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ACS Australia's Digital Pulse

Unlocking the tech sector: beyond one million

2022

Forewords

Dr Nick Tate FACS CP
ACS President

Improving the tech pipeline

It has been eight years since ACS started publishing Australia's Digital Pulse. We built this publication to get a snapshot of the Australian technology industry, gathering data nobody else in Australia was collating. This included workforce data, IT trends, and the state of the technology industry in Australia.

We've used this information to inform our own public policy work and help governments and Australian industry direct resources towards the most productive areas.

Throughout the entirety of Digital Pulse's eight-year run, a single story has bubbled to the top every time: the need for a better pipeline of technology workers in Australia. We've been keeping just ahead of the game by importing huge numbers of workers from overseas – nearly half of all IT workers in Australia were born overseas – but as COVID-19 showed, this is a risky strategy.

There is so much that can be done and needs to be done domestically to improve the technology worker pipeline. This starts right at foundational level education, where students are forming the connections that will define their future careers, through tertiary and beyond to retraining and upskilling programs, microcredentialling and certification.

For ACS, this has become a critical issue, one that we're working to address through our education assistance programs, through our training programs and through our workforce development services and activities.

I'd urge all Australian businesses to join us in this effort, working with schools, providing mentorship and assistance for students, and putting much more effort into training their own workforce. They need to abandon 'fire and replace' hiring practices and do the work of making sure that staff skillsets are regularly refreshed.

By 2027, Australia will need over 1.2 million IT workers to fulfil our needs. If businesses and governments want Australia to lead to the world, we have a lot of work to do.

Chris Vein
ACS CEO

A critical problem

Roughly 58% of Australian IT workers report having experienced discrimination at some point in their careers. Less then a third of IT workers are women. Hybrid, remote and regional work is still poorly supported, and stories of bias in hiring and promotion are common through the industry.

In an industry where employers are regularly complaining about the lack of skilled workers, we have here what seems to be an easy win. As this year's Digital Pulse shows, addressing diversity and inclusion issues in the IT industry is not just a moral imperative (although it certainly is that) – it's a practical way of addressing skills shortages.

If we can build workplaces that support diverse workforces and flexible working conditions; if we can address common biases around age, gender, sexual orientation, neurodiversity and ethnicity; if we can ensure that the IT industry is welcoming of people of all types, then we can also do a much better job of retaining current workers as well as attracting new workers.

There is more to it, of course. The education system needs to be more supportive and capable of engaging girls, indigenous students, LGBTQI+ people and other people from diverse backgrounds into tech and STEM more broadly. We need to break down those gendered stereotypes in schools that drive women away from tech and encourage more female students to engage with technology in way that leads to life-long careers.

For ACS members, this has become a critical issue. Perhaps above all, ACS members want the society to be a force for good in Australia, to progress the state of technology in the country, and ensure Australia is on the right track morally as well as technologically.

Addressing inclusivity has become an essential part of that process, and I'm very pleased with the work we've done with Deloitte to look at the issue in this year's Australia's Digital Pulse. We have the numbers now, we have the evidence. Now it's time to get to work on fixing the problem.

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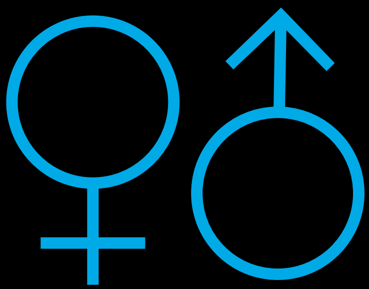
Limitation of our work

General use restriction
This report is prepared solely for the use of the Australian Computer Society. This report is not intended to and should not be used or relied upon by anyone else and we accept no duty of care to any other person or entity. The report has been prepared for the purpose of analysing Australia's digital economy and workforce. You should not refer to or use our name or the advice for any other purpose.

Glossary

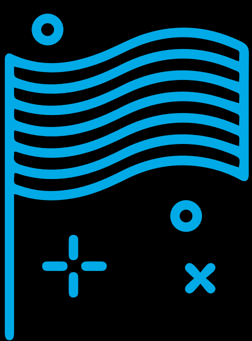
Terminology	Definition
Fractionalisation index	The fractionalisation index has been used in academic literature to measure population diversity and model its impact on economic performance.[1] The fractionalisation index aims to measure the probability of occurrence and different diversity types within a population. The fractionalisation index captures the increase in available knowledge, occupational richness and abilities due to the diversity of a population.
Information and communications technology (ICT)	The devices or infrastructure and components that enable digital technologies and modern computing.
Information, Media and Telecommunications (IMT) sector	This sector is defined in the ABS industry classification system based on the Australian and New Zealand Standard Industrial Classification 2006 (ANZSIC06). The division includes the following subdivisions: publishing (except internet and music publishing), motion pictures and sound recording activities, broadcasting (except internet), internet publishing and broadcasting, telecommunications services, internet service providers, web search portal and data processing services and library and other information services.
Intersectionality	Intersectionality is the way in which the effects of multiple forms of identity can combine and overlap, especially in the experiences of marginalised individuals or groups.
Professional services	Professional services refers to occupations in the service sector that provide specialised services to help customers manage or improve a specific part of their business. This can include occupations such as lawyers, engineers and accountants. While technology workers are typically included within the category of professional services workers, this report specifically separates these technology workers from professional services for the purpose of comparison.
Professionalisation	Professionalisation is when individuals of a shared occupation agree to practices for education, codes of practice, ethical behaviour and standards for products and services.
Technology sector	This terminology refers to workers and economic activity generated by both certain elements of the IMT industry and a large number of technology workers outside the IMT industry (for example, software developers working in the banking industry). The definition excludes some employees in the IMT industry who are not technology workers (for example, publishers of print newspapers). In this study, employment figures for technology workers have been calculated using ABS occupation and industry classifications, based on the methodology used in previous editions of Australia's Digital Pulse. This methodology draws upon definitions and nomenclature developed by Centre for Innovative Industries Economic Research (CIIER) lead researcher Ian Dennis FACS, and used in the ACS's 2008–13 statistical compendiums and other CIIER analysis. For a list of which occupations have been classified as technology workers and their industry subdivisions refer to Table A.3.



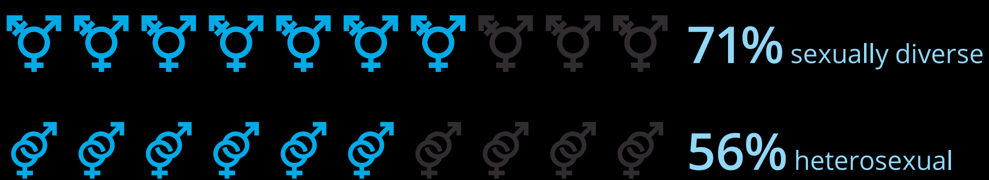
Nearly two-thirds **(64%)** of women experienced some form of discrimination at work compared to half **(53%)** of men

Three-quarters **(76%)** of people who identify as disabled or as living with disability experienced some form of discrimination, compared to **56%** of people who do not identify as disabled

Close to nine in ten **(87%)** neurodiverse individuals report experiencing some form of discrimination compared to only **56%** of people who do not identify as neurodiverse



People who identify as gay, lesbian, bisexual, pansexual, queer or asexual were more likely to report experiencing discrimination **(71%)** compared to **56%** of heterosexuals



Executive summary

Digital technology has become fundamental to Australian businesses, the workforce, and the economy. As highlighted during the COVID-19 lockdown periods of 2020 and 2021, digital technology played a crucial role in Australia's response and enabled flexible working and remote education and healthcare.

Technology workers are key to realising the benefits of digital technology. ACS Australia's Digital Pulse provides an annual stocktake of Australia's digital economy and workforce. This year's edition finds that, despite lockdowns and subsequent economic restrictions throughout 2021, there were 64,743 more workers in the technology workforce than in 2020, with the total reaching 870,268, the highest on record. This increase represented growth of 8% year on year, which is the second highest growth in the technology workforce since the ACS Australia's Digital Pulse series began.

The growth in the technology workforce could have been higher except for a lack of supply of technology workers. This is demonstrated by the fact that job advertisements for technology sector occupations have risen by 66% in 2022 compared with pre-pandemic levels.

Outlook for the technology workforce

The strong overall growth in Australian technology workers is expected to continue. By 2024, Australia's Digital Pulse forecasts that there will be over 1 million technology workers in Australia, growing to 1.2 million by 2027. This increase represents an average annual growth rate of 5.5%. This growth path will see the proportion of the Australian workforce in technology roles rise from 6.7% in 2022 to 8.5% in 2027 as employment in technology roles continues to outpace broader employment growth.

Achieving this growth will require growing the following three major pipelines for Australia's technology talent.

The first pipeline for technology talent is the number of IT graduates and digital skills in the workforce. Domestic enrolments in IT degrees have experienced high growth, reaching 9% per year for the past three years, making it the second fastest growing field of study. Completions have also increased by 25% from 2019 to 2020. While international enrolments in IT degrees only fell by 3% in 2020 relative to the previous year, larger declines are expected in subsequent years. The Department of Education, Skills and Employment reported a 15% decline in the number of international students in Australia in the first quarter of 2022 compared to 2021.

The development of digital skills begins well before tertiary education. In this edition of ACS Australia's Digital Pulse, the benefits and outcomes of digital education in Australian schools is explored. Digital education can improve academic performance, support responsible and safe use of digital technology, and increase the likelihood of gaining technology qualifications later in life.

Yet the National Assessment of Information and Communication Skills (NAP-ICT) found only half of Year 6 and Year 10 students achieved a proficient standard in ICT. Australia also lags behind other countries, ranking 16th out of the 38 countries in the Organisation for Economic Co-operation and Development (OECD) based on reading skills in a digital environment.

The second major pipeline for the technology workforce is skilled migration and temporary workers coming into Australia. Nearly half (45%) of technology workers were born overseas and 36% speak a language other than English. In fact, the technology workforce has a higher share of cultural diverse backgrounds than the Australian population. COVID-19 and the associated travel restrictions have significantly reduced this pathway to technology workforce with the number of ICT temporary work visas being issued falling by 50% in 2020–21 compared to pre-pandemic levels (2018–19).

With significant reductions in international workers and student numbers over the medium term, the **final major pipeline – consisting of workers from similar sectors reskilling into technology roles –** will be critical to the growth of the technology workforce. According to an employee survey fielded for this research, 9% of professional services workers reported they definitely want to move into a technology role. Based on overall employment in the professional services sector in 2021, this equates to nearly 120,000 workers interested in joining the technology sector who could help meet demand for these skills. The main reason these workers are considering transitioning into the technology sector included better pay and benefits (selected by 49% of professional services workers), greater flexibility around when and where they work (32%) and better working hours (32%).

Encouraging and enabling workers to transition to technology roles, particularly by increasing digital skills, will be key to growing the technology workforce. Less than half of all professional workers feel competent with handing digital information and content (43%), problem-solving using data analysis software (28%) and being safe and legal online (29%). Improving these digital skills will not only benefit the technology sector. Recent research by Deloitte found that 26% of businesses reported that their employees' digital literacy skills are out of date.

Alongside attracting new entrants to technology sector, businesses also need to consider how to retain existing talent. According to our employee survey, 20% of technology workers are planning on leaving their current workplace in the next year, while 14% are planning to leave the technology sector altogether within that time frame. While this finding reflects intentions rather than a definitive action, Australian Bureau of Statistics (ABS) data suggests that the proportion of workers leaving the IMT industry has doubled in 2022 relative to pre-pandemic levels (8% compared to 4%).

Diversity within the technology workforce

Beyond the size of the technology workforce, this year's Australia's Digital Pulse has built on previous analysis to develop a deeper understanding of diversity within the technology sector. A fresh survey of 810 workers, alongside data from the ABS, provides a snapshot of different forms of diversity within the technology sector compared to similar occupations in professional services.

When compared to professional services workers, the technology workforce is more diverse in terms of cultural and linguistic diversity, sexual orientation, and neurodiversity, but has lower levels of diversity when considering sex, age and location of workers (see Figure i). In terms of greater representation for people with disability and First Nations peoples, both sectors have room for improvement to reflect the Australian population.

Figure i: Forms of diversity within the technology and professional services sectors

Legend:* *% technology sector*, *% professional services sector

Form of diversity	% technology sector	% professional services sector
Sex	31% Women	46% Women
Regional	14% Regional	18% Regional
Aged 55+	14% 55+	16% 55+
Aged <25	6% <25	8% <25
Neurodivergent	7% Persons	4% Persons
Has a disability	0.51% Persons	0.6% Persons
Diverse sexual orientation	11% Persons	6% Persons
First Nations	0.66% First Nations	0.65% First Nations
Born overseas	45% Persons	36% Persons
Second language	36% Persons	24% Persons

Source: Deloitte Access Economics Employee Survey (2022).

For the areas of diversity in which the technology sector is lagging, there is cause for some optimism. In the last year alone, the proportion of women in technology occupations increased by 1.86 percentage points. In comparison, the proportion of women in technology occupations only increased by 1.27 percentage points from 2014 through to 2020. The proportion of people aged 55 years and over has also outpaced the growth in professional services over the last five years.

Maintaining this progress and improving representation in other areas will require concerted effort to reduce discrimination and improve workplace processes and practices. Based on the 810 workers completing the employee survey, more than half (58%) have experienced some form of discrimination during their careers. The most common forms of discrimination were a lack of support from leadership (33%), insufficient opportunities for a promotion or pay rise (30%), a lack of recognition (27%) and being paid less than someone in an equivalent role (27%).

The impacts of discrimination are significant. In addition to the damaging health and social costs associated with experiencing discrimination, it also influences workers' intentions to stay in their current role. In fact, those who have experienced discrimination – in both technology and professional services sectors – are twice as likely to expect to leave their occupation within the next two years, compared to those who have not experienced discrimination.

In addition to reducing discrimination, consideration of how workplace practices and processes affect diverse groups is required to improve and maintain diversity in the technology workforce. Our survey found that 23% of people aged 55 years and above rated their workplace as having the lowest score for inclusive infrastructure and services (such as wheelchair ramps, gender neutral toilets or change facilities), compared to 15% of people below 55 years old.

Improving diversity in the technology workforce could generate significant economic benefits. By attracting more people into technology roles, there will be a greater pool available to drive productivity through the economy. Deloitte Access Economics has modelled the benefits associated with accelerating the current increases in women, people aged 55 years and over and people with a disability in the technology workforce. Over the next 20 years, this would increase the number of technology full-time equivalent roles by approximately 14,000 each year on average , representing an increase of $21.2 billion in additional economic activity to the Australian economy in net present value (NPV) terms.

Policy priorities for the technology workforce

Overall, there is a role for both government and industry to strengthen Australia's IT workforce and industry. This can be achieved through the overarching policy outcome of growing Australia's technology workforce in terms of size, skills and diversity.

The following policy recommendations outline some approaches that would help to achieve this broader policy objective.

Develop and promote best practice workplace guidelines to encourage diverse technology talent

Attracting and retaining diverse technology talent will require thoughtful consideration of workplace practices, policies and design. Many of the barriers to increasing diversity are a product of longstanding societal norms and stereotypes. Many initiatives have been proposed to challenge these norms. The effectiveness of each initiative will vary depending on the circumstances of each workplace and the form of diversity being considered.

While guidelines supported by evidence and research could help employers make informed decisions about workplace practices and design, Dr Jane O'Leary, Director of Research at Diversity Council Australia, believes using tried and tested interventions on an increasing scale is required to improve diversity outcomes without incurring unintended consequences.

Improve student digital literacy and awareness of technology career paths

Better support for teachers is needed to improve the digital education of Australian school students. A survey conducted by the Australian Computer Society (ACS) in 2021 found that close to three in five (59%) primary school teachers self-reported being 'not proficient' when asked to rate their digital technologies/IT expertise.

Investing in teachers' skills while they train and throughout their career could help to improve IT education in schools. The recent Australian Curriculum Assessment and Reporting Authority (ACARA) Digital Technologies in Focus project provided formal digital skills for teachers. Participating teachers reported being more comfortable in delivering digital education, while students achieved higher levels of ICT proficiency. If ACARA and other similar programs could be expanded across the entire country, they could be a potential pathway for improving the ICT skills of Australian students.

Greater coordination to develop skills in the technology workforce

There are a number of initiatives and incentives from governments, at both state and federal levels, and industry aimed at addressing skills shortages in the technology sector. Where relevant, greater coordination between these stakeholders to improve awareness of available resources could improve take-up by prospective students. The establishment of the National Skills Commission (NSC) in 2020 to identify current and future in-demand workforce skills will assist. However, it is important to recognise that required skills may differ across jurisdictions based on local industry composition and local needs.

Further encouragement to deepen digital skills in other occupations

Our employee survey found many workers have an interest in transitioning to technology roles from similar occupations. Improving digital skills will be critical to enabling this transition and improving the productivity of the workforce generally.

With the newly elected Labor Government's focus on building Australia's modern manufacturing sector, the industry's need for digitally capable workers is going to become even more pressing. A key part of the $1.3 billion Modern Manufacturing Initiative's success will require reskilling and training in modern technologies across the workforce.

Alongside traditional qualifications such as undergraduate university degrees and TAFE diplomas, short courses or microcredentials provide further opportunities for reskilling and upskilling throughout a career. The 2022–23 federal budget saw $1.6 billion allocated in tax incentives for small businesses to invest in digital technology, skills and training. These initiatives could provide greater support for businesses to encourage and support employees to develop skills for a successful career.

Encourage employers to consider more diverse pathways into the technology sector

Technology employers have historically required employees to be university educated. One study found that roughly 90% of job advertisements posted by major technology companies such as Apple, Oracle and Intel required a university degree.[2] Greater consideration of applicants with relevant VET qualifications or microcredentials would allow employers to select from a larger talent pool.

Retain existing technology talent

There were approximately 80,000 technology workers departing from Australia between 2011 and 2021. With travel restrictions being lifted workers have begun looking overseas with work-related departures from Australia increased nine-fold between April 2021 and April 2022. The Australian Government should consider ways to communicate to overseas Australians about opportunities for the sector within the country. This could, in turn, help to reduce the over-reliance on short-term visa holders in the technology workforce.

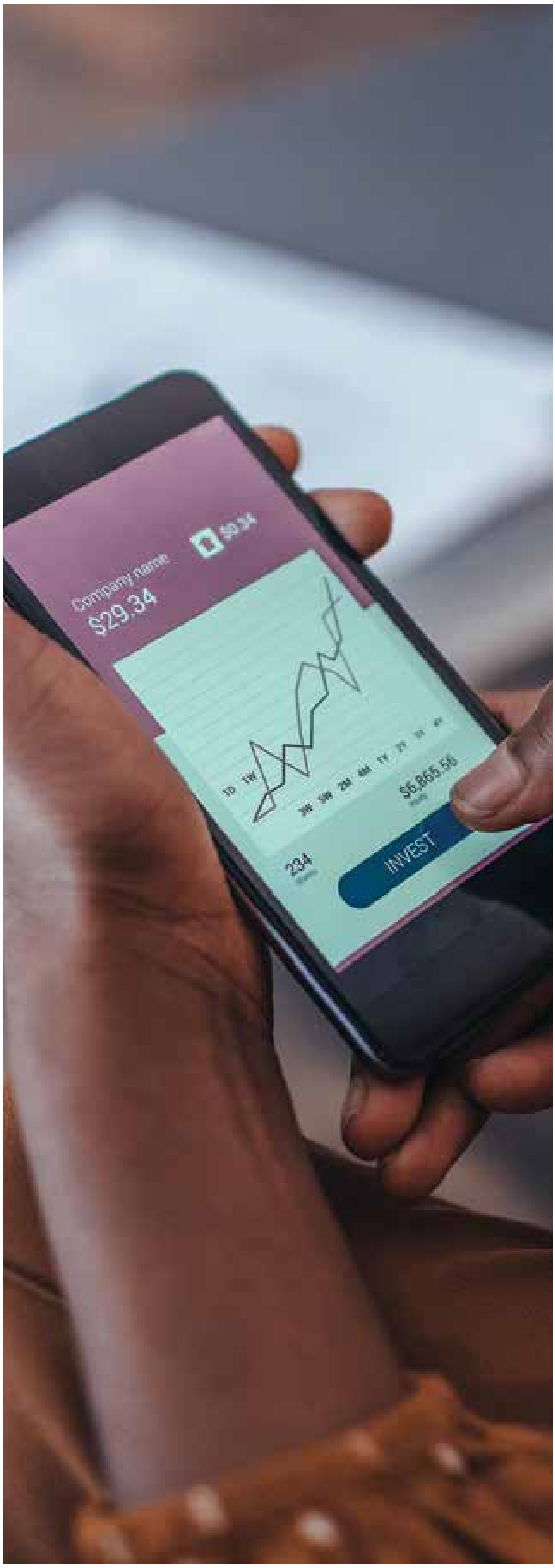
In addition, employers need to consider ways to engage with workers to increase the retention of technology talent. Recognition and mentoring are two drivers that could increase retention. An Australia Post survey revealed organisations with a well-developed culture were three times more likely to have higher levels of employee retention.[3] In addition, employees that intend to stay with an organisation for more than five years are twice as likely to have a mentor (68%) than not have a mentor (32%).[4] Government could also assist in efforts to retain talent by making pathways to permanent residency and citizenship easier for temporary workers and international students.

Further investment in growing the technology sector
Governments across all levels have recognised the need for further investment in Australia's technology and telecommunications sector. The incoming Australian Government has promised to rollout a $656 million regional telecommunications package, with $400 million earmarked for the Better Connectivity for Rural and Regional Australia plan to expand multi-carrier mobile coverage along roads, regional homes and businesses. Cybersecurity was also recently elevated to having a dedicated minister to the area in the Australian Parliament.

Further investment is required to build Australia's regional technology workforce. For example, the Australian Government could look to create and support Regional Technology Hubs in major regional centres, in cooperation with broader industry stakeholders and educational institutions. Collaboration between industry and educational institutions has been shown to be beneficial for both parties by helping to meet workforce needs while also providing students with relevant industry skills. The collaboration between IBM and Federation University in Ballarat is one example of a successful initiative of this kind.[5]

These investments and others such as the NBN upgrade in regional areas will be required to accelerate the realisation of benefits – such as faster productivity growth and a more sustainable economy – that are achieved from a well-developed technology sector and workforce.

Deloitte Access Economics



1. Introduction

The *ACS Australia's Digital Pulse* series highlights the growing importance of the technology workforce to the economy and day-to-day lives of all Australians. It highlights how demand for digital skills extends beyond the technology sector itself into a diverse range of Australian industries including agriculture, health, manufacturing and financial services.

The 2022 report represents the eighth edition in the Digital Pulse series.

In addition to profiling Australia's digital economy and workforce in the aftermath of the worst impacts of COVID-19, this year's Digital Pulse analyses the economic impact of improving diversity in the technology workforce and factors influencing workers' reskilling into technology roles. It analyses the importance of digital education with a focus on school education.

The research is based on information from a range of sources, including:

- data from the ABS, both publicly available data and from a customised data request on the technology workforce
- a fresh survey of 810 workers from both technology occupations and professional services that covers their demographic characteristics and experiences during their professional lives (more details about the survey are available in Appendix B)
- reports and statistics published by various Australian sources, particularly Australian Government departments such as Education, Immigration and Industry, and the Australian Taxation Office (ATO)
- consultations with the Tech Council of Australia, Age Discrimination Commissioner at the Australian Human Rights Commission, Diversity Council of Australia, National Artificial Intelligence Centre, and WithYouWithMe.

The report is structured as follows:

- Section 2 examines trends in digital technology and its contribution to the Australian economy
- Section 3 explores the characteristics of the technology workforce using the latest data available
- Section 4 develops a snapshot of diversity across a number of dimensions in the technology workforce and estimates the benefits from increasing diversity to the Australian economy
- Section 5 outlines trends in technology education and qualifications
- Section 6 explores factors that would assist the transition to a larger technology workforce.

2. Importance of the digital economy

Digital technology has become fundamental to Australian businesses, the workforce and the economy. As highlighted during the COVID-19 lockdown periods of 2020 and 2021, digital technology played a crucial role in Australia's response and enabled flexible working and remote education and healthcare. For example, 41% of employed people regularly worked from home in August 2021 (when some Australian jurisdictions were in lockdown) and analysis by Australia Post found ecommerce purchases rose by 32% in 2020–21 when compared to the previous financial year.[6,7]

Digital technology is also expected to play a key role in contributing to the longer-term sustainability of the Australian economy. Economic modelling and analysis that supported the development of Australia's Long Term Emissions Reduction Plan to achieve net zero emissions by 2050 revealed the important role technology is expected to play in coming years.[8] Over $20 billion of government investment is expected, which will fund low-emissions technology solutions with the potential of reducing net emissions by 85%.[9] Digital technology has a crucial role to play in enabling many aspects of Australia's transition to sustainability.

More broadly, the technology sector has played a large role in contributing to the overall productivity growth in the economy. Industries such as mining, banking and manufacturing have increasingly adopted the latest technology to optimise business operations.

Previous analysis by Deloitte Access Economics has found the productivity dividend from digital innovations has resulted in a 6.5% increase in economic activity, equivalent to an additional $126 billion in gross domestic product (GDP) to the economy.[10]

2.1 Value of the ICT sector

The critical role digital technology plays in the economy has resulted in a very large ICT sector.[i] Gross value added (GVA) – which measures the sector's output after adjusting for the costs of production – is used to estimate the size of the ICT sector.

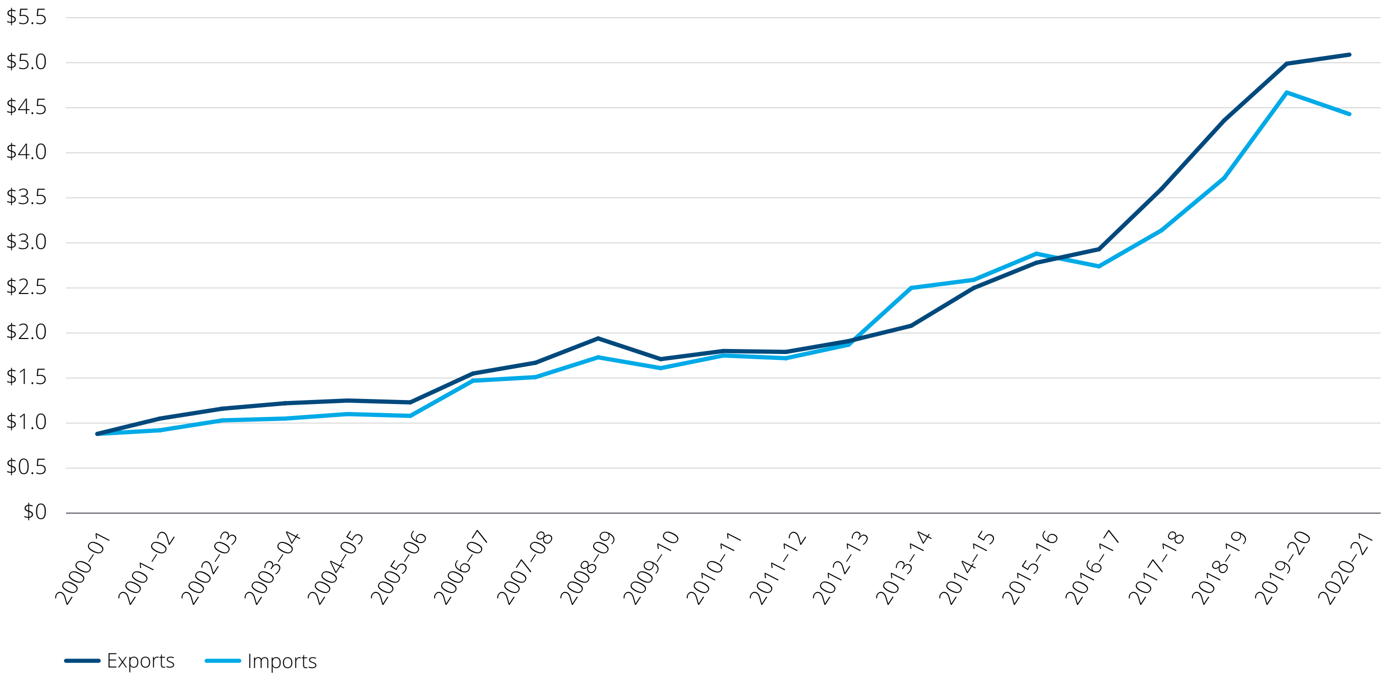
In the 2020–21 financial year, the ICT sector contributed nearly $56 billion in GVA to the Australian economy.[11] The GVA of the ICT sector in 2021 fell by 2% relative to the previous year after experiencing a compounded annual growth rate of 5% on average for the past five years. The recent deviation from the average positive trend may be due to the COVID-19 pandemic and its impact on the broader economy.

2.2 ICT exports and imports

ICT exports reached $5.09 billion in 2020–21, which represents just over 2.1% growth year on year. Meanwhile, ICT imports fell by 5.3% compared to the previous financial year, to $4.43 billion in 2020–21 (see Chart 2.1). This decline in imports is likely a result of global supply chain issues, particularly from manufacturers in China and across Southeast Asia.[12] As a result of these trends, there was a trade surplus of $665 million for ICT goods and services in 2020–21.

As Australia learns to adapt and live with the restrictions and lasting impacts of COVID-19, technology is likely to remain at the forefront and, as a result, continue to grow with respect to the number of workers in this industry.

Chart 2.1: Australia's trade in ICT services, 2001 to 2021 financial years ($ billion)



Source: Deloitte Access Economics based on ABS catalogue 5368.0 International Trade in Goods and Services (2022).[13]

[i] The ICT sector is defined for this purpose as being comprised of telecommunication services and computer design systems and related services based on the Australian New Zealand Standard Industry Classification (ANZSIC) subdivisions.

