



Hyperscale cloud and its benefits to the Australian economy

Prepared by Mandala

December 2023

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Note: All dollar figures are Australian dollars unless indicated otherwise.

Executive summary

Hyperscale cloud is the critical infrastructure underlying Australia's technology ecosystem

Hyperscale cloud offers globally standardised services to Australian businesses. It enhances user experiences with high performance and low latency across various domains, including AI, machine learning, big data, and virtual reality. Research suggests that Generative AI, supported by hyperscale cloud, has the potential to add up to \$115 billion annually to the Australian economy,¹ and AI more broadly will contribute \$15.7 trillion to the global economy by 2030.²

Acting as a central pillar within the Australian digital ecosystem, hyperscale cloud serves as a critical intermediary, facilitating daily business operations and software relied on by everyday Australians. While non-hyperscale cloud providers offer tailored capabilities, hyperscale cloud delivers globally-leading, comprehensive, sophisticated feature-sets to Australian businesses.

This study focuses on measuring the positive impact of the unique capabilities of the hyperscale cloud to Australian businesses. It examines the distinct features that set hyperscale cloud apart from non-hyperscale cloud solutions. While recognising that shared capabilities between hyperscale and non-hyperscale also contribute to economic value, our focus remains on the

benefits derived exclusively from the hyperscale environment.

Hyperscale cloud technology is crucial for Australian businesses, delivering approximately \$6.3 billion in benefits per annum

Key areas of this impact include:

- **Enhanced Capabilities:** Hyperscale cloud's advanced technological functions including on AI, machine learning, AR/VR and data querying have led to productivity boosts, generating an additional \$3 billion in benefits for Australian businesses.
- **Operational Resilience:** Hyperscale offers increased reliability of services and diminishing expected downtime compared to non-hyperscale cloud, translating to \$530 million in financial savings (avoidance of downtime cost). Hyperscale also decreases the expected likelihood of a successful security breach by 30% due to high investments and global threat intelligence, preserving an estimated \$480 million annually within the Australian economy.
- **Cost Efficiencies:** Hyperscale cloud has trimmed IT infrastructure spending by 5%, amounting to savings of up to \$980 million per year for Australian businesses, thus improving cost efficiencies.
- **Market Access:** By facilitating access to global

markets, hyperscale cloud has unlocked more than a 40% increase in revenue for Australian businesses, broadening their opportunities to serve customers overseas seamlessly and with low latency.

Hyperscale cloud creates direct employment opportunities for over 8,000 Australians, offering a broad ranges of opportunities to a diverse workforce

Over the past decade, direct jobs in hyperscale cloud have more than tripled, from 2,330 employees in 2011 to 8,240 in 2021. This growth demonstrates hyperscale cloud's vital role in job creation across a spectrum of roles, from tech trades to ICT specialists.

The workforce within hyperscale cloud is diverse, with 73% of the employees aged between 15-44, highlighting the sector's appeal to young Australians. This diversity indicates that hyperscale cloud is a driver of high-tech jobs, and also supports a variety of other professional roles crucial to the operation and management of these services.

Upskilling Australians to work in hyperscale cloud and data centre related roles will help them fill the additional global demand for 140,000 data centre staff by 2025.³

Hyperscale cloud offers scale and sophistication that unlocks \$6.3 billion in benefits for Australian businesses and creates over 8,000 direct jobs

Hyperscale means global capabilities...

Hyperscale Cloud

- 1 Hyper-scalable compute power
- 2 Sophistication in offerings

Hyperscale cloud's unique capabilities

Globally standardised services with standardised contracts		Artificial Intelligence capabilities	
Cloud-native optimisation	Pre-built integrations & APIs	High compute performance	
Scalable, appears unlimited	Automation	Consistency	Low latency
Virtual machines with up to 12TB power	On-demand and instant	Resource pooling	
Global footprint	More sustainable through load mgmt.	AR/VR Development Platforms	
Security investments	Machine learning	Broad range of features	Identity management

>8,000 Aussie jobs in Hyperscale

\$6.3B in economic benefits

...which creates unique benefits...

\$2.9B Enhanced capabilities

- **Product development:** Faster development and deployment of products using cloud-native tools, accelerating time-to-market and facilitating R&D.
- **Scaling up:** Businesses can adapt their resources more flexibly than with non-hyperscale cloud, unlocking peak performance.

\$1.0B Operational resilience

- **Lower downtime:** Access to rapid failover capabilities reduce downtime by 2 hours, offering 28% more reliability than non-hyperscale cloud.
- **Heightened security:** through major security investments and geographic resilience, reducing breach likelihood by 30%.

\$1.0B Cost efficiencies

- **Lower costs:** Hyperscale cloud offers a 5% cost savings compared to other cloud solutions in IT infrastructure; and uses 80% less energy per computing load than on-premise.¹
- **Avoided upfront capital expenditure.**

\$1.4B Market access

- **Faster time to market:** faster access to international markets and revenue opportunities with new customers.
- **Lower complexities to go global:** facilitates seamless compliance in new markets.

...that matter to Aussie businesses

As a small business, we can quickly access **AI & machine learning capabilities** to spin up new products and conduct R&D; using the developer guides and tools

Indigital EduTech

It was surprisingly easy to stand up our infrastructure with hyperscale cloud, **whilst managing crucial areas such as cyber security**

Forcite Helmet Systems

The immediate advantage of using hyperscale cloud is it's much faster. **What normally takes 40 hours to run, now takes one hour**

WA Marine Science Institution

We were able to **shave years of our development time** and become a global company overnight – with the US offering a substantial client base

Willow²

Note: 1 IBEC 2022; 2 TCA 2021; all figures are presented in AU\$. Sources: Expert & customer interviews; IDC 2022; Mandala analysis.

1

Hyperscale cloud is the critical infrastructure underlying Australia's technology ecosystem



2

The advanced capabilities of hyperscale cloud creates \$6.3 billion in economic benefits for Australian business



3

Hyperscale cloud providers are creating over 8,000 jobs and upskilling 67,000 workers



4

Coordinated, consistent policy settings with a bias to innovation will capture the benefits of hyperscale



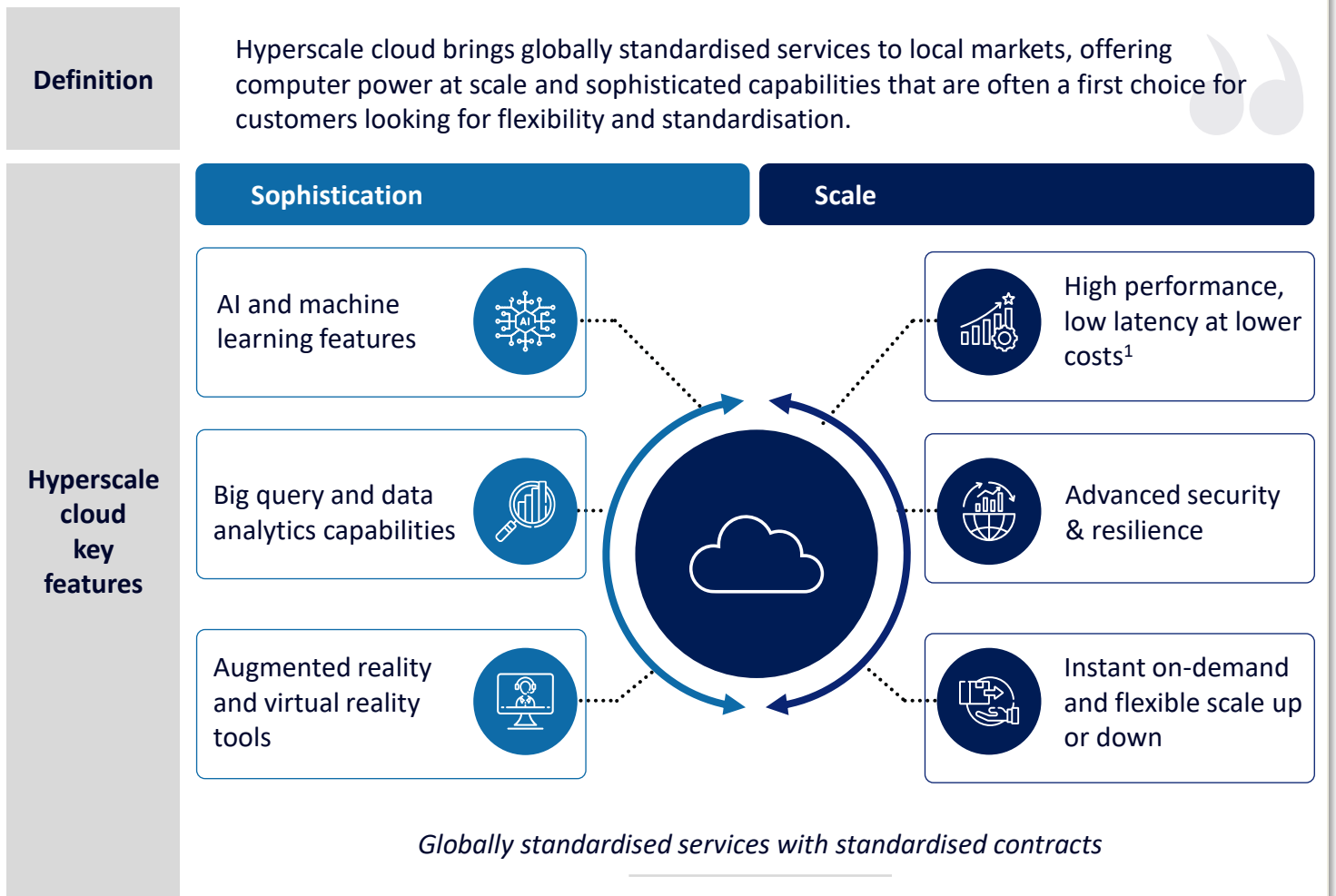
Hyperscale cloud brings globally standardised services at unmatched scale & sophistication

Hyperscale cloud brings globally standardised services to Australian businesses, offering computer power at unmatched scale and sophisticated capabilities. These capabilities make hyperscale cloud a first choice for customers looking for flexibility and standardisation.

Leveraging the sophisticated features of hyperscale cloud, Australian businesses are well-positioned to harness developments in Artificial Intelligence (AI), machine learning, big data querying, and virtual reality. Research projects that Generative AI will add \$115 billion to the Australian economy annually.¹ Looking at AI as a whole, it is predicted to contribute \$15.7 trillion to the global economy by 2030.² This underscores the need to ensure Australian businesses remain at the forefront of new technologies such as AI.

Hyperscale cloud offers high performance and low latency, meaning quicker response times and better experiences for users interacting with software. Globally standardised services make it easy to export capabilities and collaborate with teams globally. Beyond the productivity and innovation benefits, hyperscale offers security benefits of global threat scanning and mitigations.

Exhibit 1: Understanding hyperscale cloud – definition and key features

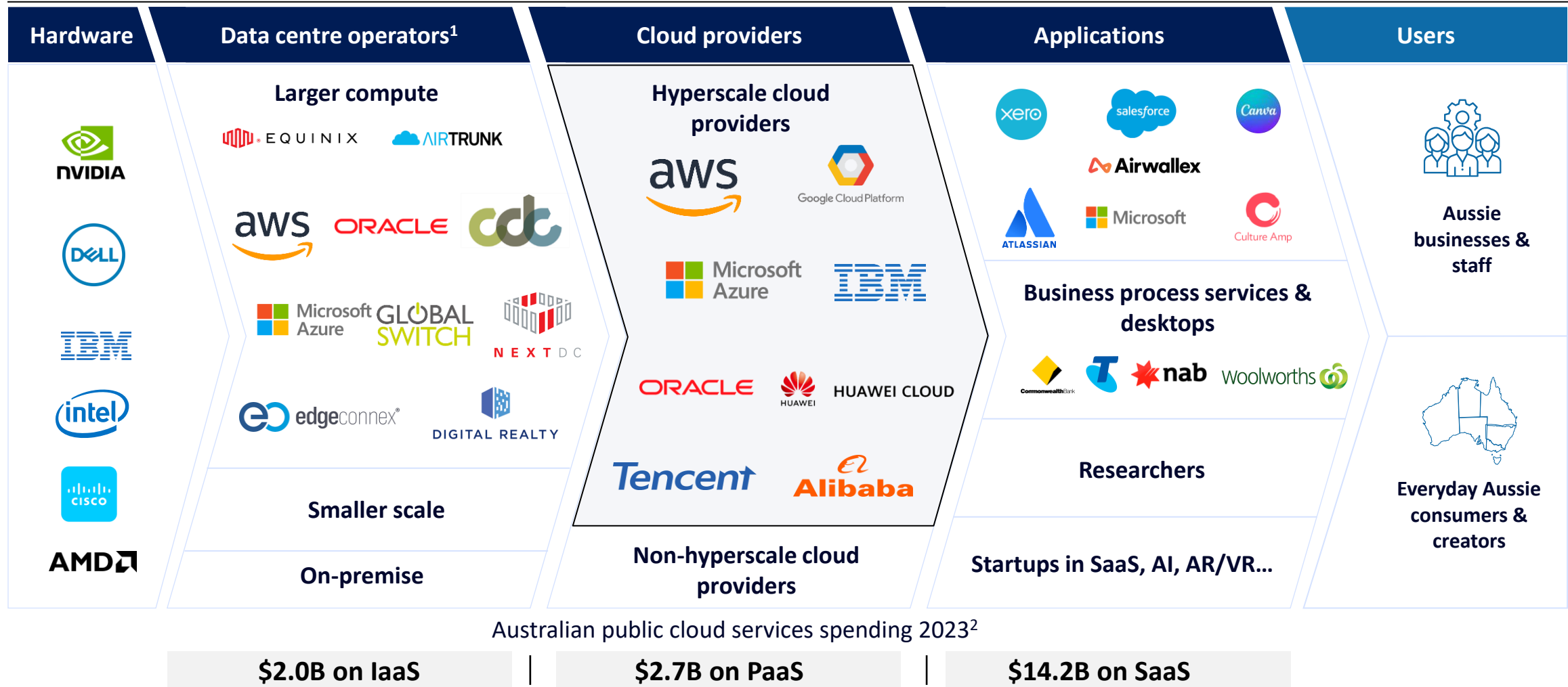


Notes: 1 The Tech Council of Australia 2023; 2 PwC 2023.

Sources: Delzer et al. 2022; Gartner 2022; Cloud Reviews; Company Reports; Expert Interviews; Mandala analysis.

For Australians, hyperscale cloud underpins the digital infrastructure used every day

Exhibit 2: Hyperscale cloud providers are critical enablers of the vibrant Australian technology ecosystem



Notes: 1 Hyperscale cloud providers typically use a mix of their own facilities and leased spaces in co-location data centres. Data centre operators such as Canberra Data Centres, Equinix, Airtrunk, NextDC facilitate hyperscale providers to use their specific hardware setups. For example, Google Cloud Platform (GCP) might not have proprietary centres in Australia but can offer hyperscale through these arrangements. Local data centre providers can house the infrastructure for hyperscale solutions without directly providing them. 2 IaaS means Infrastructure as a Service; PaaS means Platform as a Service; SaaS means software as a service.

Sources: IDC 2022; Gartner 2023; Mandala analysis.

The scale of compute power and the sophistication of capabilities set hyperscale cloud apart

There is a wide variety of cloud providers available to Australian businesses. These providers operate a different levels of scale and service offerings, with non-hyperscale cloud providers offering tailored capabilities and hyperscale cloud offering a globally standardised, sophisticated feature-set.

