Australia's National Science Agency

The geography of Australia's digital industries

Digital technology industry clusters in Australia's capital cities and regions

A report jointly prepared by CSIRO and the Tech Council of Australia

About this report

The report was prepared jointly by CSIRO and the Technology Council of Australia. It aims to share with interested parties within industry, government and community our research on the geography of Australia's digital industries to help them make better decisions about the inclusive growth and development of this industry.

Citation

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Cover: The image is of the Tech Central Innovation District in Sydney and shows future-planned buildings. It is shown here courtesy of the Greater Cities Commission of the New South Wales Government.

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Executive summary

Geography matters when it comes to technology industry growth and development

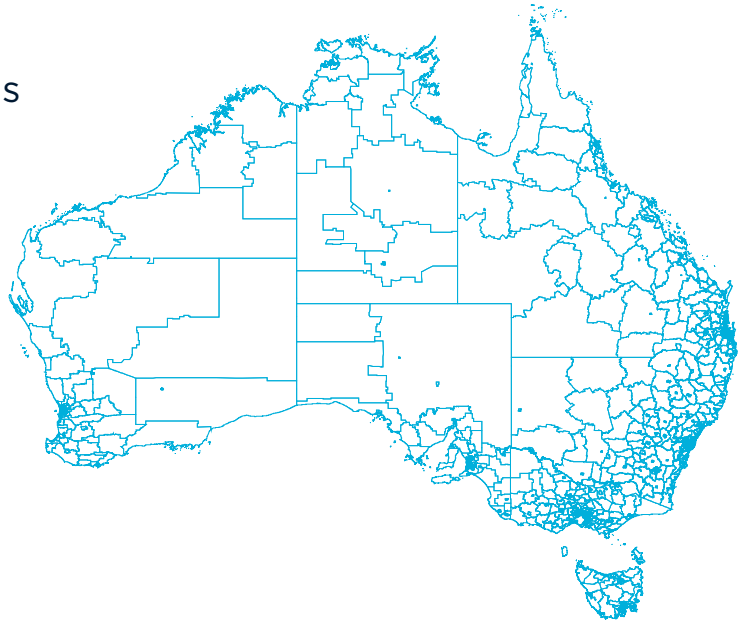
Think Silicon Valley in California, Silicon Fen in Cambridge and Tech Central in Sydney. These and other such places are examples of industry clusters. Decades of research in economic geography has shown that clusters matter. Firms inside clusters tend to grow faster, innovate more, compete and build wealth globally at the national scale.

Clusters aren't everything, but they're a critical component of effective industry growth and development strategy. In this report we have – for the first time – mapped Australia's digital technology industry clusters at the national scale. We hope this information will help decision makers in industry, community and government as they develop our digital technology industries.

We identified 96 digital technology industry clusters in Australian cities and regions

We examined 2,473 statistical areas at level two (SA2 regions) in Australia as defined by the Australian Bureau of Statistics. We found that 96 of the SA2 regions had significant levels of digital technology industry specialisation.

A cluster is a geographic agglomeration of specialised industry activity. We identify three types of digital technology industry cluster (a) super-clusters, (b) greater capital city clusters and (c) regional niche clusters.



4

super-clusters

These are Australia's largest and most significant agglomerations of digital companies and workers.

60

greater capital city clusters (SA2 Regions)

Large and highly concentrated workforces with high levels of specialisation in diverse fields and often contain large companies.

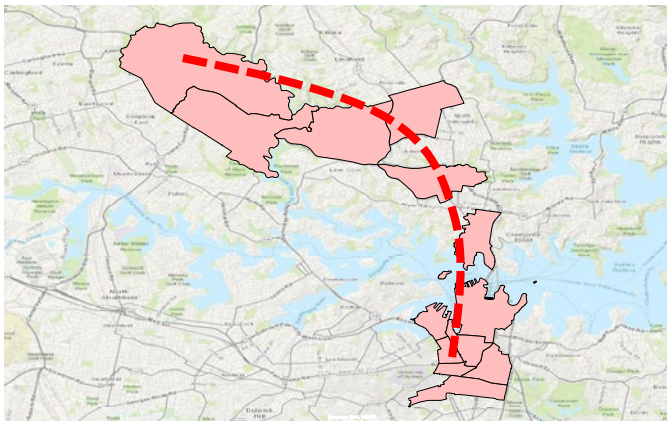
36

regional niche clusters (SA2 Regions)

Significant digital workforces specialised in one, sometimes two, areas of digital technology expertise.

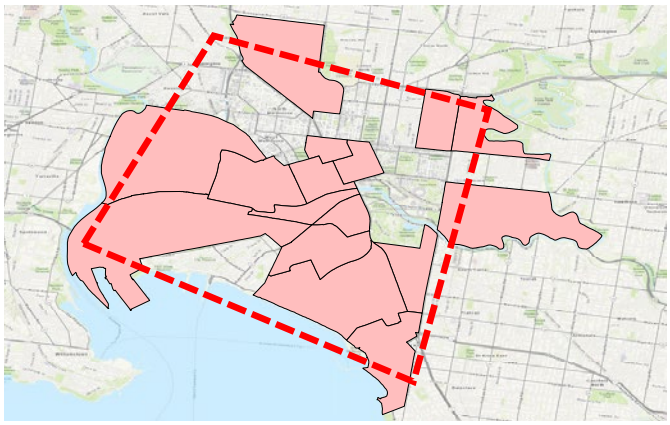
Australia's Digital Technology Industry Super-clusters

The Sydney Arc



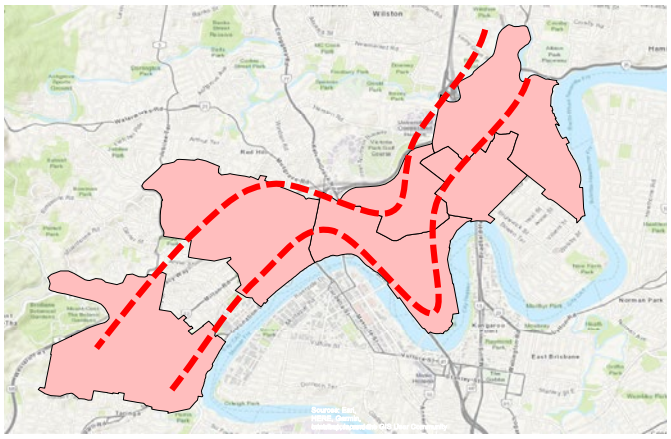
The Sydney super-cluster forms an arc extending over North Ryde, Chatswood, Lavender Bay, Millers Point and Redfern. It contains 119,636 workers in digital occupations (20.1% of the national total) and 81 ASX-listed digital technology companies worth $52 billion. This cluster contains the Australian-HQ for many international tech companies such as Google, Microsoft, Amazon and LinkedIn.

The Melbourne Diamond



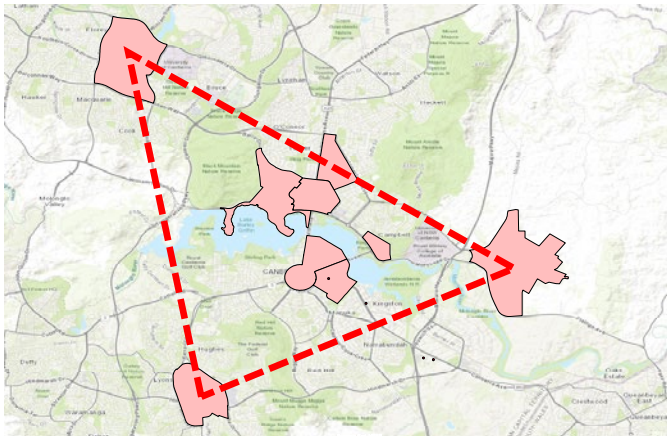
With its crown in Parkville and culet in St Kilda the Melbourne diamond super-cluster covers the Docklands to the west and Richmond to the East. It contains 95,122 workers in digital occupations (16% of the national total) and 62 ASX-listed digital technology companies worth $203 billion. A number of international tech companies have their Australian-HQs in this cluster.

The Brisbane Corridor



A trip from Bowen Hills to Toowong along Ann Street and Coronation Drive past the city centre will take you through the Brisbane corridor. This super-cluster employs 33,534 workers in digital occupations (5.6% of the national total) and contains 19 ASX-listed digital companies worth $13.29 billion.

The Canberra Triangle



Centred on the city centre at Civic the Canberra super-cluster takes the form of triangle with vertices at Belconnen in the north, Phillip to the south and the airport in the west. This super-cluster employs 19,362 workers in digital occupations (3.3% of the national total) and contains 2 ASX-listed digital companies worth $60.14 million.

Basemap sources: Esri, HERE, Garmin, Intermap, increment

Greater Capital City Digital Technology Industry clusters

Greater Sydney
Traditional lands of the Eora, Kuring-gai people

- Millers Point, Haymarket, Ultimo, Pyrmont
- Surry Hills, Redfern, Chippendale
- North Sydney, Lavender Bay, St Leonards, Chatswood , Lane Cove
- North Ryde, East Ryde, Macquarie Park, Marsfield
- Wentworth Point, Rhodes, Sydney Olympic Park
- Baulkham Hills, Bella Vista
- Paramatta North

Greater Melbourne
Traditional lands of the Woiworung, Boonwurrung and Wathaurong people

- Melbourne Central Business District
- Docklands, Southbank
- South Melbourne, Port Melbourne
- South Yarra, Albert Park, St Kilda
- Parkville, Collingwood, Abbotsford
- Richmond, Hawthorn, Glen Iris (East)
- Clayton (North), Notting Hill

Greater Canberra
Traditional lands of the Ngunawal people

- Canberra Civic, Acton, Braddon
- Barton, Parkes, Russell
- Belconnen
- Phillip
- Greenway
- Canberra Airport

Greater Brisbane
Traditional lands of the Yuggera people

- Brisbane Inner City, Central Business District
- Fortitude Valley, Spring Hill and Bowen Hills
- Paddington, Milton and Toowong
- Eight Mile Plains Technology Park

Greater Perth
Traditional lands of the Wajuk people

- Perth City (West), Northbridge
- Riverdale

Greater Adelaide
Traditional lands of the Kaurna people

- Adelaide City Central Business District
- Payneham, Felixstow
- Mawson Lakes, Globe Derby Park

Greater Darwin
Traditional lands of the Larrakia people

- Darwin City Central Business District

Greater Hobart
Traditional lands of the Nuenonne, Paredarerme and Lairmairrerner people

- Hobart City Central Business District

Regional Niche Digital Technology Industry clusters

Gold Coast (QLD)
Traditional lands of the Bundjalung people

- Ormeau (East) – Staplyton (Telecommunications Trades Workers)
- Upper Coomera – North (Graphic and Web Designers, and Illustrators)
- Arundel (Computer Network Professionals)
- Southport – North (Engineering, ICT and Science Technicians)
- Bundall (Database and Systems Administrators, and ICT Security Specialists)
- Burleigh Heads (Graphic and Web Designers, and Illustrators)
- Varsity Lakes (Graphic and Web Designers, and Illustrators)
- Surfers Paradise – North (Graphic and Web Designers, and Illustrators)
- Robina (Graphic and Web Designers, and Illustrators)
- Palm Beach (Graphic and Web Designers, and Illustrators)
- Coolangatta (Graphic and Web Designers, and Illustrators)

Sunshine Coast (QLD)
Traditional lands of the Gubbi Gubbi people

- Noosa Hinterland (Graphic and Web Designers, and Illustrators)
- Coolum Beach (Graphic and Web Designers, and Illustrators)
- Sippy Downs (Database and Systems Administrators, and ICT Security Specialists)
- Mooloolaba – Alexandra Headland (Graphic and Web Designers, and Illustrators)
- Parrearra – Warana (Graphic and Web Designers, and Illustrators)

Regional Victoria

- Daylesford (Graphic and web designers and illustrators)
  Traditional lands of the Wathaurong people
- Buninyong (Software and applications programmers)
  Traditional lands of the Wathaurong people
- North Geelong – Bell Park (Graphic and web designers and illustrators)
  Traditional lands of Wathaurong people
- Newtown (Graphic and web designers and illustrators)
  Traditional lands of the Wathaurong people
- Warrnambool – South (Telecommunications and trade workers)
  Traditional lands of the Gunditjmara people
- Torquay (Graphic and web designers and illustrators)
  Traditional lands of the Gadubanud people
- Traralgon – West (ICT Support Technicians)
  Traditional lands of the Woiworung and Kurnai people

Regional Niche Digital Technology Industry clusters

Greater Wollongong (NSW)

Traditional lands of the Tharawal people

- Thirroul – Austinmer – Coalcliff (Management and Organisation Analysts)
- Woonona – Bulli – Russell Vale (Graphic and Web Designers, and Illustrators)
- Balgownie – Fairy Meadow (ICT Support Technicians)
- Figtree – Keiraville (ICT Support Technicians)
- Kiama Hinterland – Gerringong (Software and Applications Programmers)

Greater Newcastle (NSW)

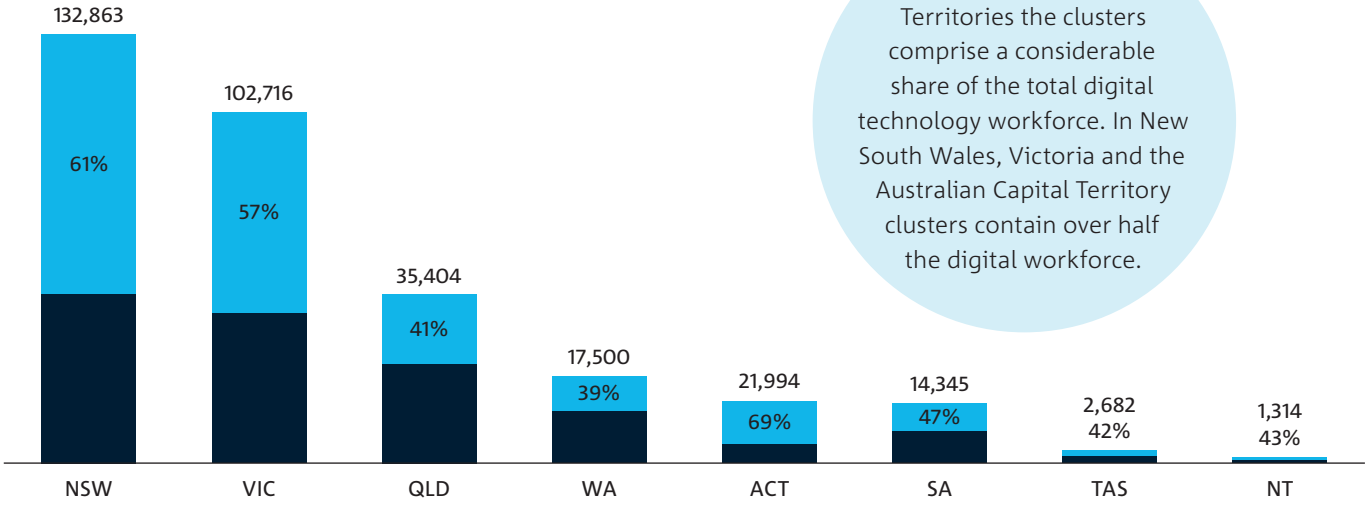
Traditional lands of the Awabakal people

- Shortland – Jesmond (ICT Support Technicians)
- Glendale – Cardiff – Hillsborough (Telecommunications Trades Workers)
- Wickham – Carrington – Tighes Hill (Graphic and Web Designers, and Illustrators)
- Newcastle – Cooks Hill (ICT Support and Test Engineers)

Other regional niche clusters

- Ashburton (Telecommunications Trades Workers)
  Traditional lands of the Nhuwala and Kurrama people
- Byron Bay (Graphic and Web Designers, and Illustrators)
  Traditional lands of the Bundjalung people
- Queanbeyan Surrounds (Management and Organisation Analysts)
  Traditional lands of the Ngambri and Ngunnawal people
- Westcourt – Bungalow (Telecommunications Trades Workers)
  Traditional lands of the Yidinjdji and Djabuganjdji people

In Australia 55% of workers in digital technology occupations* are in a cluster. It's more in some States and Territories. These clusters represent only 4% of the 2,473 statistical regions we examined.



In all States and Territories the clusters comprise a considerable share of the total digital technology workforce. In New South Wales, Victoria and the Australian Capital Territory clusters contain over half the digital workforce.

*The entire digital workforce includes workers in digital professions and within digital industries and is a much larger estimate. Here we show only digital professions.

The clusters contributed to

62%

of national digital workforce growth during 2011–21

We examined the contribution to national employment growth by statistical regions (level 2). We found the 96 clusters identified in our report accounted for 62% of the growth of the national digital technology industry workforce during 2011-21.

Firms in clusters generate

63%

more intellectual property (IP) patents

Firms in digital technology industry clusters in the information and communications technology sector in capital cities create 63% more patent applications that firms outside a cluster (but still within a capital city). This is indicative of higher R&D productivity of firms within clusters.

Policies and strategies to grow and develop the clusters

Most of the world's leading technology industry clusters have arisen from an interplay of government, industry and community dynamics. In most cases public and private sector investments, policies and strategies have played an important role. And once a cluster is mature there's much that can be done to guide its development towards improved social, economic and environmental outcomes. Clusters need nurturing to grow and ongoing care to flourish. Below is a summary of inter-linked policy and strategy mechanisms to support cluster growth and development at various stages of the cluster lifecycle (below, adapted from Cameron, 2022).

Towards inclusive and sustainable development (quality of life)

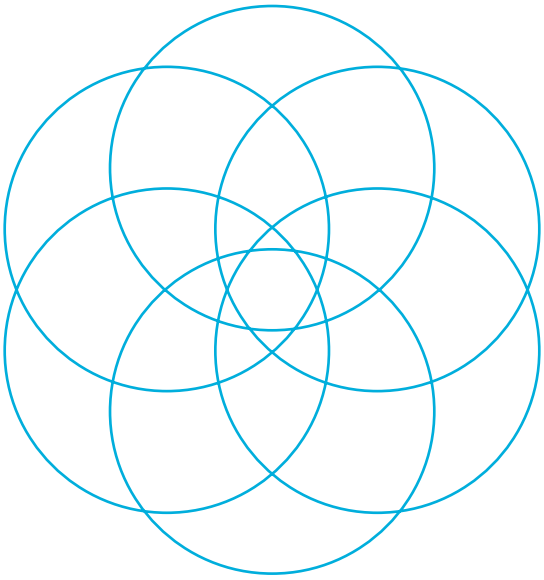
It's not just about company growth and profits. In Silicon Valley, for example, as technology sector profits and salaries increased housing and rent became unaffordable for many of the longstanding local residents. Some were forced to leave the towns and suburbs where they were raised. A cluster is where people live, work and play. Cluster development can be done well, leading to creative, inclusive, safe, environmentally-friendly and enjoyable places to be. Managing, measuring and delivering upon these aspects of technology industry clusters in Australia will be important alongside economic development.

Place-led approaches

Aim: To co-locate firms and research organisations to enhance local knowledge spillovers and improve regional branding

Skills-led approaches

Aim: To increase innovation outcomes through attracting or training skilled people



Culture-led approaches

Aim: To attract creative and innovative people by providing the right lifestyle and culture

Mission-led approaches

Aim: To solve large societal problems through defining goals for innovative and technological effort

Technology-led approaches

Aim: To modernise government services through the application of new and emerging technologies

R&D and finance-led approaches

Aim: To increase dedicated funding for R&D and commercialisation

Image credit: Johan Swanepoel / Shutterstock

Industry clusters

What are they? Why do they matter? How are they measured?
What prior research has been done in Australia? Approach taken in this report.

What are industry clusters?

Industry clusters are geographically concentrated agglomerations of companies, workers and public-sector organisations interacting with each other to produce products and services within similar, or closely, related industries. Clusters have wide ranging spatial expression and are sometimes called clusters, diamonds, corridors and agglomerations. Technology industry clusters contain firms which design, make and use innovative technologies and cutting-edge knowledge within their business processes. Technology clusters are typically engaged in science, research, technology and innovation. They are places where much of the world's game-changing new knowledge is created.

What is the digital technology industry? The digital technology industry contains firms and workers engaged in the production of digital goods and services such as software, hardware, datasets and information resources. This industry also includes firms whose business models and processes are primarily focused upon (and depend upon) the use of innovative digital technology. These firms may work within, and provide products and services to, other industries.

Apple Company Headquarters, Cupertino, California. Image credit: Uladzik Kryhin/Shutterstock

Some examples from abroad: technology industry clusters

Silicon Valley, California – This is one of the world's largest and best-known technology industry clusters. A Harvard University study indicates that with only 2.5% of the United States Population the San Francisco metropolitan area attracts 48.1% of venture capital investment, 18.4% of patents granted and 11.7% of employment in top R&D industries (Kerr and Robert-Nicoud 2020).

Image credit: Alexey Ulashchick/Shutterstock

Cambridge, United Kingdom – Sometimes referred to as "Silicon Fen" the Cambridge region saw the number of technology firms grow from around 50 in the 1960s to over 1,200 firms employing 36,000 workers by the year 2000. It is estimated the turnover of technology firms increased from $7.37 billion in the 1990s to over $88.8 billion in the year 2020 (Rezaei and Kamali 2022).

Image credit: Konstanttin/Shutterstock

Toulouse, France – An aerospace cluster in southern France, the Toulouse region is home to European aircraft manufacturer Airbus. This cluster comprises 80% of France's aerospace exports and 9% of total exports. In 2013 it contained 1,500 firms and 100,000 workers in the aerospace industry (Porter and Takeuchi 2013). It is a large and complex cluster with numerous aerospace sub-specialisations competitive on a global scale.

Image credit: milosk50/Shutterstock

Why are clusters important?

Harvard Business School, United States. Image credit: Jorge Salcedo / Shutterstock

Firms in clusters typically grow faster, employ more, innovate more, compete better at the global scale and build wealth at the national scale.

Economists began studying industry clusters in the late nineteenth century. For example, in 1890 English economist Alfred Marshall published on the positive and negative impacts of industrial districts (Cameron, 2022; Marshall, 1890). Since then, the topic has matured into a field of research largely occurring within the discipline of economic geography. One of the major developments was the publication of a book in 1990 titled "The Competitive Advantage of Nations" by Harvard Professor Michael Porter (Porter, 1990). This would become one of the most all-time highly cited books in government policy documents and was used to inform place-based innovation policy worldwide (Cameron, 2022). Porter's research found that industry clusters support innovation, improve market-access and create incentives, competition and collaboration. Porter saw clusters as essential for building globally competitive industries and wealth at the national scale.

Subsequent research within the field of economic geography over the past three decades provides evidence that firms in clusters grow faster (Beaudry and Swann, 2009; Pandit et al., 2001), innovate more (Baptista and Swan 1998; Baptista, 2000) and attract more investment (Yehoue, 2009; Powell et al., 2002). It has been observed that clusters exhibit positive feedback loops (Porter, 1990; Krugman, 1991; Aharonson et al., 2007). More firms within a cluster attract more skilled workers, which attracts more firms. This attracts investment, which attracts more firms, more workers, ... and the cycle continues until the cluster matures, morphs or declines. This process is explored in research on cluster life cycles (Menzel and Fornahl, 2010). Regional and localised geographic clusters have been shown to boost economic growth and productivity at the national scale (Ketels and Memedovic; Porter, 2000).

Previous research on technology industry clusters in Australia

To date there have been relatively few attempts by researchers to identify and describe technology industry clusters in Australia compared to global efforts. However, the topic has received attention over the decades (McPherson, 2002). And there's a significant body of government and industry policy work on the topic in Australia.

A paper published by the Australian Commonwealth Department of Industry, Tourism and Resources in 2002 argues for the development of a national "clusters policy" to achieve economic development and identifies 10 steps for its creation and implementation (McPherson, 2002). The paper also proposes the formation of an "appropriate cluster organisation". Whilst we could not find evidence of such an entity being created cluster theories and concepts played an important role in industry development, in particular high tech industry development, over the subsequent decades.

A study by the University of Technology Sydney in 2007 in the journal "Australian Geographer" (Searle and Pritchard, 2007) identifies the North Ryde–North Sydney "arc" as an information technology and telecommunications (ITT) sector cluster which the authors refer to as "Australia's Silicon Valley". The researchers go on to identify 11 local government areas of "key importance" to the ITT sector including Burwood, South Sydney, City of Sydney, North Sydney, Lane Cove, Willoughby, Warringah, Ku-Ring-Gai, Hornsby, Baulkham Hills and Ryde. The study draws upon data from the 1996 and 2001 Censuses and finds that the Sydney ITT sector had a sales and marketing focus at this time.

University of Technology Sydney. Image credit: Wirestock Creators/Shutterstock

University of Queensland, Brisbane. Image credit: haireena / Shutterstock

The extent to which the Sydney and Melbourne software industries are spatially embedded i.e., tied to particular locations within the greater city region was examined by the University of Queensland (Searle, 2010). This research was based on interviews with representatives from 50 software firms in both cities. The results show that software firms are spatially embedded and location is important for firm operation, growth and development. It was found firms need to be in a particular location to access skilled workers, sources of knowledge and customers. Whilst the study did not explicitly identify and define technology clusters it does tell us that location is an important factor in strategy and planning decisions by software firms.

A more recent study by CSIRO (Bratanova et al., 2022) uses a measure of revealed technological advantage (RTA) to identify three tiers of artificial intelligence (AI) capability regions in Australia including: AI clusters (10 regions), emerging AI regions (85 regions) and nascent AI regions (238 regions). The researchers find that AI industry is clustered in locations with higher R&D expenditure. Whilst the AI clusters are concentrated within large cities the researchers find examples of remote and regional AI clusters, especially where there has been substantial investment in innovation and technology hubs. The researchers suggest that the clusters provide useful information for government and industry seeking to grow and develop the AI sector in Australia.

Measuring clusters using location quotients to measure specialisation

A location quotient (LQ) is a metric used in the field of economic geography to measure the extent of industry and/or technology specialisation within a geographic region. A higher LQ means the region has a greater level of specialisation. Typically, LQs are based on employment data. This is because workforce data often provides the best information about where different types of industries are located. An LQ can be calculated by:

$$\text{Location quotient (LQ)} = \frac{\dfrac{\text{Number of digital technology industry workers in region}}{\text{Number of workers in region}}}{\dfrac{\text{Number of digital technology industry workers in Australia}}{\text{Number of workers in Australia}}}$$

A hypothetical region with 1,500 digital technology workers and a workforce of 10,000 workers that's within a country with 500,000 digital workers and a total workforce of 10,000,000 would have an LQ of 3. This would be considered a high location quotient and evidence of industry specialisation in digital technology within the region. We can see that this region is employing digital technology workers at three times the rate of the national average. We would do the calculations as below:

$$\text{Location quotient (LQ)} = \frac{\dfrac{1{,}500}{10{,}000}}{\dfrac{500{,}000}{10{,}000{,}000}}$$

$$\text{Location quotient (LQ)} = \frac{0.15}{0.05}$$

$$\text{Location quotient (LQ)} = 3$$

Whilst there is no formal cut-off about what makes an LQ, and industry specialisation, significant, many economic geographers would consider LQs ranging from 1.5–3 (and above) as evidence of significant specialisation (Crawley et al., 2013). There are also statistical tests (Crawley et al., 2013) which can be used to estimate error margins around LQs. These tests account for the number of workers within a region and give us greater confidence in the LQ when the workforce numbers are higher. It's important to do these tests because raw LQ scores can be misleading in regions with small numbers of workers. We apply statistical tests in this study to screen LQs for regions with small workforce numbers.

Our methods and approach

Regional framework

We use the Australian Bureau of Statistics (ABS) level two 2021 statistical areas (SA2) regions for our analysis. There are 2,473 SA2 regions in Australia. This was the finest scale regional framework at which we could calculate the location-quotient data reliably.

Types of digital technology industry clusters

We identify three types of digital technology industry clusters: (a) super-clusters; (b) greater capital city clusters and; (c) regional niche clusters. We have treated regions and greater capital cities separately in our analysis; the differences in population density call for different approaches to understand spatial patterns of digital technology industries.

Super-clusters

Super-clusters are assemblages of multiple SA2 cluster-regions within the greater capital city. They are based on expert judgements about agglomerations based on our knowledge of the digital industries within Australia's capital cities. They contain a significant share of workers in digital occupations and digital companies at the national level. The SA2s in super clusters are close to each other, and are well connected via transport systems. They are significant at the global scale.

Greater capital city clusters

These are large and diversified digital industry clusters with substantial numbers of digital workers, high levels of specialisation and many contain large publicly-listed companies in the digital technology sector. They are significant at the national scale. The SA2 regions included in this set meet the following criteria:

		Count of digital workers > 2600
Location quotient > 2		**OR**
AND	**OR**	Market Capitalisation of Digital Companies > $100 billion
Range* < 0.2		**OR**
		number of specialisations > 5

Regional niche clusters

These occur outside of Australia's eight greater capital cities. They typically contain one, sometimes two, well defined niche specialisations in digital technology such as graphic design or software engineering. They meet the criteria of having a location quotient > 1.5 for at least one digital-occupation specialisation and a range* around that location quotient of <0.75.

Data sources

We source our workforce data from the 2011, 2016 and 2021 population censuses by the Australian Bureau of Statistics. We use the Australian and New Zealand Standard Classification of Occupations. A list of occupation categories were identified by the research team as "digital". The workforce location is by place-of-work (not place-of-residence) as indicated on the census form. Market capitalisation data is sourced from the Australian Stock Exchange (ASX) with company headquarter locations calculated using the Yahoo Finance and the Google Geocoding platform. The list of digital companies was calculated using ASX sector classifications and guidance from the Technology Council of Australia.

*A statistical technique is used to calculate a range above/below the location quotient. The range is larger, and uncertainty higher, for regions with fewer digital workers. Details are provided in the appendix.

Image credit: Taras Vyshnya / Shutterstock

Greater Sydney
Digital industry clusters

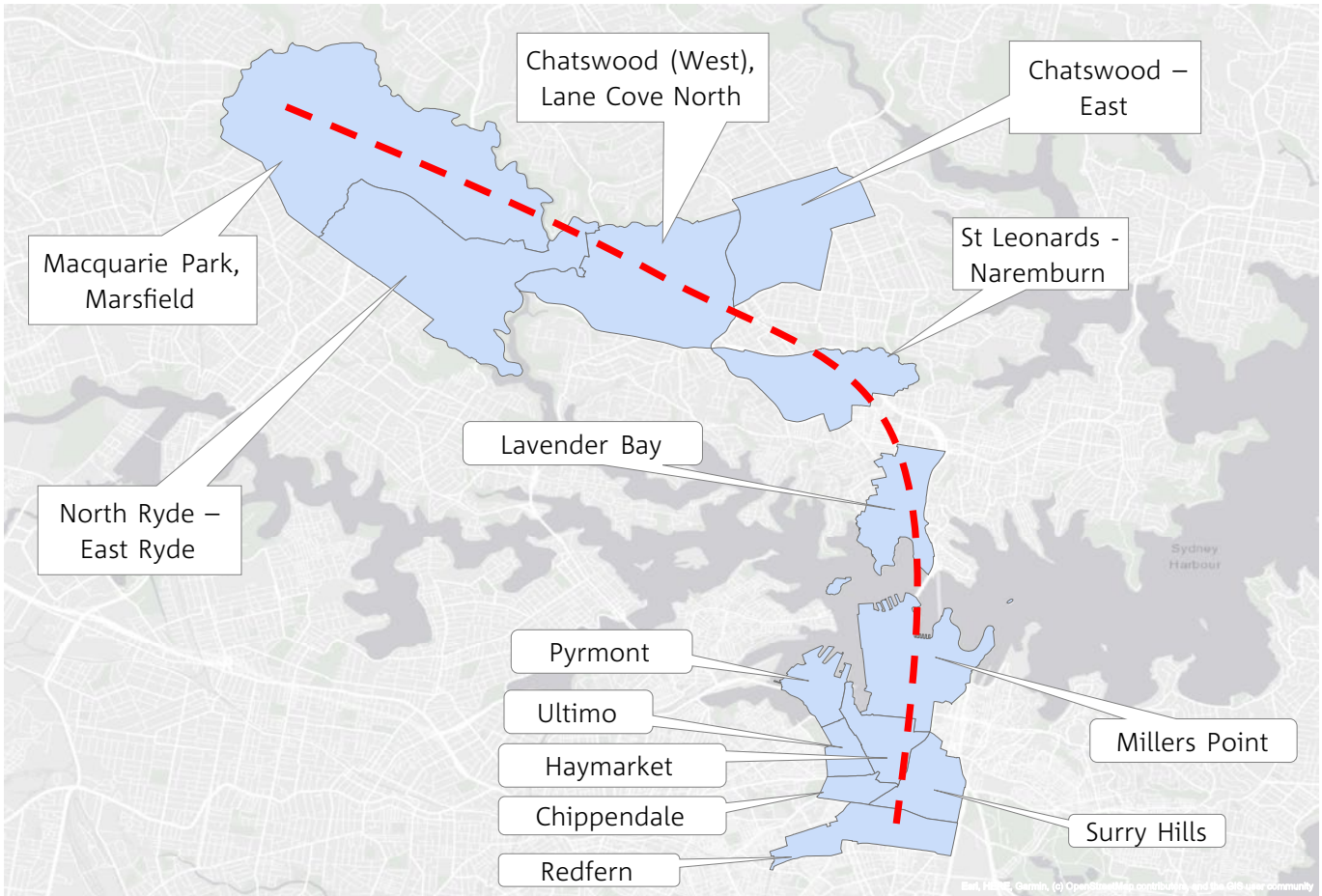
The Sydney arc super-cluster

We identify 13 SA2 regions in Sydney which meet our criteria for national significance whilst also being within close proximity and well-connected by pedestrian, cycle, road, and rail transport systems. Collectively the 13 SA2 regions form an arc across Sydney beginning at Macquarie Park in the northeast and curving down to Surry Hills and Redfern in the south.

