

# AUSTRALIA'S DIGITAL TRUST REPORT 2020

Supported by modelling by **Synergy** 

July 2020

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Australia's economic growth and job creation relies on digital trust. Having a globally competitive cyber security industry is critical to assuring Australia's future and protecting the privacy of its people.





# FOREWORD

## Australia's digitally geared economy relies on trusted infrastructure and data.


Australia's digital infrastructure and the data it carries are core to the value and growth of the nation's economy. The growing economic dependency on the digital domain has an intrinsic relationship with the trust users and consumers have in it and therefore the security, privacy and resilience of the infrastructure and data.

*Australia's Digital Trust Report 2020* highlights the role 'digital trust' plays in attracting investment and driving jobs growth. It draws on data modelled by Synergy's Advanced Modelling Group to quantify the value of digital activity to the Australian economy and model the impact of a major cyber security incident creating a digital interruption to the Australian economy.

Together with AustCyber's other key advisories on cyber security sector growth in Australia – *Australia's Cyber Security Sector Competitiveness Plan* and the *Australian Cyber Security Industry Roadmap* – this report demonstrates the role that cyber security plays as a 'horizontal sector' in enabling growth opportunities across other sectors of the economy.

The timing of the release of this report is both critical and deliberate. The COVID-19 pandemic caused a rapid move to remote working and education, renewed focus on online business delivery and fast adaptation of supply chains using digital technologies.





The quality of digitisation and its trustworthiness is now under immense pressure as the economy recovers from the pandemic. Focus is needed to ensure the digital environment is secure, resilient and effective.

This report argues that not only are key sections of Australia's economy undergoing a step-change because of the transition to a digital environment, but that Australia's economic future is founded in large part on the security of this digital step-change going forward.

For this transformation to be fully realised, Australia must invest in the means to secure digital infrastructure and data to assure trust and sustain efforts to reboot growth. This will ensure all parts of the Australian economy that are becoming increasingly reliant on digital technologies have a solid base for market confidence and guidance for successful investment. It will create the conditions for Australia to improve its global competitiveness through the necessary digital governance that provides the foundation for minimising disruptive incidences of digital intrusions that undermine our economic security.

A globally competitive Australian cyber security sector will ultimately underpin the future success of every industry in the national economy. AustCyber is a critical point of coordination for industry creation and sustainment, forming a key part of the nation's approach to better managing cyber risk and supporting the economy to become cyber resilient.

Federal, state and territory government leadership is vital. AustCyber has calculated that for every procurement dollar spent on a local cyber company, it returns at least \$4.70 in direct revenue and a further \$5.00 in spillover benefits including job creation.

A consolidated effort between government and industry is needed to preserve, but also evolve, Australia's vital digital activities while ensuring it can scale.



**Michelle Price**  
Chief Executive Officer, AustCyber







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# 1 WHAT IS DIGITAL TRUST?

Digital devices and systems now permeate all aspects of Australian life. We trust the information we are served through these devices and systems is accurate and the data stored on them is secure with privacy preserved.

This means Australia's economy is now digitally geared and breaking 'digital trust' would unwind the value of digital activities to our economy. More broadly, the Australian community is becoming aware of the risks around digital activity through disclosures by leaders, government agencies and media reporting of recent and ongoing malicious cyber activity targeting Australian organisations and individuals.


**Digital trust** is the level of confidence users have in the ability of technology to enable a high functioning cyber-physical world. It is earned by providing secure, private, safe and reliable access to (and interaction with) technology, as well as the ways in which technology has been designed, constructed and delivered. **Cyber security** is a foundational pillar of digital trust in the economy.

Making the link between digital trust and the AU\$426 billion injected into the economy through digital activity is key to understanding the opportunities available to all sectors of the economy, as well as the consequences for Australia if we suffered a loss of trust in the digitally enabled services and data we use every day.

Through the modelling of Synergy Group, we now know that a digital disruption spanning four weeks would significantly impact our economy – to the tune of AU\$30 billion or around 1.5 per cent of Gross Domestic Product (GDP), representing around 163,000 jobs. More than this, it also would break the public's trust and confidence in digital activities.

The economic impact the COVID-19 pandemic has placed on our economy has yet to be fully measured. It is not clear if Australia could have survived a sustained, serious or scaled digital disruption at the same time as the economic 'hibernation' caused by the pandemic.





**Telehealth digital transformation** – moving Australians into physical isolation resulting from the COVID-19 pandemic required the health industry in Australia to rapidly deploy video-enabled visits and virtual hospitals. In one small example, Sydney's Royal Prince Alfred's Virtual Hospital opened in February 2020<sup>1</sup> with six nurses and quickly grew to more than 30 nurses servicing over 600 registered patients. The speed of digital uplift in service delivery has created potential cyber security gaps that if exploited, would damage Australian trust in our telehealth services, which has taken years to roll out before the pandemic arrived.

**Revenue for the online shopping industry jumped to 21.8 per cent in March 2020** when viewed in year on year terms. This is a significant shift in spending activity driven by communities rapidly moving into physical isolation. Woolworths' online shopping arm reported a 30 per cent uptake in online shopping compared to the same period in 2019.<sup>2</sup> Australian households have demonstrated growing trust in online shopping and delivery services, with adoption rates increasing strongly over the last five years. As a result, the areas of the economy able to respond, such as supermarkets and clothing retailers, have reported a period of rapid growth.



## 2 KEY FINDINGS



### Digital activity currently:



contributes **A\$426 billion** to the Australian economy, up from the estimates of

**A\$315 billion** modelled by Data61 and AlphaBeta in 2018



generates **A\$1 trillion** in gross economic output; and



equates to **1 in 6** digitally geared jobs in the national economy.



### Measuring the importance of the digital economy

This report analyses and compares the impact of digital activity across seven areas of Australia's economy:







## Digital disruption

A four-week digital interruption to Australia's economy, such as a widespread cyber attack, would cost the Australian economy up to:

- **AU\$30 billion** or 1.5 per cent of Australia's GDP and over **163,000 jobs**

This starts to significantly increase when the loss of trust in digital infrastructure and data integrity is taken into consideration. The impact of one month's digital disruption to the Australian economy is up to AU\$30 billion, which is equivalent to:

- **three quarters** of Australia's Defence annual budget, and
- nearly **40 per cent** of the Australian Government's health budget

Digital interruption is non-linear and exponential. The costs of disruption caused by malicious cyber activity to the Australian economy multiplies and compounds across the economy in different ways, according to each sector analysed.



## Cyber security enables digital trust

Assuring digital trust, growing global competitiveness and better valuing the assets the nation now holds in digital infrastructure and data requires cyber security and transparent management of privacy.

Australia's cyber security sector is rapidly growing, in part due to the demand being created by more organisations understanding the need to invest in the security and resilience of their digital activities. More is needed governments and industry alike must:

- use sovereign cyber security products and services, as part of the current focus on digital transformation;
- increase investment into Australia's cyber security sector to underwrite sustained capability creation and industry growth; and
- work together to develop a culture and reputation for high 'digital trust' in Australia to attract sustained investment and drive jobs growth.

For information on how the COVID-19 pandemic affected the data, see Appendix A.



# 3

## UNPACKING THE DATA

### INTRODUCTION

Over recent years, scale, size and speed have been key variables in the rapid transition to a digitised economy that is highly integrated and increasingly additive in its industrial base. Other key factors include digital technologies increasingly becoming a convenient way for governments, businesses and the community to engage, with financial benefits of this digital uptake driving a connected and diversified economy.

### BEYOND CHANGE – INDICATORS OF A DIGITISED WORLD

To demonstrate the extent to which Australia has proceeded beyond an 'industrial economy' towards an integrated digitised economy, with a maturing digitised environment, the retail and the financial services sectors are highlighted.

Central to the Australian economy, each of these sectors now operate with core, and increasing, digital dependencies. They have both gone so far down the digital path that neither could step back from this advancement and if they faced significant digital interruptions, their ability to function would be significantly impaired, if not forced to halt.

#### Retail

The National Australia Bank's (NAB) Online Retail Sales Index (NORSI) recorded that in the 12 months to March 2020, Australians spent approximately AU\$30.91 billion on online retail.

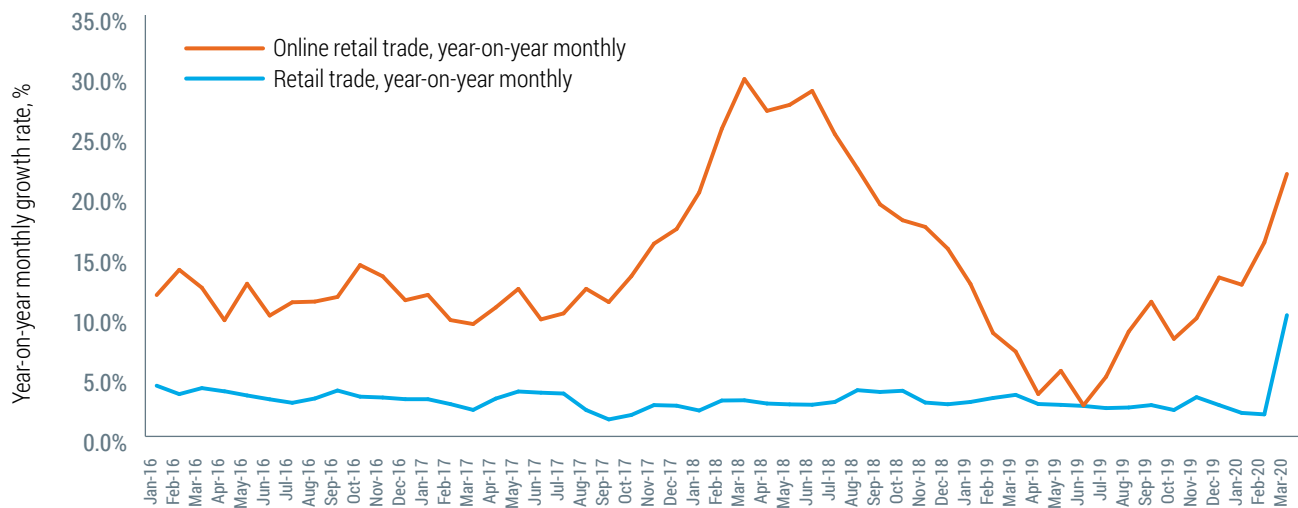
That is nearly ten per cent (9.6 per cent) of Australia's total retail trade estimate; and 11.9 per cent higher than the year previously.

Simply put, online sales now account for ten per cent of Australia's buying, a figure increasing at approximately ten per cent per year. Even accounting for variation, this trend suggests nearly a quarter of all Australian retail activity could be done online within a decade.

NORSI equally records the steady beat of growth in online sales continued unabated at a month-on-month average of two per cent, with now well-documented rapid growth in March 2020 (5.6 per cent), with a 21.8 per cent increase when viewed in year-on-year terms.



**Figure 1. Online retail sales growth (orange line) as distinct from traditional retail sales (blue line) from the National Australia Bank's Retail Sales Index of March 2020. Online sales ordinarily grow at around 21.8 per cent year-on-year and has experienced highs of up to 30 per cent during December 2017 and June 2018.**



In short, Australians are both more energised by, and becoming more attuned to, the reality of online sales as a factor in their buying behaviours. NORSI's measurements span everything from takeaway food to fashion, constituting a reliable measurement of the increasingly online buying habits of Australians in essential and recreational components of their lives.

## Financial services

If Australia's online retail sector is only starting to grow – albeit healthily – Australia's financial services sector sits at the hub of Australia's step-change to a digitally dependent economy.

Looking at the view of this step-change by the Reserve Bank of Australia (RBA), this is how the Chief Information Officer, Gayan Benedict, put it to the CIO Executive Summit in Sydney in 2019:

*"The challenge in the coming years is to go beyond only delivering new technologies and extend how we digitally enable the entire RBA and its integration into the broader economy. It's no longer about transforming IT and is now about digitally transforming the Bank."*

Benedict listed the breathtaking range and complexity of the RBA's modern digital interactions, spanning nearly every element of the bank's core services:

*"By example, our New Payments Platform, the Bank-managed Fast Settlement Service that underpins it, is integrated in real-time across the nation's banking sector. Similarly, our new core banking platform is plumbed via cloud-based API services into our government customers to enable real-time payments into citizen's accounts. The Bank's policy areas have developed new data platforms that consume massive data sets from across industry to assess credit risk and maintain stability across our markets."*

Digital transformation for the RBA is occurring to a point that commerce without digital technologies has become nearly impossible. For the RBA's internal and external interactions, its digital capabilities mean it is now both a participant in the market, or market taker, as well as a market shaper, because it is changing how financial markets operate.



### 3 UNPACKING THE DATA

The Australian financial system has recently weathered several large-scale cyber attacks, according to the Australia Cyber Security Centre, part of the Australian Signals Directorate. As the connection between the digital transactions and the economy intensifies a successful breach of our financial institutions at scale would damage the confidence of consumers in their banks' ability to protect their investments and savings.

These observations point to the Australian financial services sector undergoing a step-change requiring a frank assessment of questions of digital governance and the interaction with the broader economy that these financial markets support.

Questions about cyber security capabilities are one key component of such governance. More sophisticated analysis points to whether the Australian economy could survive any form of widespread digital disruption and for how long.

A series of sophisticated cyber attacks on Australia's critical digital infrastructure during the work from home period of the COVID-19 pandemic, and any similar future pandemic or domestic crisis, would only highlight the extent of Australia's now critical economic dependency in the digital domain.





## CYBER SECURITY AND DIGITAL TRUST – MODELLING DIGITAL ACTIVITY AND DISRUPTION

This section of the report details seven areas of the Australian economy and models them for digital disruption. That means, specifically, modelling what would happen to these sectors if their activity was interrupted for any period of time – in Synergy’s model, either for one week or four weeks – by a cyber-attack leading to **a loss of confidence in the reliability of digital systems** that underpin the operation of transactions and **other digital activity** online.

Synergy has used ‘Input-Output’ modelling to identify, respectively, the ‘Direct Economic Contribution’ of these sectors to Australia’s economy, and the ‘Total Economic Impact’ of these sectors on the economy:

- **Direct Economic Contribution:** this measurement identifies the direct contribution of the industry listed to current economic activity. It is measured as all market-related expenditure generated by a specified industry, focusing on revenues and output, and estimating the flow-on effects of the industry’s operations.
- **Total Economic Impact (or, ‘Economy-Wide Impact’):** this represents the total value of all transactions and production of goods and services generated by key measures of change in the selected industries. These changes are:
  - demand-changes for goods and services along a measured industry’s supply chains; and
  - household expenditure variations arising from employment changes in the measured industry.

Functional disruption is a core measure of change in this metric. It is composed of direct, production-induced, and consumption induced economic impacts.

In short, we identify how much the economic component or sector contributes to Australia directly (via Direct Economic Impact, or DEI); and indirectly (via Indirect Economic Impact, or IEI).

This gave us a good base to understand the true impact of digital interruption on Australian economy, alongside Australia’s implied digital wealth.

### Sectors and activity chosen for modelling

The seven sectors – or more precisely, components of economic activity – chosen for modelling are listed below.

**Table 1. For economic contribution at a macro level**

Economic activity	Focus
Digital activity	As an enabling function of economic activity
Cyber security	As a supporting component of the economy

**Table 2. As sector components**

Sector components	Sector
Online retail	TRADE
Solar power generation	
Hydrogen manufacturing	ENERGY
Digital health	
Space industry	GOVERNMENT AND PRIVATE SERVICES



## Measuring impact – tests across sectors

Activities now carried out online form a large part of Australia's economy.

