Australian Government

National Skills Commission

Australia's current, emerging and future workforce skills needs

November 2022

Acknowledgement of Country

The National Skills Commission acknowledges the traditional owners and custodians of country throughout Australia and acknowledges their continuing connection to land, sea and community. We pay our respects to the people, their cultures and to Elders, past, present and emerging.

Contents

Commissioner's foreword

This report is the second annual report by the National Skills Commission (NSC) on Australia's current, emerging and future workforce skills needs.

Like last year's report, the focus is very much on the entire labour market and 'skills' should be read in its broadest possible context (that is, encompassing secondary schooling, vocational education and training and higher education pathways). Also consistent with last year's report, this report takes both an occupational and a literal skills-based lens (using the Australian Skills Classification to transform occupational-based analysis and data into a skills lens).

Over the past year the Australian labour market has tightened significantly, with this tightening in the labour market being reflected, for example, in an increase in the number of occupations the NSC has found to be in shortage in our annual assessment of skill shortages (known as the Skills Priority List).

By combining the Skills Priority List with other sources of data the report also shows how a regional picture of skills shortages can be developed; and how some of the more pertinent current skills needs at a national level can be identified.

Looking beyond the economy's current skills needs the NSC has supplemented previously released employment projections with scenario modelling to show how different economic outcomes might impact emerging and future skills requirements.

The increasing importance of responding to climate change is highlighted in this report in initial insights into the jobs and skills that will be required as Australia transitions to a net zero carbon economy.

Looking further ahead the transition to a net zero carbon economy and the impacts of climate change are likely to have a significant impact on future skills needs.

Reflecting that, the four key future skills needs that our 2021 report identified – Care, Computing, Cognitive ability and Communication – become the Five Cs with the addition of 'Climate'. That is, the range of skills required to transition to a net zero carbon economy and respond to the impacts of climate change.

There are a range of occupations that have emerged due to green economy activities and technologies with many representing a range of cutting-edge opportunities presented by decarbonisation, which Australia could harness and grow significantly over time.

Adam Boyton
National Skills Commissioner

Executive summary

Australia's current, emerging and future workforce skills needs 2022 is the National Skills Commission's second annual stocktake of Australia's current, emerging and future workforce skills needs. [1]

Over the past year, labour market conditions have strengthened substantially …

Labour market conditions in Australia have been exceptionally strong over the past year and the unemployment rate has fallen to levels not seen in close to 50 years.

Across key cohorts, young people, women and the long-term unemployed have all experienced robust labour market conditions and improved outcomes – although there is, as the Government's Jobs and Skills Summit underscored, more work to be done to ensure all Australians can fully participate in the labour market.

… although the pattern of growth has been uneven across industries, occupations, and skill levels.

While labour market conditions have strengthened substantially in aggregate, the stronger conditions have not been evenly spread across industries and occupations.

Employment growth across industries, for example, has been driven for the most part by just five of the 19 broad industry groups, namely Health Care and Social Assistance, Professional Scientific and Technical Services, Retail Trade, Construction and Financial and Insurance Services.

Across occupations the pattern of employment growth has been much like that which prevailed prior to the pandemic – the largest gains have been recorded for employment among Professionals, Managers and Community and Personal Service Workers. Pre-pandemic patterns of growth have also prevailed across skill levels with the shift towards higher skill level occupations accelerating through the COVID-19 period.

Tight labour market conditions have seen an increase in skills shortages …

The strong labour market conditions (and the disruption to migration flows) have had a marked impact on current skills needs. Demand for labour has surged, with online job advertisements increasing by nearly 20 per cent over the year to September 2022, with the number of job ads around two-thirds higher than before the pandemic.

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[1] The report is based on data available as of 31 October 2022.

Reflecting the increase in the demand for workers, recruitment difficultly has also increased significantly, while the number of occupations assessed as being in shortage in the NSC's Skills Priority List (SPL) for 2022 was almost double relative to 2021.

… particularly for health and education professionals …

The overall increase in the proportion of occupations assessed as in shortage in the 2022 SPL has stemmed mainly from a tightening in the labour market for Professionals. Of the Professionals occupations that were assessed as in shortage in 2022 but not in 2021, Health Professionals and Education Professionals were among the most common, including medical practitioners, nurses and teachers.

Although shortages for Professionals occupations surged in 2022, skill shortages nonetheless remain most prevalent among Technicians and Trades Workers. This is particularly the case for Skill Level 3 occupations requiring an apprenticeship, such as Electricians, Carpenters, Chefs and Motor Mechanics. Analysis by the NSC suggests that the broad tightening of Australia's labour market has not necessarily been the prime driver of these shortages but rather has simply exacerbated shortages that have been persistent over time.

Combining the SPL with other data sets produced by the NSC, such as job vacancies and five-year employment projections provides an estimate of some of the economy's key skills needs. The 'top three' occupations identified using this approach are (in order of the number of job vacancies): Registered Nurses; Software and Applications Programmers; and Aged and Disabled Carers.

… with a number of skill shortages common across countries.

While methodologies for assessing skills shortages vary between countries, recent international findings suggest skill shortages – particularly for health care and IT professionals – are common across a number of economies.

The shift to services and higher skill level jobs appears set to continue …

The NSC's five-year employment projections indicate that jobs growth is expected to be strongest across service industries and in jobs requiring higher level qualifications.

While it is important to assess the changing occupational composition of the labour market, understanding the skills used in occupations is also crucial in understanding skills needs. Mapping the employment projections to the Australian Skills Classification shows the skills clusters with the largest increases in time spent will be: Health and care; Business operations and financial activities; and Communication and collaboration. Those cluster families with the fastest growth are expected to be: Performance evaluation and efficiency improvement; Digital technologies and electronics; and Health and care.

… while new jobs and skills will emerge (and are emerging) as Australia transitions to a net zero carbon economy.

As Australia transitions to a net zero carbon economy, new skills and jobs will be required across both traditional and emerging sectors.

In a number of occupations ('Green Enhanced Skills') the broad purpose of the occupation remains the same, but elements of the occupation have changed. For example, truck drivers may be increasingly focused on reducing fuel consumption.

A range of occupations will face growing demand with the shift to a net zero carbon economy ('Green Increased Demand' occupations). These include many conventional jobs like electricians, carpenters and fitters.

'Green New and Emerging' occupations are jobs that have emerged due to green economy activities and technologies. Many occupations in this category are associated with clean energy specific roles or roles associated with emerging technologies. These occupations represent a range of cutting-edge opportunities presented by decarbonisation, which Australia could harness and grow significantly over time.

Megatrends will shape our future workforce …

Major, long-term, and structural influences are driving transformative change in the economy and society, which will unfold over years or decades. These megatrends, identified by CSIRO, are: Adapting to climate change; Leaner, cleaner and greener; The escalating health imperative; Geopolitical shifts; Diving into digital; Increasingly autonomous; and Unlocking the human dimension.

The megatrends broadly underscore the importance of the 'Four Cs' identified in last year's report, namely: Care, Computing, Cognitive ability and Communication.

The megatrends also clearly identify a fifth 'C': Climate, that is, the broad set of skills required to transition to a net zero carbon economy and respond to the impacts of climate change.

… and point to Five Cs – Care, Computing, Cognitive abilities, Communicate and Climate – as key future skills needs.

While not encompassing all the economy's future skills needs, the Five Cs do point to a range of skills likely to underpin many of the jobs of the future.

- *Care* – the group of skills that provide care and support; and responds to demographic change (such as the ageing of the population) and healthcare needs.
- *Computing* – a group of skills needed to respond to the digital world and the increasing use of digital technologies across the entire economy.
- *Cognitive abilities* – the group of advanced reasoning and higher order skills computers cannot easily replace, especially non-routine cognitive skills.
- *Communication* – the group of skills needed to collaborate and engage within and across workplaces.
- *Climate* – the range of skills required to transition to a net zero carbon economy and respond to the impacts of climate change.

Part 1
Recent labour market trends

Labour market conditions in Australia have been exceptionally strong over the past year and the unemployment rate has fallen to levels not seen in close to 50 years.

Across key cohorts, young people, women and the long-term unemployed have all experienced robust labour market conditions and improved outcomes – although there is, as the Government's Jobs and Skills Summit underscored, more work to be done to ensure all Australians can fully participate in the labour market.

It is also important to note that while labour market conditions have strengthened substantially in aggregate, the stronger conditions have not been evenly spread across industries and occupations.

Employment growth across industries for example, has been driven for the most part by just five of the 19 broad industry groups, namely Health Care and Social Assistance, Professional Scientific and Technical Services, Retail Trade, Construction and Financial and Insurance Services.

Across occupations, the pattern of employment growth has been much like that which prevailed prior to the pandemic – the largest gains have been recorded for employment among Professionals, Managers and Community and Personal Service Workers. Pre-pandemic patterns of growth have also prevailed across skill levels with the shift towards higher skills accelerating through the COVID-19 period.

The exceptionally strong pace of employment growth over the past year will be difficult to sustain. As detailed in the October Budget, the Australian economy is facing headwinds. A global economic slowdown, high inflation, and rising interest rates, coupled with domestic disruptions from recent floods are expected to weigh on economic activity over the next two years, with implications for Australia's labour market outlook.

The Treasury expects employment growth to gradually ease but remain positive at ¾ per cent in 2023–24, while the unemployment rate is forecast to edge higher, reaching 4½ per cent by June 2023. While this is still below the pre-pandemic level of around 5 per cent, it may nevertheless have implications for the long-term unemployed and other disadvantaged job seekers in the labour market.