The Sydney Arc super-cluster is the workplace for 119,636 workers in digital occupations representing 20.1% of the national digital workforce. We estimate it contains the headquarters of 81 digital technology companies listed on the ASX with a combined market capitalisation of $52 billion as of January 2023.

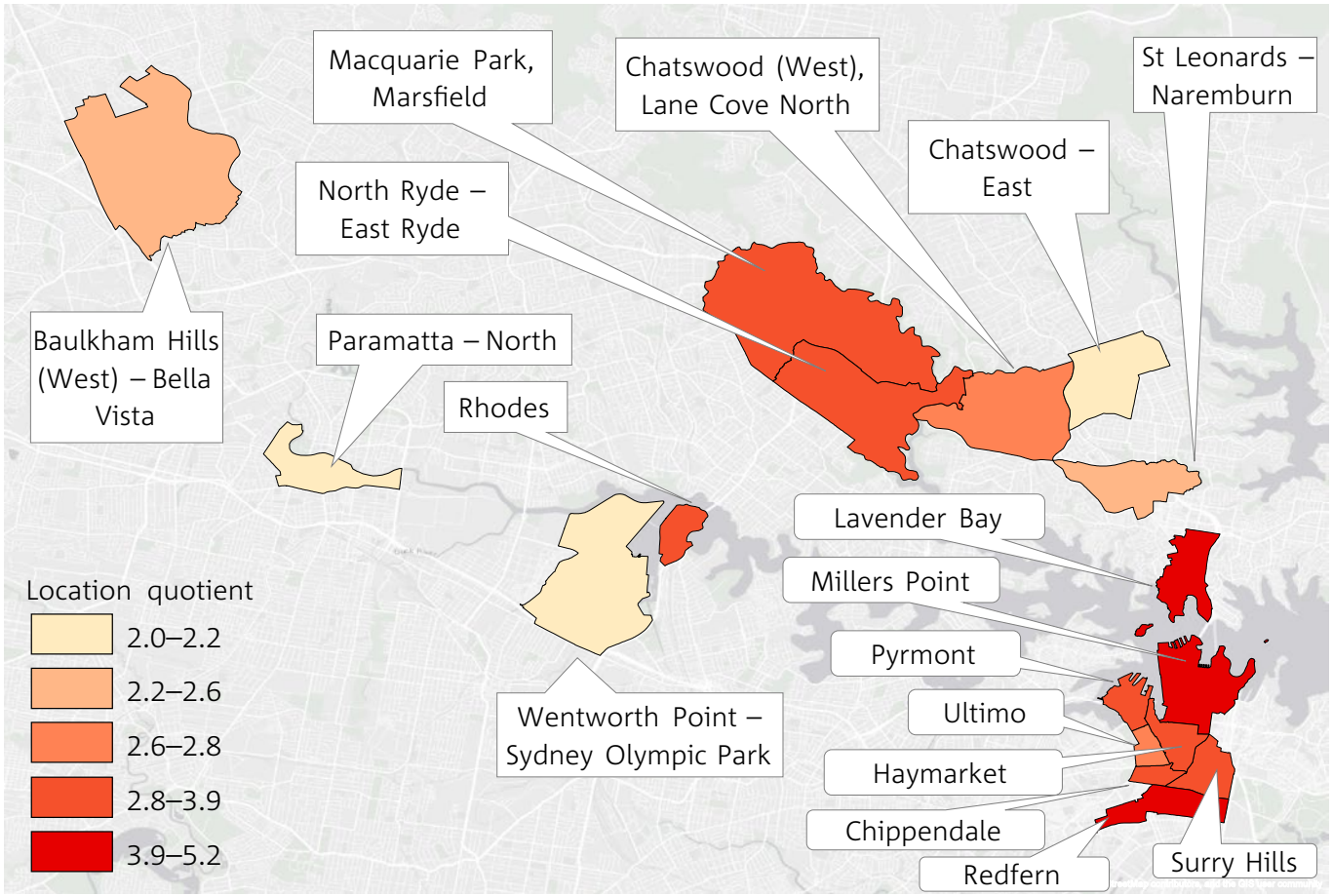
It is also home to most of headquarters of international technology companies with a presence in Australia. Well known companies such as Google, Microsoft, Adobe and Linked In have regional headquarters in the Sydney Arc super-cluster.

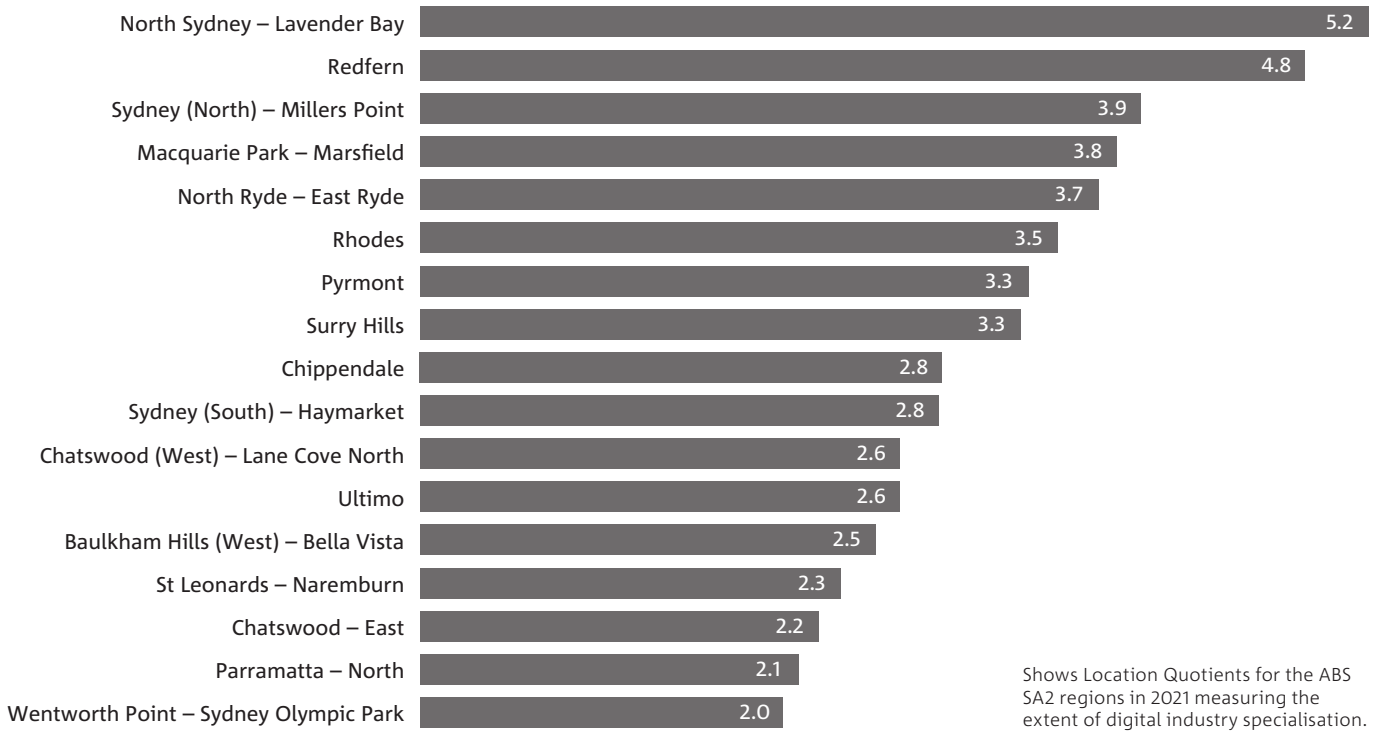
The super-cluster contains significant concentrations of digital technology industry workers specialised in practically all fields of expertise. It contains a large number of start-ups and small and large companies delivering on almost all aspects of the digital industry value chain. It is also home to a large number of research institutes and education and training providers in all aspects of digital technology.



Greater Sydney

Location quotients

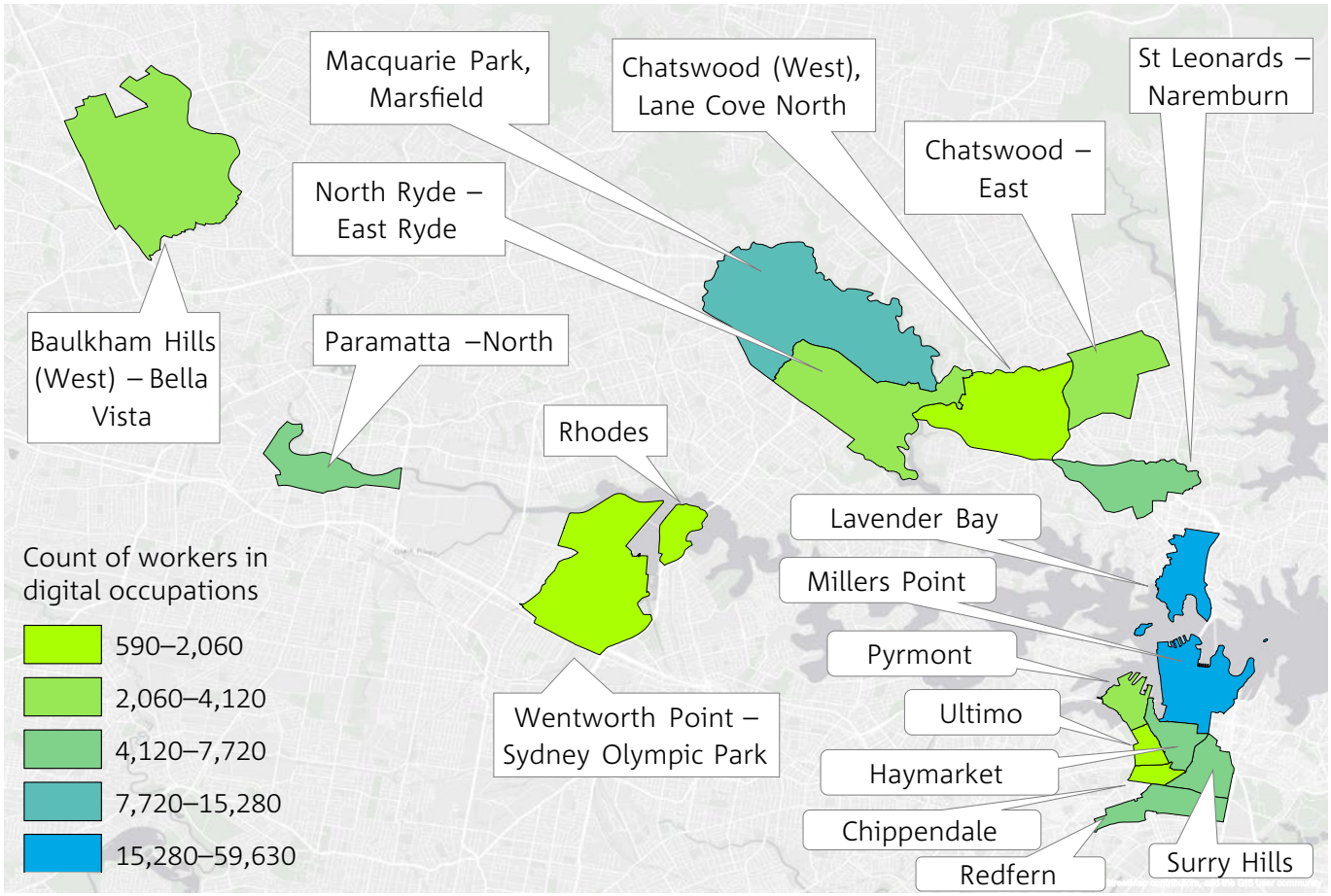


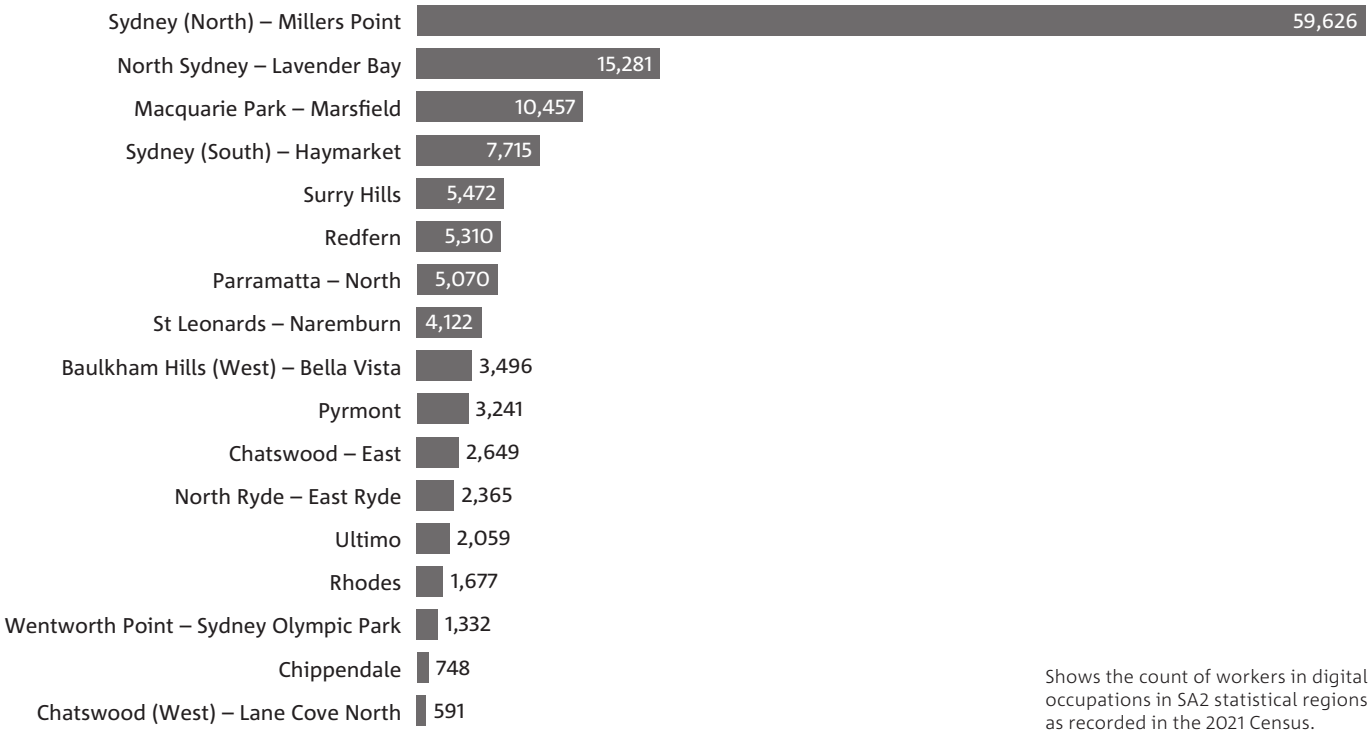


Shows Location Quotients for the ABS SA2 regions in 2021 measuring the extent of digital industry specialisation.

Greater Sydney

Count of workers in digital occupations



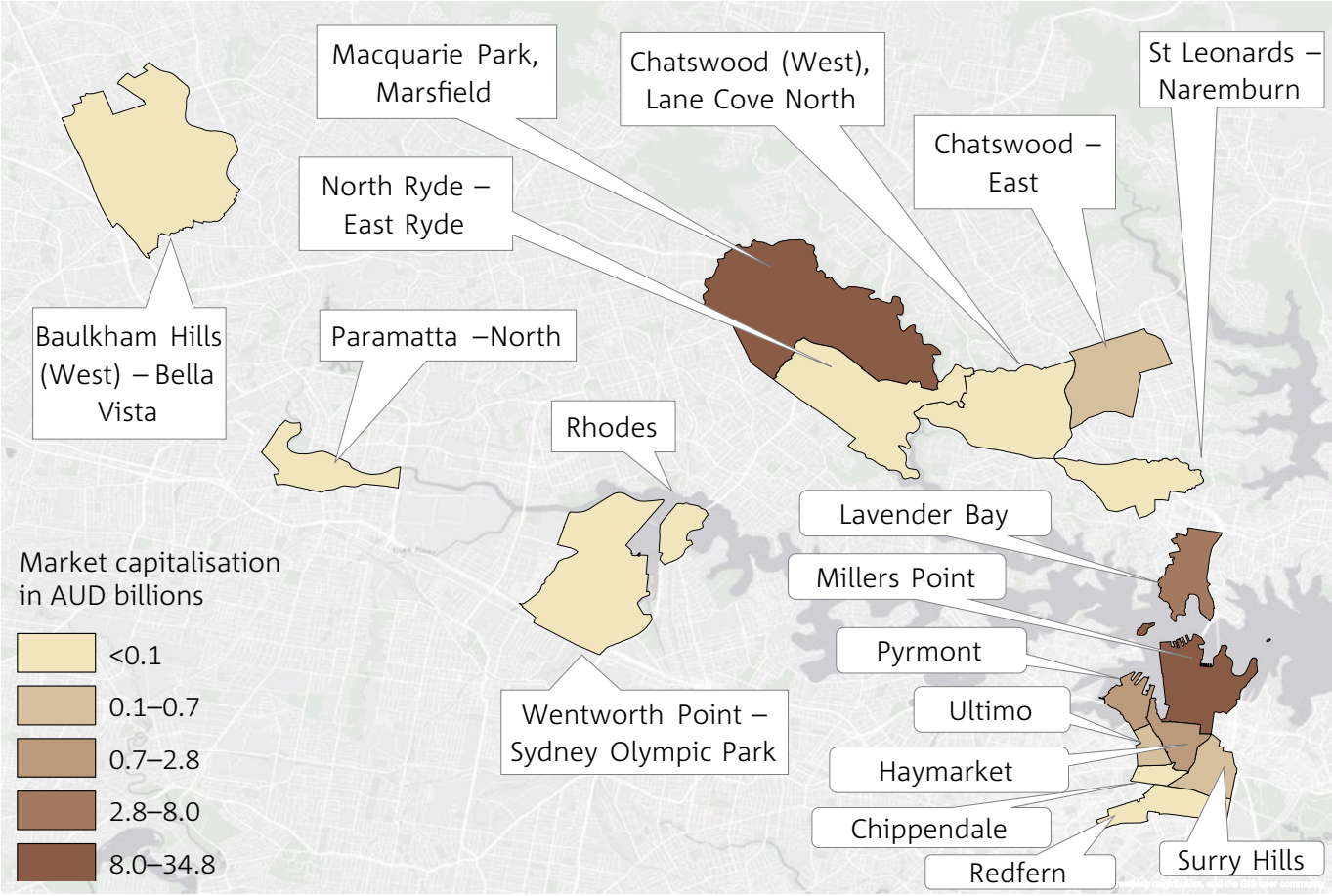


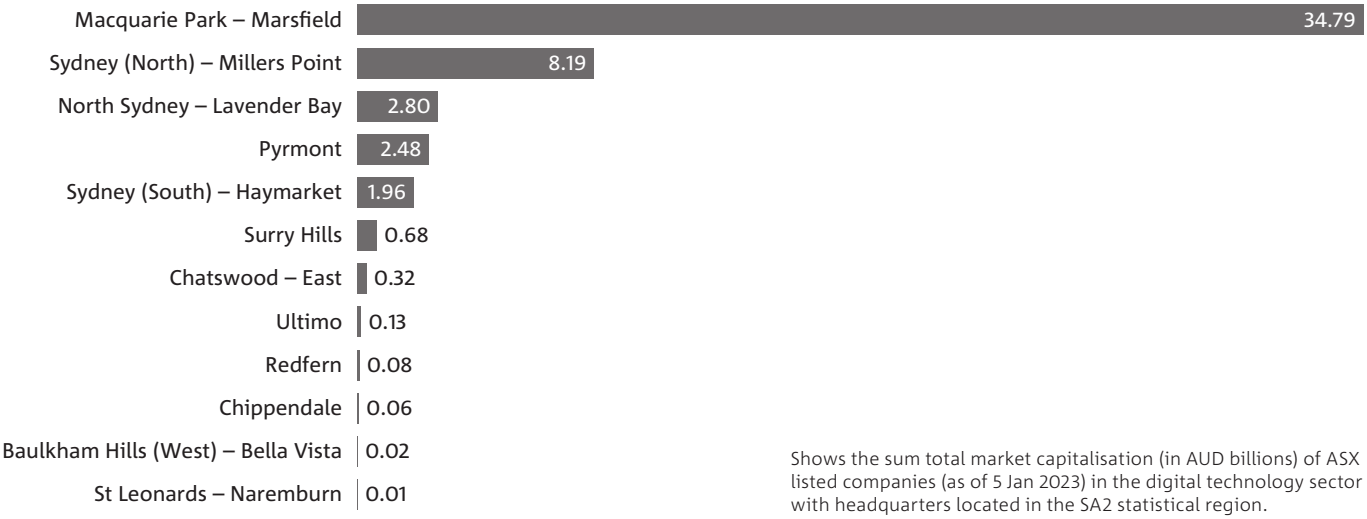
Shows the count of workers in digital occupations in SA2 statistical regions as recorded in the 2021 Census.

Greater Sydney

Market capitalisation of ASX-listed digital-technology companies

Most of Australia's digital technology companies are private (not publicly listed) and many are listed on overseas stock exchanges with presence (or headquarters) in Australia. We are showing the ASX-listed companies here because it provides a consistent reporting framework of company-sector and size (market capitalisation). However we note this is only a slice of a much larger collection of digital technology companies.

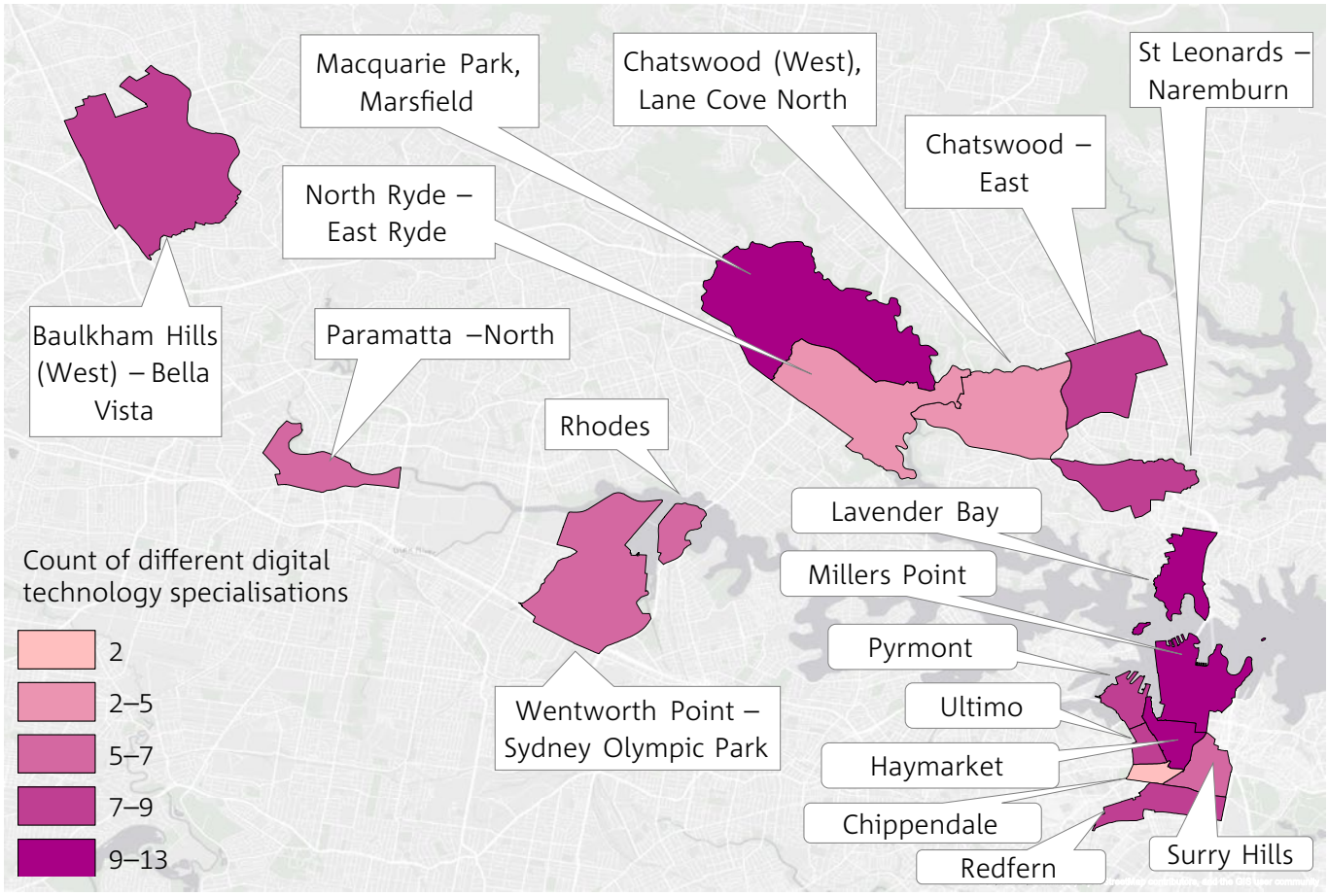


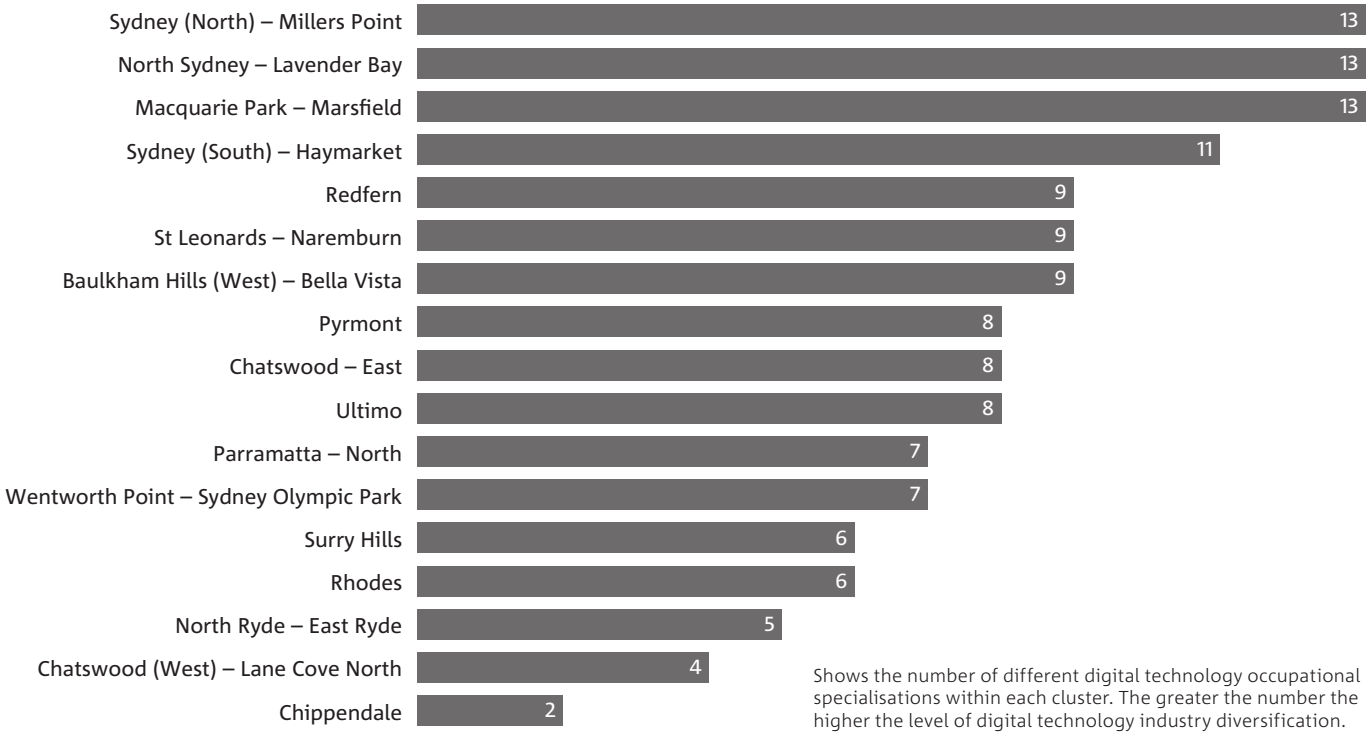


Shows the sum total market capitalisation (in AUD billions) of ASX listed companies (as of 5 Jan 2023) in the digital technology sector with headquarters located in the SA2 statistical region.

Greater Sydney

Count of digital technology occupational specialisations





Shows the number of different digital technology occupational specialisations within each cluster. The greater the number the higher the level of digital technology industry diversification.

Image credit: ProDesign studio/ Shutterstock

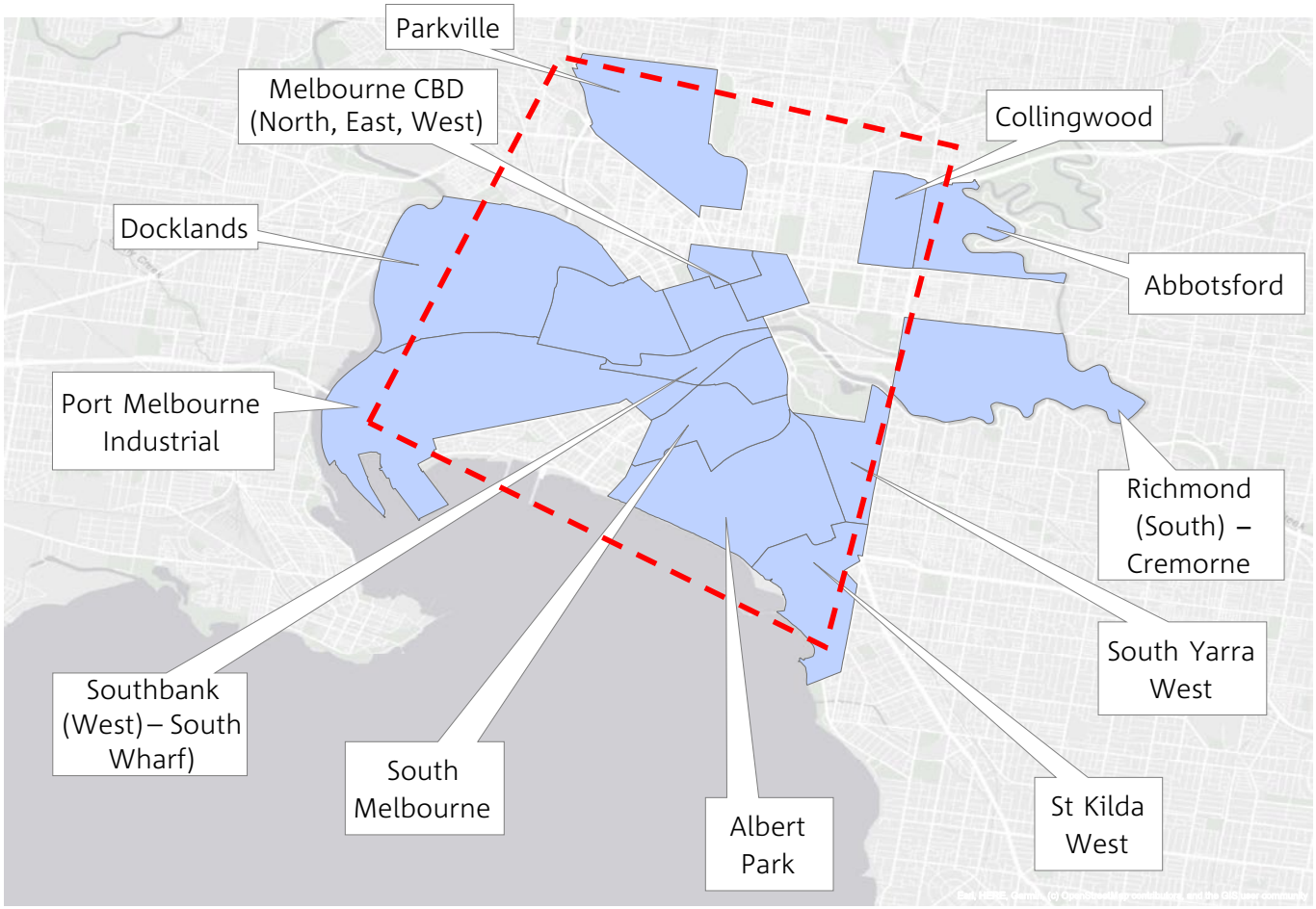
Greater Melbourne
Digital industry clusters

The Melbourne diamond super-cluster

We identify 16 SA2 regions in Melbourne which meet our criteria for national significance whilst also being within close proximity and well connected by pedestrian, cycle, road, and rail transport systems. Collectively the 16 SA2 regions form a diamond shape over Melbourne with the Crown over Parkville, the culet over St Kilda, the eastern side over the Docklands and Port Melbourne and the western edge reaching to Richmond.