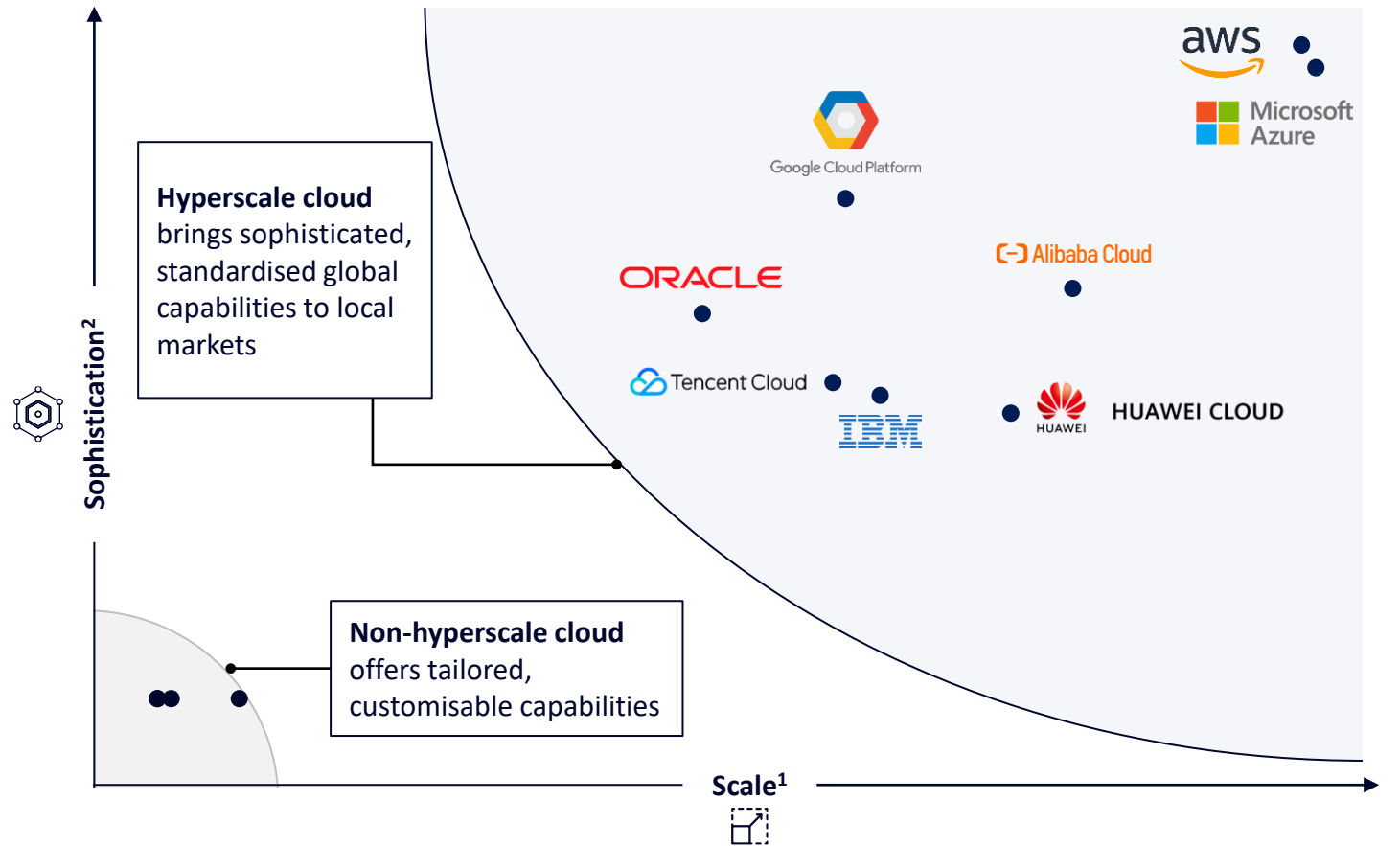
Sophistication measures customer reviews, third party assessments and capabilities in advanced features offered by cloud computing providers, such as AI tools, machine language capabilities, and AR/VR technologies. Harnessing these features is critical to Australia's future.

Scale gauges the volume of compute power a cloud provider can deliver. Major providers like Amazon Web Services (AWS), Microsoft Azure and Google Cloud Platform have invested in globally networked infrastructure to handle vast data needs and deliver market-leading performance.

Non-hyperscale cloud providers focus on specific needs, and these smaller-scale cloud facilities can offer tailored capabilities for specific requirements.

Exhibit 3: Sophistication and scale of cloud providers

X-axis: Scale index out of 10; Y-axis: Sophistication index out of 10, 2023



Notes: 1 Scale was indexed across compute power measures;

2 Sophistication was indexed using customer ratings, 3rd party assessments and geographic locations that offer proximity and low latency services when exporting services.

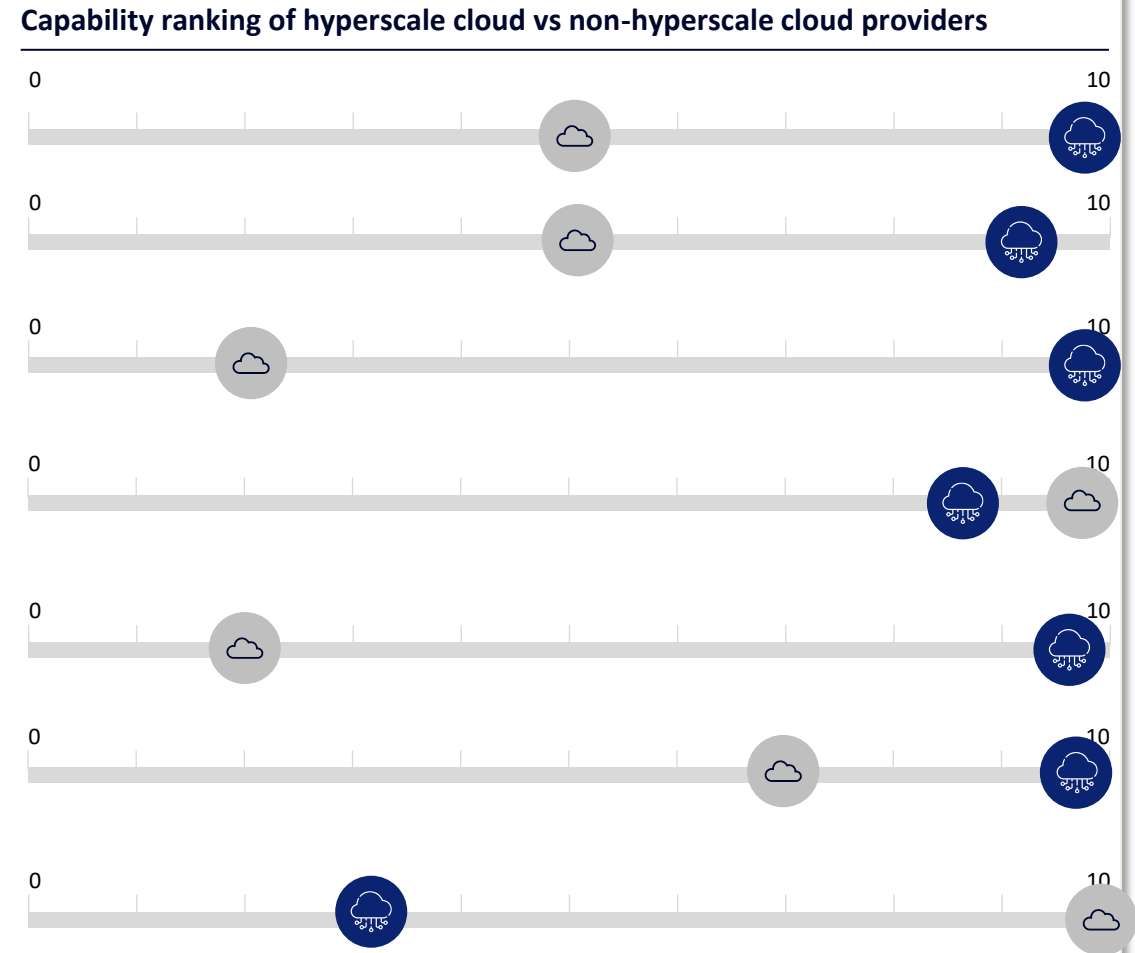
Sources: Gartner [2022](#); Cloud Reviews; Company Reports; Mandala analysis.

Hyperscale cloud offers capabilities that are distinctive and cannot be replicated by smaller non-hyperscale players that focus on customisation as key differentiator

Exhibit 6: Capabilities of hyperscale cloud vs non-hyperscale cloud¹

 Non-hyperscale cloud  Hyperscale cloud

	Description
Scale	<p>Storage</p> <ul style="list-style-type: none"> A key benefit of cloud is storage. Instantly scalable storage enables companies to rapidly scale up without needing to invest in on-premise storage. Hyperscale cloud offers the ability to scale to almost limitless cloud storage. Hyperscale uses 80% less energy per computing load than on-premise.²
	<p>Compute power</p> <ul style="list-style-type: none"> Being able to access large compute power on-demand is increasingly important for innovative and productive companies. The use of virtual machines to conduct computing functions and code is becoming increasingly important in the age of AI and machine learning, AR/VR and big data queries.
	<p>Global Expandability</p> <ul style="list-style-type: none"> Cloud enables businesses and employees to access content anywhere. Global expansion for companies is significantly enabled where they can run computing operations in close proximity to customers. The availability of local data centres also aids compliance with regulations.
Sophistication	<p>Localisation</p> <ul style="list-style-type: none"> Non-hyperscale cloud providers typically have domestic ownership and concentrate on serving a single market. They are focused on local delivery but may be limited in global reach. Hyperscale cloud providers, in contrast, adhere to market mandates and regulatory compliance across various jurisdictions.
	<p>AI, ML, VR Capabilities</p> <ul style="list-style-type: none"> Sophisticated cloud providers offer services for AI and machine learning, AR/VR and analytics. The UX on some of the capabilities is still being improved, but the focus on future innovations in capabilities, enables business to lead on new tech, such as AI, globally.
	<p>Security & Resilience</p> <ul style="list-style-type: none"> Cybersecurity is of critical concern for the cloud. Hyperscale cloud harnesses large investments in expertise and defences alongside global threat intelligence to provide fast patching and advanced security. Cloud providers use multiple locations to improve resilience to natural disasters & disruptions.
	<p>Customisation</p> <ul style="list-style-type: none"> Non-hyperscale cloud providers are able to customise their services on request. With hyperscale clouds emphasis on standardised offerings, it can sometimes be seen as a drawback or might not cater to specific non-hyperscale requirements. Hyperscale performs well on having a suite of integrations and interoperability.



Note: 1 See [Appendix](#) for full lists of hyperscale and non-hyperscale capabilities. 2 IBEC [2022](#).
Sources: Interviews with industry experts; Gartner [2022](#); Microsoft Azure [2023](#); Mandala analysis.

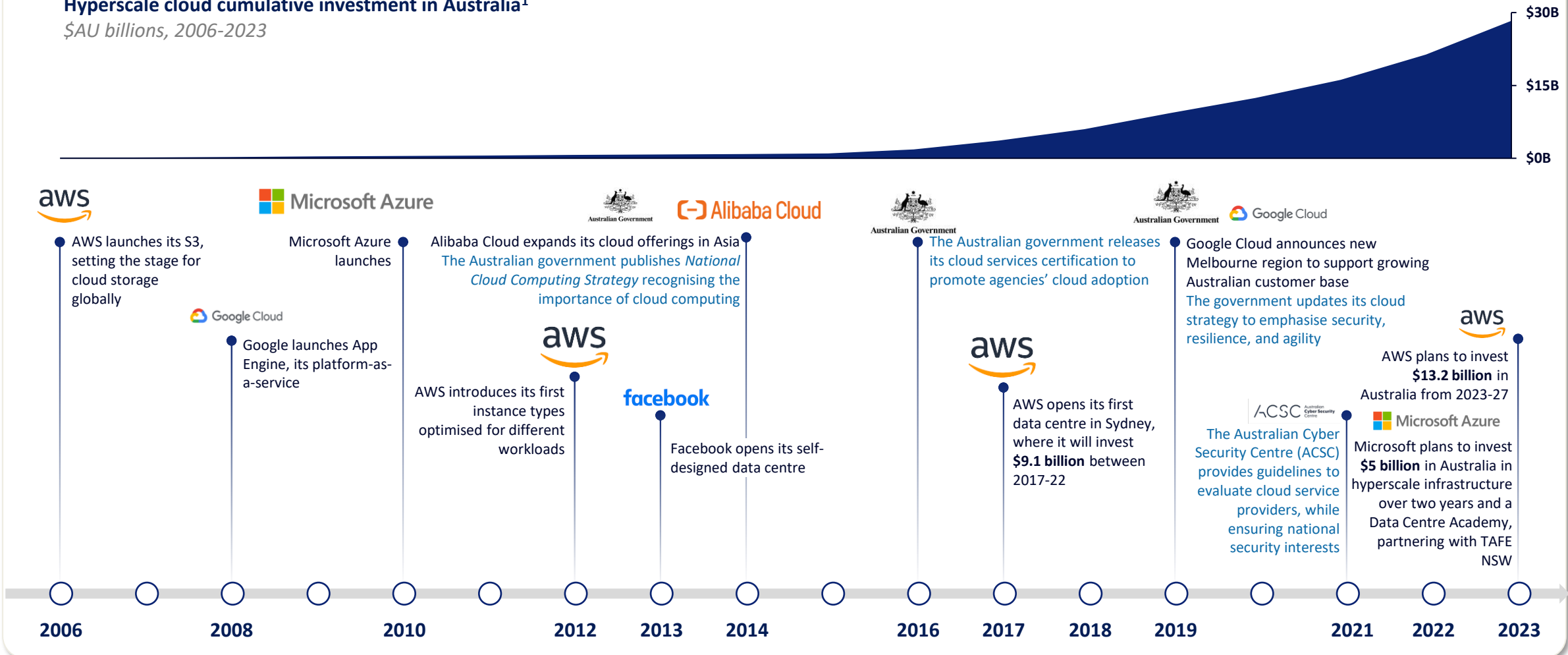
Hyperscale cloud providers have invested tens of billions of dollars in Australia over two decades to grow capacity and develop capabilities that meet customers' needs

Exhibit 7: A history of hyperscale investments and its regulation in Australia

Hyperscale cloud providers Australian government

Hyperscale cloud cumulative investment in Australia¹

\$AU billions, 2006-2023



Notes: 1 Australian figure is estimated based on global investment from hyperscale providers, adjusted for Australia's GDP. Investment for 2023 was extrapolated based on historical growth.

Sources: Synergy Research Group; Australian Government [2013](#); Reuters [2015](#); Amazon [2018](#); Meta [2021](#); IMF [2023](#); IBISWorld 2023; Austrade [2023](#); Microsoft [2023](#); Mandala analysis.

Indigital uses hyperscale cloud’s AI capabilities to integrate cultural imagery into designs, fostering a deep connection with First Nations culture

We built everything [augment reality, machine learning tools] we have from scratch. **Using hyperscale cloud, we could do this efficiently.** From documentation to create scripts and APIs, to new AI and ML interfaces, hyperscale makes it easy to use cutting-edge technologies

— Mikaela Jade, Chief Executive Officer

Indigenous-owned Indigital bridges the gap between critical infrastructure and new technologies with First Nations Country and Culture. Indigital hosts hundreds of programs for schools bringing together new technology skills, including in augmented reality (AR) and AI, and cultural knowledge. Over 9,000 kids and 170 Elders have been engaged in the program. Teachers are upskilled in digital skills through a cultural lens, including AR storytelling.

