



Atlas of Australia Online 2023

Global impact and local
geographic, economic, and
technology insight through
the lens of .au registered
domain names

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Executive Summary

The Atlas of Australia Online 2023 research report provides a contemporary atlas of the Australian internet, and reveals important insights into the digital landscape of Australia. It does so by augmenting the .au Domain Administration (auDA) domain name registration data with a range of publicly available geographic, economic, and technical data.

Australia has over four million .au domain names registered through auDA, encompassing the familiar namespaces such as com.au, edu.au, gov.au and net.au. Underpinning this research is a representative sample of the most significant 100,000 Australian domain names and their associated websites (referred to in this report as the .au100K), determined on a combination of measures including network centrality, traffic, and size. This dataset has been augmented with publicly available geographic, economic and technical data.

The key finding is that domain name registration is a leading indicator of broader innovation and digital transformation activity across the economy. This finding is important in an environment where many of the relevant metrics relied upon by industry and government analysts are lagging.

At a global level the Australian domain, .au, truly 'punches above its weight', being over-representative of size, more central, important and influential than the majority of country code top level domains (ccTLD) of Western Europe and other OECD nations; and importantly .au is highly trusted. **This means Australian information and ideas have high visibility and authority across the global internet including growing importance in relation to the new generation of Large Language Models (LLMs).**

Within Australia, while domain registrations correlate with population, Digital Business Intensity – the concentration of domain names as a proportion of businesses – is not population dependent, with the ACT, Victoria and Queensland the leading states/territories; and while Sydney metro has the most registered businesses, Brisbane metro has the highest Digital Business Intensity.

Higher levels of Digital Business Intensity correlate with higher levels of socio-economic advantage, education and occupation but also with specific focus on digital activity, providing additional insight into the challenges of the digital divide in Australia and opportunities in regional communities.

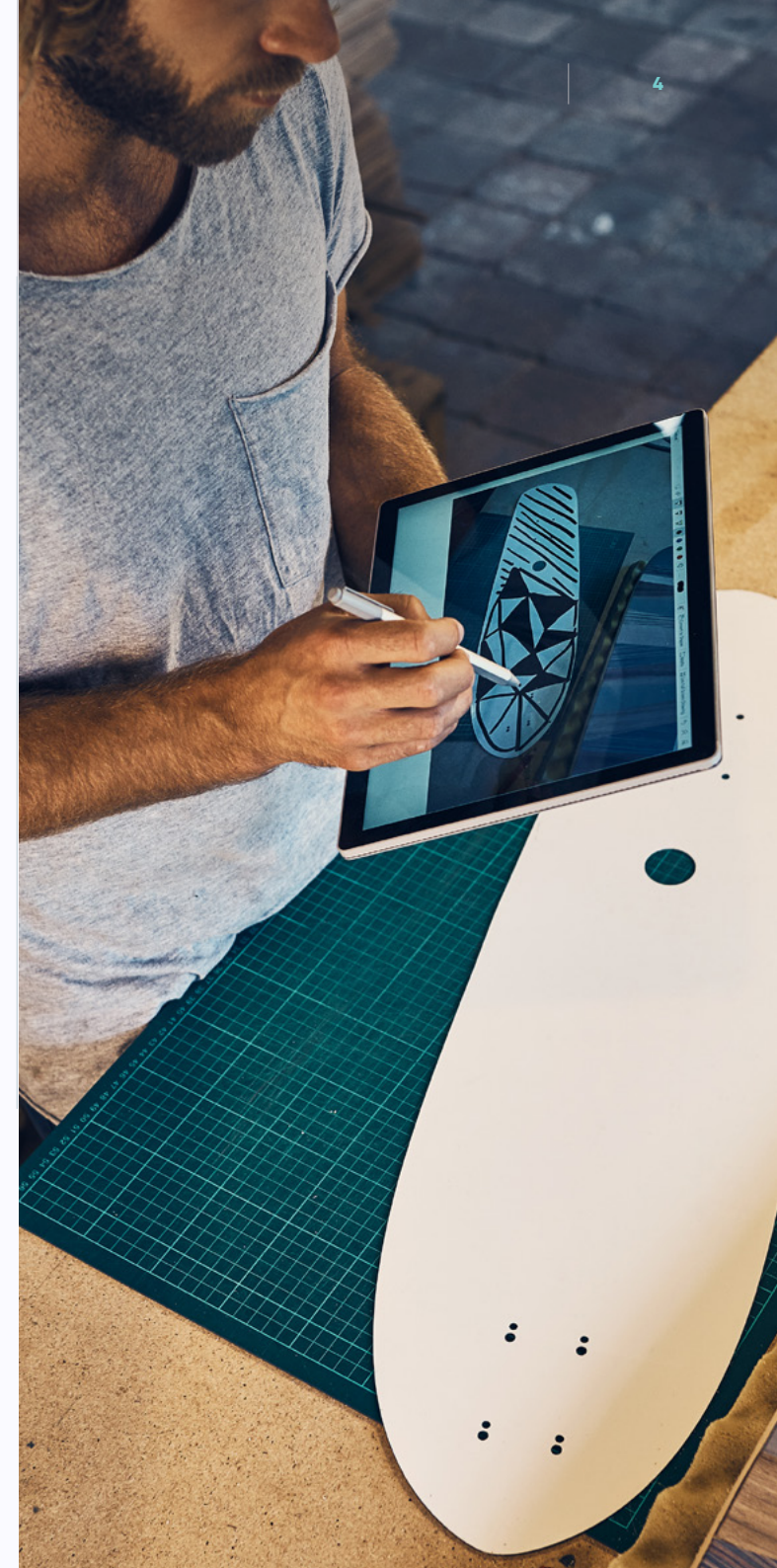
More broadly, the geographic digital divide is real. Generally, many more domain names are registered in metro suburbs, decreasing as remoteness increases. However, some regions have a higher level of domain name registrations, even after adjusting for population. Outliers like Karratha and Torquay, with high levels of digital adoption, appear to reflect specific initiatives and circumstances that have encouraged digital activity.

The .au100K list, when combined with data on technology use as exposed through an organisation's website, provides detailed and illuminating insights about technology patterns across the Australian domain name space and associated digitally enabled business activity.

Clustering analysis reveals there are eleven distinct Technology Tribes across Australian websites, where groups of organisations have adopted similar types of technologies. Each Technology Tribe has its own signature technologies - those that are used by the majority of organisations in the tribe. This reveals how organisations within each tribe uses its online presence (for example for e-commerce, media streaming or a simple hosted website), as well levels of digital maturity.

Just over 13,000 different technologies are being used by the .au100K. These technologies have been grouped into 29 high level categories, such as shipping, payment, and analytics. Revealed Comparative Advantage (RCA) analysis within the .au100K gives an indication of the relative strengths of certain categories of technology within different namespaces. This analysis shows that shopping, copyright and content distribution technologies are predominant within .au. This detailed level of analysis also reveals dominant technologies and technology providers in Australia, providing insight into the competitive landscape.

Beyond this research, and recognising the .au100K is a robust, independent collection of the most significant domain names representing the Australian internet landscape, opportunity exists for future benchmarking of digital transformation of Australian businesses. Additionally, reflecting the relative global authority and influence of the .au domain, the underpinning investment and the interest and value attached to Australia's internet domain names can be monitored. This resource can also support further research to advance cyber security defences, examine factors contributing to economic disadvantage and increase the future oriented applicability of Australian business data.



The key findings of the research include



Australian Digital Business Intensity (concentration of domain names as a proportion of businesses) is not population dependent.



Domain name registration is a leading indicator of broader innovation activity that can be tracked in almost real time.



Australian domain names have strong global impact, with higher network centrality than most of Western Europe and higher than most of the OECD nations.



Digital Business Intensity can be used to analyse the success of digital policies on a highly localised level.



Clustering analysis of the .au100K (Australia's most significant domain names and websites) reveals eleven Technology Tribes; and provides insight into the technological composition of the Australian internet, including dominant technologies and technology providers.

Introduction

More than two thirds of the world's population use the internet¹, slightly less than the proportion of the global population with access to drinking water at home². This is staggering, given three decades ago access to the internet was largely the territory of the military, academics and research institutions.

In Australia, where there is almost ubiquitous availability and usage of the internet³, examining the online landscape through the lens of the .au domain names – those domain names ending with .au, which can only be registered by those with a verifiable connection to Australia – provides valuable insight into broader geographic, economic and technical characteristics of the nation and its place in the world.

The .au country code top-level domain (ccTLD) is the internet domain assigned to Australia and administered by the .au Domain Administration (auDA). There are currently more than 4.2 million registered .au domain names (as at October 2023) and the domain includes namespaces such as com.au, gov.au, org.au and, most recently, .au direct (e.g., getyour.au).

While different .au namespaces have different rules, they all require proof of an Australian presence, which allows for deeper analysis, particularly in relation to geography. The data underpinning this research, supplied by auDA, augmented with a range of other publicly available datasets, and analysed using machine learning has resulted in new insights into Australian digital activity and the Australian economy that are of interest to policymakers and business alike.

Major finding:

Domain name registration is a leading indicator of broader innovation activity.

Registering a domain name is often synonymous with registering a business and trade mark, however this analysis of the data indicates domain name registration is also a leading indicator of patent registration.

Patents are a documented legally enforceable right for a new, inventive, useful thing. As such they are evidence of research and development (R&D). While not all businesses will undertake R&D or register a patent, such activity is a key indicator of innovation activity and of interest to policymakers and researchers alike.

This research finds that business registration and trade mark registration are correlated and coincident with domain name registration; and that patent volumes are correlated and lag by around one month (see Appendix Figure A.1). Domain name registration activity of Australian businesses appears to be providing a leading indicator of patent volume activity. This supports and adds detail to the evidence that new businesses are an indicator of innovation within the economy.

Why the key finding is important:

Innovation drives economic growth and an atlas approach provides opportunity for location-based insights. Domain name registrations can also be tracked in almost real time by organisations like auDA, allowing more timely insights into economic activity.

As expected, domain name registration correlates to business location density, however postcode level analysis reveals variations. In particular, some geographic areas exhibit much greater concentration of domain names as a proportion of the number businesses in that region which we refer to as Digital Business Intensity. This is a valuable insight into the nature of Australian business and presents an opportunity for state governments to consider the online landscape of their jurisdictions. Multiple Australian state governments are focusing on investing in and encouraging growth through innovation⁴. This report provides an additional layer of analysis, enabling deeper insight into the picture of businesses online.

Beyond the interest in place-based innovation, innovation metrics are of significant interest to both Commonwealth and state governments as they seek to better understand the drivers, inputs and outputs of innovation. A detailed Innovation Metrics Review report⁵ published by the Commonwealth Government in 2022 provides support for reliable data to both understand how the innovation system is performing and to inform policy and program development. This analysis of the Australian domain is a further important input into the understanding of Australian business and innovation.



1

The 2023 Australian online landscape: The big picture



Australia punches above its weight when it comes to the online landscape. Australia is home to just 0.3 per cent of the world's population, but accounts for 1.7 per cent of the global economy. Australia's disproportionately high contribution is also evident in the online landscape where the .au domain space occupies around one per cent of the world's domain names⁶.

Australia online comprises domain names in the .au domain such as highly recognisable websites abc.net.au, woolworths.com.au and ato.gov.au. It also includes some Australian organisations that use a generic top level domain name rather than .au such as atlassian.com, cochlear.com and qantas.com.

Just under two thirds (61 per cent) of companies listed on the Australian Stock Exchange⁷ have a com.au domain for their main corporate website, with just over one third (34 per cent) using a generic top-level domain names (.com or .net) and around 5 per cent using a combination of other country code top-level domains (ccTLDs) (e.g.: .nz, .uk) and ccTLDs that are well utilised by industries with whom they resonate (e.g.: .co, .tv, .ai⁸).

The use of generic TLDs for a company's main corporate website is mostly associated with those that are either more export orientated or rely on international investment (e.g.: Australian airline Qantas, Australian mining and metals company BHP).

Conversely the use of com.au domain names for a company's main corporate and customer facing websites is most often associated with those more focused on the Australian market and customers. In many cases, TLDs also have matched country code registrations in the com.au namespace that redirect to the one website. For example, qantas.com.au resolves to qantas.com.

The use of country-code and generic TLDs by the technology industry (e.g.: .io, .ai, .tech, .technology) is most associated with younger technology companies, while the use of commodity and business themed generic TLDs (e.g.: .gold, .bank, .limited) is most associated with related companies.

AUSTRALIA'S INTERNET DOMAIN HAS STRONG GLOBAL IMPACT

In addition to being over-represented when compared to population, .au domain names have a strong global impact. There is enduring interest in which domain names have importance or influence in the complex network of the world wide web – that is those that are most central.

Several centrality indices exist, with closeness centrality being a commonly used measure in the social sciences that infers importance of an entity (for example, a person or an organisation) in a network based on distance to all others in the network. The more central a person or thing, the closer it is to all other entities within a connected set.

However, when networks are very large and not strongly connected, such as is the case with the internet, harmonic centrality – a related, well established mathematical approach – has been found to be a more effective measure of network centrality than closeness centrality⁹. Given the internet domain is both very large and contains elements that are not strongly connected, harmonic centrality is used in this research to determine those domain names that are central, important, and influential.

Harmonic centrality can be used to rank individual websites within a network (see section 4) or as a collective measure to compare the total of one group to another.

HARMONIC CENTRALITY

An approach to measuring network centrality, or the network of connections between each domain name, to determine those that are central, important and influential. Harmonic centrality can be used to rank individual domain names within a network, or as a collective measure of an entire domain name space to understand its centrality within the global network of the world wide web.