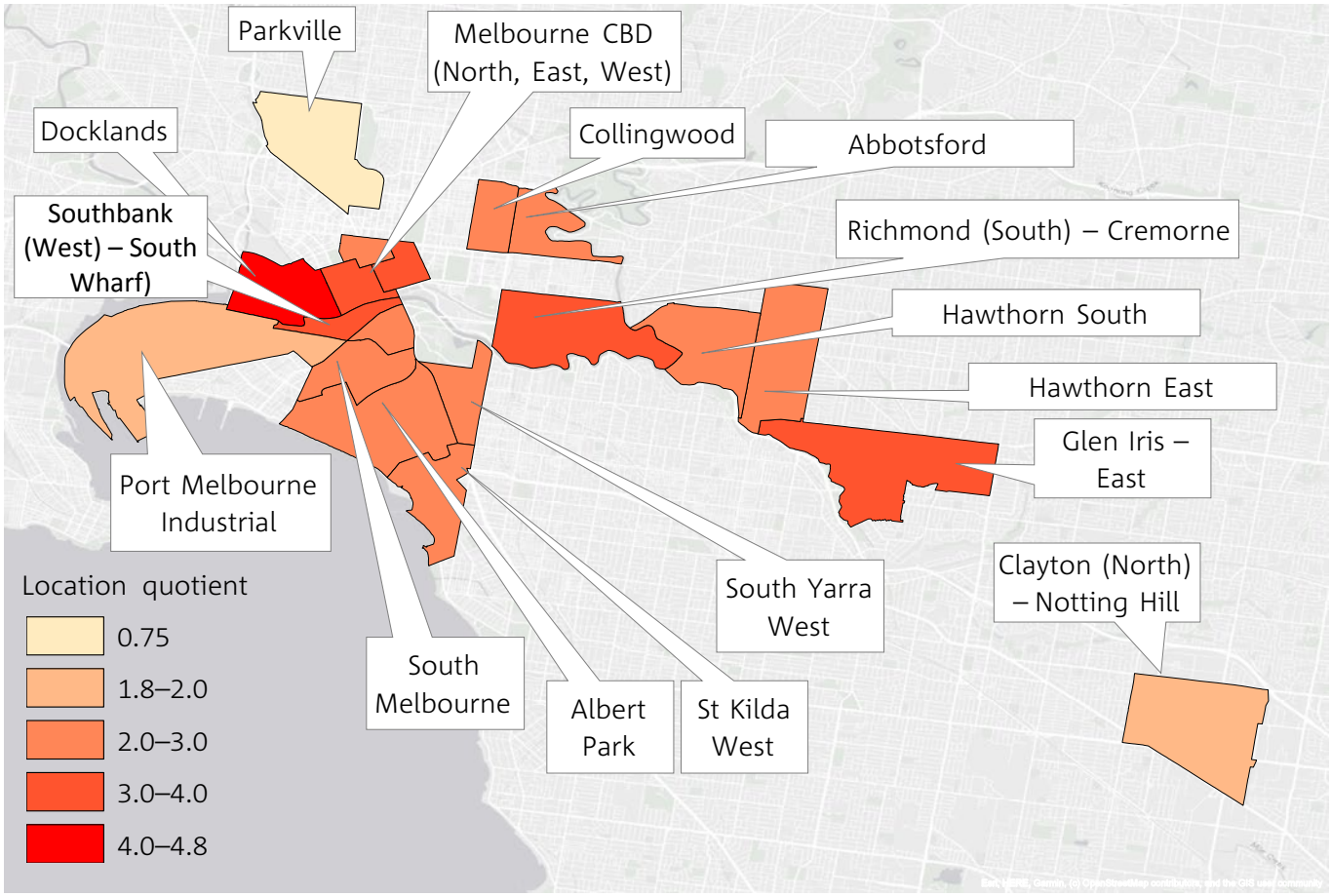
The Melbourne Diamond super-cluster is the workplace for 95,122 workers in digital occupations representing 16% of the national digital workforce. We estimate it contains the headquarters of 62 digital technology companies listed on the ASX with a combined market capitalisation of $203 billion as of January 2023. It is also home to some of headquarters of international technology companies with a presence in Australia such as DoorDash.

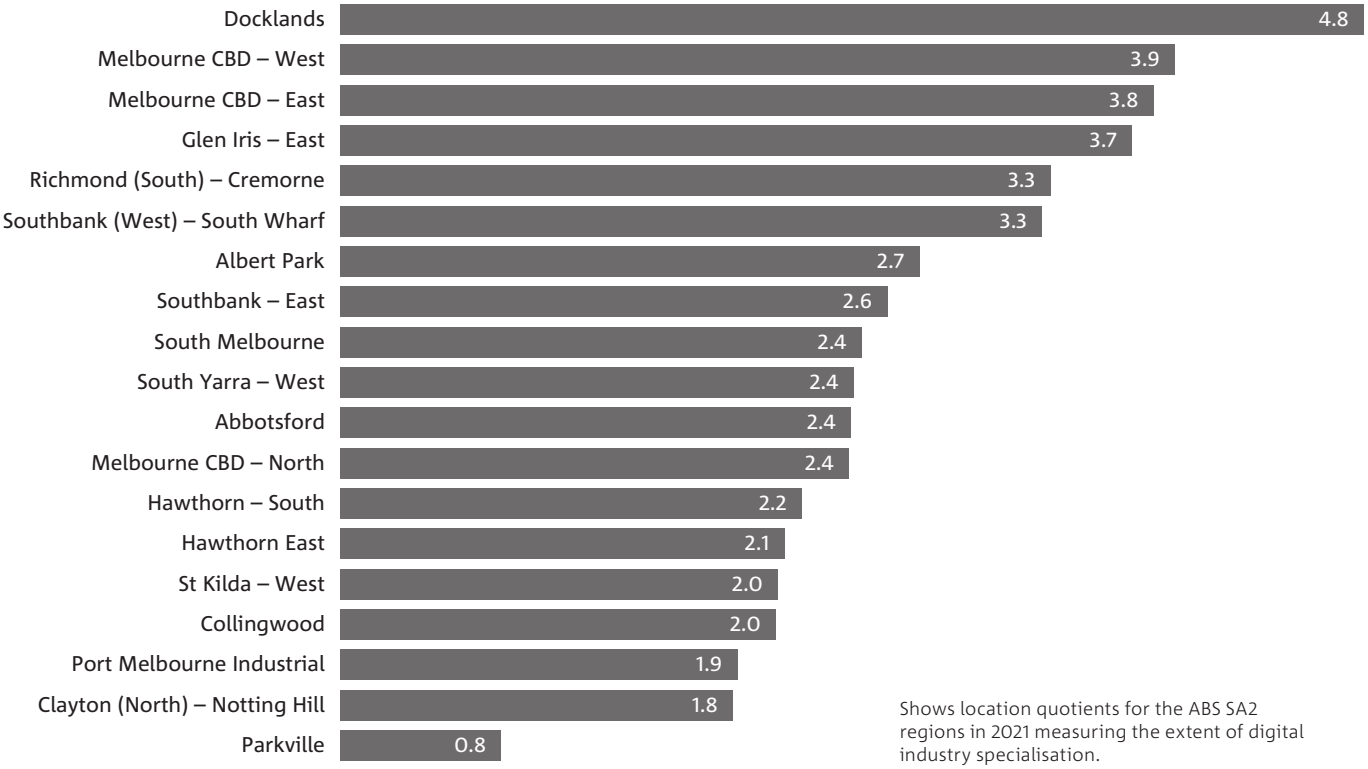
The super-cluster contains significant concentrations of digital technology industry workers specialised in practically all fields of expertise. It contains a large number of start-ups and small and large companies delivering on almost all aspects of the digital industry value chain. It is also home to a large number of research institutes and education and training providers in all aspects of digital technology.



Greater Melbourne

Location quotients

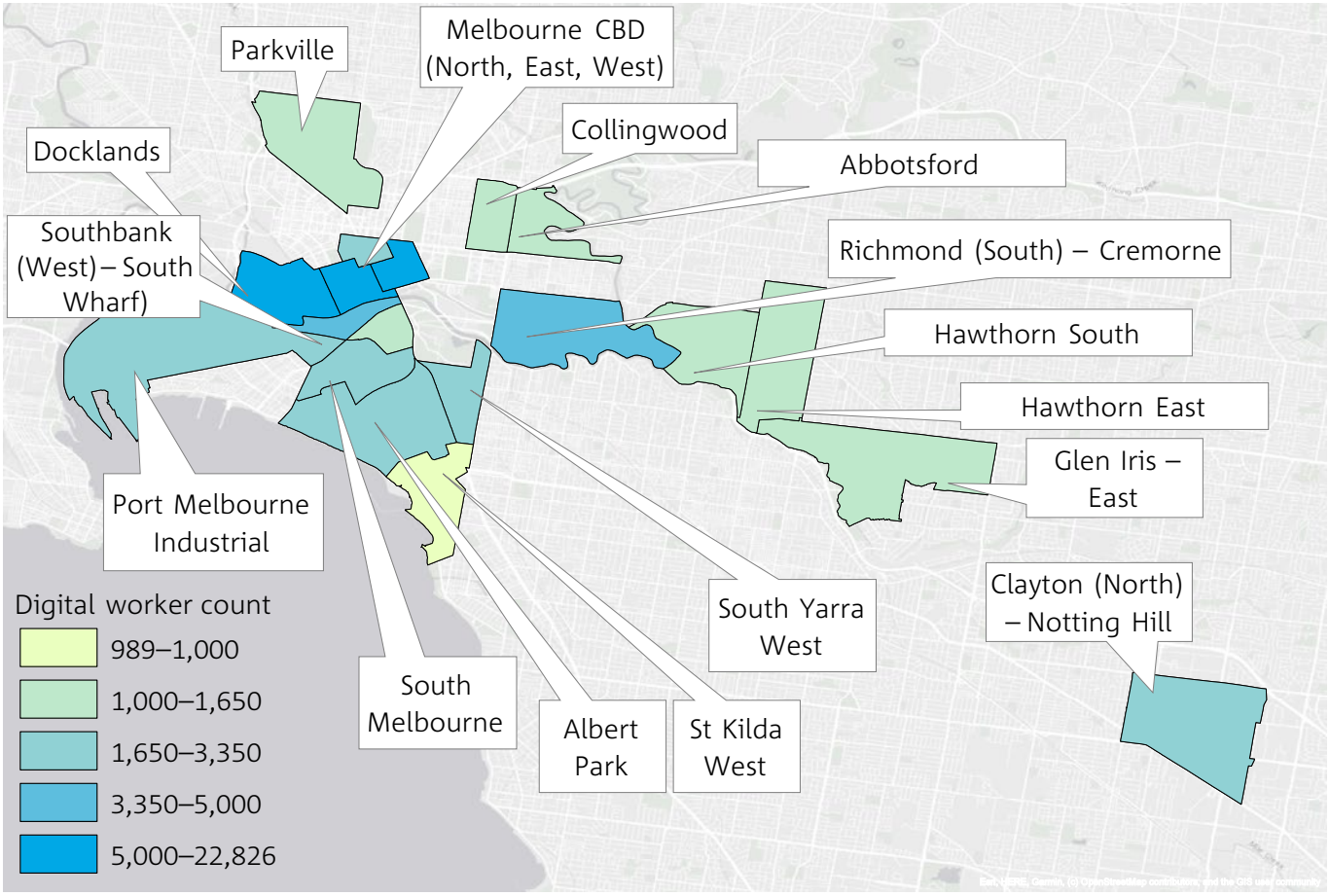


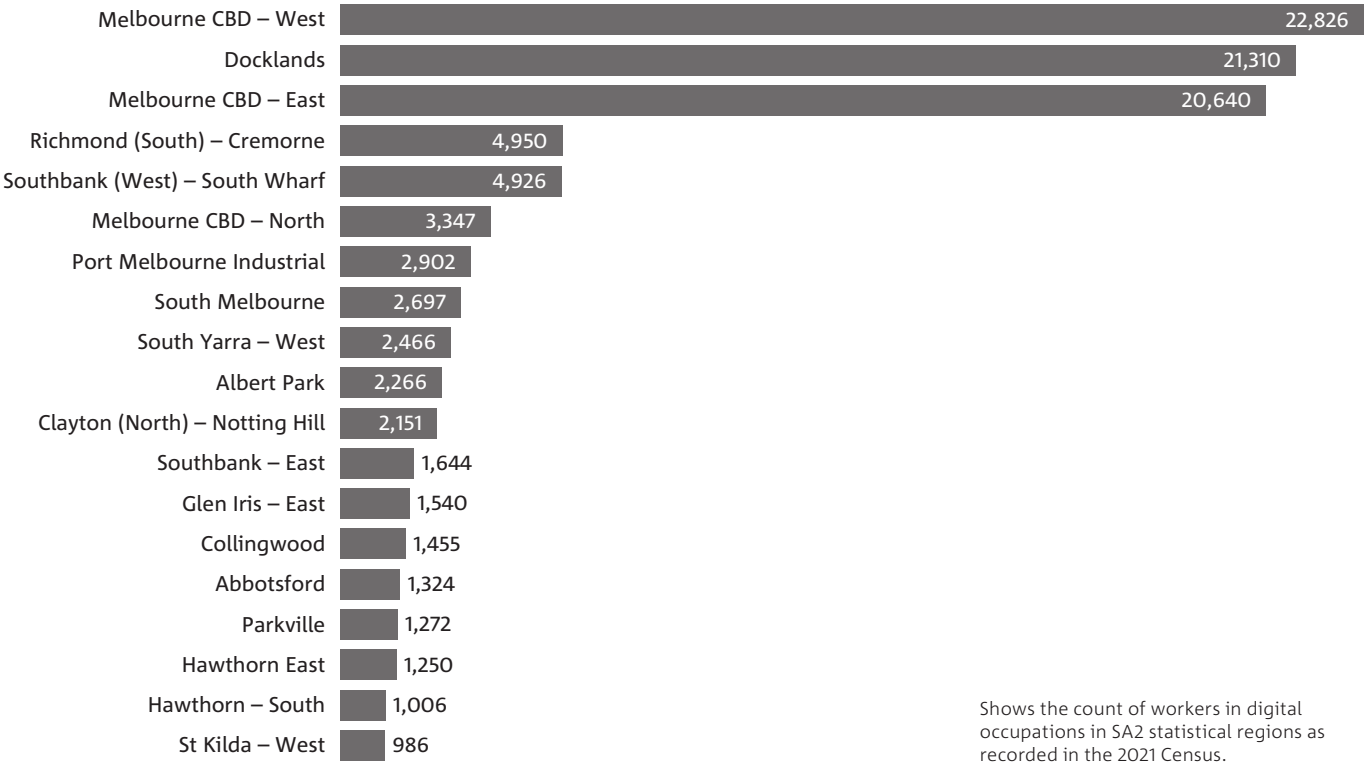


Shows location quotients for the ABS SA2 regions in 2021 measuring the extent of digital industry specialisation.

Greater Melbourne

Count of workers in digital occupations



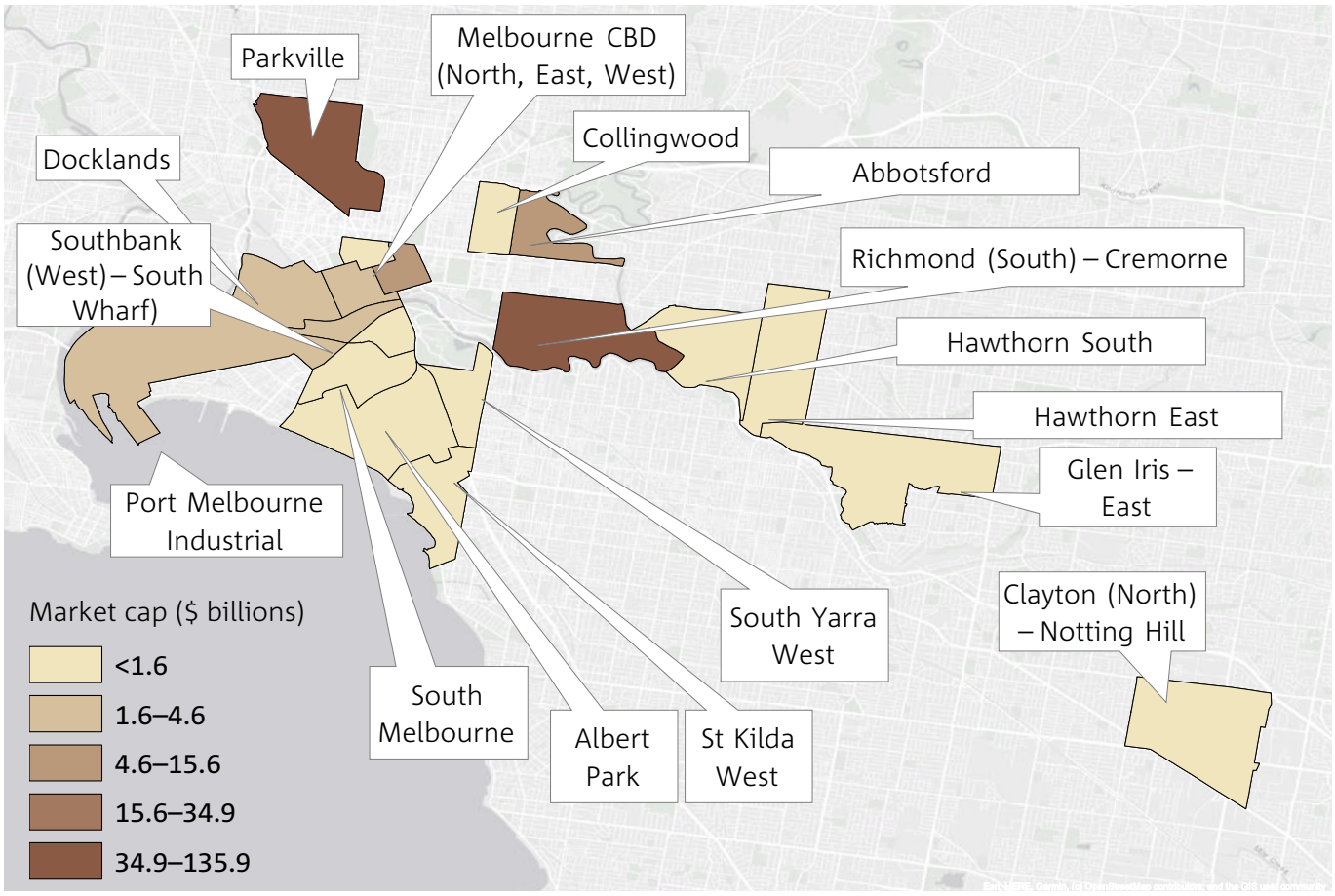


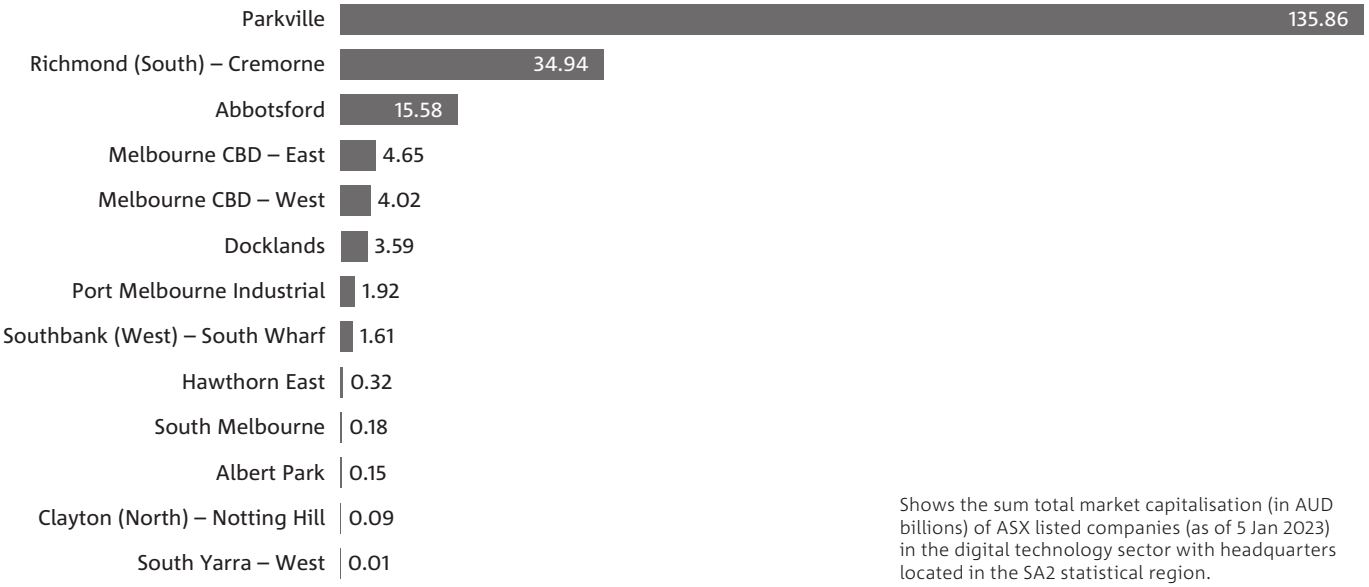
Shows the count of workers in digital occupations in SA2 statistical regions as recorded in the 2021 Census.

Greater Melbourne

Market capitalisation of ASX-listed digital technology companies

Most of Australia's digital technology companies are private (not publicly listed) and many are listed on overseas stock exchanges with presence (or headquarters) in Australia. We are showing the ASX-listed companies here because it provides a consistent reporting framework of company-sector and size (market capitalisation). However we note this is only a slice of a much larger collection of digital technology companies.

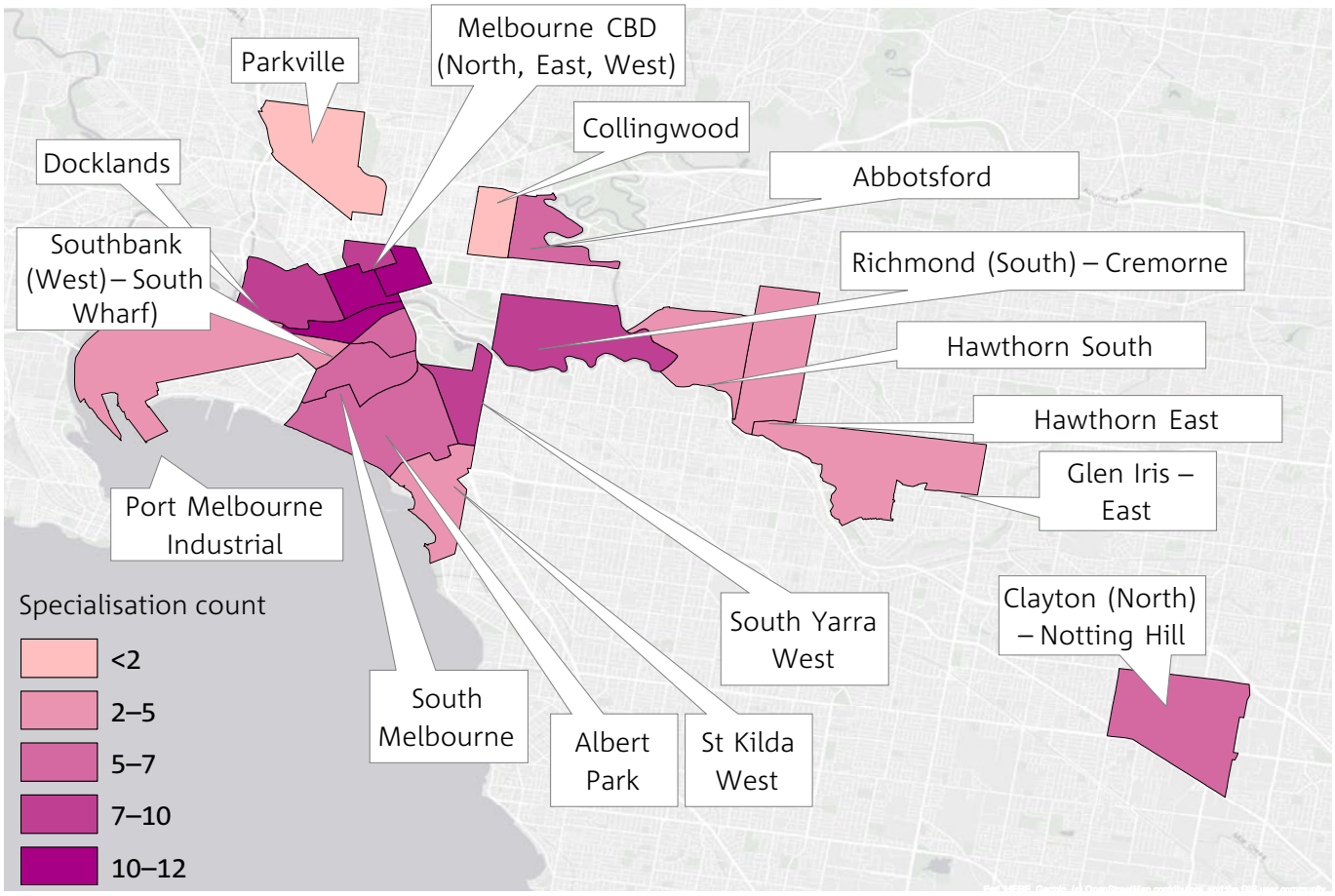


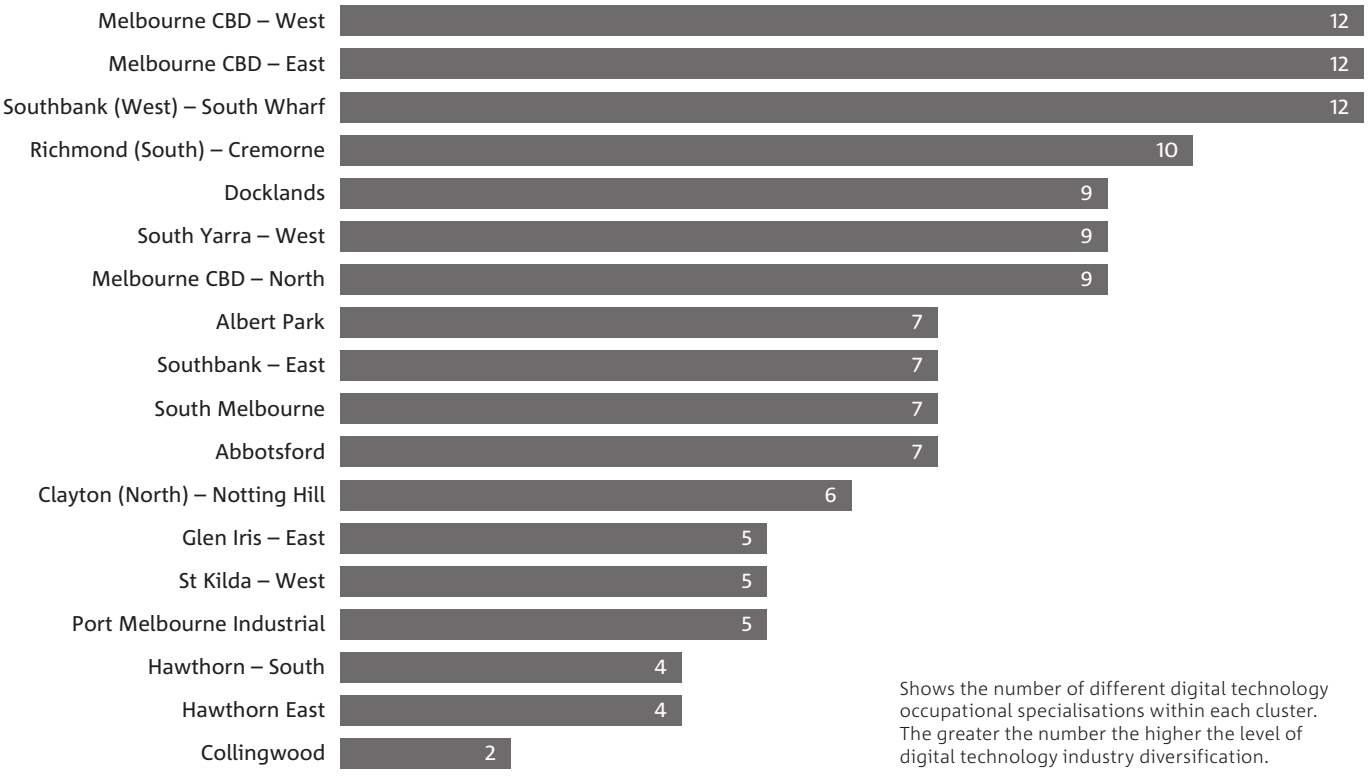


Shows the sum total market capitalisation (in AUD billions) of ASX listed companies (as of 5 Jan 2023) in the digital technology sector with headquarters located in the SA2 statistical region.

Greater Melbourne

Count of digital technology occupational specialisations





Shows the number of different digital technology occupational specialisations within each cluster. The greater the number the higher the level of digital technology industry diversification.

