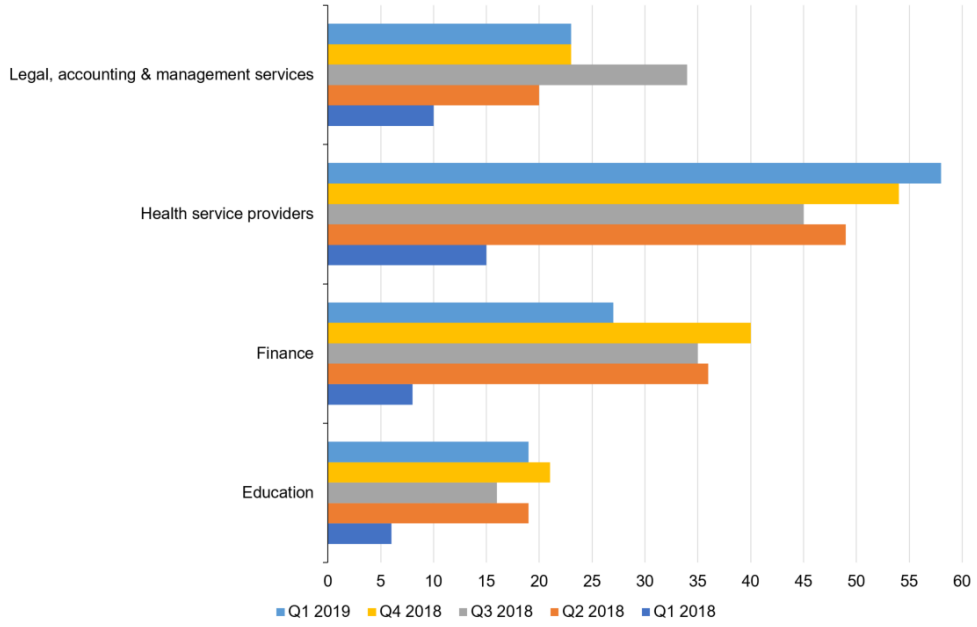
effective if it properly identifies and targets the problem that it is trying to address. Automatically reaching for penalties may not be the most effective solution, and potentially creates a compliance-only mindset. In other forms of regulation such as safety, business and government have evolved over decades from pure compliance and concerns about over-regulation to a culture of risk management. The public policy issues around cyber security and data privacy are covered in the next chapter.

As noted earlier, bodies such as the ACSC should be commended for working closely with organisations affected by data breaches. However, as the ACSC has noted, this is help after the fact.[112]

Given that a large proportion of data breaches under the

[112] OAIC, above n 108, p. 19.

Chart 27: Notifiable data breaches since NDB Scheme commenced (proportion (%), by top sectors)



Source: OAIC

NDB Scheme were triggered by malicious or criminal attacks, or human error, it is important to tackle these causes and prevent breaches occurring in the first place.

For instance, while the OAIC suggested that awareness of the NDB Scheme appeared to be high, there remains a potential gap in awareness about mitigating data breaches, as well as responding to them effectively if they do arise.[113]

On this note, the OAIC included some case studies and five best practice NDB tips for entities in its report *Notifiable Data Breaches Scheme 12-month Insights*.

Ai Group is making continued efforts to improve business awareness about the laws and mitigating data breaches. We would welcome the opportunity to work closely with government and key stakeholders to elevate business awareness with useful information such as from the OAIC.

[113] Ibid.

5 Public policy priorities

In 2015, Ai Group set out key priority areas for private and government action to seize the opportunities of a digitally enabled economy. Those priorities remain relevant.

Nevertheless, discussions around take up and engagement in digitalisation are maturing as businesses transition to and within the Fourth Industrial Revolution. There is also an ongoing conversation in public policy about the role of government, regulators and other institutions in response to these changes, as well as the broader community impacts.

This section provides a review of the public policy priorities for businesses in transition, identifying the following areas that require private and government attention:

1. **Cyber secure, resilient and trusted businesses**
2. **Business and technology investment**
3. **Innovation ecosystem**
4. **Legal and regulatory framework**
5. **Standards**
6. **Sustainability**
7. **Trade**
8. **Workforce skills**
9. **Workplace relations**

5.1 Introduction

Australian businesses are diverse, strong and poised to pursue new opportunities through digitalisation, innovation, increased participation in global markets and supply chains, as well as responses to the challenges of reducing carbon emissions and waste reduction. At the same time, there is a clear role for public policy in developing our businesses – particularly our small and medium-sized businesses; whether in new or traditional sectors, they can be equipped to broaden their horizons and enhance their competitiveness.