The increased reliance of Australians and local companies on online access have made the internet essential for many businesses and established a new business model, literally known as 'online.'

Many well-established sectors are being impacted by the new business paradigm, while the internet has also given rise to brand new opportunities that were previously unavailable to consumers and businesses.

Digital activity impacts in varying amounts almost all of Australia's industries primarily focusing on:

- retail shopping (including cars, groceries, clothing, travel, event tickets, electronics, whitegoods, furnishings, and takeaway food);
- entertainment (with streaming and online gaming);
- telecommunications (with mobile internet and apps);
- education;
- real estate and recruitment;
- advertising;
- transportation; and
- charities.

The Australian Bureau of Statistics (ABS) reports that 86 per cent of households have access to the internet and 97 per cent of households with children under the age of 15 are connected.

The three most frequently reported activities online are banking, entertainment and social networking (all reported by 80 per cent of internet users). This suggests that we have moved our finances, entertainment activities and even social interactions into the digital frontier.

As further developments in network speeds and accessibility become available to consumers and businesses (via the NBN and 5G), we can expect that a larger proportion of daily activities will continue to migrate towards the digital part of Australia's economy.

## Digital activity – contribution to the Australian economy

Digital activity supported 22 per cent of Australia's economy in 2019–20 and directly generated six per cent of the national GDP.

### 1. Direct economic contribution

- Digital activity in 2019–20 directly contributed:
  - **AU\$317 billion** dollars in gross output to the Australian economy
  - **AU\$105 billion** (5.5 per cent) to Australia's GDP
  - **527,726 jobs** to the Australian economy

### 2. Total economic impact

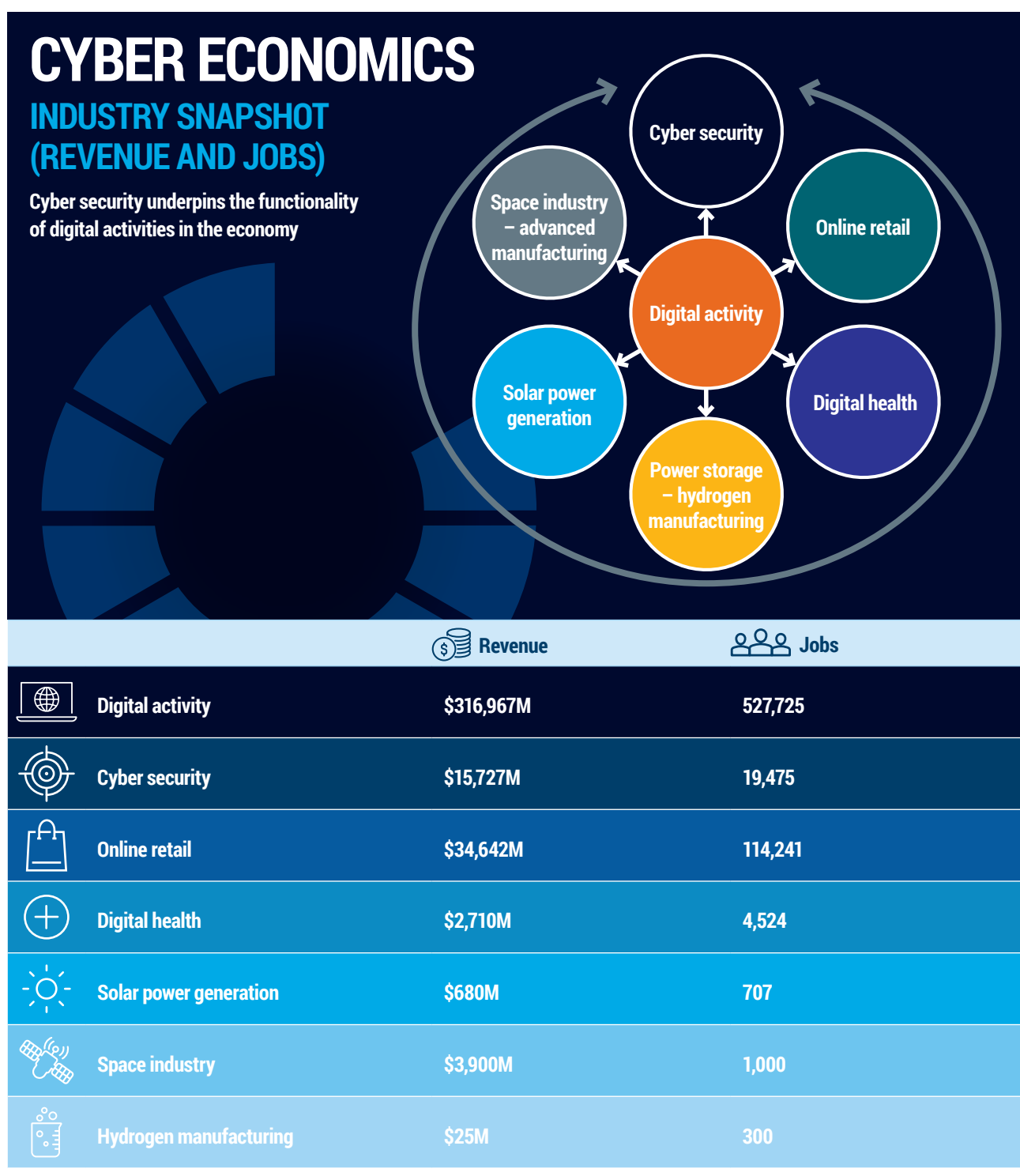
- More broadly, considered in terms of secondary expenditure and value creation in 2019–20, digital activity contributed:
  - **AU\$1.1 trillion** dollars in gross economic output to Australia's economy
  - **AU\$426 billion** (22 per cent) to Australia's GDP
  - **2,329,178** Australian jobs



The industry snapshot shown in Figure 2 measures 'Direct Economic Impact' – revenue from the measured industries and their jobs. The snapshot reveals significant contours and insights.

**Figure 2. Industry snapshot – revenue and jobs**

Source: Synergy Advanced Modelling Group





# 3 UNPACKING THE DATA

**Cyber security** is a key Australian sector. Seen in a study like this, cyber security functions as an insurance policy for ongoing digital activity. It is an already productive sector, employing around a quarter of the numbers for the online retail industry. It requires, however, significant further skills increase if the likely demand for ongoing cyber security is to be realised.<sup>3</sup> Lateral approaches may be required to develop cyber security as a core Australian capability, where Australia develops and implements secure digital architecture, governance frameworks and infrastructure, alongside increasing its base of qualified IT practitioners.

**Digital activity** is core to Australia's productivity. Businesses whose primary activities stem from digital activity – e.g., IT service providers – are increasingly central to the Australian economy, employing at least 0.5 million Australians. Reciprocally, however, the importance of this sector sees only 0.5 million Australians driving an increasing backbone of the digital economy. Government could maximise this industry base by identifying it as a kernel of Australia's economic future, and join the dots between economic development, critical infrastructure and industry development. This would help generate resilience capabilities in an increasingly digital economy.

**Online retail** is a growing sector, as demonstrated earlier in the report. But it would benefit from additional risk-mitigation infrastructure to develop a truly flourishing online economy. Deliberate attention by major companies to online sales tends to drive spikes in consumer demand and consumer confidence. The 2019 Cyber Monday phenomenon in Australia showed this.<sup>4</sup> Government could take advantage of the digital market's prime movers to help develop a secure cyber ecosystem that drives increased digital retail across the calendar year, establishing it as a norm of Australia's consumer life.

**Digital health** is a growing component of Australia's burgeoning health system. The recent entry of big global players like Amazon into online pharmaceuticals in Australia, for example, sees strong potential for this sector to grow, if Government can cut red tape to facilitate this growth while managing health checks and balances.<sup>5</sup>

**Solar power generation** is a sector where Australia is primed for growth. But it remains a reasonably small employer of Australians at less than 1,000 jobs. This suggests the future of the solar power generation industry is in the development of technologies (e.g., using the Internet of Things (IoT)) to maximise energy capture, storage, and distribution rather than replacement of traditional energy sectors. Secure digital infrastructure to support this complementary and developing energy system will only help develop the solar power generation market. This would help see return on Government's already extensive assistance to develop this component of the energy sector.<sup>6</sup>

**Space industry:** Government has committed to the development of this sector via the formation of the Australian (Civil) Space Agency in 2018. While the sector remains small, employing only around 1000 people directly, expectations of its growth are high.<sup>7</sup> Its employment to revenue ratio is also relatively high (**1 employee: \$3.9M revenue**), suggesting there is high potential for economic growth in this area. This will be especially as second-order industries in the economy benefit from government and private sector focus on Australian space capability development. This might be, for example, as commercial demand for space-technology products outpaces government demand for space sector products, and/or as advanced manufacturing technologies from the space sector enhance the development of other technology sectors.



**Hydrogen manufacturing:** Like the solar sector, hydrogen's potential may lie also in its role as a digital energy capture and storage hub. Hydrogen Manufacturing's relatively small direct revenue (**\$25 million**) compared to other sectors, and its modest jobs numbers (**300 jobs**), does not represent the sector's true significance.

The best way to understand the sector's significance is in comparison to the solar sector, whose challenges lie around energy storage. The greatest obstacle firms face in the solar industry has been the storage of generated solar power for later use. The greatest demand for domestic power is during the morning and evening when solar generation has low to zero effectiveness. Storage of solar generated power during the day becomes key to establishing and maintaining reliable electricity delivery network for households and businesses alike. Hydrogen production, via electrolysis, offers an attractive alternative to batteries as an integral part of energy storage method. It also offers another energy export possibility for Australia.

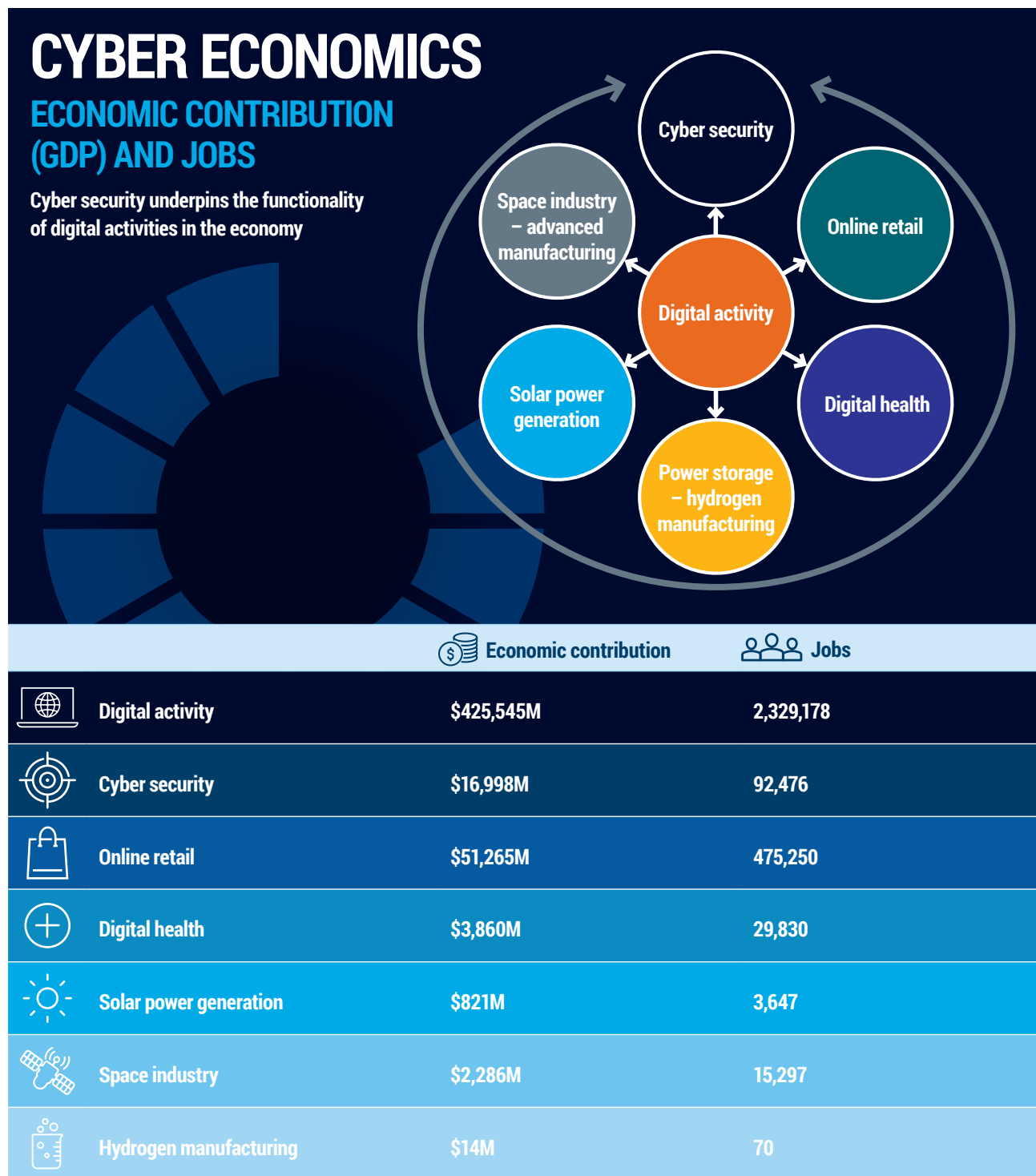
Further to this, thermochemical conversion using natural gas and coal to produce 'syngas' (synthesis gas), an intermediate input for hydrogen manufacture. This offers additional production possibilities for the future of Australia's natural resources. Hydrogen's commercial production facilities are yet to be established. When and if they are, they will likely be highly automated and internally integrated, using advanced digital systems to operate and sustain hydrogen production facilities. They will also produce highly explosive material. The safety of production facilities will therefore be paramount, including the requirement to optimise the use of any electricity produced to generate the plant's power.

This presents cyber security risks and mitigation requirements, which could be invested in at a cross-sector and individual plant level. This would enhance the security of a potentially important energy sector and fuse key questions of critical infrastructure with digital security frameworks at a national level.




**Figure 3. Economic contribution of digital activity – GDP and jobs**

Source: Synergy Advanced Modelling Group







The snapshot shown in Figure 3 measures 'Total Economic Impact', or 'Economy Wide Impact' – the overall impact of the sector on the broader economy. These metrics show the extent to which the dependencies and follow-on effects of these industries is most widely felt.

For example, 'Digital activity's' impact can now be seen in a more proportionate way, supporting something closer to 2.3 million jobs.

The figures speak for themselves. They also give a sense of scale of the risks to the Australian economy if Australia's digital activity is meaningfully compromised.

Differently put, genuine digital interruption impacts 2.3 million workers, in ways that can be unpredictable and will require detailed assessment to generate resilience measures.

This report does not provide a deeper dive into questions of resilience. An assessment is essential to help secure a key trading floor of Australia's economy, in its digital and online systems.



## Digital disruption – cost in figures

To get a sense of the true value of these figures, Synergy ran scenarios to measure a complete digital disruption at two time periods – one week, then four weeks:

- We had in mind that a truly sophisticated cyber attack across key economic sectors could impact Australia for any given period.
- Any such attack – if effective – could be repeated and/or form part of a series of such attacks designed to significantly reduce Australia's economic capabilities.
- Synergy identified that digital disruption could also occur through a serious disruption to economic activity by other means – for example, a pandemic, bushfires, substantial overloading or failure of key components of Australia's critical infrastructure (e.g., energy, transport, banking and finance, and telecommunications).