Key finding:

Australian domain names have strong global impact, with higher network centrality¹⁰ than most of Western Europe and higher than most of the OECD nations. (See Figure 1)

The ranking of countries based on network centrality as shown in Figure 1 obviously differs from rankings based on volumes of registered domain names, where China's ccTLD, .cn, has the largest number of reported domain names, followed by Germany's .de and the United Kingdom's .uk. On the measure of reported ccTLDs under management, Australia ranks seventh¹¹.

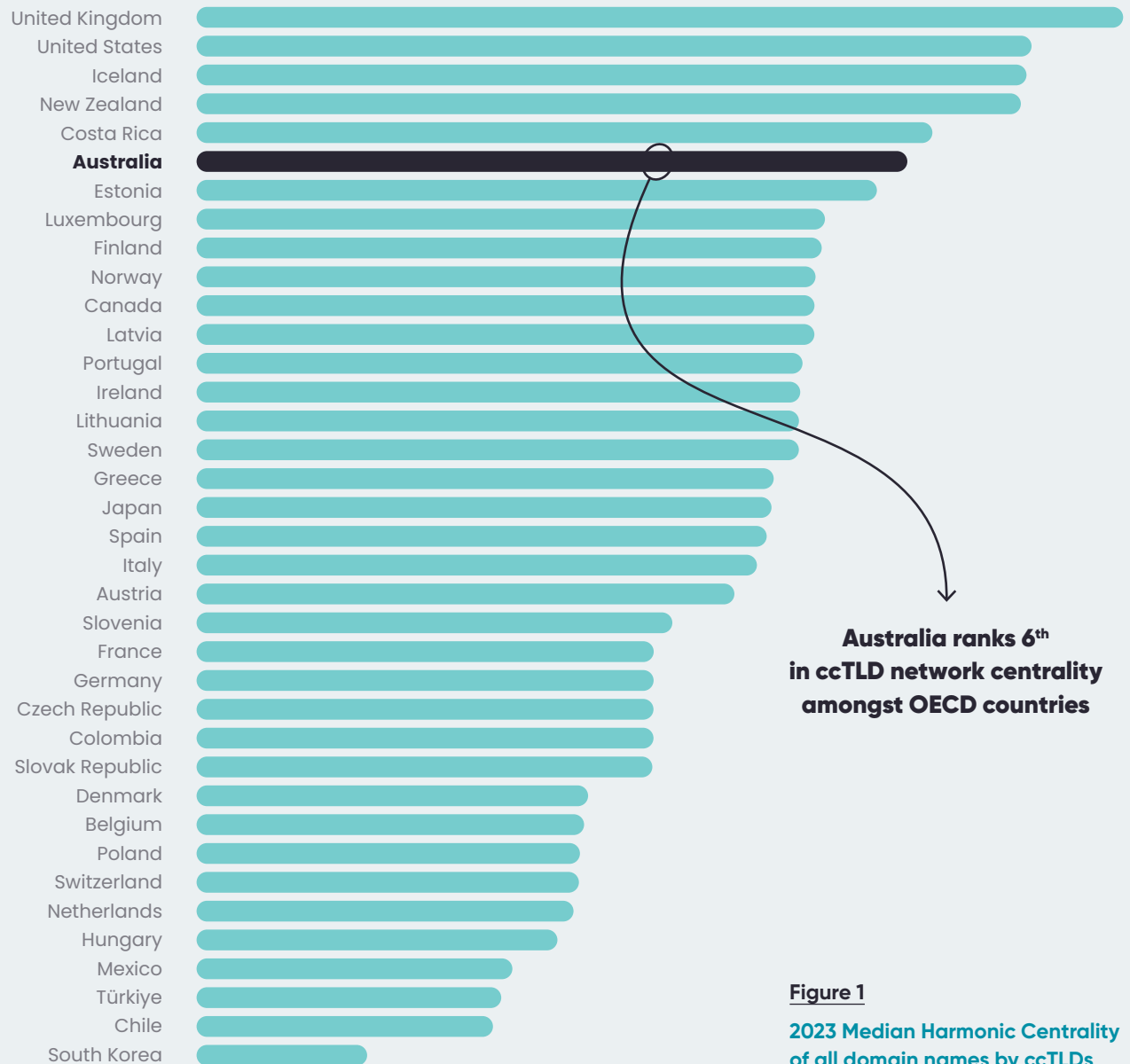
Comparing network centrality (harmonic centrality approach) for the top ten countries by the number of domains under management (ccTLD) reveals Australia ranks second after the United Kingdom ccTLD of .uk¹².

This is because network centrality (harmonic centrality approach) is measuring not just the number of registrations, but how each website associated with a registered domain name is linked to the rest of the web. The network centrality measures presented in this research, which use a harmonic centrality approach, take a global perspective and explain the context of each website with respect to the entire web by looking at the median harmonic centrality within each country domain. The median harmonic centrality of all websites within a country is representative of the whole distribution as each country follows a similar distribution pattern, enabling comparison. On this measure comparing more broadly against OECD nations, Australia ranks sixth as shown in Figure 1.

One point of further comparison indicates Australia's domain space is also one of the fastest growing globally in terms of harmonic centrality, indicating increasing influence and importance within the world wide web.

Looking specifically at the Australian domain, and not unexpectedly, gov.au domain names are the most central followed by org.au and edu.au and then net.au and com.au.

One consequence of being an important and influential English language domain space is apparent in the inclusion of Australian websites¹³ in the data set used to train tech giant Google’s large language model known as T5 (Text-To-Text Transfer Transformer) which can translate text into different languages, summarise text, classify text, answer questions, pass tests and be used in chatbot applications¹⁴. While their sources are not published, it is likely all other similar large language models such as AI research laboratory OpenAI’s ChatGPT and social media company Meta’s LLaMA are also trained on large amounts of Australian website content. One way to look at this development is that the websites of Australian organisations are taking on a new role, contributing to the next generation of worldwide knowledge infrastructure.



**Australia ranks 6th
in ccTLD network centrality
amongst OECD countries**

Figure 1
2023 Median Harmonic Centrality
of all domain names by ccTLDs

THE .au100K, A ROBUST, INDEPENDENT MEASURE OF THE AUSTRALIAN ONLINE LANDSCAPE

The basis of the powerful analysis of the Australian online landscape in this research is a new method for determining the 100,000 most significant, well connected, and well-established Australian domain names. This new, multidimensional approach samples a large cross-section of the Australian web and highlights both its richness and diversity, encompassing business, government, education and the community sector. Importantly it provides multiple perspectives and captures much of the long tail, including many smaller sites and services.

This .au100K domain universe has been developed through combining measures of network centrality, traffic, scale, and search ranking of the websites occupying the domain names.¹⁵ Figure 2 sets out the linked data sources used in the development of this domain universe and in this research. The .au100K is a dynamic dataset, sortable by different independent measures as well as a combined rank. As such it is difficult to represent in a static report format. Appendix A.3 sets out a snapshot of the .au100K.

These measures reveal the relative global authority and influence, the underpinning investment and the interest and value attached to internet domain names. The development of this domain universe for Australian domain names – the .au100K – provides a rich, robust, independent resource for analysis.

Additionally, the data within the .au100K is interesting as it reveals insights into those domain names that rank highly for network centrality based on a harmonic centrality approach, those that attract eyeballs and those that are largest in scale (based on number of pages).

Taken together, these measures establish a robust and deep collection of the most significant domain names representing the Australian internet landscape. The .au100K dataset has been further augmented with geographic, economic and technical data to create this atlas of Australia online.

	A	B	C	D	E	F	G	H
1	Combo Rank	Domain	HC	PR	DC	Tranco	BW	Majest
2	1	gov.au	4	2	1	6	25599	5
3	2	net.au	1	1	19	1	1658	2
4	3	com.au	2	4	25	4	662	3
5	4	google.com.au	13	14	13	2	25597	1
6	5	unimelb.edu.au	5	16	8	12	25605	9
7	6	amazon.com.au	19	8	3	5	25598	38
8	7	sydney.edu.au	2	17	24	21	14	15
9	8	nsw.edu.au	18	22	5	14	25604	30
10	9	unsw.edu.au	28	28	17	11	25602	7
11	10	adelaide.edu.au	8	27	2	30	120	25
12	11	qld.edu.au	32	40	4	15	230	13
13	12	nba.com.au	24	29	37	19	212	11
14	13	businessinsider.com.au	5	19	51	38	3500	36
15	14	uts.edu.au	9	37	36	54	460	29
16	15	cscn.au	43	36	6	26	1973	74
17	16	unsw.edu.au	39	58	11	47	25600	3
18	17	nla.gov.au	22	61	9	27		
19	18	ata.gov.au	24	57	23			
20	19	theage.com.au	55	45				
21	20	the.gov.au						

Linked auDA data

- Australian Business Number (ABN) / Australian Company Number (ACN)
- Postcodes
- Year of first registration

Other linked data

- Business counts (ASIC)
- Socioeconomic data (ABS)
- Patent and trade mark counts (IP Australia)
- Web Search Data (Google)
- Network centrality (Common Crawl)
- Web Traffic (Tranco)
- Tech spend and usage (BuiltWith)

Figure 2
The .au100K is a collection of the most significant domain names in the Australian internet landscape, developed through combining a deep set of data sources

2

The Australian internet landscape: A geographic and economic view

A GEOGRAPHIC PERSPECTIVE PROVIDES INSIGHT INTO AUSTRALIAN BUSINESS ONLINE

A distinct picture of the Australian online landscape is evident in the domain name registration record. Figure 3 is a map of domain name registration activity by postcode across Australia¹⁶ creating a national map of Australian website registration locations and an indicator of businesses online.

Postcodes or postal areas are useful in that they are a well understood way of defining geographic locations and are often used by researchers, particularly in relation to household data. In creating a map of domain name registration activity by postcode there are two anomalies that cannot be corrected for, firstly those instances where a firm uses a business professional (such as a web design company or an accountant) located in a different postcode to register their domain name, and secondly where a firm has moved location to another postcode after registering their domain name. However, this geographic analysis does reveal some significant insights into what the digitisation of the Australian economy looks like.

As expected, when looking at the density of domain names at a geographic level, the data reveals the strong east coast nature of the Australian domain space. Domain name registration activity can be seen in a broad arc stretching from the mid-Queensland coast down into Victoria.

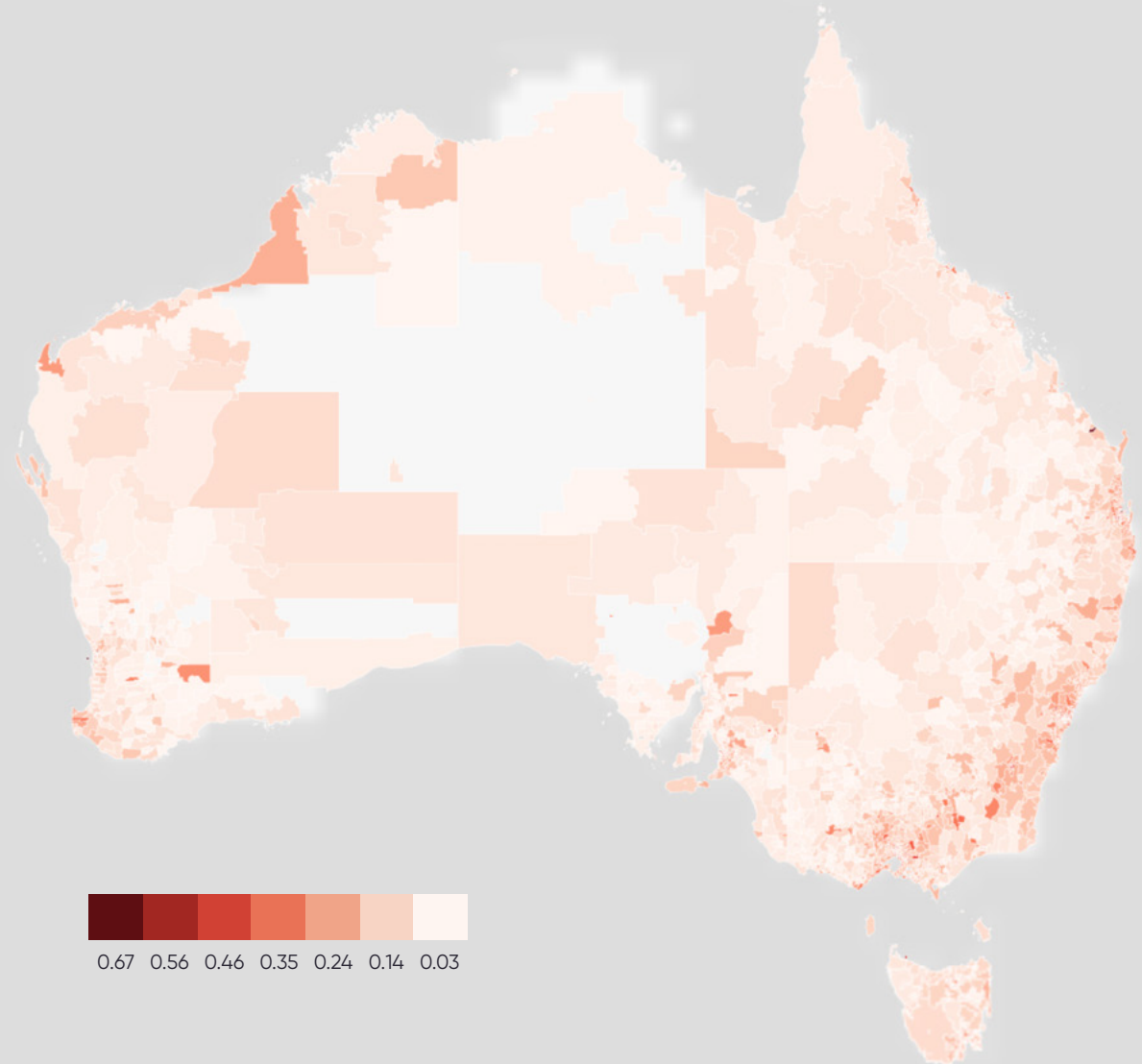


Figure 3

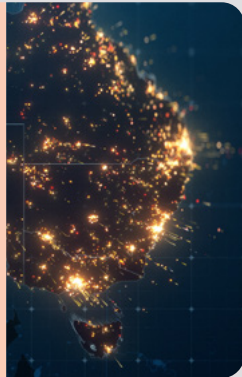
Domain name registration per ABN by postcode in Australia

Digital Landscape

Geographic and economic view of Australian online business

Australian digital business footprint is strongly east coast dominant.