Ai Group maintains that Australian business policy should have a positive, 21st century orientation. It should work, together with policy in education and training, to support a confident, dynamic and resilient private sector that not only builds on existing competitive advantages but is equipped to meet both the challenges and the opportunities presented by the transformational forces of globalisation, technological development and environmental protection.

5.2 Cyber secure, resilient and trusted businesses

Strong cyber secure and resilient businesses are central to customer trust. This includes protecting data privacy, competitiveness, the strength of our economy and the reliability of our infrastructure. While in many ways diverse, business sectors have a common and collective interest to be cyber secure. It is a critical time for improved collaboration between governments and businesses.

Cyber security threats are a continually evolving risk management issue for business. As we become more digitalised and connected through the internet, businesses will become more exposed to cyber security threats.

Once a company's security has been breached, repairing the relationship and trust between the business and its customers can be very difficult.

The revised National Cyber Security Strategy released in April 2016 set an overarching framework which included the establishment and allocation of resources for a number of key government responsibilities.

In 2018, we saw the commencement of the Australian Notifiable Data Breaches (NDB) Scheme and European Union General Data Protection Regulation (EU GDPR), and forthcoming Australian Consumer Data Right. While these may be well intentioned, they may only promote a compliance culture, as opposed to a proper proactive leadership and risk management culture. Data privacy legislations still raise unanswered questions as to how integrity and privacy measures can be put in place to mitigate data breaches from occurring in the first instance.

As mentioned earlier, while the Office of the Australian Information Commissioner (OAIC) suggests that awareness of the NDB Scheme appears to be high, there remains a potential gap in awareness about mitigating data breaches, as well as responding to them effectively if they do arise.[114] Ai Group is making continued efforts to improve business awareness about the laws and mitigating data breaches. We would welcome the opportunity to work closely with government and key stakeholders to elevate business awareness with useful information such as from the OAIC.

[114] Ibid.

It is critical that there is better collaboration between government and businesses to tackle cyber security in a safe environment where businesses can share threat information without being punished. Collaboration also helps build an innovative businesses.

Cyber crime is a global issue, requiring governments to work together more frequently – while managing their different values and approaches to issues like privacy and national security. We were therefore pleased to see global issues like digital trade and cyber crime, with an emphasis on partnerships, included as priorities in the Federal Government's 2017 International Cyber Engagement Strategy.

Despite business calls for improved collaboration in line with the spirit of the 2016 revised National Cyber Security Strategy, there are growing business and broader community concerns with recent Federal Government knee-jerk policy responses under the catch-all umbrella of national security.

The rushed development and passage in late 2018 of the *Assistance and Access Act 2018* (Cth) (also known as the Encryption or Anti-Encryption Act), despite widespread business and community objections, poses serious risks to Australians' cyber security and the reputation of Australian businesses that sell digitally-enabled products and services. Substantial amendments are needed as soon as possible to clarify the Act and limit its impact in the areas of greatest risk.

In addition to outstanding amendments required to the Anti-Encryption Act, the Federal Government separately rushed and passed the *Sharing of Abhorrent Violent Material Amendment Act 2019* (also known as the AVM Act) through the Parliament in April this year. The community expects protection against extremist violence and discretion from all media in dealing with imagery of that violence. However, the legislation can be improved upon to better address community concerns, without unnecessarily impinging on fundamental existing rights and freedoms, and other unintended consequences.

Evolving and growing cyber threats and their impact on businesses and the community are an ongoing concern. Existing initiatives such as AustCyber and the Australian Cyber Security Centre (ACSC) are positive, but contentious issues including the recent Anti-Encryption Act and AVM Act mentioned above, as well as concerns about the security of public and private digital platforms, highlight the need to review the 2016 revised National Cyber Security Strategy with input from all affected stakeholders. This may also include consideration of a new Ministerial portfolio on cyber security that takes a holistic view, has full responsibility for managing cyber security policy and can operate across relevant departments.

5.3 Business and technology investment

Leadership in promoting investment in businesses, and enabling technology and infrastructure, can help boost the economy. While businesses have the leading role in driving growth in the Fourth Industrial Revolution, governments can also contribute by improving business confidence and helping to create the conditions for more decisive improvements in business competitiveness.

Government has a leadership role to set a vision for the nation, and ensure that public policy is conducive to digital investment and competition that benefits businesses and the community in the long term. Such leadership can encourage job creation and diversify our economy to ensure resilience in the face of volatile commodity export prices. It also has a role to alleviate business and individual fears of "Digital Darwinism", by preparing the community to prosper in an increasingly technology-driven era.

While digitalisation may benefit business innovation and productivity, there may be mixed social impacts such as a new division in wealth creation between the technically literate and illiterate. Governments have a role in minimising such negative impacts. For example, government can be a skills enabler through education and training in areas such as digital capability and cyber security.