A serious digital interruption would have the following impacts on the Australian economy, measured at one week and four weeks respectively:

### 1. Direct economic impact


- One week of digital disruption would directly cost the Australian economy:
  - **AU\$1.2 billion** (0.06 per cent) of Australia's GDP
  - **6,157 jobs**
- Four weeks of digital disruption would directly cost the Australian economy:
  - **AU\$7.3 billion** dollars (0.38 per cent GDP) of Australia's GDP
  - **36,941 jobs**

### 2. Total economic impact

- One week of digital disruption would indirectly cost the Australian economy:
  - **AU\$5 billion** (0.2 per cent) of Australia's GDP
  - **27,174 jobs**
- Four weeks of digital disruption would indirectly cost the Australian economy:
  - **AU\$30 billion** (1.5 per cent) of Australia's GDP
  - **163,042 jobs**

As is clear from the above, the total economic impact of a sustained digital disruption for the Australian economy – across, say, one month – is potentially devastating.





The direct economic contribution of the digital activity sector is AU\$105 billion. The impact of one month's digital disruption to the Australian economy is up to AU\$30 billion, which is equivalent to three quarters of Australia's annual Defence budget and nearly 40 per cent of the Australian Government's health budget.

More importantly, the impact of sustained digital disruption is a non-linear function of its duration. Interruption for one week does not multiply to four times the impact of interruption across four weeks.

Instead, the multiples have an exponential relationship, at best. This generates a sense of expanding, compounding risk which, once unfolding, is increasingly difficult to harness.

As an indicator of the cost of digital disruption to the Australian economy, significant attention is needed to resolve the risks involved with Australia's cyber security, the stability of Australia's digital infrastructure and the business continuity for services provided through this infrastructure as well as the integrity of the data it holds.



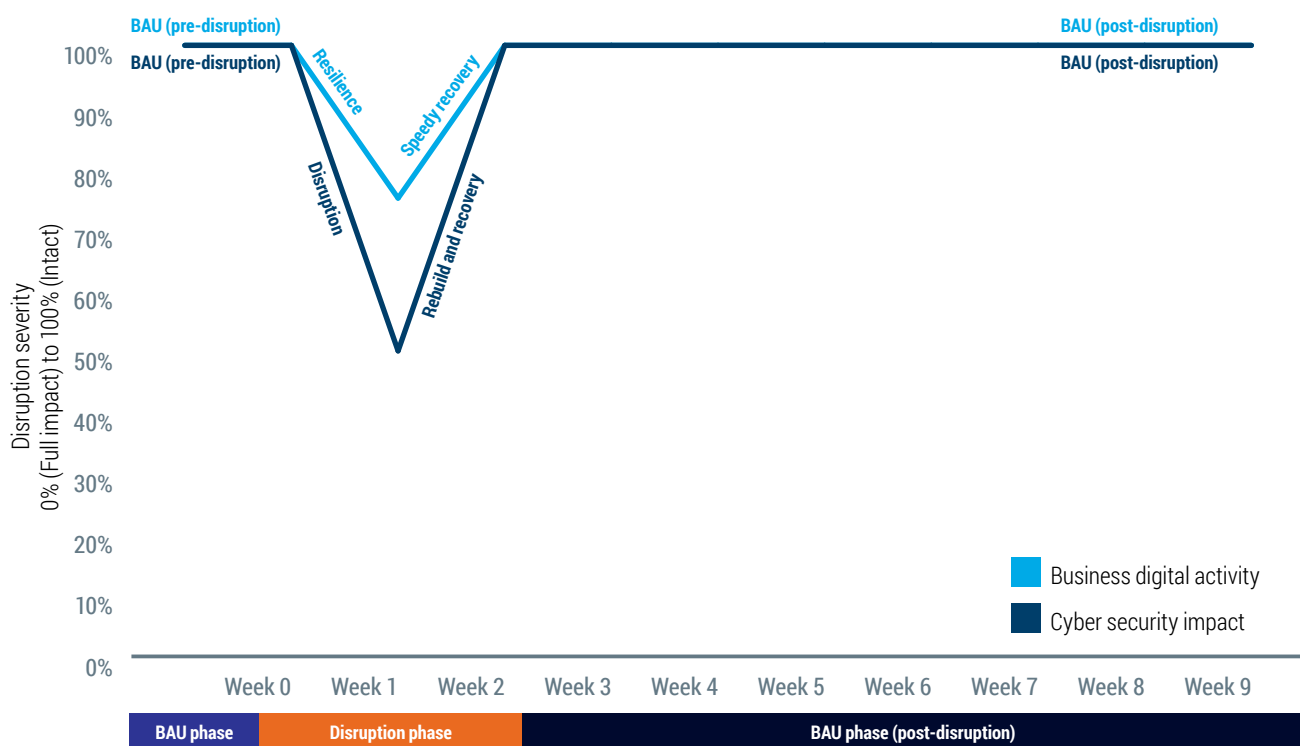
**Figure 4. Cyber disruption – 1 week**








Source: Synergy Advanced Modelling Group

## ECONOMIC IMPACTS OF DISRUPTIONS (GDP AND JOBS)

Economy-wide Impacts (direct and indirect)

Disruption (1-Week) impacts and recovery



	 GDP impact	 Jobs
 Digital activity	-\$4,965M	-27,174
 Cyber security	-\$283M	-1,541
 Online retail	-\$290M	-2,690
 Digital health	-\$27M	-189
 Solar power generation	-\$10M	-43
 Space industry	-\$27M	-178
 Hydrogen manufacturing	-\$0.16M	-1



Full-scale cyber or digital disruption for one week has devastating impacts given the relatively small timescale of interruption.

The sense of impact is best gauged by the two extremes of the analysis – digital activity at the high end of impact and hydrogen manufacturing at the low:

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Within one week, Australia loses 27,174 jobs across the economy because of a digital shutdown. This figure is an indicator of a lack of resilience and a lack of preparedness. A country well-prepared for digital disruption would not only be able to scale its workforce responses in the event of such a crisis, it would be able to predict the length of a potential shutdown and move instantly to resilience settings. It is not clear whether Australia – at the government, workforce or individual social level – has a consciousness of such risk, let alone preparedness measures for its occurrence.

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Importantly, our scenarios did not map such shutdown only in terms of scaled, sophisticated and/or persistent cyber attack. We considered the possibility that natural or other human-generated causes could cause such a disruption. The near prevalence of the latter risks, coupled with insight into the extent of Australia's digital dependency, suggests there is urgent need to stocktake Australia's digital risk settings to prepare Australia to respond to crises when digital systems, assumed to be permanent, fail.

Recent events around the COVID-19 pandemic have provided numerous examples of digital dependency and system failure when unexpected natural and national events place huge pressures on digital systems and infrastructure. Risk preparedness for such events can begin immediately.

One of the likely drivers of economic impact from a one-week digital disruption would be uncertainty about the duration of the risk. That is, a massive digital shutdown may not appear to be resolvable on days 1–6 of the crisis, and then is mitigated on day 7. The unpredictability of such events, as well as our lack of familiarity with them, accentuates the need for increased preparedness and resilience. Untreated risks remain the most consequential when they occur. Within one week, the hydrogen sector suffers nearly no economic impact from a digital disruption based on this modelling:

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However, this makes the point that the risks from digital shutdowns are not strictly economic.

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A hydrogen manufacturing plant which is secured and run using digital means is arguably a greater risk than material economic losses in the event of a digital shutdown. Unsecured explosive chemicals put additional burden on already stretched resources during a crisis.

To that extent, serious qualitative assessment of the risks of digital disruption must be added to this economic assessment to gauge the true character of digital disruption's risk.





# 3 UNPACKING THE DATA

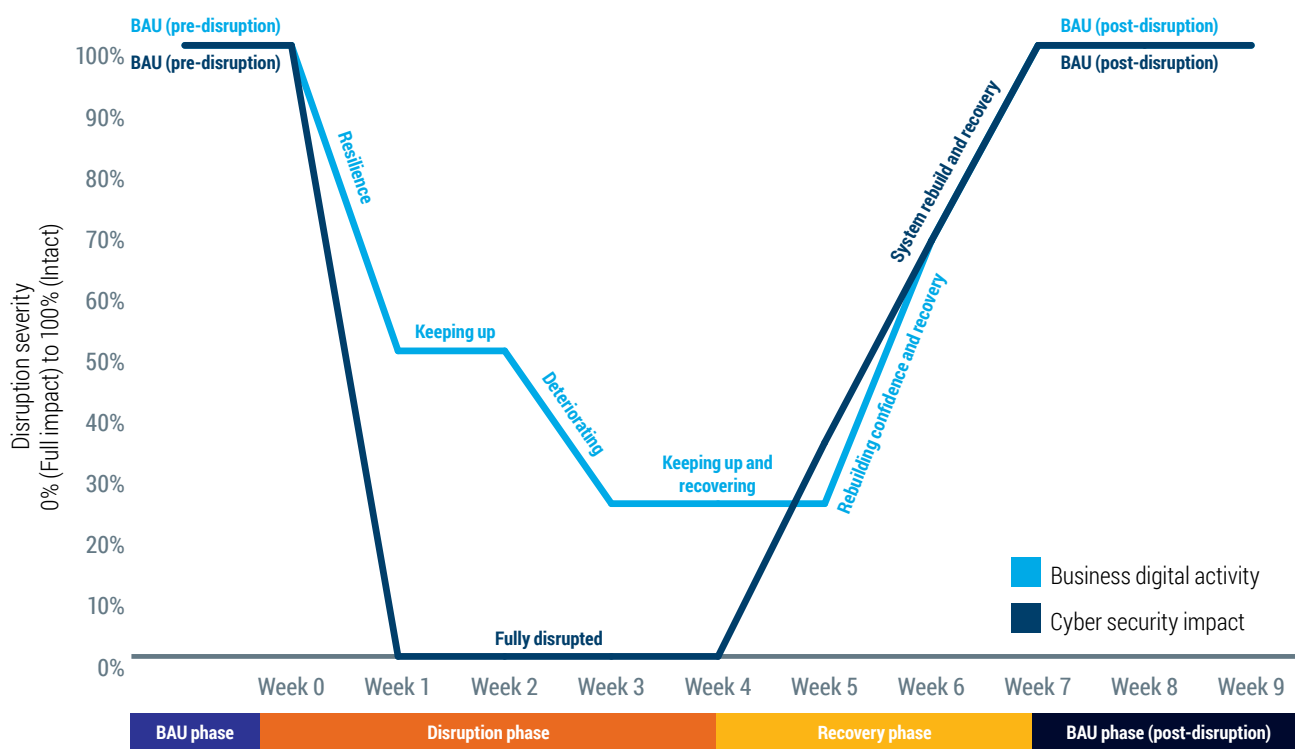
**Figure 5. Cyber disruption – 4 weeks**



Source: Synergy Advanced Modelling Group

## ECONOMIC IMPACTS OF DISRUPTIONS (GDP AND JOBS)

Economy-wide Impacts (direct and indirect)

Disruption (4-Week) impacts, resilience and recovery



	 GDP impact	 Jobs
 Digital activity	-\$29,788M	-163,042
 Cyber security	-\$1,700M	-9,248
 Online retail	-\$2,002M	-18,558
 Digital health	-\$174M	-1,202
 Solar power generation	-\$63M	-281
 Space industry	-\$178M	-1,189
 Hydrogen manufacturing	-\$1M	-5



Full-scale cyber or digital disruption for four weeks has devastating impacts, even though digital activity continues.

This study assumed, for methodology purposes, that a measure of digital activity would continue to occur in the case of a cyber disruption:

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This study assumed, for example, that even in the event of a major security breach of Australian information systems, individuals and corporations may choose to wear risk for the purpose of continuing their economic activity, even if in a more limited way.

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Additionally, in the case of a natural interruption, we presumed that some measure of connectivity may remain in a system, or in adjoining systems, even after it is interrupted.

The results were nonetheless devastating:

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Before the onset of the COVID-19, contemplating losing 163,000 jobs in one month would likely have been unthinkable.

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However, recent events have shown the extent to which immediate and catastrophic risk is not simply possible, it can occasionally be highly probable.<sup>8</sup>

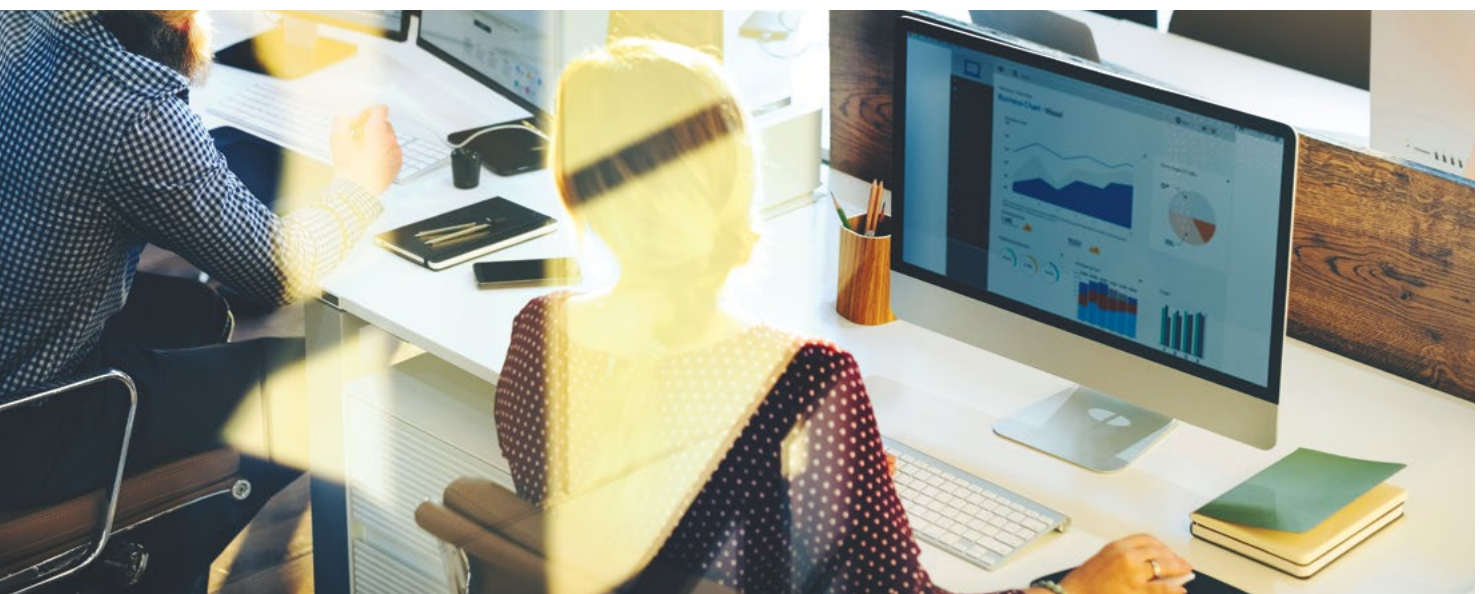
Noting the oft-highlighted vulnerability of digital systems, and the consequent vulnerability of a developed, but not secure, digital ecosystem, it is worth considering what resilience measures can be applied to the Australian economy to mitigate against the risks outlined here:

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Such measures might include, for example, the development of governance and policy settings which create a form of 'reach-back' and 'back-up' system for when digital systems fail.