Image credit: Rob D the Pastry Chef / Shutterstock

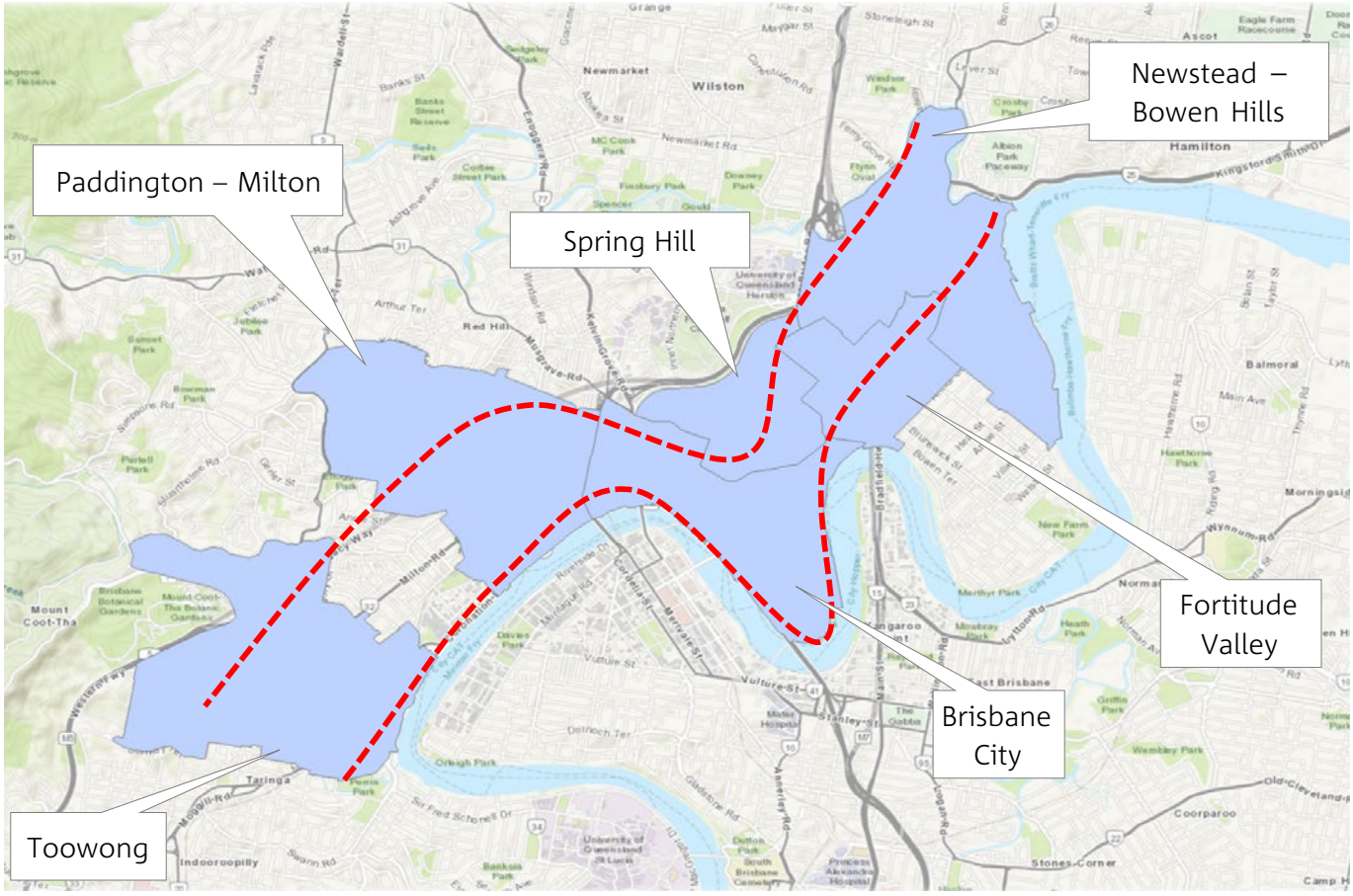
Greater Brisbane
Digital industry clusters

The Brisbane corridor super-cluster

We identify 6 SA2 regions in Brisbane which meet our criteria for national significance whilst also being within close proximity and well connected by pedestrian, cycle, road, and rail transport systems. Collectively the 6 SA2 regions form a corridor from Bowen Hills to Toowong along Ann Street and Coronation Drive. The Brisbane corridor super-cluster goes through Fortitude Valley, Brisbane City and Milton. Transport connectivity plays a key role in its formation.

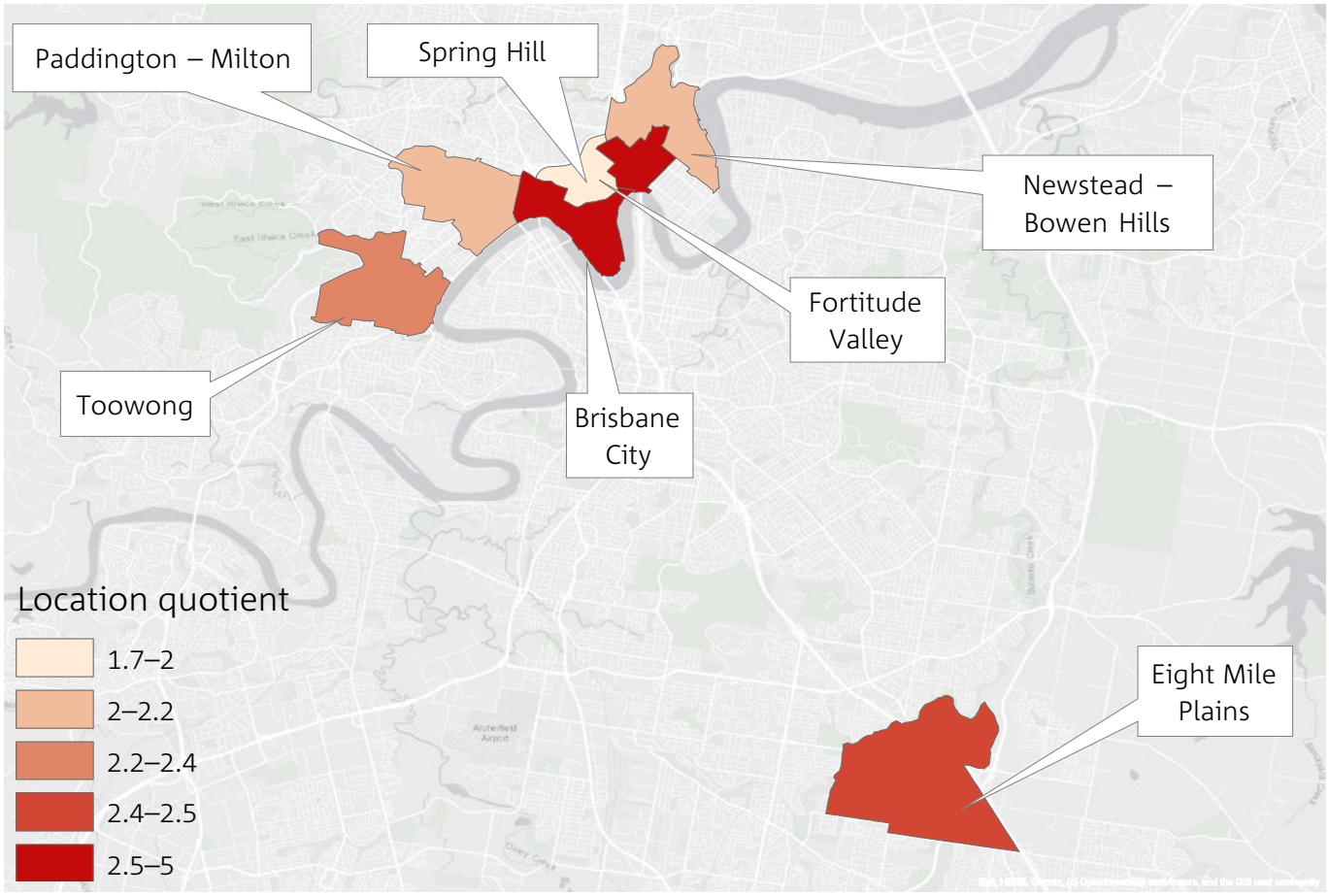
The Brisbane corridor super-cluster is the workplace for 33,534 workers in digital occupations representing 5.6% of the national digital workforce. We estimate it contains the headquarters of 19 digital technology companies listed on the ASX with a combined market capitalisation of $13.29 billion as of January 2023.

The super-cluster contains significant concentrations of digital technology industry workers specialised in practically all fields of expertise. It contains a large number of start-ups and small and large companies delivering on almost all aspects of the digital industry value chain. It is also home to, and located near to, a number of research institutes and education and training providers in all aspects of digital technology.



Greater Brisbane

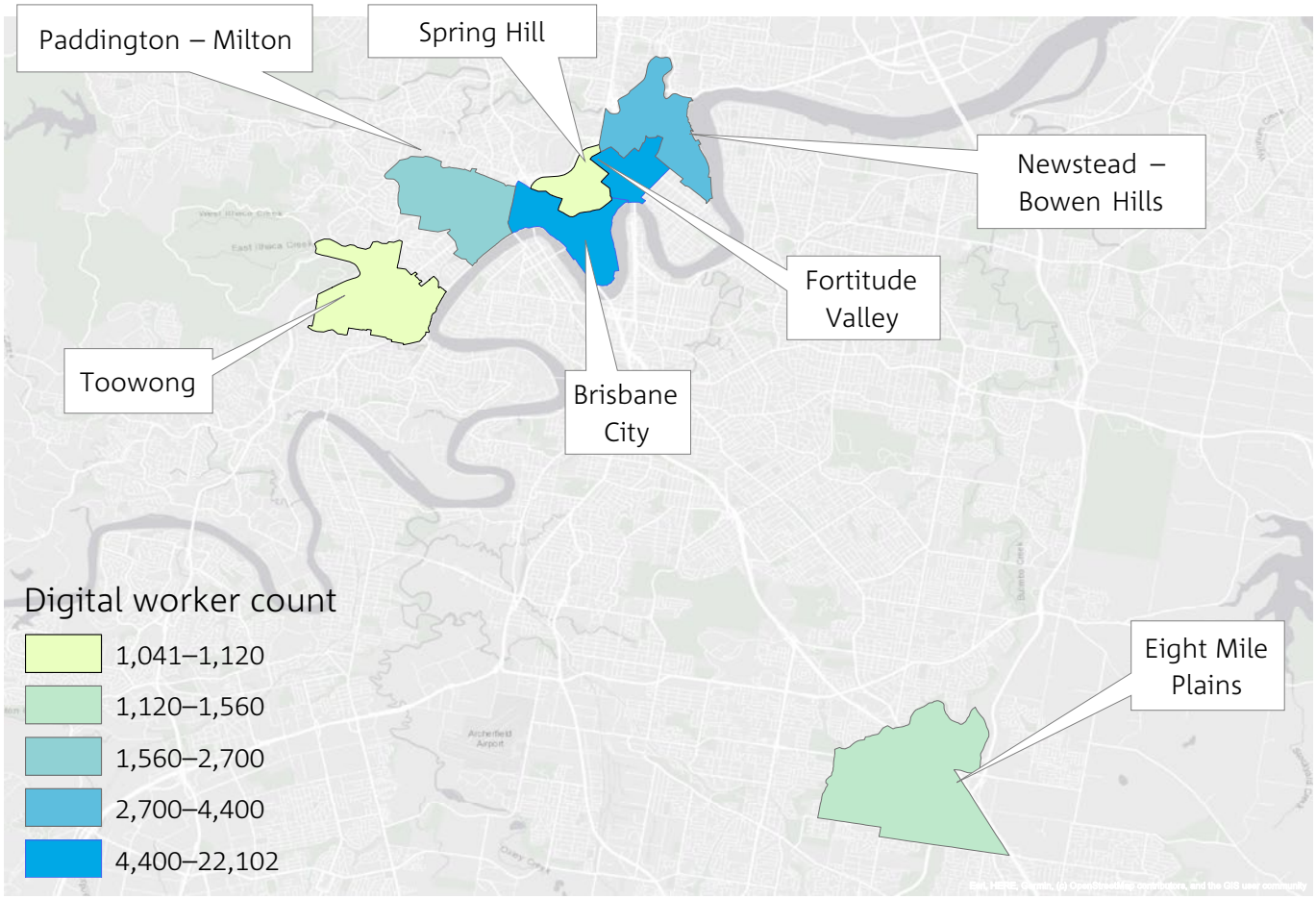
Location quotients



Shows location quotients for the ABS SA2 regions in 2021 measuring the extent of digital industry specialisation.

Greater Brisbane

Count of workers in digital occupations

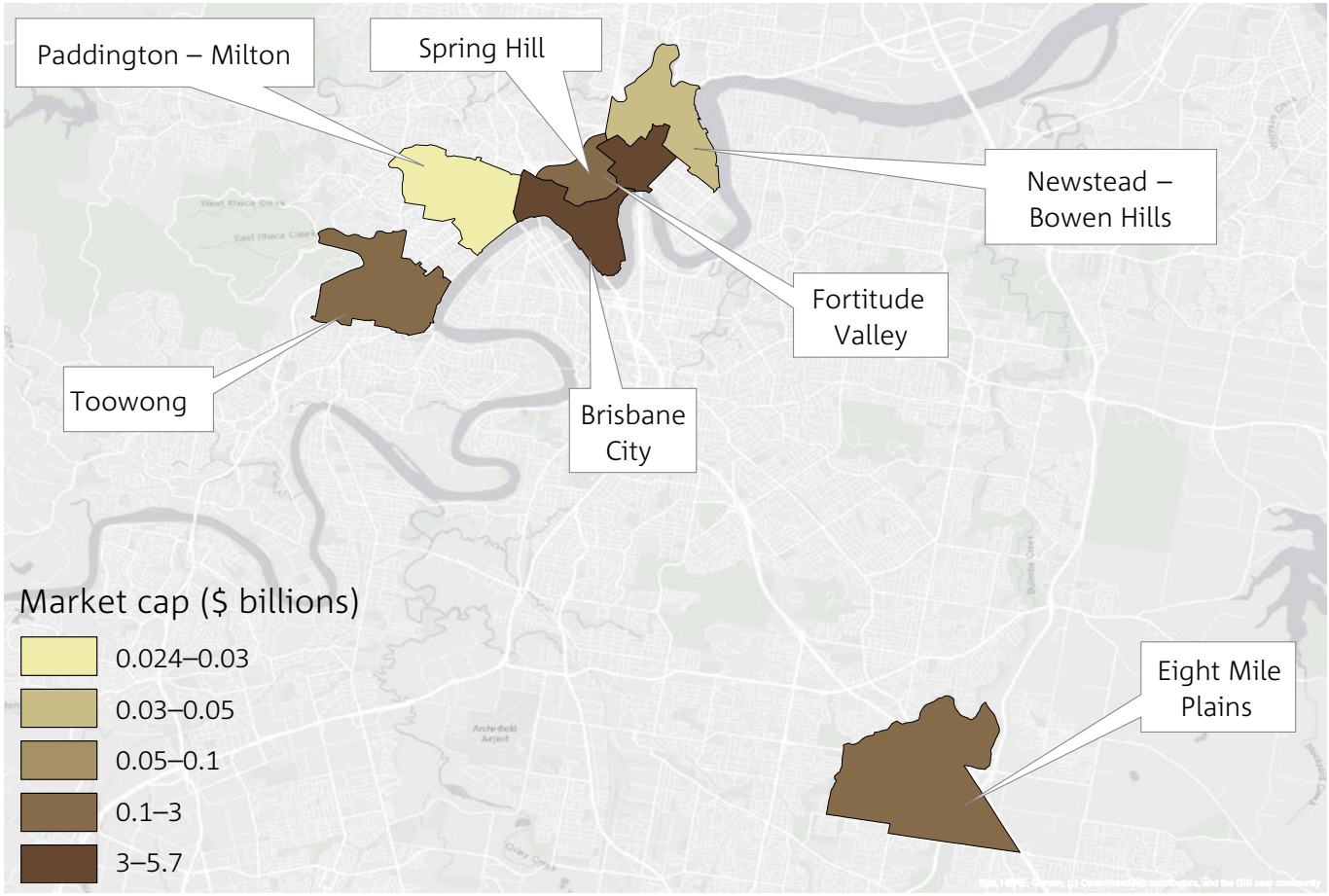


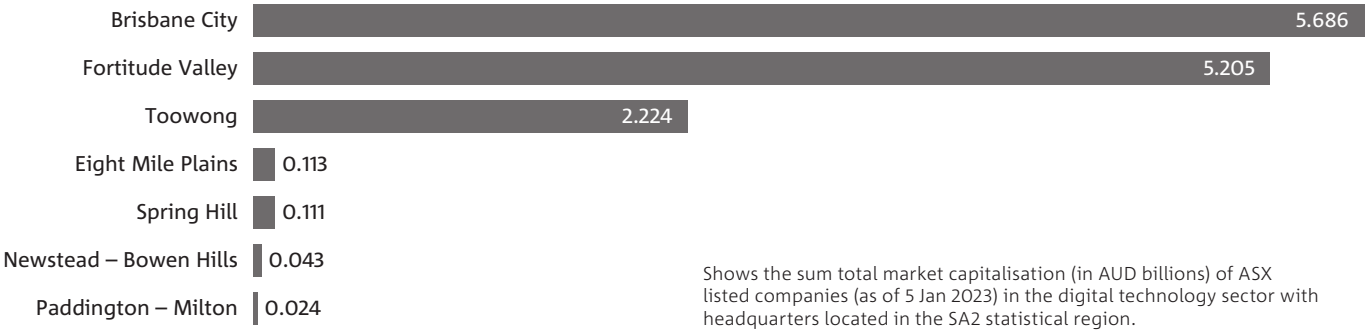
Shows the count of workers in digital occupations in SA2 statistical regions as recorded in the 2021 Census.

Greater Brisbane

Market capitalisation of ASX-listed digital technology companies

Most of Australia's digital technology companies are private (not publicly listed) and many are listed on overseas stock exchanges with presence (or headquarters) in Australia. We are showing the ASX-listed companies here because it provides a consistent reporting framework of company-sector and size (market capitalisation). However we note this is only a slice of a much larger collection of digital technology companies.

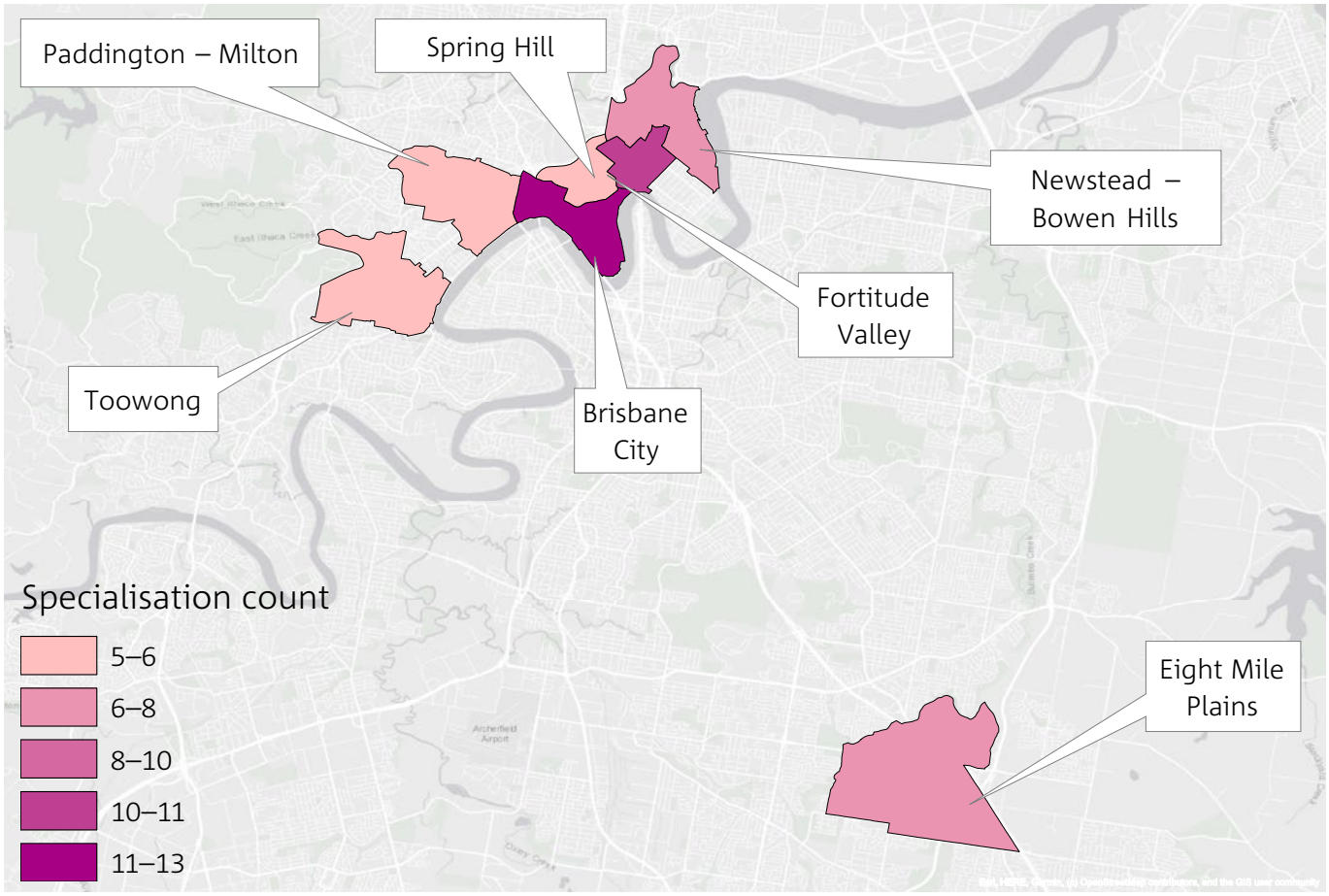


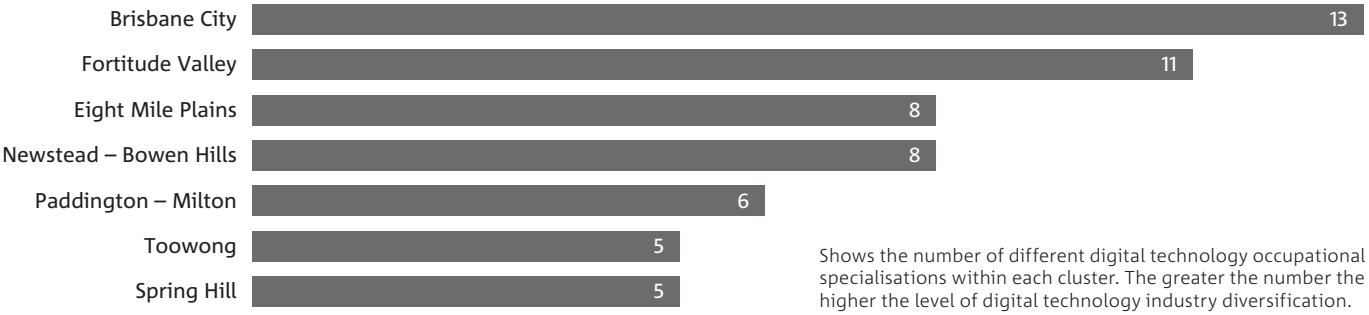


Shows the sum total market capitalisation (in AUD billions) of ASX listed companies (as of 5 Jan 2023) in the digital technology sector with headquarters located in the SA2 statistical region.

Greater Brisbane

Count of digital technology occupational specialisations





Shows the number of different digital technology occupational specialisations within each cluster. The greater the number the higher the level of digital technology industry diversification.

Image credit: Thomas Edmondson / Shutterstock

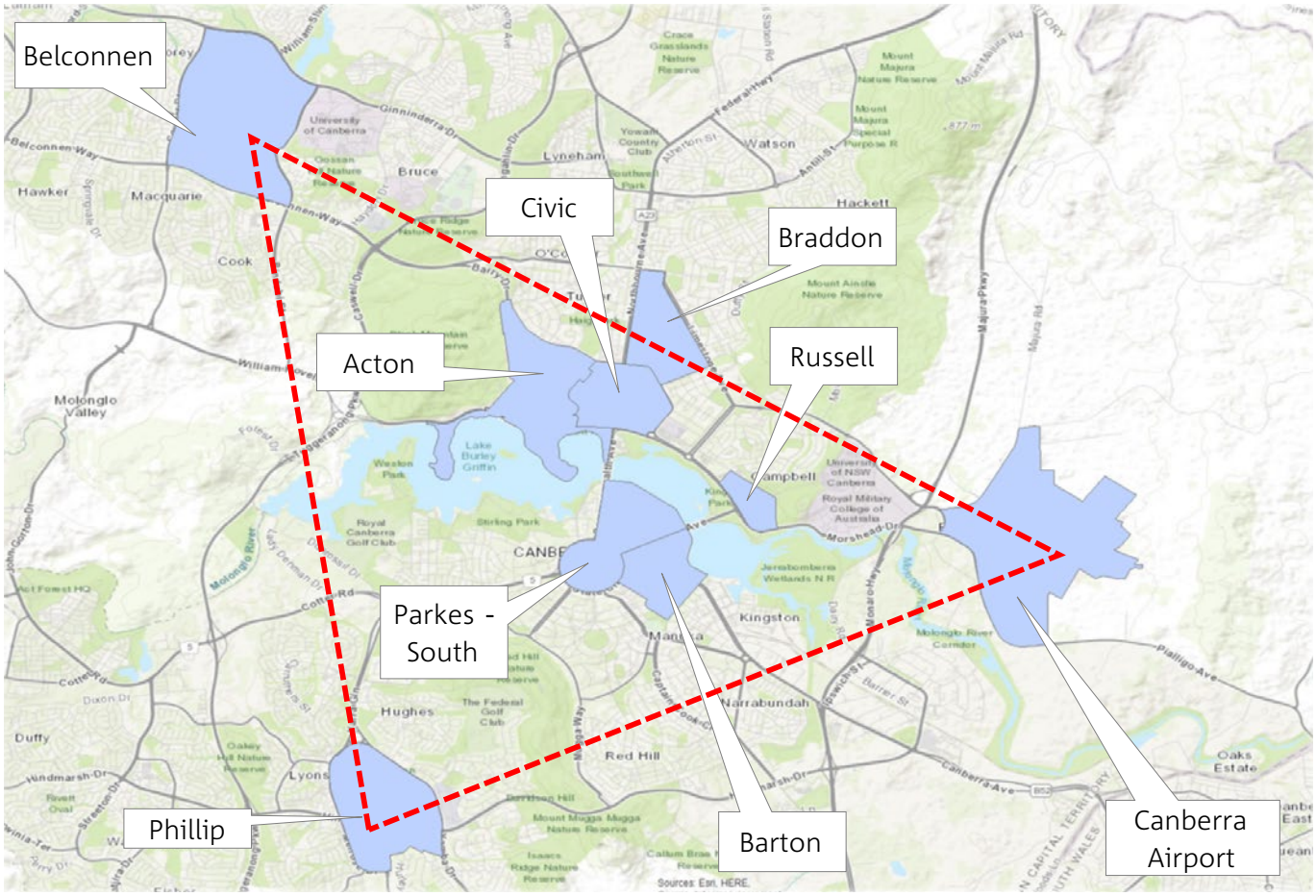
Greater Canberra
Digital industry clusters

The Canberra triangle super-cluster

We identify 9 SA2 regions in Canberra which meet our criteria for national significance whilst also being within close proximity and well connected by pedestrian, cycle, road, and rail transport systems. Collectively the 9 SA2 regions form a triangle with Belconnen in the northwest, Phillip in the southwest and Canberra Airport in the east. Canberra Civic is near the centre of the triangle.

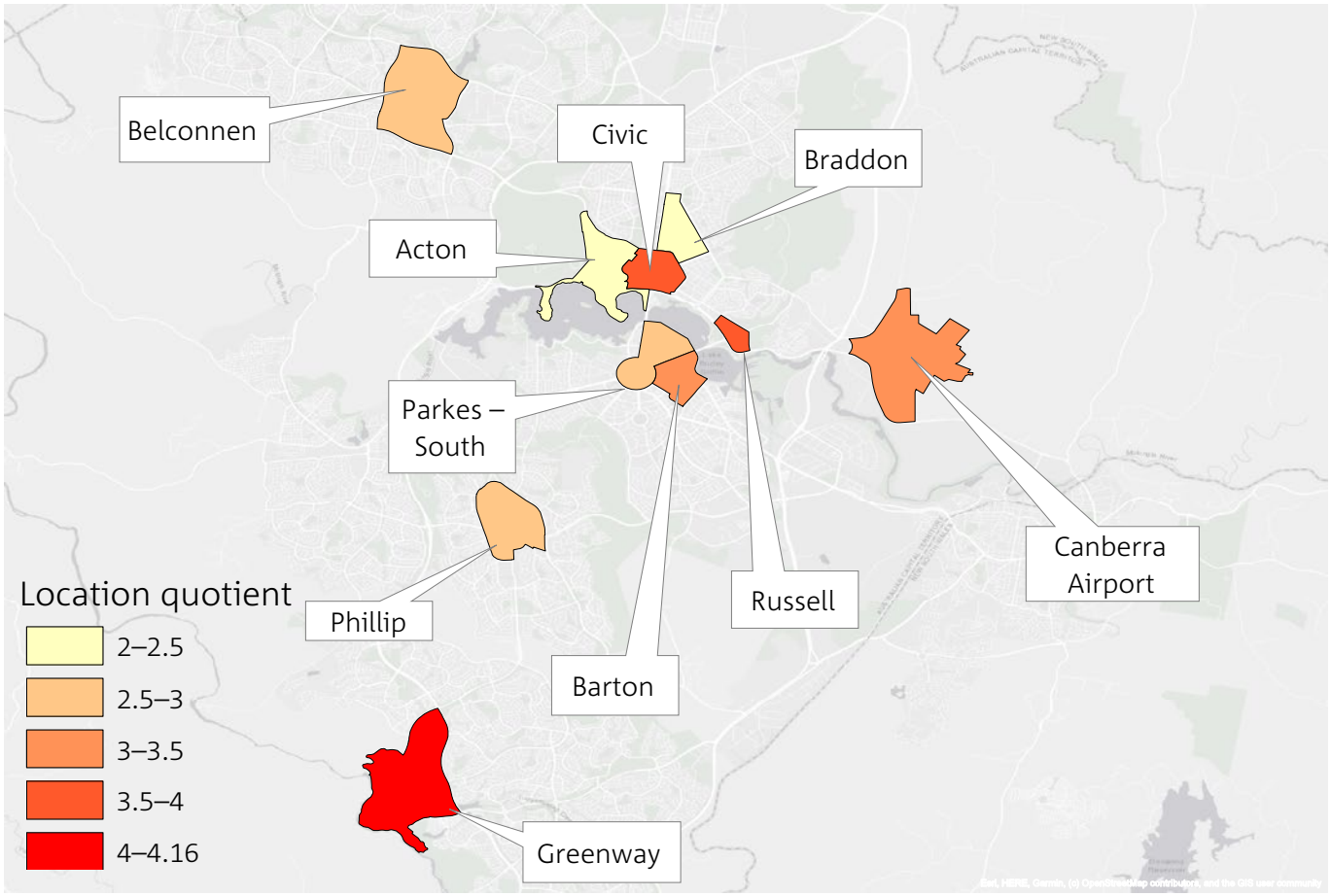
The Canberra triangle super-cluster is the workplace for 19,362 workers in digital occupations representing 3.3% of the national digital workforce. We estimate it contains the headquarters of 2 digital technology companies listed on the ASX with a combined market capitalisation of $60.14 million as of January 2023.

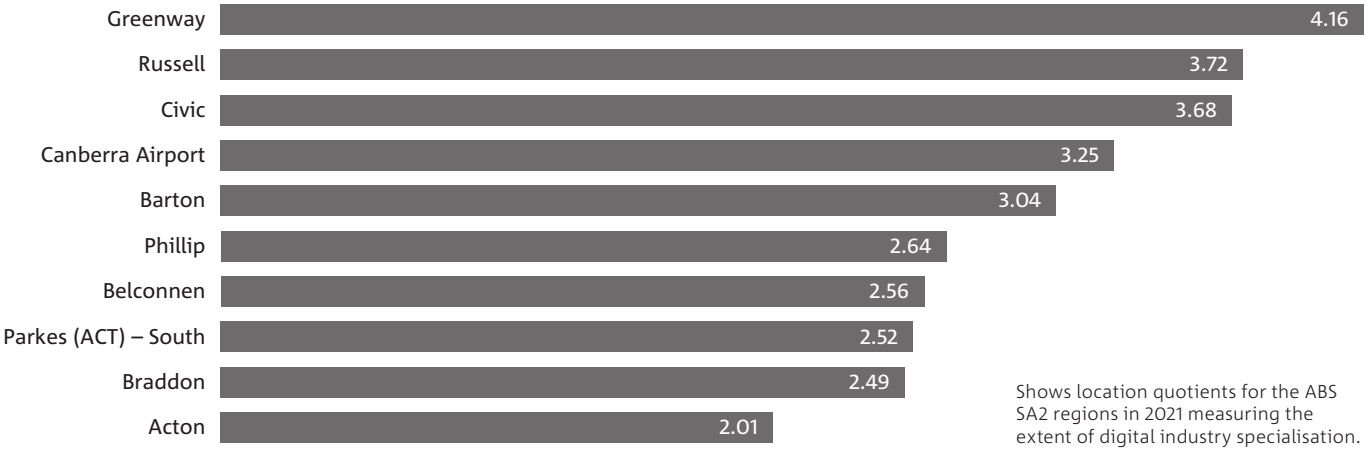
The super-cluster contains significant concentrations of digital technology industry workers specialised in practically all fields of expertise. It contains a large number of start-ups and small and large companies delivering on almost all aspects of the digital industry value chain. It is also home to a number of research institutes and education and training providers in all aspects of digital technology.