Domain name registration activity forms a broad arc stretching from the mid-Queensland coast down into Victoria.



Digital Business Intensity is not population dependent.

NSW is the most populous state, but the ACT has the strongest Digital Business Intensity.



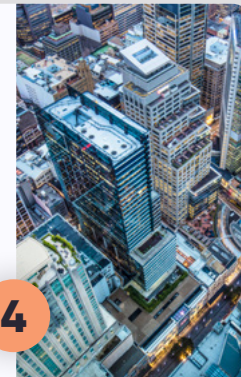
While Sydney metro has the most registered businesses, Brisbane metro has the highest Digital Business Intensity.



Geographic areas of Digital Business Intensity are clustered together in Australia's three largest cities.



Higher Digital Business Intensity correlates with higher levels of socio-economic advantage, education and occupation.

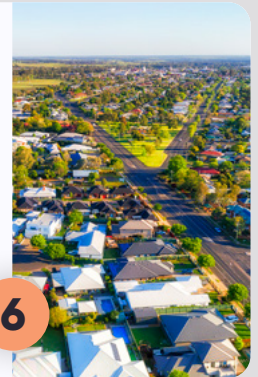


The geographic digital divide is real.

Domain name registration volumes decrease as remoteness increases.



Regional outliers have both strong endowments and encouragement of digital activity.



There is a high contrast between individual digital access and small business digital presence.

- 99% of Australian individuals access the internet*
- 59% of Australian small businesses don't have a website**



Taking a deeper dive into the data, a number of key insights are evident from a geographic analysis of the Australian domain name registration space.

AUSTRALIAN DIGITAL BUSINESS INTENSITY IS NOT POPULATION DEPENDENT 1

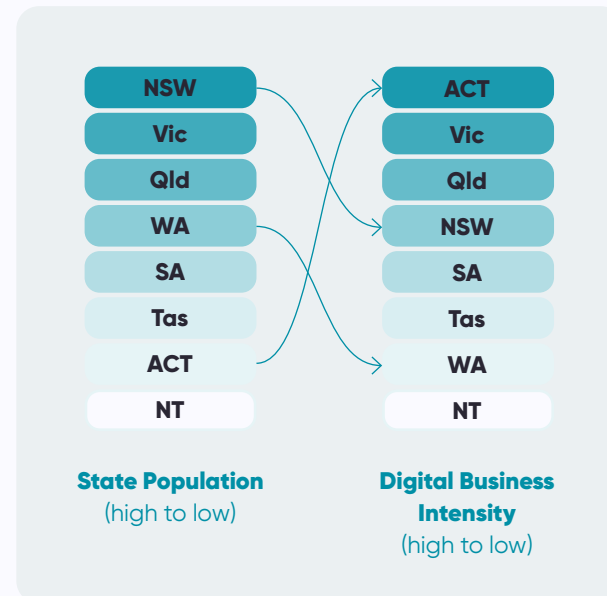
The concentration of domain names as a proportion of businesses determines the relative Digital Business Intensity within postcode areas. As expected, the volume of domain name registrations in each postcode is highly correlated to both the population and the number of businesses in that population. More people tend to mean more businesses and more domain names. However, this research finds there are significant differences in domain registrations between locations even when adjusting for differences in

Digital Business Intensity at a postcode level can be examined in detail via the NationalMap.

<https://bit.ly/AUmapDBI>

population. This Digital Business Intensity is a measure of the .au domain names registered in each postcode per Australian Business Number (ABN). Postcodes with high Digital Business Intensity (for example greater than 0.5) have a domain name registered for every two ABNs whereas postcodes with low Digital Business Intensity have less than one domain name for every 10 ABNs (for example less than 0.1)¹⁷.

Comparison at a State level reveals that Digital Business Intensity does not correlate to population. The Australian Capital Territory and Victoria have the strongest Digital Business Intensity, followed by New South Wales and Queensland, then South Australia, followed by Western Australia and Tasmania.



WHILE SYDNEY METRO HAS THE MOST REGISTERED BUSINESSES, BRISBANE METRO HAS THE HIGHEST DIGITAL BUSINESS INTENSITY 2

There is considerable variation across postcodes within the metro and outer-metro areas of the state capital cities. Looking at the east coast state capital cities, Brisbane has the highest Digital Business Intensity within its metro area, followed by Melbourne and then Sydney¹⁸. This differs from the business registration data, where Sydney has the highest number of registered businesses, followed by Melbourne and then Brisbane.



QUEENSLAND IS A TALE OF TWO CITIES AT THE HIGHEST LEVEL OF DIGITAL BUSINESS INTENSITY

New South Wales and Queensland have the highest number of postcodes exhibiting the top measure of Digital Business Intensity within this Atlas of Australia Online. In Queensland these geographic areas of intensity appear around Brisbane and around Townsville, while in New South Wales these areas of high intensity are all in Sydney.

CITIES AND TOURIST HOT SPOTS CHARACTERISE DIGITAL BUSINESS INTENSITY

Outside of the metro areas of Brisbane, Melbourne and Sydney, the locations that appear within the top three measures of Digital Business Intensity can be characterised as either light industrial / commercial (Osbourne Park WA, Parafield SA, Cavan / Dry Creek SA), smaller cities (Townsville, Canberra, and Newcastle) or tourist destinations (Rottneest Island WA, Thredbo NSW and Stanley TAS).

DIGITAL BUSINESS INTENSITY IS DISPERSED MORE BROADLY ACROSS VICTORIA COMPARED WITH QUEENSLAND

However, looking at the top three measures of Digital Business Intensity, Victoria has twice as many distinct areas of concentration as Queensland, indicating that in Victoria, high levels of businesses are engaging online across a broader geographic area¹⁹.

GEOGRAPHIC AREAS OF DIGITAL BUSINESS INTENSITY ARE CLUSTERED TOGETHER IN AUSTRALIA'S THREE LARGEST CITIES 3

The majority of geographic areas with Digital Business Intensity in the top half of the scale²⁰ appear within the three largest Australian cities of Melbourne, Sydney and Brisbane. Activity in other state capital cities is at much lower levels. The detail of Digital Business Intensity at a postcode level is available on Australia's NationalMap, managed by Geoscience Australia and CSIRO's Data61 as an authoritative source of Australian spatial data²¹. This can be found at the following URL <https://bit.ly/AUmapDBI>.

A more detailed examination revealing patterns of activity and clusters of suburbs across Melbourne, Sydney and Brisbane can be found in Appendix A.2.

HIGHER DIGITAL BUSINESS INTENSITY CORRELATES WITH HIGHER LEVELS OF SOCIO-ECONOMIC ADVANTAGE, EDUCATION AND OCCUPATION 4

Adding to this geographic nature of domain name registration, higher levels of businesses with an online presence correlates with higher levels of socio-economic advantage, education, and occupation.

These measures, from the Australian Bureau of Statistics Socio-Economic Indexes for Areas, recognise that higher levels of education can increase standards-of-living for individuals and the community, that occupation determines income and is therefore an important contribution to socio-economic advantage or disadvantage²².

This finding, that there is a correlation between online business presence and socio-economic advantage, education and occupation provides further insight into the digital divide in Australia. Looking more closely at the lower ends of each of these factors may provide insight into how to address the challenge of not being online and the disadvantage inherent in this.

THE GEOGRAPHIC DIGITAL DIVIDE IS REAL 5

Regional locations have smaller populations and less business activity in general compared with metro areas. Regional areas also have comparatively lower levels of formal education and lower numbers of domain names registered.

In general, there appears to be a lower appetite for having a website amongst small regional businesses. While just over half of surveyed small businesses across Australia do not have a website (59 per cent) this is higher for regional small businesses. Almost two thirds of regional small businesses do not have a website (65 per cent)²³.

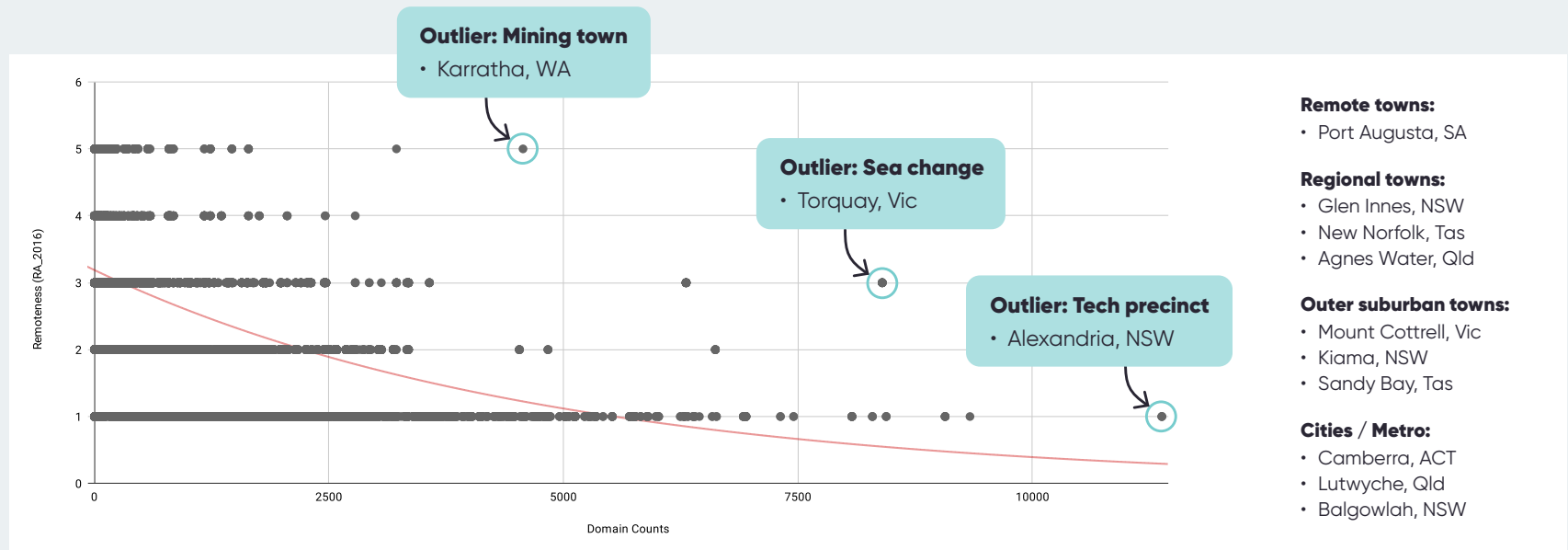
Using a five-category model of remoteness for locations²⁴ a picture of the digital divide within the Australian domain landscape is revealed (see Figure 4).

Many more domain names are registered in metro suburbs, decreasing in number as remoteness of location increases. However, regionality is an issue even after adjusting for population – there is clear evidence of a geographically based digital divide in Australia.

Figure 4

Domain name registration volumes decrease as remoteness increases.

Smaller more regional locations have less domain names.



OUTLIERS HAVE STRONG ENDOWMENTS AND RECOGNISE THE IMPORTANCE OF ENCOURAGING DIGITAL ACTIVITY 6

Within each of these remoteness categories there are outliers, and these may provide some clues as to how to address this challenge. For example, Karratha is a remote north western Australian city in the resources rich Pilbara region. As such, it is the location of some of the world's largest resources, oil and gas projects and consequently the SMEs that support this industry. Beyond this, mining employees and their families and others living in this area have community, retail, recreation and sports needs²⁵.

The Great Ocean Road coastal town of Torquay is known for its surf beaches and two of the world's largest surfwear brands – Quiksilver and Rip Curl – were founded in Torquay. Consequently, surf retail, production and related employment has traditionally been strong, as has tourism. In more recent times population growth has led to an increase in professional services, creative industries and niche manufacturing, including a strong increase in home-based businesses²⁶.

While significantly different, both Karratha and Torquay have a focus on driving economic development, as well as natural endowments that are attracting people to live and work. The higher levels of domain registrations in these areas are likely in support of SMEs seeking to reach local populations and beyond.

The City of Karratha has identified a gap where local businesses and retailers are losing market share for online shopping and online service providers and have addressed this with a 'Take your business online grant scheme'²⁷. In Torquay, self-employment is high and growth is coming from creative industries, digital nomads, knowledge-based professionals and home-based businesses. These are recognised and strongly supported in the economic development plans looking forward to 2031²⁸.