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Exercising such scenarios across the economy, and not simply at the highest levels of boards and government, would both inform and prepare a digitally dependent society like Australia for managing digital risks such as those explored here.







## 3 UNPACKING THE DATA

Figures 4 and 5 register the impact of digital disruption.

The effect of digital disruption is not a complete cessation of digital activity, but more likely a significant ramp-down which impacts across Australia's economic sectors in the way described in the study above:

- For example, critical systems which have been revealed to be compromised, such as banks, might not cease trading altogether. Instead, mitigation and control measures might be put in place which involve accepting different levels of risk for customers and traders alike.
- Similarly, electrical systems which survive a serious cyber security or similar breach may continue to function for the period the breach is still active. The requirement in this case would be around securing the system's ongoing operation.
- In each case, the level of ongoing digital activity would depend on the nature of the breach and the resilience and responsiveness of the sector(s) affected.

The point to make here is that a level of *resilience* would be crucial to surviving digital disruption, whichever way it occurred.

That resilience would include things like maintaining high levels of confidence – for example, between traders – in their equities and the norms of their market relations.

However, the generation of such confidence would require a high level of trust to be established, to ensure that digital disruption did not amount to a shut-down event for companies, government systems, or communities alike.







# 4 INTERPRETING THE DATA: KEY RECOMMENDATIONS AND ACTIONS

Australia has undertaken considerable effort to develop and strengthen cyber security across the Australian economy over recent years. Cyber security is moving from an enabler across all sectors that are being increasingly digitally enabled and transformed, to becoming a sector in its own right. All parts of the economy, including government, require cyber security products and services to manage their risk.

A globally competitive Australian cyber security sector promotes greater trust in Australia as a place for doing business. Australian cyber security products and services, hardware and software have joined global supply chains and developed worldwide reputations for high quality deep tech and niche solutions for managing increasingly complex cyber risks in a highly contextual, hostile cyber-physical environment.

*Australia's Digital Trust Report 2020* demonstrates the importance of Australia's targeted and consolidated effort to build on early successes and to strengthen our cyber industries so Australia's sovereign capability grows to ensure national and economic security. Without this, Australia could risk a significant digital disruption, which over 4 weeks, could cost the Australian economy AU\$30 billion or 1.5 per cent of GDP and over 163,000 jobs.

To minimise the Australian economy facing this risk and avoiding the economic damage modelled in this report, suitable support from both government and industry to grow sovereign capability is necessary to ensure Australia's cyber industry becomes a key foundation supporting the digital economy.

The Australian Government has opportunities, including through the next national Cyber Security Strategy, to develop a range of measures to support, strengthen and grow Australia's sovereign cyber security industry. It is clear that cyber security innovation has been a bedrock for developing the capabilities to support digital and business growth. Looking ahead, it is also an opportunity to spur growth and new jobs, with almost 17,000 new cyber security jobs forecast to be needed to 2026.

This activity links in well with the work of the National COVID-19 Coordination Commission "... to help minimise and mitigate the impact of the COVID-19 on jobs and businesses, and to facilitate the fastest possible recovery of lives and livelihoods."<sup>1</sup>

*Australia's Cyber Security Sector Competitiveness Plan* and its updates, combined with our *Cyber Security Industry Roadmap* (co-authored with CSIRO) identify the key issues the sector faces, together with actions that are needed to remove barriers for growth and enhance our global competitive advantages. These reports also highlight the role that cyber security plays as a horizontal sector in enabling growth opportunities in other priority sectors and underline the importance of greater coordination by government, industry and education institutions to effectively benefit broader Australian innovation and technology uptake.

<sup>1</sup> <https://www.pmc.gov.au/nccc>



A close-up, slightly blurred photograph of a laptop keyboard and screen. Overlaid on the image are numerous digital graphics: white binary digits (0s and 1s) and blue arrows pointing upwards, and several orange prohibition signs (a circle with a diagonal line). The background is a warm, out-of-focus light.

Partnerships to grow and develop innovative cyber capability between government and industry can take a number of forms. They include early-stage investment in research and development to encourage innovative solutions to solve complex security problems, as well as incentives and engagement as potential clients to support translating these new ideas into innovations ready for commercialising. Once product maturity has been reached, it is extremely useful for government and corporates to develop arrangements so they can become purchasers of these new innovations to support new cyber companies to grow and strengthen their product capability and enter global supply chains.

Also through government partnering with industry to develop the most effective cyber protections through regulatory arrangements, the potential of undermining cyber security growth can be minimised.



# 5 REFERENCES

- 1 Rpvirtual: our role and response to COVID-19, March 2020, <https://www.slhd.nsw.gov.au/sydneyconnect/story-2020-RoleResponse-COVID-19.html>
- 2 Woolworths F20 Half-Year Profit and Dividend Announcement, 5 January 2020, <https://www.woolworthsgroup.com.au/content/Document/Half-Year%20Results%20Announcement.pdf>
- 3 2019 update to *Australia's Cyber Security Sector Competitiveness Plan*, AustCyber: Australian Cyber Security Growth Network, pp. 54–78, <https://www.austcyber.com/resource/australias-cyber-security-sector-competitiveness-plan-2019>
- 4 "Black Friday, Cyber Monday break retail drought," *Australian Financial Review*, 3 December 2019, <https://www.afr.com/companies/retail/black-friday-and-cyber-monday-break-retail-drought-20191203-p53g9p>
- 5 "Amazon Australia to disrupt community pharmacy model," *Health Industry Hub*, 20 January 2020, <https://www.healthindustryhub.com.au/pharmaceutical-news-trends/amazon-australia-to-disrupt-community-pharmacy-model/>: "The Australian arm of retail giant Amazon has filed a trademark for the term "Amazon Pharmacy" suggesting a potential entry to the highly regulated pharmaceuticals industry." See also, "Amazon may force Australian pharmacy culture change – at last!", i2P, 26 June 2017, <https://i2p.com.au/amazon-may-force-australian-pharmacy-culture-change-at-last/>
- 6 Government has provided high levels of assistance to drive solar sector growth as part of various renewable energy targets (RETs), helping smaller players overcome significant barriers to entry. The low cost of borrowing for loans from the Australian Renewable Energy Agency Finance Corporation (AREAF) has helped many firms meet the high upfront development costs to enter or develop in the solar generation industry. The active market for 'large-scale generation certificates' (LGCs) – certificates which function as currency for businesses producing renewable electricity – has aided firms entering the solar generation industry to reach profitability in short amount of time. Many players continue to enter this market, demonstrating that government's investment has not been wasted, and that this sector is healthily nascent in its potential. Identifying technology development as a centre of gravity may help maximise its growth potential and focus investment appropriately.



- 7 Australian Government, *Australian Civil Space Strategy 2019–2028*, <https://www.industry.gov.au/data-and-publications/australian-civil-space-strategy-2019-2028>
- 8 As of Monday, 24 March 2020, estimates were that more than a million Australians will lose their jobs within weeks or months because of the Corona Virus pandemic, with half a million already at risk. Tens of thousands were reported to have been made jobless overnight between 22 and 23 March 2020, following government measures to control the spread of the virus. “Coronavirus could result in hundreds of thousands Australian job losses,” *7News*, Tuesday 17 March 2020, <https://7news.com.au/lifestyle/health-wellbeing/coronavirus-could-result-in-hundreds-of-thousands-of-australian-job-losses-c-749610>; “MyGov website crashes as thousands seek Centrelink help amid coronavirus pandemic, Government backflips on claims cyber attack to blame,” *ABC News*, 24 March 2020, <https://www.abc.net.au/news/2020-03-23/mygov-website-down-centrelink-massive-queues-coronavirus/12080558>, citing the Minister for Human Services, Stuart Robert MP, claiming that over 55,000 people had tried to access the Centrelink website at a single time due to the Prime Minister’s announced Coronavirus control measures on Sunday 22 March.





# 6 APPENDICES

[Appendix A – Supplementary report: Modelling the impact of COVID-19 on Australia’s digital economy](#)

[Appendix B – Modelling methodology](#)

[Appendix C – Scenario design \(estimation\)](#)



## APPENDIX A

# SUPPLEMENTARY REPORT: MODELLING THE IMPACT OF COVID-19 ON AUSTRALIA'S DIGITAL ECONOMY



The COVID-19 global pandemic continues to have a direct effect on Australia's business and consumer behaviour. It is likely these changes will be permanent.



## EXECUTIVE SUMMARY

### Online retail (online shopping)

- Revenue for the online shopping industry rose to 21.8 per cent compared with March 2019. This is a significant jump from 16.1 per cent (in February 2020) due to consumers increasingly shifting shopping activity online.
- Australian households have demonstrated growing trust in online shopping and delivery services, with adoption rates increasing strongly over the last five years. As a result, the industry has reported a period of rapid growth. Revenue is expected to continue to grow over the five years and has accelerated during the COVID-19 epidemic.

### Payment systems

- In February 2018, the New Payments Platform (NPP) was launched in Australia providing users the ability to pay for online services using their devices online rather than using their cards to pay for services. There has been a strong increase in overall value and volume of transactions that are carried out online without the use of payment terminals to authenticate these payments. Increased use of payment methods requiring no verification, opens the payment system to increased possibility of fraud.

### Cyber security incidents

- Cyber attacks are increasing in number and severity over time. This applies to both private and public organisations. Public organisations are attracting more attention from cyber attacks due to the sensitive and highly concentrated nature of personal data that is stored on their networks. Although most cyber-attacks result in breaches of privacy with client data being compromised, more financial data and operational disruption mainly via ransomware are being experienced in key sectors of the Australian economy.

### Digital infrastructure and services

- Demand from businesses for industry services is expected to be mixed this year. Demand for some computer hardware and software services is projected to decline, by 10 per cent.
- The demand for connected (data storage and processing) services and computer support, security and transitioning services is expected to increase to meet the needs of the remote workforce.





- Growing demands for more remote working and the ability to work on cloud platforms with the development and use of such platforms anticipated to benefit both internet service providers and data processing services. The 'Internet Service Providers' and 'Data Processing Services' sub sector are likely to experience increased effects due to the changing nature of work post COVID-19.
- A sustained increase in the number of remote workers could place additional strain on service providers' networks, forcing them to face above allocation charges to internet service providers (ISPs) based on current end user contracts. Internet service providers may also enjoy further positive impacts during this period, as the National Broadband Network's (NBN) pricing model for data charges based on total bandwidth used, with higher bandwidth use being cheaper per unit.
- Revenue growth for the 'Data Storage Services' industry is expected to increase substantially as a result of remote working due to a surge in demand for industry services, as businesses shift operations to the cloud and expand working-from-home arrangements to ensure business continuity during the COVID-19 pandemic.

## Economic impact of COVID-19

- It is estimated that digital activity will experience a significant boost to demand due to the popularity of the Internet-of-Things (IoT), estimated to increase up to 17.4 per cent (or a \$58.5B revenue increase) in 2020.
- It is estimated that online retail will also increase substantially by 27.3 per cent (or an \$8.7B revenue increase) in 2020. It is expected to return to business-as-usual (BAU) within two years.
- It is estimated the direct revenue for the computer system design services sector will likely decrease by 10 per cent (or a \$5.9BB revenue reduction). It is expected to take up to two years to return to the previous levels. The demand for data storage, data processing and web hosting services is expected to experience a small boost, estimated to increase up to 10–12 per cent (or \$450M revenue increase) in 2020, and then returning to the BAU within two years.
- The total economic revenue impact of COVID-19 is up to \$230B benefit (or around 11.8 per cent of national GDP) in the digital activity, online shopping and IT industry sectors, resulting in a GDP gain of up to \$91B per annum in Australia. Accordingly, the job benefit impact is up to 505,700 per year.
- The direct industry contribution of digital activity ranges between \$14.6B and \$58.5B in 2020, and \$7.3B and \$29.2B in 2021. This generates up to \$201B gross output, \$78.3B GDP and 405,750 job opportunities, which dominates the digital impact.





## PURPOSE AND SCOPE

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This report models the impact of COVID-19 on the Australian economy with a specific focus on overall digital activity, consumer behaviour and digital infrastructure.

### Key questions

The modelling focuses on the following key questions:

- What are the trends in online retail and what are the cyber security risks?
- What is expected impact of COVID-19 on Australia's digital infrastructure, with a focus on three areas: 'Computer System Design Services' (e.g. traditional information technology); 'Data Storage Services' (e.g. data centres); and 'Data Process Services' (e.g. cloud computing)
- What is the expected impact of COVID-19 on Australia's digital activity in terms of GDP and jobs?

### About this supplementary report

This report models three scenarios of the impact on Australia's digital economy – maximum, moderate and minimum impact from 2020–2021.

The three scenarios are not predictions or forecasts, but are simply illustrations of the growth and change in Australia's economy which would occur if certain assumptions about future levels to prevail over the projection period. The assumptions are formulated based on trends seen in past data.

The three scenarios have been selected based on combinations of the various assumptions. The 'maximum scenario' largely reflects current trends in economic activity. The 'moderate scenario' and 'minor scenario' are based on lower assumptions. The digital economy is highly interdependent, and consequently, has differential impacts in line with the modelling assumptions.

This report establishes the foundation for further analysis, but also provides high-level observations.



## THE IMPACTS OF COVID-19: ONLINE RETAIL

This section of the report describes the anticipated impact of COVID-19 on online retail activity. It describes influences of changing consumer behaviour and the potential for heightened cyber risk that accompanies that change in behaviour.

### Online retail (online shopping)

- Revenue for the online shopping industry rose to 21.8 per cent compared with March 2019. This is a significant jump from 16.1 per cent (in February 2020) due to consumers increasingly shifting shopping activity online.
- The increases include increased online access to necessities such as groceries, while negatively impacting discretionary consumption of durable goods (such as whitegoods) and other consumer goods (such as jewellery). Consumption of grocery shopping online is expected to remain permanently increased due to the new dynamic established during the COVID-19 epidemic.
- Australian households have demonstrated growing trust in online shopping and delivery services, with adoption rates increasing strongly over the past five years. As a result, the industry has reported a period of rapid growth. Revenue is expected to continue to grow over the five years and has accelerated during the COVID-19 epidemic. This is significantly disrupting the grocery shopping behaviours and habits of Australians.
- Online grocery shopping is expected to boom in 2019–20. The COVID-19 outbreak is restricting the movement of people, with government bodies encouraging Australians to stay home whenever possible. One result of isolation and social distancing practices will be a shift to online shopping. Online searches for grocery delivery services increased by over 2,000 per cent by the end of March 2020 (Google Trends), but this is not expected to be fully reflected in revenue growth until the next reporting quarter for the major supermarkets.
- From a demographic perspective, significant changes are expected among older Australians, the most susceptible group to the epidemic, as they increasingly take up online grocery shopping to reduce their exposure risks.
- Since many products retailed in Australia are manufactured overseas, the industry's purchase costs are expected to fluctuate in the current year due to availability of products on foreign markets, leading to uncertain profit margins.