They also specialise in integrating local Indigenous culture into contemporary projects, ensuring cultural connection and inclusion. Recently, Indigital harnessed AI capabilities – enabled by hyperscale cloud – to train a machine learning algorithm using traditional imagery from the Dharug Nation, producing culturally recognised patterns and imagery for use in data centre designs.



Indigital

Indigenous-owned profit-for-purpose organisation

📍 Sydney, Australia



Western Australian Marine Science Institution

Research organisation

📍 Perth, Australia

© Photo by Mike Cuttler – University of Western Australia

Researchers are using hyperscale’s flexible, collaborative capabilities to better understand new pressures on our oceans

The immediate advantage of using hyperscale cloud is it's much faster. **What normally takes 40 hours to run, now takes one hour.**

This has an **immediate impact on the volume of calculations** and the **sophistication of the scenarios** we can model.

It's a **more reliable, robust and transparent way to do environmental impact modelling** and data can be shared with a regulator considering multiple proposed projects and ecosystem changes.

— Dr Luke Twomey, CEO WAMSI

Hyperscale cloud is enabling Western Australian researchers to create a Shared Environmental Analytics Facility to model the potential impacts of a proposed port on the natural environment and coastline of Cockburn Sound.

The modelling uses large amounts of data on ecology, nutrients, geochemistry and ocean currents to forecast the likely impact of the port on the marine environment.

Using the hyperscale cloud technology, scientists can collaborate with stakeholders around the data, forecasting modelling and core science. This enables faster and better-quality decision-making to unlock environmental and economic benefits.

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Coordinated, consistent policy settings with a bias to innovation will capture the benefits of hyperscale



This study assesses the distinctive capabilities of hyperscale cloud relative to non-hyperscale cloud

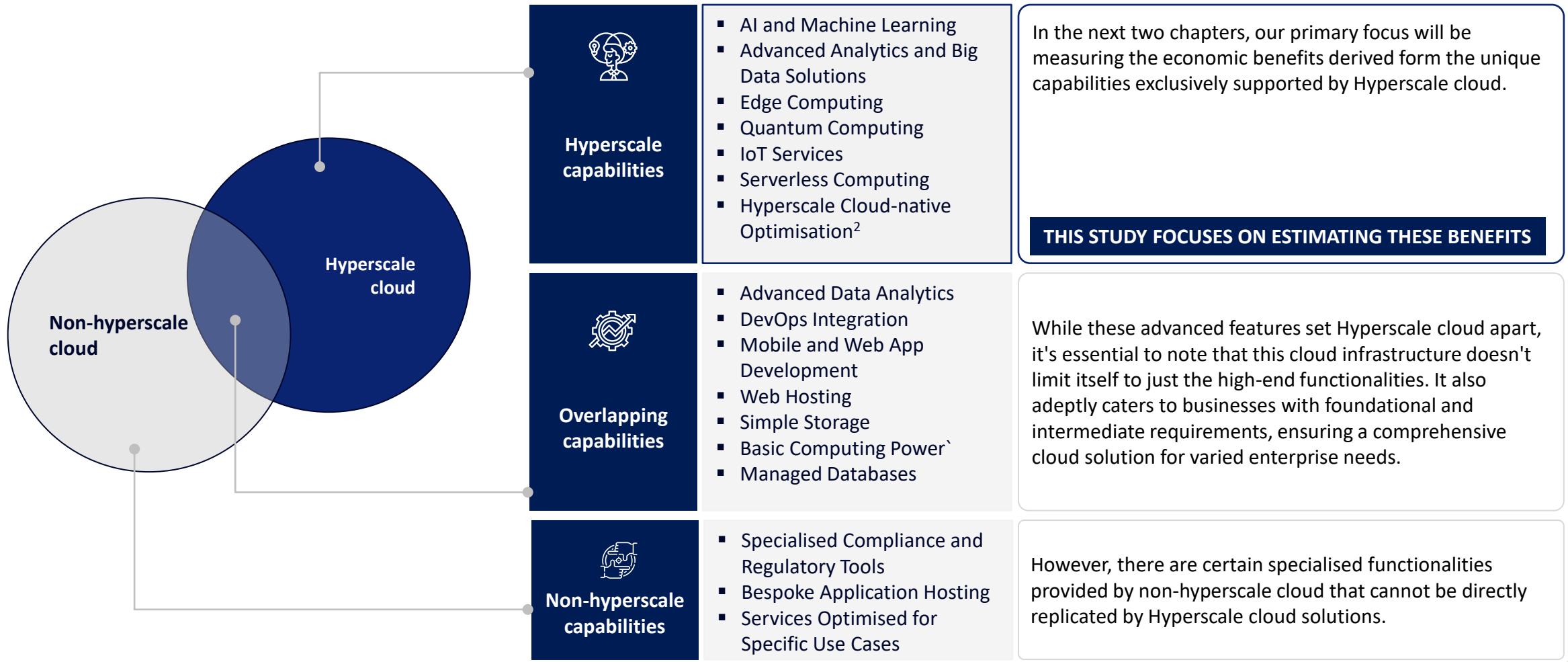
Exhibit 8: Conceptual framework for cloud capabilities



Cloud capabilities by provider¹



Focus of this study

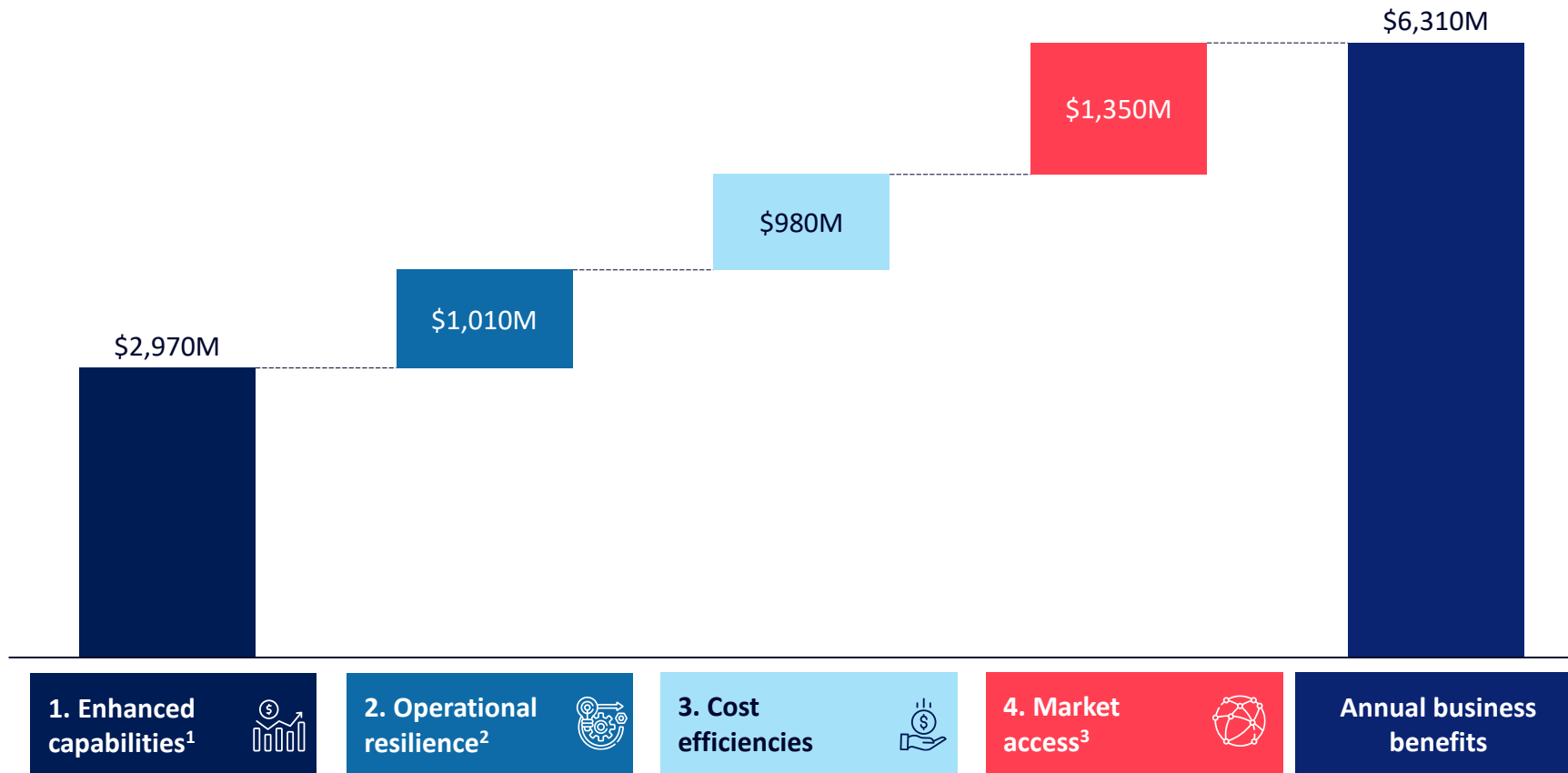


Notes: 1 For illustrative purposes and not an exhaustive list. For more detail see page 42. 2 Cloud-native optimisation refers to services and solutions designed specifically for and within the cloud environment, using the inherent strengths of hyperscale cloud architectures.

Source: Mandala analysis.

Hyperscale delivers \$6.3 billion in benefits for Australian businesses via enhanced capabilities, resilient operations, cost efficiencies and improved access to markets

Exhibit 9: Annual gross economic benefits accrued to Australian businesses from the advanced functionalities of hyperscale cloud
 \$AU millions, 2023



Strategic advantages of hyperscale cloud adoption

- Hyperscale cloud adoption has seen a robust growth trajectory in Australia over the past decade.
- Businesses, both large and small, are rapidly integrating hyperscale cloud solutions to support their operations.

Key Drivers:

- Offering cutting-edge services and tools that drive product and service innovation.
- Hyperscale cloud-native solutions which boost efficiency and agility for businesses, ensuring faster market response.
- Advanced security protocols and tools, minimising potential threats.
- Avoiding large upfront infrastructure costs.

Notes: 1 Enhanced capabilities is inclusive of both the ability for businesses to scale up IT resources instantaneously and the boost in revenue from improved product development.

2 Operational resilience refers to the avoidance of financial losses generated by downtime and security breaches.

3 Market access refers to businesses ability to deploy services and application in multiple regions worldwide, adhering to local complicate and latency requirements.

Sources: Mandala analysis.



The enhanced capabilities unique to hyperscale cloud generate \$3 billion of business benefits

Productivity boosts through hyperscale cloud’s enhanced capabilities generate \$3 billion in extra benefits for Australian businesses. Delving into these productivity boost, two primary drivers emerge: enhanced product development and scaling up capabilities.

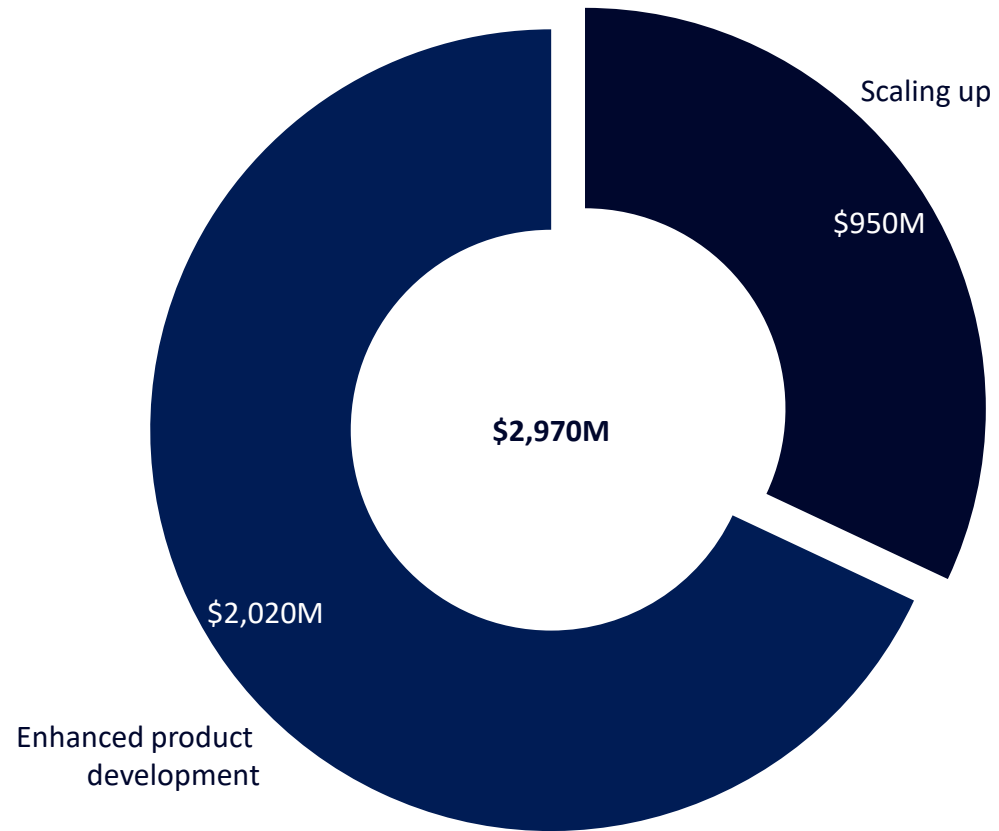
Hyperscale cloud’s sophisticated offerings include developer tools and interfaces for AI and machine learning, to name a few. These tools, combined with the ability for businesses to adopt cloud-native approaches¹, help Australian businesses to boost productivity.

Australian businesses can leverage these capabilities to rapidly develop, test, and deploy new software; keeping them agile and competitive. This unlocks \$2 billion in benefits from higher efficiency, productivity and more time spent on boosting product quality and innovation.