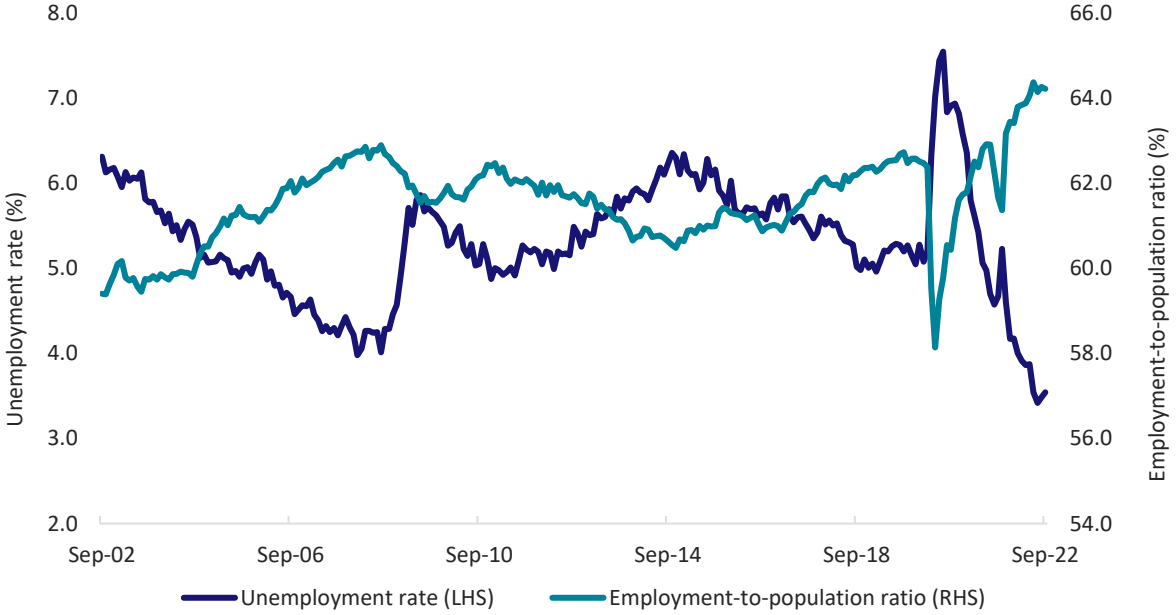
1.1 Labour market conditions in Australia

1.1.1 Broad labour market developments

The Australian labour market has recovered strongly following the lifting of the COVID-19 Delta lockdowns. Indeed, employment surged over the past year, up by 691,200 (or 5.4 per cent), to a record high of 13,590,800 in September 2022.[2] Reflecting the underlying strength and resilience of the labour market, employment is now 4.6 per cent above the level recorded in March 2020 (when Australia recorded its 100th case of COVID-19).

In line with the strong pace of jobs growth over the year, the unemployment rate fell sharply, from 4.7 per cent in September 2021, to 3.5 per cent in September 2022, close to its lowest rate in around 50 years. Robust labour market conditions also encouraged more people to enter the labour market, with the participation rate increasing significantly, by 1.9 percentage points over the year, to 66.6 per cent in September 2022, just below the record high of 66.7 per cent recorded in June 2022. The employment-to-population ratio has increased by 2.6 percentage points over the year, to 64.2 per cent in September 2022 and is now just below the record high of 64.4 per cent recorded in June 2022 (see Figure 1).

Figure 1: Employment-to-population ratio and unemployment rate, September 2002 to September 2022



Source: ABS, Labour Force, Australia, September 2022, seasonally adjusted data.

The strength of the labour market has translated into more full-time jobs. Full-time employment accounted for the majority (71.6 per cent) of the increase in employment over the past year and is now 6.8 per cent above the level recorded in March 2020. By contrast, part-time employment is 0.2 per cent below its pre-pandemic level.

As could be expected in an environment of strong full-time employment growth, total hours worked in the economy have risen considerably over the past year by 7.1 per cent, to stand at 1,853.5 million hours in September 2022.

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[2] The Delta lockdowns occurred from around late-June 2021 until mid-October 2021. As a result, employment fell substantially in August, September, and October 2021.

The strength of the labour market has meant that more people are now working the hours they want to work. The underemployment rate declined by 3.2 percentage points over the year to 6.0 per cent in September 2022 and is now well below the 8.8 per cent recorded in March 2020.[3]

Overall, there is far less excess capacity in the labour market now than prior to the pandemic.

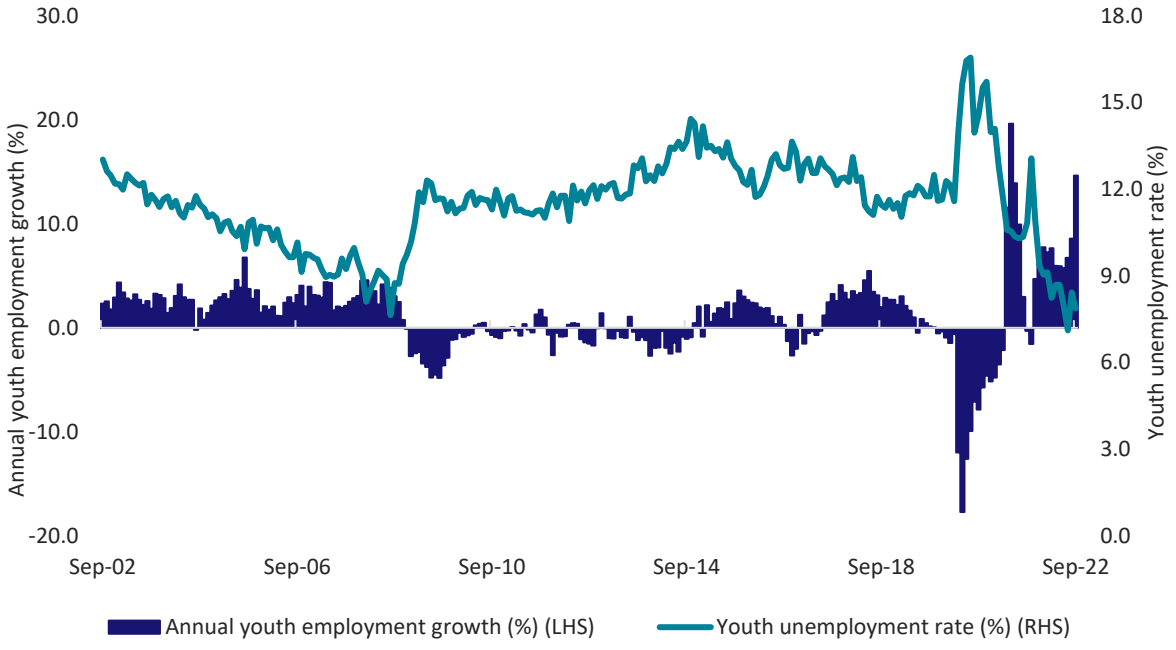
1.1.2 Trends across key cohorts

Youth (15-24 years)

Young people were particularly hard-hit during the initial months of the pandemic, as well as during the outbreak of the Delta variant. This was primarily because they were overrepresented in industries that were most severely affected by lockdowns and associated restrictions and tended to be employed in casual positions.

Fortunately, the strength of the recovery in the labour market has reversed this impact. Figure 2 shows youth employment has rebounded strongly over the year, surging by 261,400 (or 14.6 per cent) to 2,046,500 in September 2022. Youth employment is now 6.0 per cent above the level recorded in March 2020.

Figure 2: Annual youth employment growth and youth unemployment rate, September 2002 to September 2022



Source: ABS, Labour Force, Australia, September 2022, seasonally adjusted data.

[3] Underemployment estimates published in the monthly ABS Labour Force Survey are based on long-standing international standards and include two groups: part-time employed who would prefer and are available for more hours than they usually work and, full-time employed who worked part-time hours for economic reasons, such as being stood down or there being insufficient work available.

Against this stronger backdrop, the youth unemployment rate fell sharply, from 10.8 per cent in September 2021, to 7.9 per cent in September 2022, well below the 11.6 per cent recorded in March 2020. Having said that, the youth unemployment rate remains more than double the rate recorded for all persons (of 3.5 per cent).

Importantly, the recovery has drawn more young people into the labour market, with the youth participation rate at 71.6 per cent in September 2022, well above the 68.1 per cent recorded in March 2020. Furthermore, the youth underemployment rate declined 4.2 percentage points over the year to 13.6 per cent in September 2022.