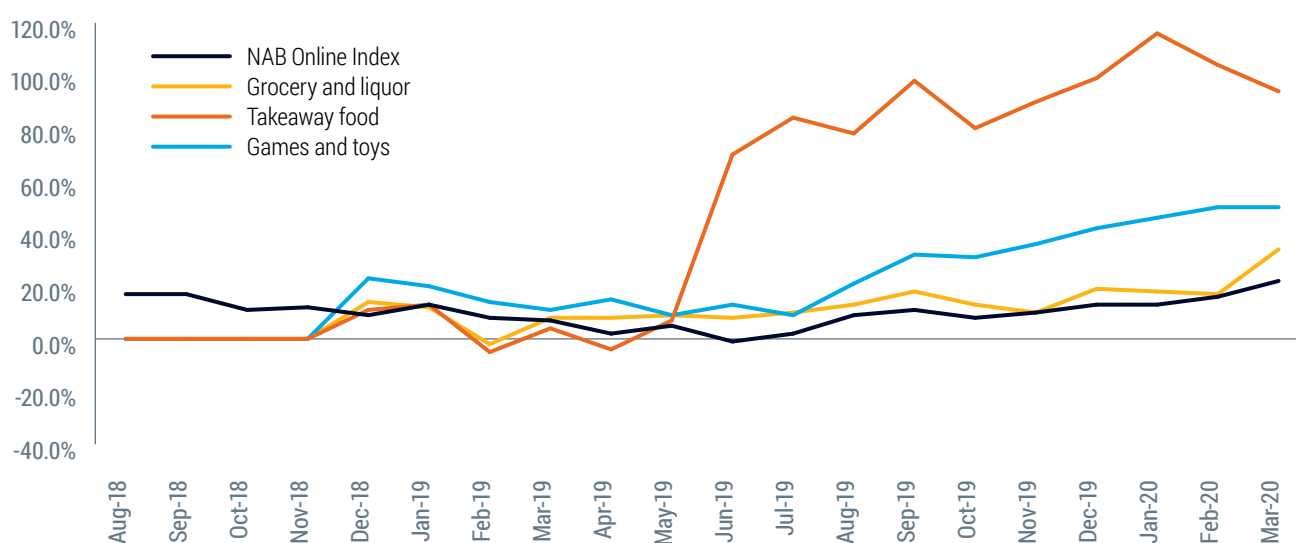
# THE INFLUENCES OF ONLINE RETAIL BEHAVIOUR

## Online retail spending

- Specific components of the NAB Online Retail Index confirm the household behaviour for online consumption. Spending on essential goods such as food and groceries has been increasing significantly since 2019. However, during the COVID-19 pandemic the expenditure on groceries online has registered the strongest growth since February 2020 while spending on other goods has increased only marginally.

**Figure 1. Spending on groceries and liquor, takeaway food, and games and toys**

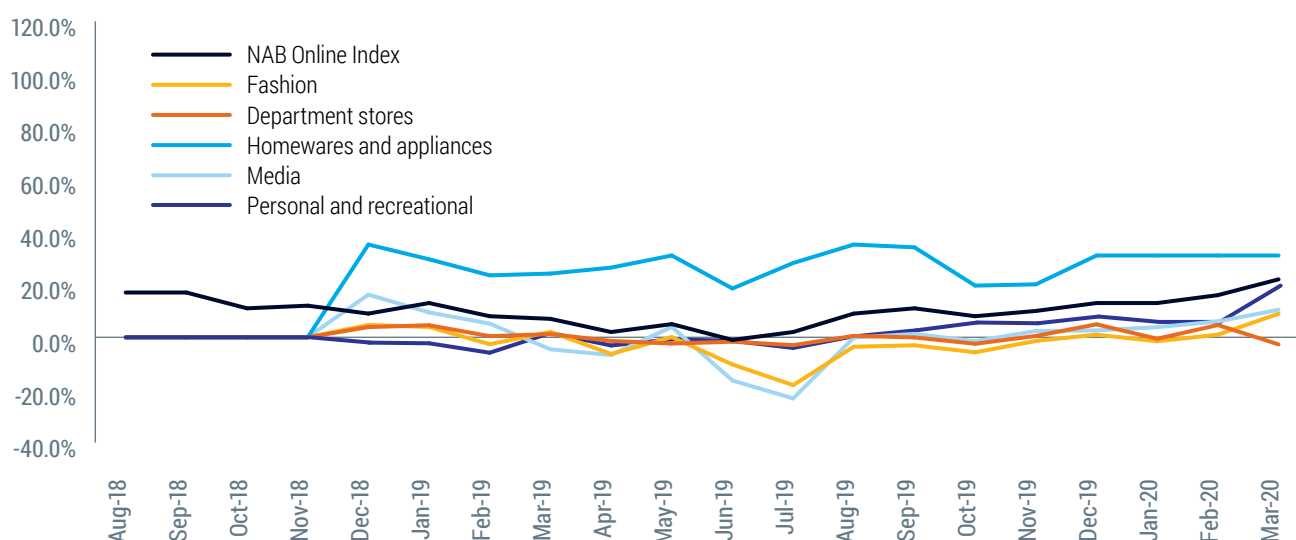
Source: NAB Online Retail Index



- Spending increases on 'Personal and recreational' goods suggests customers are taking advantage of heavily discounted vacations booked for future consumption as well as increased spending on media as the demand for consumption of entertainment increases as people are required to stay home during this period.

**Figure 2. Spending on other goods and services**

Source: NAB Online Retail Index



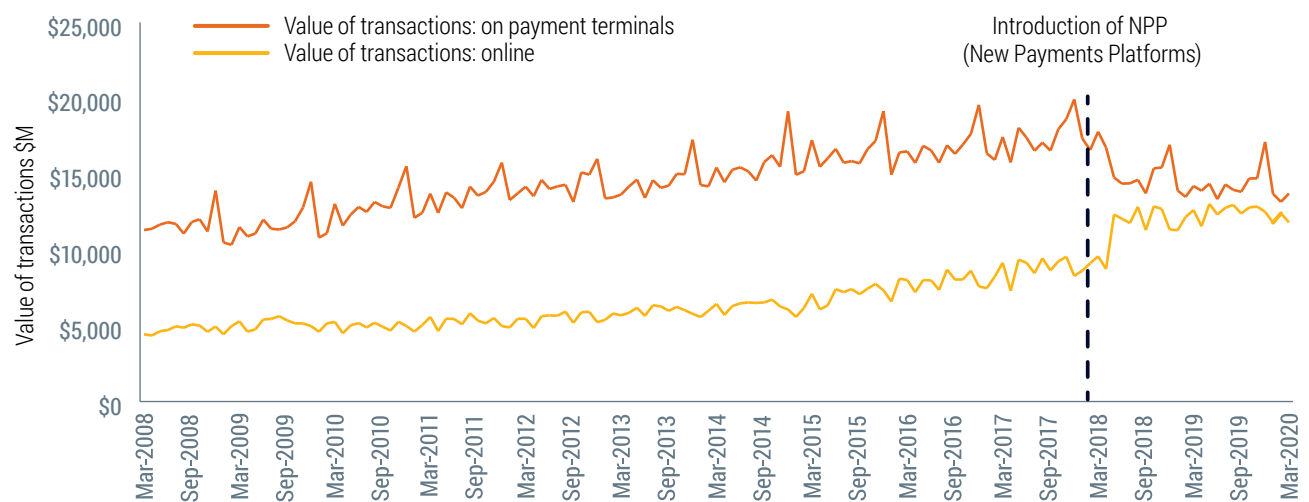


## Payment systems

- In February 2018, the New Payments Platform (NPP) was launched in Australia providing users the ability to pay for online services using their devices online rather than using their cards to pay for services. There has been a strong increase in overall value and volume of transactions that are carried out online without the use of payment terminals to authenticate these payments. Increased use of payment methods requiring no verification, opens the payment system to increased possibility of fraud.

**Figure 3. Value of transactions: terminals and online**

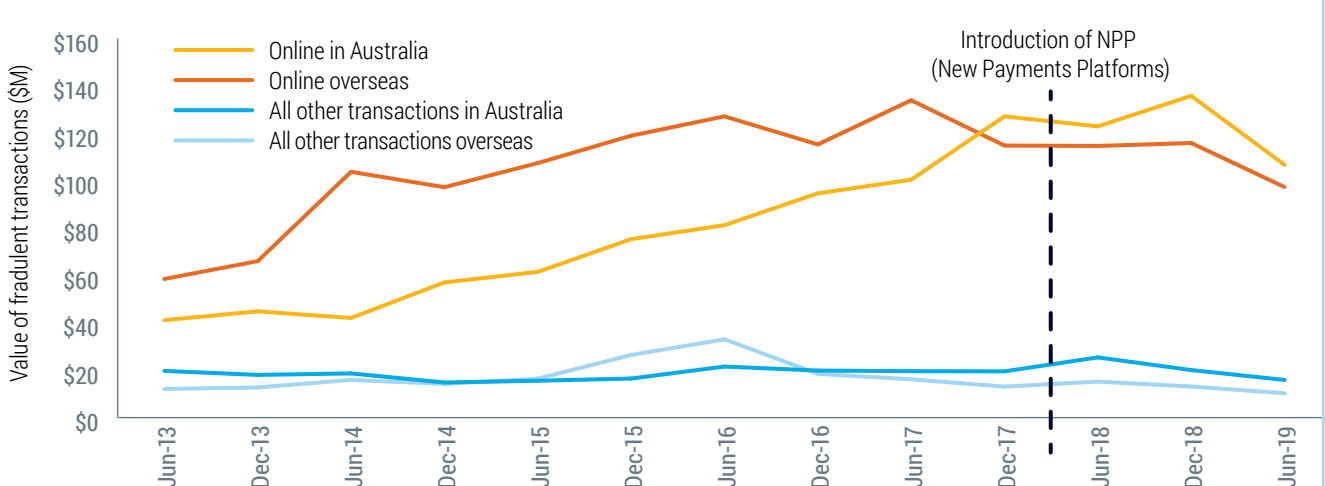
Source: RBA



- With the amount and value of payments consistently increasing in recent years, the value of fraudulent transactions is increasing. While historically, larger proportion of fraudulent transactions occurred in overseas transactions, more fraud is now experienced in domestic transactions. This is due, in no small part, to the increases in values of home transactions conducted online with the remainder of transaction fraud playing a relatively small part of overall transaction fraud by value.
- These figures are updated on a 6 month basis, so it is expected the December 2019 figures will show little change, but the June 2020 release will reflect an increase in fraud due to higher volumes of online activity.

**Figure 4. Value of fraudulent: terminals and online**

Source: Australian Payments Network



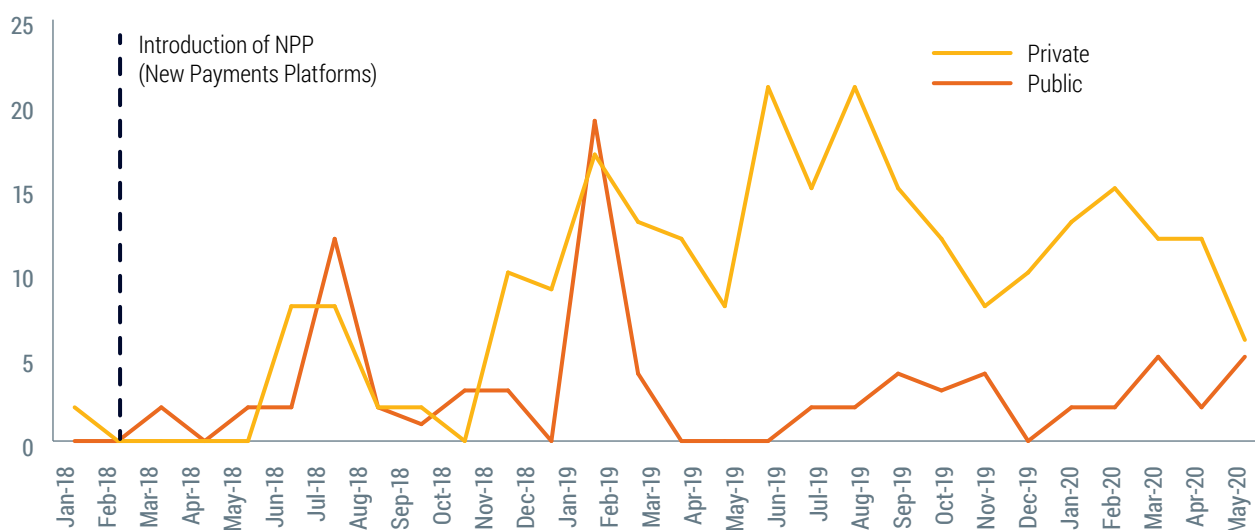


## Cyber security incidents

- Cyber attacks are increasing in number and severity over time. This applies to both private and public organisations. Public organisations are attracting more attention from cyber attacks due to the sensitive and highly concentrated nature of personal data that is stored on their networks.
- Although most cyber attacks result in breaches of privacy with client data being compromised, more financial data and operational disruption mainly via ransomware are being experienced in key sectors of the Australian economy.

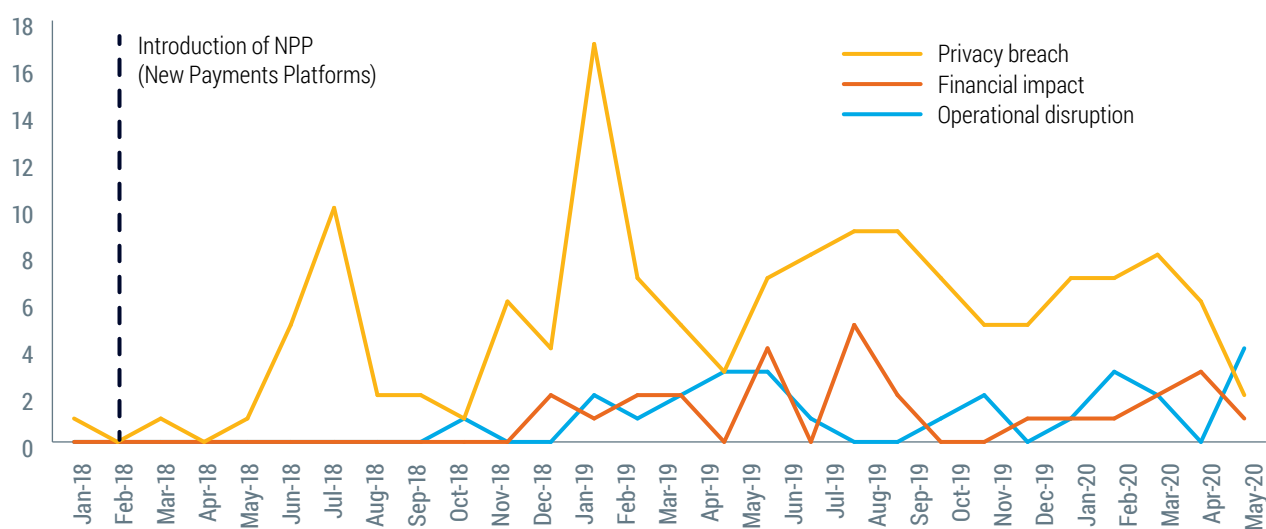
**Figure 5. Cyber security incidents by organisation type**

Source: Media



**Figure 6. Cyber security incidents by impact type**

Source: Media





# THE IMPACTS OF COVID-19: DIGITAL INFRASTRUCTURE AND SERVICES

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This section of the report describes the anticipated impact of COVID-19 on digital infrastructure.

## **Computer system design services sector (professional, scientific and technical services industry)**

- Demand from businesses for industry services is expected to be mixed this year. Demand for some computer hardware and software services is projected to decline, by 10 per cent.
- The demand for connected (data storage and processing) services and computer support, security and transitioning services is expected to increase to meet the needs of the remote workforce.
- The level of employment is expected to remain largely unchanged due to a large portion of the industry workforce being able to work from home during the COVID-19 pandemic. There are no expected productivity impacts for the sector.