Greater Canberra

Location quotients

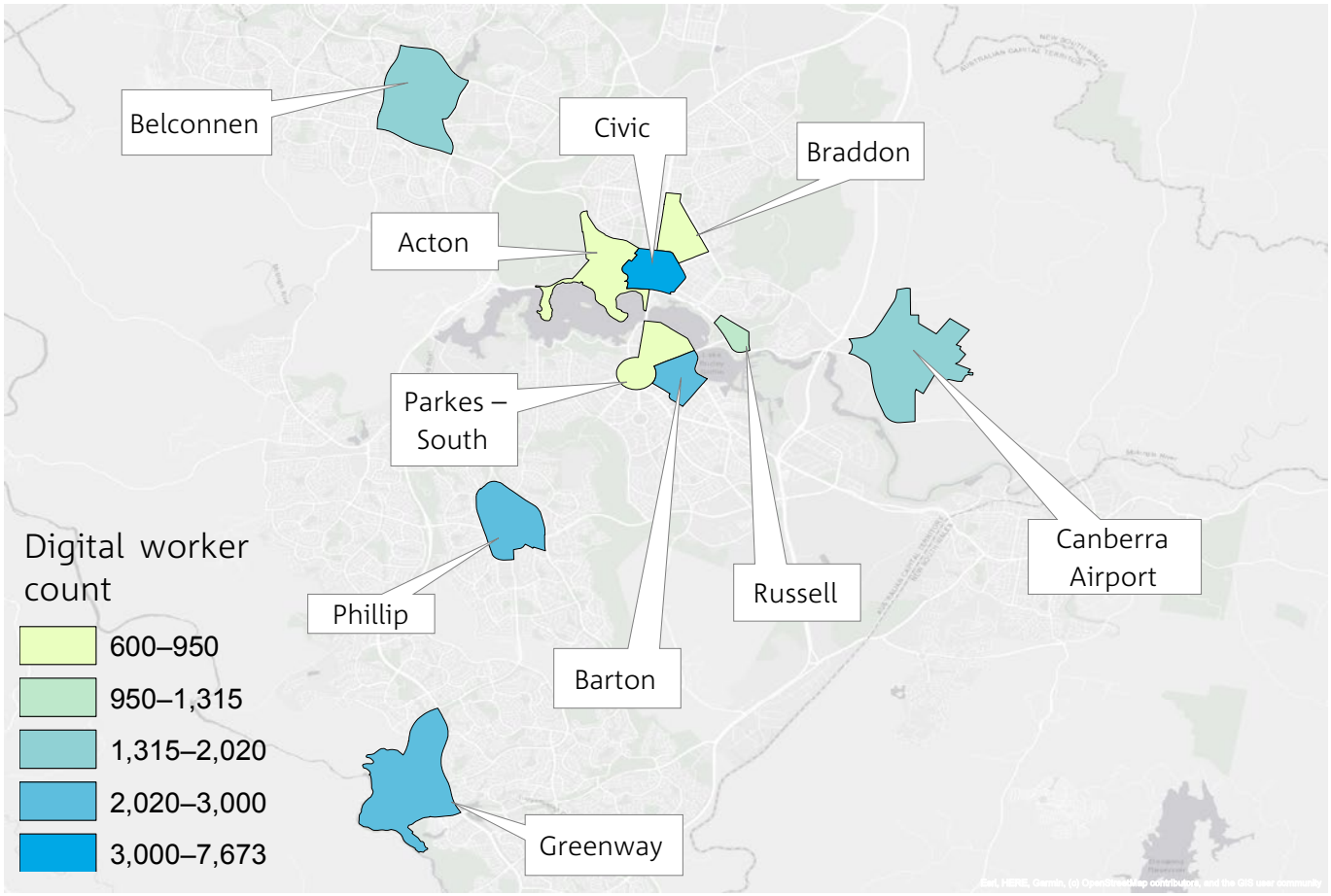


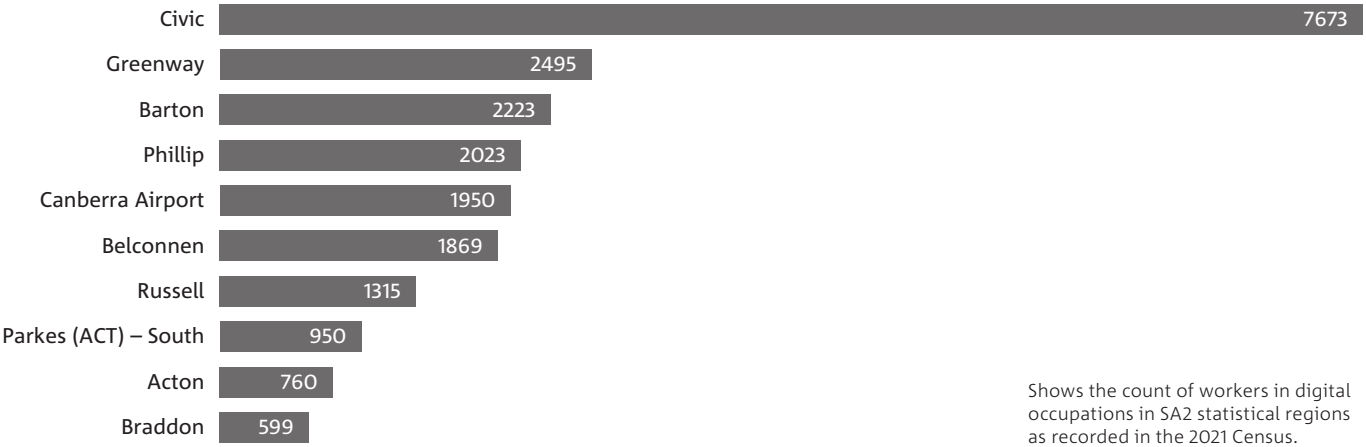


Shows location quotients for the ABS SA2 regions in 2021 measuring the extent of digital industry specialisation.

Greater Canberra

Count of workers in digital occupations



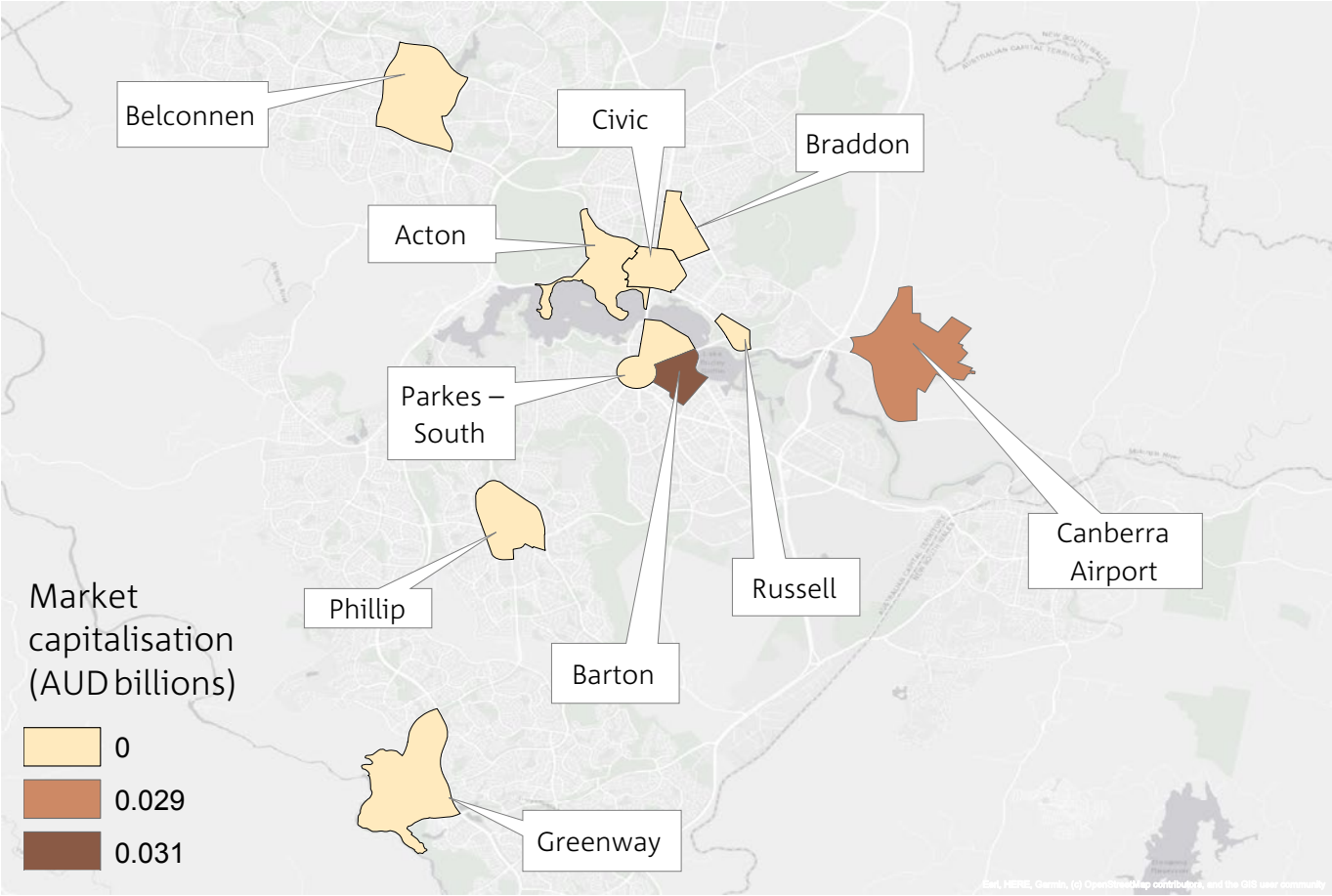


Shows the count of workers in digital occupations in SA2 statistical regions as recorded in the 2021 Census.

Greater Canberra

Market capitalisation of ASX-listed digital technology companies

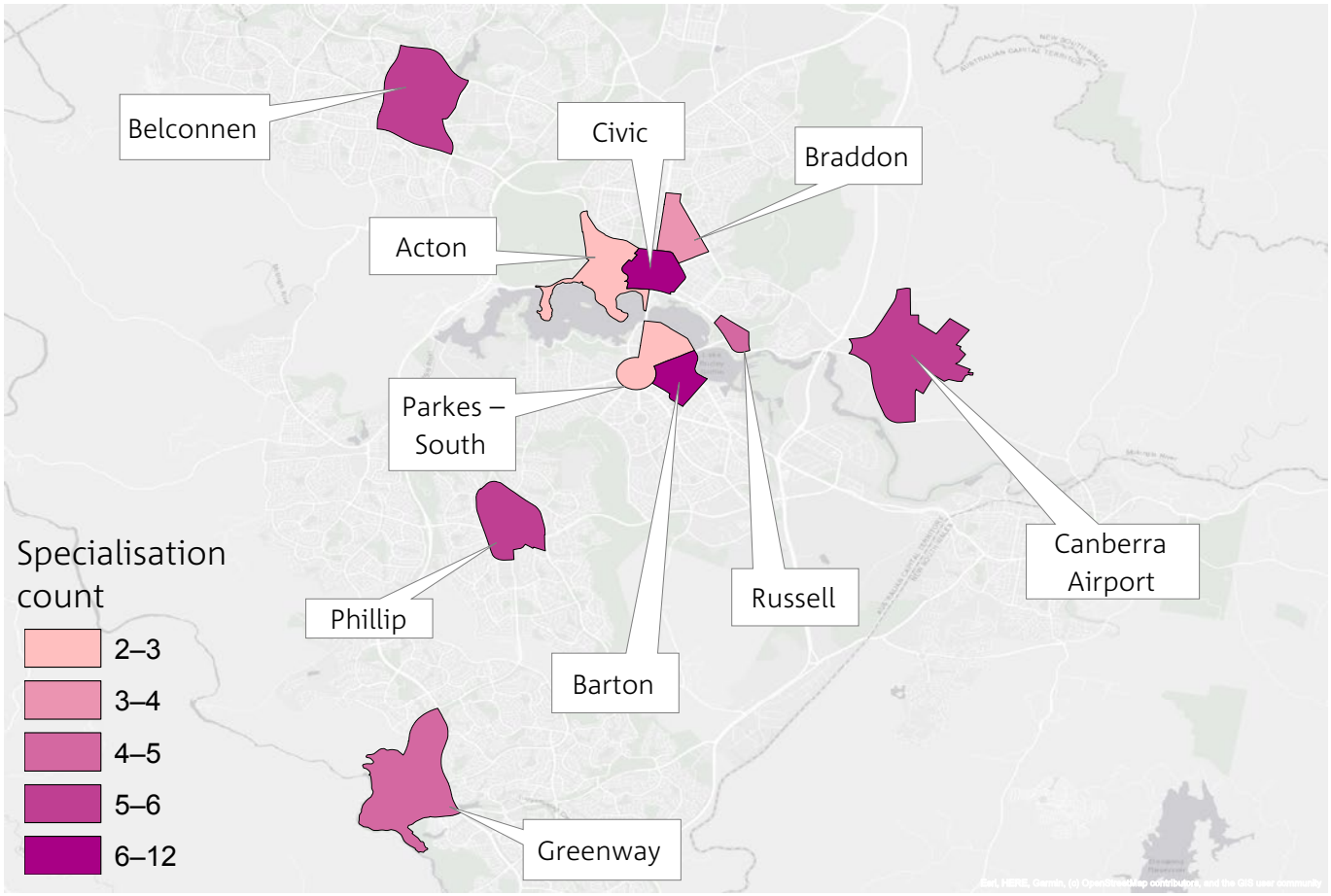
Most of Australia's digital technology companies are private (not publicly listed) and many are listed on overseas stock exchanges with presence (or headquarters) in Australia. We are showing the ASX-listed companies here because it provides a consistent reporting framework of company-sector and size (market capitalisation). However we note this is only a slice of a much larger collection of digital technology companies.

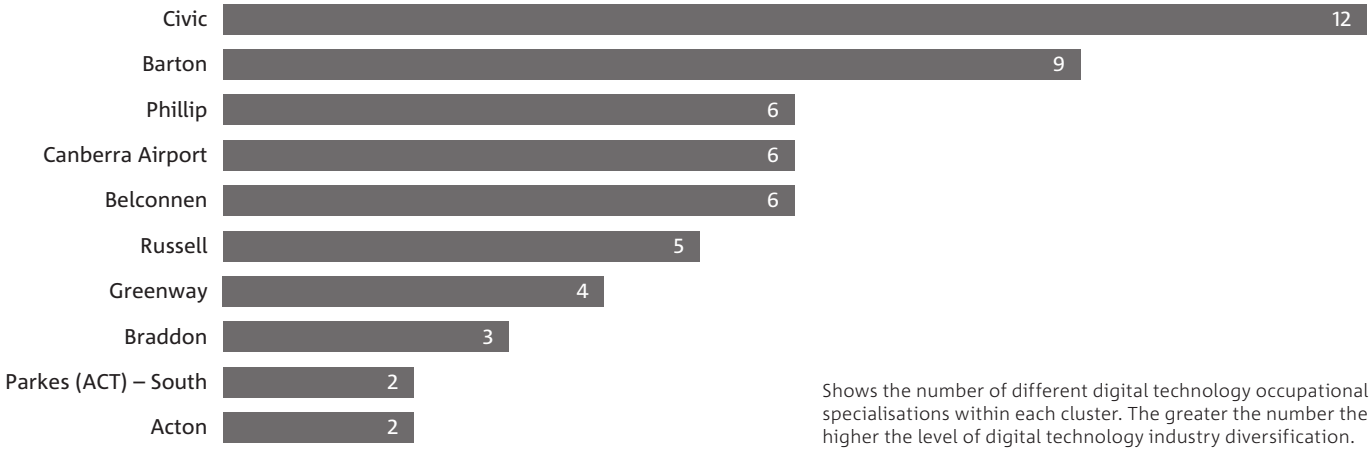


Shows the sum total market capitalisation (in AUD billions) of ASX listed companies (as of 5 Jan 2023) in the digital technology sector with headquarters located in the SA2 statistical region.

Greater Canberra

Count of digital technology occupational specialisations



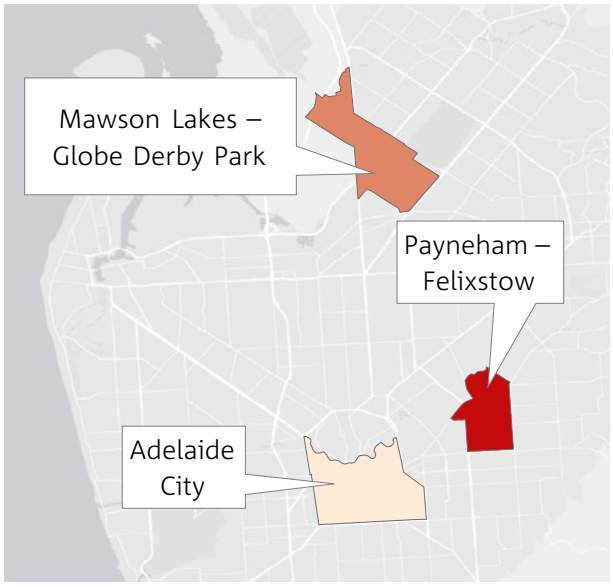


Shows the number of different digital technology occupational specialisations within each cluster. The greater the number the higher the level of digital technology industry diversification.

Other capital cities
Digital industry clusters

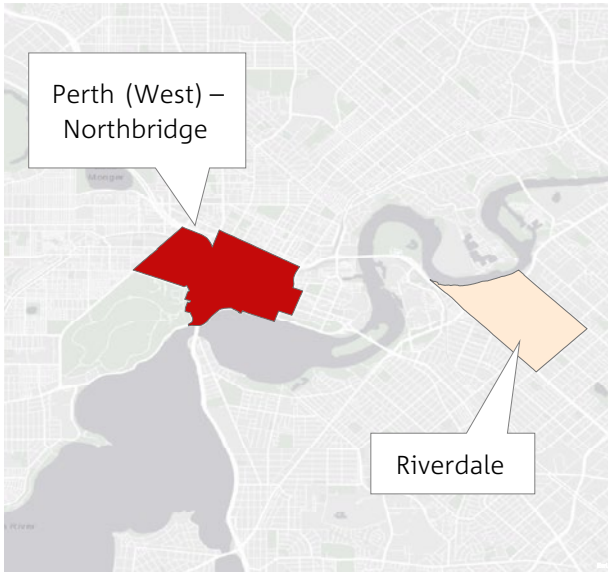
Greater Adelaide

	ADELAIDE CITY	PAYNEHAM FELIXSTOW	MAWSON LAKES GLOBE DERBY PARK
Digital workforce	12,425	683	1,133
Location quotient	1.98	2.08	2.9
Market cap ($ billions)*	0.202	0	0.717
Specialisation count	7	3	1



Greater Perth

	PERTH (WEST) NORTHBRIDGE	RIVERDALE
Digital workforce	16,744	488
Location quotient	2.39	2.33
Market cap ($ billions)*	1.223	0
Specialisation count	12	1



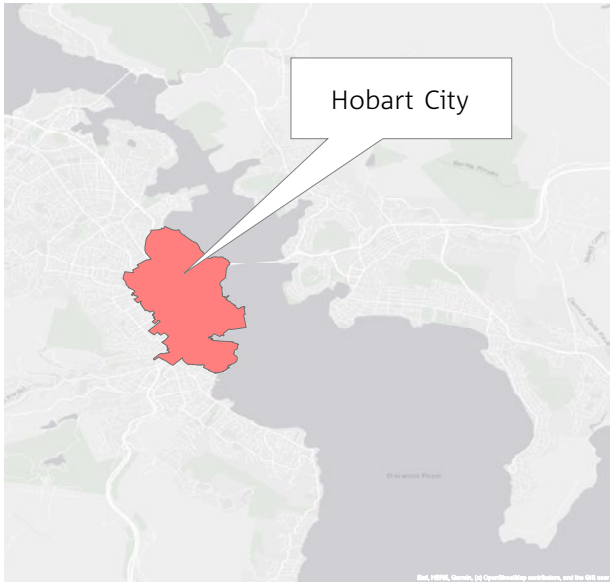
*ASX companies only. Represents a small number of total companies. Used here because ASX company data on size and industry-sector is available via a consistent reporting framework.

Darwin City

	DARWIN CITY
Digital workforce	1,300
Location quotient	1.85
Market cap ($ billions)*	0
Specialisation count	6

Greater Hobart

	HOBART CITY
Digital workforce	2,650
Location quotient	1.2
Market cap ($ billions)*	0
Specialisation count	0



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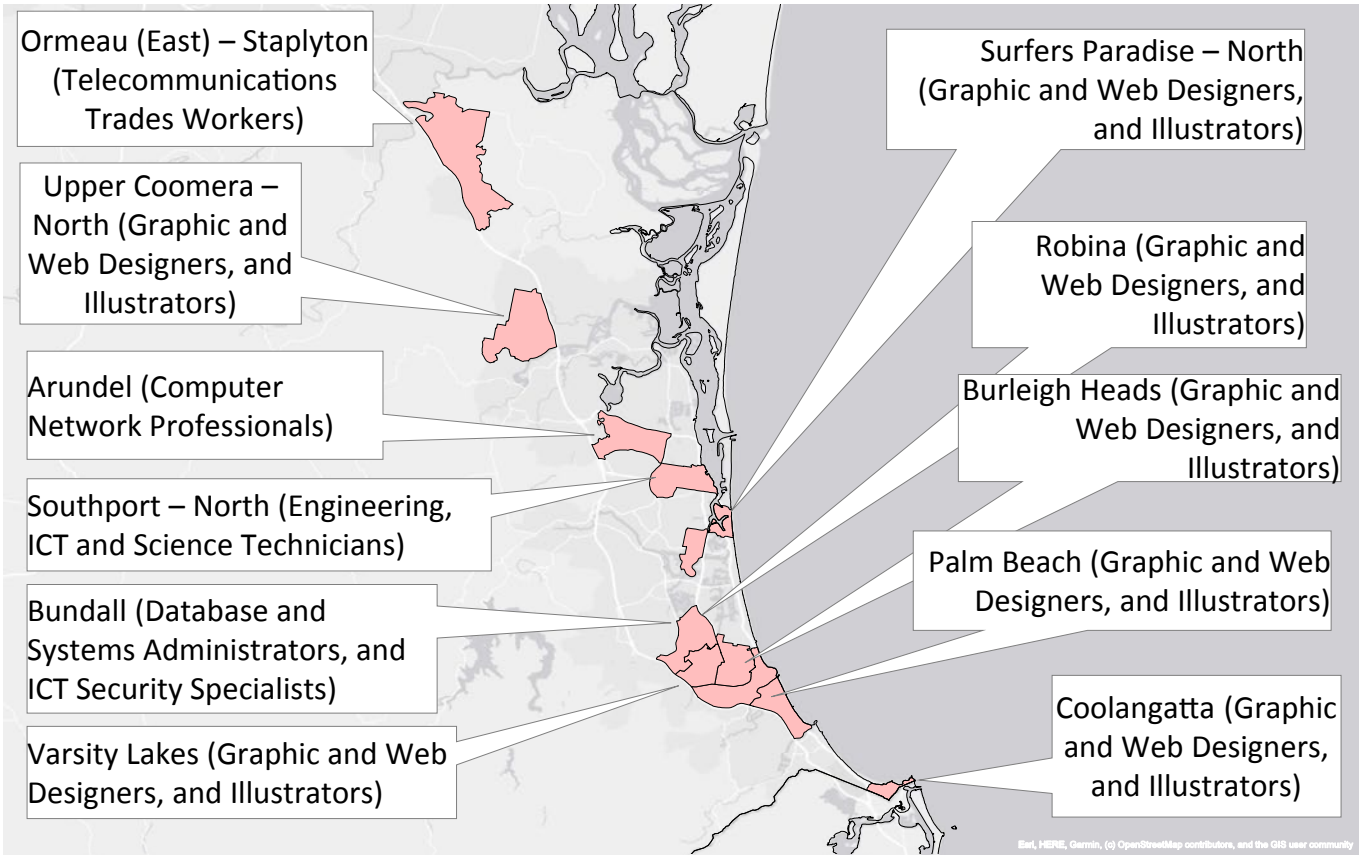
Regional niche clusters

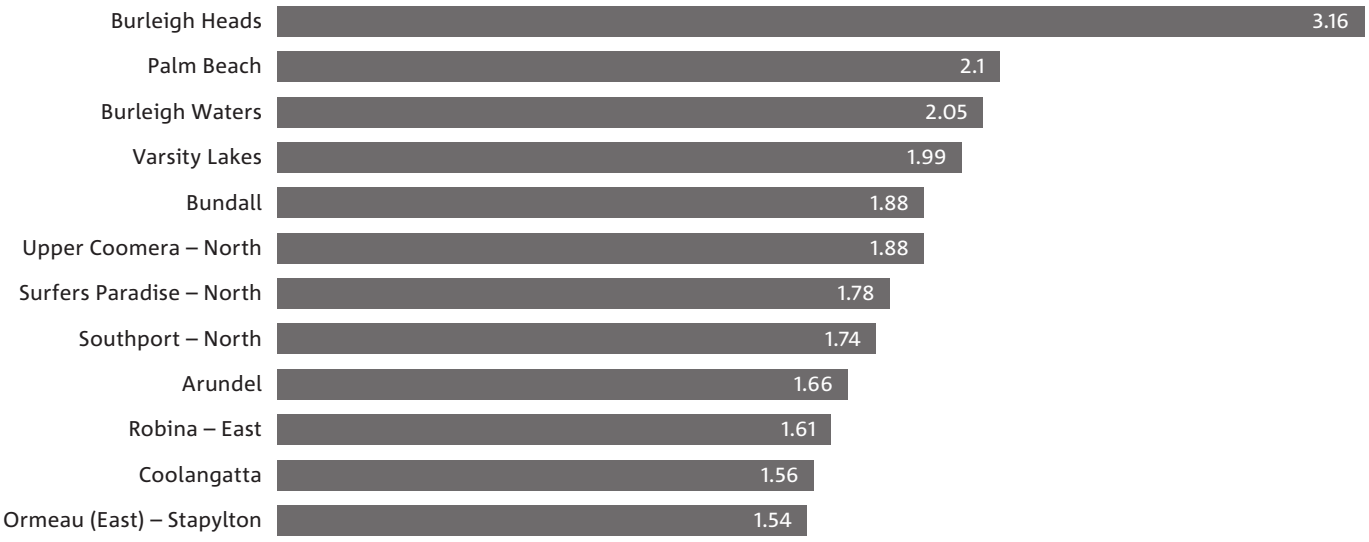
Digital industry clusters outside of the greater capital city areas focused on one (or a few) specialisations