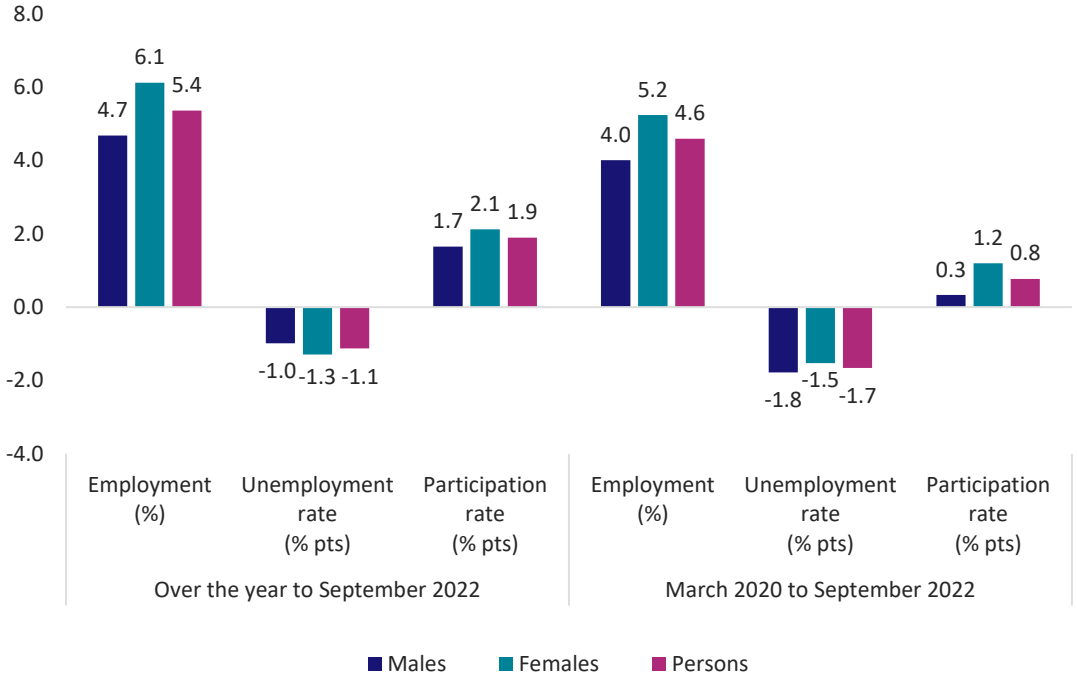
While some young people are at risk of not making a successful transition to employment, it is encouraging that labour market conditions for this cohort have strengthened considerably over the last year.

Gender

Women were also negatively affected by the pandemic, due to their over-representation in industries most affected by restrictions. Women were also more likely to reduce their working hours to take on caring responsibilities when there were school and childcare centre closures.

That said, labour market conditions for women improved considerably over the last year and women have fared better than men. Indeed, female employment increased by 6.1 per cent over the year to September 2022, compared with a rise of 4.7 per cent for men. Female employment is now 5.2 per cent above the level recorded in March 2020, while male employment is 4.0 per cent above its pre-pandemic level (Figure 3).

Figure 3: Change in key labour market indicators by gender over year to September 2022 and since March 2020



Source: ABS, Labour Force, Australia, September 2022, seasonally adjusted data.

Against the backdrop of strengthening labour market conditions, the female unemployment rate fell by 1.3 percentage points over the year, to 3.6 per cent in September 2022.[4] Moreover, the participation rate for women increased significantly over the year, from 60.2 per cent in September 2021, to 62.3 per cent in September 2022, and is well above the 61.1 per cent recorded in March 2020.

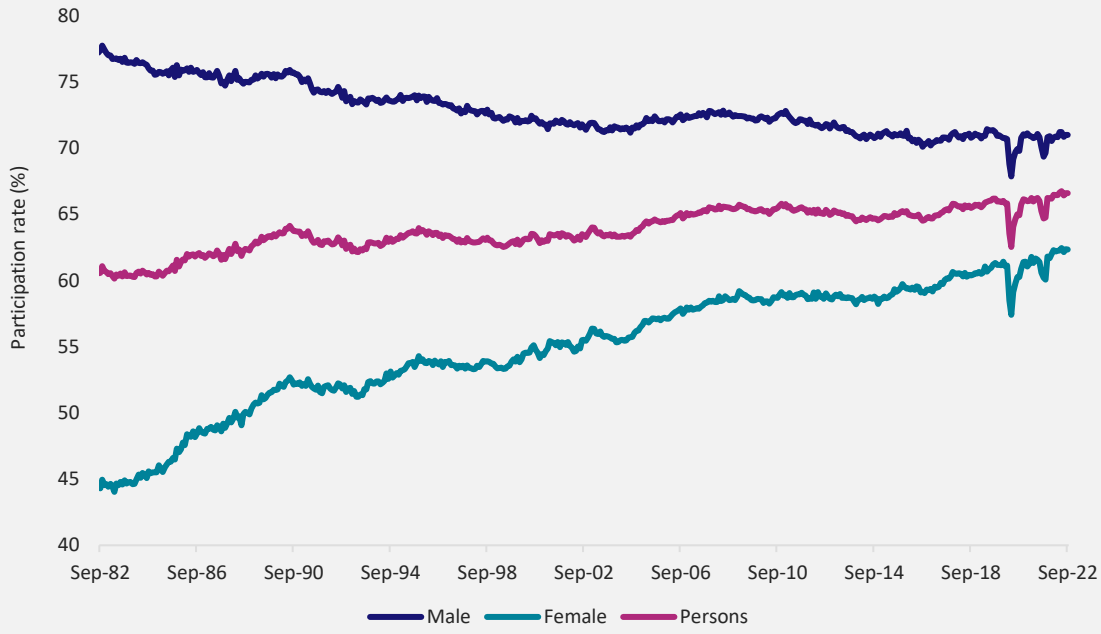
The male unemployment rate also declined over the year, by 1.0 percentage point, to 3.5 per cent in September 2022, well below the 5.3 per cent recorded in March 2020.[5] The participation rate for men also rose by 1.7 percentage points over the year, to 71.0 per cent in September 2022, above its pre-pandemic rate of 70.7 per cent.

[4] The female unemployment rate fell to 3.4 per cent in July 2022, the lowest since November 1973 (3.3 per cent).
[5] The male unemployment rate was 3.4 per cent in July 2022, the lowest rate recorded since November 1974 (3.0 per cent).

Box 1
Women's workforce participation

One of the most significant developments in the Australian labour market over the last 40 years has been the dramatic rise in female labour force participation. This sharp increase was particularly apparent in the 1980s and 1990s but has continued its upward trend, notwithstanding the impact of COVID-19 (see Figure 4, below). Indeed, the female labour force participation rate has risen from 44.3 per cent in September 1982, to 62.3 per cent in September 2022, just below the record high of 62.4 per cent recorded in June and August 2022.

Figure 4: Participation rates by gender, September 1982 to September 2022



Source: ABS, Labour Force, Australia, September 2022, seasonally adjusted data.

The significant rise in female labour force participation over the period can be attributed to a range of factors. In particular, there has been a considerable shift in social attitudes to women working since the 1970s and 80s, as well as changed perceived gender roles, which has made it easier for women to participate in the labour market across a range of occupations (and in positions that were traditionally male-dominated). That said, Australia's labour market (as the 2021 edition of this report noted), is still very gendered. Australia's fertility rate has also decreased significantly, which has meant that women are currently less likely to leave the labour force to have, and care for, children than they were in the 1960s.

Improved access to formal childcare, together with an increasing acceptance of women with children remaining in the labour force, as well as the emergence of more flexible working arrangements in Australia, has also facilitated a rise in labour force participation of women with children.

In addition, the strong rise in the educational attainment levels of women over the past 40 years, together with the recent strong growth in occupations which require degree-level qualifications, have also contributed to the significant increase in female labour force participation.

Box 1
Women's workforce participation

Structural change has also been another key factor that has contributed to the rise in female labour force participation, with strong growth recorded over recent decades in service-based industries that have traditionally employed a high proportion of women, such as Health Care and Social Assistance, and Education and Training. Service-based industries are also more likely to offer part-time employment opportunities, which are attractive to people choosing to balance work with caring responsibilities.

Interest rates can also have a significant impact on the female participation rate, as more women tend to participate in the labour force when interest rates are higher in order to help alleviate the greater debt servicing ratios that have occurred over recent decades, in part, because of the emergence of larger family mortgages. Indeed, research has found that higher levels of household debt increase labour force participation in Australia, particularly for women with young children.[6] This is significant, given the current environment of rising interest rates and cost of living pressures.

It is worth noting that while Australia ranked 6th out of 38 countries in the OECD with respect to the female (15 years and over) labour force participation rate in Q2 2022 (latest available data), it ranked much lower (26th out of 37) for the female prime-age (25-54 years) participation rate. Australia's high ranking for females aged 15 years and over can be attributed, in part, to the fact that we are one of few countries where young people tend to combine education with part-time employment.

More work needs to be done to increase the labour force participation rate for prime-age women in Australia. In this regard, at the Jobs and Skills Summit, employers, unions, governments and community groups agreed that gender equality is good for individuals, society and the economy. Addressing gender gaps in labour force participation and pay are important to support women's equality and improve Australia's economic prosperity.

The Government's *Plan for Cheaper Child Care* will make early childhood education more affordable and reduce barriers to women's labour force participation. In addition, the expansion of the Paid Parental Leave scheme will give families the ability to access up to 26 weeks of Paid Parental Leave by 2026. This will further support women's labour force participation and promote a more equal distribution of paid and unpaid work within households.

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6 Belkar R, Cockerell L and Edwards R (2007) *Labour Force Participation and Household Debt*, Reserve Bank of Australia Research Discussion Paper 2007-05.