Increasing adoption of artificial intelligence in Australian businesses

Artificial intelligence (AI) presents a significant opportunity with benefits for individuals, businesses and the Australian economy, with some of the applications of AI including improvements to disaster prevention processes, our security systems and our ability to combat and control contagious diseases such as COVID-19.

With a growing interest in AI, the Australian Government has funded the CSIRO's National AI Centre to create inclusive and leading AI ecosystem in Australia. For Stela Solar, Director of the National AI Centre, Australia is well placed to lead in AI development, noting that:

'Australia is already at the forefront in terms of research of artificial intelligence with a number of world firsts. This strength in research is impressive given the size of Australia compared to other AI leaders.'

Australia's top 10 ranking on the *Stanford Vibrancy Index* is evidence of the strong research capabilities within Australia. The Index was developed by researchers and uses a number of indicators relating to developments in artificial intelligence to allow for cross-country comparisons.

While Australia performs strongly on technical research on AI technology, there are opportunities to improve the commercialisation and business adoption of the advancements in AI. A survey of over 7,000 businesses conducted by the ABS found that only 2% reporting as using AI.[14]

Stela notes that this figure may cover up some interesting differences in terms of business adoption. In general, larger businesses have budgets that allow for investment in AI capabilities and skills, whereas small and medium sized businesses (SMBs) may not have resources for a specialised team. With 99.8% of businesses within Australia considered SMBs, this likely contributes to the low adoption rate of AI.

Stela explains that incorporating AI into SMBs may not be as complex as it might initially seem, however, noting that:

'Small and medium sized businesses are already using some form of technology that has AI capabilities – such as Customer Relationship Management (CRM) software. Adopting AI may be simply a matter of discussing with technology providers as to what AI options are available to enrich their current technology use. If providers are not able to offer AI option, businesses may consider whether they should remain with that provider.'

Moving forward, harnessing the head start we have in Australia in terms of AI research in a coordinated approach will be key to Australia developing a rich ecosystem in the field of AI. Stela notes there is an important coordination role that the National AI Centre will be playing to promote AI adoption by scaling up existing initiatives. In particular, Stela explains that:

'Being partnered with a national scientific organisation in CSIRO gives us a platform to think holistically about the opportunities and challenges we face in developing our AI capabilities. Australia has such rich skills, and our upcoming listening tour will be one of the many ways for us to continue unlocking our talent and coordinating our efforts on a national level.'

3. Growth in the technology workforce

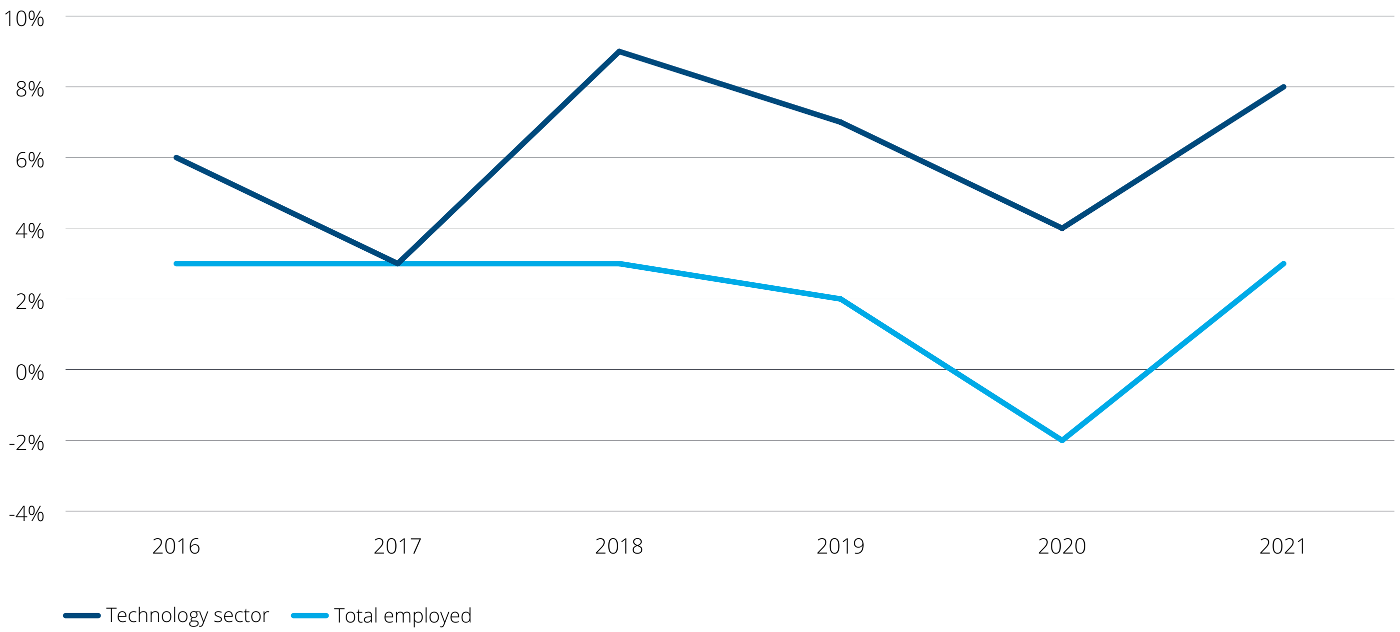
Australia's digital economy is underpinned by the technology workforce, which contributes to the sector's digital infrastructure, devices and services that are used either directly by consumers or other industries.[ii] This section estimates the current size and characteristics of the technology workforce based on the latest data from the ABS and provides forecasts of the workforce over the next six years.

3.1 Technology workforce

The growing importance technology in the workplace and the economy has led to strong demand for technology workers. **In 2021, there were 64,743 more workers in the technology workforce than in 2020, reaching a total of 870,268.** This increase represented a growth of 8.0% year on year. The growth rate in the technology workforce is significantly higher than the growth rate in professional industries, which was 6.4% in 2021, while the total number of people employed grew by only 3.4%.

The technology sector has consistently outperformed the broader workforce with growth rates that in some years doubled the national average (see Chart 3.1).

Chart 3.1: Annual growth of technology workforce relative to total employed, 2016 to 2021



Source: ABS customised report (2016 to 2022).

[ii] ABS industry classifications include an 'Information Media and Telecommunications' (IMT) industry. However, in practice there are many technology workers outside the IMT industry (for example, software developers working in the banking industry) and there are some employees in the IMT industry who are not technology workers (for example, publishers of print newspapers). In this study, employment figures for technology workers have been calculated using ABS occupation and industry classifications, based on the methodology used in previous editions of Australia's Digital Pulse. This methodology draws upon definitions and nomenclature developed by Centre for Innovative Industries Economic Research (CIIER) lead researcher Ian Dennis FACS, and used in the ACS's 2008 to 2013 statistical compendiums and other CIIER analysis. For a list of which occupations have been classified as technology workers and their industry subdivisions refer to Table A.3. In this report, we use the term 'technology workforce' to describe the group of workers previously called the 'ICT workforce' in past editions of Australia's Digital Pulse. The recent Australian and New Zealand Standard Classification of Occupations (ANZSCO) 2021 released by the ABS updates these classifications as discussed in 'Measuring and updating occupations for the technology workforce', see following page.

In 2021, over two-thirds of the technology workforce was located within New South Wales and Victoria (see Table 3.1). Victoria experienced the highest increase in additional workers, with 25,310 more technology workers in 2021 compared to 2020. Victoria's increase represents almost 40% of the total growth across Australia.

The substantial growth in total jobs in Victoria is partly a rebound from its contraction in 2020 when lengthy lockdowns and the economic downturn were more significant than in other jurisdictions.

Table 3.1: Technology workforce, by location of employment, 2021

Indicator	NSW	Vic	Qld	SA	WA	Tas	NT/ACT
Technology workers (no.)	331,516	271,474	114,738	42,376	60,404	9,663	40,098
Change from 2020 (no.)	17,432	25,310	3,164	5,601	8,319	263	4,653
Change from 2020 (%)	6%	10%	3%	15%	16%	3%	13%

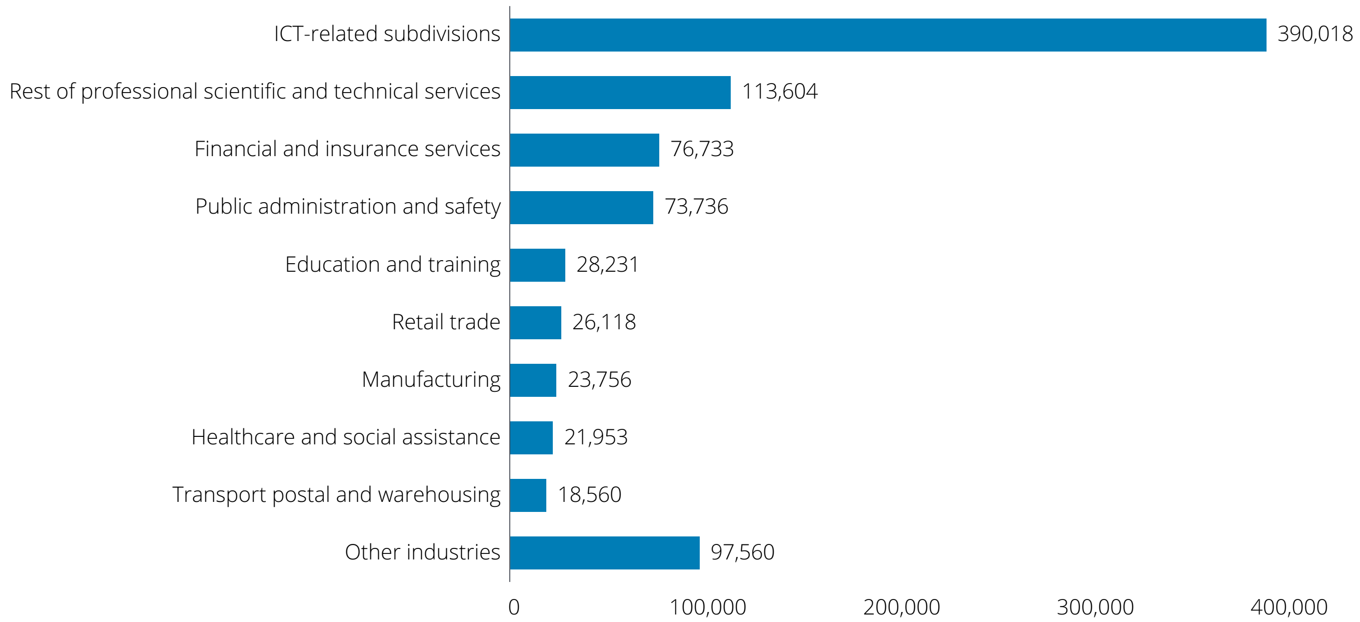
Source: ABS customised report (2022).

Western Australia and South Australia had the highest growth rates in their technology workforce with year on year growth of 16% and 15%, respectively. Meanwhile, Queensland and Tasmania experienced more modest growth, with both recording 3% growth year on year. For Tasmania, this more modest growth comes after significant growth of 17% from 2019 to 2020, while growth in Queensland was 2% during that same period.

3.1.2 Technology workforce by industry

The number of technology workers in ICT-related subdivisions (including computer system design, telecommunication services and internet service provision) grew by 3.5% to 390,018 workers in 2021 (see Chart 3.2) This grouping made up almost half (45%) of the total technology workforce in Australia in 2021. The number of technology workers employed in other industries (outside of ICT) grew by 9%, which was faster than those within the ICT subdivisions. These workers are predominantly within professional, scientific and technical services (13%); financial and insurance services (11%); and public administration and safety (9%).

Chart 3.2: Technology workers by industry, 2021



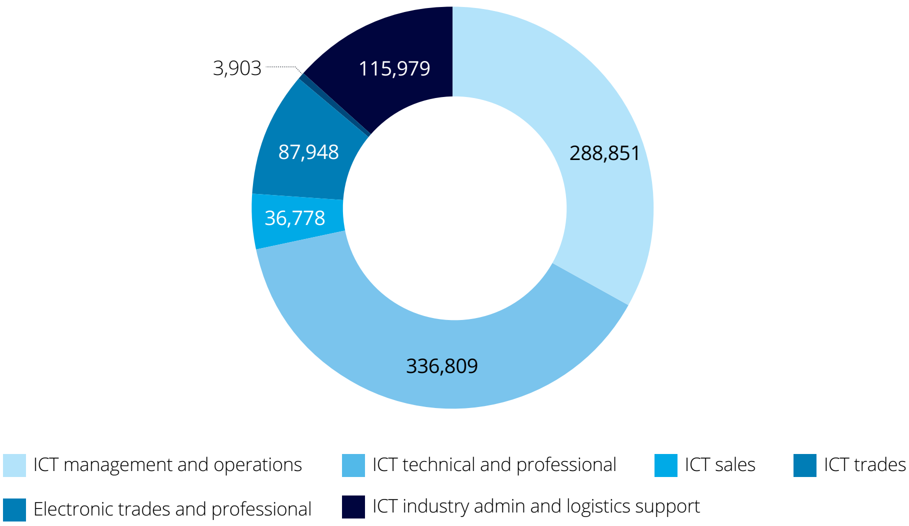
Source: ABS customised report (2022).

3.1.3 Technology workforce by occupation

Over two-thirds of technology workers are made up of occupations that fit under ICT management and operations (33%) and ICT technical and professional (39%). These two occupational groupings account for 72% of the technology workforce (see Chart 3.3), up from 70% in 2020.

Occupations grouped under the ICT industry administration and logistics support and ICT trades made up the next largest shares, with 13% and 12%, respectively. ICT trades experienced a 12% decline in the total number of technology workers under this occupation from 2020. This was the only occupation to experience a decline in the number of technology workers, with each other category recording relatively strong increases.

Chart 3.3: Technology workers by occupation, 2021



Source: ABS customised report (2022).

Measuring and updating occupations for the technology workforce

ACS Australia's Digital Pulse uses the Australian and New Zealand Standard Classification of Occupations (ANZSCO) to measure the number of technology workers. Using this consistent definition helps to track developments in the technology sector across multiple years.

Over time, roles in the technology industry have changed significantly, with new areas such as data analytics becoming their own areas. Recognising these developments, the ABS has retired some classifications and added other new categories.[15] For example, the classifications of ICT security specialists and ICT trainers were retired, and the classifications of cyber security engineer, analyst, architect, operations coordinator and advice and assessment specialists were added.[16] The updates are also consistent with 25 emerging occupations identified by the National Skills Commission (NSC), 11 of which are technology-related occupations.[17]

The ABS acknowledges the need to continue to monitor changes in demand for skills and occupations as the sector evolves.[18] By doing so, they can help to ensure that Australia is well equipped to understand and respond to future changes in economic activity. This also means that Australia's Digital Pulse can continue to have a clear understanding of the roles and size of the technology workforce moving forward.

Developing capabilities in cybersecurity

The need for safe and secure cyberspaces is more important than ever before. COVID-19 has contributed to a 20% increase in data traffic compared to the previous year and cyber crime losses in Australia reached $33 billion over the 2020-2021 financial year.[20] In addition to the direct financial costs of cyber attacks, there are indirect costs such as reputational damage, customer loss and higher insurance costs.[19,20]

A workforce with well-developed cyber capabilities will be key to limiting these attacks moving forward and enabling growth in the digital economy. In 2020, *Australia's Cyber Security Sector Competitiveness Plan* noted the need for an additional 7,000 cybersecurity specialists over four years to meet the growing need for these skills.[21] The Plan found an increasing number of cybersecurity courses and qualifications available in both formal university institutions and vocational education and training (VET) institutions. At the same time, cybersecurity course enrolments grew from around 500 students in 2014-15 to 3,800 in 2019.

The Australian Government has recognised the need for encouraging the growth in cybersecurity skills in the workforce. Last year, $60 million in grant funding was made available through the *Cyber Security Skills Partnership Innovation Fund* to support projects that involve partnerships between industry, education providers and governments to increase the cybersecurity workforce.[22] More recently, the incoming Government elevated cybersecurity with a new standalone minister in Cabinet.

However, there's more the government could be doing to increase cyber capabilities in Australia's workforce. For example:

- **Focus on upskilling disadvantaged groups.** Countries like the US and UK have implemented initiatives focused on upskilling underrepresented and disadvantaged groups such as women and at-risk young people to enter the cyber workforce. These initiatives serve the dual purpose of addressing the talent shortage for cybersecurity while also improving diversity in the workforce.[23,24] In Australia, a recent study found that 92% of those surveyed believed greater mentorship and internships would support participation of workers from diverse backgrounds into cybersecurity roles.[25]
- **Educate citizens and children about cyber risks.** Governments have a role to play in educating individuals and businesses alike on cybersecurity risks. This is especially important for children to develop the skills they need throughout their lives to stay cyber safe. In Israel for example, the Cyber Education Center's Magshimim program teaches high school students programming skills and how to mitigate various cyber attacks.[26]
- **Increase international cooperation.** Cybersecurity requires international cooperation to increase trust among various stakeholders and collectively tackle and prevent cyberattacks. As an example, the CSIRTAmericas Network includes 30 countries across the Americas and aims to help promote the exchange of information on cybersecurity alerts, provide technical assistance, and offer training to cybersecurity specialists from member countries.[27]

Deloitte's Horizon Model forecast that if businesses continue embracing the plethora of opportunities and appropriately mitigate the associated cyber risks, these positive flow-on effects can potentially increase the GDP across the 12 APAC countries by A$208 billion over the next 10 years.[28]

3.2 Forecasts for the technology workforce

Deloitte Access Economics forecasts an increase in technology workers consistent with the historical and recent high growth in the sector. The number of technology workers in Australia is expected to pass 1 million in 2024 and **continue to grow to almost 1.2 million technology workers in Australia by 2027** (Table 3.1).

Currently, the technology workforce represents 6.7% of the overall Australian workforce. This proportion is expected to grow to 8.5% in 2027 as the technology sector continues to outpace employment growth in the broader economy.

Many of these additional workers are expected to enter the workforce as international migration flows increase.

By 2027, there will be almost 330,000 more technology workers in the Australian workforce than there are today, representing an average annual growth rate of 5.5% (Table 3.1). This exceeds the forecast growth rate for the overall Australian workforce, which is expected to increase by 1.6% per annum over the same period.

The 5.5% annual growth rate is the highest growth rate predicted in any edition of Australia's Digital Pulse. The historically high forecast growth is partly a reflection of persistently high growth in technology workers. Increasing job advertisements for technology roles, as a forward-looking indicator, also suggests a likely higher growth rate in coming years. Between 2019 and 2022, job advertisements for technology sector occupations have risen by 66%.[29]

Table 3.1: Employment forecasts by CIIER occupation groupings, 2021 to 2027

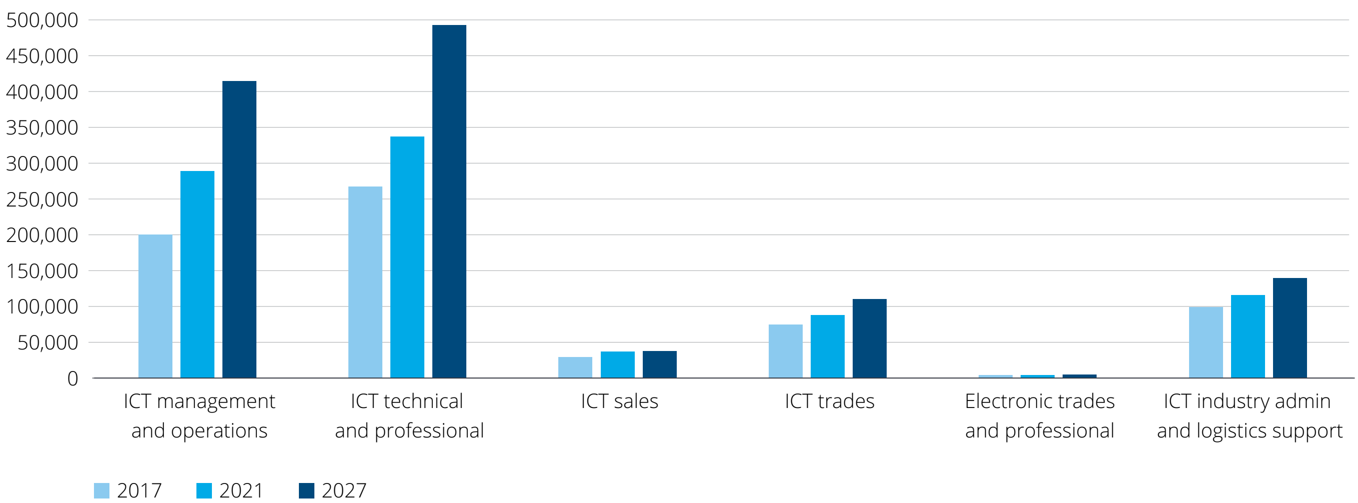
Occupational grouping	2021	2027	Average annual growth, 2021 to 2027
ICT management and operations	288,851	414,160	6.2
ICT technical and professional	336,809	492,788	6.5
ICT sales	36,778	37,376	0.3
ICT trades	87,948	110,354	3.9
Electronic trades and professional*	3,093	4,980	4.1
ICT industry admin and logistics support*	115,979	139,611	3.1
Total technology workers	**870,268**	**1,199,270**	**5.5**

* Employment in these occupations has only been counted for the ICT-related industry subdivisions, consistent with the definitions in Table A.3.
Source: Deloitte Access Economics forecasts (2022).

Nearly half of this growth is forecast to occur in ICT technical and professional roles (156,000 additional workers), while a further 38% of growth is expected to occur in ICT management and operations roles (125,300 additional workers), see Table 3.1 and Chart 3.4.

The specific occupations forecast to experience the largest increase in employment include software and applications programmers (70,694 additional workers between 2021 and 2027), management and organisation analysts (38,900), and ICT managers (31,400).

Chart 3.4: Historical and forecast technology employment, 2017 to 2027

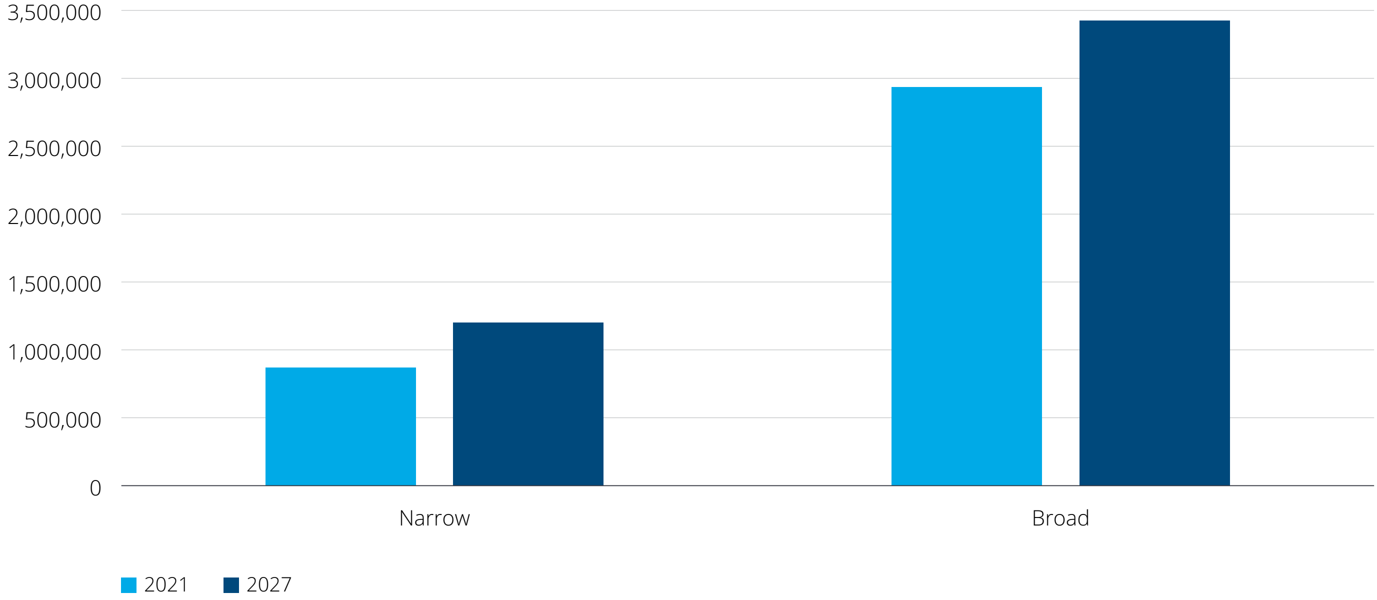


* Employment in these occupations has only been counted for the ICT-related industry subdivisions, consistent with the definitions in Table A.3.
Source: Deloitte Access Economics forecasts (2022).

Alongside the increase in technology workers will be the growth in Australia's broader digital workforce, consisting of a broad group of workers who regularly use technology as part of their jobs. People like accountants, solicitors and scientists rely on technology skills to perform their work. Many occupations may require digital capabilities, even though they are not captured in the ACS definition of core ICT workers measured in this report.

Deloitte Access Economics forecasts that demand for this broader category of digital workers will increase by 489,856 workers between 2021 and 2027, representing an average annual growth rate of 2.6% (Chart 3.5).

Chart 3.5: Historical and forecast technology employment, 2021 to 2027



Source: Deloitte Access Economics forecasts (2022).

Matching talent with teams through WithYouWithMe's platform

As businesses face technology skills shortages, WithYouWithMe offers a solution to help businesses find talent and promote employment opportunities for veterans, neurodiverse people and refugees. WithYouWithMe uses an algorithm to combine recruitment activities such as searching, interviewing and training applicants and employees into one holistic program. In doing so, the WithYouWithMe platform improves the ability of businesses to match the skills of individuals to a team with the right characteristics that enable each member to succeed.

Scarlett McDermott, Chief Technology Officer at WithYouWithMe, explains that focusing businesses on current capabilities and aptitudes has been key to helping over 20,000 people fit into technology roles. In particular, McDermott believes the absence of a university degree has prevented many capable candidates from applying for a position or getting a position the candidate could fulfil. She notes the WithYouWithMe platform looks beyond traditional recruitment markers such as degrees and resumes:

'Resumes look at what an individual has achieved, they are purely backwards looking. Focusing on capabilities and aptitudes shows what an individual is capable of and ready to do now.'

WithYouWithMe's platform has also been applied to help businesses transition teams to new roles within an organisation. With the help of WithYouWithMe, businesses can transition members from one role to another in the organisation – for instance, call centre operators to data analytics roles. These internal role changes are valuable to businesses as they avoid costs associated with recruitment and onboarding from hiring externally. The retained knowledge these workers have already gained at the organisation can also speed up the transition in moving to new roles. McDermott explains this transition relies on a change in perspective for many businesses, particularly:

'We need businesses to shift away from a human resources mindset towards a human asset one. By adopting a human asset mindset, there is a greater focus on using and building the current capabilities in a team.'

WithYouWithMe upskills and re-skills individuals in order for them to thrive in an increasingly digital workplace. McDermott believes the use of the Australian Army's training principles – teach me, show me, test me – is the key for successful training. This involves a combination of face-to-face and online training that delivers content based on the individual's skills and aptitude. Using this framework has helped several thousand veterans transition to new roles based on newly developed capabilities.

By not being open to candidates from diverse backgrounds or by excessively focusing on traditional markers such as tertiary qualifications of applicants, businesses risk missing out on key technology talent in a competitive labour market.

McDermott says she is often surprised at the extent to which businesses limit their search without realising they are doing so. She cites research by YouGov that found less than 30% of hiring managers are receiving training on interviewing neurodiverse applicants and only 52% provide accommodation during interviews to candidates who have physical access or mobility issues, limiting the ability of those with physical needs to apply, or distracting them from displaying their true capabilities.

There are a few simple things employers can do to improve the diversity of their staff according to McDermott:

'Let people work from where they are, recognise that not everyone will have their camera on, recognising a face-to-face interview is not going to get the best out of every applicant. Sometimes simply asking people what they need can allow someone to put their best application forward or do their best work.'

4. Diversity in the technology workforce

Firms that are more diverse tend to be more productive and innovative than those that are not.[30] Modelling from last year's Digital Pulse report showed increasing the proportion of women in the technology workforce would lead to an average $1.8 billion annual benefit for the Australia economy over the next 20 years, amounting to an opportunity of $11 billion in net present value (NPV) terms.

Diversity encompasses a range of different dimensions such as gender, ability status, age, cultural and linguistic diversity, sexual orientation, neurodiversity, and much more. Understanding how the technology sector fares in these dimensions is important to equip the sector to be better and deliver broader economic opportunity.

This section expands on last year's research by considering how diverse the technology workforce is across the various dimensions, drawing on fresh insights from a survey fielded in April to May 2022 of technology and professional services workers, alongside consolidated information from existing sources such as the ABS. Further details about the employee survey are available in Appendix B.

4.1 The current state of play

When compared to professional services workers as a whole, the technology workforce is more diverse in terms of cultural and linguistic diversity, sexual orientation, and neurodiversity, but less diverse when comparing gender, age, ability status and location of workers, as summarised in Table 4.1. For the estimates of diversity, the larger samples from the ABS customised data request and ABS Census made these preferable sources where available. This information was supplemented by the employee survey, which requested information of respondents not published by the ABS and provides indicative findings on diversity in terms of sexual orientation and neurodiversity within the two professions.

The following sections expand on the summary provided in Table 4.1 above for each form of diversity.

Table 4.1: Comparison of diversity measures in the technology sector and professional services

Social characteristic	Definition	Technology workers	Professional services	How does technology compare?	Source
Gender[iii]	Proportion of workforce that is made up by women	31%	46%	Lower	ABS customised request, 2021
Age	Proportion of workforce that is aged 55+	14%	16%	Lower	ABS customised data request, 2021
	Proportion of workforce that is aged under 25	6%	8%	Lower	ABS customised data request, 2021
Ability status[iv]	Proportion of workforce that reported needing assistance with core activities	0.51%	0.60%*	Lower	ABS Census, 2016
Cultural and linguistic diversity	Proportion of workforce that were:			Higher	ABS Census, 2016
	(a) Born overseas	45%	36%*		
	(b) Speak another language	36%	24%*		

[iii] The ABS notes that it only publishes information on the sex of an individual. The ABS defines a person's sex as being "based upon their sex characteristics, such as their chromosomes, hormones and reproductive organs. While typically based upon the sex characteristics observed and recorded at birth or infancy, a person's reported sex can change over the course of their lifetime and may differ from their sex recorded at birth". At the time of drafting, the ABS has published data only on whether an individual was male or female.