Burleigh Heads on the Gold Coast
Image credit: Visual Collective / Shutterstock

Regional niche digital industry clusters

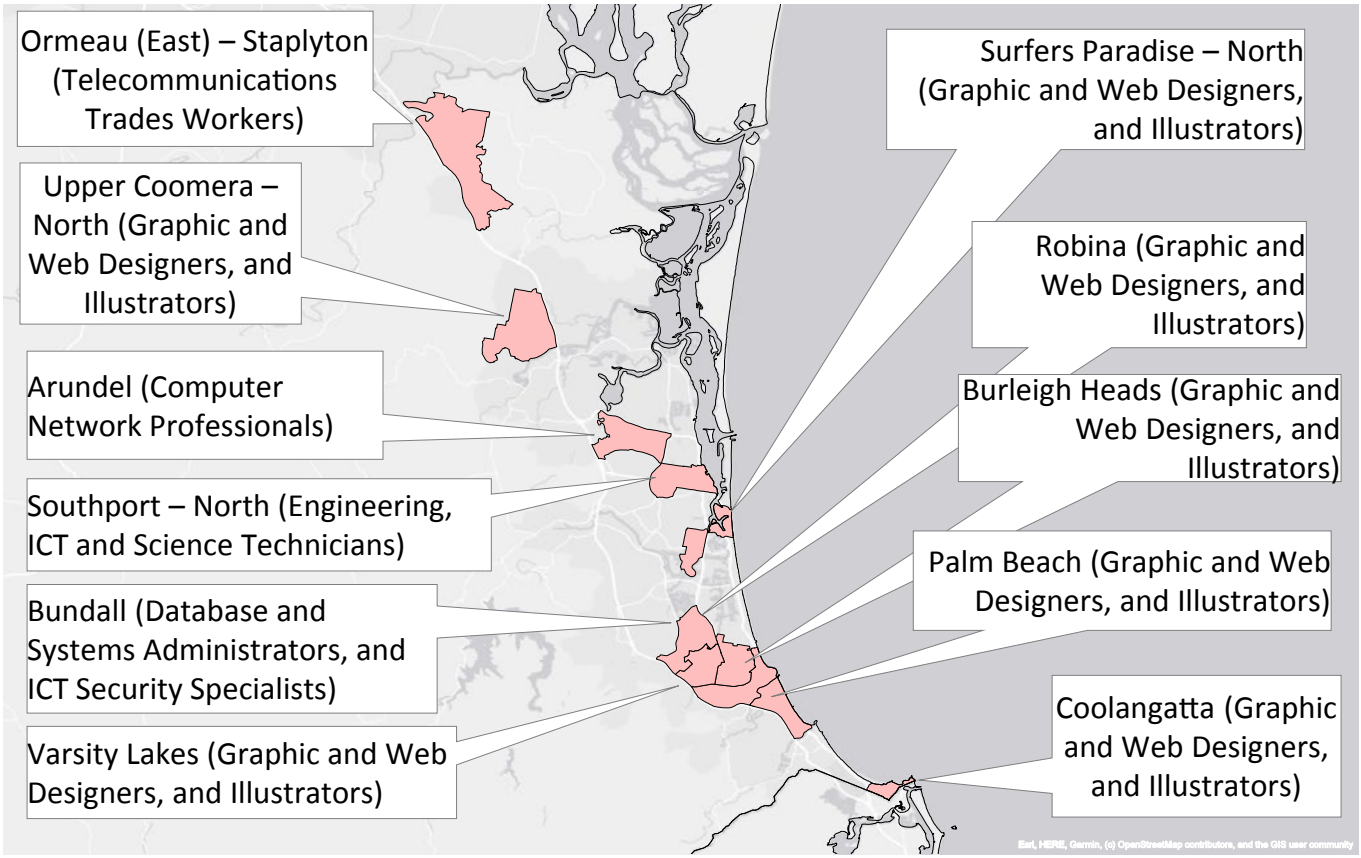
Gold Coast – location quotients

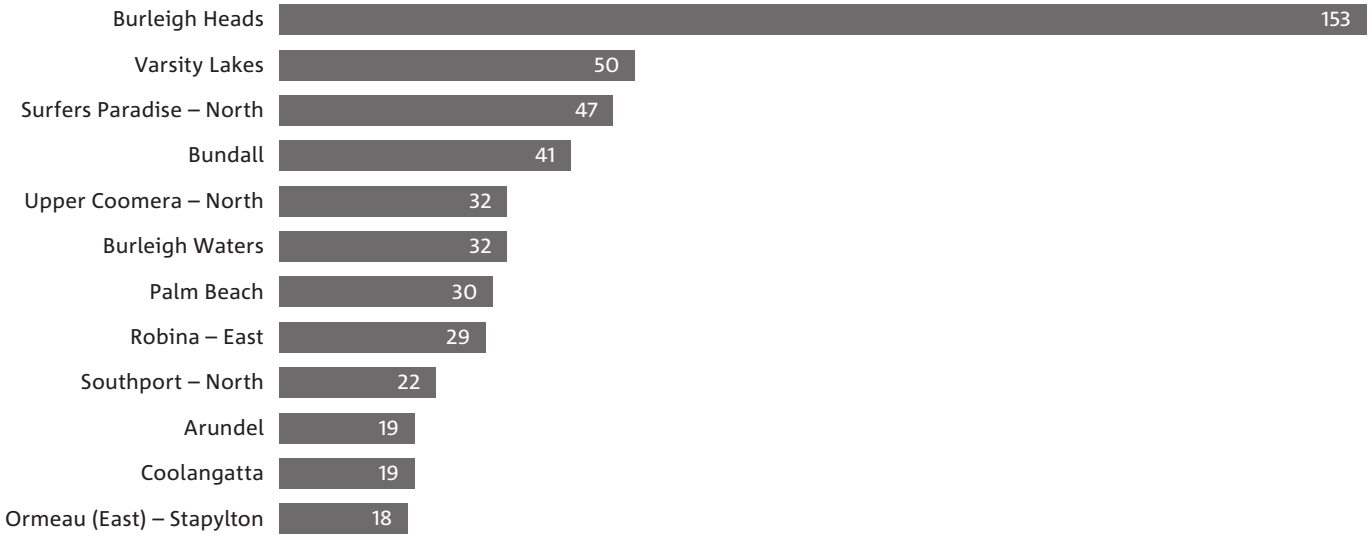




Regional niche digital industry clusters

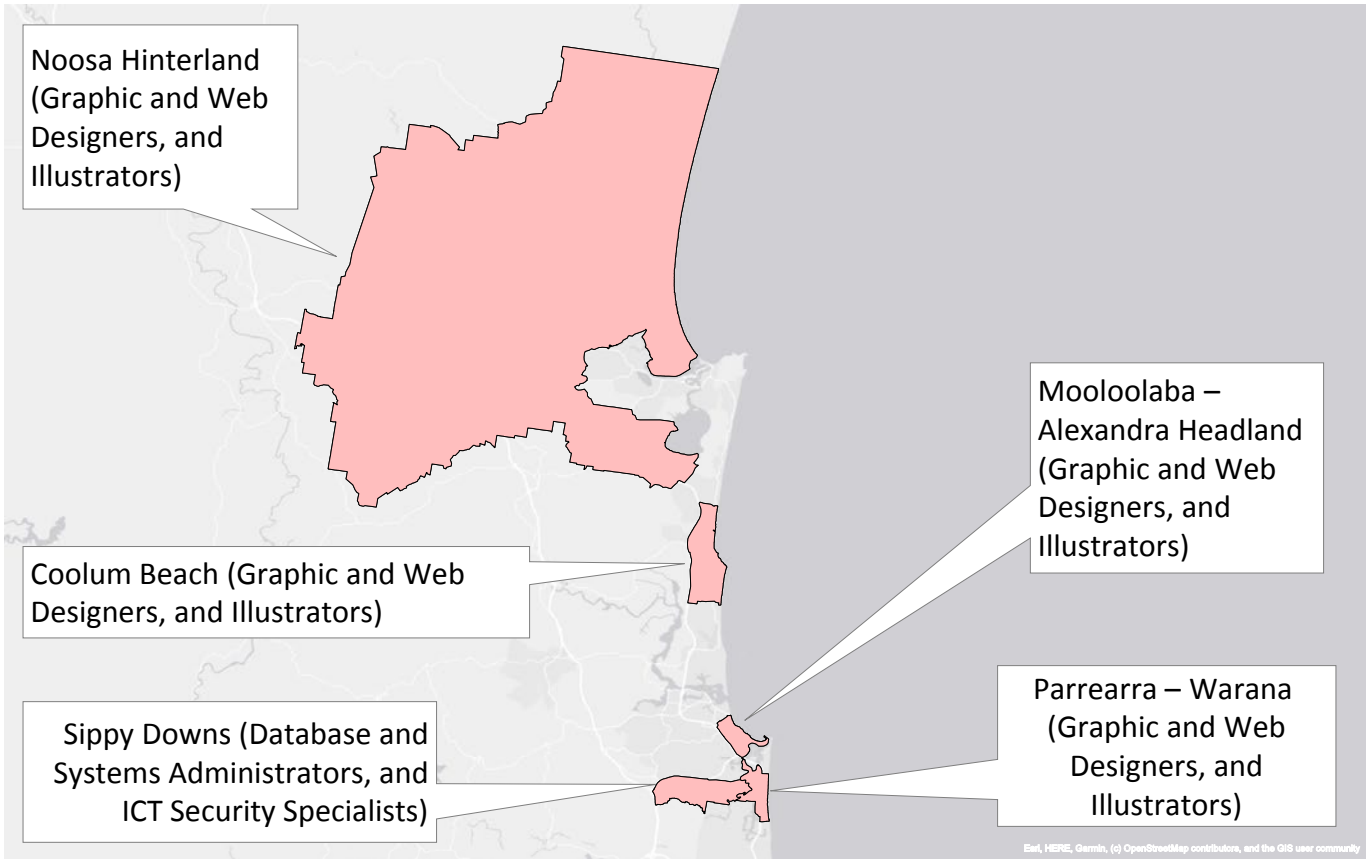
Gold Coast – worker counts



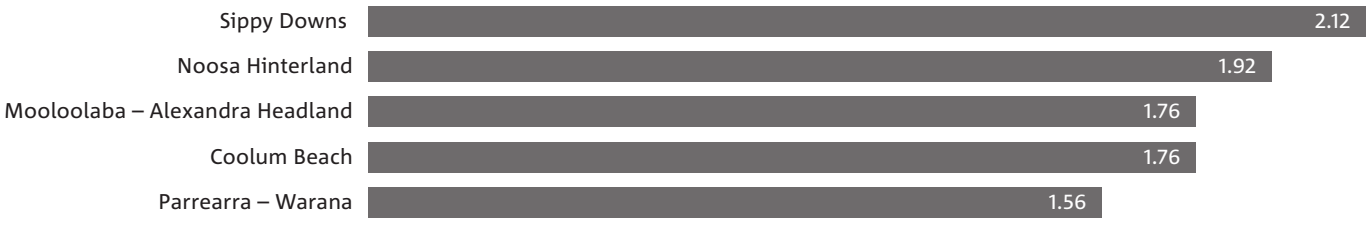


Regional niche digital industry clusters

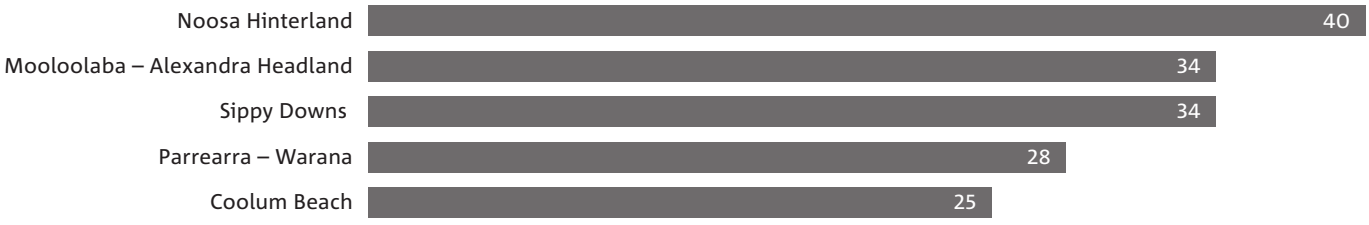
Sunshine Coast



Location quotients

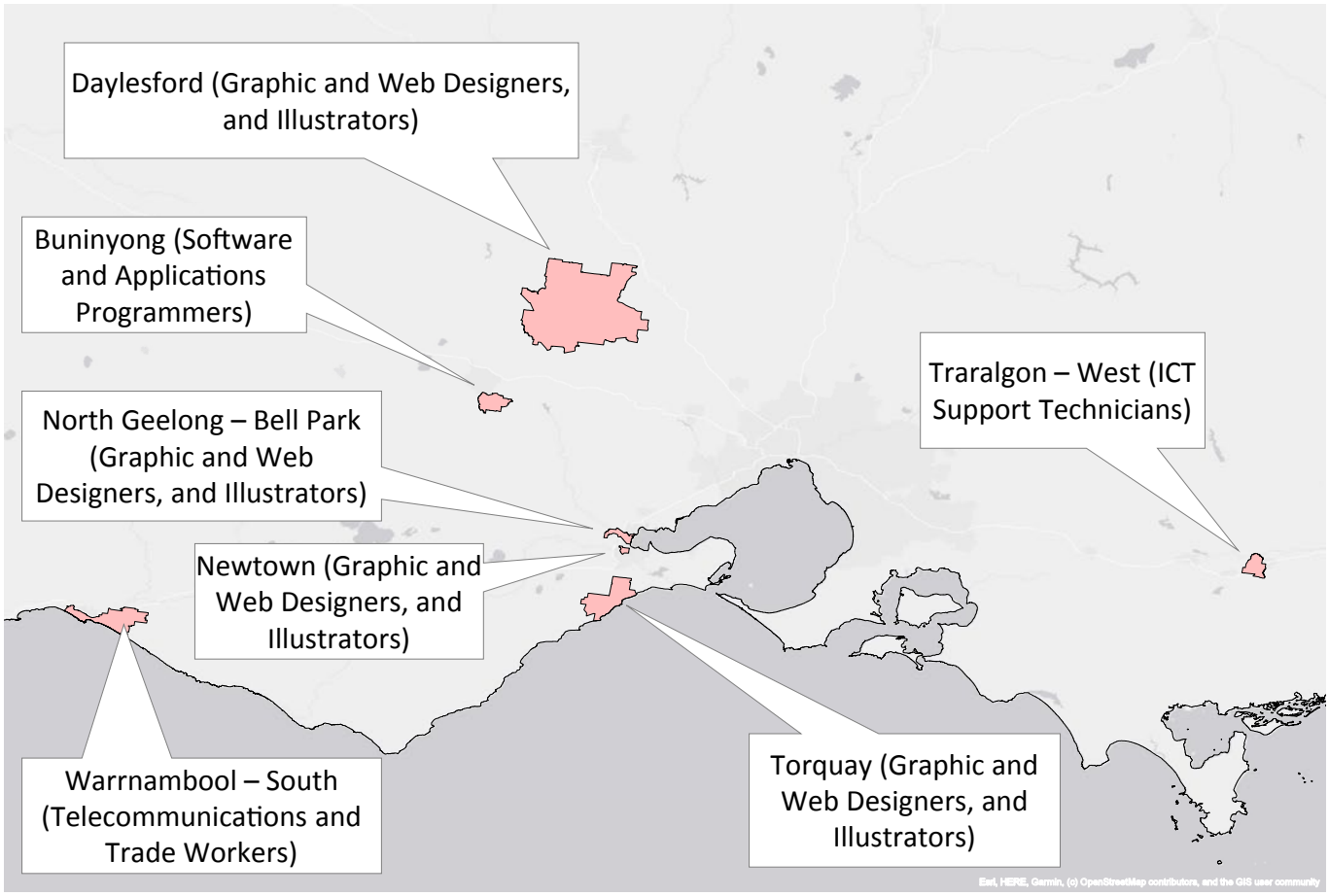


Workforce count

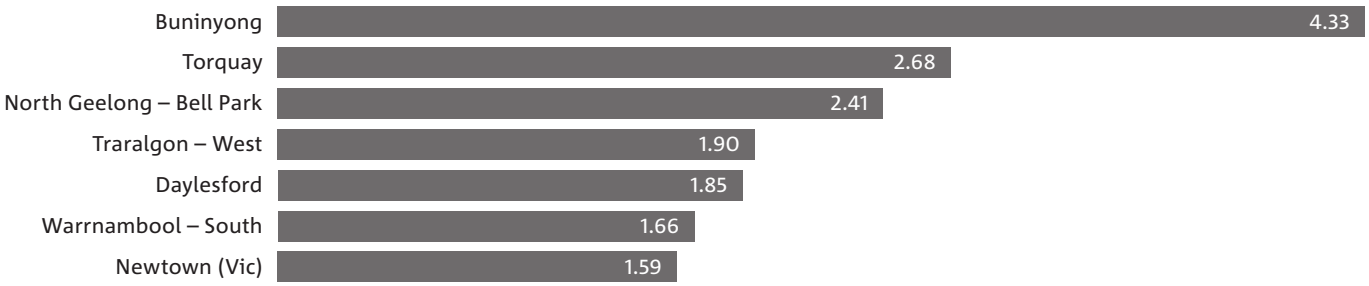


Regional niche digital industry clusters

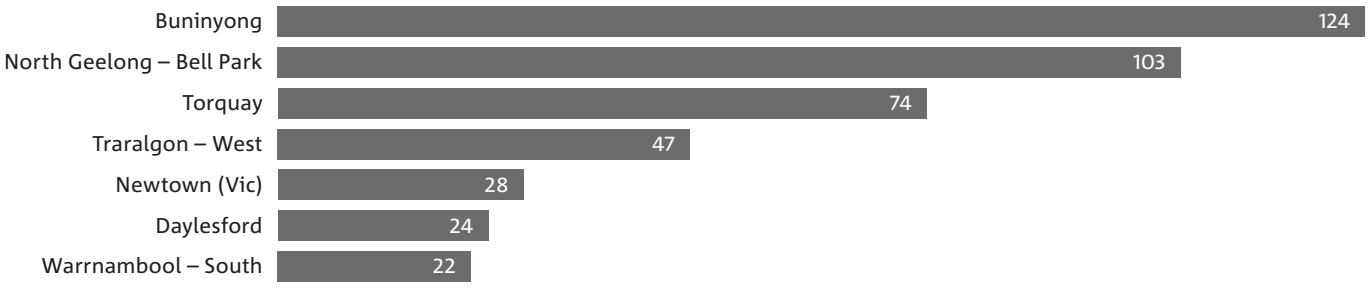
Regional Victoria



Location quotients

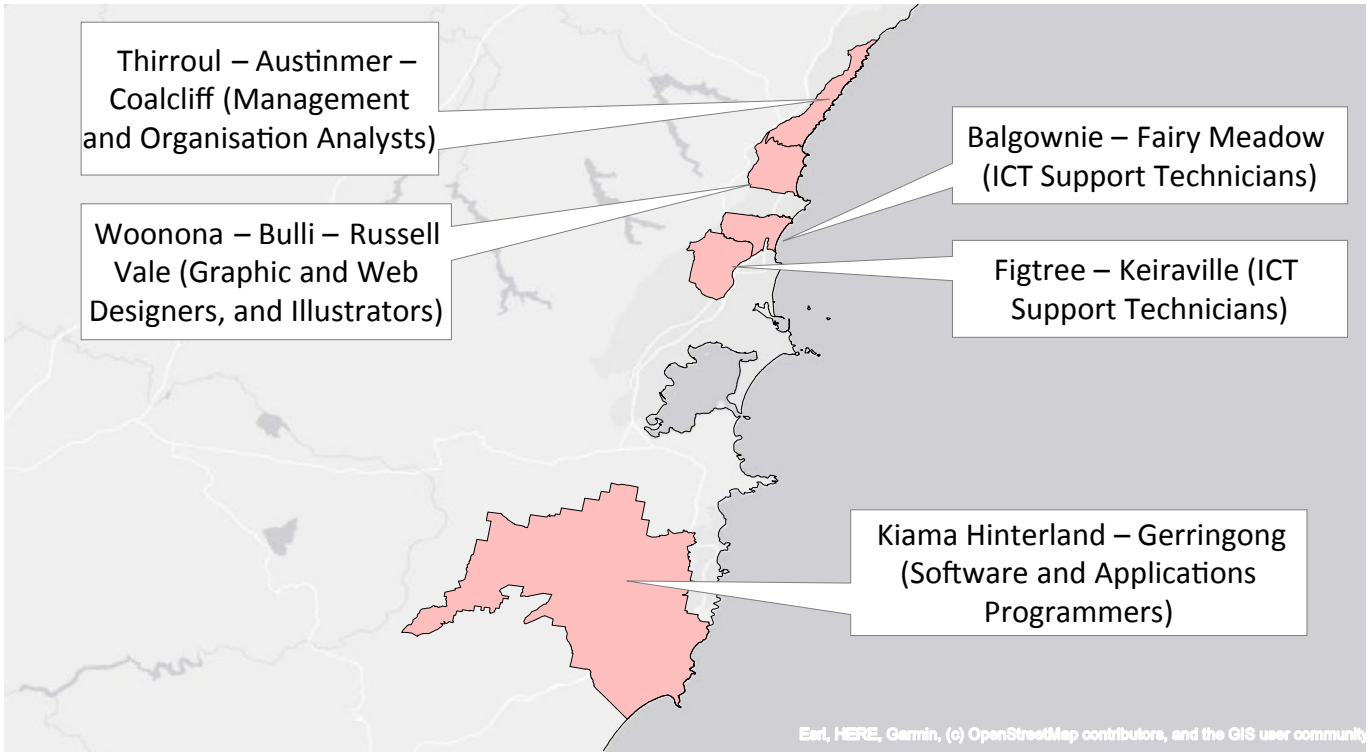


Workforce count

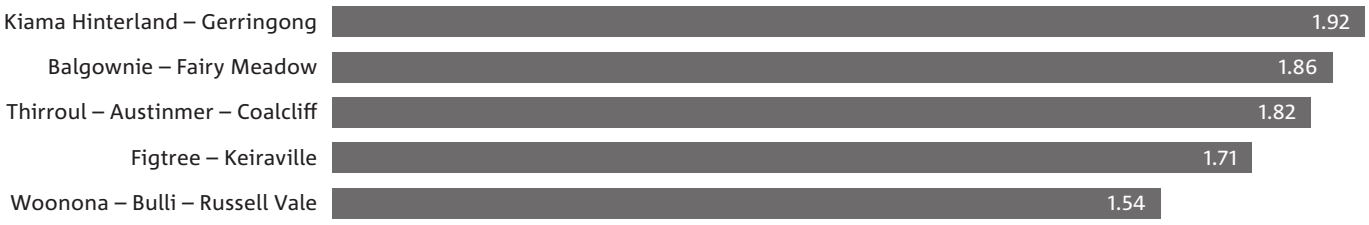


Regional niche digital industry clusters

Greater Wollongong



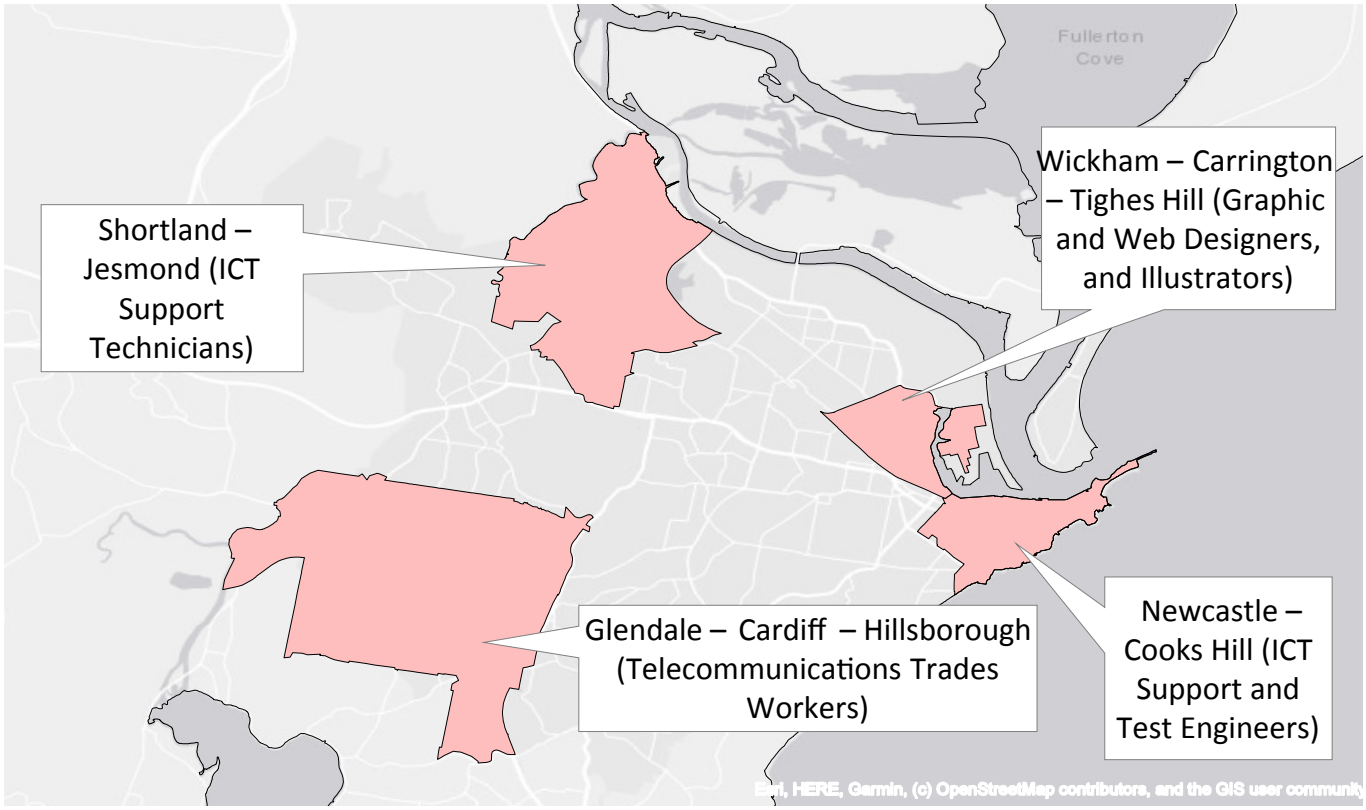
Location quotients



Workforce count

Regional niche digital industry clusters

Greater Newcastle

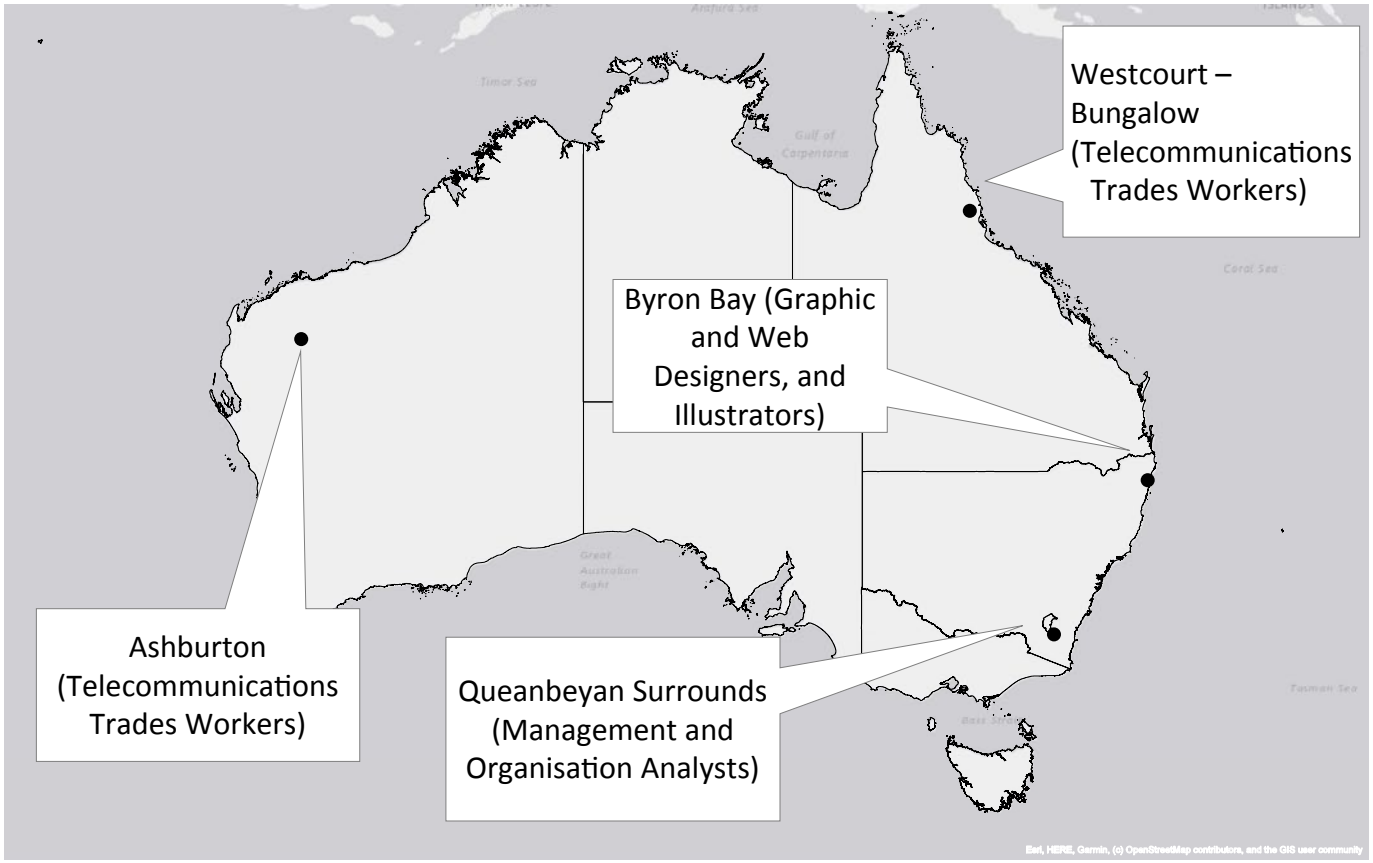


Location quotients

Workforce count

Regional niche digital industry clusters

Other regional areas



Location quotients

Workforce count

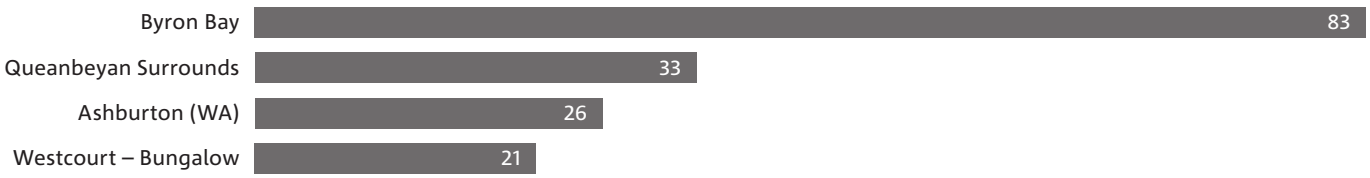


Image credit: Rawpixel.com / Shutterstock

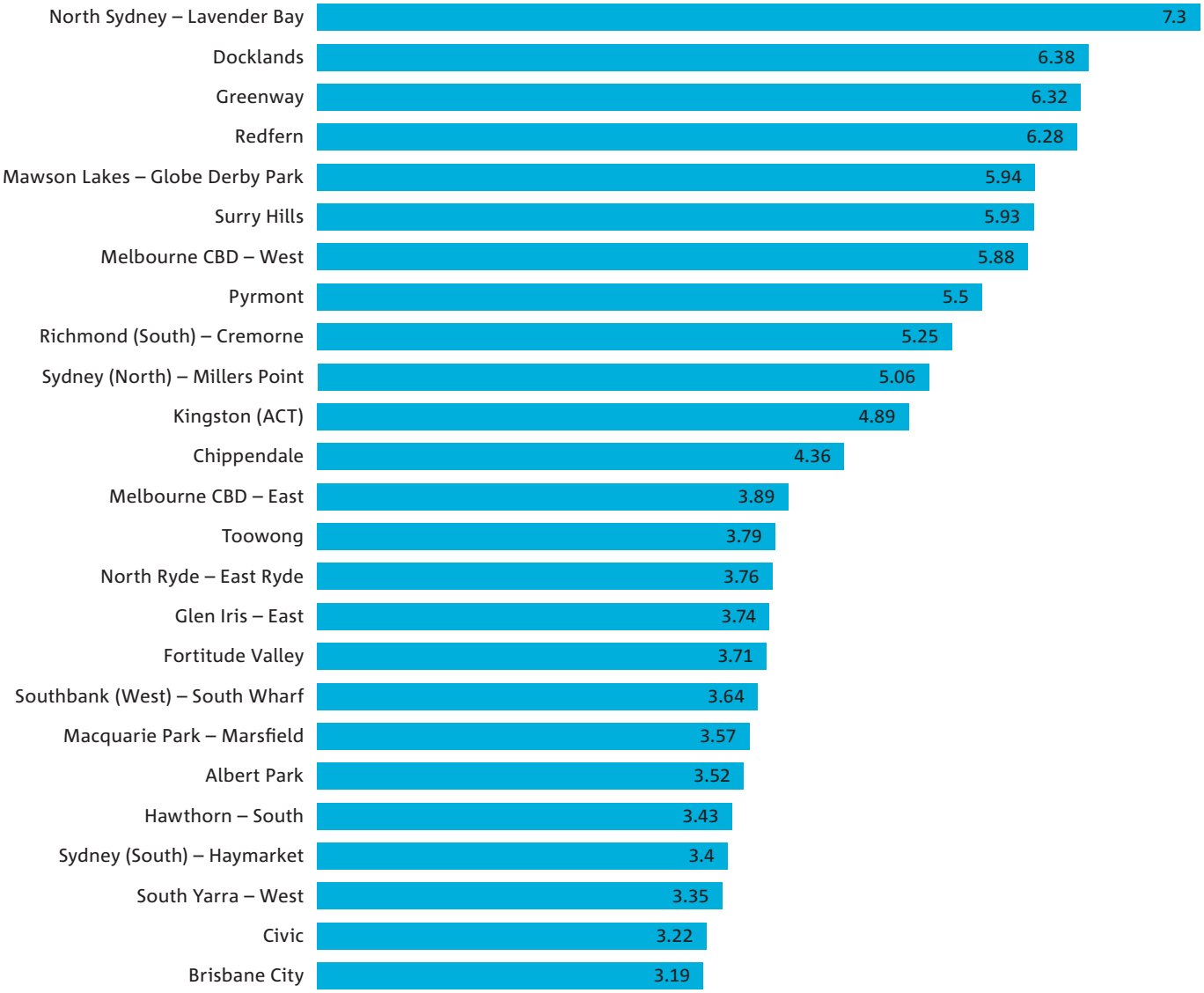
The geography of occupational specialisations

Where are the software programmers?

Top 25 SA2 Regions in Australia

The digital technology occupational specialisation of "software and applications programmers" includes workers skilled in designing, coding and producing software applications. They're a crucial part of the digital technology industry; they make the products. This profession shows high levels of geographically concentrated specialisation.

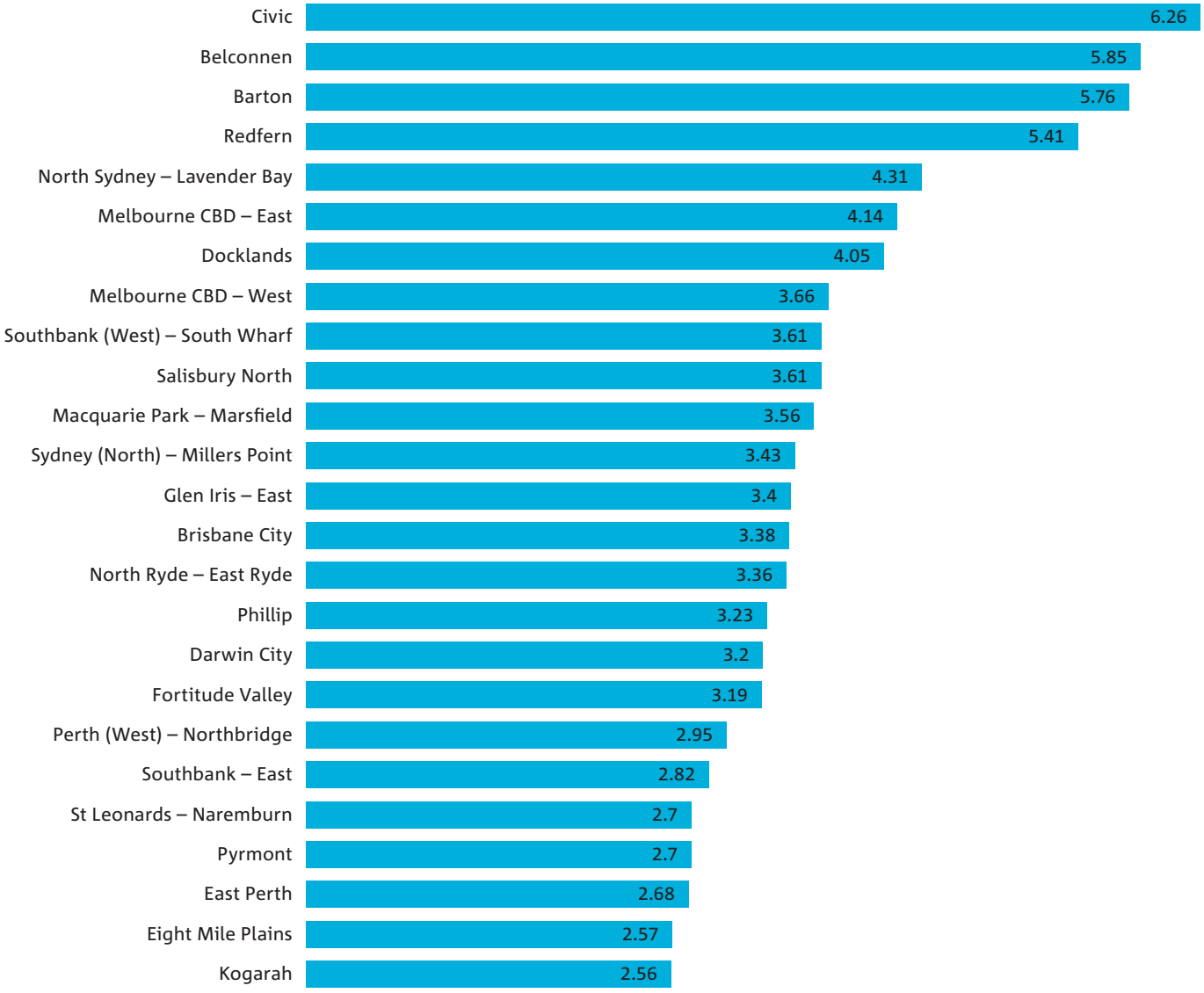
Graph shows the location quotients for software and applications programmers in SA2s. We show the top 25 SA2 regions. The Lavender Bay SA2 region is employing this skill-set at 7.3 times the rate of the national average.