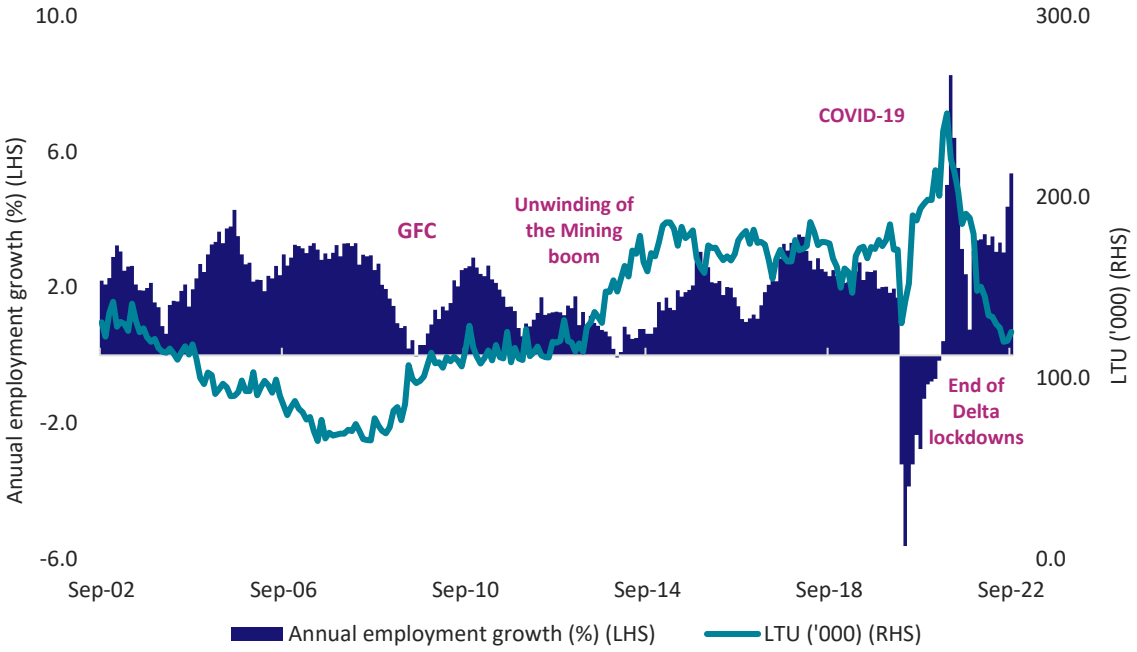
1.1.3 Long-term unemployment

While a number of characteristics can influence a person's likelihood of becoming long-term unemployed (Box 2), the level of economic activity is a key factor. As with unemployment more generally, long-term unemployment (LTU) tends to rise during periods of weak economic growth and decline during periods of strong and sustained growth.

Traditionally, long-term unemployment has risen quickly during economic downturns but has lagged the overall recovery when economic activity has picked up. Figure 5 shows that prior to the pandemic, LTU increased significantly with the weakening of employment growth in both 2009 and 2013-14, but remained stubbornly high in subsequent years, despite a pick-up in employment. With the recovery from COVID-19 shutdowns however, LTU has declined significantly as employment growth has picked up. Indeed, in September 2022, there were 45,500 fewer long-term unemployed people than in March 2020, a fall of 26.6 per cent.

That said, the exceptionally strong pace of employment growth recorded over the past year that has precipitated the sharp decline in LTU will be difficult to sustain, with employment growth expected to moderate in 2023.

Figure 5: Long-term unemployment (LTU) and annual employment growth September 2002 to September 2022



Source: ABS, Labour Force, Australia, September 2022, seasonally adjusted data for annual employment growth and ABS, Labour Force, Australia, Detailed, September 2022, seasonally adjusted data for LTU.

Box 2
Long-term unemployment in Australia

The Australian Bureau of Statistics (ABS) defines the long-term unemployed (LTU) as the unemployed with a duration of job search equal to 52 weeks or longer. The duration of job search is the time elapsed since the person began looking for work, or since that person last worked, whichever is the shorter.

There are a number of factors that can influence a person's likelihood of becoming LTU, such as their educational attainment level, age, English language proficiency, if they have a disability, their Indigenous status and geographical location. Part of the reason for this is that the LTU, who are often the most disadvantaged and lower skilled job seekers, (generally perceived by employers as 'lower quality' candidates) are competing with more highly qualified job seekers.

Data from the ABS *Survey of Education and Work* (SEW) point to a role for education and skills policy in limiting the incidence of long-term unemployment with higher levels of educational attainment associated with lower long-term unemployment rates (the number of LTU as a proportion of the labour force). For example, data from the latest SEW, conducted in May 2021, show that the long-term unemployment rate among those with a bachelor degree or higher was just 0.8 per cent compared with 3.0 per cent for those with below year 12 educational attainment. [7]

1.1.4 Employment growth across skill levels, occupations and industries

Skill level employment

Over the year to August 2022, employment increased in all five skill level groups.[8] The largest employment gains were in Skill Level 1 occupations (up by 5.2 per cent), Skill Level 4 occupations (up by 4.8 per cent) and Skill Level 3 occupations (up by 4.7 per cent).

Since February 2020, representing the change in employment from pre-COVID-19 levels, employment increased in four skill level groups and declined in one.

Table 1 shows that the largest employment gains were in Skill Level 1 occupations (up by 526,300, or 12.5 per cent), Skill Level 4 occupations (up by 93,600, or 3.0 per cent) and Skill Level 3 occupations (up by 66,600, or 3.4 per cent). A fall in employment was recorded in Skill Level 5 occupations (down by 62,100, or 3.0 per cent).

The shift towards higher skill levels through the COVID-19 period is an acceleration of a long-term trend as the workforce continues to become more highly educated and employment has transitioned towards services-based industries.

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7 ABS, Education and Work, Australia, May 2021. All data are for persons aged 15-74 years. Totals exclude educational attainment level not determined and Certificate not further defined, while Certificate I and II are included as below year 12.

8 The ABS classifies occupations according to five skill levels under the Australian and New Zealand Standard Classification of Occupations (ANZSCO), commensurate with the following qualification(s) or where relevant work experience with training may be a substitute for formal qualifications: Skill Level 1: Bachelor degree or higher qualification; Skill Level 2: Advanced Diploma or Diploma; Skill Level 3: Certificate IV or Certificate III with at least two years on-the-job training; Skill Level 4: Certificate II or III; Skill Level 5: Certificate I or secondary education. For more information see ABS, Conceptual basis of ANZSCO, 23 November 2021.

Table 1: Employment levels and changes by skill level, August 2022

Skill Levels	Aug-22 ('000)	Annual Change ('000)	Annual change (%)	Change since Feb-20 ('000)	Change since Feb-20 (%)
Skill Level 1	4,720.9	234.1	5.2	526.3	12.5
Skill Level 2	1,687.3	41.1	2.5	64.7	4.0
Skill Level 3	2,011.4	90.7	4.7	66.6	3.4
Skill Level 4	3,258.7	149.4	4.8	93.6	3.0
Skill Level 5	1,986.8	63.8	3.3	-62.1	-3.0
ALL SKILL LEVELS	**13,617.1**	**571.9**	**4.4**	**601.6**	**4.6**

Source: ABS, Labour Force, Australia, Detailed, Quarterly, August 2022, data are seasonally adjusted by the NSC.

Occupation employment

While employment growth has been strong since the start of COVD-19, there have been divergent trends in employment at the occupation level. In August 2022, employment for all occupations stood 4.6 per cent above the level recorded in February 2020, but only around half of the detailed occupations (180 out of 358, or 50.3 per cent) had employment above their pre-COVID-19 level.

Unsurprisingly, given the shift towards higher skill levels that has accelerated over the COVID-19 period, the ten largest growing occupations are dominated by Skill Level 1 (five of the 10 occupations), whereas Skill Level 4 and Skill Level 5 account for seven of the 10 largest declining occupations (Table 2).

Table 2: Top and bottom 10 occupations by change in employment, February 2020 to August 2022

Occupation	Skill Level	Change since Feb-20 ('000)	Occupation	Skill Level	Change since Feb-20 ('000)
Sales Assistants (General)	5	89.0	Checkout Operators & Office Cashiers	5	-40.7
Other Hospitality, Retail & Service Managers	2	70.6	Accounting Clerks	4	-33.2
Human Resource Managers	1	68.0	General Clerks	4	-28.1
General Managers	1	59.2	Commercial Cleaners	5	-27.5
Storepersons	4	53.9	Livestock Farmers	1	-25.9
Aged & Disabled Carers	4	48.8	Retail Managers	2	-20.1
Accountants	1	32.0	Livestock Farm Workers	5	-19.2
Software & Applications Programmers	1	31.3	Building & Plumbing Labourers	5	-17.4
Electricians	3	29.5	Other Sales Assist & Salespersons	5	-15.2
ICT Managers	1	28.5	Bank Workers	3	-15.0

Source: ABS, Labour Force, Australia, Detailed, Quarterly, August 2022, data are seasonally adjusted by the NSC.

Industry employment

Since February 2020, representing the change in employment from pre-COVID-19 levels, employment has increased in 12 industries and declined in seven.

Table 3 shows that the largest gains in employment were in Health Care and Social Assistance (up by 231,200, or 12.9 per cent), Professional, Scientific and Technical Services (up by 152,300, or 13.2 per cent) and Retail Trade (up by 116,500, or 9.3 per cent). The largest falls were in Manufacturing (down by 42,800, or 4.7 per cent), Agriculture, Forestry and Fishing (down by 38,300, or 11.8 per cent) and Education and Training (down by 23,800, or 2.1 per cent).