[iv] The ABS Census publishes information on ability status based on number of different questions. This figure represents the proportion of the workforce that reported needing assistance with core activities.

Social characteristic	Definition	Technology workers	Professional services	How does technology compare?	Source
First Nations Australians	Proportion of workforce that identify as being of Aboriginal and/or Torres Strait Islander origin	0.66%	0.65%*	Equal	ABS Census, 2016
Location	Proportion of workforce that live in regional areas[v]	14%	18%*	Lower	ABS Census, 2016
Sexual orientation	Proportion of workforce that identify as non-heterosexual i.e either homosexual, bisexual, pansexual, queer, asexual or unspecified	11%	6%	Higher	Employee survey, 2022
Neurodiversity	Proportion of workforce that identify as neurodivergent	7%	4%	Higher	Employee survey, 2022

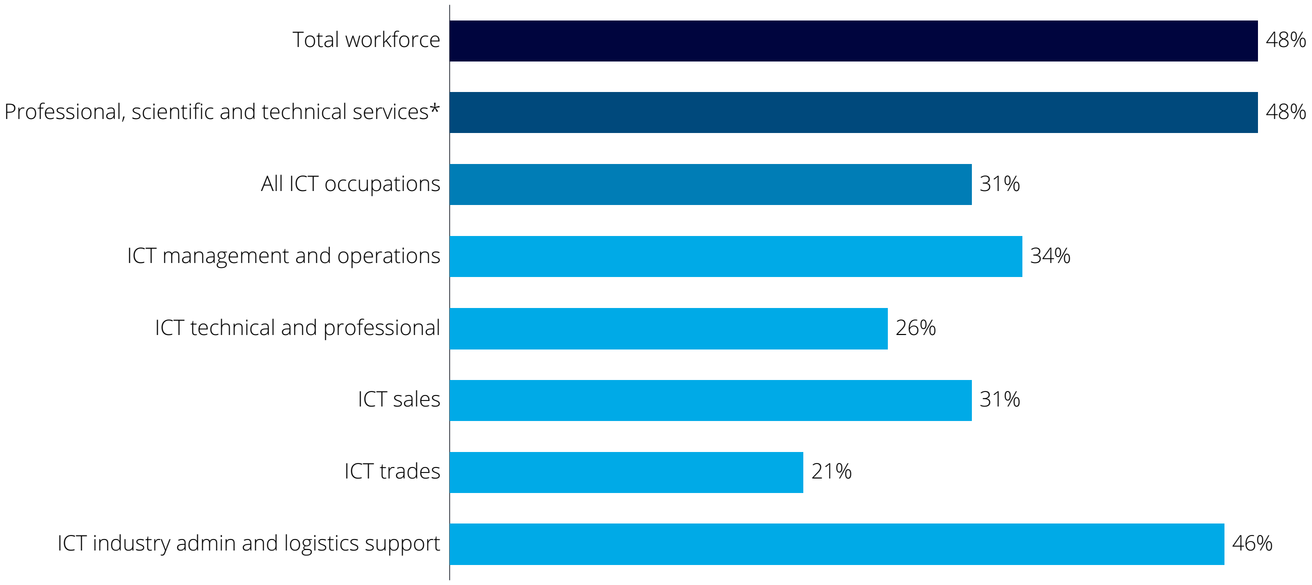
* Professional services in this case refers to the professional, scientific and technical services industry, as defined by the ABS.
Source: As noted within the table.

4.1.1 Gender

In terms of female representation, the technology sector continues to lag behind the Australian workforce and comparable occupations. Women make up just 31% of workers in the technology workforce compared to 48% of the Australian workforce as a whole and 46% in professional services.[vi]

Within the technology workforce, women were most represented in the ICT industry administration and logistics support occupations, with 46% of workers in this occupation being women. There is a much lower representation of women in ICT trades and ICT technical and professional occupations, with women making up only 21% and 26%, respectively. Chart 4.1 below illustrates the proportion of women across different technology occupations.

Chart 4.1: Proportion of women in technology occupations, 2021



Source: ABS customised report (2022).

[v] We define regional areas are those outside of Greater Capital City Statistical Areas (GCCSA) geographic areas. The ABS (2021) uses GCCSAs to represent the functional area of each of the eight state and territory capital cities, which includes populations who regularly socialise, shop or work within the city but may live either in the city or in the small towns and rural areas surrounding the city.

[vi] At the time of writing, current ABS data on sex reported only 'male' and 'female'. For this reason, this estimate does reflect non-binary people.

While the proportion of women in technology is relatively low compared to other sectors, it is growing. **In the last year alone, the proportion of women in technology occupations increased by 1.86 percentage points.** For comparison, since Deloitte Access Economics began tracking diversity across technology occupations in 2015, female representation has grown by a total of 1.27 percentage points from 2014 to 2020. This means the growth in the proportion of women in technology grew by more between 2021 and 2020 than it did in the preceding six years combined.

Continued growth will require more women pursing IT or similar qualifications. A recent study found that men were seven times more likely to attain VET education and three times more likely to attain undergraduate STEM degrees than women.[31]

The above analysis relates to the proportion of women in technology occupations is based on data from the ABS, which at the time of writing did not include information on individuals who identify as non-binary. The 2021 ABS Census included a non-binary option, which will be available for future analysis. The employee survey did collect information on workers who identify as non-binary, prefer to use another term, and prefer not to say. However, the sample sizes were too small to be considered representative of the population.

4.1.2 Age

People aged over 55 make up approximately 16% of professional services workers compared to 14% in the technology workforce. The proportion of technology workers aged 55 years and above has grown faster (1.7% per year) than professional services workers aged 55 years and over (0.1% per year) in the last five years.

Another important element of age diversity is the proportion of younger workers. In 2021, 6% of workers in technology were aged 25 or younger, which is similar to the 8% of workers aged 25 or younger in professional services. The proportion of younger workers has declined in both sectors since 2016.

4.1.3 Ability status

The ABS Census asks multiple questions about the ability status of an individual. One question relates to those people who need assistance to complete core activities. The proportion of the technology workforce that reported needing assistance with core activities is relatively lower than those within professional services, with 0.51% and 0.60% in each sector, respectively, indicating they need assistance in the 2016 ABS Census.

Both the technology and professional services workforces have a lower proportion of individuals who need assistance with core activities compared to the general population, where this proportion was 5.5% in the 2016 ABS Census. This may be partially because labour force participation is correlated with disability status. A Survey of Disability, Ageing and Carers (2018) found that 53% of Australians with disability were in the labour force, compared with 84% of those without a disability, as a result of being discouraged from seeking employment.[32]

Over the period of 2011 to 2016, the proportion of technology sector workers who reported having a disability grew at a similar rate to the proportion of workers in the professional services who reported having a disability (8% compared to 7% respectively). Both industries grew at a higher rate when compared to the proportion of the entire labour force who reported having a disability (5%).

In the employee survey, which captured a broader measure of ability status based on whether individuals self-identified as having a disability or being disabled, the opposite result arose, with professional services having a smaller share than the technology workforce (9% compared to 13%). As the survey is conducted on only a modest sample of the workforce, sampling bias could be a factor in the relative results of each sector. Other data published by the ABS indicates that 18% of the Australian population had a disability in 2018.[33]

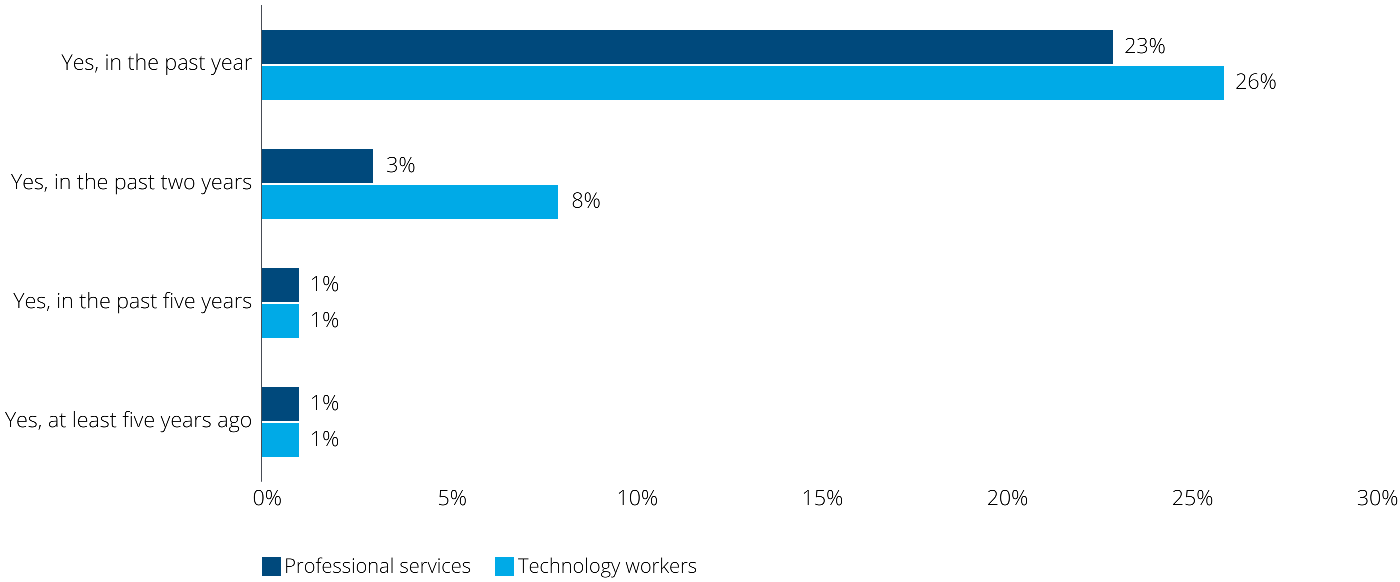
4.1.4 Cultural and linguistic diversity

The technology workforce had relatively higher levels of cultural and linguistic diversity compared with professional services, with 45% of technology workers born overseas and 36% speaking another language other than English, compared to 36% and 24% in professional services, respectively.

Over the period of 2011 to 2016, the technology sector grew at a faster rate than professional services in terms of the share of people who spoke another language other than English and who were born overseas. With a large part of the technology workforce made up by migrants, this statistic is not overly surprising.

Chart 4.2 shows the majority (26%) of technology migrants arrived over five years ago, which is likely also reflecting the impact of COVID-19 travel restrictions in the past two years on the flow of technology migrants.

Chart 4.2: Whether and when technology and professional services employees migrated to Australia

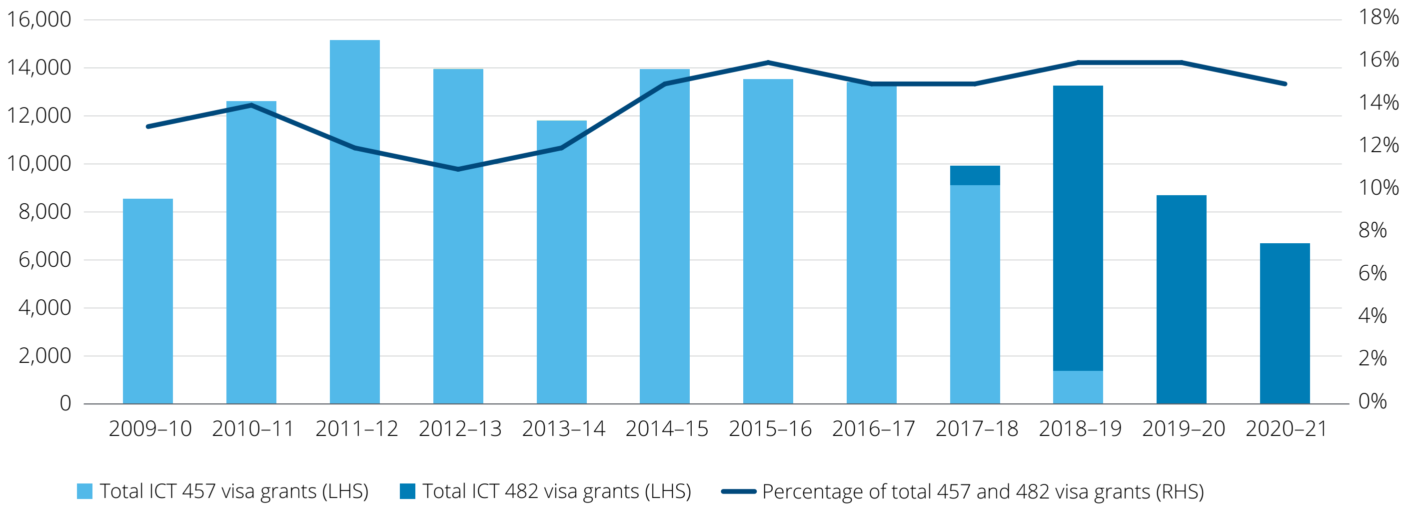


Source: Deloitte Access Economics Employee survey (2022).

COVID-19 has reduced the number of skilled migrants and temporary workers entering the technology workforce in Australia. The Grattan Institute found there was a reduction of 500,000 temporary migrants and a 20% drop in temporary skilled workers across the Australian workforce when compared to pre-pandemic levels.[38] In particular, there was significant drop of 50% in temporary technology worker visas granted between 2018–19 and 2020–21 (see Chart 4.3).

It will take some time to return to the migration levels of prior to COVID-19, which will lead to a greater reliance in the short term of IT graduates and people reskilling from other professions (see Sections 5 and 6). A survey conducted by the Australian Information Industry Association (AIIA) revealed that some businesses may already be turning to international labour to fill current vacancies. Members reported a 20% fall in positions acquiring local technology talent in the past year, while more than a third (35%) of businesses surveyed planned to hire overseas staff.[39] This trend may continue as travel restrictions implemented during COVID-19 continue to relax.

Chart 4.3: Total ICT visas granted, 2009-10 to 2020–21



Source: Department of Home Affairs, 2022.

Measuring cultural diversity and its benefits with the fractionalisation index

The fractionalisation index is a measure of population diversity, used in modelling its impact on economic performance.[34] The index aims to measure both the number of different diversity types in a population and the occurrence of diversity (that is, how evenly represented the different types of diversity are in a population). The index is interpreted as the probability that two different people, randomly selected from a sample, belong to different groups. This probability is on a scale of 0 (where all individuals belong to the same group) to 1 (where all individuals belong to their own group). Therefore, the higher the index, the more diverse a population.

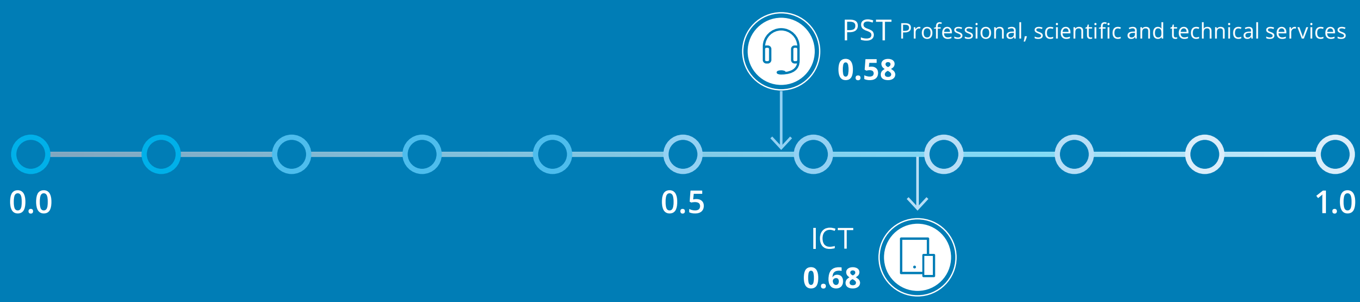
While the fractionalisation index can be applied to measure different forms of diversity, it is most commonly used to measure cultural and linguistic diversity.

Studies have used the fractionalisation index to measure the economic impacts of increasing diversity as the index reflects the increase in available knowledge, occupational richness and varying abilities from a more diverse population. This is measured through innovation, wages and productivity.

A study by Ceren Ozgen (2021) provides a review of the literature on how fractionalisation, among other measures, affects these economic outcomes.[35] This includes a study by Trax et al. (2015), who apply the fractionalisation index to measure diversity in terms of different nationalities, and find that a 0.1 increase in fractionalisation increases manufacturing productivity by 3.2%.[36] Another study by Kemeny and Cooke (2017) looks at fractionalisation in terms of birthplace, and finds that a 0.1 increase in fractionalisation increases wages by 19% in the case of high social capital.[37]

Using data from the ABS Census (2016), we applied the fractionalisation index to measure cultural diversity, in terms of birthplace,[vii] in the technology and professional services sectors.[viii] As shown in Figure 4.1 below, the fractionalisation index is higher in technology, at 0.68, than in professional services, where it is 0.58. This means the technology sector is more diverse in terms of employees' place of birth, which is consistent with data from our employee survey.

Figure 4.1: Fractionalisation index for birthplace in technology and professional services



Source: ABS Census (2016).

4.1.5 First Nations Australians

A relatively small proportion of technology workers and professional services workers identified as being of Aboriginal and/or Torres Strait Islander origin, with 0.66% and 0.65% in each sector, respectively.[ix] This is substantially lower than the 3.3% proportion of people who identified as Aboriginal and/or Torres Strait Islander in the 2016 Census.

One factor that could be contributing to this lower level of representation is a larger proportion of First Nations peoples living in regional and remote areas. For example, in 2016, 18.6% of Aboriginal and Torres Strait Islander people lived in remote or very remote areas, compared to 1.5% of non-Indigenous people.[40]

These areas are more likely to have less of the digital infrastructure required for technology and professional services roles.[41] There is evidence that the lack of digital infrastructure may affect the digital education of First Nations peoples. Indigenous students tended to have lower rates on achieving a proficient standard of ICT on the National Assessment of Information and Communication Skills (NAP-ICT) when compared with non-Indigenous students (see Table 4.2).

[vii] This was using Country of Birth of Person (BPLP) at the four-digit level.

[viii] Professional services in this case refers to the professional, scientific and technical services industry, as defined by the ABS.

Table 4.2: Proportion of students achieving a proficient standard of ICT literacy by Indigenous status

Indigenous status	Year 6	Year 10
Non-indigenous students	55%	55%
Indigenous students	24%	24%

Source: Australian Curriculum Assessment and Reporting Authority – NAP Sample Assessment ICT Literacy (2018).

4.1.6 Metropolitan/regional

Of the technology workforce, only 14% reside in regional areas, compared to 18% of professional services workforce.[x] COVID-19 and the increase in remote working will likely result in these proportions increasing over the next few years as workers shift away from metropolitan areas. In 2021, Australia's regional population grew (by 70,900 people) more than the population in capital cities, which declined by 26,000 people for the first time since 1981.[42] As work from home remains a viable option to many professional services and technology sector employees, it is likely that individuals will continue to relocate to regional areas. In fact, the employee survey found that nearly nine in ten technology workers would consider moving to regional areas.

An increase in digital infrastructure will be required to support growing numbers of technology workers who are considering relocating to regional areas. The Australian Government has recognised this need for further investment by including $1.3 billion of investment into regional Australia's telecommunications infrastructure within the 2022–23 federal budget.

The incoming government has also promised to roll out a $656 million regional telecommunications package, with $400 million earmarked for the Better Connectivity for Rural and Regional Australia plan to expand multi-carrier mobile coverage along roads, regional homes and businesses.[43] An additional $200 million has been committed under the Regional Connectivity Program to continue investing into household and business connectivity projects through better mobile voice and data coverage and improvements in microwave and fibre backhaul capacity to regional and remote Australia.[44]

Promoting the development of the technology workforce within regional Australia (rather than simply relocating metropolitan workers) will require further investment. The Australian Digital Inclusion Index (the Index) tracks and reports on digital inclusion in Australia, which includes metrics on access, affordability and digital ability. The Index has shown that while the divide between regional and metropolitan areas has narrowed in recent years, digital inclusion within regional areas was still 5.5 points lower than metropolitan areas in 2021.[45]

RMIT, as the producer of the Index, suggests that all levels of government should have a coordinated approach towards targeted digital skills and abilities initiatives in programs in regional areas. Continued and improved provision of affordable broadband across rural and urban areas is also imperative to ensure that every Australian has access to reliable internet.[46]

The Government could look to create and support Regional Technology Hubs in major regional centres, in cooperation with broader industry stakeholders and educational institutions. Collaboration between industry and educational institutions has been shown to be beneficial for both parties by helping to meet workforce needs while also providing students with relevant industry skills. One successful example of this type of initiative is the the collaboration between IBM and Federation University in Ballarat.

[ix] Throughout this report we have used the term 'First Nations peoples'. Where we have drawn on other sources of information, we have kept the terminology consistent to how it was collected for transparency.

[x] We define regional areas are those outside of Greater Capital City Statistical Areas (GCCSA) geographic areas. The ABS (2021) use GCCSAs to represent the functional area of each of the eight state and territory capital cities which includes populations who regularly socialise, shop, or work within the city but may live either in the city or in the small towns and rural areas surrounding the city.

4.1.7 Sexual orientation

Our employee survey revealed a higher level of diversity in terms of sexual orientation than for professional services workers, with 11% of technology workers identifying as either homosexual, bisexual, pansexual, queer or asexual, compared with 6% in professional services.

The higher level of people with diverse sexual orientation within the technology sector aligns with research by the Australian Workplace Equality Index. Survey results in 2021 found 11% of 2,800 technology workers identified having a diverse sexual orientation. Furthermore, research conducted by Stack Overflow found almost 10% of the surveyed technology workforce identified as having a diverse sexual orientation, also reaffirming numbers found in our employee survey.[47]

4.1.8 Neurodiversity

The technology workers responding to our employee survey also had a higher level of identification as neurodiverse, compared with professional services workers (7% compared to 4%). According to the *Harvard Business Review*, many of the characteristics associated with neurodiversity – such as the ability to recognise patterns, attention to detail and the ability to concentrate for long periods of time – align with the skills necessary for roles in the technology sector.[48]

A note on the types of diversity and intersectionality

The forms of diversity explored above are not comprehensive, and more data is required to understand how the technology workforce fares, for example, in relation to religious diversity, size diversity, and other types of diversity not explored in this analysis.

Furthermore, when exploring how diverse the technology workforce is, the above analysis has considered only one facet in isolation – for example, age diversity compared to sexual orientation. In reality, experiences of diversity can differ for those who may identify with one or more type of diversity, such as identifying as neurodiverse and living in a regional area, or identifying as having a disability and identifying as female. The interconnected nature of these dimensions of diversity creates overlapping and interdependent systems of discrimination or disadvantage.

Further work is required to understand the extent of intersectionality in the technology workforce and to provide a more nuanced view around diversity in the technology workforce.

4.2 Benefits of diversity

There is a wealth of research showing that increasing diversity in the workplace has potential benefits for not only the company itself but also the broader economy. This includes both financial benefits such as higher profitability or revenue and non-financial benefits such as improved productivity and innovation.[49,50] The nature of the benefit varies depending on the type of diversity in question. Figure 4.2 summarises some of the high-level benefits and advantages of having a more diverse workforce.

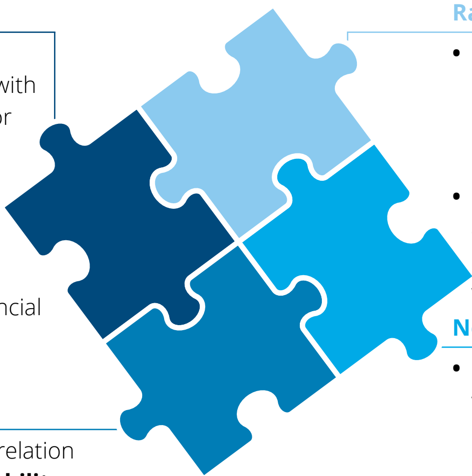
Figure 4.2: Benefit of diversity by type of diversity

Gender diversity and sexual orientation

- Businesses have better **financial performance** and higher **market value** with gender-diverse company boards and senior executives.
- Greater gender diversity is associated with improved productivity and innovation.
- Companies in the top quartile for gender diversity were 15% more likely to have financial returns above their industry median.

Diversity in ability

- Research found that there is a positive correlation between **productivity and diversity in ability.**
- People with a disability have been shown to take fewer days off, take less sick leave and stay in jobs longer than other workers.



Racial diversity

- Businesses in the top quartile for racial and ethnic diversity were 35% more likely to have financial returns above their industry median.
- Businesses with high racial diversity in **upper and lower** management have **1.32 times higher levels of productivity** than firms with low racial diversity.

Neurodiversity

- Neurodiverse individuals are often **highly talented and skilled** in areas such as mathematics, pattern recognition, and complex problem-solving.
- Neurodiverse teams have been found to be **30% more productive** than other teams.
- Managers at SAP say their neurodiversity programs have led to productivity gains, quality improvements, greater innovation and higher employee engagement.

Source: Deloitte Access Economics based on Austin and Pisano (2017),[51] Dezso and Ross (2012),[52] McKinsey & Company (2015),[53] Moeller (2021),[54] Narayanan and Terris (2020),[55] Richard, Triana and Li (2021),[56] Zhang (2020).[57]

Aside from the benefits associated with increasing diversity, workplace discrimination can impact the ability of a person to realise their own potential, resulting in costs for businesses in terms of turnover and avoidable recruitment costs. It was estimated that the Australian economy loses approximately $385 million in recruitment costs and $3.8 billion in productivity costs annually.[58] Job seekers and employees have also reported that an important factor when evaluating employers and accepting job offers is being in a diverse workforce.[59] Considering Australian businesses are dealing with a national shortage of technology talent,[60] it is vital for the technology sector to improve the diversity of their workplaces.

4.2.1 Modelling the benefits of diversity

Clearly, the technology sector has an opportunity to improve diversity in the areas outlined above. In last year's Digital Pulse, Deloitte Access Economics modelled the impact of increasing gender diversity in the technology sector in Australia.[61] This year, we expand on this modelling to determine the impact of having a more diverse technology workforce in terms of people aged over 55, women, and people living with disability.[xi] This analysis is intended to help inform the conversation around the importance of diversity in technology, by highlighting the benefits that result across the entire Australian economy.

Increasing diversity in technology contributes to economic growth in Australia through increasing participation and productivity, which are captured using two different types of shocks:

1. The first shock is based on improving the rates of workforce participation for people over 55, women, and people living with disability.
2. The second shock involves a wage uplift based on women moving from other lower skilled occupations into higher skilled technology roles, consistent with last year's modelling.

Modelling for this report finds that increasing diversity in terms of age, gender, and people living with disability in the technology workforce would grow Australia's economy by $3.1 billion every year on average, over the next 20 years. In employment terms, it would create almost 13,900 full-time equivalent (FTE) jobs each year on average.

The NPV of increasing these forms of diversity in technology amounts to an $21.2 billion opportunity for Australia's economy.

Further detail on the modelling used to calculate these estimates is provided in Appendix C.

4.2.2 Methodology

Participation

Modelling in this report captures the economic impact of increasing the number of people aged 55 and over, women, and people living with a disability in the technology sector to different targets. Specifically, this involved the adjustments as outlined below.

- Increasing the proportion of those over 55 to **22.1%**, based on the proportion of workers in the labour force aged over 55 at the end of the modelling period.[xii]
- Increasing the proportion of women to **47.5%**, based on the current proportion of women in PST occupations, consistent with last year's modelling.[xiii] This proportion has been adjusted to reflect differences in the occupational distribution of women in technology as compared to in professional services.
- Increasing the proportion of people living with disability to **5.5%**, based on the current proportion of people living with disability in the population.[62]

We assume it takes 25 years to reach the target levels for age, gender, and people living with disability in the technology workforce. This time frame has been informed by underlying historical growth rates and likely possible increases in participation, given efforts by the workforce to attract and retain diverse workers.

The increase in diversity across the technology workforce has been modelled such that it gradually ramps up over time, recognising that change may be slow initially but increase over time as the workforce makes structural shifts to accommodate a more diverse workforce. This may include implementing diversity policies such as flexible work and building more inclusive physical infrastructure to accommodate people with disability.

The increase in participation can be achieved through several different mechanisms.

- An ageing population and lower levels of retirement mean a larger proportion of workers aged over 55 can remain in the workforce.
- According to the Survey of Disability, Ageing and Carers (2018), 94% of unemployed Australians with disability report finding difficulties in finding work, and they are also more likely to report employment restrictions.[63] Therefore, lower levels of discrimination can help more people with disability move into the labour force and work in technology.
- Lastly, a shift from part-time to full-time work and movement between sectors can increase participation for women.

This modelling illustrates the potential dividends from increasing the diversity of technology workforce by increasing the number of people with disability, people aged 55 and over, and women. The modelling assumes that the technology workforce can absorb these additional workers, consistent with last year's modelling.[64] This assumption is supported by the high historical growth in the technology workforce, with 8% year on year from 2020 to 2021, despite restrictions in the supply of technology workers from skilled migration or temporary visas. It is important to note, however, that it is difficult to fully predict the absorptive capacity of the technology workforce.

[xi] The ABS currently collects information on sex, rather than gender. Questions on sex include 'Male' and 'Female' options.

[xii] The growth rate for the proportion of the labour force aged 55 and over has been estimated based on Deloitte's population forecasts by age.

[xiii] To remain consistent with last year's modelling, this reflects the share of women in professional service occupations in 2020.