New markets

In the early stages of Australia's entry into new technology sector markets such as artificial intelligence (AI), positive measures from government are critical. However, more can be done to make us globally competitive.

For example, if there is an aim to develop a new industry sector such as AI (as well as its application across other sectors) in Australia to ensure we remain competitive, then establishing a new Industry Growth Centre could be an option, if it meets the following criteria:

- Provides a net long term benefit to businesses and the community over the costs to establish and run it e.g. it leads to the creation of new local jobs, skills and talent.
- Offers funding and encourages investment to support the growth of the local Australian businesses to compete globally.
- Avoids duplication with other bodies and collaborates with relevant organisations to help achieve its objectives.

New infrastructure

A mix of communication infrastructure is critical to enable the growth of the economy towards the Fourth Industrial Revolution, including the nbn, non-nbn alternatives, 5G

mobile networks and a mix of other IoT communications networks. Some of these technologies are growing fast and accommodating them (through lower regulatory barriers and increased regulatory flexibility, for example) is challenging for slower-moving government and regulators.

While political visions of the nbn rollout and the future of NBN Co remain heavily contested, it is essential that decisions about matters like the connection technology mix, the value of the network or whether, when and how to privatise are taken on the basis of wide consultation and careful consideration. The needs of businesses that still lack fast or reliable broadband need to be met. The deployment of digital infrastructure needs continuing scrutiny against benchmarks including affordability, easing regional constraints, global competitiveness, meeting business demand and maximising business benefits.

Business capability

Organisations are grappling with transitioning in different ways and with different levels of readiness and capability. Areas where Government and public support could be of value to businesses, which in turn creates opportunities for the broader community, include:

- The Industry Capability Networks operating in each State are important resources and would benefit from a review to determine how to maximise their value through modernisation, integration with widely used digital platforms and other means.
- The former Industry Skills Fund, closed in 2016, should be replaced by a new program to bolster training and support services and foster the skills development that will support business competitiveness and growth.
- The bDigital service available to Entrepreneurs' Programme (EP) clients is valuable and should persist, but to improve capability beyond the scope of EP, the government should build on bDigital with a program targeted to larger numbers of SMEs to provide information on successful adoption by businesses of digital technologies as well as advice on options for investments in digital capabilities.
- At the federal level, the EP plays an important role in directly assisting business transformation in key sectors. The success of EP and predecessor program Enterprise Connect means that it should continue to scale up in line with business demand and economic opportunity.[115]
- EP has built up considerable recognition and it should retain its current branding. EP's sectoral coverage should stay broad, with construction remaining and energy expanded to cover cleantech. It would make sense to include businesses with prospects of successful transition to new fields, not just growth prospects within their current field.

5.4 Innovation ecosystem

Innovation is critical to improve outcomes for Australia's people, economy and environment, and it is essential to maintain and improve business competitiveness. We need to harness a wider range of capabilities through better collaboration between businesses, researchers and governments, and put this in service to a clear strategic agenda. Public policy support for innovation should be stable and informed by strategy, and should address all parts of the innovation system.

In our surveys of CEOs and leading innovators, we have found that Australian businesses are collaborating to innovate more frequently than is often recognised – but that we are still well behind most OECD countries on this front. And if we can lift our business innovation, the very strong prospect of further rapid income growth for the benefit of our broader community in our region is a huge opportunity for Australia.

The clearest path to better collaboration is for businesses to learn the practices of those who already collaborate well. As our research shows, these businesses make collaboration a process that is carefully considered and iterated for success.

Their practices include: clear-eyed awareness of their own strengths and weaknesses; careful selection of partners that complement their capabilities; shared development of a business vision for mutual benefit; and a commitment to learning from the experience of collaboration.

In addition to the role of business, governments can play a role by: improving the incentives for public sector research organisations to better collaborate with businesses to support development and uptake of new and emerging technologies; and maintaining stable support for innovation overall.

[115] Australian Government, Office of the Chief Scientist, "Business performance of Enterprise Connect participants" (Research Paper 1/2019, June 2019). This paper also found that firms that participated in both the Enterprise Connect program and the Research and Development Tax Incentive (R&DTI) program had stronger turnover growth than firms which only participated in the R&DTI program.

Regular discussion of the future of businesses by businesses, government and a wide array of stakeholders is essential to spur, inform and improve high quality business policy. For instance, the Industry 4.0 Advanced Manufacturing Forum (I4AMF), which is chaired by Ai Group, brings together stakeholders from industry, academia, unions and key institutions, and plays a valuable role in this discussion. The Government should continue to engage with the I4AMF through the Department of Industry, Innovation and Science.