THE CONTRAST BETWEEN INDIVIDUAL UBIQUITY OF ACCESS AND SMALL BUSINESS DIGITAL PRESENCE 7

Beyond the outliers, the inability to see the benefit of a digital presence by small business owners is in contrast to the pervasive use of technology in Australia. Almost all Australians (99 per cent) are accessing the internet²⁹, predominantly using mobile phones³⁰. Indeed, Australia holds the leading position globally in mobile connectivity³¹ and 99.4 per cent of the population is covered by 4G mobile services³².

This ubiquity of access means those small businesses without a domain name and a responsive digital presence are at a disadvantage, becoming increasingly invisible and missing out on opportunities to grow their business. Indeed, a majority of small business owners with a company website believe

it has contributed significant growth to their business³³ and four in five (84 per cent) Australian small businesses have indicated they would struggle to operate without the internet³⁴.

One tangible example of success in relation to regional areas taking advantage of online and mobile platforms and social media is the 'Buy from the Bush' marketplace. While it started as a campaign to encourage support for Australian bush businesses on the social media platform Instagram, it subsequently developed an online marketplace, supported by a website (www.buyfromthebush.com.au). It has now on-boarded over 250 small regional businesses, processed 50,000 transactions, and delivered \$9 million in revenue since October 2020³⁵.

The high-level analysis presented in this research may be extensible into evidence for policy action by identifying those regional areas where there is a strong mismatch between business registrations and domain name registrations. This would enable further investigation into the barriers for digital engagement, supporting targeted policy action.

A large, bold, white number '3' is positioned on the left side of the page. The background is a teal color with faint, curved lines and a dotted pattern.

The Australian internet landscape: A technology level view

The websites associated with Australian domain name registrations provide deep insights into the technology landscape of Australian businesses. The websites of the .au100K collectively use 13,000³⁶ different technologies.

For example:

- **Enterprise software products:** Oracle (Database), Salesforce (CRM) and Workday (ERP).
- **Cloud platforms:** Microsoft Azure, Google Cloud and AWS (Amazon Web Services).
- **Content Management Systems (CMS):** WordPress, Drupal, Joomla!, and Wix are some of the most popular CMS technologies that allow users to manage and create digital content.
- **E-commerce Platforms:** Shopify, WooCommerce, Magento, and BigCommerce are widely used e-commerce platforms that help businesses sell products online.
- **Web Servers:** Apache is a popular web server software that serves web pages upon request.
- **Programming Languages:** PHP and Ruby on Rails are popular programming languages used for web development.
- **Web Analytics Tools:** Google Analytics is a widely used tool for tracking and reporting website traffic.
- **Payment Gateways:** Stripe is a commonly used online payment processing platform for internet businesses.
- **Email Marketing Services:** MailChimp is a widely used email marketing service that helps businesses manage their email campaigns.

- **Advertising Networks:** Google AdSense is a popular program run by Google through which website publishers serve advertisements targeted to the site content and audience.
- **Customer Relationship Management (CRM) Systems:** Salesforce and Hubspot are popular CRM systems that help businesses manage their relationships and interactions with customers.
- **A/B Testing Tools:** Google Optimize 360 and Optimizely are popular A/B testing tools that help businesses test different versions of their web pages to see which performs better.

Analysing this data provides insights into the trends in technology take-up and usage, the broader enterprise layer of technology in Australia and the nature of Australian business online.

The 13,000 technologies used in the technology stacks of the websites of the .au100K are organised into 29 technology categories to enable easier comparison of the commonalities and differences between namespaces. The technology categories are determined based on their function or what job they perform such as shopping, shipping or payment technologies for example. One of the largest categories is 'widgets'

which is a collection of back-end and front-end tools like the Google Font API or the human versus bot differentiator reCAPTCHA. There are over 3,700 different types of widgets used in the Australian domain name space. By contrast, one of the smallest categories is 'feeds', with only ten different types of technologies. This is largely because there are a small number of well-established feed technologies including the web standard RSS (Really Simple Syndication), and RSD (Really Simple Discovery) which is a WordPress feature.

Analysing the technologies dataset further, revealed comparative advantage (RCA) shows the relative strength³⁷ of the key categories of technologies within each of the major subdomains. This provides a picture of which technologies are most prevalent within the .au domain, revealing some significant differences within each of the major namespaces. Figure 5 sets out the 29 categories, the variety of technologies within each category, the RCA of each technology within the Australian namespaces and a snapshot of the leading technology providers within each category.

Tech Category	Variety (type count)	com.au	org.au	net.au	edu.au	gov.au	asn.au	id.au	Example technologies
cdns	107	1.07	0.67	0.56	1.54	1.48	0.64	0.37	Cloudflare CDN, Amazon S3 CDN, Amazon CloudFront
Web-Server	78	0.99	0.99	1.07	1.74	0.96	1.00	0.95	Apache, nginx, LiteSpeed
mx	265	1.01	0.96	0.82	1.31	0.93	1.03	0.50	SPF, Microsoft Exchange Online, Office 365 Mail
hosting	545	1.03	0.89	0.84	1.39	0.91	0.79	0.67	Amazon, Cloudflare Network Error Logging, Cloudflare Hosting
ssl	56	1.01	0.96	0.86	1.24	0.89	0.88	0.68	SSL by Default, LetsEncrypt, HSTS
Server	51	0.99	1.04	0.99	1.61	0.76	0.98	1.37	IPv6, QUIC, Ubuntu
cms	1684	0.98	1.10	0.88	1.75	0.74	0.98	0.56	WordPress, WordPress 6.2, WordPress 6.1
mobile	13	1.02	0.96	0.86	1.07	0.70	0.88	0.65	Viewport Meta, iPhone / Mobile Compatible, Apple Mobile Web Clips Icon
media	165	1.01	1.01	0.68	1.86	0.63	0.66	0.34	YouTube, Vimeo, MediaElement.js
analytics	1116	1.08	0.68	0.62	1.37	0.61	0.50	0.21	Google Analytics, Google Universal Analytics, Global Site Tag
language	192	1.08	0.71	0.58	0.93	0.60	0.56	0.30	Australian English, English HREF LANG, Australian English HREF LANG
ns	156	1.04	0.87	0.82	1.17	0.59	0.66	1.05	Cloudflare DNS, Amazon Route 53, GoDaddy DNS
javascript	732	1.03	0.92	0.76	1.54	0.58	0.80	0.22	jQuery, Intersection Observer, core-js
cdn	71	1.05	0.84	0.72	1.36	0.57	0.70	0.37	GStatic Google Static Content, Cloudflare, jsDelivr
Generic-CDN	1	1.05	0.84	0.72	1.17	0.56	0.69	0.26	Content Delivery Network, Amazon, Cloudflare Network Error Logging
link	106	1.00	1.11	0.69	1.24	0.54	1.10	0.40	Facebook, Instagram, Twitter
robots	31	1.06	0.73	0.95	1.08	0.51	0.48	0.18	Google AdsBot Disallow, Ahrefs Bot Disallow, Google AdsBot Mobile Disallow
widgets	3725	1.02	0.97	0.77	1.37	0.51	0.80	0.26	CrUX Dataset, Google Font API, Google Tag Manager
ads	773	1.14	0.39	0.59	1.01	0.50	0.25	0.49	DoubleClick.Net, Facebook Custom Audiences, Google Remarketing
copyright	27	0.99	1.03	1.04	1.97	0.47	1.00	0.69	Copyright Year 2021, Copyright Year 2016, Copyright Year 2020
framework	2294	1.06	0.79	0.81	1.35	0.41	0.72	0.34	Organization Schema, PHP, PHP 7
Web-Master	7	1.12	0.49	0.72	0.95	0.37	0.40	0.29	Google Webmaster, MSN/Bing Webmaster, Yandex Verification
mapping	40	1.06	0.83	0.75	1.18	0.36	0.68	0.09	Google Maps, Google Maps API, Google Maps for Work
feeds	10	0.99	1.13	0.95	1.18	0.23	0.96	0.67	RSS, Really Simple Discovery, Live Writer Support
payment	215	1.11	0.66	0.53	0.69	0.21	0.37	0.10	Euro, PayPal, Visa
shipping	64	1.22	0.11	0.38	0.16	0.11	0.05	0.02	Australia Post, TNT, DHL
shop	927	1.16	0.41	0.50	0.47	0.09	0.31	0.03	WooCommerce, WooCommerce Add To Cart, WooCommerce Checkout
parked	27	1.09	0.39	1.90	0.61	0.00	0.22	1.35	ParkingCrew, SEDO Parking, GoDaddy Parking
encoding	1	0.00	7.36	0.00	0.00	0.00	0.00	0.00	UTF-8, RSS, Really Simple Discovery

Figure 5

Functional analysis of .au namespaces reveals technology prominence

THE BIG PICTURE: SHOPPING, COPYRIGHT AND CONTENT DISTRIBUTION

It is unsurprising that technologies within the functional categories of shipping, shopping and advertising are the most over-represented within the com.au namespace. These websites are the revenue engines of the internet.

Within the edu.au namespace an emphasis on copyright is revealed. These are the copyright notices commonly found within the footers of websites, often boilerplate code within content management systems. Media distribution and content management through a variety of technologies is also a strong characteristic of edu.au websites. This content is unsurprising given attribution and the transfer of knowledge is important in academia. Copyright notices appear in this analysis because they are not current year, suggesting much of the content in the edu.au namespace is static or has not been updated in the current year.

The gov.au namespace has an emphasis on content distribution via web servers and email technology. This reflects the nature of government as a large and complex organisation where communication within is essential to getting things done and where external communication of services to citizens is a key intent.

TECHNOLOGY VARIETY IS A MIX OF SIMPLE AND SOPHISTICATED, OPEN-SOURCE AND PROFIT DRIVEN

Looking at the entirety of the 13,000 technologies used in the technology stacks of the websites of the .au100K, the two most common technologies are enablers of mobile device web usage. An email protocol that enables domain owners to specify which IP addresses are authorised to send email³⁸ is the third most common technology in use. Other common technologies include javascript jQuery, SSL by Default and Google Analytics.

Some of the technology categories like 'feeds', 'shipping' and 'ssl' are comprised of a small number of technology varieties. Other categories like 'ads' or 'analytics' have larger numbers of technologies in use. Unsurprisingly, 'widgets' has the highest variety of underpinning technologies. Widgets are usually relatively simple software applications that can be easily embedded into websites to undertake specific tasks (e.g. font customisation) or show specific information (e.g. coupon code slider).

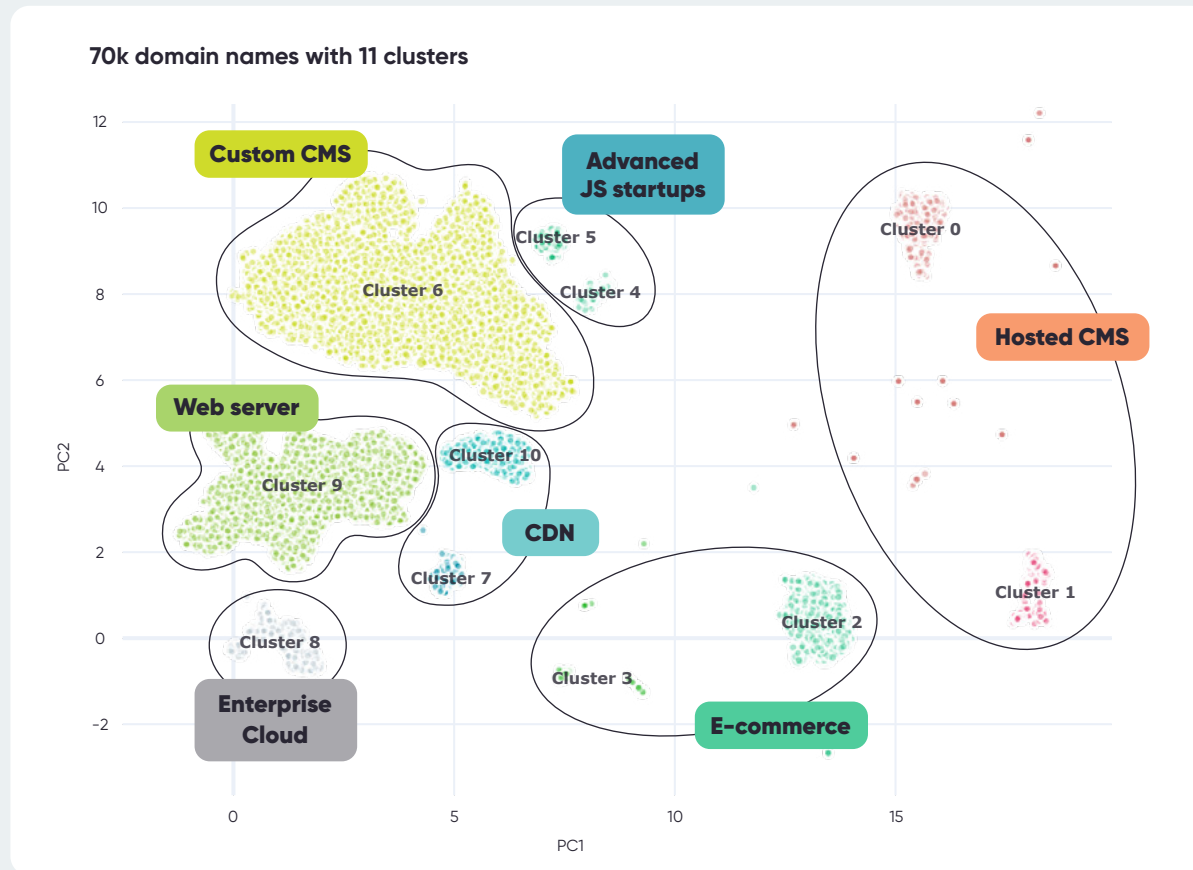
The top three technologies within each of the 29 categories shows both open-source (Apache, Ubuntu) and proprietary (Google, Amazon, Microsoft) technology companies are represented. The dominance of Google technology is clear, appearing in the top three technologies for eight of the 29 categories.