To estimate the growth rates in the base case (that is, under a business-as-usual scenario) we used the following data sources:

- For the proportion of female workers and workers aged 55 and over, data was taken from customised ABS data requests from 2014 to 2021.
- For people living with a disability, we used data from the 2011 and 2016 Censuses. This defines those living with a disability as needing assistance with core activities. However, we acknowledge that this definition does not account for all people who identify as having a disability.

The modelling also accounted for interrelationships between these different forms of diversity, as people aged over 55, women, and people living with disability are not mutually exclusive groups.

Relative to the base case, it's estimated approximately 97,000 additional FTE technology workers who are aged over 55, female or have a disability will be required to reach these target levels by 2046.

Types of diversity covered in the modelling

While diversity can come in many forms – including gender, age, ancestry, sexual orientation, people living with disability, and neurodiversity – this section focuses on quantifying the benefits associated with increasing the number of people over 55, women, and people living with a disability in the technology sector. Increasing diversity through these other dimensions, including sexual orientation and neurodiversity, could be expected to generate similar types of benefits, which would increase the overall benefits to the Australian economy.

The selection of forms of diversity included in the modelling was largely based on data availability. In particular, information regarding workers' sexual orientation and neurodiversity was not captured through the Census. While information on sexual orientation and neurodiversity was captured by our survey, the sample sizes were insufficient to base modelling on. However, the benefits of improving numbers of workers with diverse sexual orientation and numbers of neurodiverse workers have been included qualitatively in other sections of the report, including Section 4.2. Future data collection on sexual orientation and neurodiversity is encouraged to enable researchers to include additional forms of diversity in analysis.

The 2021 Census was the first to add a non-binary option; however, the results were not available at the time of producing this report.

Productivity

We assume a portion of the increase in female technology workers come from women moving from other sectors and occupations into the technology workforce (as opposed to coming from outside the labour force). Women transitioning into technology receive higher wages on average. This occurs due to the highly skilled nature of technology occupations.

As skill requirements vary across occupations, some workers don't possess the appropriate skills to move into technology roles. Following the same methodology as last year's modelling, we use data from O*NET – a database that includes information about the skills required by occupation – to assess skill similarities across occupations.[65] Based on occupational-level wage data alone, we estimate that these occupational changes will lead to a $1.8 billion net increase in labour income over the 25 years.

Having a higher proportion of workers over 55 affects labour productivity in two ways: being the individual productivity of each worker (direct effect); and the collaboration, sharing of knowledge and support through different ages (spillovers).[66] The benefits of this increased labour productivity were not modelled; however, research from the OECD (2020) finds that increasing the proportion of older workers by 10% increases firm productivity by 1.1% through both the direct effect and spillovers.[67] [xiv] Including these benefits in our modelling would likely lead to even larger benefits than what's been estimated in this report.

4.2.3 Results

While the uplift in labour supply and labour productivity is centred in the technology sector, it catalyses an economic benefit across the Australian economy more broadly. Using computable general equilibrium (CGE) modelling (see Appendix C), this report estimates the impact on output and jobs in Australia.

This report estimates Australia's economy would be $3.1 billion larger every year on average as a result of increasing participation of people aged over 55, women, and people living with a disability in technology occupations over a 20-year horizon. In employment terms, it would create close to 13,900 FTE jobs on average each year.

Of course, it takes time for policies aimed at increasing diversity to gain momentum, and progress may be slow initially. But as the number of role models in technology increases, it will catalyse exponential growth in diversity across the workforce more broadly.

Every year where diversity in technology improves represents another year of economic gains. And these economic gains will persist, even if the rate of improvement slows or stops altogether. This means that even small changes in the level of participation in technology today have the potential to create a long-lasting impact on Australia's economy.

[xiv] The OECD paper estimated benefits of age diversity for firm-level productivity. However, given that technology workers are largely dispersed across different types of businesses and sectors, it is unclear how this may translate into improved labour productivity across the workforce more broadly and as such this has not been modelled.

4.3 Barriers and opportunities to promote diversity

There are various barriers to enabling diversity in the workplace. These barriers need to be addressed to enable a more diverse range of workers to enter the technology workforce and realise the benefits outlined above.

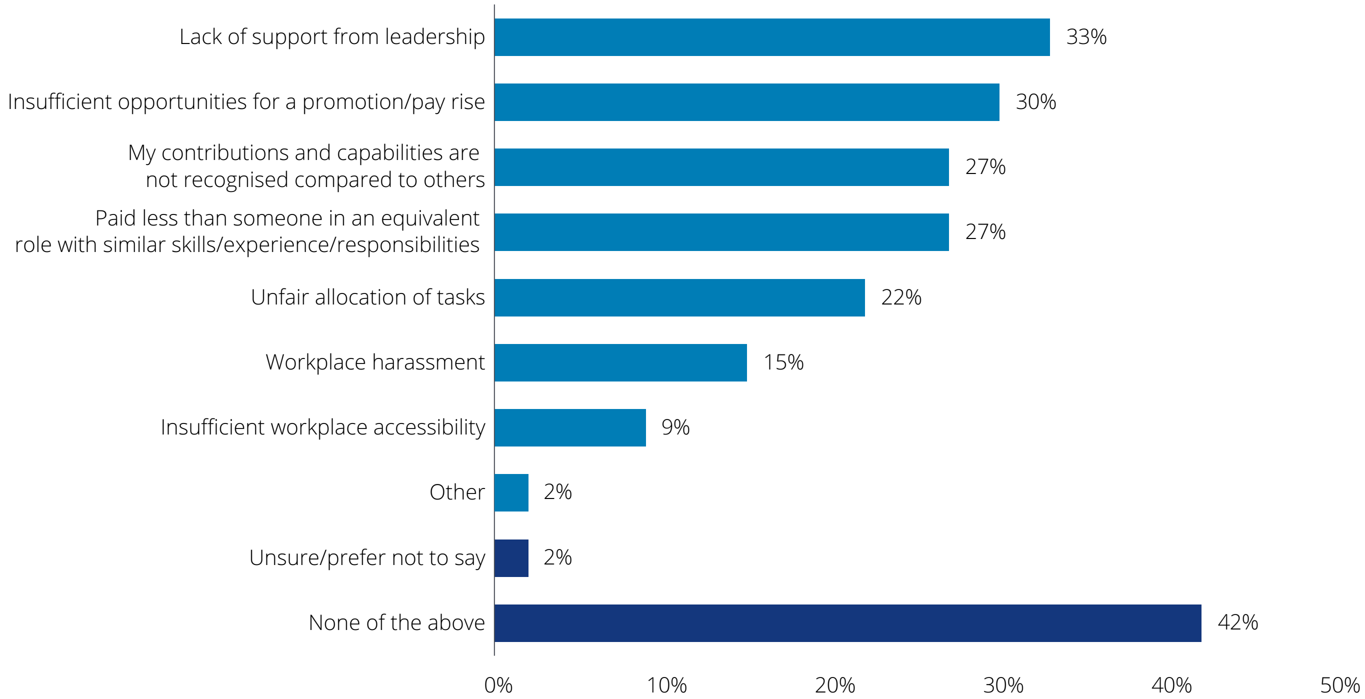
A key barrier to diversity is discrimination. Discrimination refers to the unjust and prejudicial treatment of different categories of people based on where they belong (or where they are perceived to belong). Common types of discrimination include discrimination the basis of race, sex or disability.

In 2020-21, the Australian Human Rights Commission received 15,746 enquiries and 3,113 complaints relating to discrimination.[68] However, many instances of discrimination are unlikely to end up being reported formally, with one study finding that only one-third of workers who experience discrimination raise a claim in their workplace or with another institution that accepts discrimination complaints.[69]

Based on the employee survey, more than half (58%) of all workers have experienced some form of discrimination during their careers (see Chart 4.4). This proportion of workers experiencing discrimination is relatively high compared to one estimate for the Australian workplace in general, which found that 30% of workers experienced discrimination in a survey of 1,900 workers.[70]

This high percentage in the employee survey may reflect some of the forms of discrimination included in this survey. The most common forms of discrimination cited in the employee survey were a lack of support from leadership (33%), insufficient opportunities for a promotion or pay rise (30%), a lack of recognition for their contributions and capabilities (27%), and being paid less than someone in an equivalent role with similar skills, experience or responsibilities (27%).

Chart 4.4: Forms of discrimination experienced by employees throughout their careers



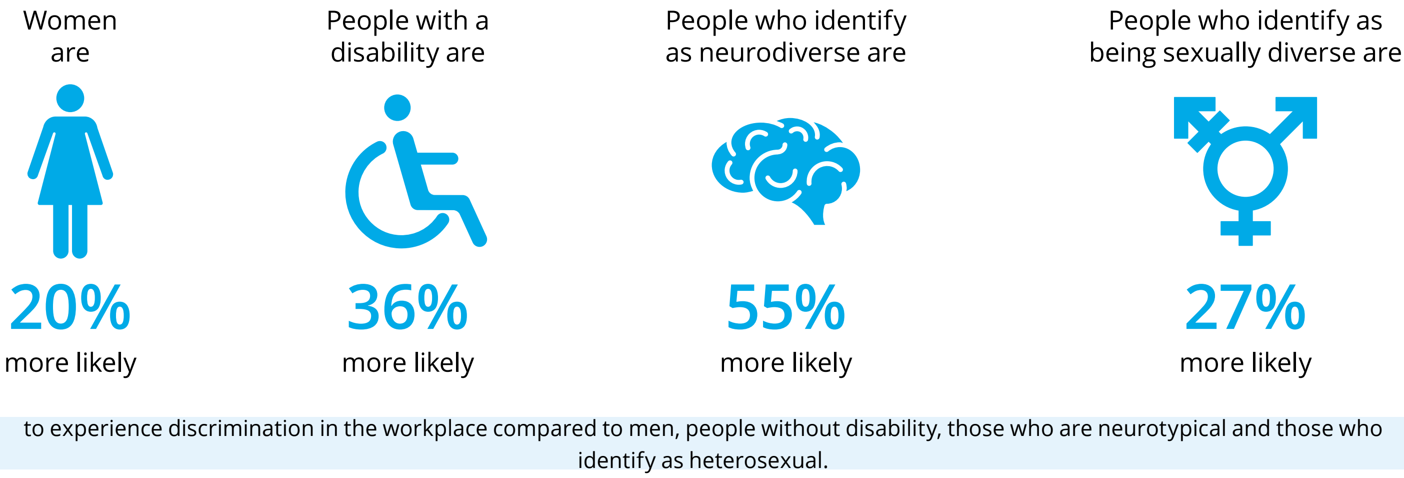
Source: Deloitte Access Economics Employee survey (2022).

It is possible workers with more time in the workforce may be more likely to have experienced discrimination, when considering the lifetime measure used in the employee survey. When comparing reported rates of discrimination between older and younger workers, older workers tended to report higher rates of workplace harassment (21% on average for workers aged 65 and older, compared to 13% for workers aged 18 to 24 years, and 9% for workers aged 35 to 44 years).

There was no clear correlation between age and likelihood of experiencing discrimination when considering the other forms of discrimination.

Importantly, some groups are more likely to report experiencing discrimination in the workplace than others (see Figure 4.3).

Figure 4.3: Workplace discrimination for different groups

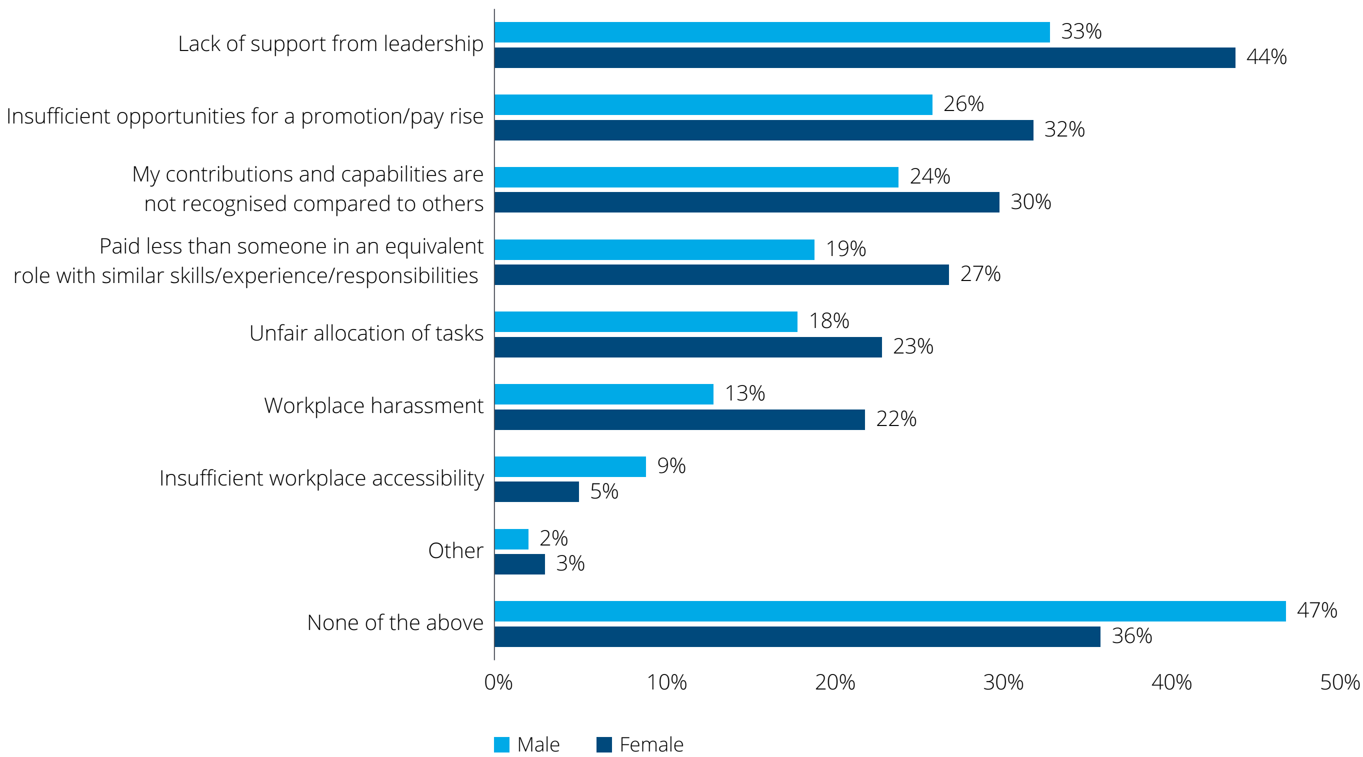


Source: Deloitte Access Economics Employee Survey (2022).

The form of discrimination also varied across groups. Chart 4.5 shows that women were more likely to report a lack of support from leadership compared to men (44% compared to 33%, respectively).

They were also far more likely to report experiencing workplace harassment, which 22% of women indicated they had experienced, compared to 13% of men.

Chart 4.5: Forms of discrimination experienced by employees throughout their careers, by sex



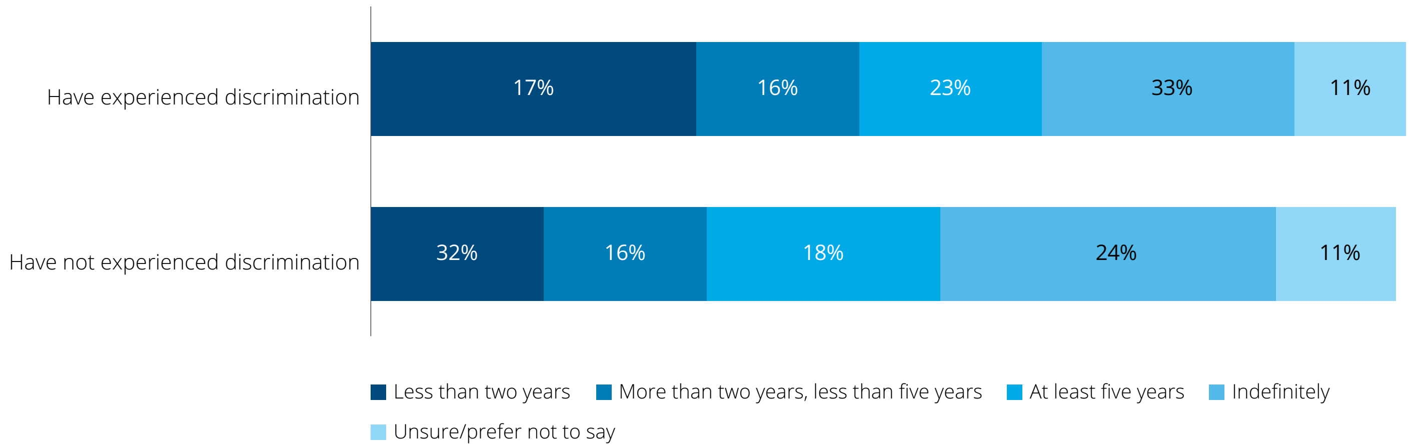
Source: Deloitte Access Economics Employee survey (2022).

Importantly, these findings are not exhaustive, and there may have been broader lived experiences that were not covered in this research.

The impacts of discrimination are significant. Discrimination is linked to a greater likelihood of experiencing mental health issues, such as anxiety and depression.[71] It has also been shown to lead to poorer overall health and greater relationship strain.[72]

In addition to the damaging health and social costs associated with experiencing discrimination, it unsurprisingly has flow-on consequences for workers' intentions to stay in their current role. In fact, **those who have experienced discrimination are twice as likely to expect to leave their occupation within the next two years, compared to those who have not experienced discrimination** (see Chart 4.6).

Chart 4.6: Intentions to stay in current occupation, for those who have and haven't experienced discrimination



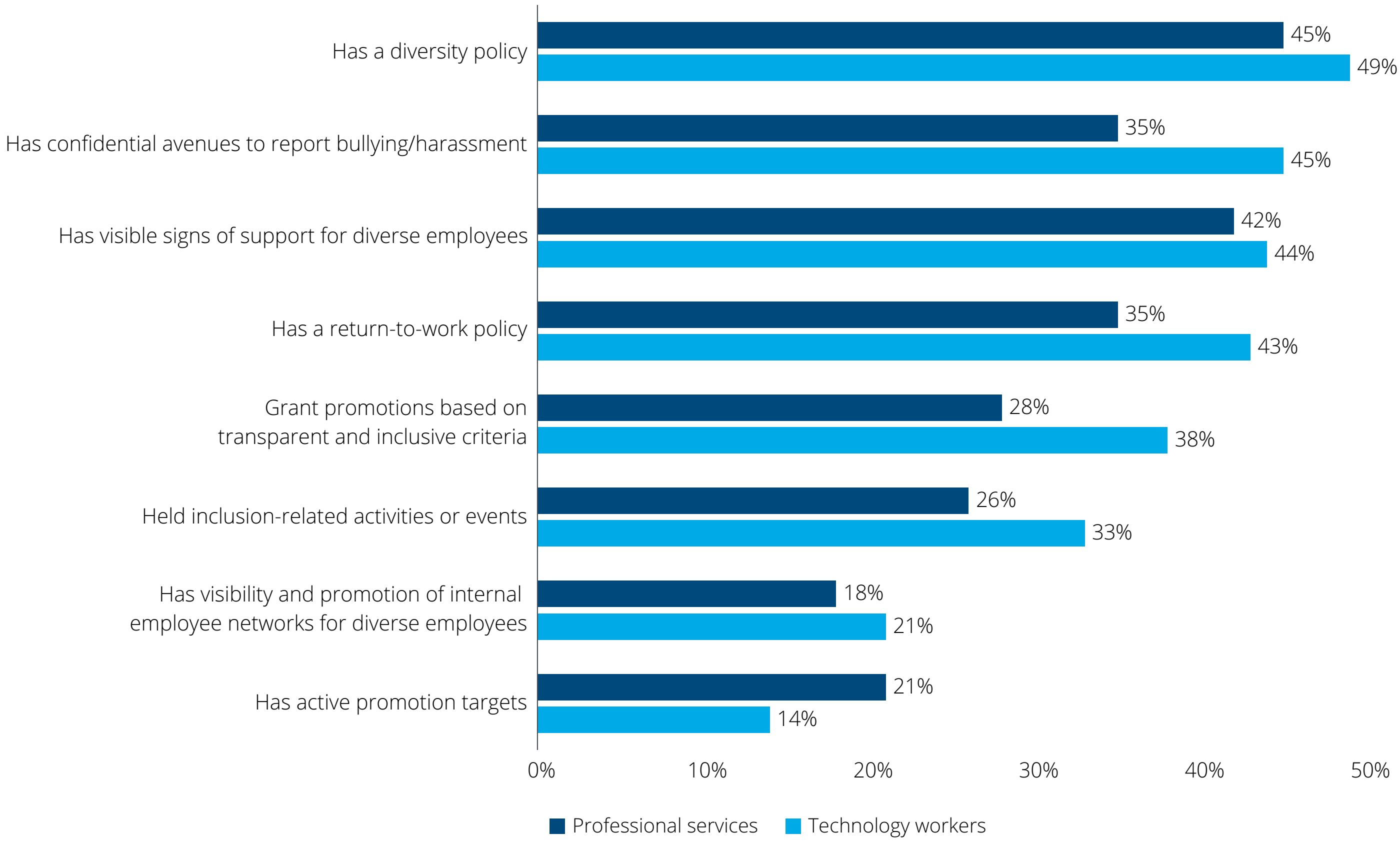
Source: Deloitte Access Economics Employee survey (2022).

The employee survey identified opportunities for workplaces to improve practices and policies to support diversity, noting:

- only half (53%) of technology workers are employed in a workplace with a diversity policy
- less than half (49%) of technology workplaces have confidential avenues to safely report bullying or harassment related to employee diversity
- one in five have active targets for promotions in their workplace.

It should be noted that the indicators are based on self-reported responses and may reflect the employees' awareness of company practices and policies. Furthermore, Chart 4.7 shows that while these findings suggest that workplaces employing technology workers have room for improvement, they are nevertheless ahead of professional services in all aspects of diversity policies and practices.

Chart 4.7: Workplace diversity policies, as reported by professional services and technology workers



Source: Deloitte Access Economics Employee survey (2022).

When considering how to support diversity in the workplace, it is important to consider the pain points that are specific to particular groups and are unique to their lived experiences. For example, our survey found that 12% of people aged 55 years and above rated their workplace as having the lowest score for inclusive infrastructure and services (for example, wheelchair ramps, gender neutral toilets or change facilities), compared to 5% of people below 55 years old.

More broadly, the employee survey was used to identify a non-exhaustive list of areas covering the top reasons provided for wanting to leave the technology workforce, and the lowest rating of workplace inclusivity practices, for each demographic (see Table 4.3).

This analysis revealed that reasons for leaving and perceptions around workplace inclusivity varied significantly between groups.

For example, the most common reasons for wanting to leave the technology sector provided by people aged over 55 were looking for a change or something different (26%) and insufficient opportunities for career growth (21%).

In contrast, migrants were more likely to identify pay as their primary reason for leaving (41%). Similarly, in relation to workplace inclusivity, people with a disability were more likely to rate their workplace poorly in terms of having more inclusive infrastructure and services (25%), whereas non-heterosexual individuals were more likely to rank their workplace poorly in relation to talking about mental health (26%).

Importantly and as noted earlier, further work is required to understand how the intersection between different forms of diversity changes the experiences of individuals, as this analysis has focused on only one social characteristic in isolation.

Table 4.3: Areas of improvement for different forms of diversity

Social characteristics	Top reasons stated for wanting to leave the technology workforce (top three)	Areas of improvement for workplace inclusivity practices*
Women	• Looking for better **pay** and benefits (21%) • Looking for **a change** or something different (18%) • Insufficient opportunities for **career growth** (17%)	• Feeling comfortable talking about their **mental health** (22%) • **Inclusive infrastructure** and services (e.g. wheelchair ramps, websites which meet accessibility guidelines) (20%)
Aged over 55	• Looking for **a change** or something different (26%) • Insufficient opportunities for **career growth** (21%) • Lack of support from **leadership** (18%)	• Having more **inclusive infrastructure** and services (23%) • Feeling comfortable talking about their **mental health** (21%)
Migrants	• Looking for better **pay** and benefits (41%) • Looking for **a change** or something different (40%) • Looking for better **job security** (26%)	• Having more **inclusive infrastructure** and services (18%) • Feeling more comfortable in talking about their **mental health** (18%)
Homosexual, bisexual, pansexual, queer, asexual or other	• Looking for better **pay** and benefits (39%) • Insufficient opportunities for **career growth** (35%) • Looking for a **change** or something different (30%)	• Feeling comfortable talking about their **mental health** (26%) • Feeling more comfortable about disclosing their **gender identity or sexual orientation** at work (23%)
With disability	• Looking for better **pay** and benefits (52%) • Insufficient **flexibility** in when and where they work (30%) • Struggling to manage work-life balance (30%)	• Having more **inclusive infrastructure** and services (25%) • Feeling more comfortable about disclosing their **gender identity or sexual orientation** at work (19%)

Source: Deloitte Access Economics Employee Survey (2022).
Note: Percentages given are the proportion of the group specified.
*Note: Survey respondents were asked to rate their workplace on a scale of 1 to 5, with 1 being the worst and 5 being the best. This column is based on the combination of the lowest two quintiles.

Turning insights from research into tangible action at Diversity Council Australia

Growing interest in promoting a diverse and inclusive team has led many businesses to change human resource processes and encourage more inclusive work practices. While these changes and investments can result in positive results, there are times where changes can produce unintended consequences. For this reason, Diversity Council Australia (DCA) works in partnership with over 1,000 member organisations to generate evidence-based research that enables Australian organisations to improve diversity and inclusion outcomes.

Dr Jane O'Leary, Director of Research at DCA, believes improving diversity and inclusion at work requires implementing trialled and tested initiatives that have been shown to deliver positive diversity and inclusion outcomes. For example, unconscious bias training for hiring managers is a common diversity and inclusion initiative implemented by organisations to enable bias-free recruitment. Dr O'Leary explains that research shows recruiters can be more likely to make biased decisions after sitting through a training course as it can give people a false sense of confidence that they won't make biased decisions now they know about. Instead, Dr O'Leary suggests that:

'Businesses are better off changing their organisational practices and processes in such a way that promotes unbiased decision making. For example, scheduling interviews at the start of the day or after lunch and shortlisting more than one candidate from a diverse background before making a decision significantly improves the chances of recruiters selecting more diverse candidates.'

Another example that highlights the benefit of using tried and tested interventions to improve diversity outcomes is the use of de-identified recruitment, which was trialled by the Department of Prime Minister and Cabinet. In the trial, 2,100 public servants from 14 departments received de-identified applications to investigate whether the change would lead to more unbiased recruitment outcomes. Surprisingly, the de-identifying candidates reduced the likelihood of women being selected for the shortlisting. The explanation for this unexpected result was that affirmative action was already in place to promote diversity and the process of de-identification prevented this positive process from eventuating.

Addressing unconscious bias and the results from the trial de-identifying applicants shows that improving diversity requires a well-considered and evidence-based approach. Dr O'Leary notes that businesses are too often attempting to address these issues without planning, evaluating and adjusting their approach. In particular:

'Businesses want a soundbite that can solve an issue with diversity, but in practice, testing change initiatives in small trial settings and scaling these up once successful is much more likely to deliver real change.'

Alongside trialling interventions, DCA recommends having a diversity of team members and perspectives when designing recruitment and workplace settings. People who have unique lived experience of being marginalised in the labour market and first-hand experience of workplace exclusion and bias are better placed to identify diversity and inclusion issues and potential ways that businesses can rectify them. O'Leary supports this idea, saying that:

'If you are going to create change in your organisation, you need those who have lived and experienced exclusion to lead the way.'

Dr O'Leary believes that businesses do recognise the benefits of a diverse and inclusive team, yet some are having difficulty realising these benefits. Dr O'Leary believes a greater focus from business leaders and human resources departments on how to effectively encourage full participation in teams from individuals with a diversity of backgrounds is the priority. Dr O'Leary explains this shift in the discourse:

'In the next five years, I hope we are spending less time asking why increase diversity in favour of asking how we can increase diversity.'

5. Building the skills of the future

The need for digital skills in the professional lives of all Australians is growing. Previous research by Deloitte Access Economics found that 87% of jobs in Australia required digital skills.[73]

With more occupations today demanding digital skills, investment in ICT education will be critical to preparing Australia's future labour force. While previous editions of *Australia's Digital Pulse* analysed trends in tertiary IT qualifications, this year we extend this analysis by considering ICT education in Australian schools and how Australia compares on an international stage.

Beyond setting up students with the skills they will need when they join the workforce, ICT education has also been linked to improved academic performance,[74] and responsible use of digital technologies as well as ensuring students can access digital services and participate in an increasingly digitalised world.[75,76] Exposure to digital skills at a young age in school may also lead to further study, helping to build a pipeline of workers (Figure 5.1).

Figure 5.1: Benefits of ICT education

Improved employment prospects

Technology has reshaped the way businesses operate and the way tasks within jobs are completed. Because of this, teaching digital skills in schools is vitally important as it will equip students with the skills that will be required for their future working lives and improve their employment prospects.

Improved academic performance

Strong digital skills have been linked with improved levels of academic performance. The ability to use technology to search for, interpret and communicate information helps learners to exercise their critical thinking skills as they evaluate the quality of digital sources as well as the methods and expression of information. This in turn improves the communication skills of students, which is a key component to strong academic performance.

Smart safe and responsible use of digital technologies

Familiarity with digital technology will ensure students are able to use online platforms safely and responsibly. Students are increasingly being exposed to a variety of content online through social media, blogs, videos and more. Ensuring students have strong digital skills allows them to understand what sources may be credible, making them less vulnerable to scams and allowing them to be informed users of technology.

Participation in the digital world

Outside of employment, digital skills are important as our society increasingly becomes more intertwined with technology. Things as simple as ordering in restaurants and using government services have become digitalised, accelerated by COVID-19. Strong digital skills will ensure our students can participate in the digital economy.

Building a pipeline of workers

Students who are exposed to digital skills are more likely to take on subjects that require these skills in later schooling years. This may translate to an increased uptake of university courses and occupations that require such skills. This is important for the future of the Australian economy as more and more jobs require digital skills.