Where are the database administrators?

Top 25 SA2 Regions in Australia

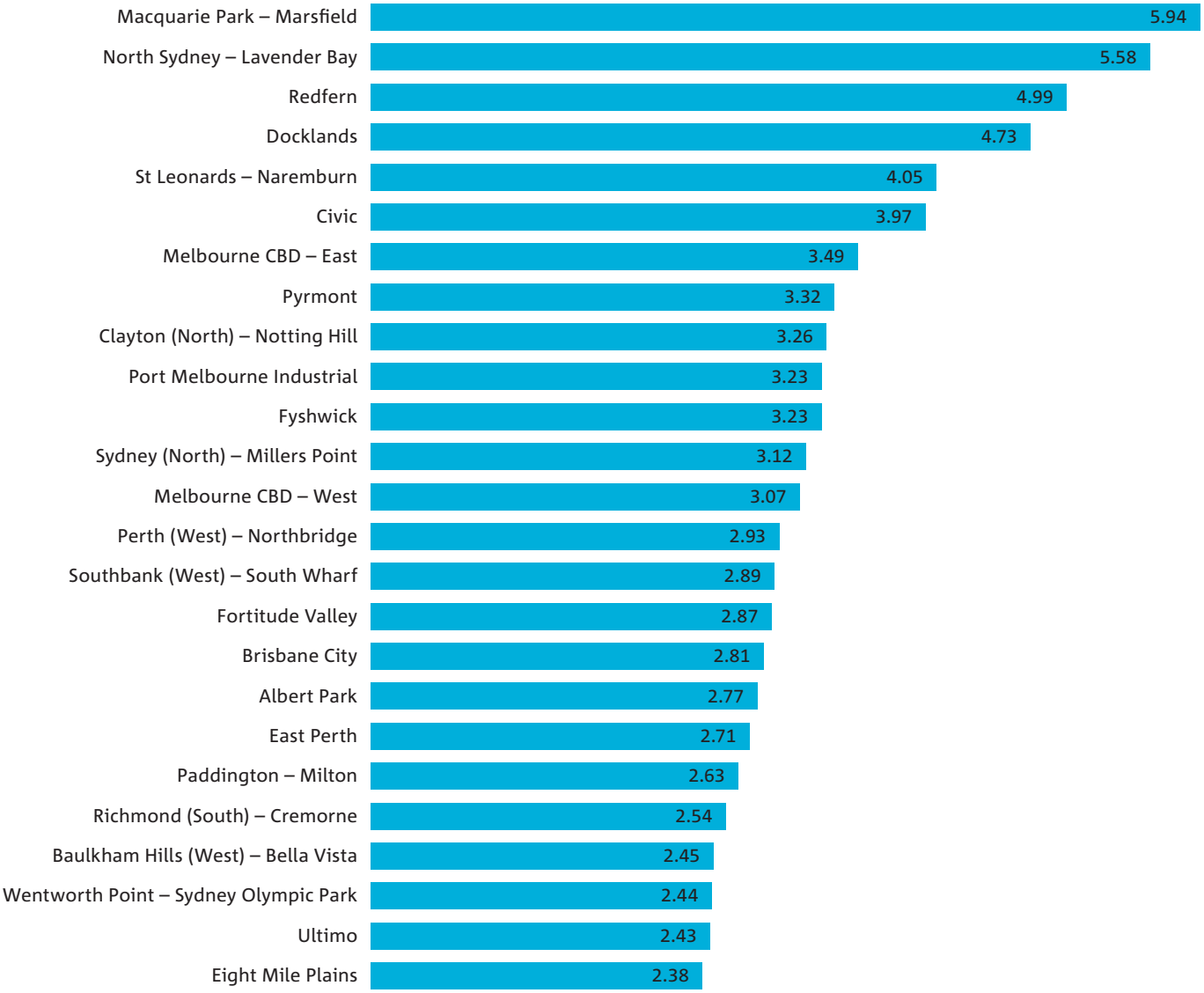
The digital technology occupational specialisation of “database and systems administrators and ICT security specialists” includes workers skilled in managing and protecting large and complex databases and defending against cyberattacks.



Where are the network professionals?

Top 25 SA2 Regions in Australia

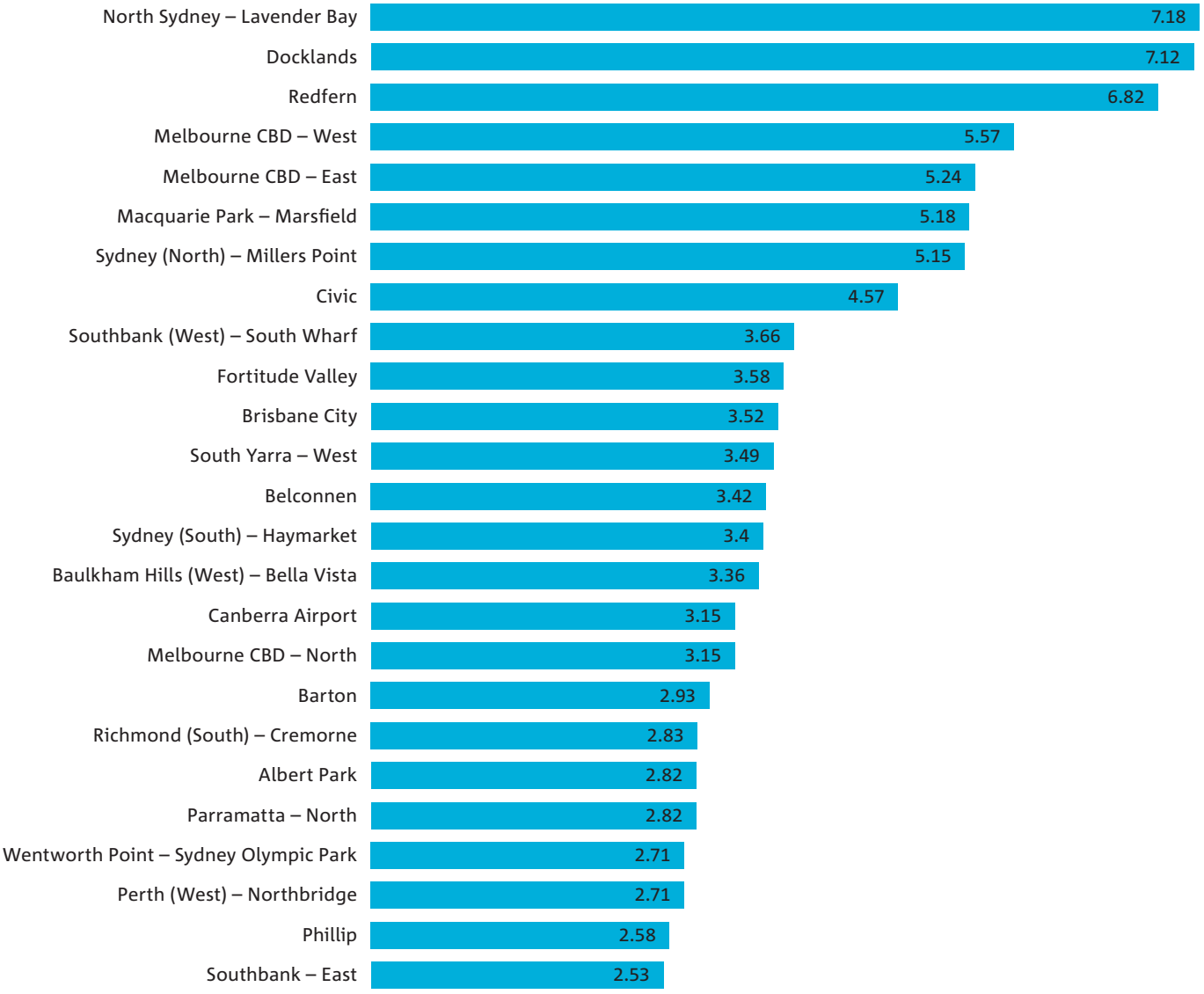
The digital technology occupational specialisation of “computer network professionals” includes workers who design, operate and maintain network architecture enabling data connectivity for users and devices.



Where are the ICT business analysts?

Top 25 SA2 Regions in Australia

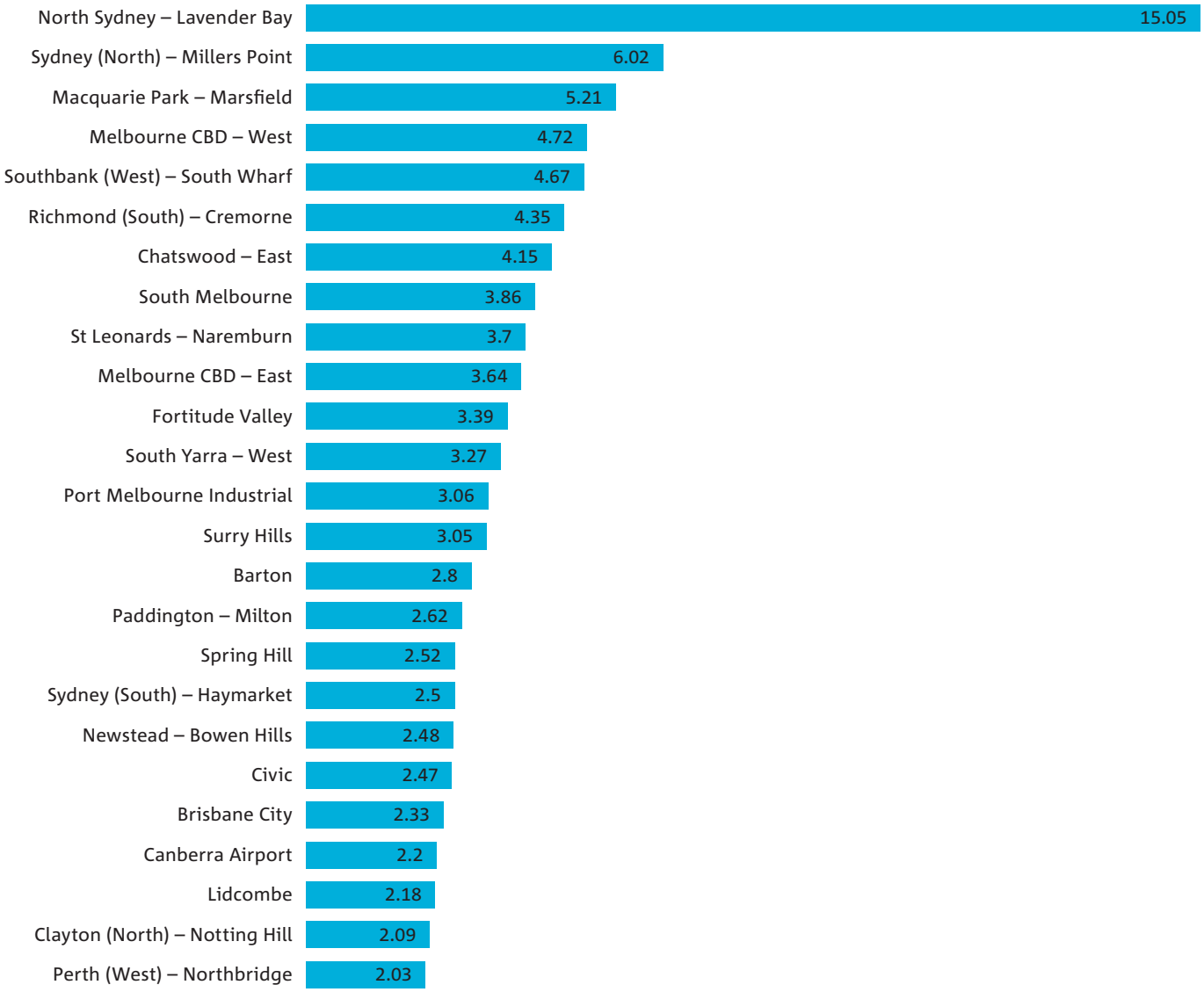
The digital technology occupational specialisation of “ICT business and systems analysts” includes workers who ascertain user needs, formulate system requirements, and review/evaluate current ICT system capabilities or future upgrades.



Where are the ICT sales professionals?

Top 25 SA2 Regions in Australia

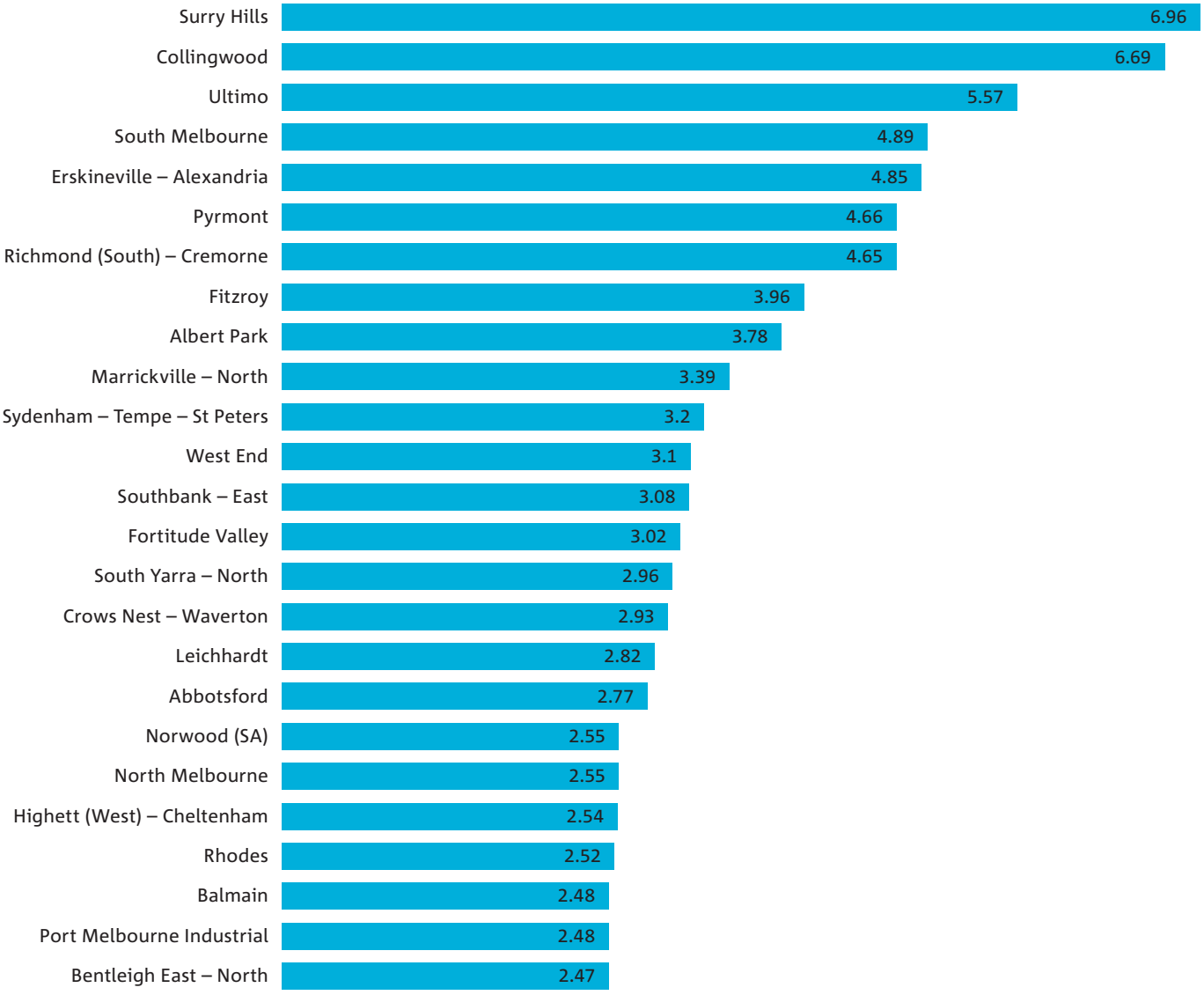
The digital technology occupational specialisation of “ICT sales professionals” includes workers who understand customer requirements and market, advertise and promote products on behalf of companies. This profession shows high levels of spatial concentration, with an extremely high location quotient in Lavender Bay.



Where are the graphic designers?

Top SA2 Regions in Australia

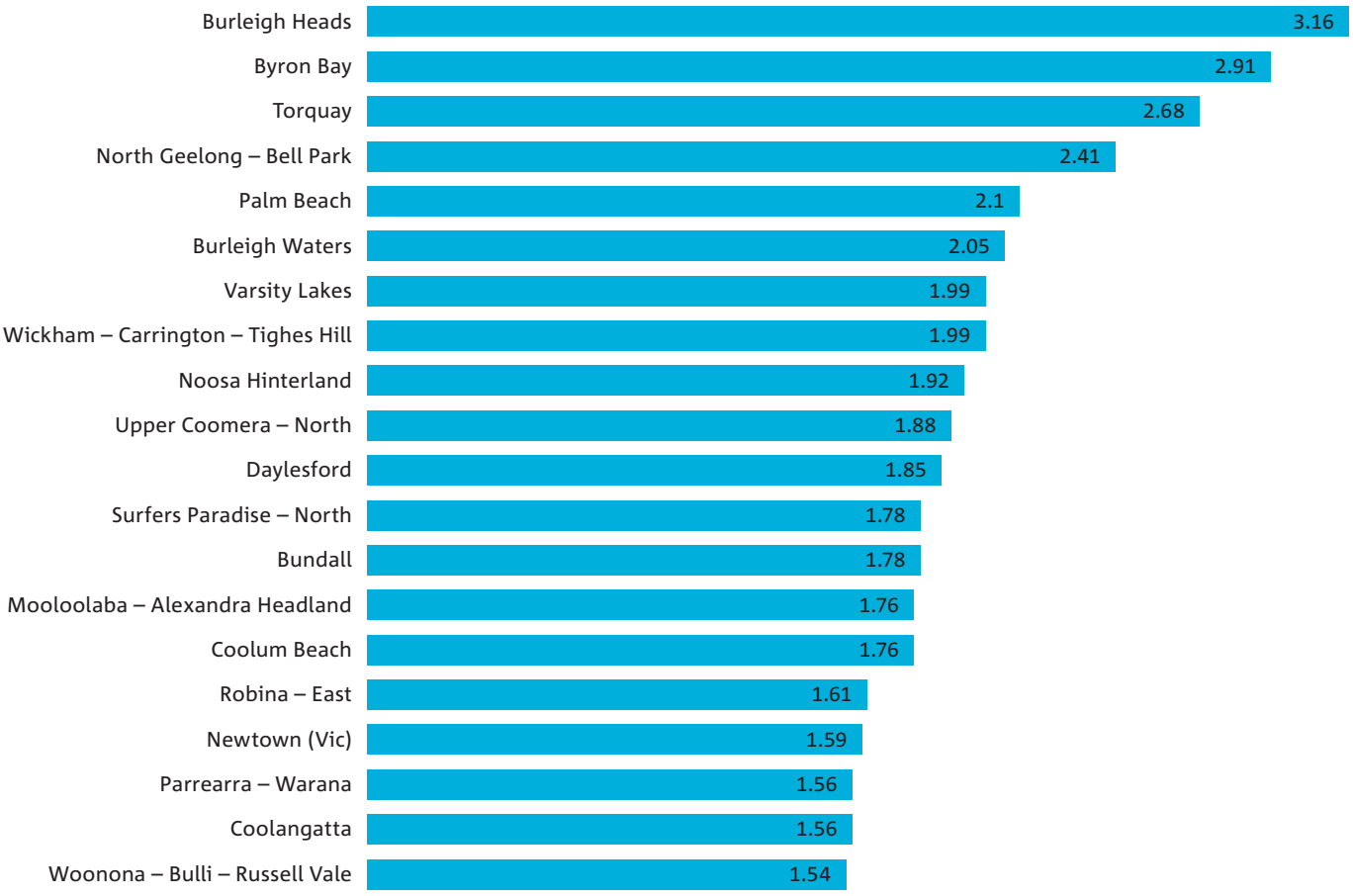
The “graphic and web designers, and illustrators” profession is skilled in audio and visual communication using print, electronic and other forms of audio-visual media.



Top SA2 Regions in Regional Australia Only (excludes capital cities)

The vast bulk of digital technology specialisations are in our greater capital cities. However, one of a few professions that defies this trend is graphic designers. Whilst present in our cities, the "graphic and web designers, and illustrators" profession is well represented in regional areas. We identify 20 SA2 regions with location quotients and confidence ranges which meet our cut-offs for significance.

Graph shows the location quotients for the graphic and web designer and illustrator occupation in regional SA2s. Burleigh Heads on the Gold Coast has a high specialisation, employing this profession at 3.2 times the rate of the national average.



Additional insights
Digital technology industry clusters – innovation, investment and patterns of change over time

Innovation in clusters

Patent productivity – comparing clusters to other areas

Prior research has shown that firms inside clusters tend to innovate more and produce more intellectual property patents.

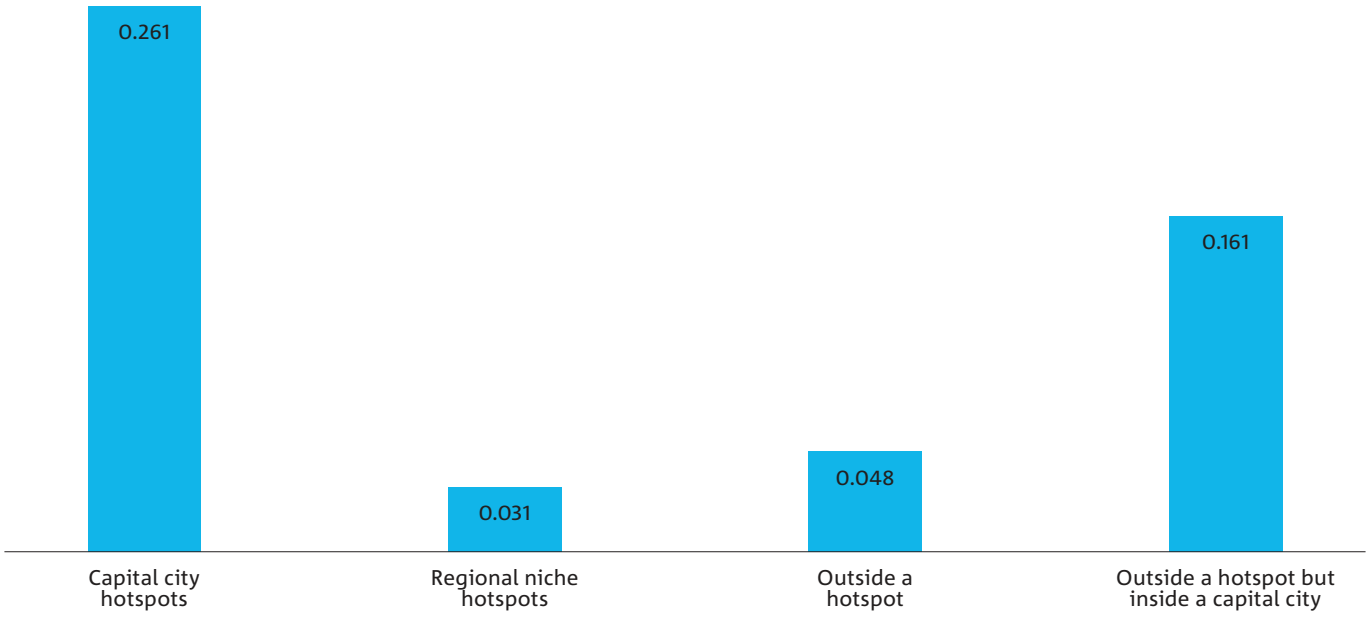
A recent study of 109,846 inventors in the United States found that the nation's ten largest industry clusters in computer science accounted for 69% of inventors. The researcher concludes that "the agglomeration of inventors generates large gains in the aggregate amount of innovation produced in the United States" (Moretti, 2021).

We found supporting results. We found that firms in our greater capital city clusters were making applications for intellectual property (IP) patents through IP Australia at roughly 5 times the rate of firms outside of a cluster (in any location).

When we compare firms in capital cities within clusters to firms also in capital cities but outside clusters we find the average patent creation for firms within the cluster is 63% higher. We found only minor differences between regional niche clusters firms and firms outside a cluster.

These findings apply to firms in the information, communications and technology (ICT) sector drawing upon data from the Queensland University of Technology's The Longitudinal Australian Business Integrated Intelligence (LABii) dataset.

Using the LABii dataset we found that of Australia's 5,622 patent applications, the ICT sector accounted for 16% of all patent applications in Australia in the year 2020.



Patent productivity – The average number of patent applications per firm per year during 2016–2021 in the information communications and technology sector

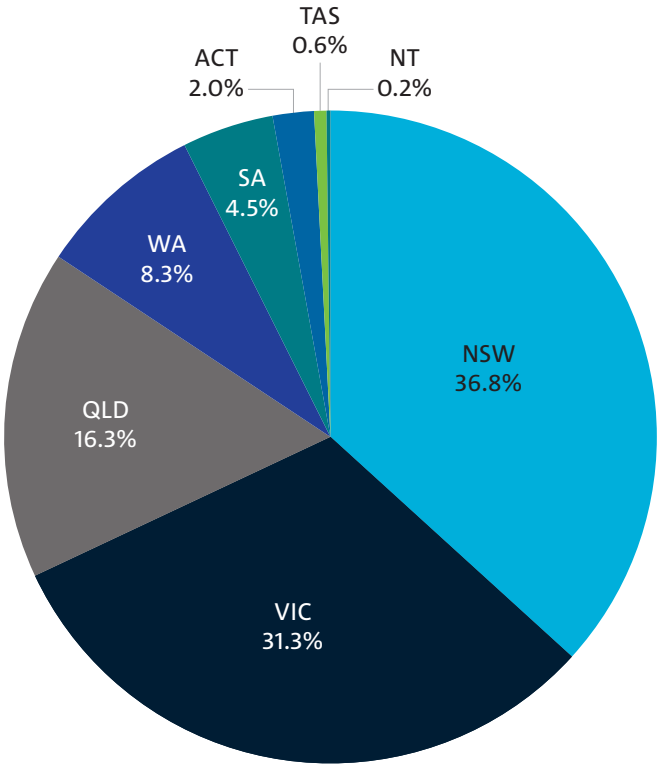
Investment patterns

State and Territory data

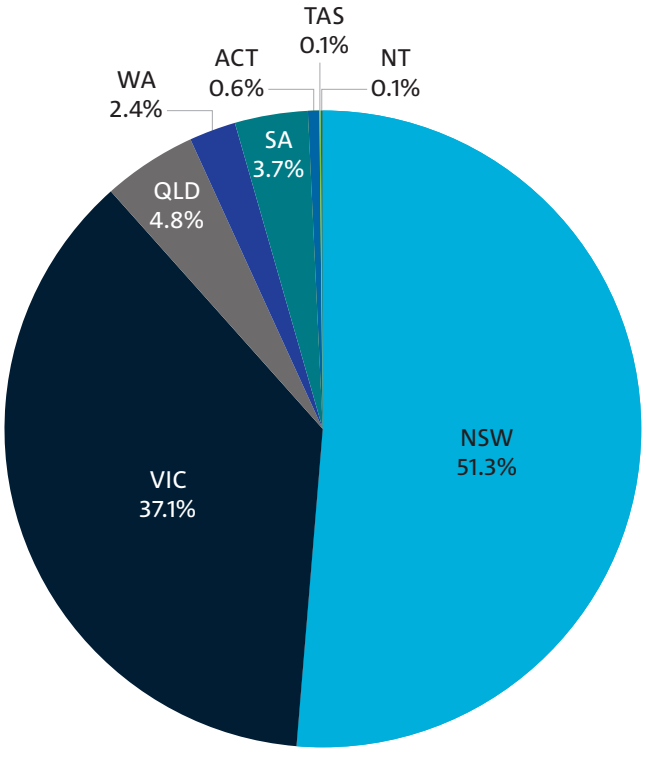
Digital industry clusters tend to attract large shares of venture capital and other forms of investment. For example, one of the main reasons start-ups locate their activities in Silicon Valley is to gain proximity to investors. We examined investment in this project but were unable to obtain data for fine/detailed regions. The finest level of geographic detail we could attain was at the State/Territory level.

Our data on investment comes from Pitchbook (March 2023) and is for an industry sector called "information technology" (IT) in the Pitchbook database. In the IT industry, there were 3,589 companies headquartered in Australia with investment deals registered between 2013 and 2022. Almost 37% of the companies were headquartered in NSW, 31% in Victoria, 16% in Queensland and 8% in WA.

NSW companies accumulated over 51% of venture capital invested in the Australian IT industry. Further 37% of investments were attracted by companies headquartered in Victoria, followed by Queensland companies receiving almost 5% of invested capital over 2013–2022. Major investors in the Australian IT industry were asset management firms, accelerators and incubators, venture capital firms and government organisations. Out of 15 major investors, 12 are located in NSW, one in Victoria, one in WA and one overseas.



Share of companies

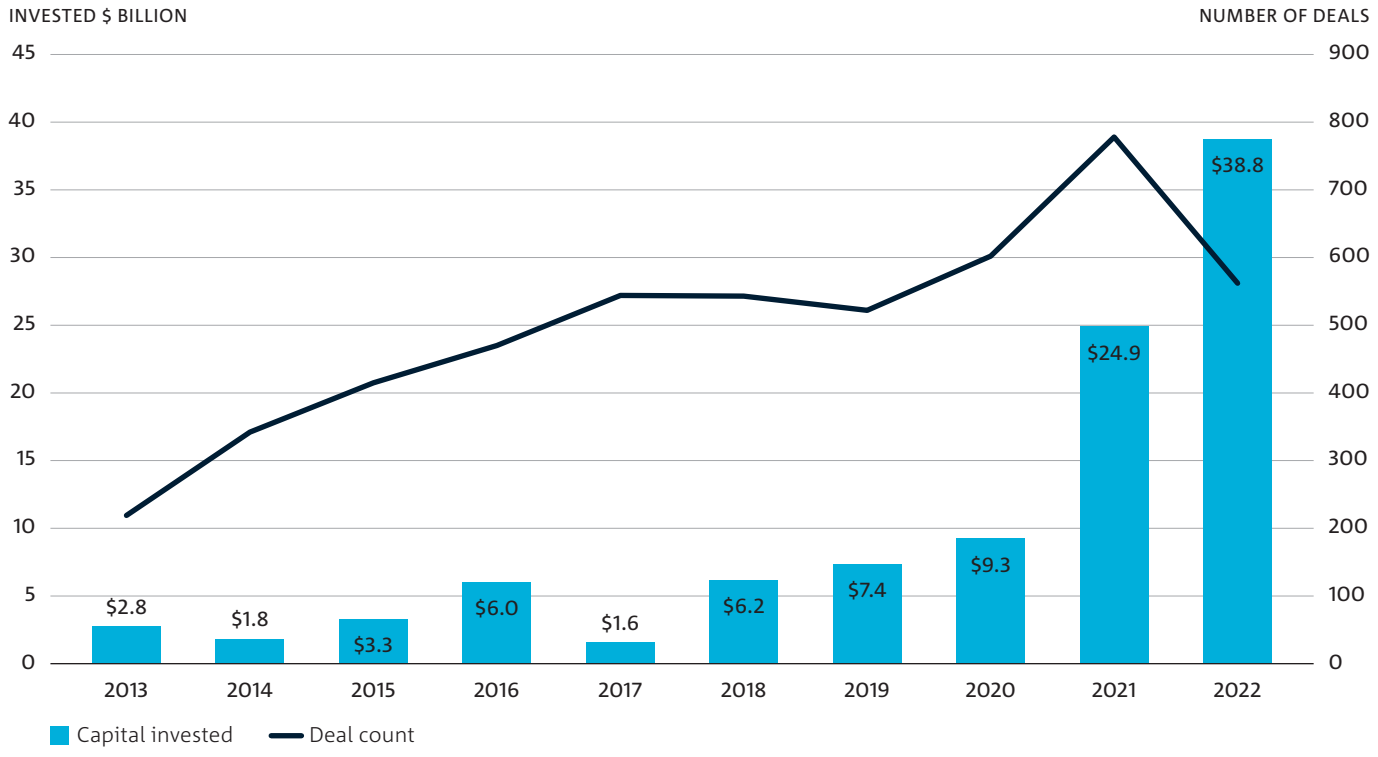


Share of investment

Change over time

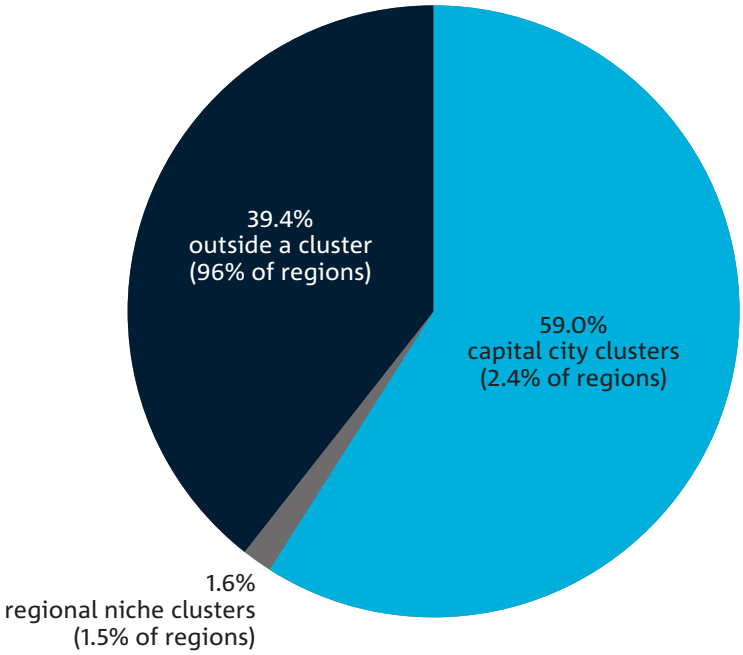
Australian IT companies are attracting an increasing amount of investment annually. The amount invested in 2022 was over 13 times the level of 2013 for companies headquartered in Australia as recorded on Pitchbook. This rate of growth is much higher than was seen in other Australian industries. The share of capital invested in Australian IT companies increased from 1–3% in 2013-2015 to 18–21% in 2020–2022 (Pitchbook 2023).