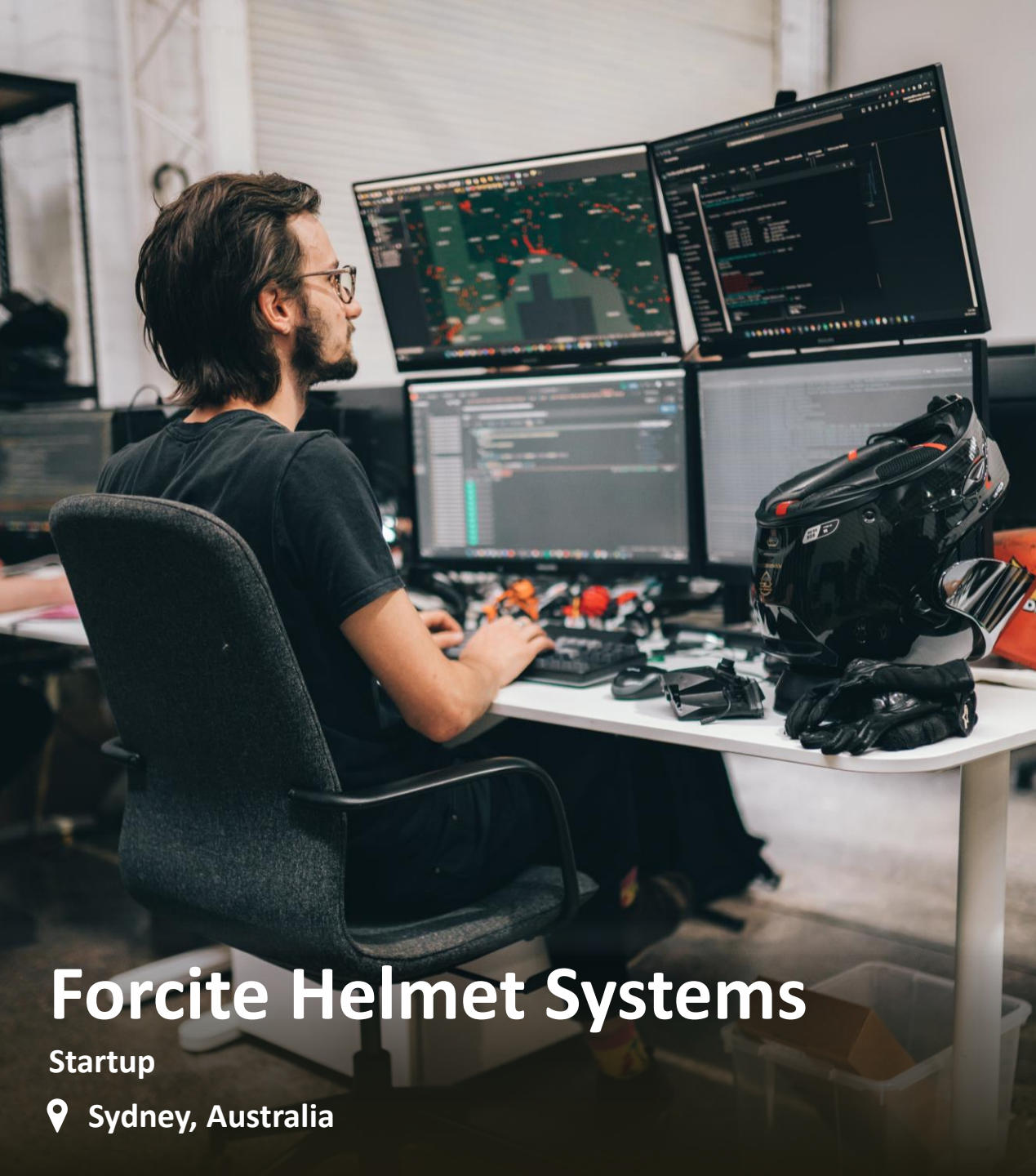
The ability to scale and access compute power and virtual machines on-demand creates an additional \$950 million in benefits for Australian businesses. Businesses can access the scale they need; at the times they want. Whether that is a regular peak time, a seasonal peak, a gradual scale up in capacity needs or a short period of need. The robustness and adaptability of the hyperscale model underpin this capability, giving companies the confidence to scale ambitiously.

Exhibit 10: Productivity benefits from hyperscale cloud

\$AU millions, 2023



Note: 1 Cloud-native architecture and technologies are an approach to designing, constructing, and operating workloads that are built in the cloud and take full advantage of the cloud computing model.
Source: Mandala analysis.



Forcite Helmet Systems

Startup

📍 Sydney, Australia

Using cloud-enabled smart analytics, Forcite's smart helmet showcases innovative product development for motorcycle safety

It's critical for us to get deeply **contextual information to the rider with extremely low latency.**

This requirement has driven us to explore uncharted territory, including **leveraging AI technologies onboard the helmet itself.**

— Tom Larcher, Chief Technology Officer

In 2014, Alfred Boyadgis and Julian Chow began their journey with Forcite, seeing an opportunity to improve motorcyclist safety with innovative helmet technology. With the support of a hyperscale cloud platform, their idea transformed into a tangible smart-helmet that uses AI to predict hazards when riding.

Having raised a significant \$14 million, Forcite is set for expansion. A crucial element in their steady growth has been harnessing the power of hyperscale cloud platforms. The advantages of using hyperscale cloud in product development include consistent scalability, reliable infrastructure, and straightforward deployment of resources.



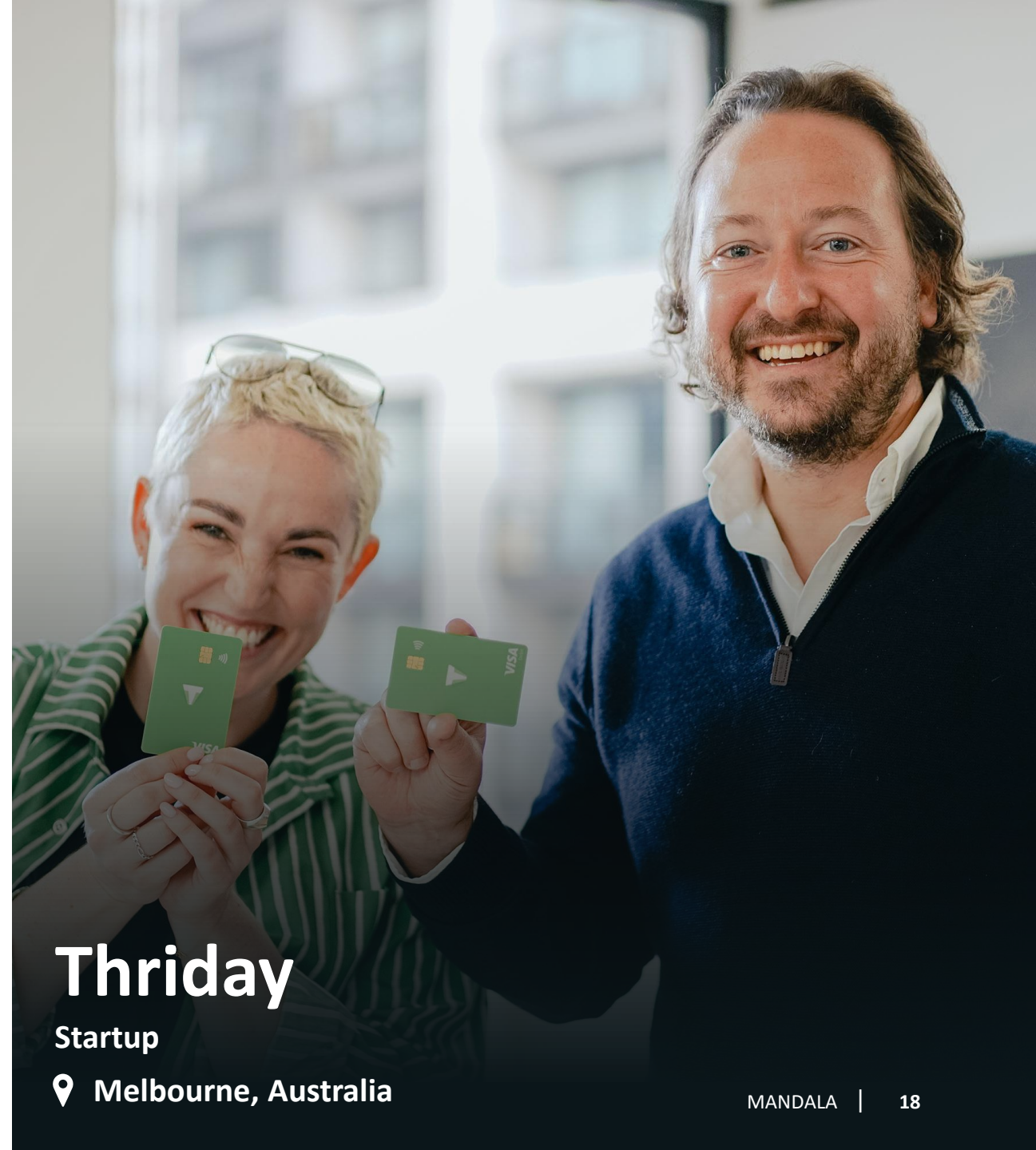
Thriday leverages hyperscale cloud capabilities to fuel its swift expansion in helping small businesses

It's been an absolutely crazy few months at Thriday HQ. Even saying 'absolutely crazy' feels like a severe understatement. We went live to sole traders after a four-month Beta phase, we hired half a dozen people, and **we successfully completed a pre-Series A fundraising of \$6 million.**

— Michael Nuciforo, Chief Executive Officer

Founded in 2019 by Michael Nuciforo and Ben Winford, Thriday aims to alleviate the financial administrative burdens of small business owners in Australia. Their platform uses AI and machine learning to streamline financial tasks such as creating invoices, real-time cash flow forecasting, and lodging business activity statements.

Leveraging from hyperscale cloud capabilities, Thriday ensured robust data security and compliance. This technological decision has been pivotal in their scaling journey. Since its launch, Thriday quickly amassed a waitlist of over 11,000 small businesses and has expanded its team to 30 employees working globally. Their growth strategy is underpinned by a commitment to customer satisfaction and a long-term vision, evident in their partnerships and successful fundraising milestones.



Thriday

Startup

📍 Melbourne, Australia

Hyperscale cloud's improved reliability is saving Australian businesses \$530M per year

Exhibits 11 and 12 shows the reduction in the financial impact of downtime incidents, with hyperscale cloud helping all businesses save a total of \$530 million in 2023.

Hyperscale cloud platforms reduce service interruptions, translating to financial savings for businesses. With a 28% decline in expected downtime per incident, companies utilising hyperscale cloud experience approximately 4 hours of outage, while non-hyperscale cloud users face about 6 hours. In the context of data centre statistics: smallest data centres face the largest costs during outages whereas largest data centres bear roughly half of those costs.²

The financial implications of this improved uptime are immense. An annual expected financial saving from reduced downtime, when using hyperscale cloud, is roughly \$24,000 on average for an Australian business. This means that over the course of a year, businesses can redirect these funds towards growth initiatives, R&D, or other critical areas.

Geographic consistency ensures unmatched reliability with hyperscale cloud. Through a networked computing system, data can be shifted between data centres should a natural disaster occur, such as fire, flood, tsunami or earthquake.

Exhibit 11: Modelled operational downtime when a low probability downtime incident occurs

Hours of outage per occurrence

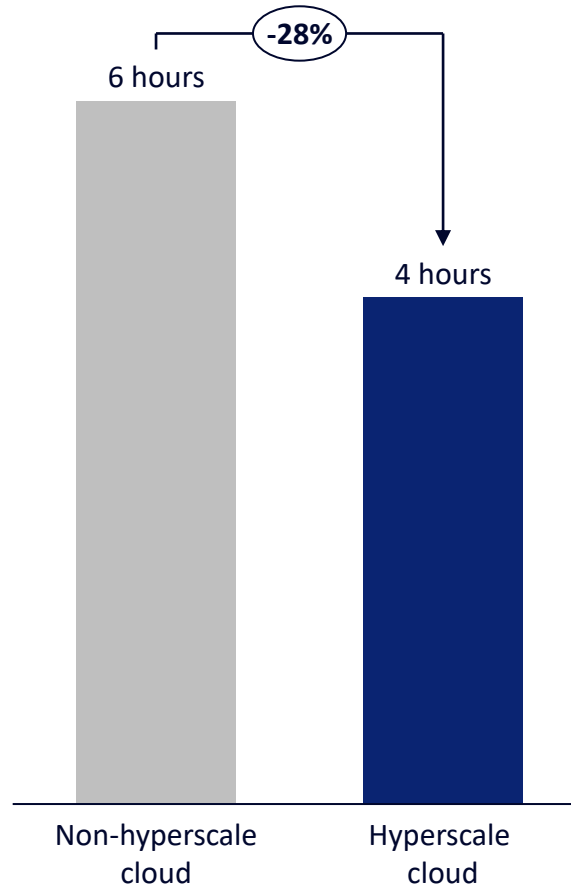
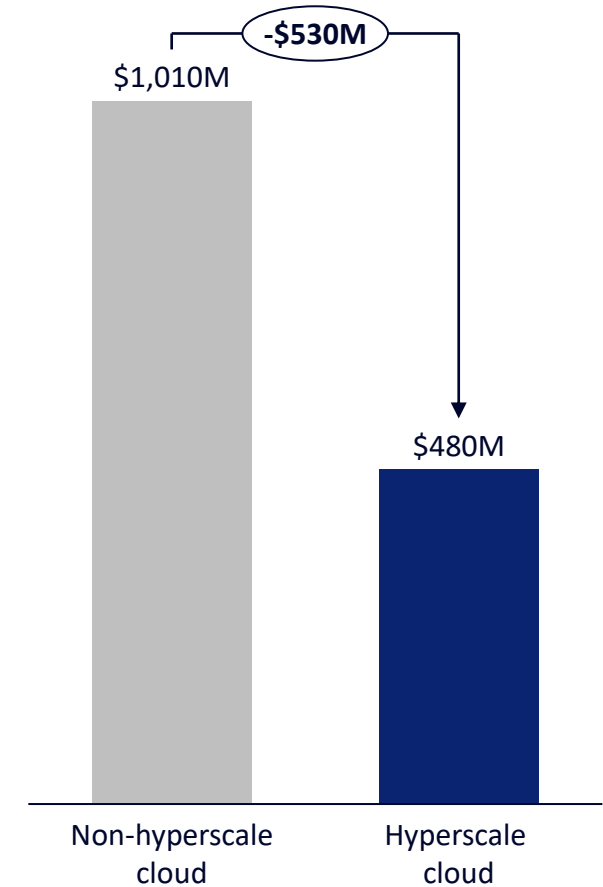


Exhibit 12: Expected financial losses from downtime incidents¹

\$AU millions, 2023



Notes: 1 The expected financial loss is the average annual cost of an outage, weighted with a scenario of 99.9% uptime.

2 Ponemon Institute [2016](#).

Sources: Mandala analysis.



Hyperscale cloud investment in cyber security reduces breaches by 30 per cent, avoiding \$480M in losses

The digital landscape faces increasing security threats, underscoring the importance of robust protection for businesses. As our reliance on online platforms grows, the need to minimise potential vulnerabilities becomes paramount.

22 per cent of 700 surveyed Australian businesses reported a cyber incident in FY22—a rise from 8 per cent in FY20—with 14.6 per cent facing financial implications.³ Australia’s average breach cost has risen to \$4 million, with industries like financial services experiencing higher costs of up to \$5.6 million.⁴

Hyperscale cloud decreases the likelihood of security breaches by 30 per cent, effectively making more resilient against cyber threats, as per Exhibit 14. This enhanced security is a result of advanced infrastructure and constant updates based on global threat intelligence, bolstered by billions in investments from hyperscale providers.

Hyperscale cloud preserves an estimated total of \$480 million in the Australian economy annually by reducing the average business losses from security breaches.

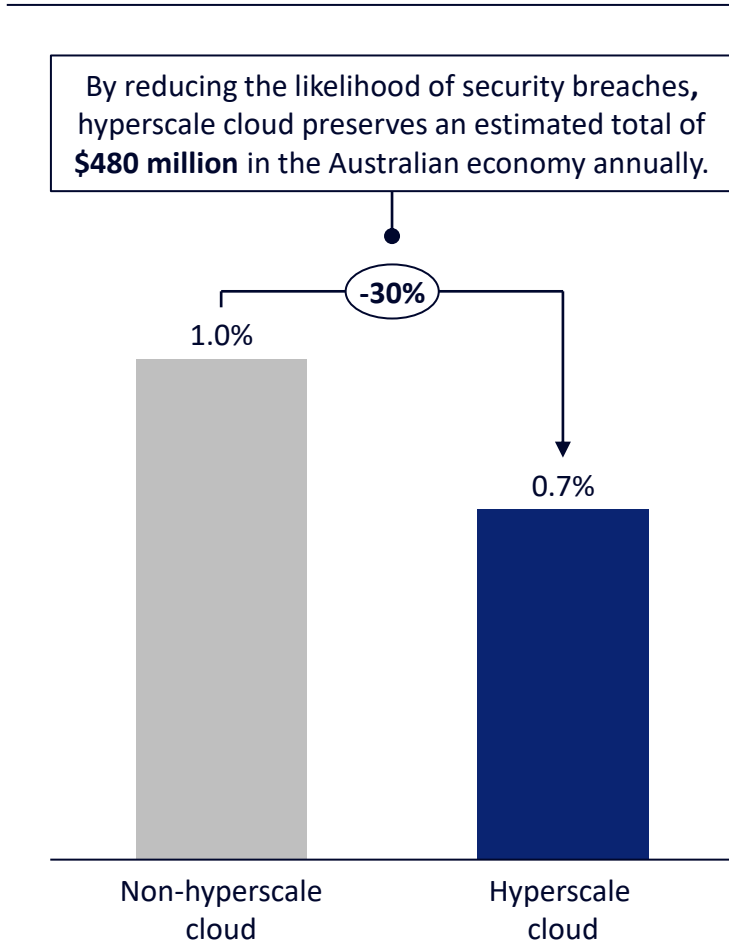
Exhibit 13: Global Investments in cybersecurity¹

\$AU billions, 2023



Exhibit 14: Likelihood of security breach²

Average probability per annum



Notes: 1 We adjusted the cybersecurity spending plans to annual figures presented in AU\$.