Table 3: Employment levels and changes by industry, August 2022

Industry	Aug-22 Level ('000)	Annual Change ('000)	Annual change (%)	Change since Feb-20 ('000)	Change since Feb-20 (%)
Agriculture, Forestry and Fishing	287.3	-27.3	-8.7	-38.3	-11.8
Mining	270.5	0.7	0.2	28.3	11.7
Manufacturing	867.8	-121.5	-12.3	-42.8	-4.7
Electricity, Gas, Water and Waste Services	155.0	12.2	8.6	22.4	16.9
Construction	1,262.2	129.4	11.4	77.3	6.5
Wholesale Trade	373.6	24.8	7.1	-18.9	-4.8
Retail Trade	1,363.0	105.4	8.4	116.5	9.3
Accommodation and Food Services	923.2	104.9	12.8	-9.4	-1.0
Transport, Postal and Warehousing	692.0	56.1	8.8	41.1	6.3
Information Media and Telecommunications	201.8	13.8	7.3	-9.7	-4.6
Financial and Insurance Services	537.7	18.1	3.5	71.2	15.3
Rental, Hiring and Real Estate Services	241.8	3.7	1.6	22.8	10.4
Professional, Scientific and Technical Services	1,306.2	94.6	7.8	152.3	13.2
Administrative and Support Services	435.3	27.1	6.6	2.4	0.5
Public Administration and Safety	859.8	-46.6	-5.1	29.3	3.5
Education and Training	1,109.9	9.6	0.9	-23.8	-2.1
Health Care and Social Assistance	2,025.4	151.6	8.1	231.2	12.9
Arts and Recreation Services	229.5	25.0	12.2	-18.2	-7.3
Other Services	531.2	-7.6	-1.4	43.3	8.9
TOTAL EMPLOYMENT	**13,617.1**	**571.9**	**4.4**	**601.6**	**4.6**

Source: ABS, Labour Force, Australia, Detailed, Quarterly, August 2022, data are seasonally adjusted by the NSC.

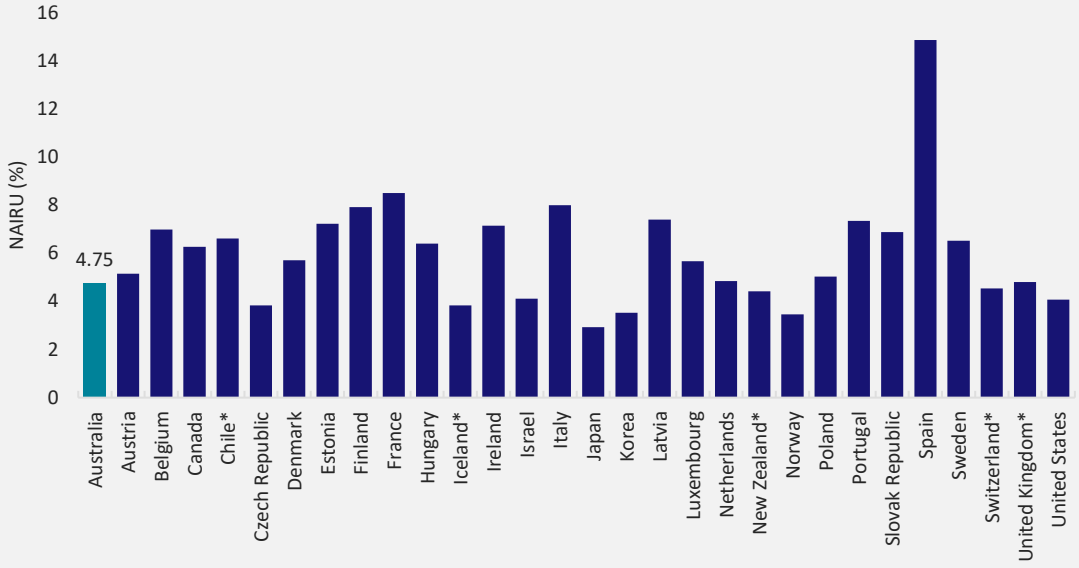
Box 3
International unemployment rates

Measures of unemployment and labour market tightness

The Non-Accelerating Inflation Rate of Unemployment (NAIRU) is a concept used by economists to assess the extent of labour market slack. The NAIRU is the unemployment rate below which inflation is likely to accelerate and often considered to approximate 'full employment' (noting that concepts such as full employment may not pay sufficient regard to those cohorts with more tenuous labour market connections).

Around the world, estimates of the NAIRU vary greatly. This reflects differences in the labour markets, economies and societies in each country. Figure 6 compares OECD estimates of the NAIRU in 31 countries in 2020, ranging from 2.9 per cent in Japan to 14.9 per cent in Spain.

Figure 6: Non-accelerating Inflation Rate of Unemployment (NAIRU), OECD countries, June 2022

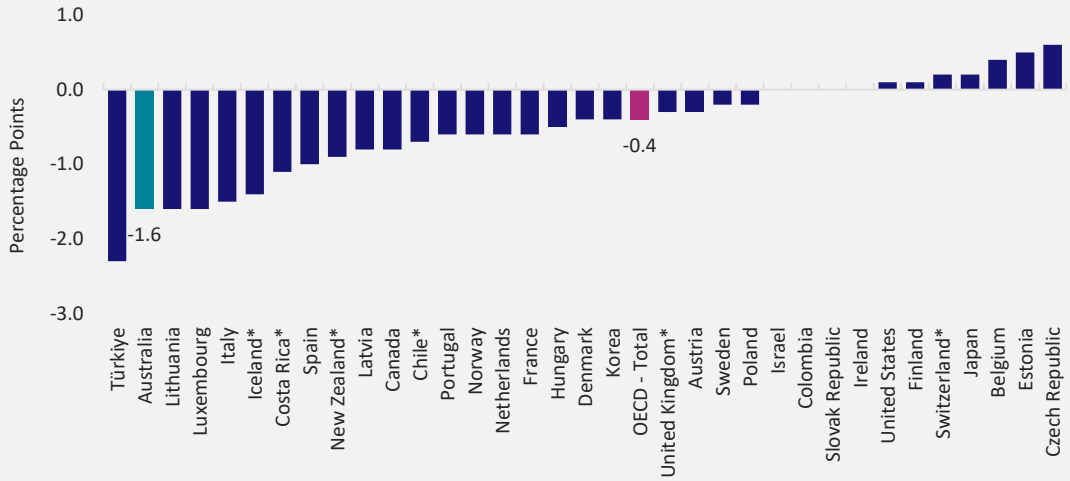


Note: Australian results are based on the Australian Commonwealth Treasury point estimates (April 2021). *Data for Chile and Iceland presented for May 2022, for New Zealand for the second quarter of 2022, and for Switzerland and the UK for the first quarter of 2022. The OECD has renamed NAIRU the equilibrium unemployment rate, as a percentage of labour force. The OECD NAIRU baseline estimates in this chart use 2020 data.

Most OECD countries have reported falls in unemployment rates since the onset of the pandemic in February 2020. Australia has recorded one of the largest falls in unemployment rates among the developed economies, and significantly larger falls than the average OECD fall of 0.4 per cent. Figure 7 shows that unemployment rates fell for 23 of 34 OECD countries between February 2020 and June 2022.

Box 3
International unemployment rates

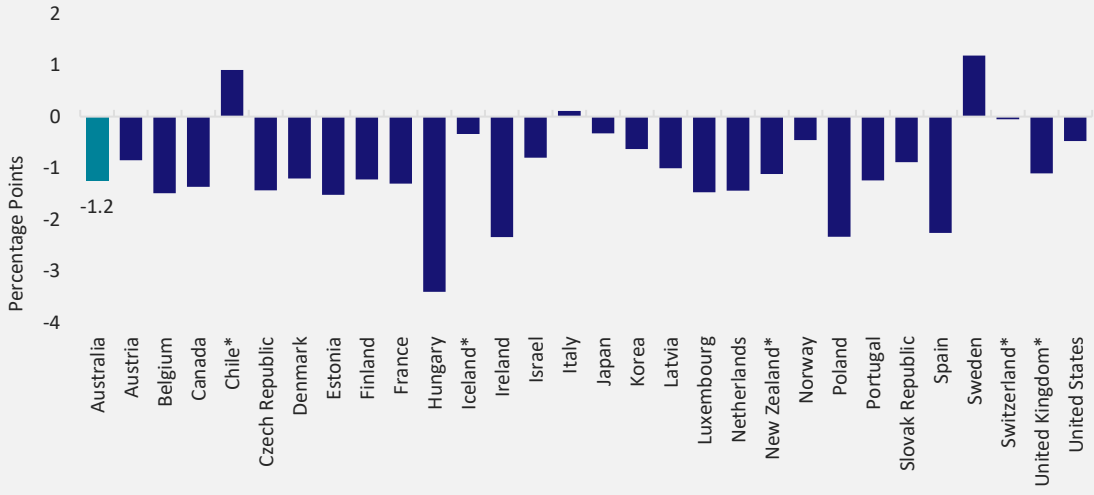
Figure 7: Changes in unemployment rates, OECD countries, February 2020 to June 2022, (percentage points)



Note: *Data for Chile, Costa Rica and Iceland presented for February 2020 and May 2022, for New Zealand for the first quarter of 2020 and the second quarter of 2022, and for Switzerland and the UK for the first quarter of 2020 and the first quarter of 2022.

As a result of these falls in unemployment rates, many OECD countries, including Australia, are experiencing unemployment rates below the NAIRU (Figure 8). That is, labour markets in most OECD economies could be considered 'tight' in mid-2022. Whether this global labour market tightness will be sustained is uncertain, given the current degree of global economic instability.

Figure 8: Gap between the unemployment rate and the NAIRU, OECD countries, June 2022 (percentage points)



Note: Australian results are based on the Australian Commonwealth Treasury point estimates (April 2021).*Data for Chile and Iceland presented for May 2022, for New Zealand for the second quarter of 2022, and for Switzerland and the UK for the first quarter of 2022.The OECD has renamed NAIRU the equilibrium unemployment rate, as a percentage of labour force. The OECD NAIRU baseline estimates in this chart use 2020 data.