But more work is needed. Government should:

- Not proceed with the previously proposed stepping of the Research and Development Tax Incentive (R&DTI) rate based on research intensity, which would amount to a substantial across-the-board reduction in support for innovation and not provide meaningful incentives. Improved data analytics to assess the novelty of R&DTI claims would be a better way to focus the program;
- Commit to much-needed stability for the R&DTI and maintain a strong envelope for innovation support overall, including Cooperative Research Centres, Industry Growth Centres and broader research funding; and
- Provide additional funding of Defence research and development and innovation programs to help boost the ADF's capability edge, including a review of the national security innovation system as a whole.

Lifting the frequency and quality of collaborative innovation between Australian businesses and our substantial capabilities in scientific research is essential to improve competitiveness and open new commercial opportunities. Government should:

- Continue and expand the Innovation Connections element of the Entrepreneurs' Programme (EP);
- Consider wider access beyond EP to incentives for employment of recent STEM PhD graduates in innovation roles;
- Not introduce a higher rate of R&DTI for collaboration until and unless the practical difficulties of assessing collaboration with sufficient rigour and minimal costs can be overcome;
- Promote case studies and best practices for collaboration to both business and researchers, including the benefits of cross-organisational teams and deeper "stage zero" collaboration that starts from problem analysis rather than contracting out solution delivery; and
- Assess the success of the Commonwealth's efforts to link public sector research funding to business collaboration and real-world impact, and refine the formulae and metrics if warranted, in consultation with businesses and the research community.

5.5 Legal and regulatory framework

Australia's legal and regulatory framework needs to be sufficiently flexible to accommodate rapid changes in technologies that lead to new types of business models and competition, maximising the benefits that flow from that, while also protecting broader community interests.

From digitalisation to decarbonisation, major waves of change bring novel and transitional challenges along with the opportunity to increase shared national prosperity. New and emerging technologies such as AI, augmented reality, drones and robotics can benefit business and the community through improved services, higher productivity and greater quality of life. But they can also present challenges to traditional ways of doing things, along with more concentrated costs. This raises government and public demands to manage or even halt change, such as through heavy regulation or bans.

Thoughtful strategy and credible policy responses from governments and regulators are important to plan for and respond to economic and technological change in ways that will meet community expectations. Making the most of new technologies requires room to experiment and learn, particularly where the technologies involved have the potential to be low-cost and widely distributed, like additive manufacturing, encrypted communications and CRISPR gene editing.

As mentioned above, Australia's entry into new technology sector markets requires positive measures from Government. However, more can be done to make us globally competitive. Regulation can boost or break the growth of an early stage industry sector. The extent to which new technologies like AI are regulated can act as an investment barrier and diminish our attractiveness relative to other jurisdictions.

Highly reactive or overly change-averse responses risk curtailing innovation, reducing competitiveness and limiting the benefits of developments like digitalisation. A policy and regulatory vacuum is likely to provoke subsequent hasty overreaction to any problems that emerge. Regulation has a role in addressing reasonable public concerns, for instance around security, safety, privacy and the environment. But there are also often alternative approaches to the regulatory "stick", including consultation and dialogue, codes of practice, transitional support and education. Where regulatory measures are warranted they still require careful development.

Government should proactively:

- Consult about major technological and economic

changes;

- Consider the full range of options for response;
- Adopt regulatory responses only where they are proportionate and likely to provide net community benefits; and
- Develop any regulatory response in full consultation with affected stakeholders.

More generally, Government should reinvigorate best practice regulation initiatives, and study global best practices in regulation and business support that encourage – rather than inhibit – innovation and productivity.

5.6 Standards

Standards are fundamental to promoting digitalisation because they can promote an ecosystem for technological innovation, competition, international trade and interoperability. Standards, when called up by regulation, offer a mechanism to quickly respond to changing markets.

Much global standards work seeks to address broad systems approaches to significant challenges, including smart factories, smart grids, smart cities, IoT, AI and other related topics. These challenges require a new level of coordination and effort, and development of new ways to exchange knowledge between the public and private sectors, academia, standards and conformity institutions.

While collaborative efforts have been made by organisations such as between the German Plattform Industrie 4.0 group and the Industrial Internet Consortium to set global standards for IoT, other issues relating to IoT standards remain unresolved. In the absence of international consensus (made more difficult by a continually evolving technology landscape), there is a risk of fragmentation and diverging standards in IoT.

For example, Australia needs a roadmap for considering and adopting home and building automation standards. There are many communications protocols in the international market. Simply selecting one protocol and elevating it as an Australian Standard without adequate consideration may have unintended consequences such as a reduction in competition, especially as Australian standards are given greater weight under the Commonwealth Procurement Rules.

More generally, it is vital that Australian businesses and consumers have support and access to all international fora involved in standards development (particularly the International Electrotechnical Commission (IEC)) to ensure our national interests are preserved. This will allow for effective contribution to standards development at an ideal stage in which products and services are still under development. Australia is generally known to play a strong role in standards development. Accelerating technological change makes this role even more important to facilitate fast adoption of new technology and realisation of its benefits.