2 The likelihood is determined by the average probability of a breach with financial losses per business, factoring in employment size. The numbers listed present an average of probabilities across business sizes. 3 ABS 2023. 4 IBM cited in Sharma 2023.

Sources: CNBC 2021; AWS 2022 & 2022; Mandala analysis.



DTEK Group

Commercial energy operator

📍 Kyiv, Ukraine

Hyperscale’s cybersecurity features helped DTEK Group keep the lights on during the Ukraine – Russia conflict

With the help of hyperscale, we guarantee convenient and secure operation of IT systems and new solutions for our business. **The hyperscale platform also helped maintain stability in challenging environments.**

Digital transformation is a matter of business survival and competitiveness. **It is not a luxury, but a necessary condition for business protection and development.**

— Dmytro Osyka, CIO of the DTEK Group

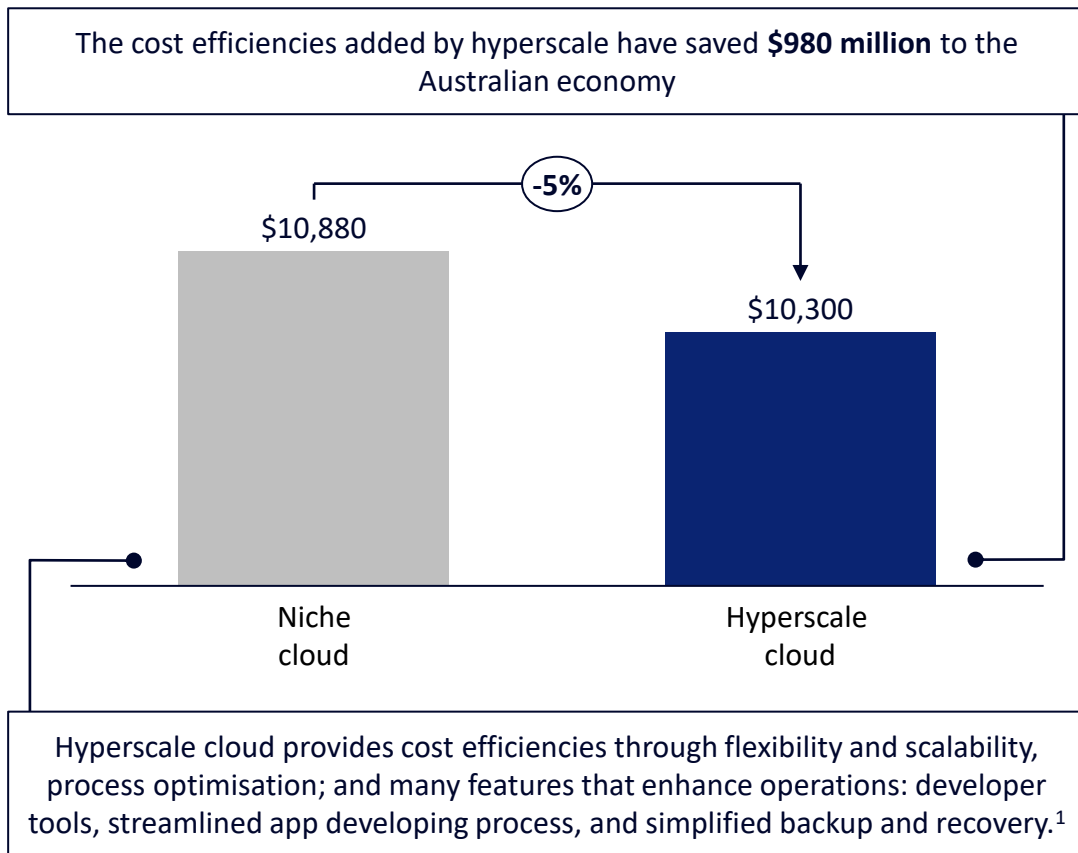
DTEK Group, Ukraine's premier commercial energy operator, delivers power to the nation's homes, businesses, and essential infrastructure. During the war in Ukraine, the operator turned to hyperscale cloud capabilities to reinforce its digital defence mechanisms. By harnessing the power of enhanced resilience, DTEK maintains seamless, secure global communication; while also strengthening data protection amidst escalating cyber threats. This highlights the pivotal role of advanced cloud technologies in supporting businesses and countries during periods of threat.



Hyperscale cloud reduces spend on IT infrastructure by 5 per cent, saving Australian businesses up to \$980M per year

Exhibit 15: Revenue spent on physical IT infrastructure

\$ spent on tangible IT assets out of every \$500,000 of revenue, 2023



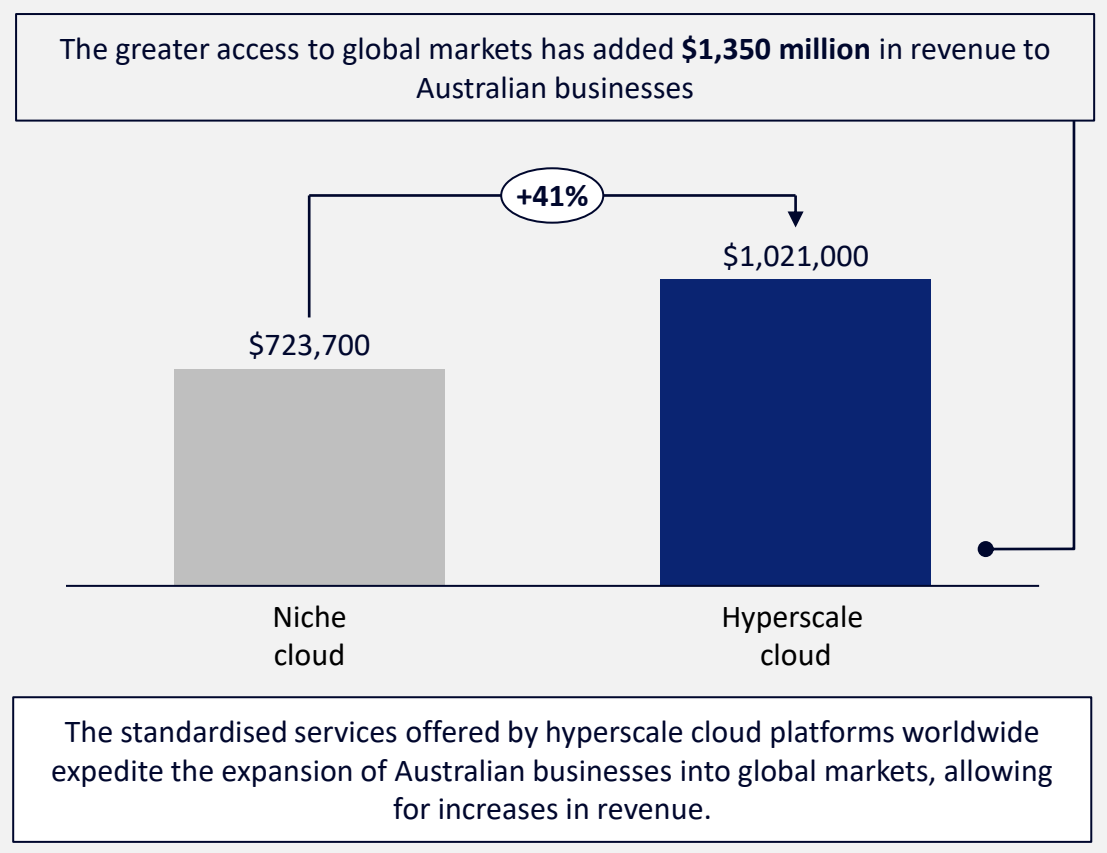
Note: 1 See [Appendix](#) for full lists of hyperscale and non-hyperscale capabilities.
Sources: Delzer et al. [2023](#); Mandala analysis.



Hyperscale cloud unlocks more than 40% in revenue by enabling Australian businesses access to global markets

Exhibit 16: Estimated average revenue boost from global access to markets

\$AU, 2023



Sources: ABS [2023](#); Mandala analysis



Investment in Renewables

Hyperscale cloud infrastructure

 Global

Hyperscalers such as Microsoft are investing in renewable energy to power the tech ecosystem

“Data centres, essential for modern digital services, are assisting the transition to renewable energy sources.”

This is a key principle of Microsoft’s renewable procurement strategy – that we contribute to growing grid capacity rather than just purchasing what is already available.

— Microsoft

Many hyperscale providers are prioritising renewable energy investments to power their data centres. For example, Microsoft is investing in power purchase agreements with partners world-wide to buy clean energy, sometimes even before its produced. This helps expand and accelerate the production of renewable energy resources.

One example is Microsoft’s 15-year power purchase agreement with Fotowatio Renewable Ventures Australia. The renewable energy from its new Walla Walla Solar Farm in the Riverina region of NSW will help meet Microsoft’s goal of 100 per cent renewable energy supplies by 2025 for its Australian data centres.

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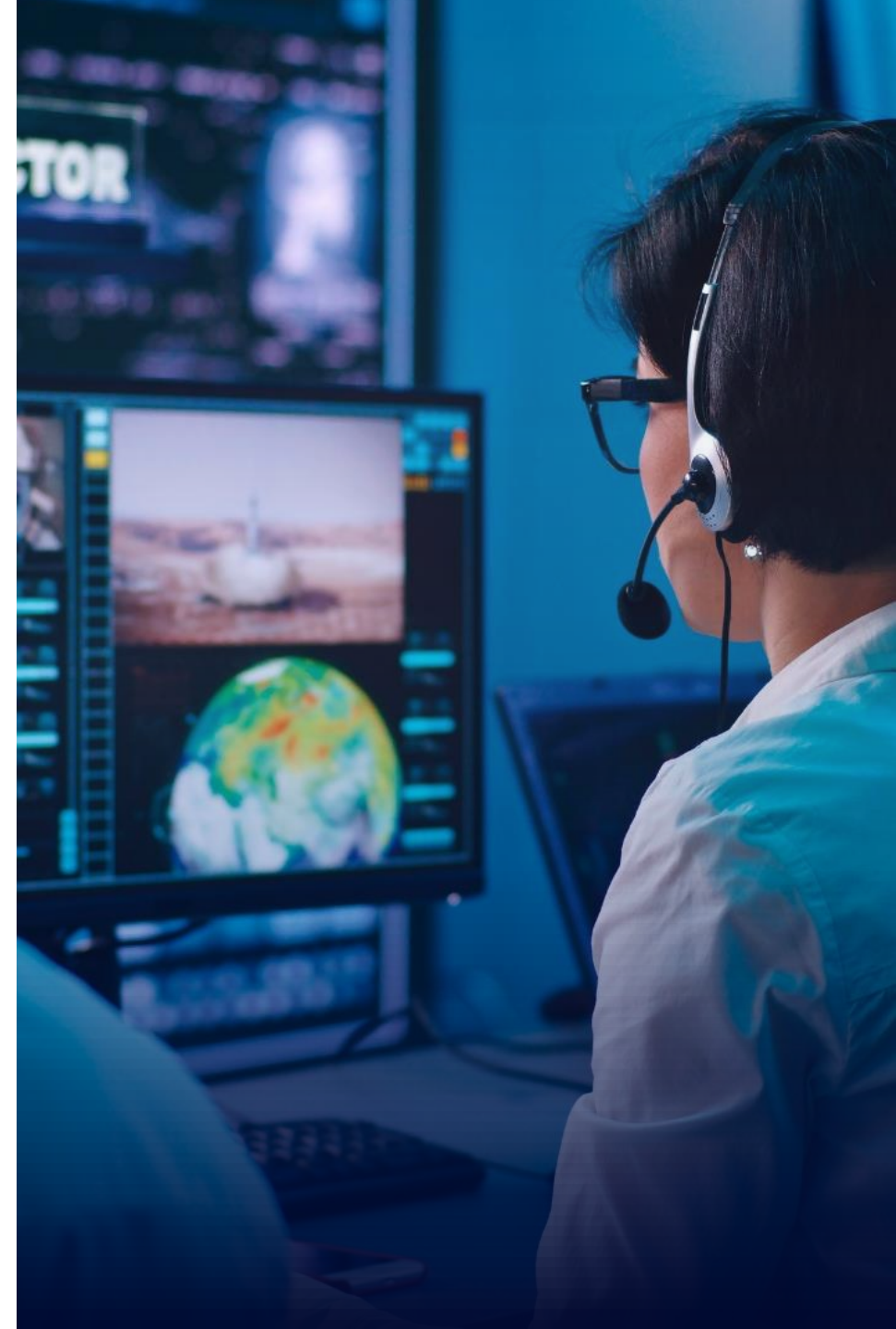
3

Hyperscale cloud providers are creating over 8,000 jobs and upskilling 67,000 workers



4

Coordinated, consistent policy settings with a bias to innovation will capture the benefits of hyperscale



Hyperscale cloud provides direct job opportunities for over 8,000 Australians

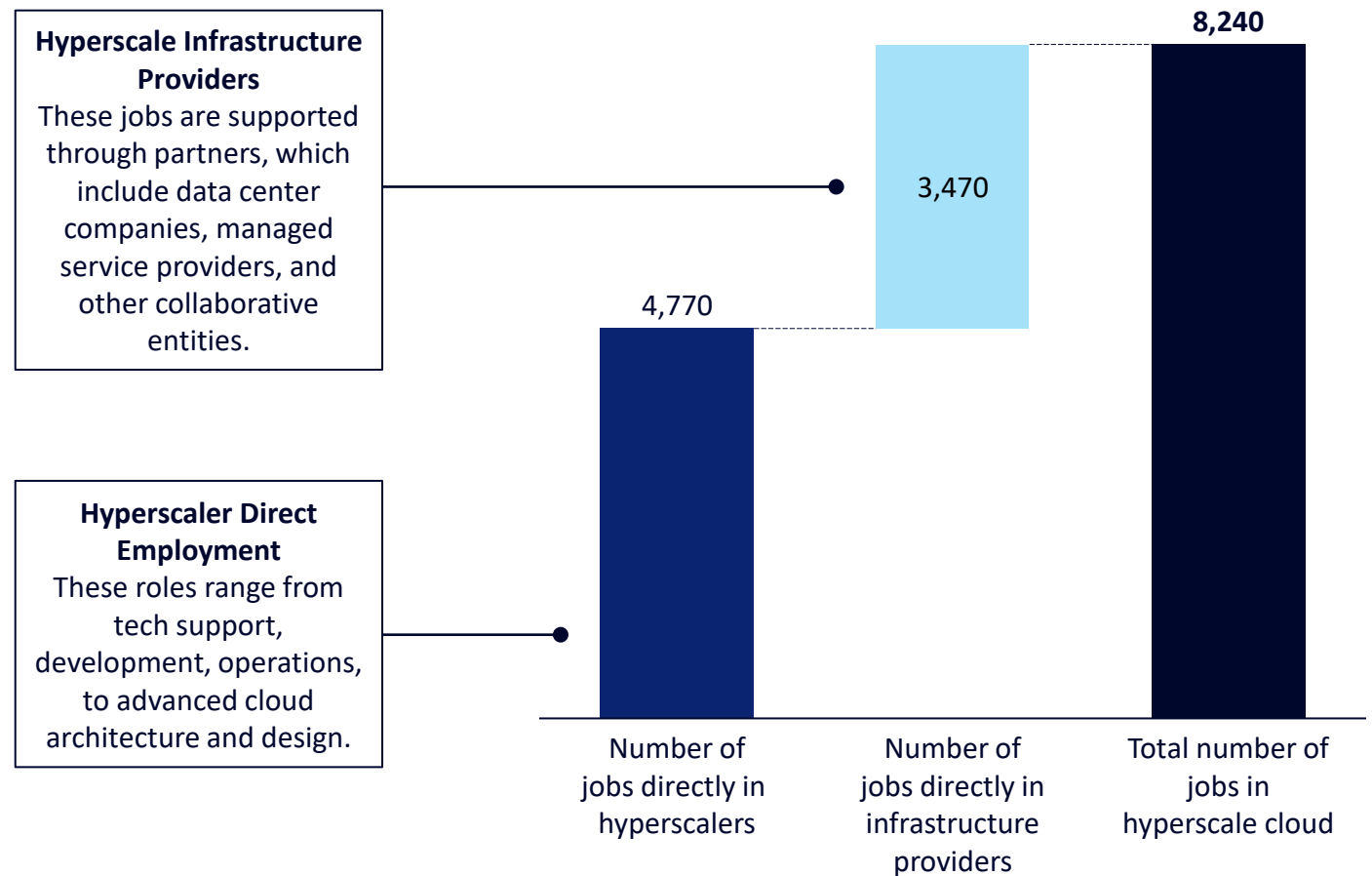
Hyperscale cloud platforms play a pivotal role in bolstering the Australian job market. In 2021, hyperscale cloud providers directly supported almost 5,000 jobs in Australia, and the employment they generated in their partnering data centre organisations accounted for an additional 3,500 more.