1.1.5 Labour market outlook

While labour market conditions in Australia over the past year have been particularly robust, the exceptionally strong pace of employment growth will be difficult to sustain. As detailed in the October 2022 Budget, Australia is not immune to the global forces driving higher inflation and slower global growth, which will also have implications for the labour market.

That said, a number of forward indicators point to a continued tight labour market and a further expansion in employment in the coming months.

The NSC's Internet Vacancy Index (IVI) shows that job advertisements fell by 17,600 over the month, to 282,600 in September 2022. Despite the decrease recorded in September, job advertisements remain at historically high levels. Indeed, over the past 12 months, 3.4 million job advertisements have been recorded by the IVI, the largest 12-month total since the 12 months to November 2008. Job advertisements are up by 67.9 per cent (or 114,300 job advertisements) compared to pre-COVID-19 levels.

The NSC's Recruitment Experiences and Outlook Survey (REOS) shows recruitment activity remained high in September 2022, at 58 per cent, just below the peak of 59 per cent recorded in both May 2022 and July 2022.

Recruitment difficulty also remains high at 67 per cent of recruiting employers (representing 38 per cent of all employers). While this is a decline from the record high of 75 per cent seen in July 2022, the September figure is still higher than the difficulty rates seen in 2021 and most of early 2022. A high rate of recruitment difficulty is one of the consequences of the tight labour market.

Box 4
Budget labour market outlook

As detailed in the October 2022–23 Australian Government Budget papers, a global economic slowdown, high inflation, and rising interest rates, coupled with domestic disruptions from recent floods, are expected to weigh on economic activity over the next two years, with implications for Australia's labour market outlook.

- Treasury has downgraded the global growth forecast by ¾ of a percentage point in 2022, 1 percentage point in 2023, and ½ a percentage point in 2024, since the Pre-election Economic and Fiscal Outlook (PEFO).

As set out in Table 4, Treasury's domestic economic forecasts reflect both the challenges facing, and the resilience of, Australia's labour market.

- Treasury forecasts Australia's economic growth to slow from 3¼ per cent in 2022–23 to 1½ per cent in 2023–24, a downgrade of ½ a percentage point from the July Ministerial Statement and 1 percentage point from PEFO.
- Employment growth is expected to gradually ease but remain positive at ¾ per cent in 2023–24, which is ½ a percentage point slower than forecast in the July Ministerial Statement and half the growth rate forecast at PEFO.
- The unemployment rate is forecast to rise to 4½ per cent by the June quarter of 2024, which is still below its pre-pandemic level of around 5 per cent.
- Tight labour market conditions are expected to see annual wage growth pick up to 3¾ per cent by June 2023, the fastest pace since 2012. Even so, high inflation is still expected to see real wages fall over 2022–23 before rising slightly over 2023–24.

Table 4: Outcomes and forecasts for Australia of major economic and labour market parameters

	Outcome	Forecast					
	2021–22	2022–23			2023–24		
		PEFO	Update	Budget	PEFO	Update	Budget
Real GDP	3.9	3½	3	3¼	2½	2	1½
Employment	3.3	1½	1½	1¾	1½	1¼	¾
Unemployment rate	3.8	3¾	3¾	3¾	3¾	4	4½
Wage price index	2.6	3¼	3¾	3¾	3¼	3¾	3¾

Note: The unemployment rate is the rate for the June quarter. The Wage Price Index is through the year growth to the June quarter.

Source: Budget October 2022–23, Budget Paper No 1: Budget Strategy and Outlook, 25 October 2022; Ministerial Statement on the Economy, 28 July 2022; Pre-election Economic and Fiscal Outlook 2022, 20 April 2022.

Part 2
Current skills needs

The strong labour market conditions have had a marked impact on current skills needs. Demand for labour has surged, with online job advertisements increasing by nearly 20 per cent over the year to September 2022, with the number of job ads around two-thirds higher than before the pandemic.

Reflecting the increase in the demand for workers and disruption to migration flows, recruitment difficultly has also increased significantly, while the number of occupations assessed as being in shortage in the NSC's Skills Priority List (SPL) for 2022 was almost double that relative to 2021.

The overall increase in the proportion of occupations assessed as in shortage in the 2022 SPL has stemmed mainly from a tightening in the labour market for Professionals. Of the Professionals occupations that were assessed as in shortage in 2022 but not in 2021, health and education professionals were among the most common, including medical practitioners, nurses and teachers.

Although shortages for the Professionals occupation group surged in 2022, skill shortages nonetheless remain most prevalent among Technicians and Trades Workers. This is particularly the case for Skill Level 3 occupations requiring an apprenticeship, such as Electricians, Carpenters, Chefs and Motor Mechanics. Analysis by the NSC suggests that the broad tightening of Australia's labour market has not necessarily been the prime driver of these shortages; but rather has simply exacerbated shortages that have been persistent over time.

While methodologies for assessing skills shortages vary between countries, recent international findings suggest skill shortages – particularly for health care and IT professionals – are common across a number of economies.

The SPL provides a point–in-time assessment of occupations in shortage. Combining the SPL with other data sets produced by the NSC, such as job vacancies and five-year employment projections provides an estimate of some of the economy's key skills needs. The 'top three' occupations identified using this approach are (in order of the number of job vacancies): Registered Nurses; Software and Applications Programmers; and Aged and Disabled Carers.

To help gain a better understanding of regional skills pressures, the NSC has developed an indicator based on the ratio of online job ads (IVI) to employment at the regional level. This regional skills pressures indicator can be combined with findings from the SPL to test current labour demand pressures for occupations across regions.

2.1 Current labour demand

2.1.1 Job vacancies

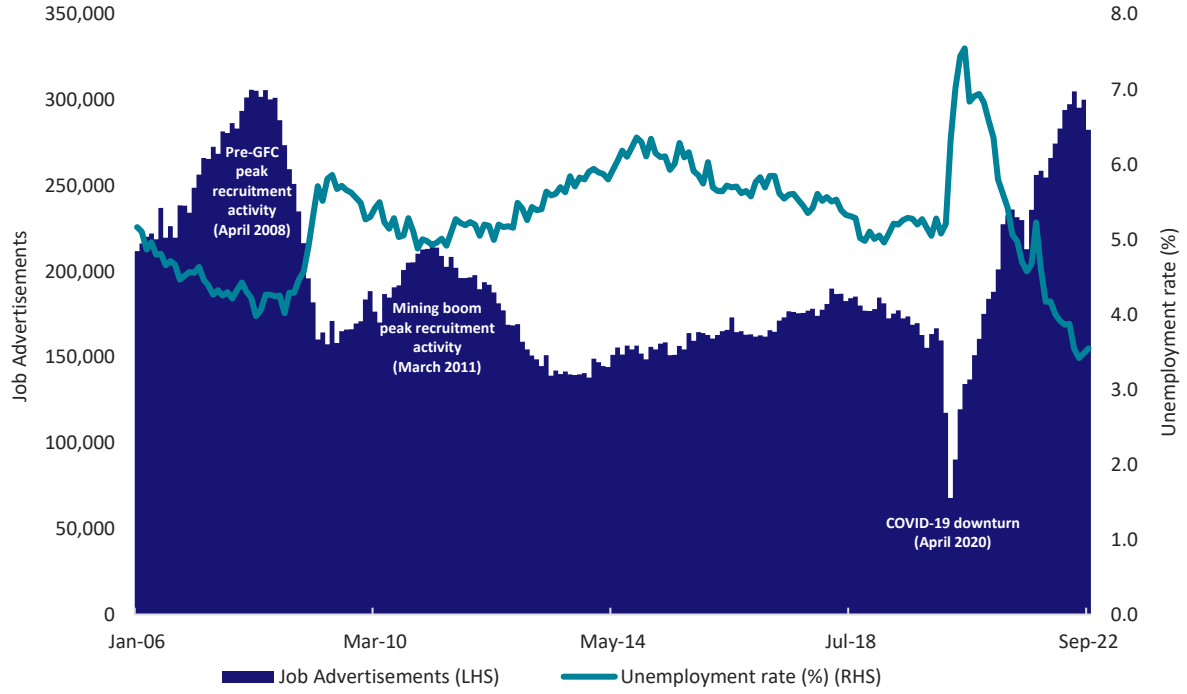
Employers' recruitment activity has surged over the last year and while the most recent data indicate this activity is beginning to ease slightly, it remains significantly elevated compared with pre-COVID-19 levels.

Data from the ABS Job Vacancy Survey indicate there were 470,900 job vacancies in August 2022, a substantial increase of 136,600 or 40.9 per cent over the year.[9] More recent changes over the quarter indicate that pressure may be starting to ease however, with the number of vacancies falling by 10,000 or 2.1 per cent in the August 2022 quarter. Despite this fall, vacancies are still 243,800 or 107.4 per cent higher than in February 2020.

Online job advertisements across Australia

The NSC's Internet Vacancy Index (IVI) shows that job advertisements increased by 46,600 or 19.7 per cent over the year to September 2022, to stand at 282,600. This is down 7.4 per cent from the near record high of 305,100 advertisements in June 2022 but is still close to record highs (Figure 9).

Figure 9: Job advertisements IVI, January 2006 to September 2022



Source: NSC Internet Vacancy Index, September 2022, seasonally adjusted data; ABS, Labour Force, Australia, September 2022, seasonally adjusted data.