Source: Deloitte Access Economics, using Adobe,[77] Education World,[78] and University of Helsinki.[79]

5.1 Trends in digital education in Australian schools

Digital education is a broad term that can refer to a variety of different things. In this report, we refer to digital education as being the ability of individuals to use ICT appropriately to access, manage and evaluate information, develop new understandings, and communicate with others in order to participate effectively in society.[80]

According to the Australian Curriculum, there are five core ICT capabilities: investigating with ICT; communicating with ICT; creating with ICT; managing, and operating ICT; and applying social and ethical protocols and practices when using ICT.[81]

Data from Australia's *National Assessment of Information and Communication Skills* (NAP-ICT) shows that Australian students have declined in terms of their ICT proficiency, with a lower portion of students achieving the proficient standard in 2017 compared to previous years (see Table 5.1).[82,xvi]

The performance of year 10 students has been steadily declining with **just over half (54%) of students achieving the proficient standard in 2017** compared to 61% in 2005. For year 6 students, results peaked in 2011 and have declined since to 53% in 2017, although this is still higher than the 49% recorded in 2005.

Table 5.1: Percentage of students achieving proficient standard in NAP-ICT, 2005 to 2017

Year	2005	2008	2011	2014	2017
Year 6	49%	57%	62%	55%	53%
Year 10	61%	66%	65%	52%	54%

Source: Australian Curriculum (2021).

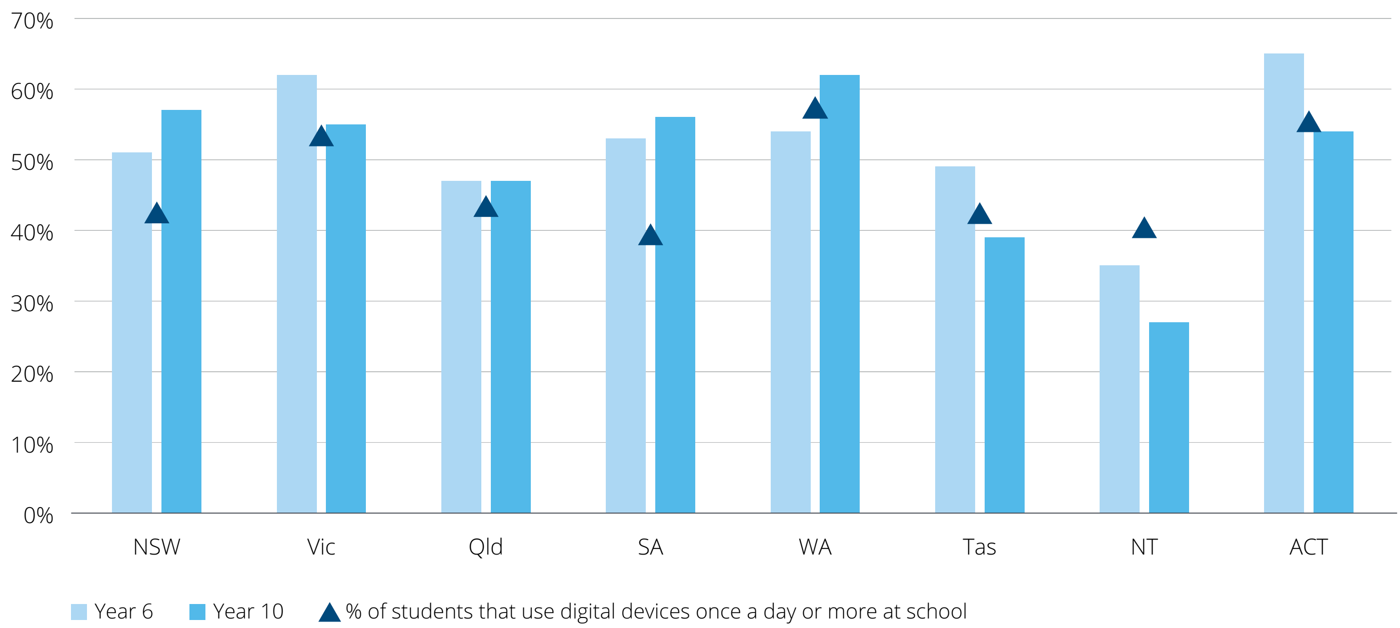
The highest scores for years 6 and 10 were recorded for the ACT and Western Australia, respectively (see Chart 5.1). In contrast, there are a significantly lower proportion of students achieving the ICT proficient standard in the Northern Territory. There appears to be some correlation between NAP-ICT results and access to digital devices.

For example, the Northern Territory had the lowest percentage of students with at least five years of experience using digital devices and the equal second lowest rate of year 6 students who used digital devices at least once a day.

In contrast, the ACT and Western Australia were ranked the highest on these metrics. These results suggest usage and familiarity with digital devices may influence students' performance in digital literacy, alongside other factors.

However, there is evidence that the use of digital devices or tools can negatively affect student performance as well, with a survey of 1,876 survey teachers, principals, and school support staff in 2019 finding that 43% of Australian teachers and principals believe digital technologies enhance their teaching and learning activities, and 84% believe digital technologies are a growing distraction in the learning environment.[83]

Chart 5.1: Percentage of students achieving proficient standard across Australia, 2017



Source: Australian Curriculum Assessment and Reporting Authority – NAP Sample Assessment ICT Literacy (2018).

[xvi] The latest available data is for 2017, with COVID-19 preventing NAP-ICT in 2020.

Improving teachers' proficiency in IT is also likely to increase student ICT literacy. A survey conducted by the ACS on educators teaching the Digital Technologies curriculum found that more than half (51%) of primary school teachers did not hold a relevant ICT qualification. Furthermore, on average close to three in five (59%) primary school teachers reported 'not proficient' when asked to rate their digital technologies/IT expertise.[84]

Investing in teachers' skills could help to improve IT education in schools. The ACS's survey revealed that almost one in five (19%) primary school teachers receive no professional development or training related to teaching digital technologies and one in two (54%) teachers receive between only one to five hours, suggesting more could be done to prepare teachers to provide digital skills.

Similar results were found in other research, with a survey of year 8 teachers finding three-quarters of teachers believed they were lacking in ICT skills required to teach students and half reporting the need for more ICT learning resources for teachers.[85] These results were higher for teachers in schools located in lower socio-economic ares and regional areas in which there was more limited access to resources, lower internet speeds and less professional support available.[86]

Greater support for teachers has become even more important recently with the switch to online delivery of education. COVID-19 has resulted in a significant increase in the use of digital devices and digital related skills for day-to-day learning.

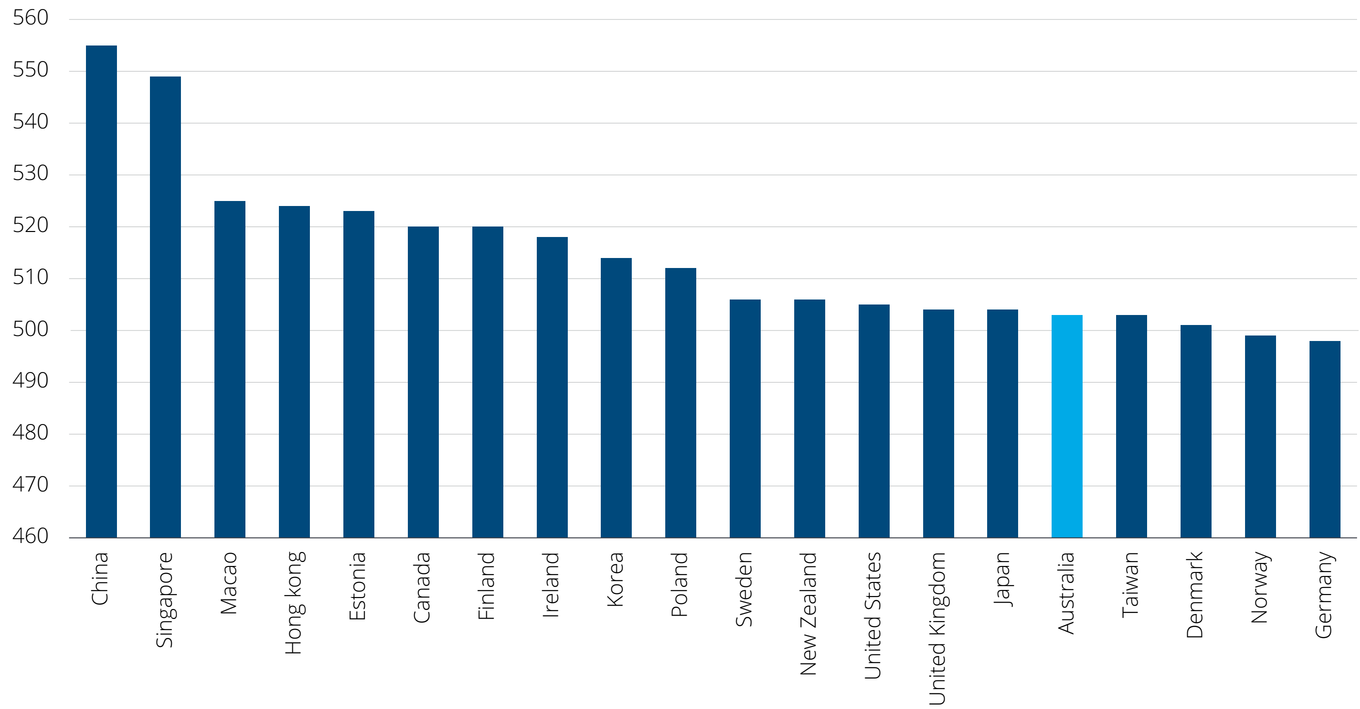
The *Australian Curriculum Assessment and Reporting Authority (ACARA) Digital Technologies in Focus* project, funded by the Australian Government, supported teachers in low socio-economic areas transitioning to digital platforms with formalised digital skills training. Over 160 schools and 2,300 teachers participated in the program, impacting over 30,000 students and their digital education.[87]

Teachers reported being more comfortable in delivering digital education after their own technology skills increased. Students also reported positive outcomes with a higher level of engagement in things such as computational thinking, design thinking and problem-solving. ACARA and other similar programs offer a potential path for improving the ICT skills of Australian students.

5.1.1 How does Australia compare internationally?

Australia's performance on the global stage also suggests Australia lags behind global leaders in IT education. The 2018 Program for International Student Assessment (PISA) assessed students from the Organisation for Economic Co-operation and Development (OECD) countries on their reading skills in a digital world. Participating students from almost 80 countries were asked to navigate online sources of information to complete tasks, with Australia placing 16th among OECD countries (see Chart 5.2).

Chart 5.2: PISA 2018 reading assessment test scores



Source: OECD – PISA (2018).[88]

In general, countries that performed well in the PISA had student populations with greater access and use of digital devices on average – such as Denmark, Sweden, and New Zealand – suggesting this could help improve students' digital literacy.

A 2013 study for the International Association for the Evaluation of Educational Achievement (IEA) more directly assessed the digital skills of 60,000 year 8 students from over 3,300 schools from 21 countries across Europe, America and Asia.[xvii] The study looked at students' computer and information literacy skills by assessing their ability to investigate, create and communicate using digital technology in a variety of settings.

In this assessment Australian students were among the top performers internationally, with an average score of 542 compared to 500 for the included countries. In fact, Australia was second only to the Czech Republic, while Poland, South Korea and Norway closely followed.[89]

Some of the key factors were correlated with higher average test scores include:

- **Students' ICT familiarity** (measured by years of experience with computers and regular use of computers).
- The **availability of ICT resources at home** (measured by the number of computers at home and access to internet at home). On average students who reported having three or more computers at home scored 94 points higher, or in other words going from first place on the scale to 13th, compared to those who reported having none.
- **Socioeconomic status** (measured by parental occupation status, home literacy and expected university education).

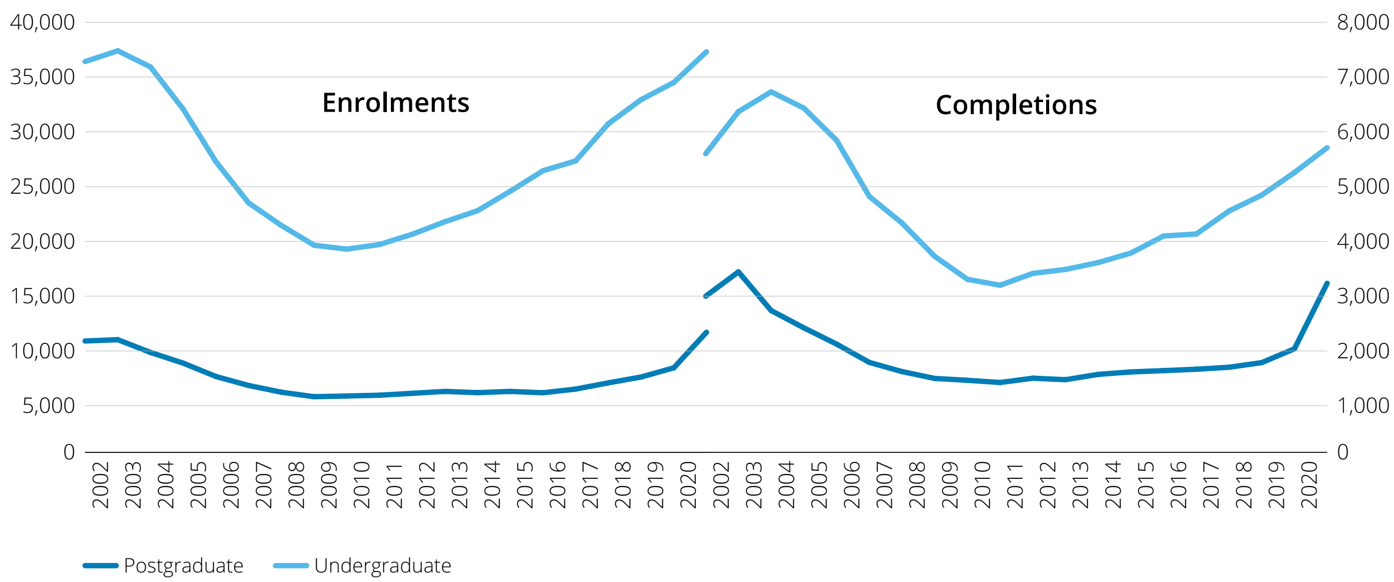
5.2 Current tertiary qualifications

A key source of technology workers are graduates from IT degrees and tertiary qualifications. These qualifications have traditionally come from universities and vocational training, which have both seen increases from 2019 to 2020.

5.2.1 Universities

Domestic enrolments in undergraduate and postgraduate IT degrees at Australian universities continued to increase in 2020, growing by nearly 15% from 2019 to 2020. There was a total of 36,560 undergraduate enrolments, and a total of 10,962 enrolments in postgraduate studies. This reflects strong growth (averaging 9% per year) over the past three years, making it the second fastest growing field of education for domestic enrolments. Domestic completion rates also continued to increase at a faster pace, growing by 25% over the year (Chart 5.3).

Chart 5.3: Domestic enrolments in, and completions of, IT degrees, 2001 to 2020



Source: Department of Education, Skills and Employment Student Data (2021).[90]

[xvii] Australia did not participate in the most recent 2018 ICILS assessment and as such the 2013 results are the most recent.

Attrition rates measure the proportion of students leaving university degrees after their first year. Although attrition rates for domestic students undertaking IT degrees fell from 2018 to 2019, they remain slightly lower than the average rate for all fields of education. The attrition rate for undergraduate IT degrees in 2019 was 14%, which is lower than the rate of 19% for postgraduate IT degrees.

With the border restrictions imposed during 2020, international enrolments in IT degrees decreased by 3% from 2019 to 2020 to a total of 33,405 undergraduate enrolments, and a total of 40,127 postgraduate enrolments. In comparison, completion rates demonstrated strong growth, increasing by 26% from 2019 to 2020.

Attrition rates for international students studying undergraduate IT degrees were higher than those for domestic students at 22% in 2019, a slight increase from 2018. This was significantly higher than the attrition rate for all fields of education, at 13%. For postgraduate international students, the attrition rate was 18% in 2019 and was relatively similar to the level of attrition for all fields of education.

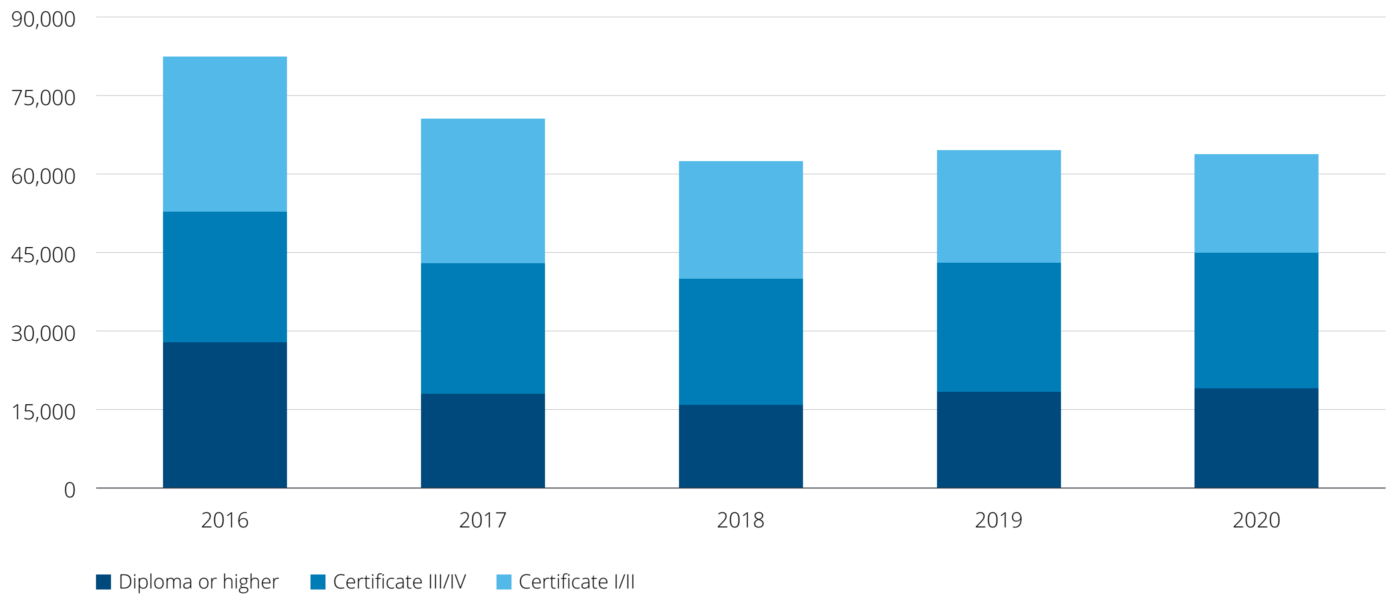
The decline in international enrolments is expected to have continued into 2021, with Australia's international borders only opened to vaccinated international students in December 2021.[91] The Department of Education, Skills and Employment has already reported a 15% decline in the number of international students in Australia in the first quarter of 2022, compared to the same period last year.[92] According to the *Australian Strategy for International Education 2021-2030*, this decline in enrolments and onshore student numbers may continue for some years.[93]

There is an expectation that international education – including international IT student numbers – will recover over the medium term. However, with low levels of international student arrivals, a concerted effort will be required to attract similar levels of international students to pre-pandemic levels. The Australian Government has already implemented changes to student visas. This includes a refund of visa application fees (approximately $630) for international student visa holders who arrived in Australia between January and March 2022. Other changes include waiving the application fee for students to lodge another application if unable to complete their studies within their original visa, a temporary removal of limits on student working hours, and visa extensions for eligible Temporary Graduate visa holders.[94]

5.2.2 Vocational training

Enrolments in entry-level Vocational Education and Training (VET) ICT subjects continued to decline in 2020, with enrolments in Certificate I/II courses falling by 13% on 2019, or over 37% from 2016. Although enrolments in Diploma and above Diploma level courses rose 4% from 2019, they are still nearly 32% below 2016 levels. By comparison, enrolments in Certificate III/IV courses have remained relatively stable, rising 5% in 2020, or increasing 4% since 2016 (Chart 5.4). Courses at this level tend to offer more job-specific training compared to the basic skills taught in introductory courses and may not require completion of an earlier Certificate I/II course. The change in composition of demand for vocational training courses may indicate that students are interested in gaining more job-specific skills compared to those offered in Certificate I/II courses.

Chart 5.4: Vocational Education Training (VET) ICT subject enrolments by qualification level, 2016 to 2020



Source: NCVER Total VET Students and Courses DataBuilder (2021).[95]

Looking forward, the incoming Australian Government announced during the campaign a plan to spend $621 million over four years to deliver 465,000 free TAFE places.[96]

While the certifications will be aimed at industries hard hit by COVID-19, they will also look to fill future skills gaps in digital and other areas.[97]

5.3 Forecasts for qualifications

Consistent with forecast growth in the technology workforce between 2021 and 2027, demand for qualifications is also expected to increase. Deloitte Access Economics **predicts that employers will demand an additional 573,000 ICT qualifications in 2027**. This demand for qualifications depends not only on forecast employment growth, but also on other labour market considerations such as the demand for workers with different levels of education.

As a result, the largest growth in demand is forecast to occur for workers with the highest levels of qualifications. This includes an expected increase of approximately 257,500 workers with undergraduate degrees and 135,900 workers with postgraduate degrees in the technology workforce by 2027 (Table 5.2).

Table 5.2: Forecasts of total qualifications held by technology workers, 2021 to 27*

Qualification level	2021	2027	Average annual growth, 2021 to 27
Postgraduate	285,898	421,831	6.7
Undergraduate	586,386	843,895	6.3
Advanced diploma/diploma	233,081	330,607	6.0
Certificate III and IV	155,146	210,088	5.2
Certificate I and II	74,176	101,264	5.3
Total	**1,334,686**	**1,907,684**	**6.1**

* One person may hold multiple qualifications.
Source: Deloitte Access Economics forecast (2022).

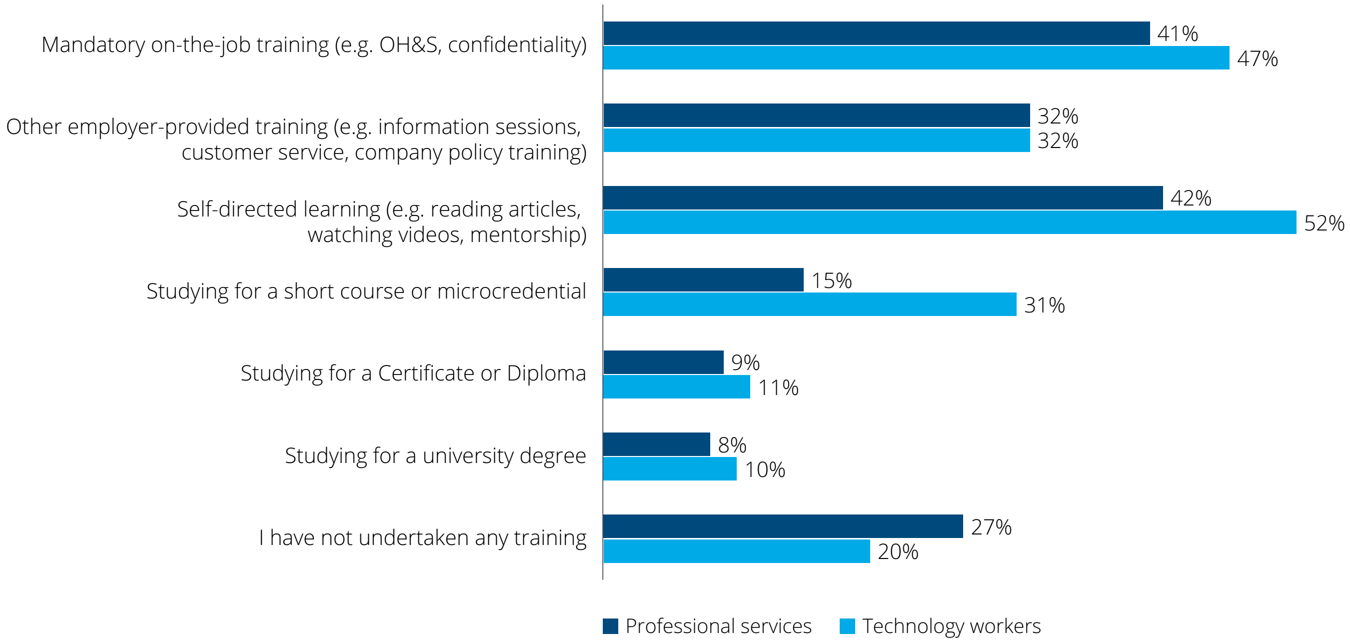
Increasing the quality and quantity of tertiary qualifications will be important to supporting Australia's technology capabilities. The incoming Australian Government pledged 465,000 fee-free TAFE places and 20,000 additional university places focussed in areas of skills shortage.[98] This is likely to be welcomed by technology employers, with a survey by the Australian Information Industry Association's (AIIA) finding that 73% of its members indicating that the government should focus on addressing technology skills deficit by further investment in the education system. Yet only 5% of AIIA members believe the education system produces job-ready graduates, and almost half (49%) indicated that further training is required by graduates for them to be job-ready.

5.4 Microcredentials and further study

Alongside traditional qualifications, such as undergraduate degrees and VET diplomas, there has been an increasing trend towards shorter courses or microcredentials. The term microcredentials generally refers to smaller learning modules than traditional qualifications and they can contribute towards microdegree or full qualifications. Universities Australia recently released guidance to improve the portability of microcredentials, to encourage further enrolment in these new more flexible forms of study.

Our employee survey found that technology workers were more than twice as likely to have undertaken a short course or microcredential in the past six month compared to professional services workers. Technology workers were also more likely to have undertaken self-directed learning (Chart 5.5). This may reflect the continual changes to the technology sector necessitating continual study by technology workers.

Chart 5.5: Training undertaken in the past six months, for professionals and technology workers



Source: Deloitte Access Economics Employee Survey (2022).

There could be further increases in investment of digital skills, with the 2022-23 federal budget allocating $1.6 billion in tax incentives for small businesses to invest in digital technology, skills and training.[99] Building on Federal Australian Government investments, state governments are incentivising shorter form courses focused on improving digital skills.

The Victorian Government Digital Jobs program funds short courses to support 5,000 reskilling jobseekers, with most of this activity expected to be in short-form, unaccredited, university-level credentials.[100]

Embracing the knowledge of older workers and how to prepare ourselves for the uncertain future: a perspective from the Age Discrimination Commissioner

According to research conducted by the National Skills Commission, in the last 40 years, the proportion of workers aged 55 years and over in the workforce has almost doubled. This equates to an increase in mature age employment of more than 1.86 million over that period. Improvements to health and life expectancy and wanting to maintain social interactions from work have contributed to this increase. Dr Kay Patterson, Age Discrimination Commissioner at the Australian Human Rights Commission, believes many people and businesses have not adjusted to this change. Dr Patterson notes that many policies and practices still rely on an increasingly outdated view of retirement around the age of 65 years old.

Dr Patterson explains workers need to think about what a longer career will mean for them sooner rather than later, pointing out how fast workplaces have changed in recent decades. This need for reskilling is important workers of all ages. Dr Patterson emphasises the need to consider skills that will become increasing important, explaining:

'Many of us have the right skills now, but what is going to be required for your industry in 20 or 30 years? What are the changes around the corner that are going to occur that you are not ready for?'

Beyond reskilling and lifelong learning to have in-demand skills, older workers face additional challenges when they remain in or re-enter the workforce, according to Dr Patterson. Negative stereotypes pertaining to older workers include being less adaptive to change and taking more sick leave. Dr Patterson believes a shift in the mindset towards older workers is required, explaining that there are benefits from having older workers in the workplace.

One benefit is the tacit knowledge older workers have about internal operations or clients that often is not written down or requires years of experience to discern when the knowledge is relevant. Businesses where there is a fast turnover of older workers may risk losing this important information. Businesses who retain older workers also gain a reputational advantage from their staff for demonstrating the value they place on their workers and demonstrations of loyalty. More generally, Dr Patterson explains:

'Encouraging workplaces to tap into the benefits of a multi-generational workforce will enhance productivity of businesses. Older workers have many years of experience behind them. This allows them to contribute a wealth of knowledge to their workplace and mentor younger team members who often have fresh and exciting ideas.'

An increasing number of businesses are recognising the benefits from an older workforce, according to Dr Patterson. A joint survey of the Australian Human Rights Commission and Australian Human Resources Institute of 600 employers found 52% had an age above which they were reluctant to hire in 2014, which dropped down to 27% of businesses in 2021. Dr Patterson also believes skills shortages magnified by COVID-19 and the associated restrictions on migration have highlighted the untapped resource potential of older workers. Going forward, Dr Patterson hopes the recent increase in older workers in the workforce will lead to a greater appreciation of the benefits of having a multi-generational workforce.

To realise the benefits from retaining older workers requires employers to consider flexible working arrangements. Older workers are more likely to work part-time or may have caring responsibilities, which means that having flexible arrangements related to working hours could improve the ability for older workers to participate. Dr Patterson explains:

'In recognising the needs for older workers now, businesses can set themselves up to create an inclusive environment for an important, and growing, segment of Australia's workforce.'