Hyperscale cloud providers collaborate extensively with various infrastructure providers, intertwining with the broader technological landscape of Australia. These infrastructure providers, primarily data centre companies and managed service providers (MSPs)², collectively accounted for an additional 3,470 job opportunities.

In addition to the employment generated directly by hyperscalers and their partnerships, 67,000 Australians completed online certifications with AWS, Azure and Google Cloud Platform to upskill in roles within their businesses related to using the cloud.³

Exhibit 17: Jobs supported by hyperscale cloud data centres in Australia¹

Number of jobs, 2021

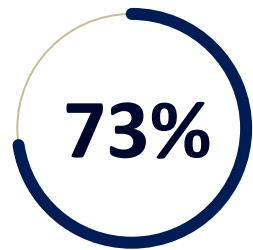
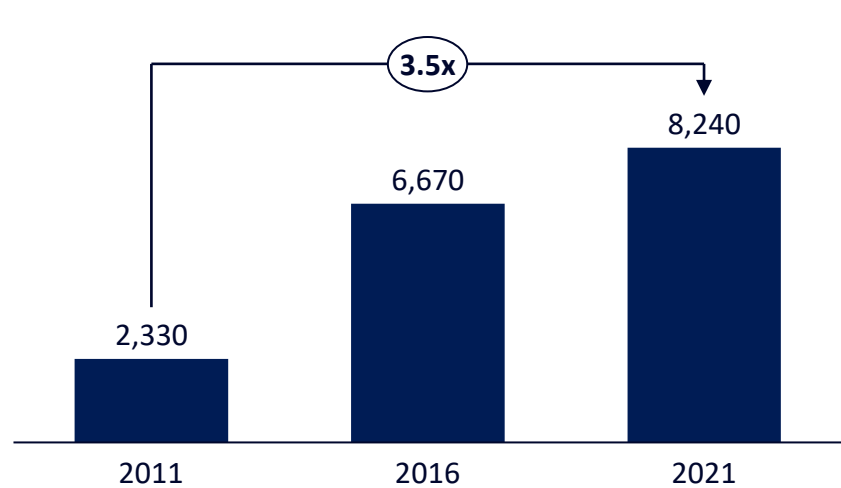


Notes: 1 The hyperscale cloud data centre workforce is subsetting from ABS Census data on those working in 'Data Processing and Web Hosting Services' and 'Electronic Information Storage Services' industries. 2 Managed Service Providers, or MSPs, are specialised firms that manage a client's IT infrastructure and/or end-user systems.. 3 Based on LinkedIn 2023 data.

Sources: ABS Census of Population and Housing 2021; Hyperscale providers company reports, Mandala analysis.

Hyperscale cloud is providing fast-growing job opportunities in a broad range of roles from tech trades to ICT specialists

Exhibit 18: Hyperscale data centre jobs tripled since 2011¹...
Number of employees, 2011-2021

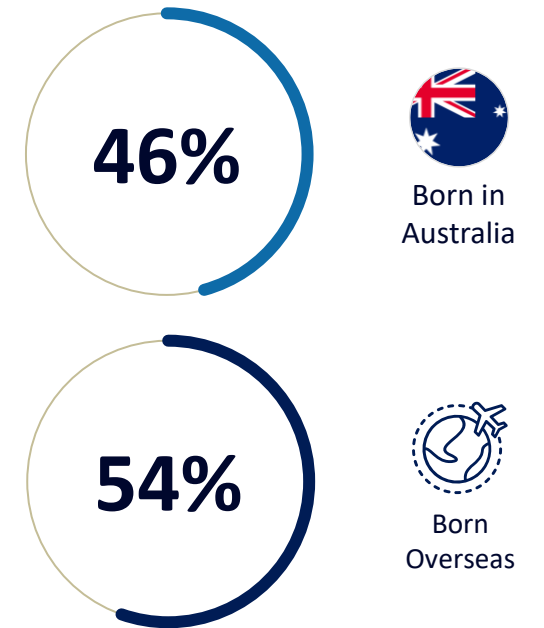


Are aged 15-44. Hyperscale cloud provides important employment opportunities for young Australians.

...in roles ranging from trades to coding²...
percentage of hyperscale employment, 2021



...for a diverse workforce
percentage of hyperscale employment, 2021



Notes: 1 The hyperscale ratio of the total cloud workforce in Australia has been held constant across 2011-2021.

2 Tech tradespeople include roles such as Design, Engineering and Science Professionals, Engineering & ICT Technicians, various Trades, as well as Machine Operators and Factory Process Workers.

Sources: ABS Census of Population and Housing 2011; ABS Census of Population and Housing 2016; ABS Census of Population and Housing 2021; Mandala analysis.



Cem Otay

Data Centre Operations Manager, Microsoft

📍 Western Sydney Australia

Hyperscale cloud provides a rewarding career pathway for tech tradies

Managing Microsoft's data centres in Sydney means **carrying the trust of countless businesses**. I work to ensure uptime for cloud infrastructure. We manage electricals, energy, cooling, engineering and monitoring alerts.

During the COVID-19 pandemic when the world was shifting to digital-first, **the NSW State Government recognised data centre workers as critical workers** – due to the hands-on nature of our roles in keeping tech running.

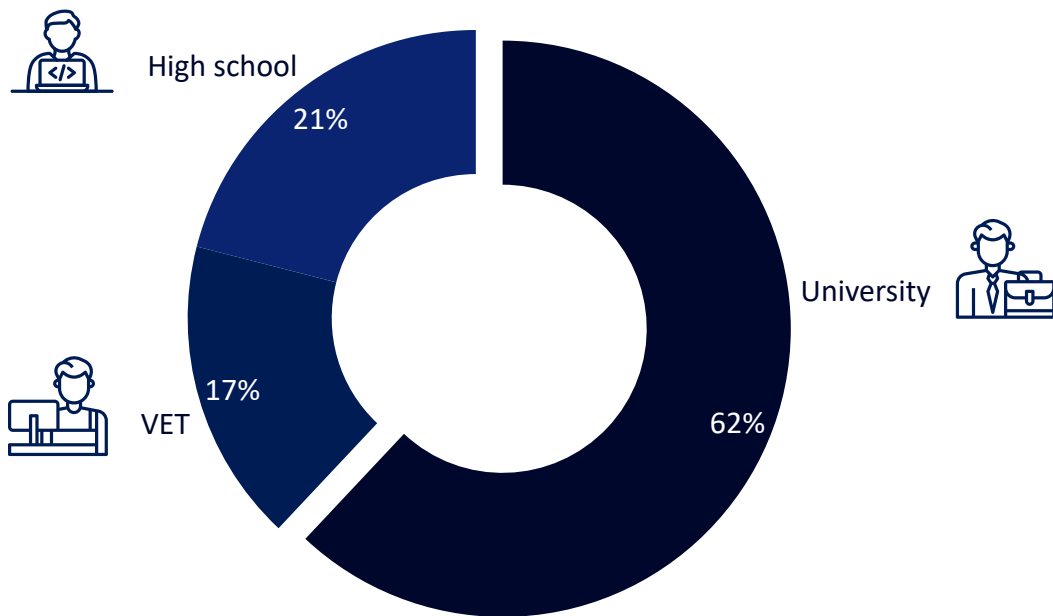
Every day it offers me a new learning opportunity, and with AI and emerging tech, this is a new market that offers many new opportunities.

— Cem Otay, Data Centre Operations Manager

Raised in Sydney and educated at Granville Boys High in Western Sydney, Cem completed his HSC before gaining a Network Administration Diploma at Lidcombe Technical College. Now a Data Centre Operations Manager in Sydney, Cem oversees new and existing site builds, handles leases, schedules, and trains his team.

Four in ten hyperscale cloud workers have a high school or VET qualification

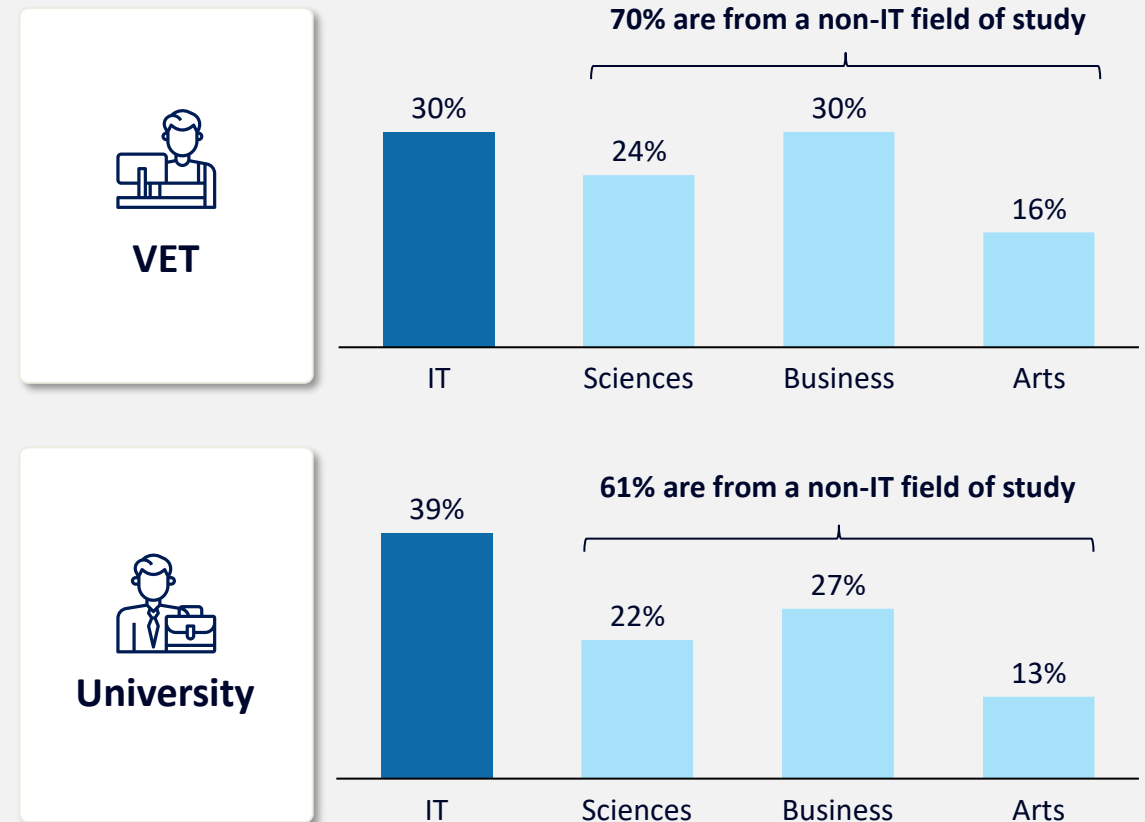
Exhibit 19: Hyperscale cloud's workforce by highest level of education attainment¹
percentage of hyperscale cloud workforce, 2021



Note: 1 VET includes Cert I, II, III, IV, Diploma and Advanced Diploma. University includes any completed university study.
Sources: ABS Census of Population and Housing 2021; Mandala analysis.

Majority of the hyperscale cloud workforce also came from non-IT backgrounds

Exhibit 20: Hyperscale cloud's workforce by field of study²
percentage of hyperscale workforce with qualification, 2021



Note: 2 Business includes food, hospitality, and personal services.
Sources: ABS Census of Population and Housing 2021; Mandala analysis.

Hyperscale cloud is attracting diverse talent to Australia's tech ecosystem

I think data centres and hyperscale cloud have become integral to our day-to-day lives. We carry the pride of supporting this infrastructure, knowing its significance.

Our foremost priority during COVID was to protect our team while also understanding that we were carrying the community's infrastructure. It was essential to keep the economy running.

I feel a strong sense of accomplishment—whether I'm mentoring individuals, playing a part in data centre operations, or simply seeing a project through to its objective.

— Satoko Tsuchida, Data Centre Regional Director

From studying French literature in Japan to directing Data Centre operations in ANZ for Microsoft, Satoko Tsuchida exemplifies the diverse paths leading to the hyperscale industry. Now based in Australia, she plays a pivotal role in expanding and managing data centre operations, demonstrating the sector's allure for varied talents.



Satoko Tsuchida

Data Centre Regional Director for ANZ, Microsoft

📍 Sydney Australia

Hyperscale cloud has driven significant economic benefits and job opportunities across the country

Hyperscale cloud is catalysing significant economic growth and job prospects across Australia. Large investments by AWS and Microsoft Azure will see significant hyperscale compute power come online close to Sydney, Melbourne and Brisbane. Smaller hyperlocal data centres are also expected to grow in number over the next five years.