More generally, Australia should strive for a more judicious and effective mix of standards and regulation in lifting public safety, consumer confidence and business performance.

There is considerable potential for the more effective use of consensus-developed standards in addressing a range of economic and social opportunities and challenges. In some cases, standards can work alongside formal regulatory approaches (such as when standards are called up in regulatory instruments) and at other times as a lower-cost substitute for formal regulation.

There has been a tendency for government to move away from the use of Australian standards. While international consistency and efficiency have clear value, international standards development processes may be unduly influenced by particular interests without adequate opportunities for Australian input reflecting domestic expertise, local conditions and needs. The Australian Government should continue to help fund Australian involvement in international standards development and it should ensure that an Australian filter is applied before the adoption of international standards in Australia.

There is also a disturbing tendency for Australian government agencies to forego the well-regarded model of the transparent, consensus approach to the development of standards in favour of rules and regulations developed by the agencies themselves, including with respect to product energy efficiency. Government agencies typically do not have the technical expertise, the practical experience or the proficiency in effective and structured consultation with businesses and others in the community. The result is often sub-standard, and government should be more willing to back and expedite the use of the more transparent consensus driven standards development model.

5.7 Sustainability

Climate policy presents a particularly important business transition challenge, creating both economic opportunities for new products and industries, as well as vulnerabilities where existing industries may experience a challenging transition or risk exit. At the same time, waste reduction, materials efficiency and the circular economy present important opportunities over the long term.

Global efforts to combat climate change will ultimately require greenhouse gas emissions to reach net zero or below in most countries, including Australia. This transition

will take decades and entail substantial changes in technology and practices across many sectors. This creates both economic opportunities for new products and industries, as well as vulnerabilities where existing industries may experience a challenging transition or risk exit.

Governments should develop and resource a strategy to seize the economic opportunities and manage the vulnerabilities. Bioproducts, carbon capture use and storage, electrification, hydrogen products, solar, wind, energy productivity and more offer opportunities for new industries and the successful transition of existing industries. Coordinated policies, supporting infrastructure, and commercialisation finance can support growth and manage the considerable uncertainties. Digitalisation of energy production, transport and use presents huge opportunity in a world of variable renewables, distributed energy, storage and demand response. Governments need to ensure that market rules, pricing structures, technical standards and infrastructure help realise this potential. Any climate policy should ensure that Government assistance arrangements for trade exposed industries achieve trade neutrality and support decisions on longer term investments by those industries to decarbonise.

Some activities are likely to contract over time, including coal-fired electricity generation. Industry closures have far reaching impacts, including on direct employees, on the supply chains in which impacted industries are embedded, and the communities and regions in which they are located. Ai Group strongly supports a fair and successful transition for these sectors. To that end, policy makers should work with representatives of industry, employees, States, local government and community organisations to develop effective and proactive responses to anticipated closures or transitions of existing emissions-intensive facilities.

Waste reduction, materials efficiency and the circular economy present important opportunities over the long term, while Australia also faces an ongoing crisis as our waste and recycling systems are roiled by the international clampdown on the contaminated plastics we previously exported for processing.

There are also opportunities to further build the circular economy case with developments in other initiatives such as smart cities and Industry 4.0.

Ambitious National Waste Policy targets for improved waste outcomes need to be supported by effective policies and investments, including:

- Support for innovation and commercialisation of technology options to close materials loops and utilise waste products, and improved technologies for automated waste sorting;
- A coordinated push to revise standards at all levels to encourage, rather than discourage, the use of recycled content which performs adequately;
- Improved education of the public to encourage better sorting and reduced contamination; and
- Adoption of effective and efficient measures to address waste-related externalities.

5.8 Trade

The democratising nature of the internet has reduced the barriers that previously excluded SMEs from global markets, exposing them to greater opportunities and risks. Public policy can play a key role to boost the prospects of the vast majority of Australian exporters.

In today's digitally enabled economy, more Australian businesses are transforming, and leveraging off a trusted network of global supply chains in order to maintain their competitive edge. It is essential that these businesses and their networks are strengthened and secure.

Unfortunately, our multilateral rules bodies have not kept up with the changes that digital technology has wrought on the international trade landscape, particularly when faced with protectionist barriers. Trade in the 21st century goes well beyond the cross-border flow of physical goods to include a large number of previously unforeseen services as well as goods that are digitally delivered. Transactions and business integrations are also being made possible through data flow. Trade rules must be developed to reflect this new reality.

Digital trade is also becoming common in international trade discussions. This includes issues around foreign governments restricting data flows across borders, forced localisation of servers and enforced sharing of programming and software with governments.