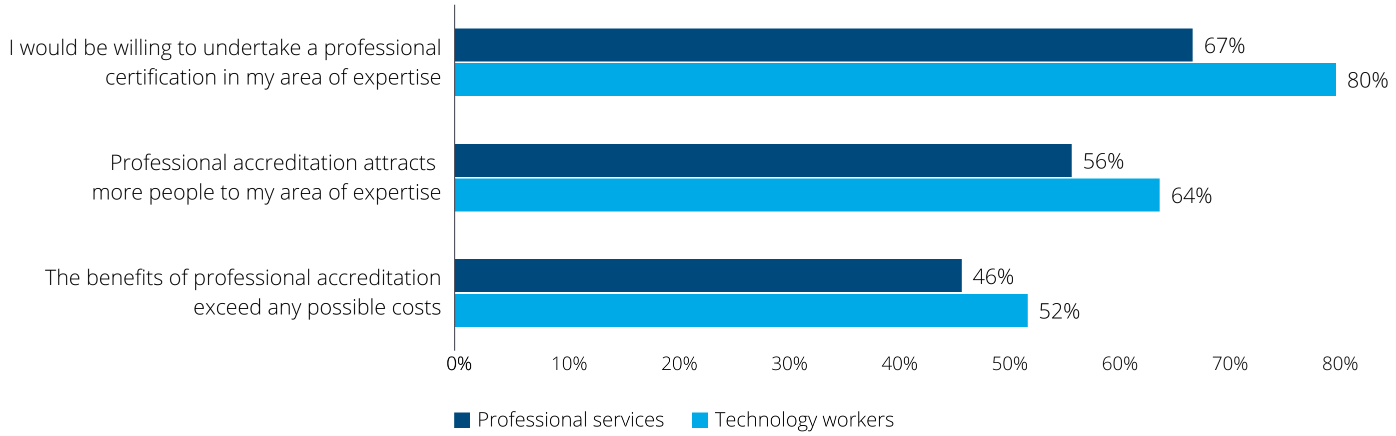
5.5 Professionalisation and upskilling throughout a technology career

In addition to formal qualifications, professionalisation of the technology workforce can encourage upskilling and reskilling through a professional certification. Broadly, 'professionalisation' refers to when individuals of a shared occupation agree to practices for education, continuing professional development (CDP), codes of practice throughout a career and standards for products and services. ACS provides certification in the form of technology-agnostic professional certification through either becoming a Certified Technologist (CT) or a Certified Professional (CP). These professional certifications recognise a broad range of technology skills, capabilities and experience. These certifications differ from vendor certifications that validate expertise in certain products from technology vendors such as Amazon Web Services (AWS) cloud certifications.

Last year's Digital Pulse explored the broader benefits of professionalisation for the workforce related to increased trust with customers, improved capabilities, and efficiencies and innovation from standards.[101] There is evidence that certification could result in significant benefits for individuals, with a US study showing that IT professionals holding certifications can earn up to 5% to 10% more than their peers.[102]

Technology workers recognise the benefits associated with professionalisation, with 80% indicating they are willing to undertake professional certification in their field (see Chart 5.6). This exceeds the proportion of workers in professional services occupations willing to undertake professional certification. Technology workers were also more likely than professional services workers to report that accreditation attracts more people to their fields and that the benefits of professionalisation exceed the costs.

Chart 5.6: Attitudes towards professionalisation for technology workers and professional services workers



Source: Deloitte Access Economics employee survey (2022).

The survey results should be interpreted with some caution. To date, only a very small proportion of the technology workforce are certified professionals. This may reflect a difference in between reported attitudes and realised actions.

Another factor that could be limiting the number of certified professionals could be a lack of demand from employers or significant purchasers of technology goods and services. Almost a third (32%) of technology workers reported that their workplace does not place significant value in professional certification or accreditation. While greater levels of certification in the sector can develop organically through employers and purchasers placing requirements for certification and accreditation, it can be difficult for the demand to displayed when there are not currently high levels of certification.

Deloitte's lead partner for Integrity, Professor Deen Sanders OAM, believes that businesses could be missing out on significant benefits by not encouraging greater levels of professional certification among technology employees. Professor Sanders explains:

'Employers often think about organisation's brand and reputation separately to the brand and reputation of their staff, but having higher levels of certified employees in an organisation builds the brand and reputation of the organisation.'

According to Professor Sanders, a workforce with higher levels of certification may protect organisations from a greater regulatory burden.

A range of regulatory approaches can be employed for an industry or for a specific regulatory issue. Figure 5.2 shows a stylised regulatory spectrum, ranging from no regulation to direct government regulation. While no one regulatory approach will always produce better outcomes than another, as the regulatory approach leans towards direct government regulation, compliance and reporting costs for businesses can increase. There is also a risk that for a fast-changing environment such as technology, direct regulation can be relatively difficult to change.[103]

As professional certification places greater obligations and codes of conduct on individuals to achieve outcomes, an industry with higher levels of certification may result in less direct regulation and greater levels of no regulation and self-regulation.

Professor Sanders notes that by encouraging greater certification among staff, employers may proactively reduce the level of regulation faced by the industry.

Figure 5.2: Different regulatory approaches

No Regulation	Self-Regulation	Quasi-Regulation	Co-Regulation	Direct Government Regulation
No formal agreement on setting rules by industry or government	Industry agreement on setting rules No involvement by government	Industry and government agreement on practices No enforcement mechanisms from government	Industry agreement and design of the regulation Enforcement of regulation by government	Government design of the regulation through legislation Enforcement of regulation by government

Increasing involvement by government in setting and enforcing regulation

Source: Deloitte Access Economics, Australian Law Reform Commission (2012).[104]

6. Enabling sustainable growth in the technology workforce

The number of technology workers in Australia will pass 1 million in 2024 and continue to grow to almost 1.2 million technology workers in Australia by 2027. As discussed in Section 4, increasing diversity within the technology workforce will mean almost 13,900 additional FTE jobs each year on average over the next 20 years.

Meeting the need for additional technology workers will require increasing the supply of workers across the common technology pipelines – including skilled migration, IT graduates and workers transitioning from other sectors of the economy.

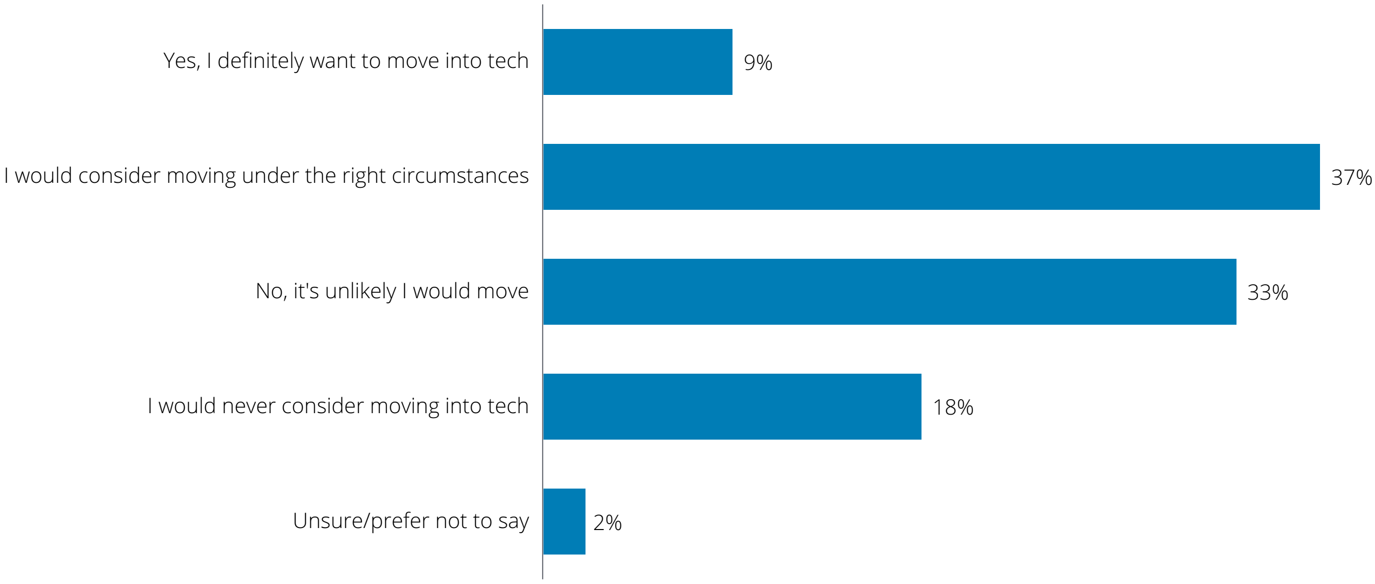
With the number of IT graduates being less than 9,000 per year, upskilling and reskilling more people into technology roles and retaining current technology workers will be critical to sustainable growth in the technology workforce.

This section draws on insights from the employee survey to understand the appetite for moving into a technology occupation and the rationale underpinning the decision to shift careers. The focus of the analysis is on professional services workers who share some of the foundational skills and occupational characteristics of technology workers.

6.1 Smoothing the transition

According to the employee survey, nearly half (47%) of all professional services workers would be interested in moving into a technology occupation. In fact, 9% of professional services workers reported: 'I definitely want to move into tech'. Based on the current number of people employed in professional services sector in 2021, this equates to nearly 120,000 workers interested in joining the technology sector.

Chart 6.1: Intentions to move to technology sector by professional services workers

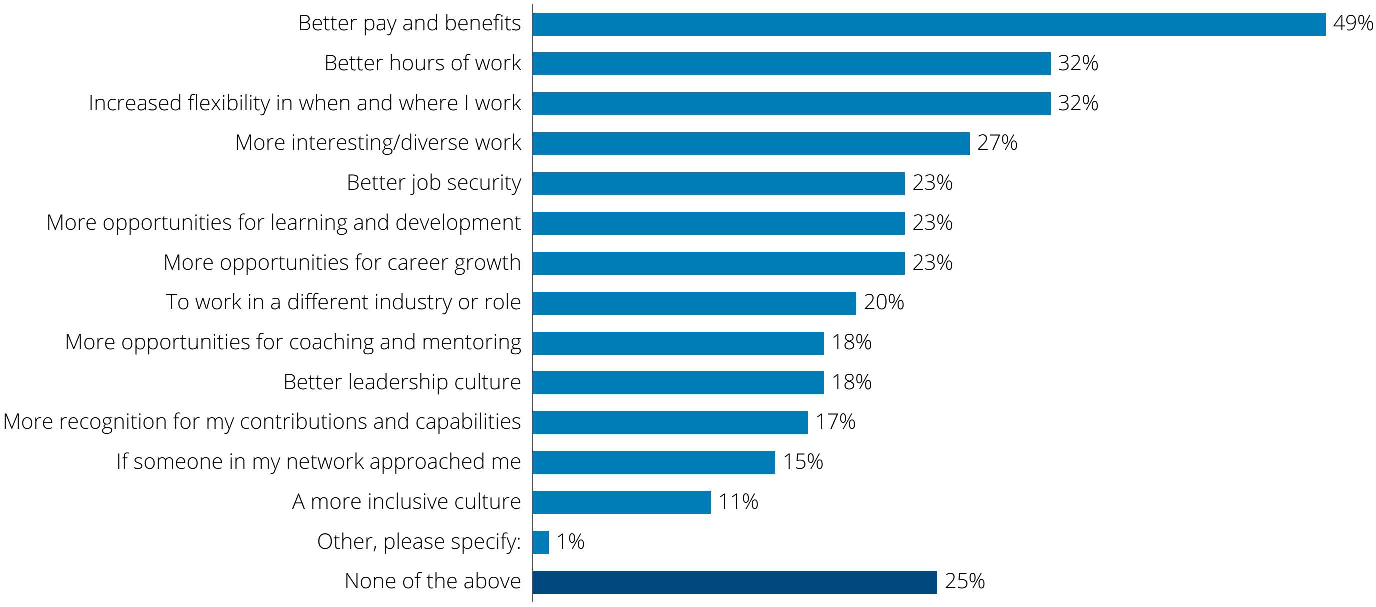


Source: Deloitte Access Economics Employee Survey (2022).

The main reason for considering transitioning into the technology sector included better pay and benefits (selected by 49% of professional services workers), greater flexibility around when and where to work (32%) and better working hours (32%) (see Chart 6.2). On average, technology workers receive better pay with an average wage premium of $11,336 per year as described in the box below.

In contrast, a more inclusive culture and network connections were less commonly selected by professional services workers when considering transitioning into the technology workforce. Yet an inclusive workplace will be important for attracting more professional services workers, and women were almost twice as likely to report that they would never consider moving into a technology occupation (23%), relative to men (12%).

Chart 6.2: Reasons for considering transitioning into the technology sector, for professional services workers



Source: Deloitte Access Economics Employee Survey (2022).

The wage premium for technology workers

Technology workers earn a wage premium of $11,336 per annum on average in 2022 compared to workers employed in the professional services sector according to ABS data.[xviii] This premium has increased from the wage premium in 2020, which was equal to $10,548 per year. These estimates are consistent with research that found learning a digital skill is equivalent to an additional $7,700 increase in wages per worker, per year.[105]

Technology workers also earn a substantial wage premium of $41,490 per year compared to non-technology workers in the economy. This gap is similar to that shown by research from the UK that found the average technology salary is up to 50% higher than the average for all jobs advertised in the UK.[106] However, it should be noted that this premium may also include premiums related to education and skills.

This wage premium represents an opportunity for both professionals from other industries and workers throughout the economy to re-skill in technology knowledge and skills.

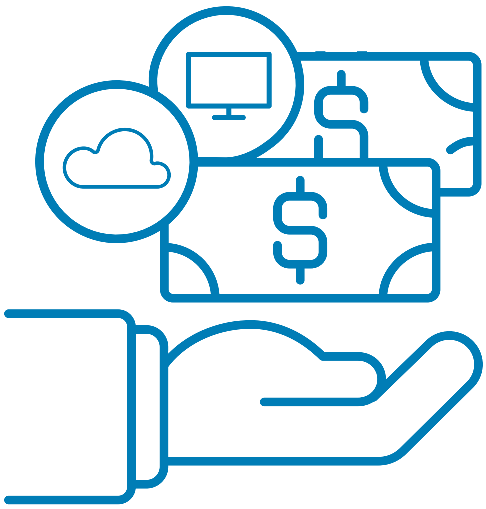
Even during the COVID-19 pandemic and the associated economic restrictions, wages for technology workers grew significantly, rising by 10.4% between 2019 and 2022. This growth rate is comparable to that of growth in professional services more generally (11.8%), which may also reflect a higher level of digital skills required in professional services occupations. In addition, the growth for technology wages clearly outperforms wage growth for all non-ICT occupations (6.9%) during this period.

There are a number of potential explanations for this wage premium.

One reason is the long-term increasing demand for technology workers. Over time, as businesses become increasingly digitalised, they will require highly qualified technology staff who are proficient in specialised areas such as cloud computing, Internet of Things, and cybersecurity.[107] COVID-19 has widened the digital skills gap even further. This is evident in the growing size of the ICT sector explored in Section 2. As a result, competition between growing businesses and a larger number of businesses for talent inevitably drives up the wages to attract and retain talent.[108]

On the supply side, Australia's border controls during COVID-19 drastically reduced the arrival of skilled migrants with digital skills.[109] More generally, the specialised and niche skills that technology workers require can mean some technology workers will be compensated at a higher rate than workers in some occupations in the professional services.[110]

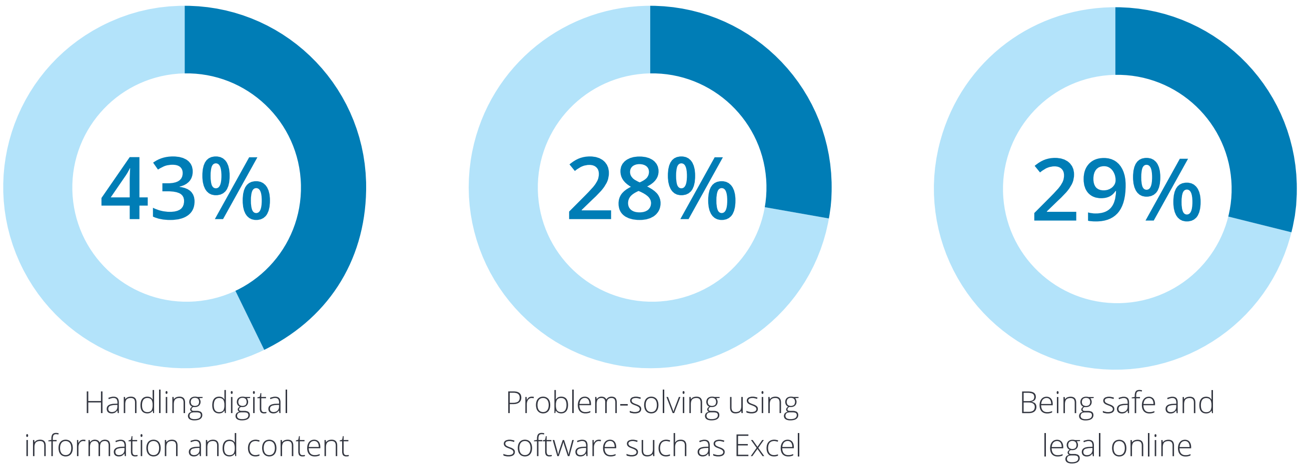
Based on current trends, it appears that the wage premium for technology workers will persist throughout the coming years. Accordingly, the Australian Government has announced several initiatives to encourage the development of digital skills and education, as a part of its vision to transform Australia into a leading digital economy and society by 2030.[111] One notable initiative is the Digital Skills Cadetship, which aims to retrain individuals who are changing careers, have been displaced because of the pandemic, or are returning to the workforce in the in-demand skills of cybersecurity, data analytics and cloud computing.[112]



[xviii] This is calculated as the difference between the average annual wage earned by technology workers ($115,290) and workers employed in professional, scientific and technical services ($103,954) in 2022. This represents a relevant comparison as previous editions of Australia's Digital Pulse have found that one in four technology workers had a previous job that was a non-technology role.

Improving digital skills will be the key to enabling professional services workers to switch careers. Deloitte's employee survey found that less than half of all professional workers feel competent with handing digital information and content (43%), problem-solving using data analysis software (28%), and being safe and legal online (29%).

Figure 6.1: Proportion of professional services workers that reported being proficient in the following skills

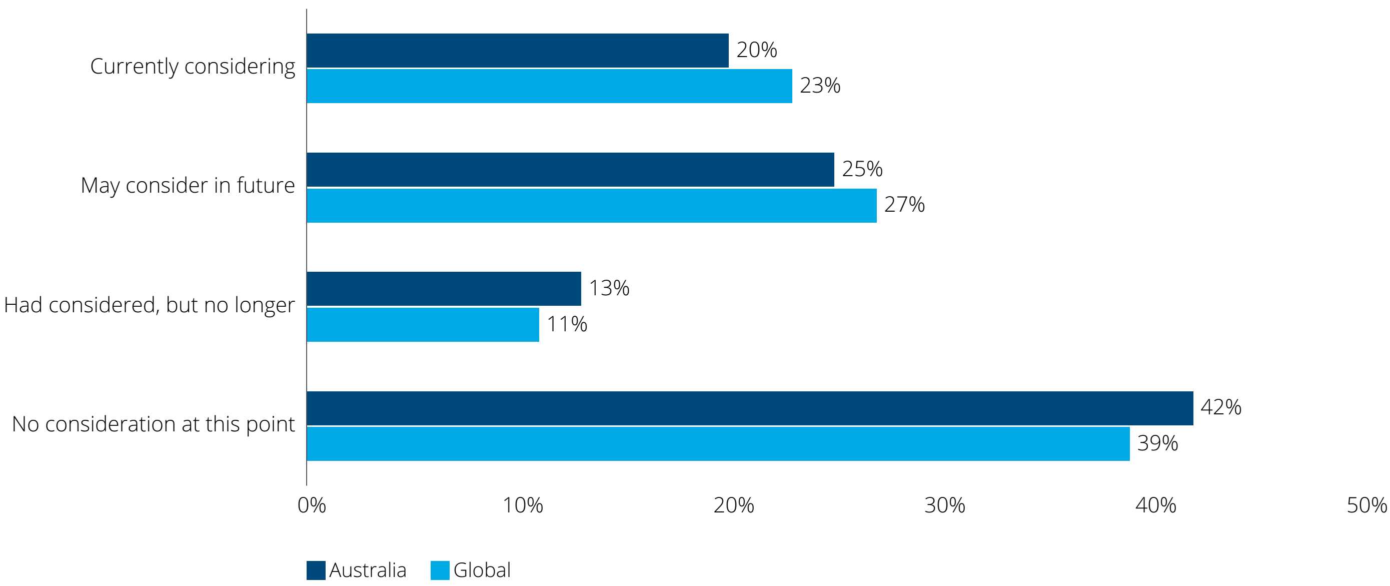


Source: Deloitte Access Economics Employee Survey (2022).

More broadly, addressing the digital skills gap would likely improve the productivity of professional workers in their current role. Previous research by Deloitte found that 26% of businesses reported that their employees' digital literacy skills are out of date.[113]

Research conducted by the Computing Technology Industry Association found that 45% of Australian students were considering or may consider a career in the technology industry (see Chart 6.3),[114] compared to the global average of 50%.[xix]

Chart 6.3: Australian students considering a career in technology



Source: CompTIA (2019).[115]

Some of the perceived barriers reported by students entering the technology sector included a lack of preparation and exposure to technology in school and a lack of mentors or guidance in how to pursue technology-related jobs.

Over a quarter of surveyed students reported limited job opportunities in their local area as well as lack of affordable training options as barriers to entering the technology industry.

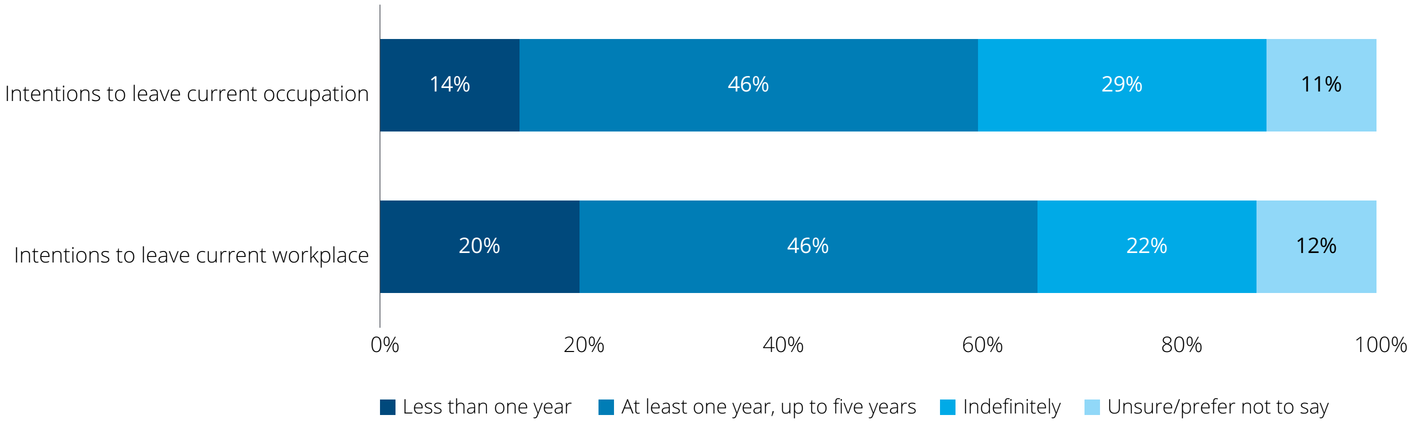
[xix] Participating countries in the research included: Australia, Brazil, Canada, India, Japan, Netherlands, Saudi Arabia, United Arab Emirates, South Africa, United Kingdom and the United States.

6.2 Retaining current workers

According to the employee survey, 20% of technology workers are planning on leaving their current workplace in the next year, while 14% are planning to leave the technology sector altogether within that time frame (see Chart 6.4). These results are similar to those from a recent study which found that 23% of adult Australians were considering leaving their current place of employment.[116]

In fact, less than a third (29%) of technology workers say they will stay in their current occupation indefinitely. With demand for technology workers already elevated and growing, this finding presents a significant risk to businesses that may already be struggling to find workers with the relevant skills.

Chart 6.4: Intentions to leave current occupation and workplace, among technology workers



Source: Deloitte Access Economics Employee survey (2022).

These findings are supported by evidence of an increasing attrition rate in the technology sector, with the proportion of workers leaving the IMT industry in the past year doubling from 4% in 2019 to 8% in 2022.[xx]

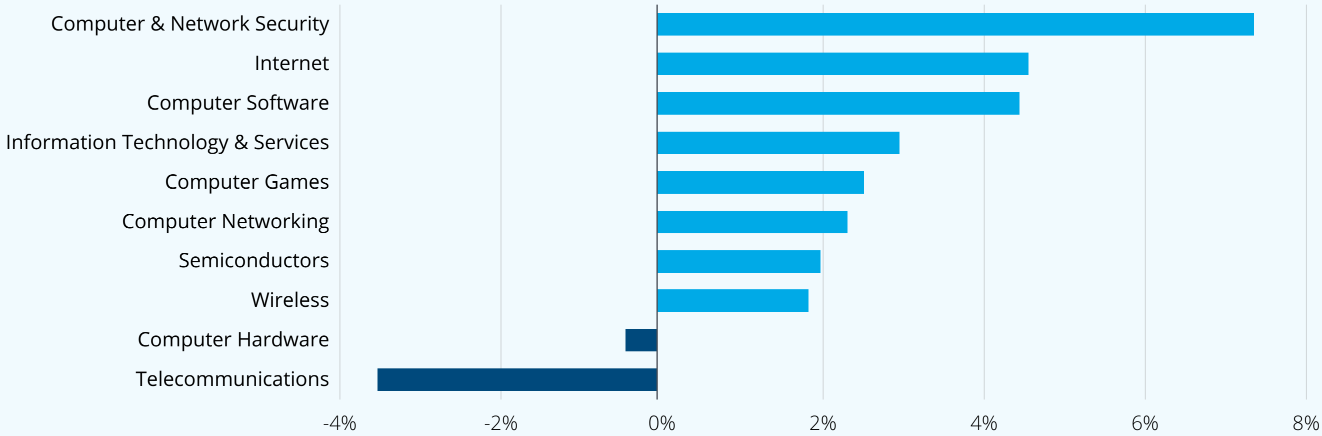
At the same time, the proportion of employed workers across the Australian workforce leaving their industry of employment in the last year only increased from 4% to 5%.[117] While these figures are lower than the stated intentions reported in the employee survey, they do suggest a potentially rising attrition rate.

[xx] While IMT does not directly translate to technology workers due to the presence of the traditional media (see glossary), more granular data was not available from the ABS.

Improving the retention of Australia's technology talent

Incoming migrants and temporary workers are a key source of technology talent for Australia's workforce. According to LinkedIn data, between 2017 to 2020, Australia received net inflows of workers in the majority of technology roles.[xxi] Chart 6.5 shows that the largest net increases were for workers in computer and network security (with 7.5% growth over three years), and Internet (4.6%) and computer software (4.5%). Only computer hardware technicians and telecommunications roles had net outflows of workers during this period.

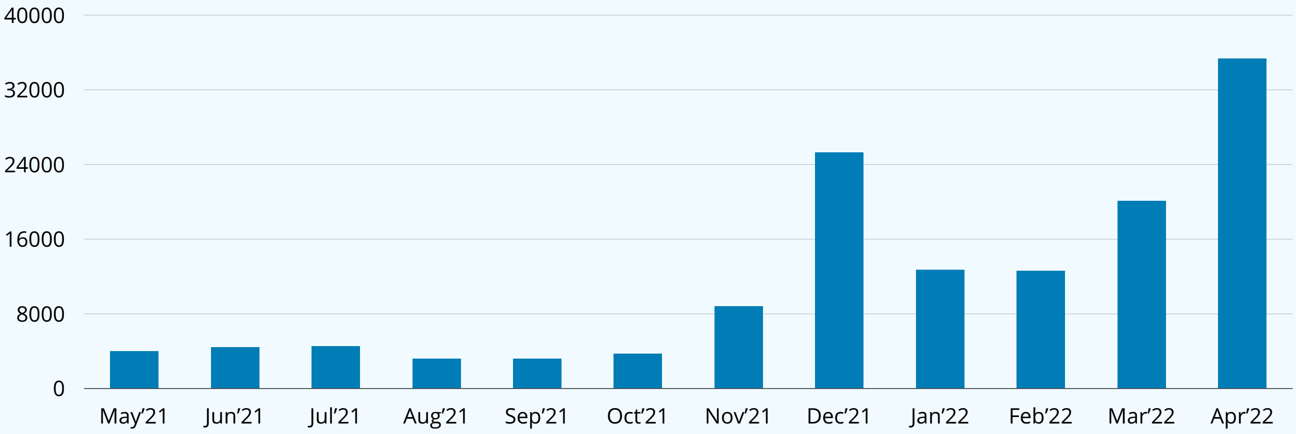
Chart 6.5: Growth from Industry sub-division transitions in Australia



Source: World Bank Group & LinkedIn Corporation (2018).[118]

Even with this net inflow of workers, growth in the technology workforce could be supported further by improving the retention of Australia's technology talent or encouraging those who have left Australia to return. **Chart 6.6 shows work-related departures (consisting of skilled migrants, skilled temporary workers and temporary workers) from Australia recently increased nine-fold, between April 2021 and April 2022, as international travel restrictions eased.** Although departures are still below pre-pandemic levels, their strong growth suggests they will continue to increase in the near future.

Chart 6.6: Work related departures from Australia



Source: Australian Bureau of Statistics (2022).[119]

Technology workers comprise a relatively small share of total work-related departures. Yet between 2011 and 2021, the departures account for approximately 80,000 technology workers. While some of these workers may have since returned to Australia, increasing the proportion that do return to the country could bolster the technology talent in Australia.

Greater consideration of how government could increase retention of Australia's existing technology talent within national borders and attract those who have left the country is required. This will be increasingly important with the global shortage of technology talent estimated to reach more than 85 million technology workers by 2030. To encourage overseas Australians to return, the Australian Government could consider some initiatives trialled overseas such as relocation grants for workers.

[xxi] This metric is calculated on an annual basis, and reported as an average of the last three years. It is built entirely on a sample of LinkedIn members that have a company registered on LinkedIn on their profile.