Despite the substantial increase, in 2022 the share of investment in IT industry in Australia remains below the levels observed in the leading economies, including the USA (34% in 2022), Singapore (32%) and the UK (33%).

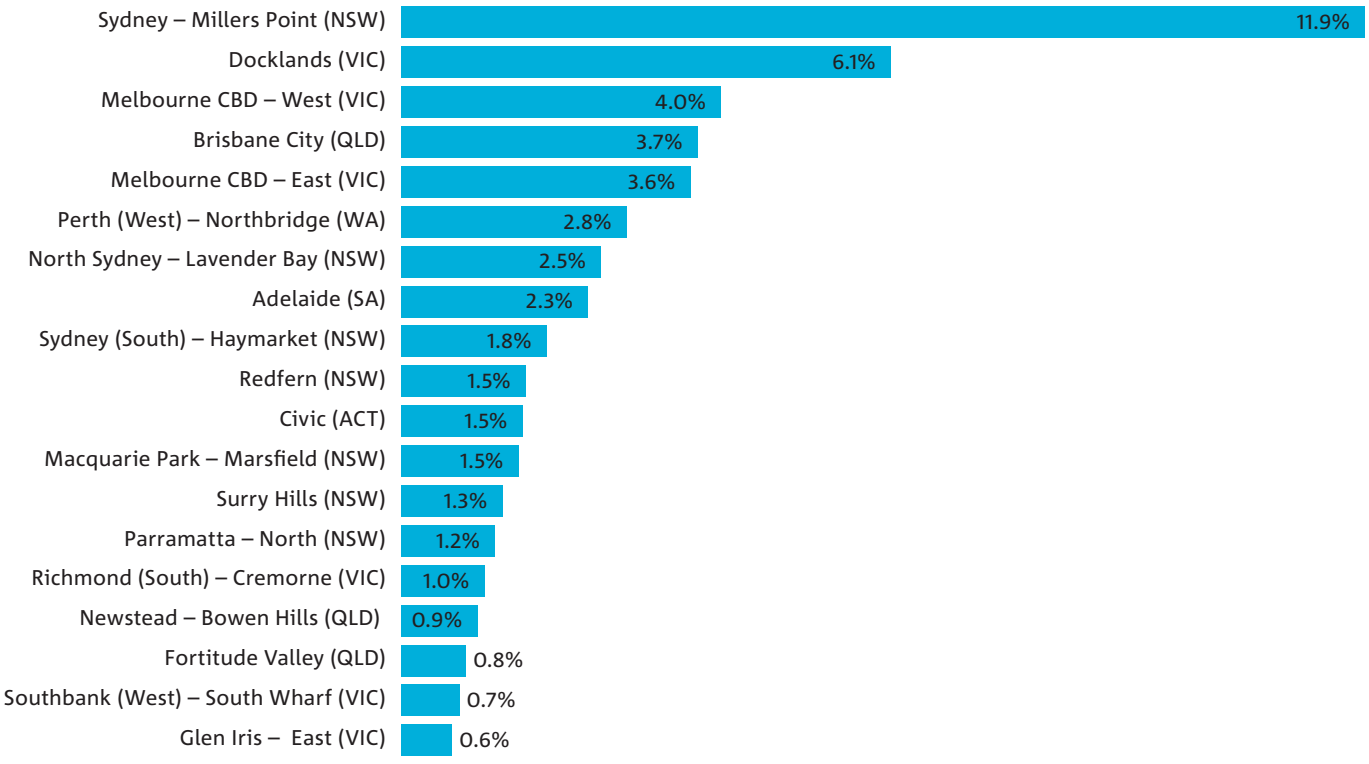


Which locations drive growth?

Greater capital city clusters, particularly their Central Business Districts, are making the most significant contributions to the national growth of the digital technology industry workforce. Sydney-Miller Point contributes nearly 12% to the national growth, followed by Docklands (6.1%), Melbourne CBD-West (3.96%) and Brisbane City (3.67%).



Contribution to Growth at the National Level (2011–2021). Greater capital city clusters represent 2.4% of statistical (level 2) areas but contributed 59% of digital technology workforce growth.



Contribution to National Growth, Top 20 SA2 Regions, 2011–2021

Changes in capital city clusters

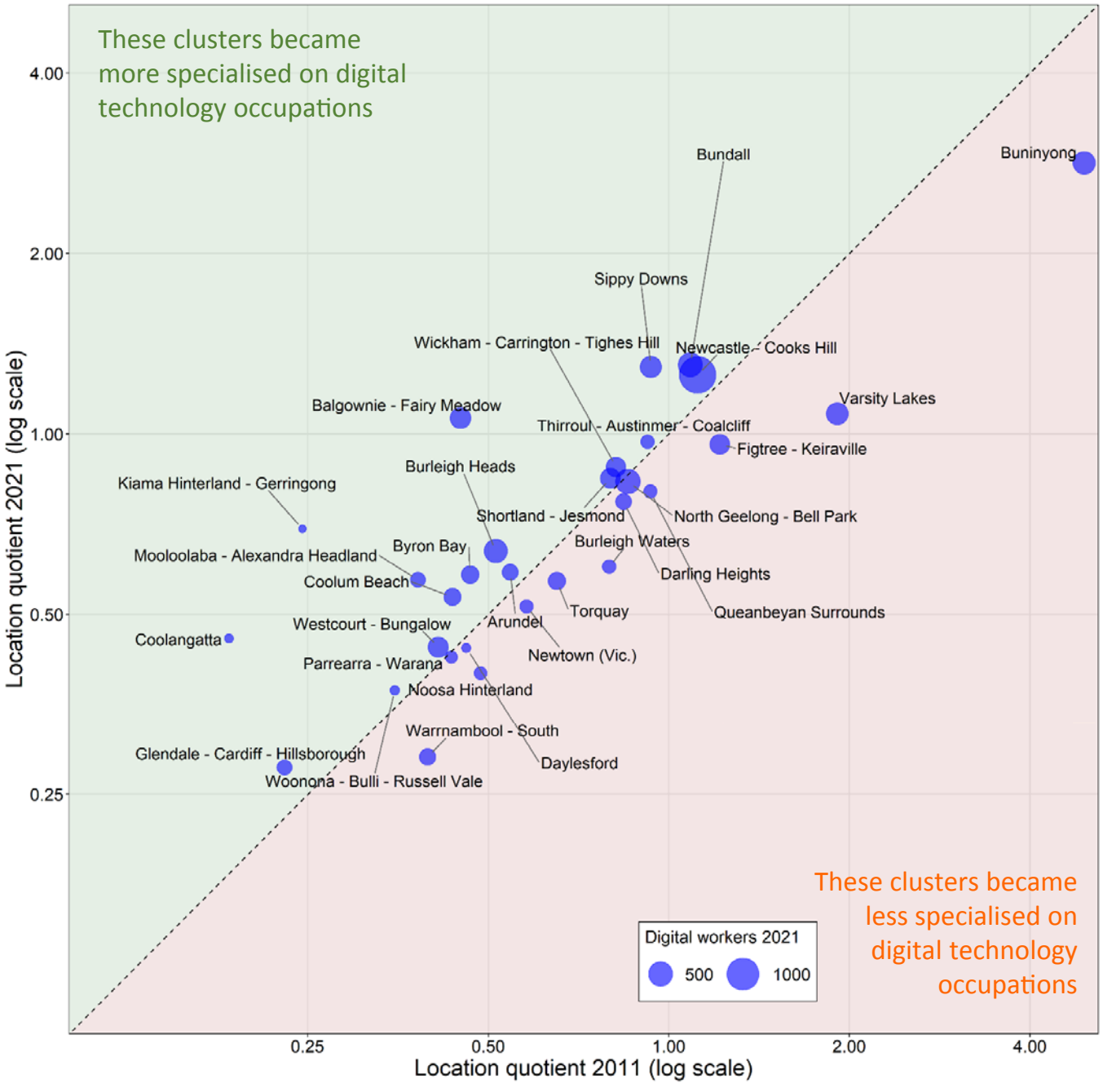
Shifts in the location quotients from 2011 to 2021

Greater capital city clusters tend to be long-established, with most of them having had high concentrations of digital workers (LQ > 2) in 2011. Between 2011 and 2021 LQs increased significantly in several capital city clusters (green region below), indicating rising concentrations of digital workers relative to the national average. LQs decreased significantly in other clusters (red region below), indicating declining (but still high) concentrations of digital workers relative to the national average.

Changes in regional niche clusters

Shifts in the location quotients from 2011 to 2021

Most regional clusters have low concentrations of digital workers relative to the national average (LQ < 1) due to the high concentration of digital workers in capital city clusters. Between 2011 and 2021, LQs increased significantly in several regional clusters (green region below), such as Balgownie – Fairy Meadow in Wollongong and Sippy Downs on the Sunshine Coast, and decreased significantly in other regional clusters (red region below), such as Varsity Lakes on the Gold Coast.

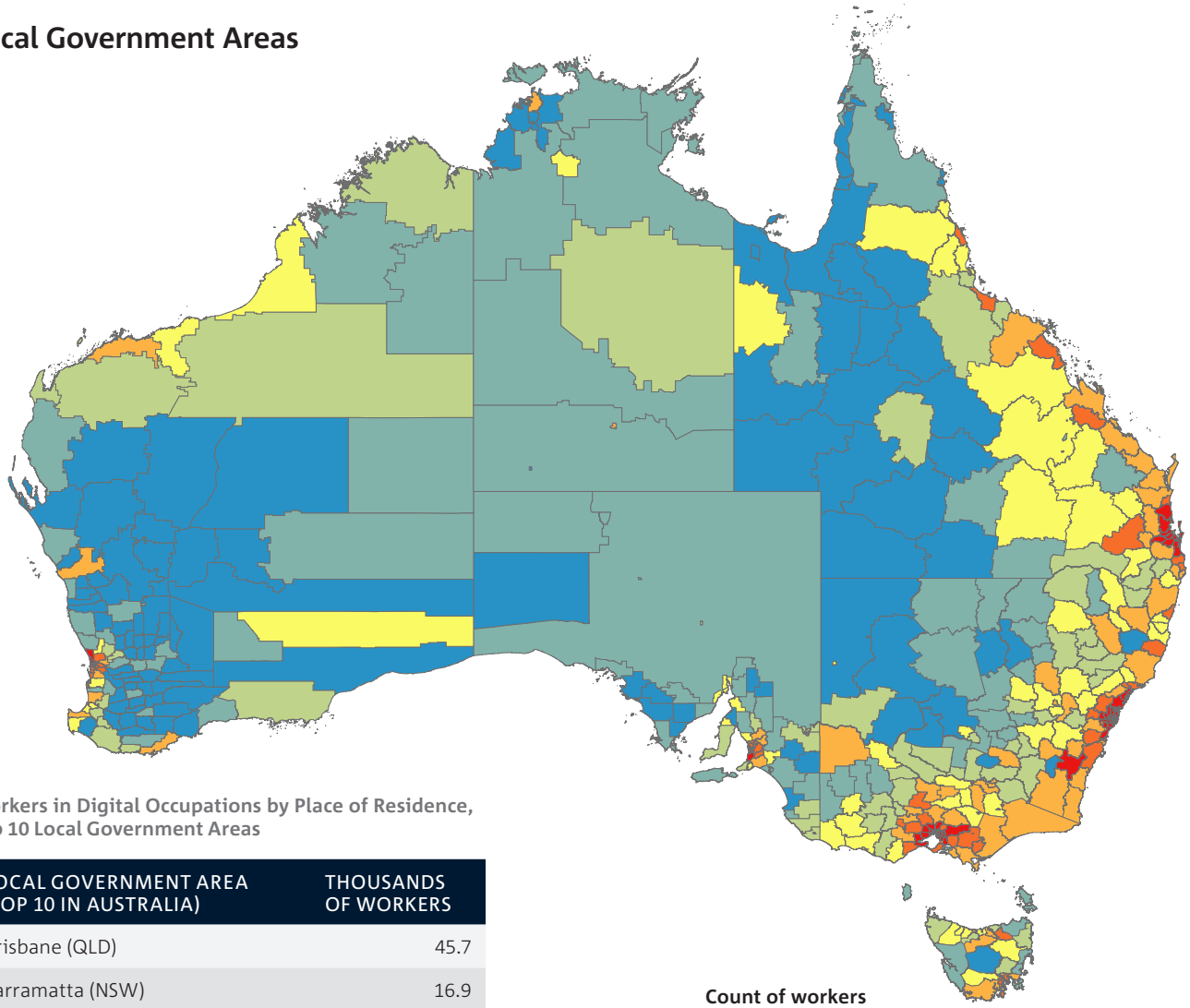


Place of residence

Number of workers in digital occupations by place of residence

The Census forms collected by the Australian Bureau of Statistics ask workers to indicate an address for their place of work and their place of residence. This allows us to analyse spatial patterns about where workers in digital occupations reside (as opposed to where they work, which forms the basis for earlier maps in this report). When viewed for local governments at the national scale we can see people in digital occupations are much more widely spread across greater cities and regional (and remote) areas.

Local Government Areas



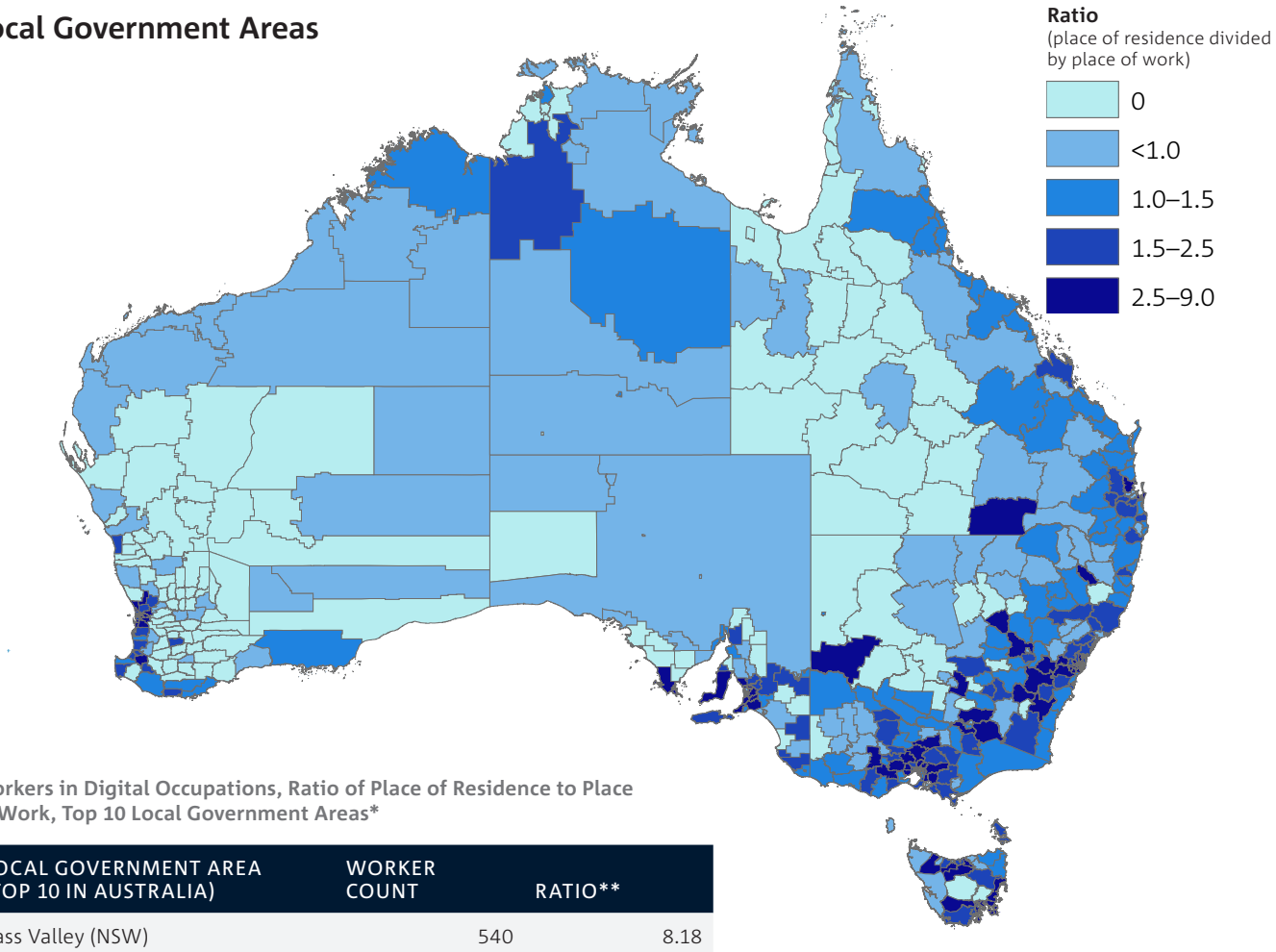
Workers in Digital Occupations by Place of Residence, Top 10 Local Government Areas

LOCAL GOVERNMENT AREA (TOP 10 IN AUSTRALIA)	THOUSANDS OF WORKERS
Brisbane (QLD)	45.7
Parramatta (NSW)	16.9
Blacktown (NSW)	16.5
Sydney (NSW)	14.7
Wyndham (VIC)	13.6
Melbourne (VIC)	11.9
The Hills Shire (NSW)	10.5
Northern Beaches (NSW)	10.2
Inner West (NSW)	9.7
Gold Coast (QLD)	9.6

Workers in digital occupations by place of residence, divided by place of work

The ratio of digital workers by place of residence to digital workers by place of work gives insight into where the digital workforce is commuting or teleworking. Where the ratio is high, there's likely to be a large teleworker or commuter population. We see that parts of greater capitals, regional and remote Australia have significant teleworker/commuter workforces.

Local Government Areas



Workers in Digital Occupations, Ratio of Place of Residence to Place of Work, Top 10 Local Government Areas*

LOCAL GOVERNMENT AREA (TOP 10 IN AUSTRALIA)	WORKER COUNT	RATIO**
Yass Valley (NSW)	540	8.18
Sorell (Tas)	168	7.00
Campbelltown (SA)	1,574	6.70
Queanbeyan-Palerang (NSW)	2,644	5.88
Armadale (WA)	1,568	5.72
Palmerston (NT)	574	5.47
Wyndham (VIC)	13,553	5.16
Gosnells (WA)	2,120	5.00
Hornsby (NSW)	9,544	4.66
Melton (VIC)	4,126	4.61

Of the 13,553 digital workers who live in Wyndham only 2,626 also work there. That means the remaining 10,927 digital workers who live in Wyndham work in another local government area and either commute or telecommute.

*Only includes local governments with >100 resident workers in digital

**Count of workers in digital occupations by place of residence divided by place of work

Image credit: Southworks / Shutterstock

Policies and strategies
For inclusive and sustainable growth and development of digital technology industry clusters

Place-based strategies

Place-based strategies aim to attract similar knowledge-intensive enterprises to a particular location in the hope that they then build local supply chains, knowledge spillovers resulting from greater face-to-face interaction between local individuals, a skilled local workforce where individuals move between enterprises, and a strong regional brand. Mature industry clusters combine these factors to create a virtuous economic cycle that grows the cluster without further intervention or support.

Place-based strategies include the creation of science and technology parks (STPs), deliberate innovation precincts or districts, and the provision of incentives such as cheap rents, tax concessions or relocation payments to incentivise certain knowledge-based industries to co- locate. Sometimes land is rezoned to promote and encourage tech-industry growth. Place-based strategies include physical works such as building or improving walking tracks, cycling tracks, pedestrian infrastructure, greenspace, parklands, water features, public facilities, community buildings, public art and transport infrastructure.

Industry clusters usually take decades to reach the point where they become self-sustaining. Many place-based attempts have under-estimated the costs of relocating or attracting industry, or they have not lasted beyond electoral or economic cycles due to their heavy reliance on the vagaries of government policy or the R&D budgets of anchor tenants.

Property effects can also mean that successful clusters can evolve to push out start-up enterprises that can no longer afford to rent there.

Place-based efforts that adopt a triple helix approach combining contributions from government, industry and research sectors, may have higher resilience due to the utilisation of a combination of R&D funds, venture capital and private investment in knowledge intensity over the economic and political cycles (Cameron, 2022).

Brisbane Technology Park

Brisbane Technology Park at Eight Mile Plains 15 km south of Brisbane's CBD was created in 2000 in a deliberate place-based initiative to attract larger technology companies to Queensland and co-locate them in one strategic location.

Now, 23 years later Brisbane Technology Park sustains one of Brisbane's digital clusters outside the central inner-city corridor.

Image credit: Alexandra Bratanova, CSIRO

Culture-led strategies

Culture-led strategies focus on growing or attracting creative entrepreneurs. They aim to create the right 'people environment' for new industry development by providing urban amenity, lifestyle attractors, support for start-ups, and proximity to education institutions. Culture-led strategies can also seek to break down institutional silos developed by private firms and R&D organisations and promote risk-taking, knowledge-sharing, networking events, meet-ups, makerspaces, coworking spaces and clubs that focus on developing and sharing technical and financial knowledge.

Cultural and event strategies are often the primary function of curation organisations overseeing STPs or innovation precincts. They can also include downtown rejuvenation projects and urban design encouraging exercise, playfulness, artistic and cultural expression and interaction spaces.

Improvements in local liveability don't always result in increased knowledge intensity or new industry development, however, and an increase in cultural amenity can sometimes lead to local gentrification that disperses start-ups and new enterprises seeking cheap space to rent to outer suburbs.

The increasing use of video networks, especially post COVID-19, is impacting where digital workers choose to live. The last five years have seen the growth of digital clusters in lifestyle locations, and digital connectivity is allowing greater locational freedom for many workers in the ICT industry. This means that 'lifestyle' has risen in importance in the creation of digital clusters.

Docklands, Victoria

Melbourne's Docklands development has repurposed over 200 ha of industrial land 1.2 km west of Melbourne's CBD into a mixed-use residential, commercial and recreational precinct focusing on public art, cultural amenity, liveability and digital start-up support (Cameron, 2022). Docklands is now part of Melbourne's Digital Diamond.

Image credit: Mark and Anna Photography / Shutterstock

Skills-led strategies

Skills-led strategies focus on education, training and attracting skilled migrants who can provide knowledge and technology transfer. Population skills have been some of the most robust indicators of innovation across an economy, with STEM skills being more important in product development, while softer skills are more important in commercialisation and business development – both of which are necessary for the successful development of industrial clusters.

The presence of a training centre that both skills up individuals and attracts younger people is an asset to any knowledge-intensive industrial cluster. Training institutions also add to the resilience of clusters, as they can assist in any re-skilling and industrial transformation that may be needed to meet global economic conditions. This is more important in single-industry economies that can suffer from mass unemployment in economic downturns.

Skilled migration can also contribute to the development of knowledge-intensive clusters. Strategies to increase skills need to be buttressed with industry engagement and financing strategies, however, as skilled people will quickly leave if they find there are better opportunities for their skills elsewhere. The global competition for skilled people who can innovate and create wealth is fierce (Cameron, 2022).

Sippy Downs, the Sunshine Coast

The University of the Sunshine Coast (USC) at Sippy Downs in Queensland was created in 1996 as part of a planned 'education and technology hub' defined in Queensland's South East Regional Plan (Department of Infrastructure Local Government and Planning, 2017). Through education and training USC aims to build a 6000-person workforce to supply the region's knowledge-based businesses. Sippy Downs is one of Queensland's regional digital clusters.

Image credit: Uscjkirklan, CC BY-SA 4.0

Mission-led strategies

Creating goals, targets or missions to focus innovative effort is another strategy used by governments or organisations to bring together collaborative partners and increase knowledge intensity within an industry.

Although aimed more at creating coalitions rather than geographic clusters, missions can be used by cluster development organisations to bring together local industry sectors and enhance a regional brand.

Mission-led strategies add purpose to technology development and apply theoretical science to real-world use cases as quickly as practicable. In some cases, missions in the development of science are implicit: e.g. winning wars is the focus of R&D by the Defence Departments.

In other cases, missions are broad but may be made more effective through greater specificity – e.g. the mission of a Health Department is to improve the health and wellbeing of the population, but a more specific appropriate sub-mission for technological effort may be to decrease cardiac arrests for people under 60 by 25%.

Missions can be effective, but creating missions has many pitfalls and can embarrass organisations or governments if they're created but not achieved.

Fort Collins, Colorado

It is hard to find an Australian example of mission-led digital cluster development. Overseas local net-zero targets have incentivised green energy transformation and digital innovation. Fort Collins, a small regional university town in Colorado in the US, was one of the early adopters of a local net-zero target, and this brought together the local government, research and business sectors in a triple helix model of cluster development that saw the city patent green energy technologies at four times the rate of the US city average (Bedi 2015). Appropriate missions for digital cluster development in Australia may relate to e-government services, ending waste, drone deliveries, reducing the digital divide or cutting costs to government or industry through digital technologies.

Image credit: marekuliasz

Finance-led strategies

Increasing research and development (R&D), venture capital (VC) and other start-up funding can help build digital clusters. Increased funding has a lag to impact though, and government spending can crowd out other investment if it not done wisely and independently.

R&D credits have been shown to increase innovation and digital adoption in the business sector and matter most to businesses where costs are constrained. VC availability is probably most associated with the digital and ICT clusters, as it focuses on easily scalable and global business models.

Many attribute the tight clustering in Silicon Valley to the hands-on approaches of VC managers, supporting and networking their portfolio companies. VC funds are becoming more risk-averse and increasingly focus on later-stage companies with proven products rather than start-ups.

Establishing and attracting VC funds to an area is sometimes done through matched government funding. This is best done when fund managers can be appointed independently to avoid politicisation and the perception of government 'picking winners' or crowding out other industry players with investment funds from government.

Venture Growth Fund and Breakthrough Victoria – Victorian Government

The Victorian Government announced the $25 million Venture Growth Fund (VGF) in the 2020–21 state budget to support high-growth start-up companies with 'a proven market fit and scaling revenues.' (Victorian Government, 2021). An external and government-independent company – OneVentures – has been appointed fund managers. OneVentures specialises in tech-sector investments and has links to Viola – Israel's largest technology investment group. It is hoped that VGF will turbocharge Victoria's existing digital clusters through upskilling, supporting job creation and developing new industries (Victorian Government 2021). Breakthrough Victoria is also an independent investment company set up by the Victorian Government to manage over $2 billion for the growth and commercialisation of new intellectual property in Victoria.

Image credit: ProDesign studio / Shutterstock

Technology-led strategies

Technology-led strategies focus on the potential of new technologies to progress government aims and deliver services. Governments that can see the potential impacts of new digital technologies and how they can be applied to government work can build local technology clusters by providing contracts to early-stage technology companies.

Defence contracting has been particularly important in building ICT clusters. Defence contracts were particularly instrumental in building Silicon Valley in the US and the technology cluster known as Silicon Wadi in Israel.

Digital Restart Fund – NSW Government

In 2020 the NSW Government announced more than $700 million for a Digital Restart Fund. This fund was used to modernise government services, including rural and remote education, cyber security, law courts, planning departments and e-lodgements. The fund's aims were to modernise services and cut costs for the NSW Government, while also providing a 'downpayment on the future economic growth of NSW' (NSW Government, 2020). In 2021 this fund was further boosted to over $2 billion in total, along with $36 million for R&D and support for the State's Data Analytics Centre.

The fund was used to build 'a secret weapon': a government procurement platform that was 'light years ahead of the competition' (Brookes, 2021). Projects cover a range of digital technologies including AI, e-government, digital twins and data management. Although there are no rules on needing to be a NSW company to submit a proposal under the scheme, many of the 107 projects funded were small, and the administrators claim to have created 3000 new jobs in NSW – presumably mostly in digital service development. Many of these would be in the Sydney Arc.

Central Station Sydney – the site of Tech Central. Image credit: Taras Vyshnya / Shutterstock

Delivering social, economic and environmental outcomes in technology industry clusters

Technology-led industry clusters are exciting places, laden with social and economic opportunity. But there are downsides too. Lack of affordable housing, crime, loneliness, income inequality, overcrowding and poor work-life cultures have been observed in the world's leading technology industry clusters. However, sustainable and inclusive development of a technology cluster is possible.

One of the most common issues is housing affordability. Researchers from the University of California, Santa Cruz mapped the ratio of low-wage jobs to affordable rental units (Benner and Karner, 2016). They found that, for nearly all southern San Francisco Bay areas, every 4 workers in a low-paid job were competing for 1 affordable rental unit on average. This has created a worker shortage and harmed quality-of-life for all residents. There are efforts underway to address this problem. For example, in June 2019 Google announced a US$1 billion Bay Area housing commitment to enable over 20,000 new homes to be built at "a range of income levels" (Pichai, 2019). A further US$1 billion was announced by the Governor of California in March 2023, delivering homes to Silicon Valley and other areas.

Transport connectivity, with a focus on pedestrian and cycle connectivity, is also seen to be part of the solution and is receiving large investments and new policies from Local and State Governments and technology corporations. For example, the planned Google development in San José includes 4,000 new homes in the Diridon Station area with support for 25% affordable housing in the region. It also has a target for zero net new carbon emissions and 65% non-single occupancy vehicle commuter trips for promoting of walking, cycling, carpooling or public transport (Google, 2023).

Planned Google Urban Development in San Jose, California. Photo courtesy of Google

Conclusion

This report has shown the geographic patterns, and intensity of local-area clustering, of Australia's digital technology industries. For the first time the locations of our digital industry clusters and their specialisations have been identified, via a consistent methodology and dataset at the national scale.

The analysis shows that geography matters when it comes to Australia's technology industries. There are many highly specialised clusters of digital industry in our capital cities and regions. As in many other countries across the globe, Australia's digital industries aren't evenly spread. They are concentrated in localised areas and have distinct spatial patterns.

Place-based approaches, which account for these geographic patterns, can catalyse the growth and development of our digital industries.

The clusters identified in this report are relevant at federal, state, territory and local scales. Governments and industry bodies can use the information in this report to identify targeted strategies for developing of the digital technology industries within their jurisdictions. There is a strong "go-with-the-flow" aspect to developing digital industry clusters. This means looking at the data to see where specialised digital technology clusters are organically forming and then designing and implementing tailored policies to catalyse growth.

We can see in these data that digital industry clusters may form gradually, so they need to be given time to emerge. Some of the clusters identified in this report are the result of government policies and programs initiated over 20 years ago. At the early stages, they may not have looked like much, but our datasets show cases where precincts have grown into nationally significant agglomerations of digital workers and companies.

We note that technology industry clusters aren't just about economic growth. They are places for people to live and play. From overseas, and in Australia, we can find examples where clusters have impacted housing affordability, traffic congestion and quality of life. Such impacts are being recognised and new technology industry developments are increasingly aiming to deliver positive social, environmental as well as economic outcomes for communities.

Overall, we hope that the data presented in this report helps industry, government and community plan for the development of Australia's digital industry clusters. Better data can help decision makers identify what to do and where to achieve economic, social and environmental outcomes.

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