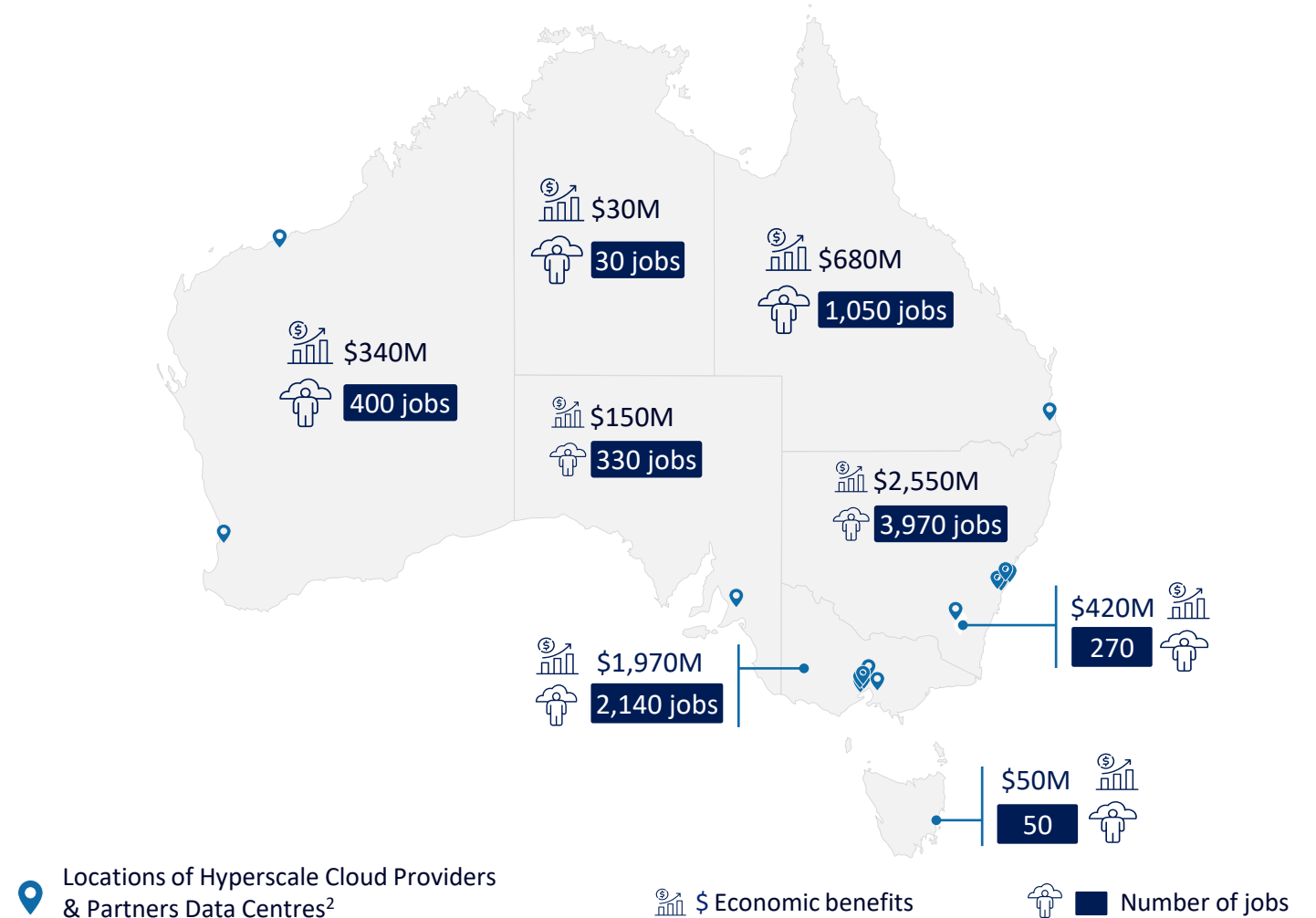
Based on ABS data of the geographies of the hyperscale cloud workforce, Sydney and Melbourne stand out as pivotal hubs, together offering over 6,000 job opportunities. Meanwhile, locales such as Brisbane, Canberra and Perth are showing an upward trajectory both in benefits and career openings, underlining a consistent technological expansion across Australia.

Schneider Electric’s Joe Craparotta shared that there will be “thousands, if not tens of thousands of these micro centres around Australia and New Zealand over the next decade” in commercial buildings, and under 5G towers to ensure that people have instant connectivity across their IT architecture.³

Upskilling Australians to work in hyperscale cloud and data centre related roles will help them fill the additional global demand for 140,000 data centre staff by 2025.⁴

Exhibit 21: Distribution of extra benefits from hyperscale cloud’s sophisticated capabilities; and the hyperscale cloud workforce¹

\$AU millions, 2023



Notes: 1 Geographic distribution of benefits estimated based on states’ digital tech workforce from TCA [2023](#). 2 The data centres represent both hyperscale cloud providers’ own facilities and those of its partners staffed with own personnel and/or hardware.

3 Australian Financial Review [2022](#). 4 Uptime Institute [2021](#).

Sources: ABS Census of Population and Housing 2021; AWS Local Zones [2023](#); Tech Council of Australia [2023](#); Mandala analysis.



Upskilling future workers: Data Centre Academy

Specialised training academy

📍 NSW, Australia

Microsoft is investing \$5 billion to expand its hyperscale data centres, complemented by workforce training initiatives

In Australia, Microsoft is set to significantly enhance its digital infrastructure with an investment of \$5 billion, aimed primarily at expanding its hyperscale data centres. This initiative will see an increase in Microsoft's data centre sites from 20 to 29, spread across Canberra, Melbourne, and Sydney.

Recognising the importance of a trained workforce, Microsoft has committed to equip over 300,000 Australians with skills tailored for a cloud and AI-driven economy. In addition, **Microsoft is partnering with TAFE NSW to establish the Microsoft Data Centre Academy**, this academy will specialise in preparing individuals with the skills tailored for roles within hyperscale data centres, from data centre technicians to IT operations personnel.

Using their global footprint as a reference, Microsoft has established similar hyperscale data centre training initiatives globally. A nearby example is in Singapore, where they partnered with a local technical institute to launch a Data Centre Academy. **This academy provides hands-on training, equipping students for technical roles within the hyperscale data centre industry.** This Singaporean model could potentially inform and inspire the Australian initiative's trajectory.

This is a major **investment in the skills and workers of the future**, which will help Australia to strengthen our position as a world-leading economy.

— The Hon Anthony Albanese, Australian Prime Minister

1

Hyperscale cloud is the critical infrastructure underlying Australia's technology ecosystem



2

The advanced capabilities of hyperscale cloud creates \$6.3 billion in economic benefits for Australian business



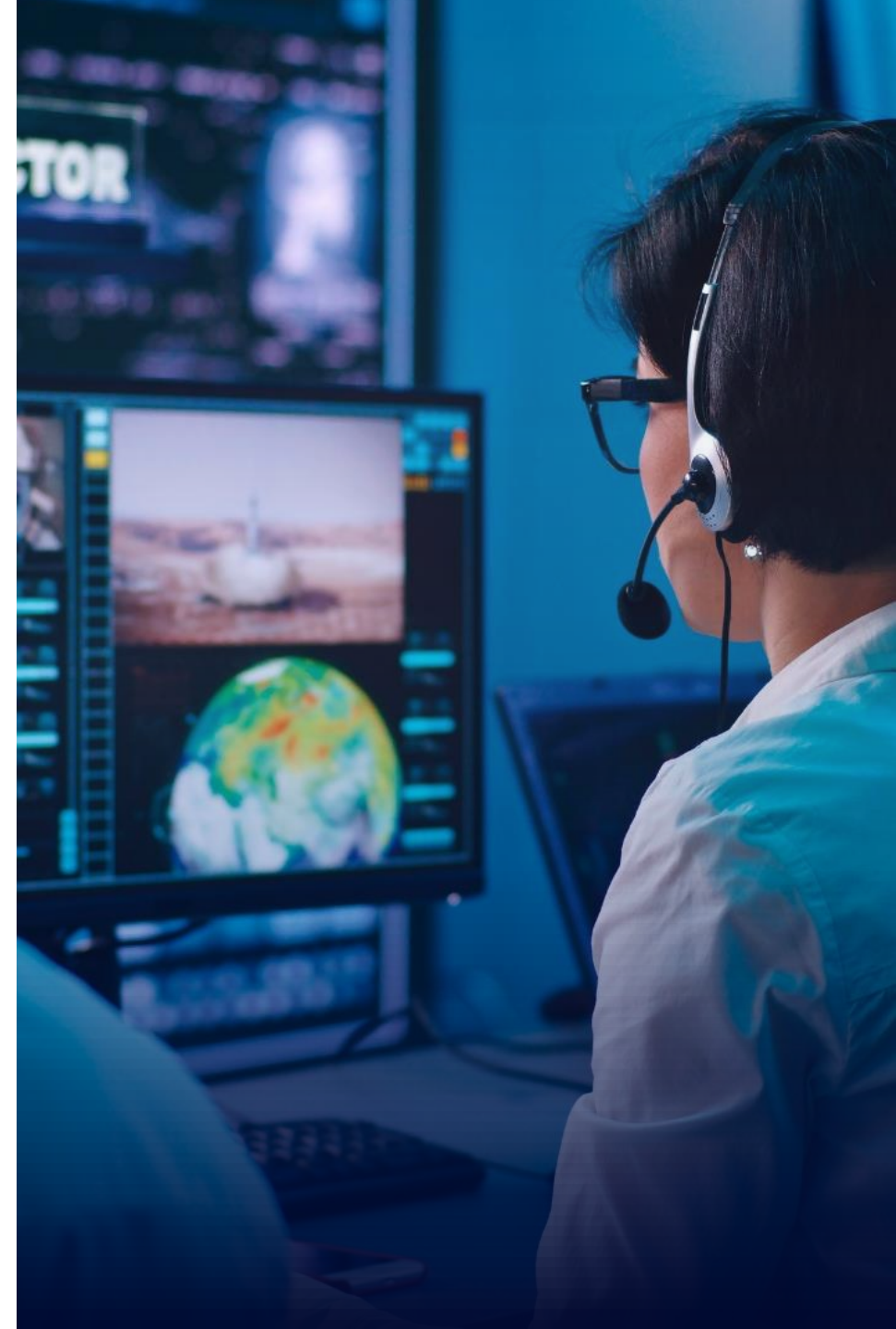
3

Hyperscale cloud providers are creating over 8,000 jobs and upskilling 67,000 workers



4

Coordinated, consistent policy settings with a bias to innovation will capture the benefits of hyperscale



Capturing the potential of hyperscale cloud for the Australian economy will require coordinated, consistent policy settings with a bias to innovation and growth

Exhibit 22: Creating an environment where hyperscale cloud thrives will ensure that Australian businesses can capture productivity, competitiveness and global market gains

Source	Principle	Key focus	Outcomes for Australian businesses and users
<i>Principle-led development of regulation¹</i>	Informed and coordinated	<ul style="list-style-type: none"> Ensuring policy settings allow Australian businesses a large market with unified policy Understanding existing world-leading compliance Harmonising with global, technical best-practice across other jurisdictions 	<p>Market access: Australian businesses can thrive internationally by accessing large markets with consistent regulations. This helps Australian businesses to comply with international regulations without onerous adjustments.</p> <p>Productivity: Hyperscale cloud boosts Australia’s productivity; it brings world-leading security and threat intelligence standards, as well as accelerated and efficient access to new techniques, products and optimisation. Coordinated policy across jurisdictions and industry protects these productivity gains and avoid suboptimal outcomes.² Hyperscale cloud is delivered globally, and any individual country regulation that requires bespoke regulatory requirement implementation will be costly for the users of cloud in that jurisdiction.</p> <p>Advanced technical solutions: Policy formulation should align with international best-practice and understand what is already being complied with (for example, hyperscale providers encrypting data in transit offers a technically advanced solution to the previous solution of localisation).</p>
	Consistent and interoperable	<ul style="list-style-type: none"> Prioritising interoperability and integration Consistency with international standards 	<p>Interoperability: Consistent regulatory settings lay the ground for interoperable products and services. Australian researchers interviewed highlighted the ability to move their modelling from hyperscale cloud to a local supercomputer as needed as a key benefit, highlighting the interoperability of globally standard products.</p> <p>Highly integrated: Integrations between platforms and services can be developed when there is consistent global, technical best-practice regulations across jurisdictions, boosting productivity for users and businesses.</p>
	Bias to innovation and growth	<ul style="list-style-type: none"> Supporting access to latest technological developments Unlocking the innovation and growth of Australian businesses 	<p>Competitive: Australian businesses lag peers in other countries in making use of cloud-enabled technologies such as big data and AI.³ Policy settings that help business adoption of these technologies will help Australia thrive. Coordination with international standards that cover markets of hundreds of millions of people will ensure Australian businesses can access the same services at the same efficient timing – ensuring we are competitive.</p> <p>Future-focused: Hyperscale cloud supports Australian businesses and researchers at every scale to access the new technologies of the future including AI and machine learning, AR/VR, IoT and data analytics capabilities.</p>

Sources: 1 Tech Council of Australia [2023](#), *Pre-Budget Submission*; 2 Productivity Commission [2023](#), *5-Year Productivity Inquiry: Australia’s data and digital dividend*; 3 OECD [2022](#); Mandala analysis

5

Appendix



A

Methodology



B

Supporting analysis








C

References








Methodology and key assumptions (I/II)

Key modelling assumptions

	Metric 	Assumption for non-hyperscale cloud 	Source or rationale 	Enhancement attributed to Hyperscale unique capabilities 	Source or rationale 
Hyperscale cloud users	Proportion of businesses using hyperscale cloud capabilities	<ul style="list-style-type: none"> 59% of all businesses adopt cloud technology Adoption rate varies by employment size 	<ul style="list-style-type: none"> ABS 2023a 	<ul style="list-style-type: none"> Around 10% of these businesses utilised hyperscale to its maximum 	<ul style="list-style-type: none"> Based on business marked as established or advanced in the Digitisation Intensity Index from ABS 2023c
Calculation: numbers of businesses harnessing hyperscale cloud unique capabilities * [average revenue * increase in revenue attributed to hyperscale cloud adoption] * revenue driver					
Productivity boost	Increase in revenue attributed to cloud adoption	<ul style="list-style-type: none"> After accounting for the overlapping capabilities of hyperscale cloud, we conservatively assume that the revenue trajectory for both non-hyperscale cloud and hyperscale is the same Thus, a specific boost due to non-hyperscale cloud adoption was not estimated 	<ul style="list-style-type: none"> To ensure an unbiased and objective assessment, we controlled for the commonalities between hyperscale and non-hyperscale cloud solutions We aimed to isolate the unique benefits of each cloud type Given the similarities in their foundational features and capabilities, there's no distinct revenue advantage attributed solely to non-hyperscale cloud when the shared features with hyperscale are considered 	<ul style="list-style-type: none"> Businesses harnessing the full potential of hyperscale can achieve an incremental revenue boost of 1.1% over those using non-hyperscale cloud solutions 	<ul style="list-style-type: none"> McKinsey survey 2017 findings on revenue trajectory adapted to the Digitisation Intensity Index from ABS 2023c Empirical data underscores the unique benefits of hyperscale when fully leveraged by businesses
	Revenue driver	-	-	<ul style="list-style-type: none"> Three revenue drivers were identified: product development, ability to increase or decrease output to meet demand (scaling up) and greater access to customers Businesses of different sizes have varied revenue contributions from scaling up, market access, and product development For instance, Large businesses attribute 20% of their revenue to scaling up, 30% to market access, and 50% to product development. Similarly, estimates are derived for Medium, Small, and Micro businesses 	<ul style="list-style-type: none"> Given the dynamic nature of the business environment, especially concerning cloud services, certain revenue drivers play a more pronounced role at different business scales The figures used are based on informed assumptions derived from typical business practices and observable market trends Assumptions have been validated with empirical data where available






Methodology and key assumptions (II/III)