[9] ABS (2022) *Job Vacancies, Australia*, August 2022, released 29 September 2022.

Internet Vacancy Index (IVI)

The **IVI** is a monthly data series measuring online job advertisements, compiled by the NSC. The series dates back to January 2006 for occupation, skill level and state and territory-based data and May 2010 for regional data.

The IVI is based on administrative data provided by contributing job boards (SEEK, CareerOne and Australian JobSearch) during the reference month.

The IVI can be used as a proxy for the level of Australian recruitment activity and an indicator for labour demand, subject to an understanding of the following conceptual limitations.

The IVI does not reflect the total number of job advertisements in the Australian labour market as it does not account for jobs advertised through other online job boards, employer websites, social media, newspapers, or informal methods such as word-of-mouth.

Job vacancies and job advertisements are different. Some employment opportunities are not advertised by employers, who may instead fill their vacancies via internal promotion or alternative recruitment methods.

Online job advertisements can be slightly skewed towards higher skilled positions. Employers with lower skilled vacancies tend to use other recruitment methods like social media or word-of-mouth more regularly.

The IVI is the only publicly available source of detailed information of this kind.

Online job advertisements across states and territories

All states and territories have observed strong growth in job advertisements over the past year, particularly in those most affected by the Delta lockdowns in the third quarter of 2021, including Victoria, New South Wales, and the Australian Capital Territory (Table 5). As with the trend for Australia more broadly however, recruitment activity is beginning to ease, with job advertisements falling across all states and territories in the month of September 2022. The sharpest decline was for Tasmania, where recruitment activity fell by 20.5 per cent (or 890 job advertisements) however job advertisements in the state remain well above pre-COVID-19 levels, as is the case with all the other states and territories.

Table 5: Job advertisements by state and territory, September 2022

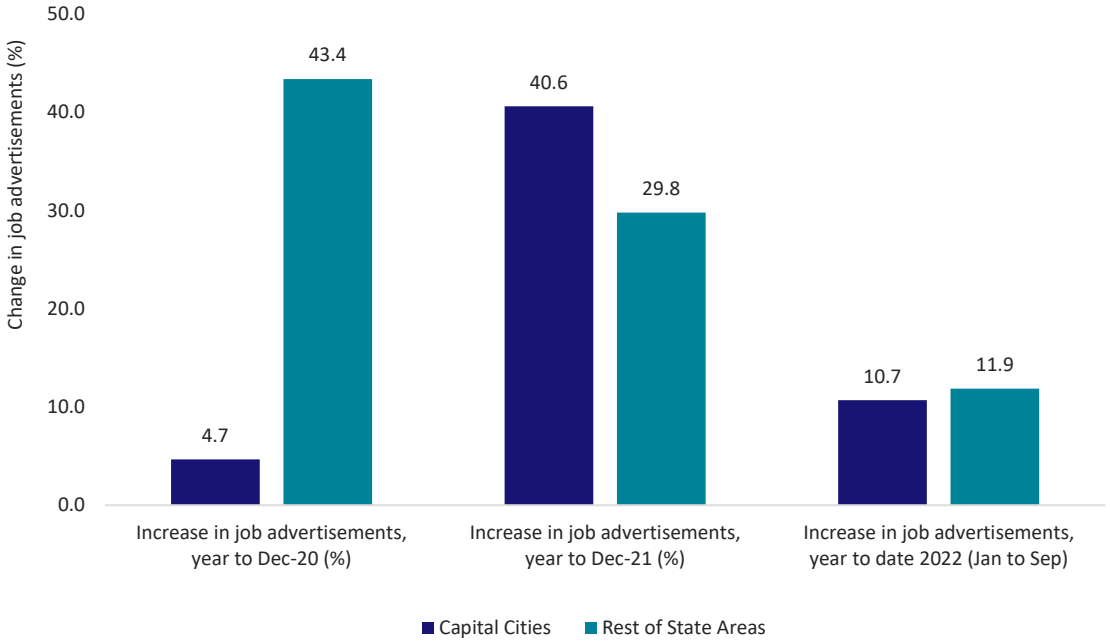
	Sept-22	Change over the month		Change over the year		Pre-COVID-19 comparison	
State/Territory	(no)	(no)	(%)	(no)	(%)	(no)	(%)
New South Wales	89,400	-5,600	-5.9	14,300	19.0	30,800	52.5
Victoria	79,100	-3,900	-4.7	19,500	32.8	33,500	73.3
Queensland	56,300	-3,200	-5.4	8,600	18.0	25,300	81.4
South Australia	14,100	-1,200	-7.6	980	7.5	6,500	85.3
Western Australia	29,900	-3,000	-9.0	1,900	6.7	13,700	84.6
Tasmania	3,400	-890	-20.5	310	10.0	1,700	95.1
Northern Territory	2,900	-250	-8.0	110	4.1	1,200	73.4
Australian Capital Territory	7,800	-130	-1.6	1,600	26.4	1,900	33.5
AUSTRALIA	**282,600**	**-17,600**	**-5.9**	**46,600**	**19.7**	**114,300**	**67.9**

Source: NSC Internet Vacancy Index, September 2022, seasonally adjusted data.

Online job advertisements across regions

Trends in job advertisement growth have varied across regions during different stages of the COVID-19 pandemic. Job advertisement growth in regional areas outpaced capital cities in the early stages of the pandemic then, over 2021, capital cities recorded stronger job advertisement growth than regional areas. Over 2022, the rate of growth in job advertisements has been relatively similar across both capital city and regional areas (Figure 10). These trends in job advertisement growth – with stronger growth in the regions in 2020, followed by a shift back towards capital cities – also have an impact on the degree of recruitment difficulty that has been experienced by employers, which is discussed further below.

Figure 10: Change in online job advertisements, capital city and regional areas since start of COVID-19



Source: NSC, Internet Vacancy Index, September 2022; unpublished seasonally adjusted data.

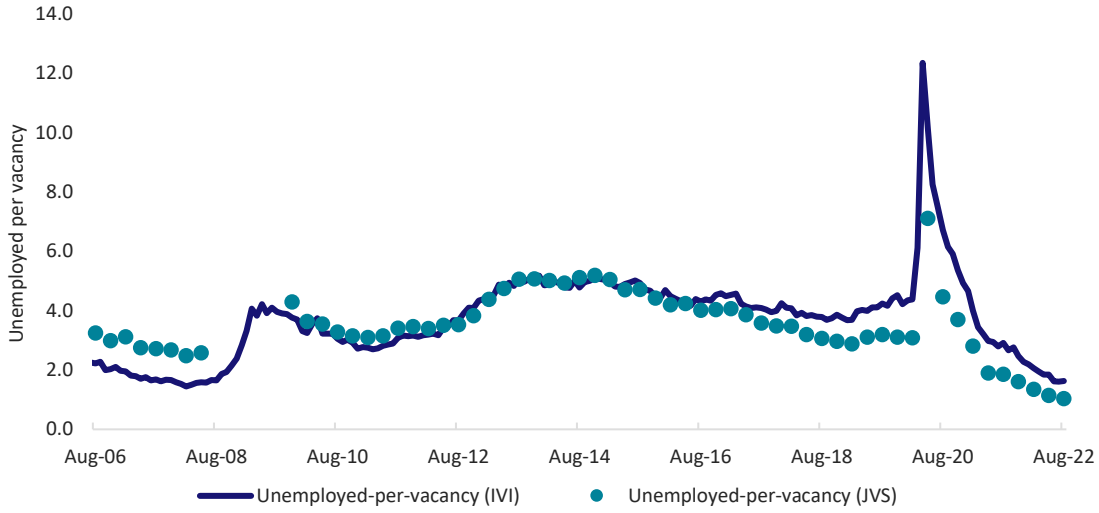
2.1.2 Recruitment difficulty

Labour market tightness

The tightening labour market over 2022 has led to widespread reporting of recruitment difficulty by employers. The level of difficulty that is experienced by employers when recruiting staff is influenced by a range of factors. However, increases in recruitment difficulty are often associated with an increase in demand for labour, a decrease in the supply of labour available, or both.

Recent trends in the Australian labour market point to both increasing demand and reduced supply (through a reduction in the number of unemployed persons and fewer migrant workers), which are leading to significant increases in recruitment difficulty. As Figure 11 shows, the growth in job vacancies and the decline in the number of unemployed persons have contributed to a significant increase in labour market tightness, with just one unemployed person for every job vacancy, a record low level.