Due to the ubiquitous nature of data and digital tools used in Australian businesses, Ai Group is concerned about the increasingly protectionist measures that many foreign governments are introducing.

While global trade friction has grown, new trade agreements and the fuller use of existing agreements remain important to business growth.

Of the 51,992 Australian businesses directly exporting goods from their Australian base in 2016-17, 49% had fewer than 3 export transactions, 41% had between 3 and 50 export transactions and only 10% had more than 50

export transactions.[116]

The most problematic issue for Australian businesses wanting to export is identifying markets and customers. Despite the advances in electronic communication and availability of market information, understanding how to find customers is still a significant barrier for many companies, particularly SMEs, even if they are current exporters.

To improve the prospects of the vast majority of Australian exporters, Government should:

- Pursue new trade agreements where these are on balance in Australia's national interest;
- Advocate for pro-business digital trade policies that protect international data (information) flows, limit data localisation rules and promote good data stewardship;
- Promote both outbound Australian investment in other countries, and the inclusion of reasonable and appropriate provisions for investor-state dispute settlement in trade agreements;
- Maintain and expand the successful Export Market Development Grants program;
- Resource Austrade appropriately so it has the skills and resources to support Australian companies to access global value chains and to invest abroad, including by increasing the availability of one-on-one support for new and emerging exporters;
- Provide Austrade with increased funding to expand the existing TradeStart footprint – to ensure that SMEs are better supported to compete in international markets;
- Maintain an anti-dumping system that is fair to all parties and is stable, reliable and transparent; and
- Strive for a more judicious and effective mix of standards and regulation in lifting public safety, consumer confidence and business performance.

5.9 Workforce skills

Education and training play critical roles in the transitioning economy and the broader community, both in addressing workforce skill needs and improving social inclusion. The digitally enabled economy is leading to skill mismatches and shortages due to new tasks in existing jobs and to new jobs being created. While businesses and government are making efforts to close the gaps, a range of measures is required to sufficiently meet business needs.

Education and training plays a critical role in the economy and the broader community both in addressing workforce skill needs and improving social inclusion.

If Australians are to have access to challenging, high-paid jobs in high-productivity industries with greater social and economic opportunities, our education and training outcomes need to lift and be more closely aligned with the rapidly changing opportunities in the labour market.

Digitalisation is disrupting the skills that education and training systems strive to supply. It is leading to reallocations of employment between tasks, sectors and regions. It is shifting labour demand towards higher level, more cognitive skills for which many workers are not adequately trained – in critical enquiry, problem solving and communication – that can be coupled with technical capability to build a broader set of skills for application in different environments, including global environments.

These pressures are reflected in significant skills shortages, particularly for professionals, technician and trades workers with STEM capabilities. At the same time, almost all employers are currently impacted in some way by low levels of literacy and numeracy – a concern when foundational skills now include digital literacy.

Dynamic workplaces mean that continuing education and training needs to be provided to existing workers when required, in shorter forms, for quick adaptation to new skill demands. Workers more capable of undertaking productive and engaged roles are better able to contribute to innovation in the workplace.

Youth unemployment is a concern for Australia, highlighting the need to equip individuals with the right skills to enable them to fully participate in the workforce and to experience a richer range of opportunities.

Emerging needs are challenging our higher education and vocational education and training (VET) sectors. The VET system is suffering from a long-term decline in funding. Work-based learning models are suited to rapidly changing work environments and yet a number of sustained issues are dogging Australia's apprenticeship system. Higher apprenticeship models are required to deliver the higher skill levels increasingly needed by businesses. Higher education, as the important developer of advanced critical enquiry, requires stable policy settings, balanced performance-based funding measures, closer connections with business and flexible credentials.

[116] Ai Group, "Who are Australia's exporters?" (Economics Factsheet, June 2018).

Government must play a stronger role through:

- More regular skills forecasting to assist skills alignment between education and training outcomes and business needs. This should relate to specific skills in demand, rather than qualifications, for workers to be mobilised to perform tasks;
- Support for businesses to develop workforce plans around their digital strategies, assess existing workers' capabilities and train when necessary. Using an Industry Skills Fund model, this will assist in normalising cultures of continuous learning;
- Leadership on a strategy that addresses critical workforce STEM skills shortages through education and skills training and support to businesses, and funding for initiatives that enhance the VET sector's role in filling these gaps, such as Ai Group's Industry 4.0 Higher Apprenticeships;
- A national workforce language, literacy and numeracy (LLN) strategy in connection with businesses. It should incorporate digital literacy skills and include a new co-contribution program specifically for workplaces;
- A review of apprenticeship incentives to put greater priority on high-skill occupations that will play key roles in the digital economy. These include traditional trades that develop STEM skills, but also should include higher level technical qualifications that prepare people to work at the forefront of equipping businesses to digitalise;
- Support for work-based and work integrated learning models underpinned by closer partnerships between businesses and the education and training sector. Rapidly changing work environments and skills are best served by learning that is connected to and closely reflects workplace skill needs;
- Investment in the higher education and VET sectors to provide more flexible and shorter form education and training in a range of environments;
- Increased investment in programs that prepare students for work and the post compulsory years to combat Australia's youth unemployment rate; and
- Reform of the tertiary education sector to create greater coherence between VET and higher education. This goes beyond reforms being actioned from the Expert Review of Australia's VET System, to solve a number of issues identified in Ai Group's position paper, *Realising Potential: solving Australia's tertiary education challenge*.