## **Data processing and web hosting services sector (telecommunications services industry)**

- Growing demands for more remote working and the ability to work on cloud platforms with the development and use of such platforms anticipated to benefit both internet service providers and data processing services. The 'Internet service providers' and 'Data processing services' sub sector are likely to experience increased demand effects due to the changing nature of work post COVID-19.
- A sustained increase in the number of remote workers could place additional strain on service providers' networks, forcing them to face above allocation charges to internet service providers (ISPs) based on current end user contracts. Internet service providers may also enjoy further positive impacts during this period, as the National Broadband Network's (NBN) pricing model for data charges based on total bandwidth used, with higher bandwidth use being cheaper per unit.

## **Data storage services sector (telecommunications services industry)**

- Revenue growth for the 'Data storage services' industry is expected to increase substantially as a result of remote working due to a surge in demand for industry services, as businesses shift operations to the cloud and expand working-from-home arrangements to ensure business continuity during the COVID-19 pandemic.
- New customers, particularly within the 'Education' sector, are expected to expand their demand and contribute more to industry revenue, as education facilities establish and expand their remote learning operations.
- The 'Data storage services' industry may face some import challenges due to COVID-19 if demand begins to increase rapidly, as the components required for data centres are largely sourced from overseas.
- The 'Data storage services' industry does not require a large workforce to operate effectively and is unlikely to be shut down as it is now a part of critical digital infrastructure supporting the functioning of the economy.



# ECONOMIC IMPACT OF COVID-19

## Scenario design and direct impact (industry revenue)

The scenario design focuses on the estimated revenue impact on digital infrastructure related industries for two years (2020–2021) due to COVID-19.

It is estimated that digital activity will experience a significant boost to demand due to the popularity of the Internet-of-Things (IoT), estimated to increase up to 17.4 per cent (or a \$58.5B revenue increase) in 2020.

It is estimated that online shopping will also increase substantially by 27.3 per cent (or an \$8.7B revenue increase) in 2020. It is expected to return to business-as-usual (BAU) within two years.

It is estimated the direct revenue loss for the computer system design services sector will likely decrease by 10 per cent (or a \$5.9B revenue reduction). It is expected to take up to two years to return to the BAU condition. The demand for data storage, data processing and web hosting services will experience a small boost, estimated to increase up to 10–12 per cent (or \$450M revenue increase) in 2020, and then returning to the BAU within two years.

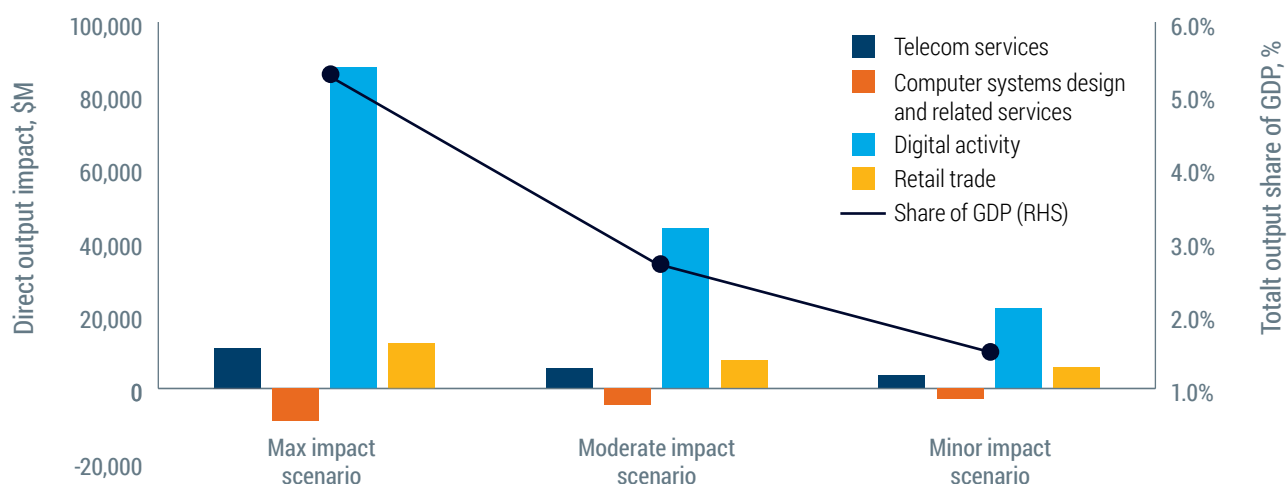
These three scenarios are considered to capture the impact range, with peak impact in 2020.

**Table 1. Impact scenario design**

	Sectors/scenario/impact	Max impact scenario	Moderate impact scenario	Minor impact scenario
<b>Economy</b>	Digital activity	Up to 17.4%	8.7%	4.4%
<b>Retail trade</b>	Online retail	Up to 21.8%	10.9%	7.3%
<b>Digital infrastructure and services</b>	Computer system design services (professional services)	Up to -10%	-5%	-3.3%
	Data storage services (telecommunication services)	Up to 12%	6%	4%
	Data process services (telecommunication services)	Up to 10%	5%	3.3%

The following charts present the direct cumulative output impact on 'Digital activity', 'Online retail', and 'IT industry' (up to \$68.2B revenue gain) for two consecutive years. This is dominated by 'Digital activity' component.

**Figure 7. Direct cumulative output impact on digital infrastructure, \$M, 2020–2021**





## Total economic impact (COVID-19)

Digital infrastructure and use (e.g. digital activity, online retail, IT industry sector) is impacted by COVID-19 up to two years, 2020–2021. The net impact brings a good economic contribution within the sector itself and beyond.

The total economic revenue impact is up to \$230B benefit (or around a quarter of 11.8 per cent of national GDP) in the Digital Activity, online retail and IT industry sectors, resulting in a GDP gain of up to \$91B per annum in Australia. Accordingly, the job benefit impact is up to 505,700 per year.

Figure 8. Total gross output – digital economy

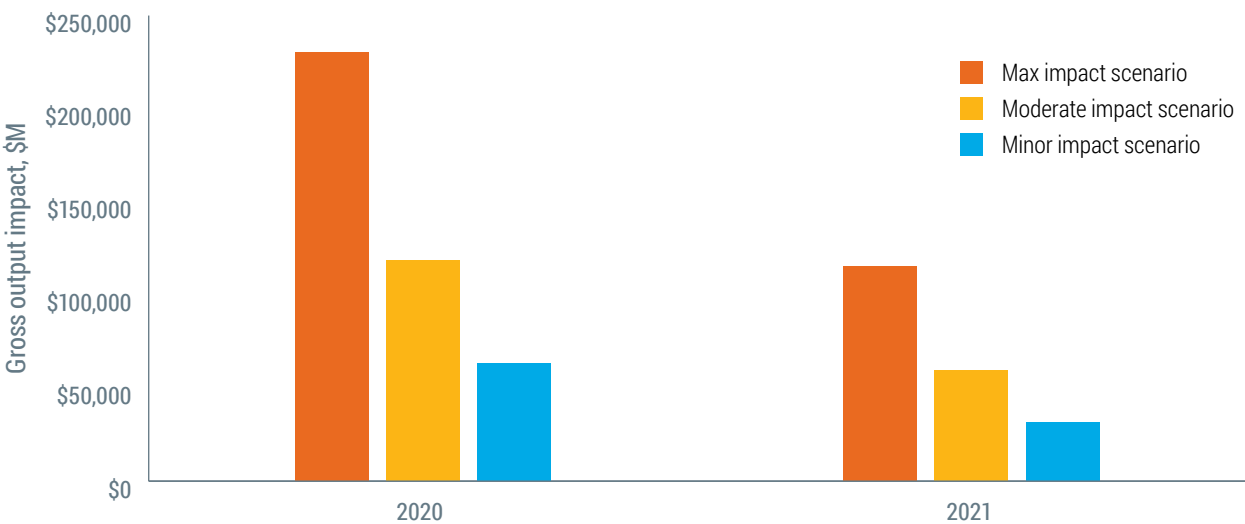
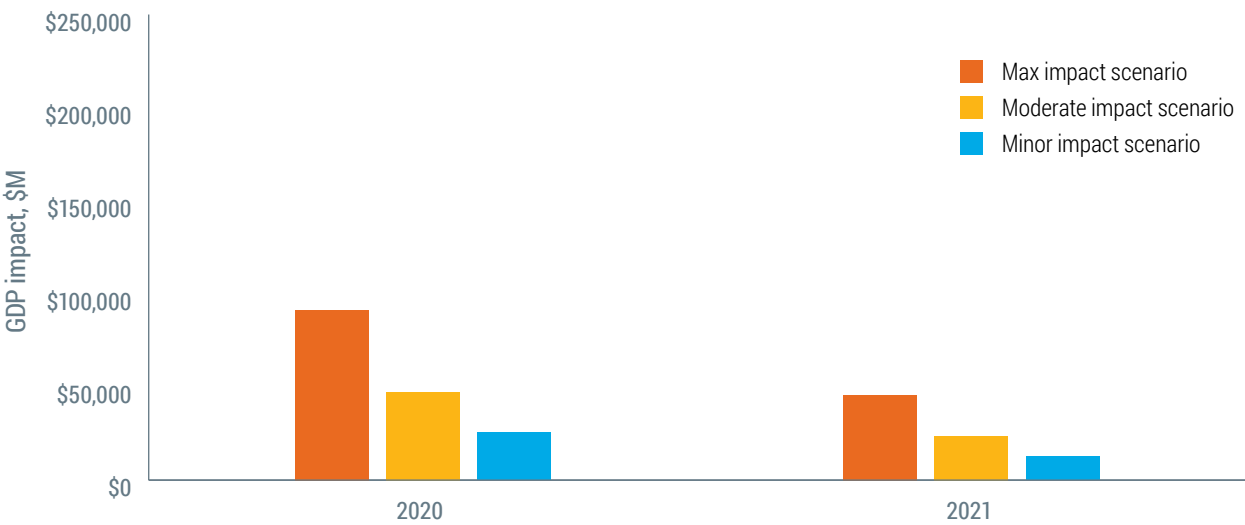
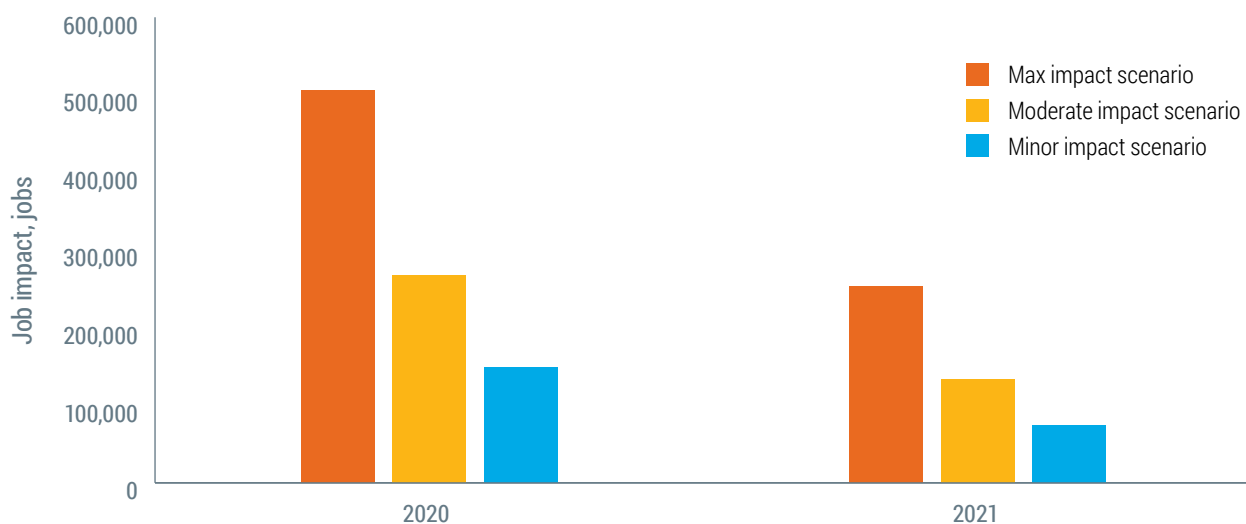


Figure 9. Total GDP impacts – digital economy





**Figure 10. Total job impacts – digital economy**



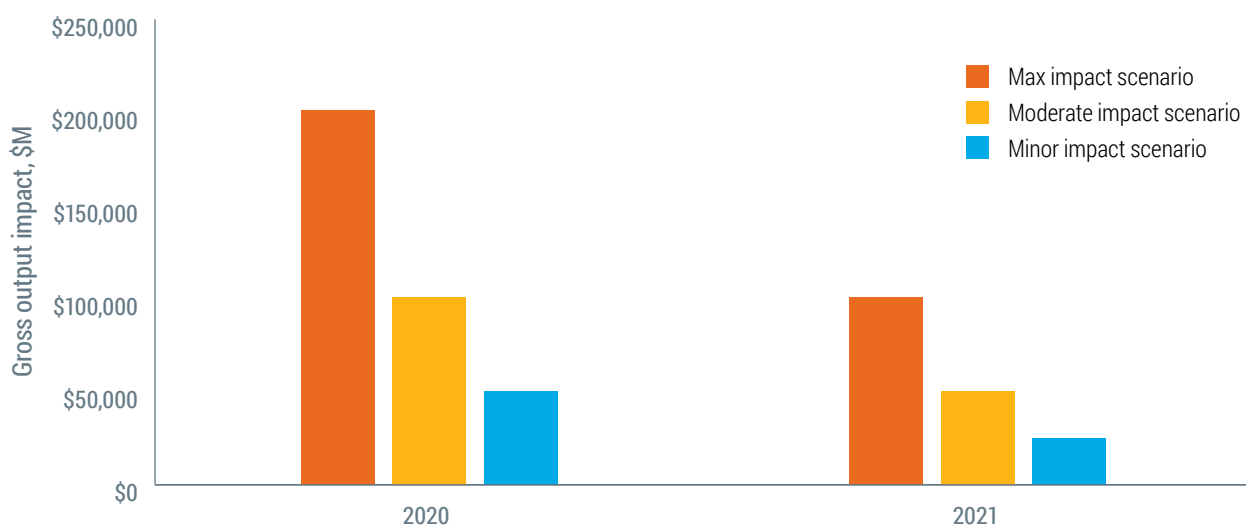
## Digital activity impact

The following sections present the breakdown of digital impact of

- 'Digital activity',
- 'Online retail' and
- 'IT Industry'.