THE ELEVEN TECHNOLOGY TRIBES OF THE .AU100K

The size and complexity of this dataset of 13,000 technologies used in the websites of the .au100K presents the opportunity for cluster analysis to examine the patterns and groups of organisations based on their website technology components, their 'technology stacks'. It is important to note this analysis is looking at the technologies underpinning websites (rather than the content or audience of the websites).

Using an unsupervised machine learning clustering methodology³⁹, eleven distinct clusters emerge as set out in Figure 6. These clusters – or Technology Tribes – of the .au100K group similar websites together based on their technology usage patterns.

Every website – residing at a domain name – within each cluster uses a similar set of technologies. This in turn reveals the technology choices of the organisations behind the domain names which in turn reveals things about the organisations themselves. At a collective level, these eleven clusters provide insight into the nature of the Australian domain name space – particularly when additional data, such as business revenue, and age of domain name are considered as set out below in Figure 7 and Figure 8.



Cluster characteristics

When examined, each of the eleven clusters of websites has a principal technology function. Some of these functions are similar across clusters and the differentiation between each cluster comes from the signature technology in use. For example, as Figure 7 shows, there are two dominant leading technology providers in both the broader Platform CMS and e-commerce arena. For some clusters there are other characteristic technologies, and in some cases there are noticeable website characteristics.

Cluster #6 is the largest at more than twice the number of domain names as the next and is characterised by a significant share of large companies and the use of custom content management systems, predominantly WordPress with Themes. The second largest, cluster #9, also has a significant share of large companies, however, is characterised by the use of web servers, predominantly Microsoft IIS, and other enterprise software applications, including SAP. Optimizely, a digital experience platform enabling both content management and monetisation/value tracking, is also a characteristic technology within this cluster. This combination may reflect the age of these domain names which are comparatively mature.

The other relatively stand-alone cluster #8, is characterised by use of enterprise cloud. This smaller cluster is also home to relatively old domain names. Domain names within this cluster tend to have high harmonic centrality, with websites using a small number of technologies, including cloud services from AWS or Microsoft, mail servers, Oracle databases and have no advertising.

Machine Learning Approach

- 2023 Technology use matrix using BuiltWith Data: Top100k .au websites, 13k Technologies, and 29 Categories
- Principal component analysis on 300 dimensions
- Dimensionality reduction using UMAP using HDBSCAN
- Clustering based on sample size minimum (n>650)

- CDN** Content delivery network
- CMS** Content management system
- JS** JavaScript
- PC** Principal component

Figure 6 Eleven Technology Tribes of the .au100K revealed through machine learning clustering

The other clusters can be considered as pairs, determined by technology use. Clusters #2 and #3 are characterised by the use of e-commerce technology, either Shopify (#2) or Bigcommerce (#3). Clusters #7 and #10 are characterised by use of content delivery networks, the larger of which #10 is predominantly using Cloudflare and exhibits high harmonic centrality, while the other #7 is predominantly younger domain names using AWS CDN. The two related clusters with the greatest relative distance between them are characterised by use of hosted content management systems, with Wix (#0) and Squarespace (#1) the predominant technology. The two smallest clusters (#4 and #5) are characterised by the use of custom JavaScript.

Importantly, a number of generally high-profile websites (for example, google.com.au) are outliers because their technology usage is unlike that of most other websites and they do not meet the density criteria of the clustering algorithm to form their own cluster. The resulting cluster map doesn't include these outliers.

This technology level view of the websites associated with the Australian domain name space may provide input into future analysis of areas of potential opportunity or vulnerability. There may be some clusters of domain names where new Australian developed technology is particularly applicable or there may be some clusters with higher cyber security risk profiles. For now, these initial findings cast new light on the nature and make-up of the online activity of Australian businesses.

CLUSTER	Function	Signature technology	Other characteristic technology	Website characteristics
#0	Platform CMS	Wix		NGOs
#1	Platform CMS	Squarespace		High revenue
#2	E-commerce	Shopify	Payments, Shipping, TikTok	E-commerce
#3	E-commerce	BigCommerce	Payments, Shipping	E-commerce
#4	Custom Interactivity	JS Custom A		Interactive
#5	Custom Interactivity	JS Custom B		Interactive
#6	CMS	WordPress w/ Themes		Large organisations
#7	CDN	AWS CDN	Analytics	Video rich, New
#8	Enterprise Cloud	AWS / MS Cloud	No ads, Mail, Oracle	Established large
#9	Web Server	MS(IIS)	Optimizely, SAP	Government
#10	CDN with Security	Cloudflare		Media

Figure 7 Cluster function and technology characteristics

CLUSTER	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Scale of Cluster	M	M	L	S	S	S	L	S	S	L	M
No. URLs	3,401	1,716	5,874	965	755	708	36,072	787	893	17,151	2,601
Revenue		High						High		High	
Large Co. Share							High			High	
No. Technologies			High	High					Low		
Harmonic Centrality		High							High		High
Age of Domain								Young	Old	Old	

Figure 8 Cluster size and impact characteristics

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.au traffic: Top websites visited

The rise of the ‘attention economy’ has increased the interest in time spent online, engagement (‘Likes’) and visits. However, this is only one measure of the traffic of the internet.

Indeed, there are multiple ways in which internet traffic is measured, and consequently multiple lists of top websites. Obviously, the number of visits and levels of engagement received by commercial websites is going to be of interest to advertisers who seek to reach the right audience. However, as set out above in the technology level view, there are large numbers of websites that do not include advertising.

Alternative views on the traffic and usage of the internet provides insight into both the technology landscape and the activity of society. Figures 9 and 10 set out two different perspectives, one revealing top sites by traffic and another revealing top sites by harmonic centrality. While some similarities exist between the lists, there are differences too.

TRAFFIC	com.au	org.au	edu.au	net.au	gov.au	.au direct
Top10 2023 (IP based - DNS traffic CISCO Umbrella)	realestate.com.au harveynorman.com.au ebay.com.au gumtree.com.au pinterest.com.au news.com.au zipmoney.com.au digitaldealer.com.au ralphlauren.com.au smh.com.au	rch.org.au healthdirect.org.au zoo.org.au racgp.org.au vision.org.au openminds.org.au rspca.org.au nps.org.au pregnancybirthbaby.org.au auda.org.au	uq.edu.au deakin.edu.au sydney.edu.au swin.edu.au uts.edu.au mq.edu.au uow.edu.au adelaide.edu.au latrobe.edu.au aarnet.edu.au	abc.net.au abc-cdn.net.au hostingplatform.net.au static9.net.au iprimus.net.au ventraip.net.au email-hosting.net.au optus.net.au wide.net.au aarnet.net.au	bom.gov.au homeaffairs.gov.au immi.gov.au healthdirect.gov.au defence.gov.au ato.gov.au nt.gov.au dfat.gov.au nla.gov.au rba.gov.au	golebysparts.au usermanuals.au csiro.au amazon.au google.au melbourneit.au ftso.au mastodon.au webcentral.au greatercities.au
Top10 2023 (human - Alexa)	ebay.com.au news.com.au realestate.com.au commbank.com.au seek.com.au auspost.com.au ozbargain.com.au nab.com.au gumtree.com.au bunnings.com.au	amsi.org.au engineersaustralia.org.au acs.org.au racgp.org.au psychology.org.au rch.org.au auda.org.au sjog.org.au pregnancybirthbaby.org.au heartfoundation.org.au	sydney.edu.au uq.edu.au deakin.edu.au rmit.edu.au swin.edu.au uts.edu.au swinburne.edu.au griffith.edu.au qut.edu.au uow.edu.au	abc.net.au whirlpool.net.au raisingchildren.net.au ecd.net.au nga.net.au hostingplatform.net.au abc-cdn.net.au clubfit.net.au echo360.net.au applynow.net.au	bom.gov.au my.gov.au ato.gov.au homeaffairs.gov.au business.gov.au centrelink.gov.au legislation.gov.au passports.gov.au immi.gov.au asic.gov.au	futurised.au wetttest100.au theadacheclinic.au people20.au garfield.au identitydigital.au golebysparts.au quiktrak.au melbourneit.au elevenaustralia.au

Figure 9 Top websites according to two different approaches to measuring traffic as of October 2023

NETWORK CENTRALITY	com.au	org.au	edu.au	net.au	gov.au	.au direct
Harmonic Centrality (Common Crawl)	smh.com.au news.com.au businessinsider.com.au 9news.com.au penguin.com.au dailybulletin.com.au fixitrightplumbing.com.au businesses.com.au sbs.com.au theaustralian.com.au	greenleft.org.au lifeline.org.au beyondblue.org.au ruok.org.au mardigras.org.au orygen.org.au reconciliation.org.au australianoftheyear.org.au guild.org.au risingtide.org.au	sydney.edu.au adelaide.edu.au uts.edu.au austlii.edu.au uow.edu.au uq.edu.au mq.edu.au deakin.edu.au westernsydney.edu.au unisa.edu.au	abc.net.au australianmuseum.net.au gutenberg.net.au raisingchildren.net.au businesslistings.net.au whirlpool.net.au acmi.net.au netspace.net.au solarchoice.net.au vicnet.net.au	aec.gov.au healthdirect.gov.au health.gov.au accg.gov.au abs.gov.au homeaffairs.gov.au bom.gov.au aihw.gov.au humanrights.gov.au dfat.gov.au	csiro.au cibc.au thebigdeal.au meaghanjsmith.au rtas.au amazon.au bigblueplumbing.au google.au mastodon.au 123host.au
PageRank (Common Crawl)	smh.com.au bitpointx.com.au projectrocket.com.au cybersafetysolutions.com.au buenavistafarm.com.au koala.com.au sheskills.com.au news.com.au businessinsider.com.au architectureanddesign.com.au	butterfly.org.au orygen.org.au thebutterflyfoundation.org.au lifeline.org.au ehespace.org.au greenleft.org.au sah.org.au risingtide.org.au beyondblue.org.au aspi.org.au	sydney.edu.au adelaide.edu.au austlii.edu.au uts.edu.au uq.edu.au uow.edu.au rmit.edu.au mq.edu.au monash.edu.au unisa.edu.au	abc.net.au abc-cdn.net.au iso45001.net.au static9.net.au businessvaluationadelaide.net.au ledlightingaustralia.net.au raisingchildren.net.au efm.net.au pantone.net.au arma.net.au	oaic.gov.au health.gov.au accg.gov.au legislation.gov.au homeaffairs.gov.au healthdirect.gov.au abs.gov.au esafety.gov.au dfat.gov.au aec.gov.au	csiro.au amazon.au bigblueplumbing.au cibc.au mastodon.au searcht.au ngn.au spums.au greatercities.au

Figure 10 Top websites according to two different approaches to measuring network centrality as of October 2023

Other lists, like those provided by data aggregation and analytics company, similarweb⁴⁰ and online visibility management company, semrush⁴¹ are different in composition.

The variety occurs due to different methodologies of determining which factors are important in creating a ranked list. The take-out should be that there's no one

definitive list of Australian websites, rather there is a consistent set of websites that tend to appear across a number of different types of ranked lists. This indicates both enduring interest from the internet audience and ongoing investment from the owners and developers of those websites. The .au100K can be considered one such list.

In totality, this all adds to the picture of the Australian internet landscape as a rich and varied place, reflecting the interests of the Australian people.

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Potential future research

A number of areas for potential future research have been identified throughout this research.



CONTRIBUTION TO CYBER SECURITY DEFENCES

With cyber security one of the enduring issues facing connected society, future work may be able to identify the prevalence of known technology vulnerabilities and / or clusters of domain names with higher cyber security risk profiles and enable pro-active action to alert domain owners.



EXAMINING FACTORS CONTRIBUTING TO DISADVANTAGE

As outlined above, a correlation exists between online business presence and socio-economic advantage, education, and occupation. Exploring the lower ends of these factors can provide insights into addressing the challenges of not being online and the associated disadvantages. Future research into whether there are elements of causation that can be addressed would be a good starting point.

The high level analysis presented in this report may be extensible into evidence for policy action by identifying those regional areas where there is a strong mismatch between business registrations and domain name registrations. This would enable further investigation into the barriers for digital engagement, supporting targeted policy action.