5.10 Workplace relations

Flexible workplace relations arrangements are fundamental to the improved productivity that is so important to Australia's national competitiveness and our capacity to further improve Australian living standards, especially as industries transition to and within the Fourth Industrial Revolution.

Employers need the flexibility to employ the types of labour that they need, including full-time, part-time, casual, fixed term, independent contractors and labour hire. Employees also need flexibility. Many people prefer casual and part-time work and are not available or willing to work on a full-time basis. ABS statistics refute claims of the increasing casualisation of the Australian workforce, and show that the level of casual employment is the same today as it was 20 years ago – about 20% of the workforce.

Maintaining or imposing workplace relations barriers adversely impacts employers and employees. It is employees who are the worst affected when their employers decide to close plants, relocate, downsize or offshore because the operating environment in Australia imposes too many inflexibilities and other hurdles.

Priorities include:

- Defining the term "casual employee" in the *Fair Work Act 2009* (Cth) as, "an employee engaged and paid as a such". This is consistent with the industry practice and the very common definition in modern awards. This approach is also inherently fair. It is unfair for an employee who has been engaged as a casual and paid a casual loading, to claim annual leave and other entitlements of permanent employees.
- Making necessary changes to reinvigorate Australia's enterprise bargaining system, including amending the Better Off Overall Test in the *Fair Work Act 2009* (Cth) to ensure that it is applied to logical classes of employees and not individual employees. Preserving the role of common law tests in defining an "independent contractor" but with some amendment to the *Fair Work Act 2009* (Cth) so that persons who engage contractors can still provide benefits that do not risk contractors being classed as employees.
- Amending the *Fair Work Act 2009* (Cth) to ensure that modern awards do not become overly restrictive on employers. The Fair Work Commission's recent *Annualised Salaries Decision [2019] FWCFB 4368* imposes excessive record-keeping obligations on employers who provide annualised salary arrangements to employees covered by a large number of modern awards.

Appendix A – 2019 CEO Survey of Business Prospects 2019: Survey participants

Responses were received from the CEOs of 252 private-sector businesses across Australia in October and November 2018. Together, these businesses employed around 87,000 people (median number of employees was 51) and had an aggregate annual turnover of around $72 billion in 2018 (median turnover was $15 million).

All Australian states and all major non-farm private-sector industries are represented in this year's CEO survey. The manufacturing sector contributed the highest proportion of respondents (65%). Manufacturing's share of this sample is higher than its share of national production (5.8%). Victoria was somewhat over-represented in the sample, relative to other states.

The data presented in the summary section of this report were weighted by business sector (based on ABS estimates of their value-added contribution to GDP in 2017-18) in order to adjust for these characteristics of the sample.

The services sectors represented in this year's sample include: IT, communications and media services; transport, post and storage services; wholesale trade; retail trade; finance and insurance; real estate and property services; professional services; administrative services; health and welfare services; education; hospitality (food and accommodation services); arts and recreation services; and personal services.

	CEO Survey: Business Prospects 2019		ABS data (2017-18)
Sector	Number of respondents	% of respondents	Value-added output, % of GDP
Manufacturing	164	65.1	5.8
Services	55	21.8	53.5
Construction and mining services	33	13.1	8.2
Total	**252**	**100.0**	**67.5**

Notes:

1. Only includes construction value-added output.
2. These industries do not sum to GDP due to the exclusion of utilities (2.4% of GDP), public administration and safety services (5.5%), agriculture (2.4%), mining other than mining services (5.8% of GDP), ownership of dwellings (8.7% of GDP) and other additional statistical items that are included in GDP.