Improving the retention of the current technology workforce will require employers addressing the concerns of their employees. Our employee survey found that better pay (cited by 39% or technology workers) and the desire for change (33%) are the most common reasons for wanting to leave the technology sector, followed by job security (23%) and insufficient career opportunities (18%).[xxii] With technology roles receiving higher pay on average than other professional services workers, there may be an opportunity for employers to correct some misperceptions about their workforce.

Existing research shows that employees are less likely to look for alternative employment if they have higher levels of job satisfaction. One way to increase job satisfaction is through recognition and appreciation of employees, with employment surveys showing that appreciation was the top driver of employee engagement.[120]

Research links these high levels of employee engagement to both higher levels of retention and lower turnover.[121] In addition, organisations that rated their culture of recognition as high were three times more likely to have increased employee retention.[122]

Another way that organisations can increase retention rates is through coaching and mentoring. A study on millennials found that employees intending to stay with an organisation for more than five years are twice as likely to have a mentor (68%) than not have a mentor (32%), making mentoring one of the most effective ways to increase employee retention. This same study cites communication as a major factor in employee satisfaction. Specifically, the study found that organisations with high levels of employee satisfaction tend to have higher levels of communication (47%) compared to organisations with low levels of employee satisfaction (26%). Therefore, increasing job satisfaction through recognition, mentoring and communication can help to improve the retention of the current technology workforce.

The 1.2 million tech jobs opportunity

Research undertaken by the Tech Council of Australia underscores the importance of the sector to the Australian economy. Analysis by the Tech Council of Australia shows that the number of people employed by the technology sector has increased by 66% since 2005, almost double the rate of growth in employment across the Australian economy during the same period. If the technology sector was considered its own industry, current employment in the technology roles would make the sector Australia's seventh largest employer.

Kate Pounder, CEO of the Tech Council of Australia, explains that the Tech Council also seeks to support future growth in the industry, with a goal for the sector reach 1.2 million people in tech jobs in Australia by 2030. Achieving this goal would require a 40% uplift in employment for the sector above business as usual projections. While historic growth provides some rationale for the target, and the latest analysis in Australia's Digital Pulse 2022 has shown strong growth over the past 12 months, Pounder acknowledges the challenges of maintaining the high growth rate, explaining:

'The current trend of growing employment in the tech sector is promising, and the tech sector offers a diverse range of meaningful, stable and well-paying careers, but supporting 1.2 million Australians to be working in tech jobs by 2030 will require coordinated action by industry, educators and government.'

In particular, the consistent high employment growth in the sector, exacerbated by the restrictions on migration caused by COVID-19, has led to difficulty for businesses in finding additional technology workers. An analysis by the Tech Council of job postings on Indeed found that tech jobs were open for an average of 16% longer on the website than jobs such as financial analyst, accountant and project managers.

While the tech sector offers an incredibly diverse range of career opportunities, there are misconceptions and limited knowledge about the sector. Pounder advises:

'Recent research through the Tech Council has identified there is a lack of understanding about the technology industry in Australia, particularly around what a technology worker does, and the diverse opportunities that exist, with certain stereotypes persisting. And for those who are interested in the sector, there is uncertainty about the pathways into the industry.'

To support jobs growth in the sector, the Technology Council has partnered with the Digital Skills Organisation and major technology employers and educators through the Digital Employment Forum to transform the way Australia attracts and trains our tech workforce. The Digital Employment Forum is focused on supporting strategic workforce planning for tech; identifying innovative approaches to education, training and employment pathways; and strengthening relationships between tech employers and tech educators.

[xxii] Further demographic breakdowns and analysis of responses to this question are presented in Section 4.3.

Appendix A: Statistical compendium

At a glance – Australia

Table A.1: Summary of key national statistics

Indicator	Statistic	Period
Technology workers in Australia (actuals)	870,268	2021
Of which: ICT-related industry subdivisions	390,018	2021
Other industries	480,250	2021
Of which: Technical, professional, management and operational occupations	629,563	2021
Other occupations (including trades and sales)	240,705	2021
Technology workers as proportion of total workforce	6.6%	2021
Forecast size of technology workforce	1,199,270	2027
Inbound temporary migration of technology workers (457 and 482 visas granted)	6,678	2020–21
Net migration inflow of technology workers	20,664	2015–16
Women as a proportion of technology workers	31%	2021
Older workers (aged 55+) as a proportion of technology workers	14%	2021
Businesses' ICT research and development expenditure	$7.09bn	2019–20
Total ICT service exports	$5.09bn	2020–21
Total ICT service imports	$4.43bn	2020–21
IT university enrolments by domestic students	47,522	2020
IT university completions by domestic students	8,647	2020
IT university enrolments by international students	73,532	2020
IT university completions by international students	23,109	2020

Source: ABS catalogue 5368.0 (2022); Labour Force Estimates customised tables (2022); Employee Earnings and Hours, Australia (2021); 5368.0 (2022) and 8104.0 (2022) and customised report (2022); Department of Education, Skills and Employment Student Data (2021); Department of Home Affairs Temporary Work (Skilled) Visa Program pivot table (2021).

At a glance – states and territory

Table A.2: Summary of key state statistics

Indicator	NSW	Vic	Qld	SA	WA	Tas	ACT	NT
Technology workers in Australia (2021)	331,516	271,474	114,738	42,376	60,404	9,663	35,209*	4,889*
Of which: ICT-related industry subdivisions	157,196	117,566	54,300	18,047	24,865	3,647	N/A	N/A
Other industries	174,320	153,908	60,438	24,328	35,539	6,016	N/A	N/A
Of which: Technical, professional, management and operational occupations	238,150	200,109	79,416	31,138	42,018	6,783	20,748*	3,376*
Other occupations (including trades and sales)	93,366	71,365	35,321	11,238	18,386	2,880	5,874*	956*
Technology workers as proportion of total workforce (2021)	8.1%	7.9%	4.4%	4.9%	4.3%	3.7%	N/A	N/A
IT university enrolments by domestic students (2020)	16,133	15,468	8,331	3,010	2,480	353	1,497	190
IT university completions by domestic students (2020)	2,647	2,113	1,150	325	385	54	300	7

* While the 2021 labour force data from the ABS contained combined figures for the NT and the ACT for confidentiality reasons, NT employment has been separated from ACT employment at an aggregate and occupational level using the Deloitte Access Economics employment forecast model.

Source: ABS customised report (2022), Deloitte Access Economics (2022) and Department of Education, Skills and Employment Student Data (2021).

At a glance – ICT employment

Table A.3: CIIER classification of technology workers at the four-digit Australian and New Zealand Standard Classification of Occupations (ANZSCO) level

ICT management and operations
1351 ICT managers
2232 ICT trainers
2247 management and organisation analysts
2249 other information and organisation professionals
2621 database and systems administrators, and ICT security specialists
2632 ICT support and test engineers
ICT technical and professional
2324 graphic and web designers, and illustrators
2611 ICT business and systems analysts
2612 multimedia specialists and web developers
2613 software and applications programmers
2631 computer network professionals
2633 telecommunications engineering professionals
3132 telecommunications technical specialists
2600 ICT professionals nfd
2610 business and systems analysts, and programmers nfd
2630 ICT network and support professionals nfd
3130 ICT and telecommunications technicians nfd

ICT sales
2252 ICT sales professionals
6212 ICT sales assistants
ICT trades
3131 ICT support technicians
3424 telecommunications trades workers
Electronic trades and professional*
3123 electrical engineering draftspersons and technicians*
3124 electronic engineering draftspersons and technicians*
3423 electronics trades workers*
ICT industry admin and logistics support*
All other occupations where the employee works in an ICT-related industry subdivision (telecommunications services; internet service providers, web search portals and data processing services; and computer system design and related services)

* For these occupations, only workers employed in the ICT-related industry subdivisions (telecommunications services; Internet service providers, web search portals and data processing services; and computer system design and related services) are counted as technology workers

Sources: Australian Computer Society and CIIER (2022).

Table A.4: OECD's broad measure of ICT-skilled employment at the four-digit ANZSCO level

1111 chief executives and managing directors	2349 other natural and physical science professionals
1112 general managers	2512 medical imaging professionals
1311 advertising and sales managers	2600 ICT professionals nfd
1320 business administration managers not further defined (nfd)	2610 business and systems analysts, and programmers nfd
1322 finance managers	2611 ICT business and systems analysts
1323 human resource managers	2612 multimedia specialists and web developers
1324 policy and planning managers	2613 software and applications programmers
1332 engineering managers	2621 database and systems administrators, and ICT security specialists
1335 production managers	2630 ICT network and support professionals nfd
1336 supply and distribution managers	2631 computer network professionals
1351 ICT managers	2632 ICT support and test engineers
1419 other accommodation and hospitality managers	2633 telecommunications engineering professionals
1494 transport services managers	2710 legal professionals nfd
2210 accountants, auditors and company secretaries nfd	2711 barristers
2211 accountants	2712 judicial and other legal professionals
2212 auditors, company secretaries and corporate treasurers	2713 solicitors
2220 financial brokers and dealers, and investment advisers nfd	3100 engineering, ICT and science technicians nfd
2221 financial brokers	3123 electrical engineering draftspersons and technicians
2222 financial dealers	3124 electronic engineering draftspersons and technicians
2223 financial investment advisers and managers	3130 ICT and telecommunications technicians nfd
2232 ICT trainers	3131 ICT support technicians
2241 actuaries, mathematicians and statisticians	3132 telecommunications technical specialists

2242 archivists, curators and records managers	3400 electrotechnology and telecommunications trades workers nfd
2243 economists	3420 electronics and telecommunications trades workers nfd
2244 intelligence and policy analysts	3423 electronics trades workers
2246 librarians	5100 office managers and program administrators nfd
2247 management and organisation analysts	5121 office managers
2249 other information and organisation professionals	5122 practice managers
2251 advertising and marketing professionals	5211 personal assistants
2252 ICT sales professionals	5212 secretaries
2320 architects, designers, planners and surveyors nfd	5321 keyboard operators
2321 architects and landscape architects	5510 accounting clerks and bookkeepers nfd
2322 cartographers and surveyors	5511 accounting clerks
2326 urban and regional planners	5512 bookkeepers
2331 chemical and materials engineers	5513 payroll clerks
2332 civil engineering professionals	5521 bank workers
2333 electrical engineers	5522 credit and loans officers
2334 electronics engineers	5523 insurance, money market and statistical clerks
2335 industrial, mechanical and production engineers	6111 auctioneers, and stock and station agents
2336 mining engineers	6112 insurance agents
2341 agricultural and forestry scientists	6212 ICT sales assistants
2342 chemists, and food and wine scientists	6399 other sales support workers
2343 environmental scientists	7123 engineering production systems workers
2344 Geologists and geophysicists	2349 other natural and physical science professionals
2345 life scientists	

Source: OECD (2012).

Table A.5: Technology workers by industry and CIIER occupational grouping, 2021

	ICT management and operations	ICT technical and professional	ICT sales	ICT trades	Electronic trades and professional	ICT industry admin and logistics support	Total technology
Industry divisions	**workers**						
Agriculture, forestry and fishing	657	476	150	-	-	-	1,284
Mining	4,066	3,945	-	827	-	-	8,839
Manufacturing	10,155	11,357	455	1,788	-	-	23,756
Electricity, gas, water and waste services	5,778	5,037	342	712	-	-	11,869
Construction	2,092	2,743	86	3,028	-	-	7,949
Wholesale trade	4,526	7,584	2,867	2,486	-	-	17,463
Retail trade	8,029	8,189	6,709	3,191	–	–	26,118
Accommodation and food services	1,241	1,525	–	358	–	–	3,124

	ICT management and operations	ICT technical and professional	ICT sales	ICT trades	Electronic trades and professional	ICT industry admin and logistics support	Total technology
Transport, postal and warehousing	10,634	6,276	–	1,650	–	–	18,560
Rest of information media and telecommunications*	1,699	6,688	-	737	–	–	9,124
Financial and insurance services	40,413	31,662	315	4,343	–	–	76,733
Rental, hiring and real estate services	3,134	2,201	128	691	–	–	6,154
Rest of professional, scientific and technical services**	58,705	50,268	720	3,911	–	–	113,604
Administrative and support services	6,036	5,228	344	1,056	–	–	12,665
Public administration and safety	42,677	23,435	341	7,283	–	–	73,736
Education and training	10,071	11,221	–	6,938	–	–	28,231
Healthcare and social assistance	10,056	7,858	179	3,859	–	–	21,953
Arts and recreation services	3,201	6,034	96	637	–	–	9,968
Other services	3,052	2,118	552	3,398	–	–	9,121
ICT industry subdivisions							
Telecommunications services	9,938	17,825	6,226	10,026	1,195	32,101	77,311
Internet service providers, web search portals and data processing services	1,387	1,586	286	793	132	5,450	9,634
Computer system design and related services	51,301	123,551	16,982	30,235	2,575	78,427	303,072
Total technology workers	**288,851**	**336,809**	**36,778**	**87,948**	**3,903**	**115,979**	**870,268**

* Excluding telecommunications services, and internet service providers, web search portals and data processing services, which are separately identified as ICT industry subdivisions.

** Excluding computer system design and related services, which is separately identified as an ICT industry subdivision.

Source: ABS customised report (2022).

Table A.6: Technology employment forecasts by occupation grouping, 2021 to 2027

Occupation grouping	2021	2027	Average annual growth (%)
ICT management and operations	288,851	414,160	6.2
ICT technical and professional	336,809	492,788	6.5
ICT sales	36,778	37,376	0.3
ICT trades	87,948	110,354	3.9
Electronic trades and professional*	3,093	4,980	4.1
ICT industry admin and logistics support*	115,979	139,611	3.1
Total technology workers	**870,268**	**1,199,270**	**5.5**

* Employment in these occupations has only been counted for the ICT-related industry subdivisions, consistent with the definitions in Table A.3.

Source: Deloitte Access Economics (2022).

Table A.7: Technology skills forecasts by occupation grouping, 2021 to 2027

	2021	2027	Average annual growth (%)
ICT management and operations			
Postgraduate	114,215	172,285	7.1
Undergraduate	205,522	303,799	6.7
Diploma or Advanced Diploma	82,087	121,371	6.7
Certificate III or IV	47,494	68,061	6.2
Certificate I or II	23,373	34,248	6.6
ICT technical and professional			
Postgraduate	113,058	175,760	7.6
Undergraduate	261,091	395,668	7.2
Diploma or Advanced Diploma	90,887	136,460	7.0
Certificate III or IV	45,493	66,193	6.4
Certificate I or II	23,144	34,243	6.7
ICT sales			
Postgraduate	7,279	7,757	1.1
Undergraduate	17,085	18,262	1.1
Diploma or Advanced Diploma	7,049	7,294	0.6
Certificate III or IV	5,115	5,071	-0.1
Certificate I or II	2,674	2,678	0.0
ICT trades			
Postgraduate	29,173	38,778	4.9
Undergraduate	55,095	67,778	3.5
Diploma or Advanced Diploma	27,269	33,390	3.4
Certificate III or IV	31,957	39,986	3.8
Certificate I or II	14,402	17,171	3.0

	2021	2027	Average annual growth (%)
Electronic trades and professional*			
Postgraduate	375	535	6.1
Undergraduate	911	1,222	5.0
Diploma or Advanced Diploma	1,040	1,354	4.5
Certificate III or IV	1,948	2,599	4.9
Certificate I or II	685	877	4.2
ICT industry admin and logistics support*			
Postgraduate	21,797	26,718	3.5
Undergraduate	46,682	57,166	3.4
Diploma or Advanced Diploma	24,749	30,738	3.7
Certificate III or IV	23,140	28,177	3.3
Certificate I or II	9,898	12,046	3.3

* Employment in these occupations has only been counted for the ICT-related industry subdivisions, consistent with the definitions in Table A.3.

Source: Deloitte Access Economics (2022).

Technology worker migration

Table A.8: Temporary skilled migration (457 and 482) visa grants for technology occupations, 2014–15 to 2020–21

	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
1351 ICT managers	939	918	852	524	708	437	258
2232 ICT trainers	10	15	22	16	28	16	13
2247 management and organisation analysts	1,445	1,345	1,362	990	1,218	974	497
2249 other information and organisation professionals	452	399	350	177	183	171	182
2252 ICT sales professionals	527	531	604	376	557	405	302
2324 graphic and web designers, and illustrators	472	411	459	220	219	128	115
2611 ICT business and items analysts	2,098	2,208	2,125	1,709	2,334	1,579	747
2612 multimedia specialists and web developers	162	133	121	55	106	97	73
2613 Software and applications programmers	5,231	4,984	4,909	3,900	5,241	3,023	3,060
2621 Database and systems administrators, and ICT security specialists	383	385	424	269	383	267	157
2631 Computer network professionals	272	260	294	257	469	289	145
2632 ICT support and test engineers	767	854	864	829	956	705	665
2633 telecommunications engineering professionals	127	99	81	48	70	71	46
3123 electrical engineering draftspersons and technicians	351	353	305	177	234	206	155

	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
3124 electronic engineering draftspersons and technicians	112	91	71	N/A	N/A	N/A	N/A
3131 ICT support technicians	320	291	273	143	176	134	101
3132 telecommunications technical specialists	52	43	79	99	155	75	64
3423 electronic trades workers	115	80	94	90	168	100	72
3424 telecommunications trades workers	102	121	117	38	45	18	26
Total technology workers*	**13,937**	**13,521**	**13,406**	**9,917**	**13,250**	**8,695**	**6,678**

* Excludes ICT industry admin and logistics support, for which breakdowns are unavailable; electronic trades and professional data is for all industries.

Source: Department of Home Affairs 457 and 482 Visa Statistics (2021).

ICT higher and vocational education

Table A.9: Domestic enrolments and completions in IT degrees, 2001 to 2020

	Course enrolments		Course completions	
	Undergraduate	**Postgraduate**	**Undergraduate**	**Postgraduate**
2001	35,661	10,161	5,451	2,850
2002	36,647	10,280	6,219	3,294
2003	35,172	9,118	6,580	2,588
2004	31,323	8,139	6,283	2,272
2005	26,527	6,923	5,696	1,976
2006	22,762	6,101	4,672	1,642
2007	20,709	5,488	4,185	1,474
2008	18,905	5,077	3,577	1,349
2009	18,545	5,143	3,159	1,315
2010	18,966	5,213	3,050	1,275
2011	19,902	5,386	3,266	1,353
2012	21,047	5,562	3,339	1,326
2013	22,055	5,447	3,463	1,423
2014	23,829	5,560	3,638	1,468
2015	25,700	5,438	3,949	1,491
2016	26,596	5,774	3,985	1,517
2017	29,993	6,342	4,405	1,553
2018	32,188	6,875	4,695	1,638
2019	33,756	7,713	5,108	1,890
2020	36,560	10,962	5,561	3,086

Source: Department of Education, Skills and Employment Student Data (2021).

Table A.10: International enrolments and completions in IT degrees, 2001 to 2020

	Course enrolments		Course completions	
	Undergraduate	**Postgraduate**	**Undergraduate**	**Postgraduate**
2001	17,009	10,225	2,993	3,558
2002	20,843	11,238	4,157	4,821
2003	21,701	11,087	5,659	4,337
2004	20,683	12,638	6,010	3,586
2005	17,480	13,512	5,213	5,428
2006	15,475	11,580	5,021	5,635
2007	14,415	10,265	4,433	4,258
2008	14,236	10,964	3,715	4,369
2009	15,113	12,104	3,851	4,009
2010	15,018	11,435	4,120	5,037
2011	15,108	9,452	3,996	4,528
2012	14,495	8,992	3,749	3,385
2013	13,978	10,908	3,673	3,223
2014	14,152	13,742	3,617	3,573
2015	14,217	15,406	3,516	4,537
2016	16,063	17,953	3,602	5,263
2017	19,488	24,368	4,046	5,604
2018	25,314	35,664	5,007	8,392
2019	31,831	43,840	5,941	12,420
2020	33,405	40,127	7,254	15,855

Source: Department of Education, Skills and Employment Student Data (2021).

Table A.11: Government-funded VET subject enrolments in the IT field of education, 2015 to 2020

	2015	2016	2017	2018	2019	2020
Diploma or higher	26,285	27,790	17,970	15,805	18,190	19,030
Certificate IV	11,080	10,765	10,870	11,170	12,305	13,235
Certificate III	15,965	14,285	14,085	12,930	12,355	12,715
Certificate II	16,755	13,305	12,970	10,425	9,730	8,610
Certificate I	19,840	16,310	14,740	12,085	11,805	10,185

Women in technology

Table A.12: Female technology workers by industry, 2021

	Female technology workers	Percentage of female technology workers	Percentage of female workers in all occupations
Industry divisions			
Agriculture, forestry and fishing	395	31%	34%
Mining	2,202	25%	18%
Manufacturing	8,723	37%	29%
Electricity, gas, water and waste services	4,628	39%	25%
Construction	1,353	17%	13%
Wholesale trade	5,799	33%	34%
Retail trade	8,401	32%	54%
Accommodation and food services	1,304	42%	55%
Transport, postal and warehousing	5,121	28%	22%
Rest of information media and telecommunications*	3,658	40%	44%
Financial and insurance services	24,900	32%	48%
Rental, hiring and real estate services	2,569	42%	48%
Rest of professional, scientific and technical services**	39,782	35%	44%
Administrative and support services	4,329	34%	49%
Public administration and safety	23,945	32%	48%
Education and training	9,612	34%	72%
Healthcare and social assistance	8,969	41%	77%
Arts and recreation services	2,864	29%	47%
Other services	3,071	34%	45%
ICT industry subdivisions			
Telecommunications services	24,347	31%	31%
Internet service providers, web search portal and data processing services	3,960	41%	41%
Computer system design and related services	79,208	26%	26%
Total technology workers*	**269,142**	**31%**	**48%**

* Excluding telecommunications services, and internet service providers, web search portals and data processing services, which are separately identified as ICT industry subdivisions.

** Excluding computer system design and related services, which is separately identified as an ICT industry subdivision.

Source: ABS customised report (2022)

Older technology workers

Table A.13: Older technology workers by CIIER occupation grouping, 2021

	Number of ICT workers aged 55+	Percentage of total technology workforce
ICT management and operations	49,073	17%
ICT technical and professional	35,461	11%
ICT sales	4,125	11%
ICT trades	9,144	10%
Electronic trades and professional	8,659	24%
Total technology workers*	106,463	14%

* Excludes ICT industry admin and logistics support, for which breakdowns are unavailable; electronic trades and professional data is for all industries.

Source: ABS customised report (2022).

ICT research and development

Table A.14: Business expenditure on R&D, 2011–12 to 2019–20

	2011–12	2013–14	2015–16	2017–18	2019–20
Information and computing sciences	5,496,165	6,073,221	6,634,394	6,747,648	7,092,231
Engineering	8,686,256	7,474,231	5,538,180	4,710,279	5,268,259
Biomedical and clinical services	–	–	–	–	2,190,039
Agricultural and veterinary sciences	455,372	553,754	632,619	654,046	1,255,252
Commerce, management, tourism and services	144,273	227,088	152,082	150,551	468,221
Chemical sciences	425,941	565,758	404,003	431,150	328,353
Built environment and design	231,743	238,591	166,626	162,413	291,514
Environmental sciences	281,155	270,044	158,043	170,354	273,188
Biological sciences	112,724	150,686	88,597	231,970	252,197
Health sciences	941,159	1,123,956	1,253,415	1,958,471	212,287
Other fields of research	1,464,642	2,170,273	1,630,943	2,219,625	539,084

Source: ABS, Research and Experimental Development, Businesses, Australia (2021).

Table A.15: Government expenditure on ICT R&D, 2011–12 to 2018–19

	2011–12	2013–14	2015–16	2017–18	2018–19
Commonwealth ICT R&D expenditure	$314,437,000	$240,828,000	$247,462,000	$254,504,000	$262,306,000
Commonwealth ICT share of R&D expenditure	13%	10%	11%	12%	12%
State and territory ICT R&D expenditure	$8,596,000	$12,778,000	$20,882,000	$38,627,000	$2,496,000
State and territory ICT share of R&D expenditure	1%	1%	2%	3%	0.2%

Source: ABS catalogue 8109.0 (2020).

Trade in ICT services

Table A.16: Exports and imports of ICT services, 2012–13 to 2020–21 ($bn)

	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
Exports	1.91	2.08	2.50	2.78	2.93	3.60	4.36	4.99	5.09
Imports	1.87	2.50	2.59	2.88	2,74	3,14	3,72	4.67	4.43

Source: ABS catalogue 5368.0 (2022).

Detailed state figures

Table A.17: State breakdown of technology workers by industry, 2021

	NSW	Vic	Qld	SA	WA	Tas	ACT*	NT*
Industry divisions								
Agriculture, forestry and fishing	150	652	320	122	–	–	N/A	N/A
Mining	822	265	2,297	592	4,773	31	N/A	N/A
Manufacturing	10,580	6,346	3,226	1,566	1,576	157	N/A	N/A
Electricity, gas, water and waste services	2,238	4,908	2,403	106	1,557	422	N/A	N/A
Construction	2,270	2,256	1,425	761	1,043	23	N/A	N/A
Wholesale trade	6,555	5,457	3,836	702	468	161	N/A	N/A
Retail trade	11,178	9,154	2,449	1,297	1,330	245	N/A	N/A
Accommodation and food services	2,016	528	513	66	–	–	N/A	N/A
Transport, postal and warehousing	5,561	7,856	3,319	658	857	154	N/A	N/A
Rest of information media and telecommunications**	3,732	3,935	477	234	540	114	N/A	N/A
Financial and insurance services	39,815	26,664	4,838	2,697	2,089	360	N/A	N/A
Rental, hiring and real estate services	2,547	2,213	938	270	99	87	N/A	N/A
Rest of professional, scientific and technical services***	39,007	38,290	13,474	5,472	10,204	1,574	N/A	N/A
Administrative and support services	4,728	4,519	2,014	605	388	23	N/A	N/A
Public administration and safety	20,489	16,308	8,282	6,218	5,426	1,486	N/A	N/A
Education and training	8,902	10,801	3,285	1,520	2,159	680	N/A	N/A
Healthcare and social assistance	7,010	7,568	3,966	821	1,916	315	N/A	N/A
Arts and recreation services	3,437	3,847	1,707	117	513	88	N/A	N/A
Other services	3,283	2,341	1,670	504	600	96	N/A	N/A
ICT industry subdivisions								
Telecommunications services	27,997	25,834	12,068	4,049	4,318	1,288	N/A	N/A
Internet service providers, web search portals and data processing services	4,105	3,541	847	252	526	186	N/A	N/A
Computer design and related services	125,095	88,190	41,385	13,747	20,021	2,173	N/A	N/A
Total technology workers	**331,516**	**271,474**	**114,738**	**42,376**	**60,404**	**9,663**	**30,948***	**4,497***

* While the 2021 labour force data from the ABS contained combined figures for the NT and the ACT for confidentiality reasons, NT employment has been separated from ACT employment at an aggregate level using the Deloitte Access Economics employment forecast model.

** Excluding telecommunications services, and internet service providers, web search portals and data processing services, which are separately identified as ICT industry subdivisions.

*** Excluding computer system design and related services, which is separately identified as an ICT industry subdivision.

Sources: ABS customised report (2022), Deloitte Access Economics (2022).

Table A.18: Australian Capital Territory's technology employment forecasts by CIIER occupation grouping, 2021–27*

	2021	2027	Change	Average annual growth rate (%)
ICT management and operations	14,157	21,475	7,318	7.2
ICT technical and professional	13,924	19,163	5,239	5.5
ICT sales	560	451	-109	-3.5
ICT trades	4,162	5,073	911	3.4
Electronic trades and professional**	37	60	23	8.6
ICT industry admin and logistics support**	2,369	2,440	71	0.5
Total technology workers	**35,209**	**48,662**	**13,453**	**5.5**

* While the 2019 labour force data from the ABS contained combined figures for the NT and the ACT for confidentiality reasons, NT employment forecasts have been produced separately from ACT employment forecasts using the Deloitte Access Economics employment forecast model.

** Employment in these occupations has only been counted for the ICT-related industry subdivisions, consistent with the definitions in Table A.3.

Source: Deloitte Access Economics (2022).

Table A.19: New South Wales's technology employment forecasts by CIIER occupation grouping, 2021–27

	2021	2026	Change	Average annual growth rate (%)
ICT management and operations	113,585	167,874	54,289	6.7
ICT technical and professional	122,856	181,926	59,070	6.8
ICT sales	14,884	14,796	-88	-0.1
ICT trades	28,822	38,710	9,888	5.0
Electronic trades and professional*	1,709	1,824	115	1.1
ICT industry admin and logistics support*	49,660	64,742	15,081	4.5
Total technology workers	**331,516**	**469,871**	**138,355**	**6.0**

* Employment in these occupations has only been counted for the ICT-related industry subdivisions, consistent with the definitions in Table A.3.

Source: Deloitte Access Economics (2022).

Table A.20: Northern Territory's technology employment forecasts by CIIER occupation grouping, 2021–27*

	2021	2026	Change	Average annual growth rate (%)
ICT management and operations	2,230	3,382	1,152	7.2
ICT technical and professional	1,586	2,189	603	5.5
ICT sales	145	118	-27	-3.4
ICT trades	588	715	126	3.3
Electronic trades and professional**	16	25	9	8.0
ICT industry admin and logistics support**	324	329	6	0.3
Total technology workers	**4,889**	**6,758**	**1,869**	**5.5**

* While the 2019 labour force data from the ABS contained combined figures for the NT and the ACT for confidentiality reasons, NT employment forecasts have been produced separately from ACT employment forecasts using the Deloitte Access Economics employment forecast model.

** Employment in these occupations has only been counted for the ICT-related industry subdivisions, consistent with the definitions in Table A.3.

Source: Deloitte Access Economics (2022).