MATCHING UP AND INCREASING THE FUTURE ORIENTED APPLICABILITY OF BUSINESS DATA

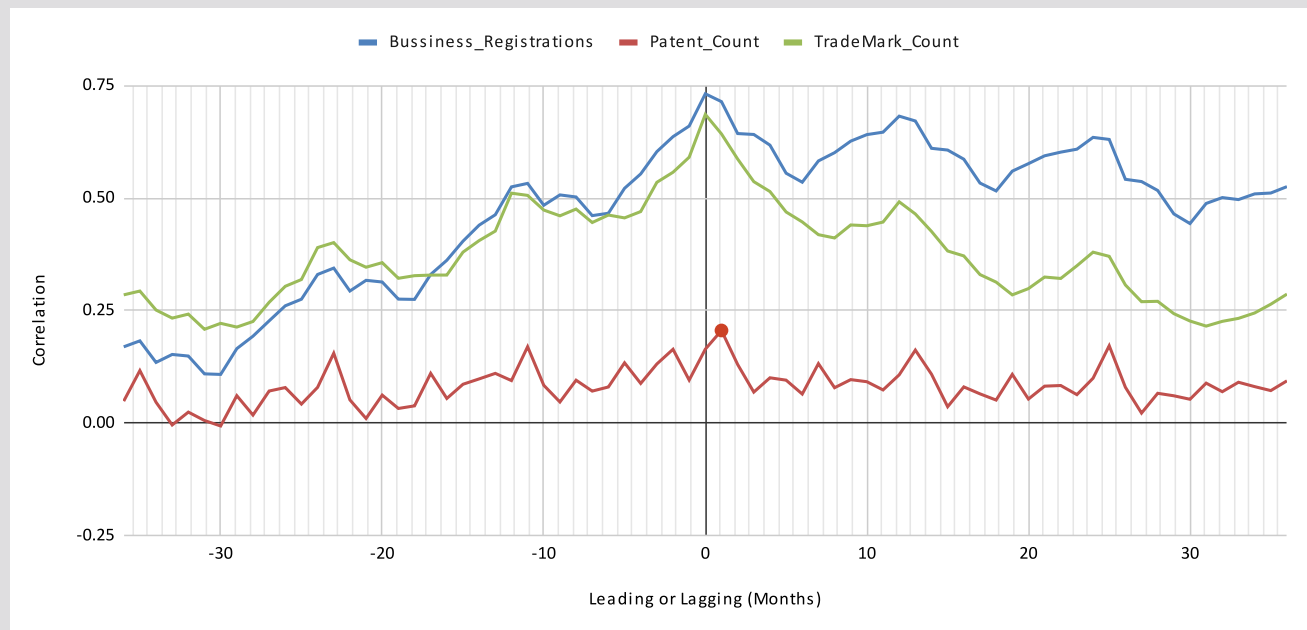
Matching data up across the business landscape in Australia would be a valuable future research project. The inclusion of official identifiers such as an Australian Business Number (ABN) or Australian Company Number (ACN) alongside a domain registration and the matching of this data to broader business registry datasets such as those available through the Australian Bureau of Statistics Business Longitudinal Analysis Data Environment (BLADE)⁴² to further analyse business dynamics, demography and characteristics would be a valuable source of insight to support effective policy making.

Additionally, machine-learning may prove useful in identifying the ANZSIC class of any Australian organisation using the descriptive text used on their website. This potential future project to create a new type of company classification may prove useful not only in economic metric measurement but also in identifying Australian companies with specific capabilities including in areas of national interest such as quantum computing, synthetic biology or artificial intelligence.

Appendix

A.1

Domain registrations associations with other business and IP registrations 2002-2016



Business and trade mark registrations are correlated and coincident and patent volumes are correlated and lag by one month.

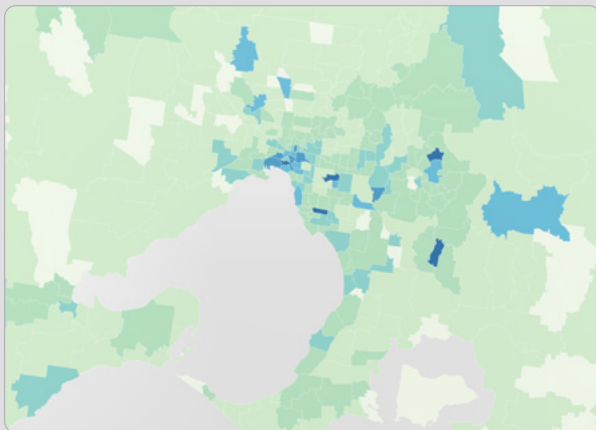
Figure A.1.1

Temporal correlations of domain registrations with business, trade mark and patent registrations

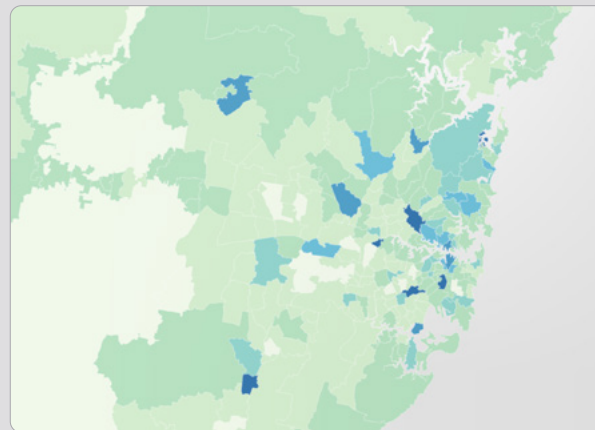
A.2

Geographic areas of Digital Business Intensity are clustered together in Australia's three largest cities

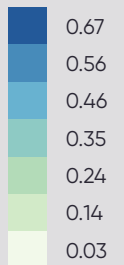
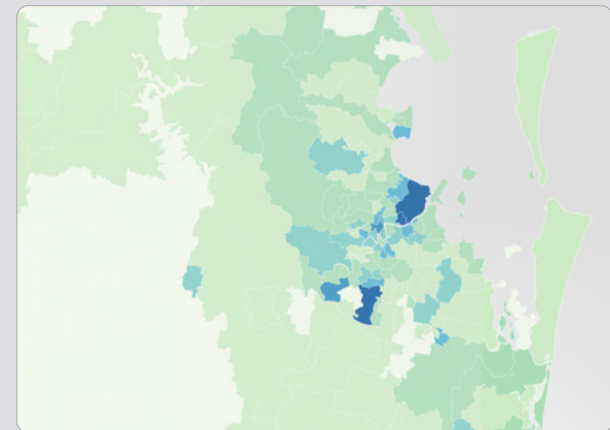
MEL



SYD



BRI



Melbourne

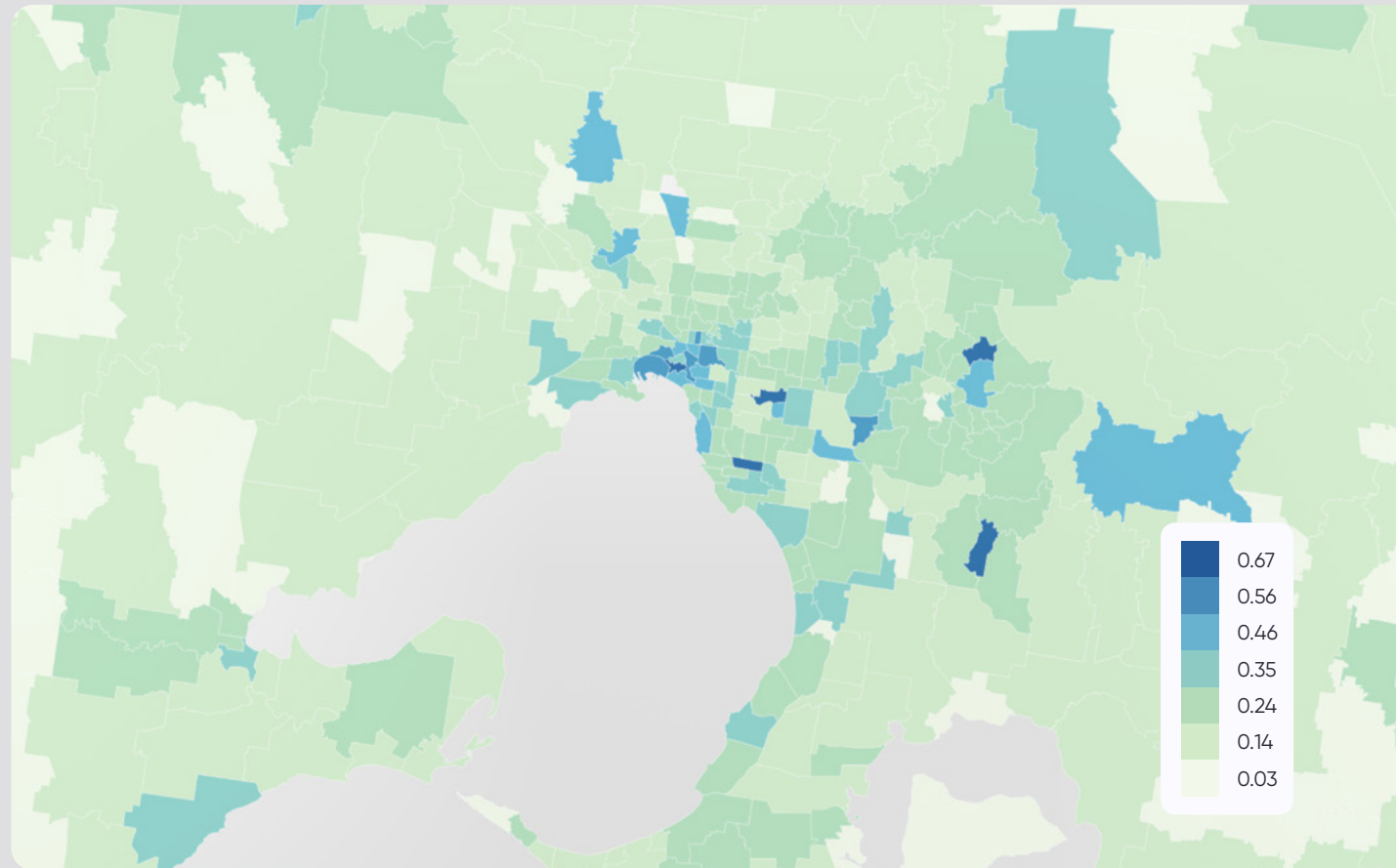
A broad spread of Digital Business Intensity

In Melbourne, high Digital Business Intensity spreads from Port Melbourne (3207) and Docklands (3008), just east of the CBD, through the inner Melbourne suburbs, including Collingwood (3066) and Kew (3101) in the north east and Albert Park (3206) in the south, then stretches out to Richmond (3121) in the east, down through Prahran (3181) to Chadstone (3148) and relatively affluent Ashburton / Ashwood (3147) in the south east.

Beyond this, just a few suburbs over, commuter suburb Mulgrave (3170) and then residential / industrial Scoresby (3179) appear. Closer to the bay, another stretch of high Digital Business Intensity appears through Elwood (3184) and Brighton (3186), the largely industrial suburb Moorabbin (3189) and market garden / golfing suburb Heatherton (3202).

Further east, Beaconsfield / Guy Hill (3807) exhibits strong Digital Business Intensity, as do popular Dandenong Ranges tourist destinations Kalorama (3766) and neighbouring Olinda (3788), and the large geographic area of Gembrook (3783).

To the north of the CBD, Gladstone Park / Tullamarine (3043), where Melbourne Airport is located, and surrounding areas of residential / industrial Campbellfield (3061) have high Digital



Business Intensity. Small, semi-rural Oaklands Junction / Yuroke (3063) is further out in this direction.

West of the CBD, commuter suburb Laverton North (3026) and Geelong (3220), to the south west of the CBD also has a high Digital Business Intensity.

Figure A.2.1

Melbourne Digital Business Intensity

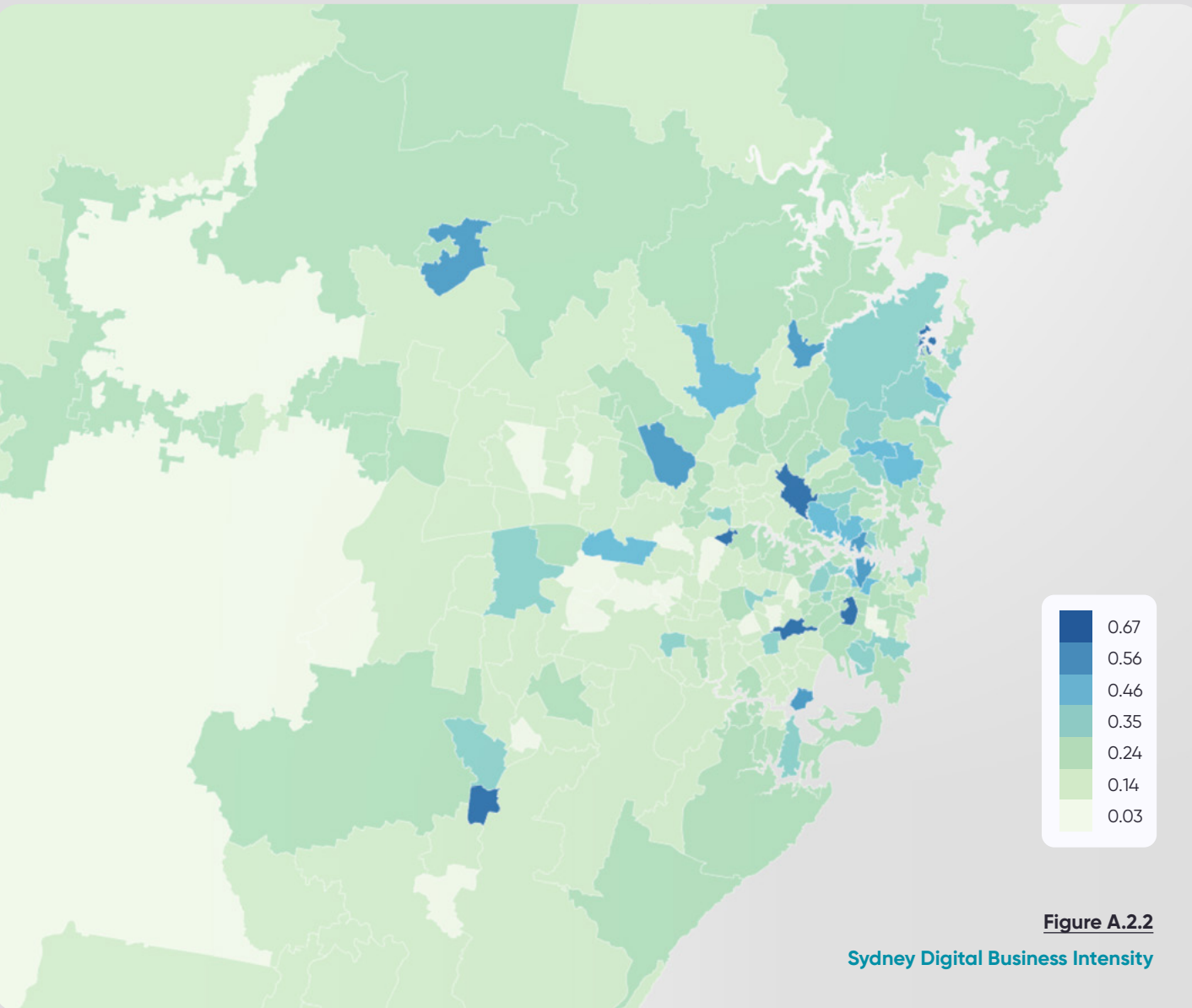


Figure A.2.2

Sydney Digital Business Intensity

Sydney

Strong pockets of Digital Business Intensity

In Sydney, areas of higher Digital Business Intensity form an arc across the city, and distributed pockets appear around the city. A corridor stretches from Alexandria / Eveleigh (2015) and Rozelle (2039) through Darlinghurst / Surry Hills (2010) and Pyrmont (2009), Broadway / Ultimo (2007), Sydney CBD (2000) and then across the Harbour Bridge to encompass North Sydney (2060) and St Leonards (2065), Lane Cove (2066) and then North Ryde and Macquarie Park (2113).