Appendix B – CEO Survey of Business Prospects 2019: Questionnaire

1. Business name:

2. Postcode:

3. In which industry does your business mainly operate? *Please tick one box only, for your main activity*

- ☐ Mining and/or mining services (e.g. exploration, mining engineering or mining processing)
- ☐ Manufacturing (e.g. making food, beverages, chemicals, equipment, building materials, metals, textiles, furniture)
- ☐ Construction (e.g. engineering, infrastructure, commercial, residential construction or contracting)
- ☐ Services (e.g. retail, wholesale, transport, professions, real estate, IT, media, health, education, cafes, hotels)
- ☐ Other industry (please specify): _____

4. What was your approximate annual turnover in 2018? $ _____

5. How many fulltime equivalent (FTE) people did you employ in 2018? _____ FTE people

6. By what percentage did the following factors change in your business in 2018, compared to 2017?

Please complete one box only for each of:	Down *(write in %)*	No change *(tick if applicable)*	Up *(write in %)*
Annual turnover	_____ %	☐	_____ %
Gross profit margin	_____ %	☐	_____ %
Number of employees	_____ %	☐	_____ %
Spending on staff training & development	_____ %	☐	_____ %
Spending on physical capital (e.g. buildings)	_____ %	☐	_____ %
Spending on research & development	_____ %	☐	_____ %
Spending on new technology	_____ %	☐	_____ %
Export income	_____ %	☐	_____ %
Input prices	_____ %	☐	_____ %
Energy prices (inputs)	_____ %	☐	_____ %
Selling prices	_____ %	☐	_____ %
Labour productivity (output per hour worked)	_____ %	☐	_____ %
General business conditions in your sector	☐ Worse	☐ No change	☐ Better

7. Did you change any parts of your business model, plan or strategies in 2018 due to business conditions?

☐ Yes ☐ No ☐ we don't have a formal business model, plan or strategy

If yes, what did you change in 2018? _____

8. If exporting, what was the total value of exports for your business in 2018? $ _____

9. Approximately what percentage of all your inputs (by value) were imported in 2018? _____ %

10. IF your business was EXPORTING in 2018 or planning to export in 2019, at what AUD/USD exchange rate do your exports become uncompetitive with products from other countries? _____US cents

11. IF your business was competing with IMPORTS in the Australian market in 2018 or expecting to compete against imports in 2019, at what AUD/USD exchange rate do your products become uncompetitive with imported products from other countries? _____US cents

12. How did your business use the internet in 2018? *Please tick all uses that are applicable to your business*

☐ Business website	☐ Ordering / buying from suppliers	☐ Online applications (e.g. payroll)
☐ Advertising / marketing	☐ Data storage and / or analysis	☐ No internet used in the business
☐ Orders / sales from customers	☐ Other:	

13. Did your business experience any internet security problems in 2018?

☐ Yes ☐ No ☐ Don't know ☐ Not applicable to my business

14. Did your business invest in any internet security measures in 2018?

☐ Yes	☐ No	☐ Don't know	☐ Not applicable to my business

15. Did your business use any internet security assistance or advice from Government in 2018?

☐ Yes	☐ No	☐ Don't know	☐ Not applicable to my business

If yes, please briefly describe the Government assistance or advice on internet security used by your business?

_____

16. Do you expect the following factors to change in your business in 2019, compared to 2018?

Please tick one box only for each of:	Down	No change	Up
Annual turnover	☐	☐	☐
Gross profit margin	☐	☐	☐
Number of employees	☐	☐	☐
Spending on staff training & development	☐	☐	☐
Spending on physical capital (e.g. buildings)	☐	☐	☐
Spending on research & development	☐	☐	☐
Spending on new technology	☐	☐	☐
Export income	☐	☐	☐
Input prices	☐	☐	☐
Energy prices (inputs)	☐	☐	☐
Selling prices	☐	☐	☐
Labour productivity (output per hour worked)	☐	☐	☐
General business conditions in your sector	☐	☐	☐

17. What factors do you expect will inhibit your business growth in 2019?
Please rank all factors that will inhibit your business in 2019, starting with 1 as your most important inhibiting factor

Lack of customer demand _____	Government regulatory burden _____
High and/or variable exchange rate _____	Competition from imports / internet sellers _____
Flexibility of industrial relations _____	Wage pressures or high wage costs _____
Skills shortages _____	Other (please specify): _____

18. What key growth strategies do you plan to implement in your business during 2019?
Please rank all relevant strategies for 2019, starting with 1 as your most important strategy

Introduce new products/services _____	Downsize / reduce operational costs _____
Improve sales of current products/services _____	Increase online presence / capability _____
Develop new domestic markets _____	Increase advertising / marketing _____
Develop new overseas markets _____	Other (please specify): _____

19. What are your highest priorities for your business investment spending in 2019? *Please rank all types of investment that you are considering for 2019, starting with 1 as your most important area of investment*

Staff training and development _____	Research and development _____
Physical capital (e.g. buildings) _____	Information and communication technologies (ICT) _____
Equipment (e.g. new machinery) _____	New technologies other than ICT _____
Other (please specify): _____	

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