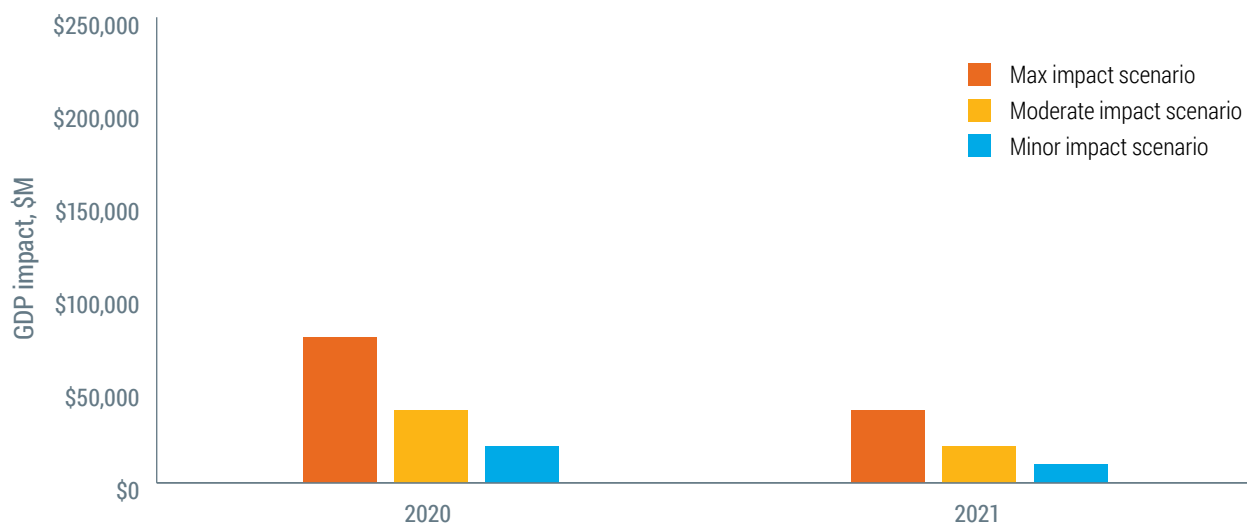
The direct industry contribution of 'Digital activity' ranges between \$14.6B and \$58.5B in 2020, and \$7.3B and \$29.2B in 2021. This generates up to \$201B gross output, \$78.3 GDP and 405,750 job opportunities, which dominates the digital impact.

**Figure 11. Total gross output impacts – digital activity**

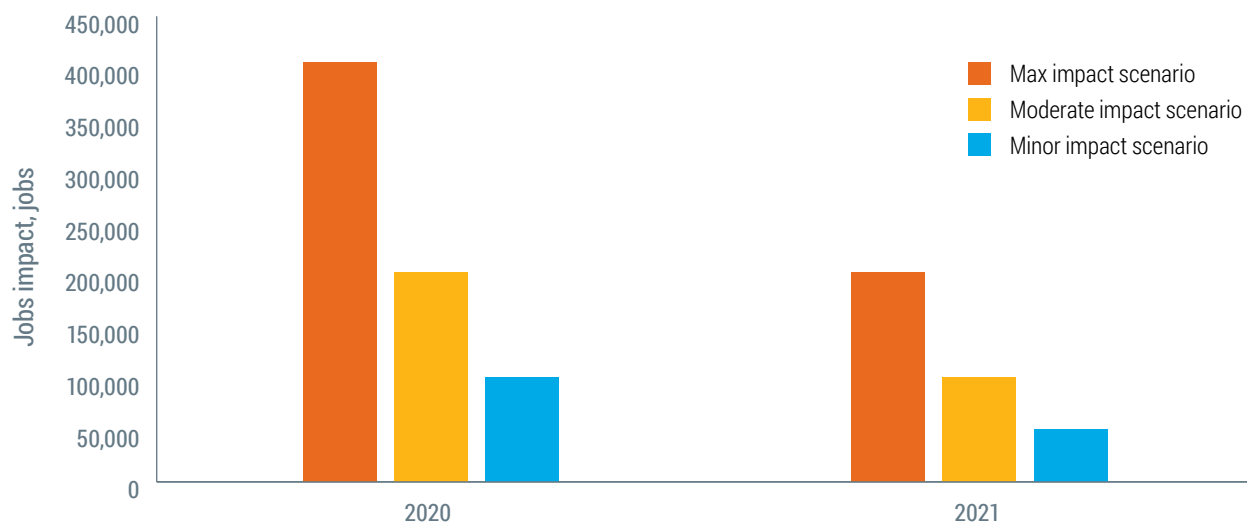




**Figure 12. Total GDP impacts – digital activity**



**Figure 13. Total job impacts – digital activity**

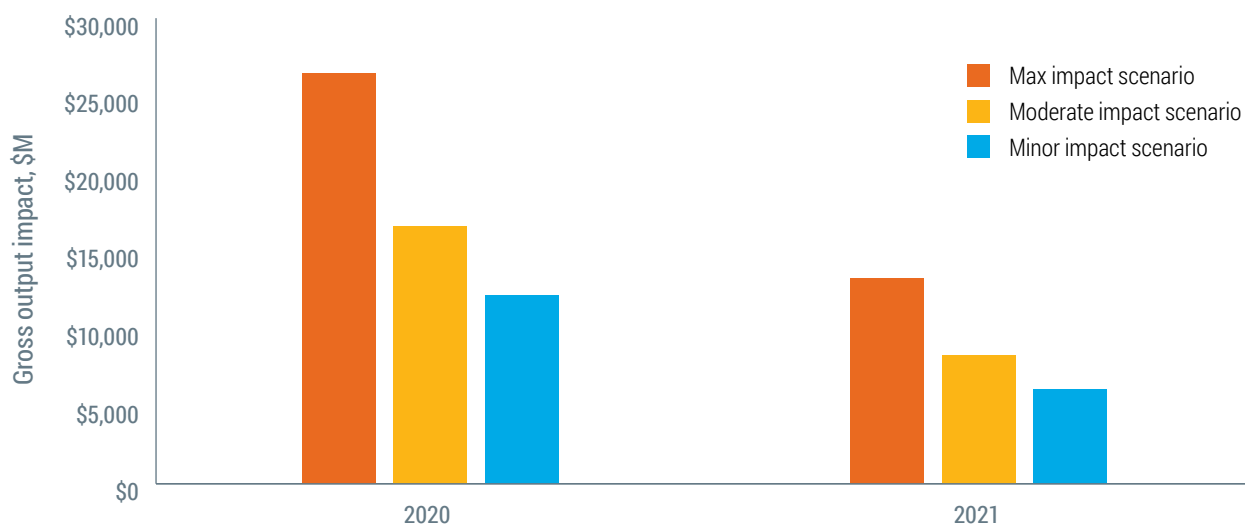




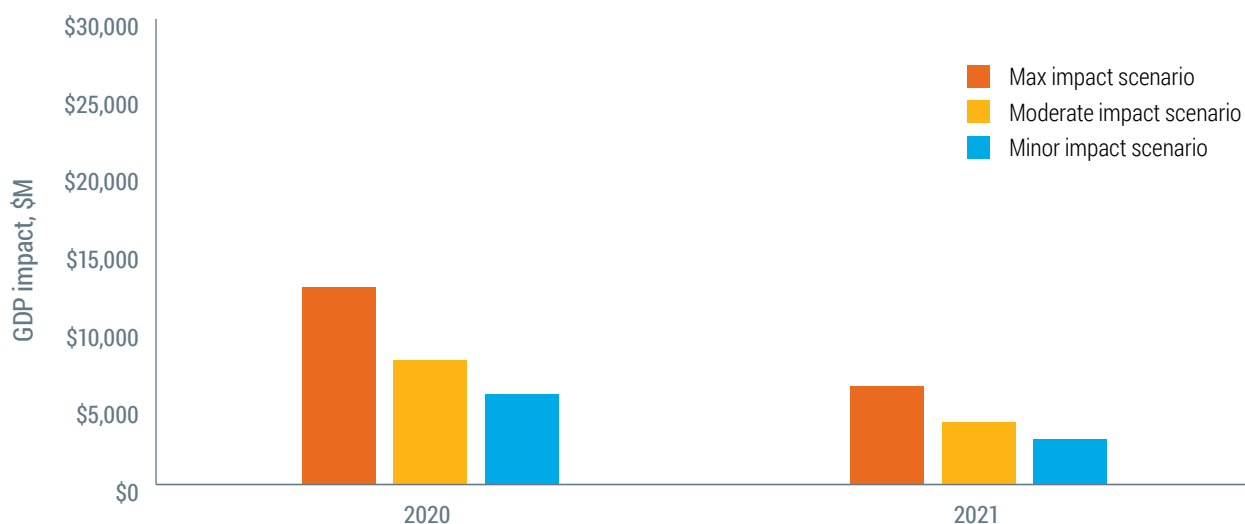
## Online retail impact

Online retail sales continue to grow strongly due to COVID-19 situation, which gradually change how people rely on the internet of things to search, shop and purchase. Online Retail contributes up to 11.5 per cent of gross output impact of the total Digital Infrastructure, while 21.7 per cent of job creation.

**Figure 14. Total gross output impacts – online retail**

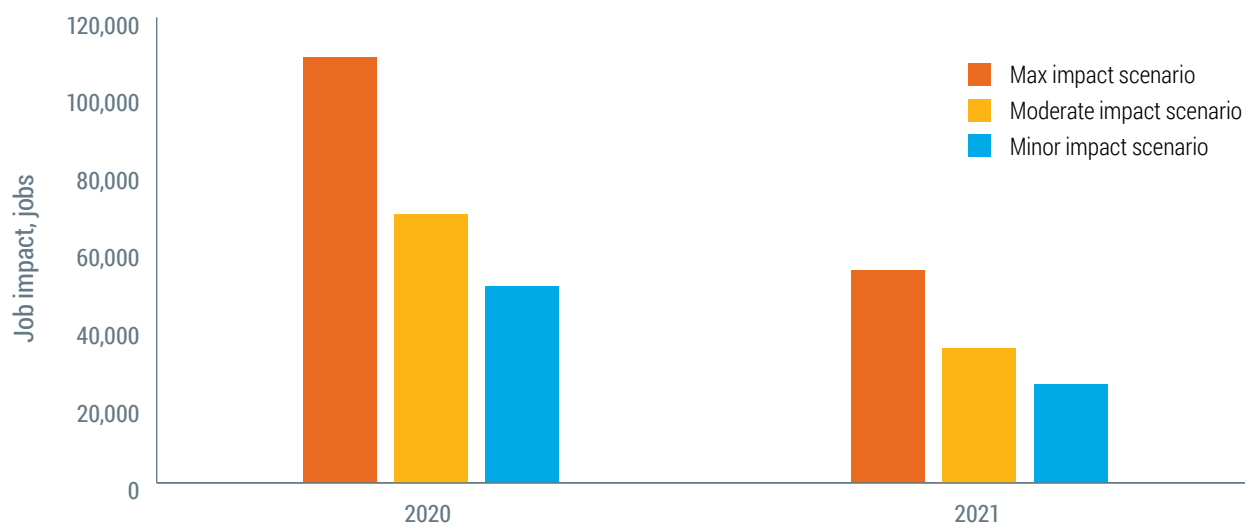


**Figure 15. Total GDP impacts – online retail**





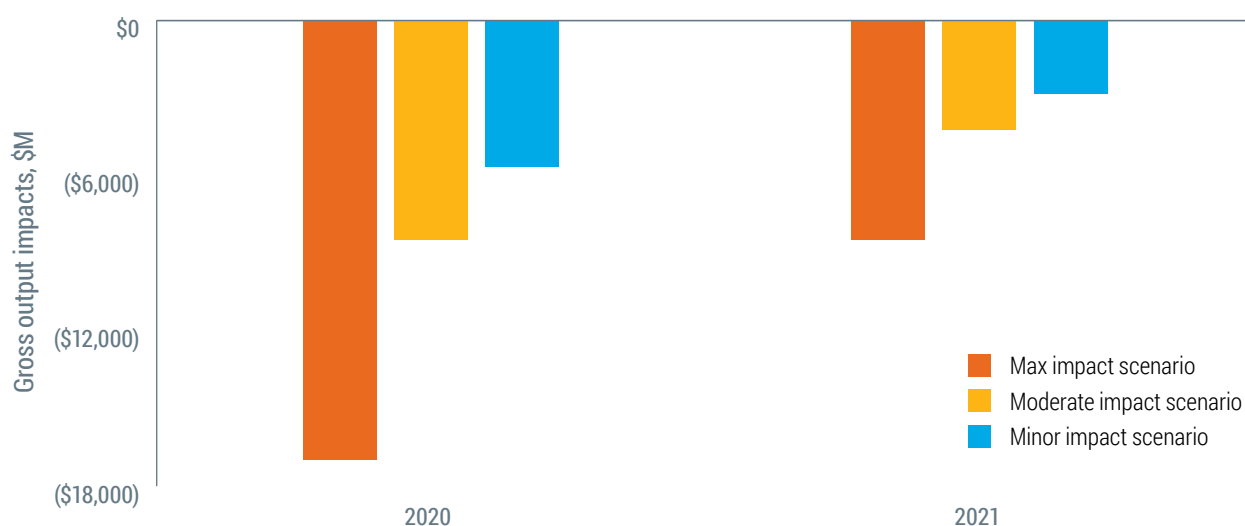
**Figure 16. Total job impacts – online retail**



## IT industry impact

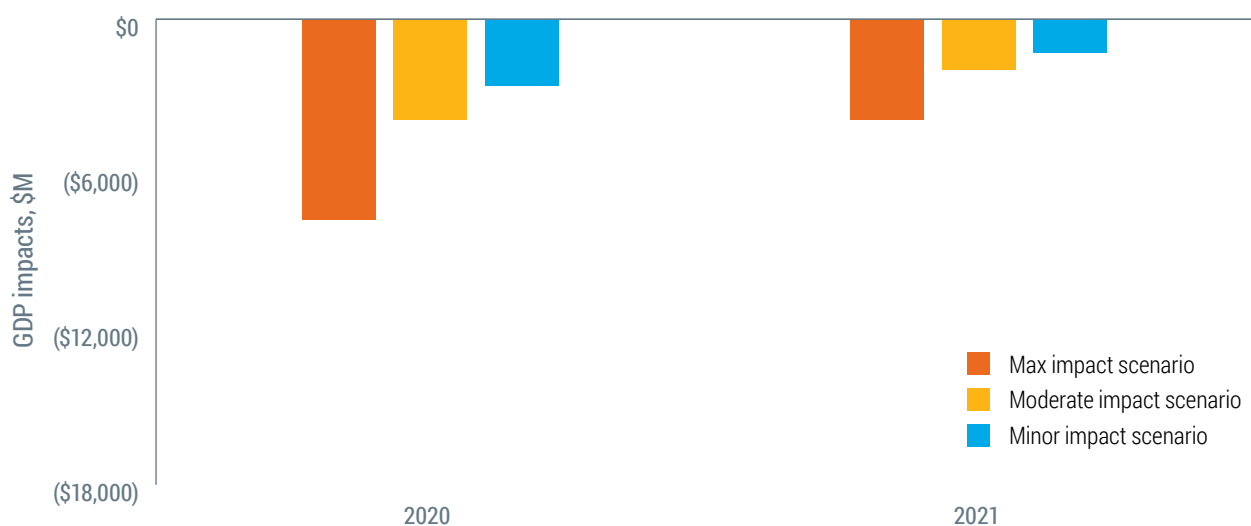
The total economic revenue impact is up to \$16.8B loss (or around 0.86 per cent of national GDP) in the IT industry sectors, resulting in a GDP loss of up to \$7.8B in 2020. Accordingly, the job loss impact is up to 44,885 per year.