Additionally, there is high Digital Business Intensity to the west of the city in Silverwater (2128) known for its industrial and commercial heritage, likewise Smithfield / Wetherill Park (2206). South of the city, the largely residential suburbs of Earlwood / Clemton Park (2206) and Sans Souci / Dolls Point (2219) are also areas of high Digital Business Intensity.

Further out, to the north west, the relatively newly developed Norwest Business Park, housing around 400 companies and part of the Norwest / Bella Vista / Baulkham Hills (2153) postcode area exhibits strong Digital Business Intensity.

To the north east of the CBD a cluster of postcodes around the Northern Beaches areas of Frenchs Forest (2086), Brookvale / Warringah Mall / North Manly (2100), Warriewood (2102), and Church Point / Scotland Island (2105) exhibit high Digital Business Intensity.

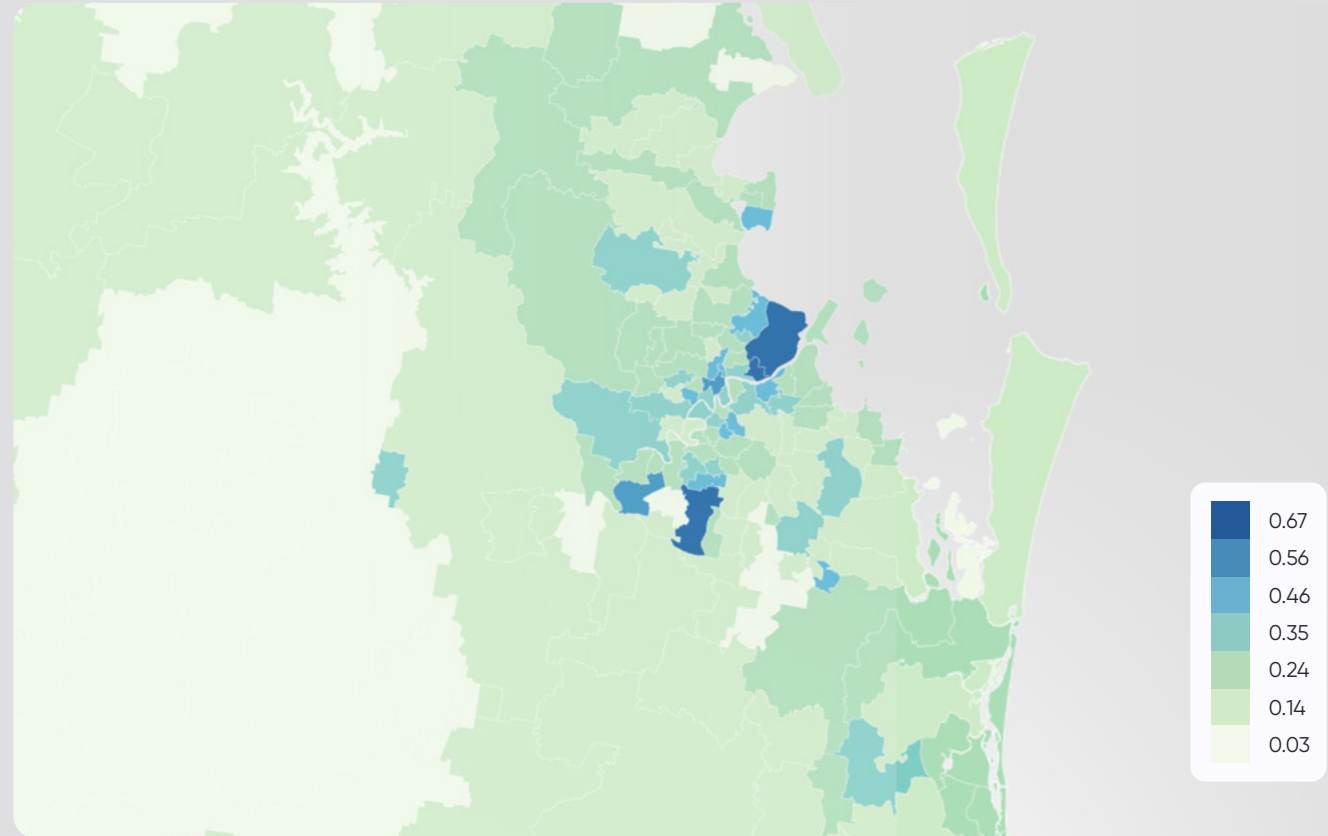
Brisbane

Bookended by Digital Business Intensity

Brisbane is bookended by two geographic areas of high Digital Business Intensity. On the northern side of the city, there is a spread of high Digital Business Intensity stretching from commuter suburbs Nudgee / Virginia (4014) just north of Brisbane Airport (4008) through the industrial suburb of Eagle Farm (4009). Residential / industrial Murarrie (4172), on the opposite side of the river to Eagle Farm is part of this cluster which also spreads north of the city through Albion (4010), and Lutwyche / Kalinga (4030).

On the western side of the city, another cluster of suburbs exhibit high Digital Business Intensity, encompassing Archerfield / Coopers Plains (4108) and mixed residential / industrial Acacia Ridge / Heathwood (4110). Further south west of the CBD and closer to the river, Darra / Wacol (4076), is home to the Brisbane Technology Park, which houses over 200 companies.

Between these, pockets of high Digital Business Intensity include the entertainment and residential districts of Fortitude Valley / Bowen Hills / Newstead (4006) and Milton / Paddington (4064). Also, the residential / café loving suburbs of Greenslopes / Stones Corner (4120) and Coorparoo (4151).



Between Brisbane and the Sunshine Coast is Clontarf / Margate (4019) home to a mix of industrial, commercial and Brisbane commuters. However, the other popular tourist areas of the Sunshine Coast (major commercial area of Maroochydore (4558), Noosa Heads / Sunshine, Sunrise, and Castaway Beaches (4567) and Surfers Paradise (4217) down to Coolangatta (4225) are not areas of high Digital Business Intensity.

Figure A.2.3

Brisbane Digital Business Intensity

Townsville

A regional city with a strong digital heart

Townsville is Australia's fourteenth largest city by population, around one third the size of Newcastle/ Maitland and 25 times smaller than Melbourne, which is the largest Australian city by population. Of note in relation to Townsville is the extent to which the National Broadband Network has been available over the last decade. In 2013 Townsville claimed to be Australia's most NBN-ready city, with take-up rates higher than the national average. By 2015 Townsville City Council had a Digital Economy Strategy⁴³ in place focusing on business growth and development in areas of online transactions and e-commerce, in online marketing – particularly identifying and developing new markets, and in online collaboration to improve efficiency and outcomes. This commitment to accessing the benefits associated with the digital economy by Townsville City Council looks to have paid dividends as evidenced in the very high Digital Business Intensity of Townsville suburbs. More recently, Townsville City Council has joined with James Cook University and the NQ Regional Organisation of Councils to establish Smart Precinct NQ, a business support organisation with a focus on start-up acceleration and incubation, Small to Medium Enterprise (SME) business growth and investment support. In the twelve months to September 2022 over 350 largely Townsville based founders and businesses have been supported to build capability⁴⁴.



A.3

Snapshot of the .au100K dataset

The .au100K represents a new method for determining the 100,000 most significant, well connected, and well-established Australian domain names.

This new, multidimensional approach samples a large cross-section of the Australian web and highlights both its richness and diversity, encompassing business, government, education and the community sector. Importantly it provides multiple perspectives and captures much of the long tail, including many smaller sites and services.

The .au100K domain universe has been developed from an initial public repository of over 700K .au domain names. This has been augmented with registry data provided by auDA including date of registration, postcode of registration and then linked to economic, social and technical data, including from the Australian Bureau of Statistics, IP Australia, the Australian Securities and Investment Commission and BuiltWith⁴⁵. The resulting dataset has been foundational to the research presented in this report.

In addition, the .au100K is a robust list of the most significant domain names in Australia, established through combining measures of network centrality including both harmonic centrality⁴⁶ (HC) and PageRank⁴⁷ (PR), scale as determined by host domain count⁴⁸ (DC), and traffic as determined by Tranco⁴⁹. Each of the domain names within the .au100K has been ranked according to these measures and an average score based on these four factors has been calculated. This enables a Combined Rank, which is simply the 1 – 100,000 ranked order based on the average score. For example, the top Combined Rank domain of nsw.gov.au has an average score of 4.

The .au100K is a dynamic dataset, sortable by the different independent measures as well as by the Combined Rank. As such it is difficult to represent in a static report format. A snapshot of the first 100 entries, representing 0.1 per cent, is presented here.

.au 100k		Network centrality		Scale	Traffic	Average score
Rank*	domain names	HC	PR	DC	Tranco	4 Factor
1	nsw.gov.au	4	3	1	6	4
2	abc.net.au	1	1	19	1	6
3	amazon.com.au	19	8	3	5	9
4	smh.com.au	2	4	25	4	9
5	google.com.au	13	14	13	2	11
6	unimelb.edu.au	5	16	8	17	12
7	anu.edu.au	18	22	5	14	15
8	adelaide.edu.au	8	27	2	30	17
9	sydney.edu.au	7	17	24	21	17
10	news.com.au	3	15	50	3	18
11	unsw.edu.au	28	28	17	11	21
12	uq.edu.au	32	40	4	15	23
13	sbs.com.au	24	29	37	19	27
14	csiro.au	43	36	6	26	28
15	businessinsider.com.au	6	19	51	38	29
16	health.gov.au	29	26	34	35	31
17	uts.edu.au	9	37	36	54	34
18	uwa.edu.au	39	58	11	47	39
19	nla.gov.au	72	61	9	27	42
20	abs.gov.au	33	43	35	62	43
21	ato.gov.au	74	57	23	40	49
22	theage.com.au	55	45	91	16	52
23	mq.edu.au	35	105	31	44	54
24	usyd.edu.au	52	117	7	50	57
25	aph.gov.au	99	54	20	68	60
26	ebay.com.au	31	127	77	7	61
27	dailytelegraph.com.au	41	107		37	62
28	eventbrite.com.au	76	47	44	83	63
29	uow.edu.au	27	51	116	56	63
30	pinterest.com.au	51	50	128	23	63
31	9news.com.au	11	44	165	39	65
32	rmit.edu.au	56	103	68	34	65
33	business.gov.au	88	64	32	79	66
34	legislation.gov.au	69	31	92	80	68
35	curtin.edu.au	10	38	151	76	69

.au 100k		Network centrality		Scale	Traffic	Average score
Rank*	domain names	HC	PR	DC	Tranco	4 Factor
36	nine.com.au	98	138	16	36	72
37	gizmodo.com.au	48	121	47	82	75
38	telstra.com.au	59	100	137	32	82
39	latrobe.edu.au	95	144	27	71	84
40	nt.gov.au	141	104	15	102	91
41	healthdirect.gov.au	16	39	238	74	92
42	newcastle.edu.au	79	195	49	49	93
43	act.gov.au	107	114	66	88	94
44	utas.edu.au	113	173	10	85	95
45	dfat.gov.au	57	49	174	108	97
46	accg.gov.au	30	30	191	139	98
47	asic.gov.au	150	108	42	93	98
48	griffith.edu.au	103	125	104	70	101
49	bom.gov.au	36	59	284	24	101
50	itnews.com.au	54	135	100	132	105
51	deakin.edu.au	37	120	216	48	105
52	7news.com.au	83	224	57	63	107
53	flinders.edu.au	92	205	12	125	109
54	qut.edu.au	89	112	210	43	114
55	westernsydney.edu.au	42	123	160	147	118
56	aihw.gov.au	45	122	140	170	119
57	booktopia.com.au	87	147		127	120
58	penguin.com.au	15	52	126	302	124
59	unisa.edu.au	50	111	244	90	124
60	tga.gov.au	164	148	56	138	127
61	csu.edu.au	134	262	14	100	128
62	beyondblue.org.au	49	99	177	187	128
63	realestate.com.au	127	247	146	13	133
64	canberratimes.com.au	110	202	161	98	143
65	thewest.com.au	128	301	48	95	143
66	jcu.edu.au	175	208	84	107	144
67	ga.gov.au	143	167	18	252	145
68	murdoch.edu.au	109	285	99	92	146
69	tpg.com.au	53	228	127	201	152
70	treasury.gov.au	104	131	150	229	154

.au 100k		Network centrality		Scale	Traffic	Average score
Rank*	domain names	HC	PR	DC	Tranco	4 Factor
71	mumbrella.com.au	40	65	224	289	155
72	huffingtonpost.com.au	93	191		184	156
73	seek.com.au	146	159	305	18	157
74	domain.com.au	97	384	87	64	158
75	ecu.edu.au	166	213	115	151	161
76	brisbanetimes.com.au	90	279	170	113	163
77	monash.edu.au	61	106	439	51	164
78	optus.com.au	78	146	277	163	166
79	scu.edu.au	176	295	53	155	170
80	defence.gov.au	167	166	248	99	170
81	une.edu.au	86	272	179	150	172
82	foxsports.com.au	120	320	178	96	179
83	mamamia.com.au	121	325	86	185	179
84	acma.gov.au	154	222	58	286	180
85	perthnow.com.au	151	391	59	120	180
86	iinet.net.au	108	164	455	10	184
87	theiconic.com.au	168	444	33	103	187
88	vodafone.com.au	125	193	355	81	189
89	canberra.edu.au	204	316	45	191	189
90	vu.edu.au	158	310	155	149	193
91	kotaku.com.au	137	337	208	135	204
92	bunnings.com.au	172	547	73	59	213
93	woolworths.com.au	119	243	434	66	216
94	crikey.com.au	138	430	64	236	217
95	kidspot.com.au	85	157	402	233	219
96	mja.com.au	149	275	225	248	224
97	jbhifi.com.au	147	383	299	69	225
98	gumtree.com.au	269	546	46	46	227
99	mydeal.com.au	101	375	102	331	227
100	architectureanddesign.com.au	178	24	189	521	228

* Combined

HC – Harmonic centrality / PR – Page rank / DC – Domain count

Data compiled as of October 2023.