Key modelling assumptions

	Metric 	Assumption for non-hyperscale cloud 	Source or rationale 	Enhancement attributed to Hyperscale unique capabilities 	Source or rationale 
Calculation: number of businesses * [annual probability of breach * average cost per breach]. To get the benefits of <i>hyperscale</i> , we subtract the benefits of the counterfactual (<i>non-hyperscale cloud</i>).					
Security	Annual security breach likelihood	<ul style="list-style-type: none"> Breach likelihood is defined as the probability of attacks in a year that result in security breaches with a financial loss Breach likelihood ranges from 0.5% to 2%, depending on employment size 	<ul style="list-style-type: none"> Adoption and breach stats from ABS 2023a Bayesian approach used with an informative prior and a Beta distribution based on Hubbard et al. 2016 Breach stats consider only financially damaging incidents; frauds or scams excluded 	<ul style="list-style-type: none"> Overall average reduction in breach likelihood of 30% from hyperscale cloud The decrease in breach likelihood, based on employment size, ranges between 25% to 35%. This reflects the differential impact of hyperscale cloud adoption on businesses of varying sizes 	<ul style="list-style-type: none"> Calibrated using Gordon–Loeb Class One Model (from Gordon and Loeb 2002) which reduces probability of breaches by the size of investment
	Security breach cost	<ul style="list-style-type: none"> For companies with over 200 staff, the cost of a breach stands at A\$4 million For SMEs (including sole traders), this cost is proportionally adjusted based on their average revenue 	<ul style="list-style-type: none"> IBM 2023 ABS 2023b 	<ul style="list-style-type: none"> No direct impact on security breach cost by the cloud service provider The cost of lost time was not included 	<ul style="list-style-type: none"> Cloud service providers offer infrastructure, not guarantees on breach costs Excluding lost time costs avoids double counting, ensuring a clearer financial perspective
Calculation: number of businesses * [365 * probability of incident * average duration in days * cost per day]. To get the benefits of <i>hyperscale</i> , we subtract the benefits of the counterfactual (<i>non-hyperscale cloud</i>).					
Operational (avoiding downtime)	Cost of downtime per hour	<ul style="list-style-type: none"> The cost of a downtime incident equates to 1.5% of the average revenue of each employment size bracket per day down For large businesses this is \$247k, medium \$11k, small \$1,600 and micro (0-4 employees) \$225 per hour 	<ul style="list-style-type: none"> Informed by Atlassian 2023, the 1.5% metric was chosen to include business disruption too. This provides a consistent benchmark that relates directly to a company's financial scale ABS 2023b 	<ul style="list-style-type: none"> The cloud service provider has no direct influence on the daily downtime cost 	<ul style="list-style-type: none"> Downtime costs primarily stem from operational losses within an organisation
	Average duration per incident	<ul style="list-style-type: none"> In the case of a downtime incident, the impact of downtime hours varies from 3 to 13 hours, depending on employment size 	<ul style="list-style-type: none"> Ponemon Institute 2016 The duration of downtime is assumed to be negatively correlated with the size of a business' workforce. That is, a greater impact is seen on smaller business. 	<ul style="list-style-type: none"> 28% reduction in downtime from hyperscale cloud compared to non-hyperscale cloud 	<ul style="list-style-type: none"> According to a 2020 AWS report, moving from on-premises to cloud resulted in a 56% reduction in downtime. Of this, 50% was attributed specifically to the benefits of hyperscale cloud. AWS 2020
	Downtime probability per day	<ul style="list-style-type: none"> Uptime of 99.9% translates to a potential 0.1% downtime, which we've used as our probability metric 	<ul style="list-style-type: none"> Industry standard Service-Level Agreement for cloud services 	<ul style="list-style-type: none"> Increment in uptime of 0.05%, leading to an SLA of 99.95% uptime 	<ul style="list-style-type: none"> Enhanced infrastructure and redundant systems in hyperscale environments provide better resilience and uptime

Methodology and key assumptions (III/III)

Key modelling assumptions

	Metric 	Assumption for non-hyperscale cloud 	Source or rationale 	Enhancement attributed to Hyperscale unique capabilities 	Source or rationale 
Cost efficiencies	IT expenditure percentage of sales dedicated to IT infrastructure	<p>Calculation: number of businesses * [average revenue * IT expenditure percentage of sales dedicated to IT infrastructure]. To get the benefits of <i>hyperscale</i>, we subtract the benefits of the non-hyperscale cloud.</p> <ul style="list-style-type: none"> Expenditure on IT as a percentage of revenue ranges from 3% to 7%, depending on employment size 20% of businesses' IT spend is assumed to be attributed to both hardware and software on-premise 	<ul style="list-style-type: none"> Informed by Deloitte 2017 and Computer Economics 2021 Gartner 2023 	<ul style="list-style-type: none"> 5% reduction in IT infrastructure expenditure from hyperscale cloud compared to non-hyperscale cloud 	<ul style="list-style-type: none"> According to a 2020 AWS report, moving from on-premises to cloud resulted in a 27% reduction in IT infrastructure expenditure. Of this, 15% was attributed specifically to the benefits of hyperscale cloud. AWS 2020

Number of jobs in hyperscale cloud and partners

1. Cloud workers. Started with the total number of jobs from the 'Data Processing and Web Hosting Services' and 'Electronic Information Storage Services' industries according to the ABS census.

2. Hyperscale workers. Used Australian company and parent subsidiary registers sourced from investor reports to determine the number of individuals employed by hyperscale cloud providers. Adjusted the total employee count based on the percentage contribution of cloud services to overall revenue from global financial reports.

3. Partner workers. The difference between the **cloud** and **hyperscale** workers provides the combined figure for those working in non-hyperscale cloud services and as partners of hyperscale providers. Using market share data for cloud services, a conservative assumption was made that 70% of (cloud-hyperscale) represent jobs in partners of hyperscale.

5 Appendix



A Methodology



B Supporting analysis




C References



Hyperscale cloud enables customers to scale their usage with demand

Defining hyperscale cloud

 <p>Definition used in report</p>	<p>Hyperscale cloud is computing architecture that appropriately scales as customers increase system demand. Hyperscale cloud includes data storage, computing power and memory, and network capability behind a distributed computing environment.</p>
<p>Ionos definition</p>	<p>The term “hyperscale” refers to scalable cloud computing systems in which a very large number of servers are networked together.</p>
<p>Access partnership definition</p>	<p>Hyperscale cloud provides... reliable and scalable cloud storage and compute service on a pay-as-you-go basis, while ensuring low latency, security, and enabling cloud customers to comply with data localisation requirements. Hyperscalers offer an innovative edge through the breadth and depth of world-class cloud services and capabilities, the simplification of operational processes for global expansion, and the institutional expertise to help SMEs and start-ups navigate operational and regulatory issues when expanding overseas.</p>
<p>Accenture definition</p>	<p>Cloud allows users to procure on-demand, scalable IT products and services over the internet or a private network.</p>
<p>Google definition</p>	<p>Google Cloud provides core IaaS functionalities such as virtual machines (e.g. Compute Engine), PaaS services for app development and hosting (e.g. App Engine), and SaaS applications such as email, storage and word processing services. Google Cloud offers additional services such as Networking, API Platforms and Ecosystems, Identity and Security tools, monitoring and management tools, data transfer services, developer tools and professional services offering expert support.</p>

Capabilities of hyperscale cloud vs non-hyperscale cloud

Capabilities of hyperscale cloud vs non-hyperscale cloud

Hyperscale cloud		VS	Non-hyperscale cloud	
<p>1. Compute:</p> <ol style="list-style-type: none"> Virtual Machines Container Services Serverless Computing Batch Computing 	<p>6. AI and Machine Learning:</p> <ol style="list-style-type: none"> Machine Learning Platforms Natural Language Processing Speech Recognition Computer Vision Translation Services 		<p>1. Compute:</p> <ol style="list-style-type: none"> Virtual Machines (on a smaller scale) Container Services (specialized for certain applications) 	<p>8. Security and Identity:</p> <ol style="list-style-type: none"> Identity and Access Management (IAM) (tailored to specific needs) Key Management Service
<p>2. Storage:</p> <ol style="list-style-type: none"> Object Storage Block Storage File Storage Cold Storage / Archive Data Lakes 	<p>7. IoT (Internet of Things):</p> <ol style="list-style-type: none"> IoT Core (Device connectivity and management) IoT Analytics IoT Security 		<p>2. Storage:</p> <ol style="list-style-type: none"> Object Storage (specific to certain data types or applications) Block Storage File Storage (potentially for specific use-cases) 	<p>9. Management & Governance:</p> <ol style="list-style-type: none"> Monitoring and Logging (specific to certain applications) Configuration Management
<p>3. Networking:</p> <ol style="list-style-type: none"> Virtual Private Cloud (VPC) Content Delivery Network (CDN) Load Balancer VPN and Direct Connect Network Peering 	<p>8. Developer Tools:</p> <ol style="list-style-type: none"> Continuous Integration and Delivery Code Repositories IDEs 	<p>11. Management & Governance:</p> <ul style="list-style-type: none"> Monitoring and Logging Configuration Management Infrastructure as Code Job Scheduler 	<p>3. Networking:</p> <ol style="list-style-type: none"> Virtual Private Cloud (VPC) (on a smaller scale) Load Balancer (specifically tailored) 	<p>10. Application Integration:</p> <ul style="list-style-type: none"> API Gateway (tailored for specific integrations)
<p>4. Databases:</p> <ol style="list-style-type: none"> Relational Database Service NoSQL Databases Database Migration Service In-memory Databases 	<p>9. Migration & Transfer:</p> <ol style="list-style-type: none"> Migration Services (Database, data, application) Transfer Appliances (physical devices to move large amounts of data) 	<p>12. Application Integration:</p> <ul style="list-style-type: none"> API Gateway Message Queues and Topics 	<p>4. Databases:</p> <ol style="list-style-type: none"> Relational Database Service (might be specialized for certain applications) NoSQL Databases (specific to certain data types or applications) 	<p>11. Mobile Services:</p> <ul style="list-style-type: none"> Mobile App Development (specific to an industry or application)
<p>5. Analytics:</p> <ol style="list-style-type: none"> Big Data Processing Data Warehousing Data Lakes Real-time Analytics 	<p>10. Security and Identity:</p> <ul style="list-style-type: none"> Identity and Access Management (IAM) Key Management Service Security Groups Compliance Scanners 	<p>13. End User Computing:</p> <ul style="list-style-type: none"> Virtual Desktops App Streaming 	<p>5. Analytics:</p> <ol style="list-style-type: none"> Data Warehousing (for specific industries) Real-time Analytics (for specific applications) 	<p>12. End User Computing:</p> <ul style="list-style-type: none"> Virtual Desktops (specific scenarios)
		<p>14. Mobile Services:</p> <ul style="list-style-type: none"> Mobile App Development Mobile Analytics User Authentication for Mobile 	<p>6. Developer Tools:</p> <ol style="list-style-type: none"> Continuous Integration and Delivery (specialized tools) 	
		<p>15. AR & VR (Augmented & Virtual Reality):</p> <ul style="list-style-type: none"> AR/VR Development Kits and Platforms 	<p>7. Migration & Transfer:</p> <ol style="list-style-type: none"> Migration Services (specifically for the non-hyperscale they cater to) 	
		<p>16. Blockchain:</p> <ul style="list-style-type: none"> Blockchain as a Service 		
		<p>17. Satellite:</p> <ul style="list-style-type: none"> Satellite Data Ingestion and Processing 		
		<p>18. Robotics:</p> <ul style="list-style-type: none"> Robotic Process Automation (RPA) 		
		<p>19. Quantum Technologies:</p> <ul style="list-style-type: none"> Quantum Computing Services 		
		<p>20. Game Development:</p> <ul style="list-style-type: none"> Game Servers and Engines 		

5 Appendix



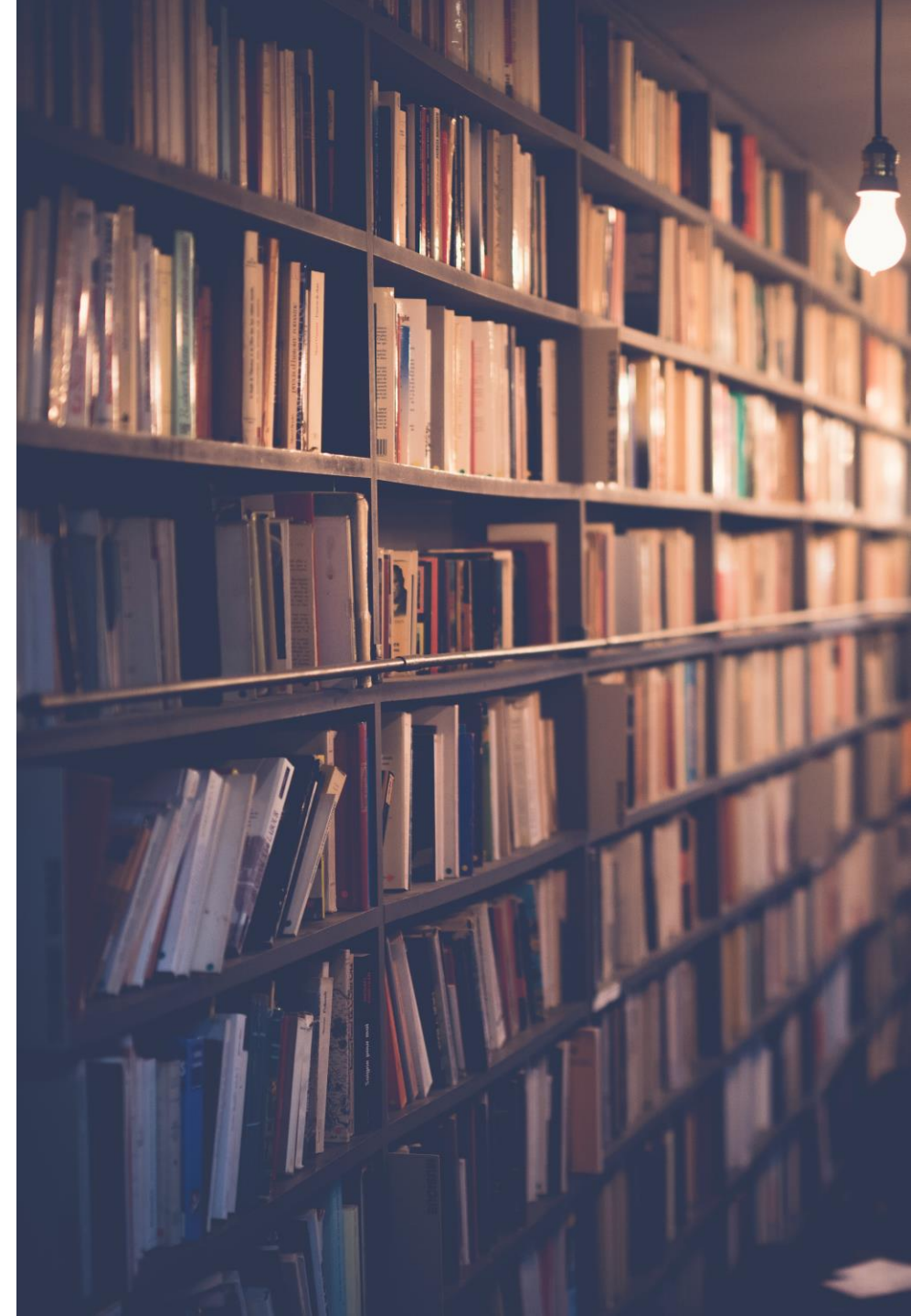
A Methodology



B Supporting analysis

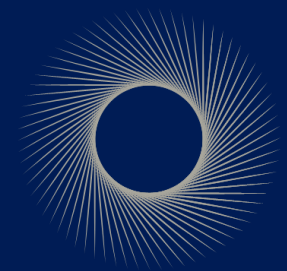


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