**Figure 17. Total gross output impacts – IT industry**

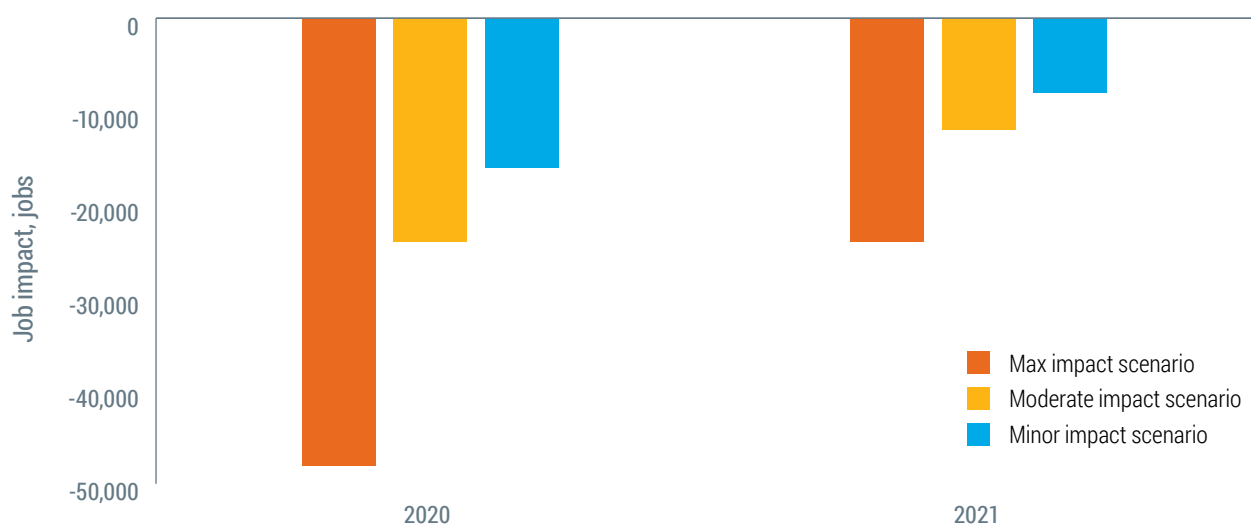




**Figure 18. Total GDP impacts – IT industry**



**Figure 19. Total job impacts – IT industry**



## DATA SOURCES FOR SUPPLEMENTARY REPORT

- ABS National Input-Output Table (#5209.0.55.001), National Accounts: State Accounts (#5220.0), National Accounts: National Income, Expenditure and Product (#5206.0), Labour Force (#6202.0)
- NAB Online Retail Sales Index
- IBISWorld



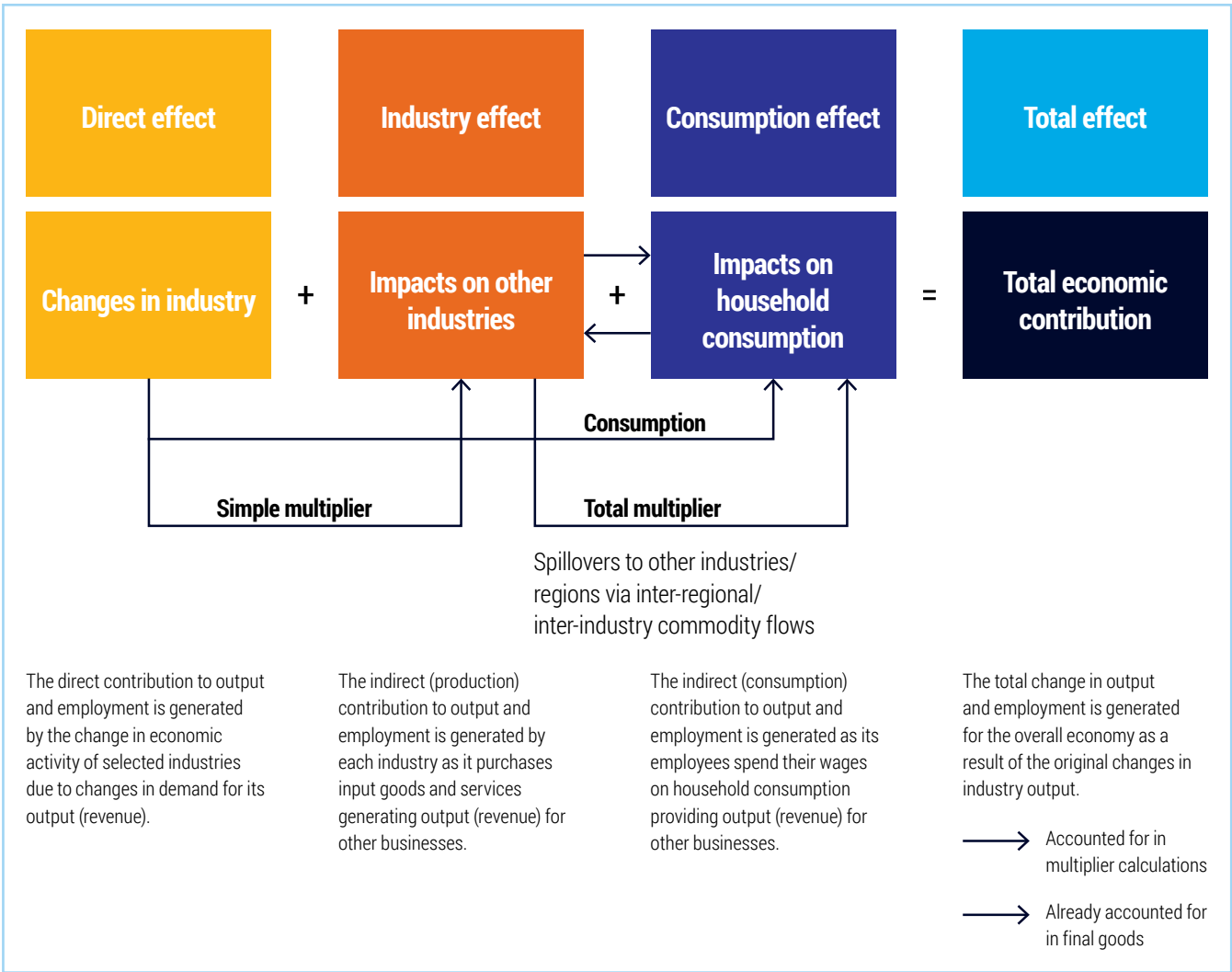
# APPENDIX B

## MODELLING METHODOLOGY

Using the Australian Input-Output databases from the ABS, the Input-Output econometric modelling method is used to measure the economic impact on the industry. The database captures in detail the structure of all industries, use and supply of products, wages, turnover, value added and profits in a fully integrated framework through inter-linkages.

Economic impact analysis using inter-industry models provides a method to evaluate the effects of a project or proposed policy change. The Input-Output econometric modelling approach was selected over other economic impact methods because of transparency and timing; however, the approach does assume that the structure of the economy will remain largely unchanged through the analysis period.

This methodology allows the quantification of additional demand for goods and services, as well as labour through the computation of industry specific multipliers. These are obtained through a mathematical operation known as the Leontief Inverse applied to the Direct Requirements Coefficients of the I-O table. Below is a high-level flow structure.





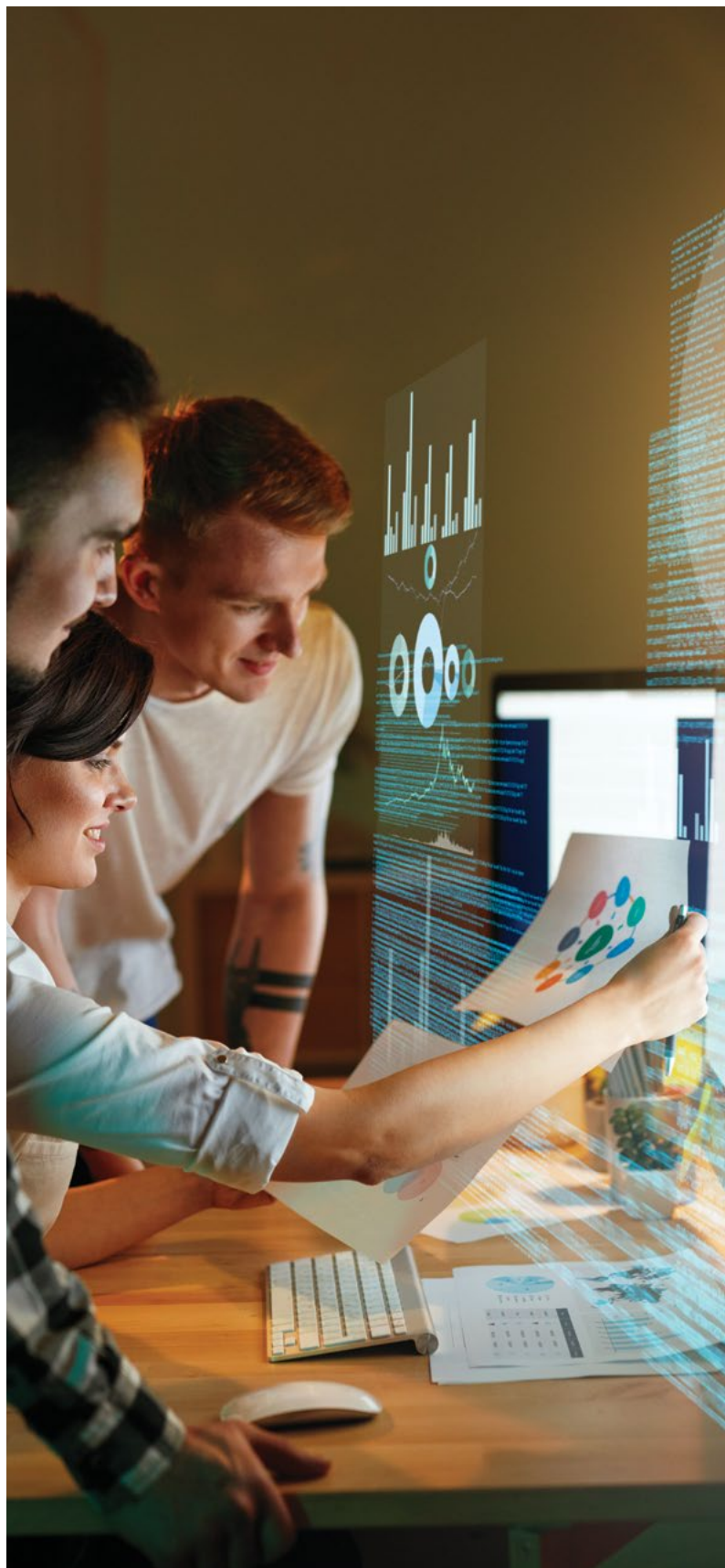
Input-Output econometric modelling was used to estimate the direct, indirect<sup>1</sup> and total economic contribution/impact of COVID-19 onto the categories of 'Digital activity', 'Online retail' and 'IT Industry' to a range of economic variables, including output (or revenue), GDP and jobs. Input-Output econometric modelling uses fixed multipliers based on industry output (i.e. data storage, data process and computer services), if the structure of the economy remains relatively unchanged by economic events. As such, caution should be used when interpreting the results.

## Model limitations

The I-O modelling framework has limitations based on critical assumptions which should be understood when interpreting the results of this type of analysis.

- The methodology assumes fixed production structure for each industry, as well as constant returns to scale. This means that no matter how much output of each industry varies, the per unit cost of production will remain constant.
- The effects of technological changes in production efficiency improvements are not considered unless separately set up on top of the current industry supply-chain setup.
- It is assumed that economic production is not limited by any resource constraints. This means that there exist unlimited supplies of production inputs available to be used in production (including labour).
- The methodology does not account for any price changes that may result from increased competition for limited resources.
- The model does not consider substitution effects to other industries or what may happen to expenditures in other industries (what may happen if a certain industry was completely lost).
- This model considers average effects rather than marginal effects, meaning that the model does not consider unused capacity.
- The I-O model accounts for transfers of direct expenditure from the economy. It is possible for the economic contribution presented to be realised in regions other than the primary region of the economic impact.

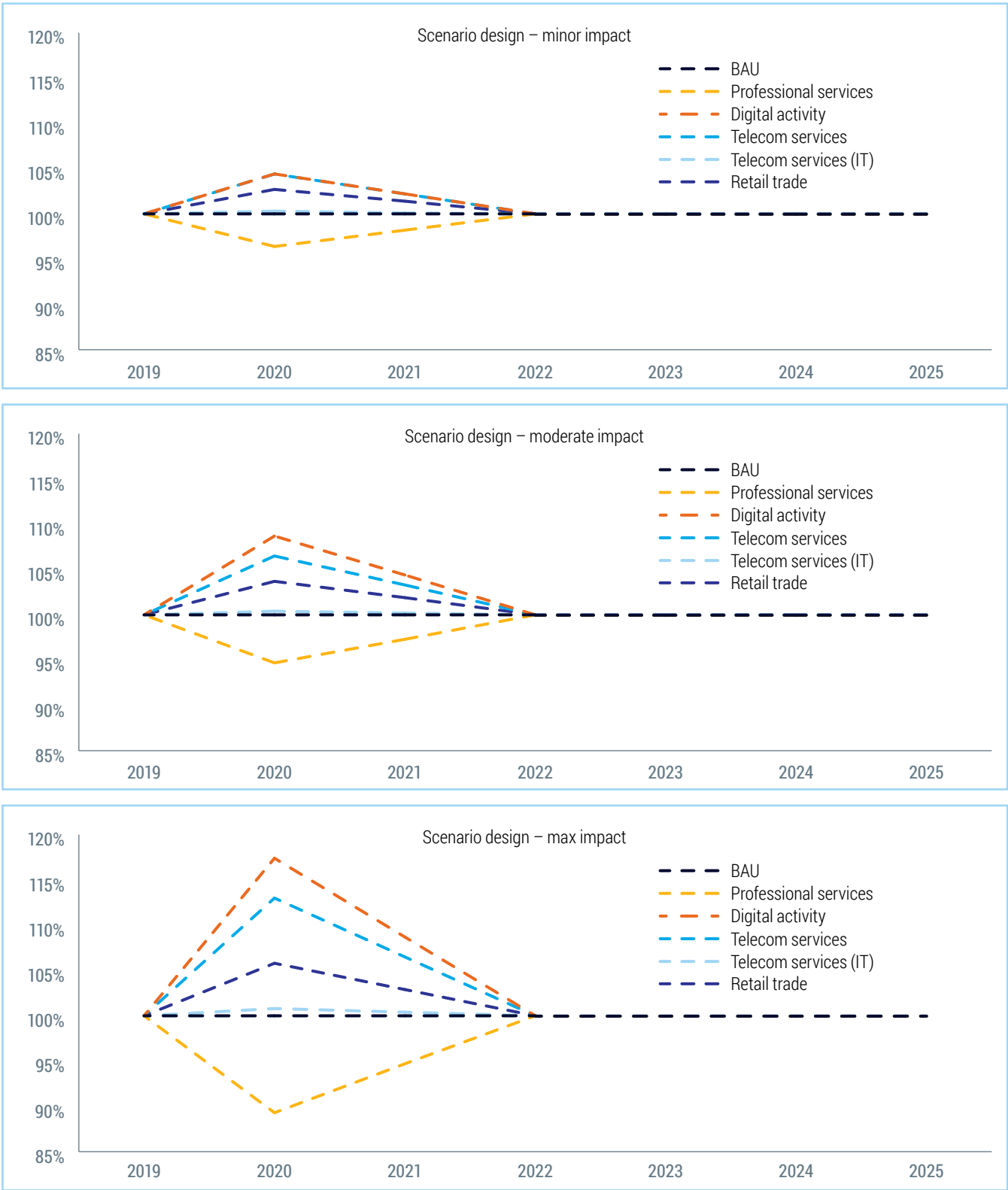
<sup>1</sup> Indirect impact is composed of production-induced and consumption-induced impact.





# APPENDIX C

## SCENARIO DESIGN (ESTIMATION)





## Contact

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