Endnotes and references

- 1 Internet penetration rate (per cent population) is 67.9 per cent as of June 30, 2022. Internet users as of 31 Dec 2021 estimated as 5.4 billion people. Internet usage information comes from data published by Nielsen Online, by the International Telecommunications Union, by GfK, by local ICT Regulators and other reliable sources and is provided by www.internetworldstats.com
- 2 In 2020, 74 per cent of the global population (5.8 billion people) used a safely managed drinking-water service – that is, one located on premises, available when needed, and free from contamination. World Health Organization, March 2022. <https://www.who.int/news-room/fact-sheets/detail/drinking-water>
- 3 ACMA reports 99% of Australian adults went online in the six months to June 2022. Communications and media in Australia series: How we use the internet. <https://www.acma.gov.au/sites/default/files/2023-03/HOWWEU~1.PDF>
- 4 NSW Greater Cities Commission focus on four distinct geographic places identified as the CBD based Tech Central, Westmead Health and Innovation District, Macquarie Park and the Central Coast. <https://greatercities.au/innovation-districts/districts>, Victoria and South Australia focusing on sector specific, business specific, and geographic precincts Victoria State Government – Innovation Victoria Agenda: Driving economic growth and jobs. <https://djsir.vic.gov.au/innovation-victoria/about/our-agenda>, and Plan for growth areas <https://www.infrastructurevictoria.com.au/report/3-4-plan-for-growth-areas/> and South Australia State Government focus on Space <https://lotfourteen.com.au/> and BioMed <https://www.diis.sa.gov.au/innovation/science/eiti>
- 5 Australian Government Department of Industry, Science and Resources, Innovation Metrics Review, 30 September 2022 <https://www.industry.gov.au/publications/innovation-metrics-review>
- 6 Estimates vary. Statista estimates .au is around 1.6% of top-level domains as of June 2023 <https://www.statista.com/statistics/265677/number-of-internet-top-level-domains-worldwide/>
- 7 Author analysis as of May 2023 for 1,275 companies listed on the Australian Stock Exchange.
- 8 For example, the ccTLD for Colombia, .co, is sometimes used by companies more generally, the ccTLD for Tuvalu, .tv, is sometimes used by video production companies, and the ccTLD for Anguilla, .ai, is popular with companies associated with artificial intelligence.
- 9 P. Boldi and S. Vigna, “In-Core Computation of Geometric Centralities with HyperBall: A Hundred Billion Nodes and Beyond,” 2013 IEEE 13th International Conference on Data Mining Workshops, Dallas, TX, USA, 2013, pp. 621–628, DOI: 10.1109/ICDMW.2013.10. Note also, harmonic centrality measures the shortest distances to all other websites by counting the number of clicks (via links) required to reach them and then adds the inverse of these distances. Consequently, websites close to the “centre of the web graph” have higher network centrality scores, while those on the periphery have lower scores.
- 10 Higher network centrality determined using a harmonic centrality approach.
- 11 The Domain Name Industry Brief publishes rankings of countries by the number of reported domain names. <https://dnib.com/articles/the-domain-name-industry-brief-q1-2023>
- 12 According to the Domain Name Industry Brief, the rankings of ccTLDs by number of reported domain names as of March 31, 2023 (per Endnote 11) are: .cn, .de, .uk, .nl, .ru, .br, .au, .fr, .eu, .it. However, taking median network centrality (harmonic centrality approach) the ranking is: .uk, .au, .it, .eu, .fr, .de, .br, .nl, .ru, .cn.
- 13 The Washington Post, Inside the secret list of websites that make AI like ChatGPT sound smart, https://www.washingtonpost.com/technology/interactive/2023/ai-chatbot-learning/?itid=mc_magnet-ai_inline_collection_1
- 14 Google Research Blog, Exploring Transfer Learning with T5: the Text-To-Text Transfer Transformer <https://ai.googleblog.com/2020/02/exploring-transfer-learning-with-t5.html> and Exploring Google’s T5 Text-To-Text Transformer Model https://wandb.ai/mukilan/T5_transformer/reports/Exploring-Google-s-T5-Text-To-Text-Transformer-Model--VmlldzoyNjkzOTE2#when-you-would-use-the-t5-model?

- 15 The .au100K is determined through a combination of measures of network centrality including both harmonic centrality (HC) and PageRank (PR), scale as determined by host domain count (DC), and traffic as determined by Tranco. See Endnotes 46 – 48.
- 16 Australia Post uses four digit postcodes to assist with mail delivery, however does not currently define geographic boundaries for postcodes. The geographic boundaries used in this research are the closely related Australian Bureau of Statistics Postal Areas (POAs). <https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/non-abs-structures/postal-areas>.
- 17 The data in this report, as displayed on the NationalMap (<https://bit.ly/AUmapDBI>) has been binned into seven numerical measures or seven categories from highest to lowest.
- 18 Calculated using Australia Post categorisation of metro postcodes.
- 19 Counts of postcode areas in top three categories of Relative Digital Business Intensity, NSW 18, VIC 16, QLD 8, WA 3, SA 1, TAS 1.
- 20 Postcodes with Relative Digital Business Intensity measures of 0.40 and above are designated as high in this analysis, with the addition of Geelong which measures 0.38.
- 21 About Australia's NationalMap – <https://nationalmap.gov.au/about>
- 22 Socio-Economic Indexes for Areas (SEIFA) Technical Paper. <https://www.abs.gov.au/statistics/detailed-methodology-information/concepts-sources-methods/socio-economic-indexes-areas-seifa-technical-paper/2021/data-underpinning-indexes>
- 23 GoDaddy 2019 research study conducted by YouGov Galaxy – Australian SMBs and websites. <https://au.godaddy.com/blog/study-reveals-why-59-of-australian-small-businesses-dont-have-a-website/>
- 24 The Australian Bureau of Statistics Remoteness Structure defines Remoteness Areas for the purpose of releasing and analysing statistics. Remoteness Areas (RA) divide Australia into five classes of remoteness which are characterised by a measure of relative geographic access to services. <https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/remoteness-structure/remoteness-areas>
- 25 City of Karratha Economic development <https://karratha.wa.gov.au/business-and-economy/economic-development>
- 26 Torquay-Jan-Juc Retail & Employment Land Strategy 2020 and The Surf Coast Shire: A Prosperous Place, Our Economic Story 2021 <https://www.surfcoast.vic.gov.au/Community/Businesses/Economic-Development-Strategy-2021-2031>
- 27 City of Karratha Take Your Business Online Grant Scheme (matched funding) <https://karratha.wa.gov.au/community/grants-and-funding/business-grants/take-your-business-online>
- 28 Surf Coast Shire Economic Development Strategy 2021 – 2031 <https://www.surfcoast.vic.gov.au/Community/Businesses/Economic-Development-Strategy-2021-2031>
- 29 ACMA 2020, Trends in online behaviour and technology usage, consumer survey. <https://www.acma.gov.au/sites/default/files/2020-09/Trends-in-online-behaviour0-and-technology-usage-ACMA-consumer-survey-2020.pdf>
- 30 IBID. Mobile phone is the top device used to go online at 91 per cent, laptop computers at 76 per cent, tablets at 61 per cent.
- 31 Australia leads 170 countries analysed by the international GSM Association on measures of infrastructure, affordability, consumer readiness and content and services in relation to mobile connectivity <https://amta.org.au/australia-global-leader-in-mobile-connectivity/>.
- 32 Telstra claims to cover 99.4 per cent of the Australian population with 4G. <https://www.telstra.com.au/coverage-networks/our-network>
- 33 GoDaddy 2019 research study conducted by YouGov Galaxy – Australian SMBs and websites. <https://au.godaddy.com/blog/study-reveals-why-59-of-australian-small-businesses-dont-have-a-website/>
- 34 .auDA 2022 – Digital Lives of Australians 2022 https://assets.auda.org.au/a/2022-11/auda_digital_lives_of_australians_2022_research_report_171122.pdf?VersionId=1O_bi31mYof0ybFTABWaRJstNSfw.36y
- 35 Buy From The Bush: Harnessing the power of digital tools to create lasting change in rural Australia. Impact Report, February 2022. https://drive.google.com/file/d/1fXTlwMwUl_mhlaLVITYqm8uVIDfQ5PXA/view Note also 97 per cent of BFTB businesses are owned by women compared to the national small business average of 34 per cent.
- 36 The technology underpinning the websites of the .au100K have been analysed using BuiltWith (<https://builtwith.com/>), an organisation that provides deep and detailed data on the technology utilisation of active domain names across the internet.

- 37 Revealed Comparative Advantage is calculated for instances of particular technologies in the domain space. That is, the number of instances of a particular technology within one namespace as a proportion of the number of instances of the same technology within the collective namespaces. A value greater than one indicates a revealed comparative advantage or relative strength, less than one is a disadvantage or relative weakness.
- 38 SPF or "Sender Policy Framework" is the third most common technology in the websites within the Australian domain namespace. <https://techterms.com/definition/spf>
- 39 UMAP dimension reduction and HDBSCAN clustering techniques have been used in this analysis.
- 40 Similarweb lists the top five most visited websites in Australia in July 2023 as Google.com, youtube.com, Facebook.com, reddit.com and Instagram.com <https://www.similarweb.com/top-websites/australia/>
- 41 Semrush lists the top five most visited websites by traffic in Australia for July 2023 as youtube.com, google.com, facebook.com, Wikipedia.org, reddit.com <https://www.semrush.com/website/top/australia/all/>
- 42 The Business Longitudinal Analysis Data Environment (BLADE) is a statistical resource that contains information on Australian businesses. <https://www.industry.gov.au/publications/business-longitudinal-analysis-data-environment-blade>
- 43 Townsville Digital Economy Information Sheet – https://www.townsville.qld.gov.au/_data/assets/pdf_file/0023/9365/PDI0302-009-Digital-economy-information-sheet.pdf
- 44 Smart Precinct.NQ Shape the Future Impact Report 2022 – <https://spnq.org/wp-content/uploads/2022/11/SPNQ-IMPACT-REPORT-2022.pdf>
- 45 BuiltWith (<https://builtwith.com/>) is an organisation that provides deep and detailed data on the technology utilisation of active domain names across the internet
- 46 Harmonic centrality is a measure of how close a node is to all other nodes in a network. It is calculated by summing the inverse of the shortest path distances from all other nodes to the node. It is a variant of closeness centrality that can handle large and unconnected graphs. It can be used to find nodes that can quickly communicate with other nodes. <https://neo4j.com/docs/graph-data-science/current/algorithms/harmonic-centrality/>
- 47 PageRank is an algorithm that assigns a numeric value to a webpage based on the number and quality of links to that page. The value ranges from 0 to 10, with higher values indicating more importance. A version of PageRank is used by the Google search engine to measure the authority of a webpage. <https://www.techopedia.com/definition/12984/pagerank>
- 48 Host domain count (DC) refers to the number of hosts within each domain from the Common Crawl corpus. Common Crawl regularly publish Host- and Domain-Level web graphs, <https://commoncrawl.org/blog/host-and-domain-level-web-graphs-mar-may-oct-2023>. One familiar example would be the host names within the nsw.gov.au domain which include service.nsw.gov.au and health.nsw.gov.au.
- 49 Tranco ranking is a meta ranking of the most popular websites on the Internet, based on the average of different traffic rankings and currently includes: Cisco Umbrella, Majestic, Chrome User Experience Report, and Cloudflare Radar. Tranco ranking is designed to be more reliable, reproducible, and transparent than other rankings, and is widely used by web security and Internet measurement researchers. <https://tranco-list.eu/methodology>

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