Table A.21: Queensland's technology employment forecasts by CIIER occupation grouping, 2021–27

	2021	2027	Change	Average annual growth rate (%)
ICT management and operations	36,088	48,989	12,901	5.2
ICT technical and professional	42,815	61,107	18,292	6.1
ICT sales	4,688	4,612	-76	-0.3
ICT trades	15,762	20,885	5,123	4.8
Electronic trades and professional*	513	725	212	5.9
ICT industry admin and logistics support*	14,872	16,472	1,600	1.7
Total technology workers	**114,738**	**152,790**	**38,053**	**4.9**

* Employment in these occupations has only been counted for the ICT-related industry subdivisions, consistent with the definitions in Table A.3.
Source: Deloitte Access Economics (2022).

Table A.22: South Australia's technology employment forecasts by CIIER occupation grouping, 2021–27

	2021	2027	Change	Average annual growth rate (%)
ICT management and operations	15,060	20,622	5,562	5.4
ICT technical and professional	15,629	22,653	7,024	6.4
ICT sales	1,510	1,457	-53	-0.6
ICT trades	5,025	5,756	732	2.3
Electronic trades and professional*	449	490	41	1.5
ICT industry admin and logistics support*	4,703	5,166	463	1.6
Total technology workers	**42,376**	**56,144**	**13,769**	**4.8**

* Employment in these occupations has only been counted for the ICT-related industry subdivisions, consistent with the definitions in Table A.3.
Source: Deloitte Access Economics (2022).

Table A.23: Tasmania's technology employment forecasts by CIIER occupation grouping, 2021–27

	2021	2027	Change	Average annual growth rate (%)
ICT management and operations	2,944	3,509	565	3.0
ICT technical and professional	3,805	5,914	2,109	7.6
ICT sales	401	396	-4	-0.2
ICT trades	1,460	1,515	55	0.6
Electronic trades and professional*	34	28	-6	-2.9
ICT industry admin and logistics support*	1,019	986	-33	-0.6
Total technology workers	**9,663**	**12,348**	**2,685**	**4.2**

* Employment in these occupations has only been counted for the ICT-related industry subdivisions, consistent with the definitions in Table A.3.
Source: Deloitte Access Economics (2022).

Table A.24: Victoria's technology employment forecasts by CIIER occupation grouping, 2021–27

	2021	2027	Change	Average annual growth rate (%)
ICT management and operations	85,940	125,733	39,792	6.5
ICT technical and professional	113,367	161,601	48,234	6.1
ICT sales	12,807	13,902	1,095	1.4
ICT trades	24,126	28,836	4,710	3.0
Electronic trades and professional**	801	1,617	816	12.4
ICT industry admin and logistics support**	34,432	38,282	3,850	1.8
Total technology workers	**271,474**	**369,970**	**98,497**	**5.3**

* Employment in these occupations has only been counted for the ICT-related industry subdivisions, consistent with the definitions in Table A.3.

Source: Deloitte Access Economics (2022).

Table A.25: Western Australia's technology employment forecasts by CIIER occupation grouping, 2021–27

	2021	2027	Change	Average annual growth rate (%)
ICT management and operations	18,847	22,578	3,731	3.1
ICT technical and professional	22,826	38,236	15,409	9.0
ICT sales	1,783	1,642	-141	-1.4
ICT trades	8,003	8,865	861	1.7
Electronic trades and professional**	345	211	-133	-7.8
ICT industry admin and logistics support**	8,600	11,194	2,594	4.5
Total technology workers	**60,404**	**82,726**	**22,322**	**5.4**

* While the 2019 labour force data from the ABS contained combined figures for the NT and the ACT for confidentiality reasons, NT employment forecasts have been produced separately from ACT employment forecasts using the Deloitte Access Economics employment forecast model.

** Employment in these occupations has only been counted for the ICT-related industry subdivisions, consistent with the definitions in Table A.3.

Source: Deloitte Access Economics (2022).

Table A.26: State breakdown of domestic enrolments and completions in IT degrees, 2020

	Course enrolments		Course completions	
	Undergraduate	**Postgraduate**	**Undergraduate**	**Postgraduate**
NSW	12,723	3,410	2,261	1,092
Vic	10,914	4,554	1,626	1,158
Qld	7,103	1,228	946	335
SA	2,573	437	275	72
WA	1,554	926	191	269
Tas	1,137	332	177	140
NT	326	27	54	9
ACT	143	39	14	8
Multistate	87	9	17	3

Source: Department of Education, Skills and Employment Student Data (2021).

Table A.27: State breakdown of international enrolments and completions in IT degrees, 2020

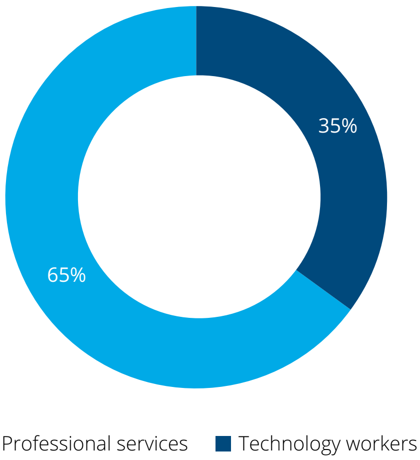
	Course enrolments		Course completions	
	Undergraduate	**Postgraduate**	**Undergraduate**	**Postgraduate**
NSW	12,041	9,919	2,293	3,904
Vic	13,969	18,712	3,242	7,614
Qld	2,476	5,741	559	2,598
SA	1,702	2,054	243	363
WA	1,087	1,530	387	494
Tas	867	1,092	194	490
NT	959	883	243	324
ACT	187	143	53	44
Multistate	117	53	40	24

Source: Department of Education, Skills and Employment Student Data (2021).

Appendix B: Survey

The analysis contained in this report has been informed by a fresh survey of individuals employed in professional services or technology occupations. The survey was fielded between April and May 2022, with a total of 810 individuals completing the survey. Technology workers made up 35% of the total sample with the remainder working in professional services (see Chart B.1).

Chart B.1: Proportion of respondents by sector



Source: Deloitte Access Economics Employee survey (2022).

The survey was fielded using two different collection methods. The first was an advertisement targeting technology workers in the *Information Age*, the flagship news publication of the ACS. The second included a panel of both professional services and technology workers provided by survey provider Ipsos. As there were two collection methods used, there may be some sample selection bias. The advertisement in the *Information Age* contained more information about what the survey entailed in order to gain interest and increase survey participation. This included outlining that the survey was about the experiences of professionals with diversity and inclusion, reskilling and professionalisation. However, the panel provided by Ipsos did not include any additional information or context.

The breakdown of the sample by these two collection methods is provided in Table B.1 below.

Table B.1: Breakdown of survey sample by collection method

	Ipsos	ACS	Total
Professional services	511	12	523
Technology	210	77	287
Total	721	89	810

Source: Deloitte Access Economics Employee Survey (2022).

The questions were designed to develop a detailed understanding of diversity – in terms of gender, age, regional, sexual orientation, neurodiversity and, physical ability and cultural background – of the technology workforce relative to professional services, factors influencing decisions to enter or leave the technology workforce and attitudes towards professionalisation.

The survey is not representative of the population, and should not be interpreted as such. Other data sources provided by the ABS, such as the Census, are representative of the population and are used in place of the survey to produce analysis of the benefits of diversity in the technology workforce and detailed breakdowns of the technology workforce in general.

However, the results of this survey help to give insights into workplace experiences and attitudes, workforce movements and professionalisation for professional services and technology workers across different demographics. While the survey sample is not exhaustive, we believe there were good response rates.

The demographic characteristics of the individuals are shown in the charts below.

Demographics

Gender

Of the 810 respondents, 369 were female (46%) and 440 were male (54%). As shown in Table B.2 below, this differed between the professional services and technology workforce. Professional services had a higher proportion of female respondents at 54%, compared to 29% in the technology workforce.

Table B.2: Proportion of respondents by sector and sex

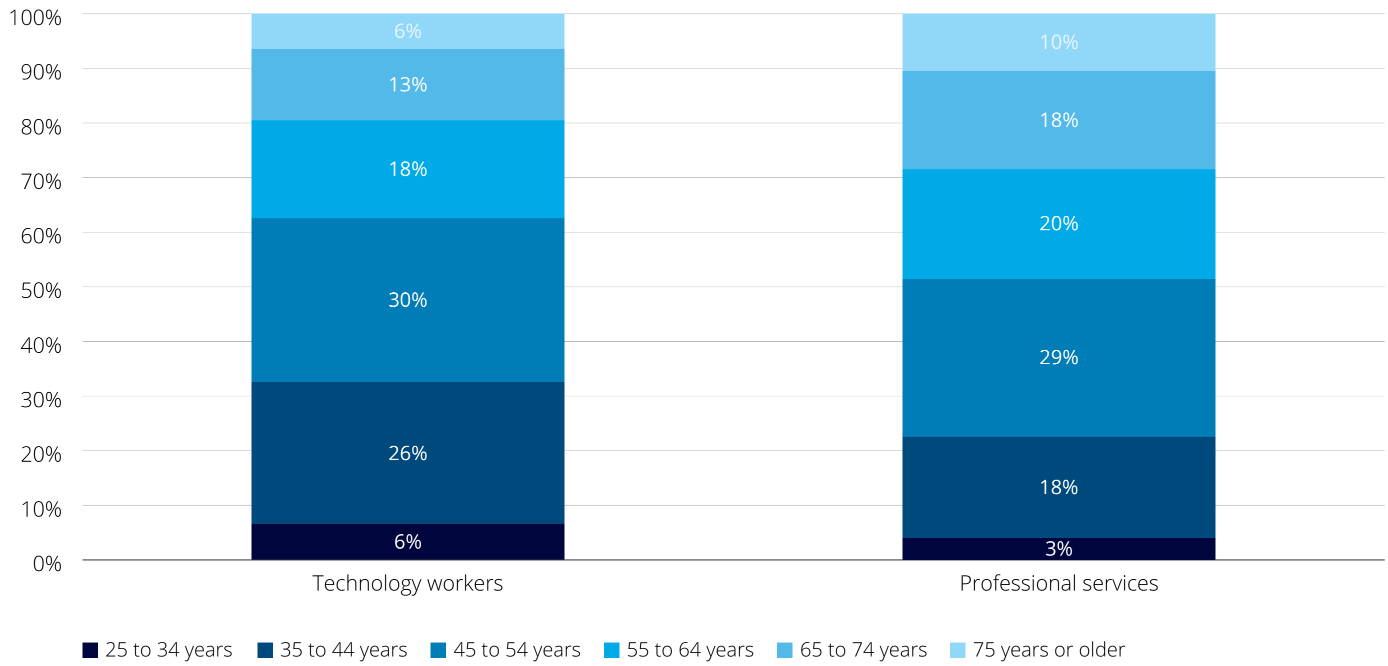
	Female	Male
Professional services	45%	54%
Technology workers	29%	70%

Source: Deloitte Access Economics Employee Survey (2022).

Age

Of the respondents, the largest age category was 45 to 54 (29%), followed by 55 to 65 (20%). As shown in Chart B.3 below, the technology workforce has a higher proportion of workers aged under 55 (62%) than the professional services workforce (50%).

Chart B.3: Proportion of respondents by sector and age



Source: Deloitte Access Economics Employee survey (2022).

Ability status

In total, 10% of respondents identified as being a person living with a disability. This proportion was higher for technology workers (12%) compared to professional services (8%), as shown in Table B.3 below.

Table B.3: Proportion of respondents by sector and location

	Identifies as a person living with a disability	Does not identify as a person living with a disability
Professional services	8%	92%
Technology workers	12%	88%

Source: Deloitte Access Economics Employee survey (2022).

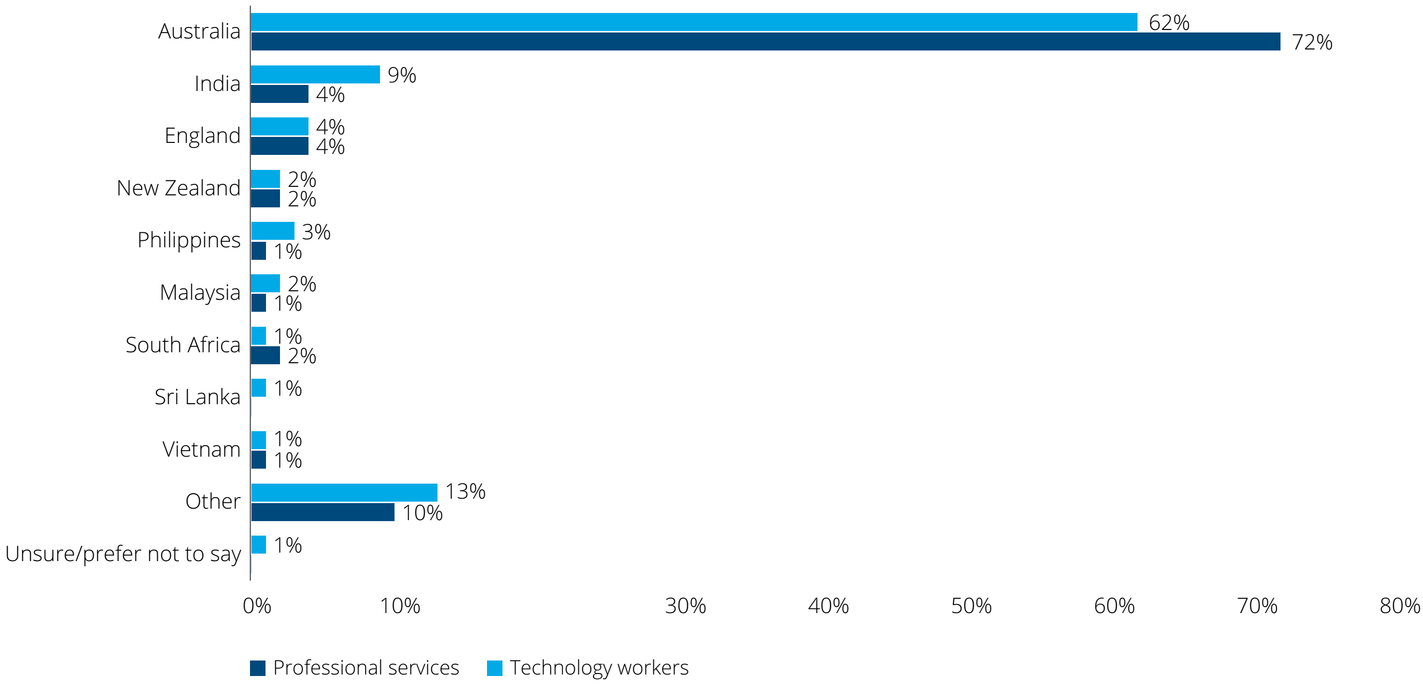
Cultural and linguistic diversity

In terms of cultural and linguistic diversity, survey respondents from the technology workforce had higher levels of cultural and linguistic diversity compared to professional services.

Birthplace

Survey respondents from the technology workforce had a higher proportion of workers born overseas (38%) compared to those in professional services (28%). For those born overseas, the top countries for both technology workers and professional services were India, England and New Zealand. This is shown in Chart B.4 below.

Chart B.4: Proportion of respondents by sector and birthplace



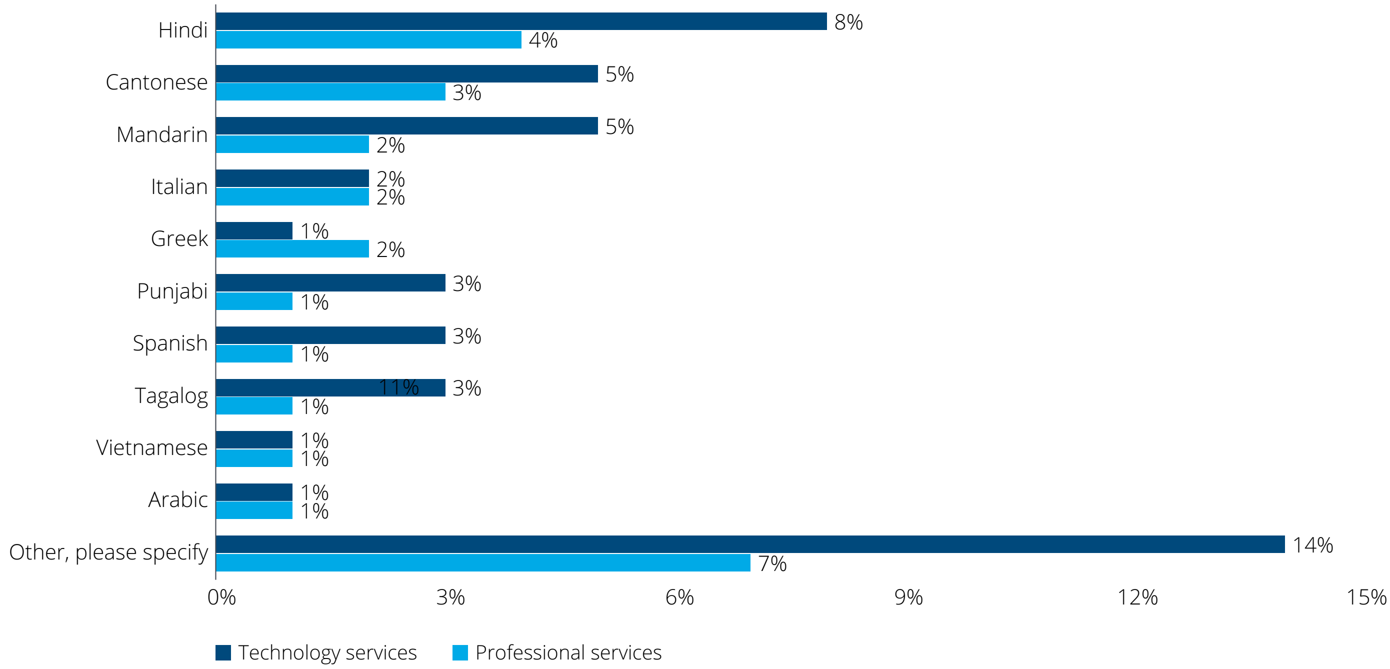
Source: Deloitte Access Economics Employee Survey (2022).

Language

Survey respondents from the technology workforce had a higher proportion of workers speaking a language other than English at home (44%) compared to those in professional services (26%).

The top languages spoken were the same for technology and professional services workers, which were Hindi, Cantonese and Mandarin. This is shown in Chart B.5 below.

Chart B.5: Proportion of respondents by sector and language spoken at home



Source: Deloitte Access Economics Employee Survey (2022).

Metropolitan/regional

In total, 81% of survey respondents were from a metropolitan area. This proportion was higher for technology workers (88%) compared to professional services (78%), as shown in Table B.3 below.

Table B.4: Proportion of respondents by sector and location

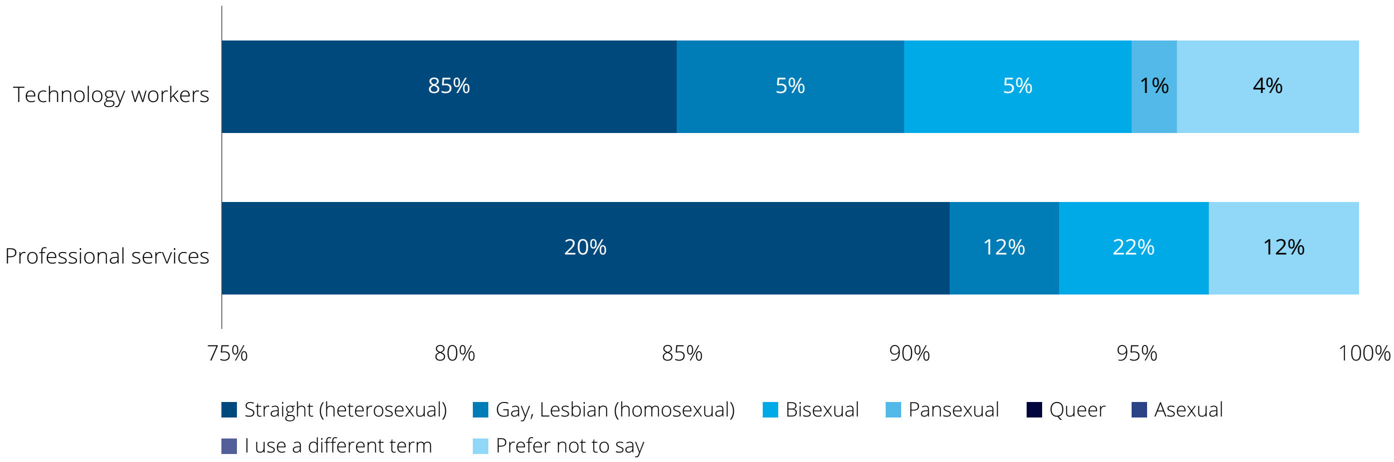
	Metropolitan	Regional
Professional services	78%	22%
Technology workers	88%	12%

Source: Deloitte Access Economics Employee Survey (2022).

Sexual orientation

Survey results revealed the technology sector ranked more diverse than professional services in relation to sexual orientation, as shown in Chart B.6 below.

Chart B.6: Proportion of respondents by sector and sexual orientation



Source: Deloitte Access Economics Employee survey (2022).

Neurodiversity

In total, 5% of survey respondents identified as neurodivergent. This proportion was higher for technology workers (7%) compared to professional services (4%), as shown in Table B.5 below.

Table B.5: Proportion of respondents by sector and neurodiversity status

	Identifies as neurodivergent	Does not identify as neurodivergent
Professional services	4%	96%
Technology workers	7%	93%

Source: Deloitte Access Economics Employee survey (2022).

Appendix C: Modelling the economic impact of diversity in technology

Section 4 estimates the economic impact of increasing diversity in the technology sector. This Appendix describes in further detail the data, assumptions and methodology underpinning these results.

The modelling aimed to determine the net impact of increasing age, ability and gender diversity in the technology workforce.

- For age, this involved an increase in the proportion of workers over 55 up to a level of 22.1% (the target rate for age). The figure was based on the proportion of workers in the labour force aged over 55 at the end of the modelling period.[xxiii]
- For ability, this involved an increase in the proportion of those who need assistance with core activities up to a level of 5.5% (the target rate for disability). For disability, this figure was calculated based on the level of those who need assistance with core activities in the population.
- Lastly, for gender, this involved an increase in the proportion of female workers up to a level of 47.5% (the target rate for gender). The figure for gender was calculated based on the level of female participation in the professional, scientific and technical (PST) services industry (excluding technology occupations) and weighted by the occupational profile of the technology workforce, and is consistent with last year's modelling.

The current and target levels are summarised below in Table C.1.

Table C:1: Current and target levels for areas of diversity included in the modelling

	Current level	Target level	Source
Age (% over 55)	13.5%	22.1%	ABS (based on labour force levels)
Gender (% of women)	30.9%	47.5%	ABS (based on PST levels)
Disability (% of people living with a disability)[xxiv]	0.5%	5.5%	ABS (based on population levels)

Source: ABS Census (2011, 2016) and ABS customised reports (2022).

To calculate the net impact of increasing diversity in the technology workforce, we calculated the difference in employment and labour income in a business as usual scenario (the base case) with a scenario where diversity in technology was increasing (the project case). Further detail on these two scenarios is provided below.

Growth rates

Under a business-as-usual scenario, we assume the level of participation improves at current rates of 0.99% for people aged 55 and over, 0.75% for women, and 7.80% for people living with a disability, based on ABS data (see Table C.2). The supply of technology workers in the base case is based on Deloitte Access Economics forecasts.

In the project case, we model the impact of reaching each of these target rates in 25 years. To reach these targets by 2046, this implies a growth rate of 1.98% for people aged over 55, 1.73% for women and 10.00% for people living with a disability.

The increase in participation is assumed to occur through the attraction of net additional workers to the technology workforce, as opposed to being hired in place of existing workers. This means the aggregate supply of technology workers is higher in the project case than in the base case. This can occur through several different mechanisms. An ageing population and lower levels of retirement mean a larger proportion of workers aged over 55 can remain in the workforce. Lower levels of discrimination can help more people with disability move into the labour force and work in technology. Lastly, a shift from part-time to full-time work and movement between sectors can increase participation for women.

Relative to the base case, it's estimated approximately 97,000 additional full-time equivalent (FTE) technology workers in these forms of diversity will be required to reach the target level by 2046.

[xxiii] The growth rate for the proportion of the labour force aged 55 and over has been estimated based on Deloitte's population forecasts by age.

[xxiv] The ABS Census defines those living with a disability as needing assistance with core activities. However, we acknowledge that this definition does not account for all people who identify as having a disability.

Table C:2: Growth rates in the base and scenario case

Occupation	Base case growth rate	Scenario case growth rate	Base case source
Age (% over 55)	0.99%[xxv]	1.98%	ABS customised reports (2014–21) and macroeconomic forecasts developed by Deloitte Access Economics
Gender (% of females)	0.75%	1.73%	ABS customised reports (2014–21)
Disability (% of people living with a disability)	7.80%	10.00%	ABS Census (2011 and 2016)

Source: ABS Census (2011, 2016) and ABS customised reports (2022).

The benefits of increasing diversity

Increasing participation yields two main benefits for the economy more broadly. Firstly, it will encourage some people to enter the workforce or increase their hours of work (their labour supply), lifting participation rates. Second, it creates a productivity dividend through channels such as allowing a portion of existing workers to move from other sectors into higher skilled occupations in technology, the individual productivity of each worker and the collaboration, sharing of knowledge and support through different people. The first of these benefits is modelled for increased participation of people aged over 55, people with a disability, and women. The second of these benefits is modelled for people aged over 55 and women.

Increased labour supply

The uplift in labour supply is from encouraging some people to enter the workforce or increase their labour supply.

Interrelationships

The modelling accounted for interrelationships between these different forms of diversity, as people aged over 55, women, and people living with disability are not mutually exclusive groups.

Accounting for these interrelationships involved creating six different categories, which captured the following intersections:

- those who are male and are aged over 55
- those who are male and are living with a disability
- those who are male, and are not aged over 55 or living with a disability
- those who are female and aged over 55
- those who are female and are living with a disability
- those who are female, and are not aged over 55 or living with a disability.

Using these categories ensured there wasn't any double counting of increased labour supply for people aged over 55, people with a disability, and women. In addition, to reach each of the targets, we ensured the interrelationships and proportions of these different forms of diversity were kept largely consistent with the base case.

Results of increased labour supply

In total, we estimate that there will be roughly 96,800 additional workers in FTE terms, comprising of people aged over 55, women and people living with disability, who will move either into full-time work from part-time work, remain in the labour force or join the labour force.

We assume the increase across the technology workforce will occur in parallel with the current occupational breakdown within the industry. The increase in labour supply at the occupational level is shown in Table C.3.

[xxv] Reflects the weighted average of 2.8% for the first five years (the current growth rate in technology, based on ABS customised reports) and 0.5% for the last 15 years (the growth in the proportion of the population age over 55, based on macroeconomic forecasts).

Table C.3: Change in labour supply across occupations (one digit ANZSCO)

Occupation	Change in labour supply
Managers	8,053
Professionals	63,338
Technicians	10,505
Clerical and administrative workers	12,907
Sales workers	2,046
Total increase in labour supply	**96,849**

Source: Deloitte Access Economics (2022).

Higher labour productivity

Gender

The remaining supply of additional female workers is assumed to move from other sectors into highly skilled occupations in technology, creating a productivity dividend.

To account for differences in skill requirements, the modelling uses inputs from last year's Australia's Digital Pulse, which used O*NET data to determine which occupations female workers will move from. Developed in the US, O*NET is a comprehensive system for exploring information about jobs and includes information about skills by occupation. Importantly, O*NET data includes information about skill requirements by occupation.

O*NET data was mapped to Australian occupational categories, to compare skill requirements across occupations. It was assumed the top 100 occupations with the most similar skill requirements to technology will be the occupations female workers move from.

The increase in productivity was captured as a net increase in labour income. This was modelled by taking the wage difference between technology occupations and the occupations female workers move from, using wage data from ABS (catalogue number 6306.0). Based on this modelling, the net increase in labour income was estimated to be $1.7 billion. The breakdown of the change in labour income across occupations is shown in Table C.4. It is noted that for certain occupations – clerical and administrative workers, as well as sales workers – the difference in wages is negative. However, in aggregate, the net change in labour income is positive.

Table C.4: Change in labour income for women across occupations (one digit ANZSCO)

Occupation	Change in labour income (millions)
Managers	$1,684
Professionals	$1,525
Technicians	$446
Clerical and administrative workers	-$501
Sales workers	-$50
Total increase in labour income	**$3,103**

Source: Deloitte Access Economics (2022).

Computable-general equilibrium (CGE) modelling

The economic impact of increased participation from people aged over 55, people who identify as having a disability, and women in technology occupations was calculated using the Deloitte Access Economics Regional General Equilibrium Model (DAE-RGEM).

The DAE-RGEM is a large scale, dynamic, multi-region, multi-commodity computable general equilibrium (CGE) model of the world economy with bottom-up modelling of Australian regions. The model is based upon a set of key underlying relationships between the various components of the model, each of which represents a different group of agents in the economy. CGE modelling is useful in estimating net benefits when the activity concerned is likely to create opportunity costs for other industries or a significant change in aggregate demand, such as transitions of labour supply between occupations where economy-wide general equilibrium effects are likely to be important. This model captures the dynamic relationships between sectors in the economy and is used to estimate the net increase of economic activity in the Australian economy. It accounts for the opportunity cost of providing this labour supply to technology occupations and produces the value added for the Australian economy.

The CGE model assumes the shock to labour supply and labour income shown in the tables above are phased in over 25 years, from 2022 to 2046.

Results

It's estimated that increasing diversity in the technology workforce will grow Australia's economy by $3.1 billion on average every year over the first 20 years. In year one, Australia's GDP is just $120 million larger than under the baseline scenario. This is compared to close to $12 billion in year 20.

Increasing diversity in technology also creates employment benefits for the Australian economy. Modelling for this report finds that it creates an additional 13,900 FTE jobs on average every year over a 20-year horizon.

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