Figure 11: Unemployed persons per job vacancy, August 2006 to August 2022

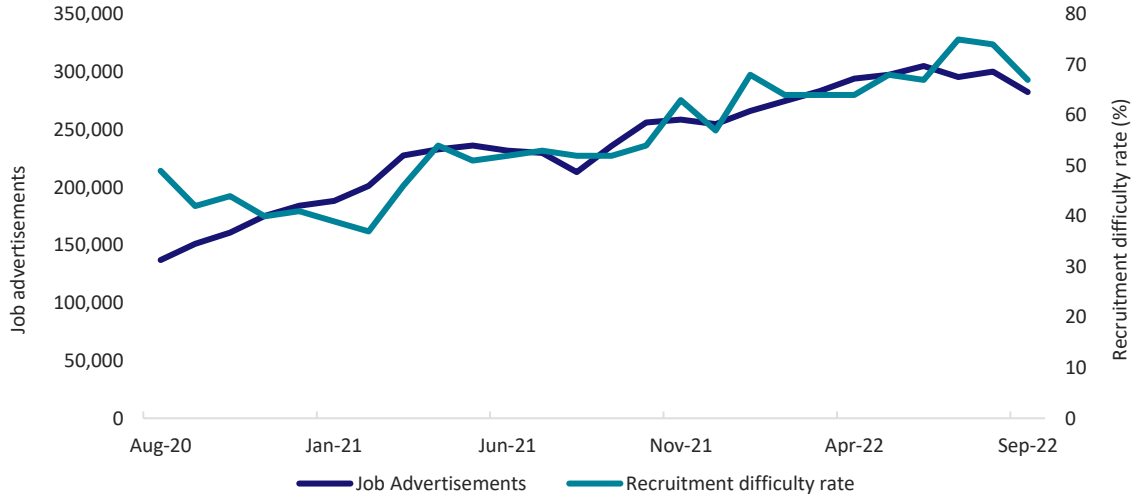


Source: NSC, Internet Vacancy Index, September 2022; ABS, Labour Force, Australia, September 2022, seasonally adjusted data; ABS, Job Vacancies, Australia, August 2022, seasonally adjusted data.

Recruitment difficulty rate

The tight labour market means that an increasing number of employers are competing for applicants, making recruitment more difficult. The most recent data from the NSC's Recruitment Experiences and Outlook Survey (REOS) indicate that in September 2022, the rate of recruitment difficulty eased by 7 percentage points to 67 per cent of recruiting employers (representing 38 per cent of all employers). While a notable decline over the month, it remains higher than the difficulty levels seen in 2021 (Figure 12).

Figure 12: Job advertisements and recruitment difficulty rate (%), August 2020 to September 2022



Source: NSC, Recruitment Experiences and Outlook Survey, September 2022; NSC, Internet Vacancy Index, September 2022, seasonally adjusted data.

Note: The 'recruitment difficulty rate' is calculated as employers who recruited and reported difficulty, divided by all employers who recruited (excluding 'unsure' responses).

Recruitment Experiences and Outlook Survey (REOS)

The **REOS** is conducted by the NSC to monitor recruitment activity and conditions. The REOS surveys employers across Australia, and up to 14,000 businesses respond to the survey throughout the year.

REOS collects information on employer recruitment activity, recruitment difficulty and staffing outlook – all important indicators to help policy makers and analysts monitor and understand current and emerging labour market conditions. Data are released as close to collection as possible, providing an almost real-time view of recruitment activity across Australia.

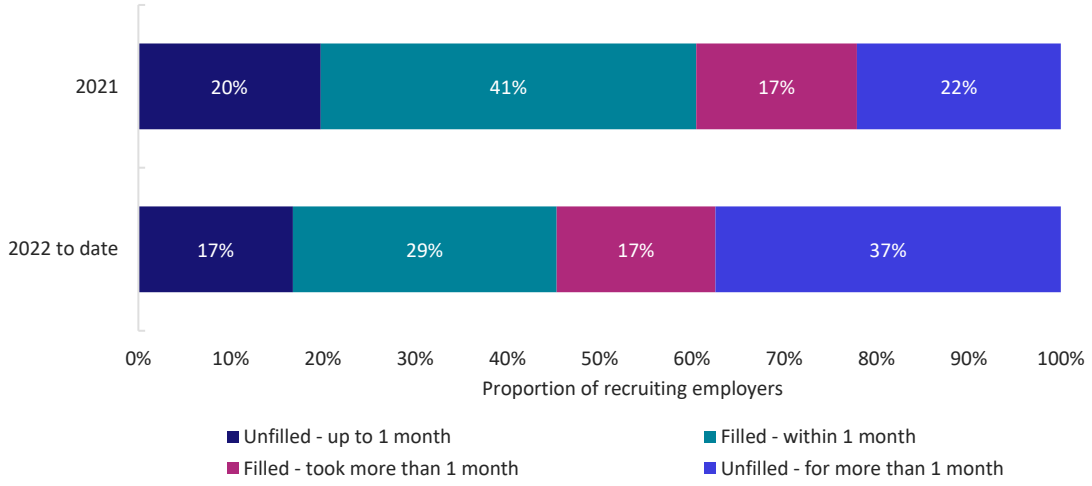
REOS data are published on the Labour Market Insights webpage, including a monthly report summarising key trends (the 'Recruitment Insights Report') together with a corresponding data file. Information on the survey methodology, key concepts used in the survey and a copy of the questionnaire, can be found in the *REOS Concepts Methods and Questionnaire* paper, also available on the Labour Market Insights webpage.

The REOS questionnaire continually evolves to stay current with changes in the Australian labour market that directly impact on businesses and their recruitment.

Time taken to fill vacancies

Tighter labour market conditions have also resulted in employers taking longer to fill vacancies. In general, recruitment difficulty results in vacancies taking longer to fill (it is important to note that recruitment difficulty doesn't necessarily mean that positions go unfilled). Figure 13 below shows the length of time taken for employers to fill their vacancies. From 2021 to 2022 (to date), the proportion of employers who had unfilled vacancies for more than 1 month increased from 22 per cent to 37 per cent.

Figure 13: Time taken to fill vacancies, 2021 and 2022 to date



Source: NSC, Recruitment Experiences and Outlook Survey, September 2022.

Note: '2022 to date' covers the period January to September 2022.

Recruitment difficulty by region

Rates of recruitment and recruitment difficulty vary by individual rest-of-state and capital city areas (as shown in Figure 14). With the exception of Queensland, rest-of-state regions reported a higher rate of recruitment activity than the relevant capital city over the year to September 2022 (for example, the recruitment activity rate for Rest of WA was higher than for Greater Perth). Similarly, with the exception of New South Wales, rest-of-state regions reported a higher rate of recruitment difficulty than the relevant capital city (for example, the rate of recruitment difficulty for Rest of SA was higher than for Greater Adelaide).

Figure 14: Rates of recruitment and recruitment difficulty by region (12 months to September 2022)

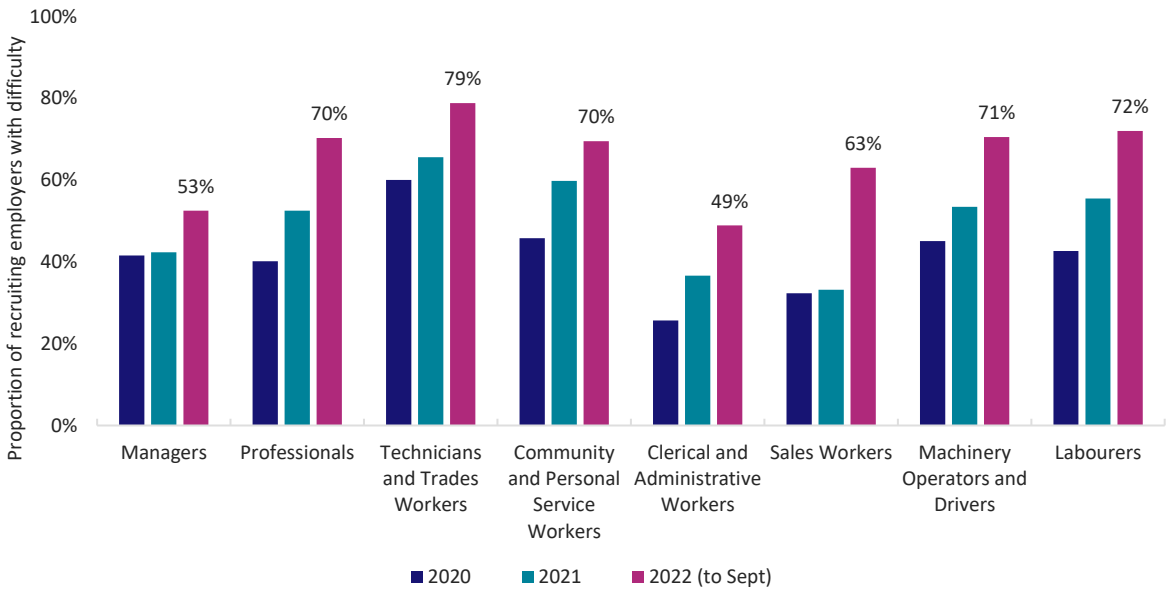
Source: NSC, Recruitment Experiences and Outlook Survey, September 2022.

Recruitment difficulty by occupation

There is currently strong demand for skills across all eight broad occupational groups reflected in increases in recruitment difficulty (Figure 15).

Compared to pre-COVID-19 levels, internet job vacancies have increased by more than 80 per cent for four occupational groups: Community and Personal Service Workers; Sales Workers; and Machinery Operators and Drivers; and Labourers. These four occupational groups all experienced an increase in recruitment difficulty of at least 24 percentage points between 2020 and 2022 (see Figure 15). That said, the highest rate of recruitment difficulty is for Technicians and Trades Workers (which is also where skill shortages are most pronounced as discussed later in this chapter).

Figure 15: Recruitment difficulty rate by occupation recruited for, 2020 to 2022 (to September)



Source: NSC, Recruitment Experiences and Outlook Survey, September 2022.

Note: 2020 covers the period from August 2020 to December 2020 and so may not reflect conditions at the height of the initial COVID-19 outbreak in Australia.

Labour demand by skill level

Labour demand is strong across all skill levels, with all of the five skill levels recording an increase in job advertisements over the year to September 2022. While Skill Level 1 has recorded the lowest growth rate over the past year and, when compared to pre-COVID-19 levels, it still represents around one-third of all advertisements (Table 6).

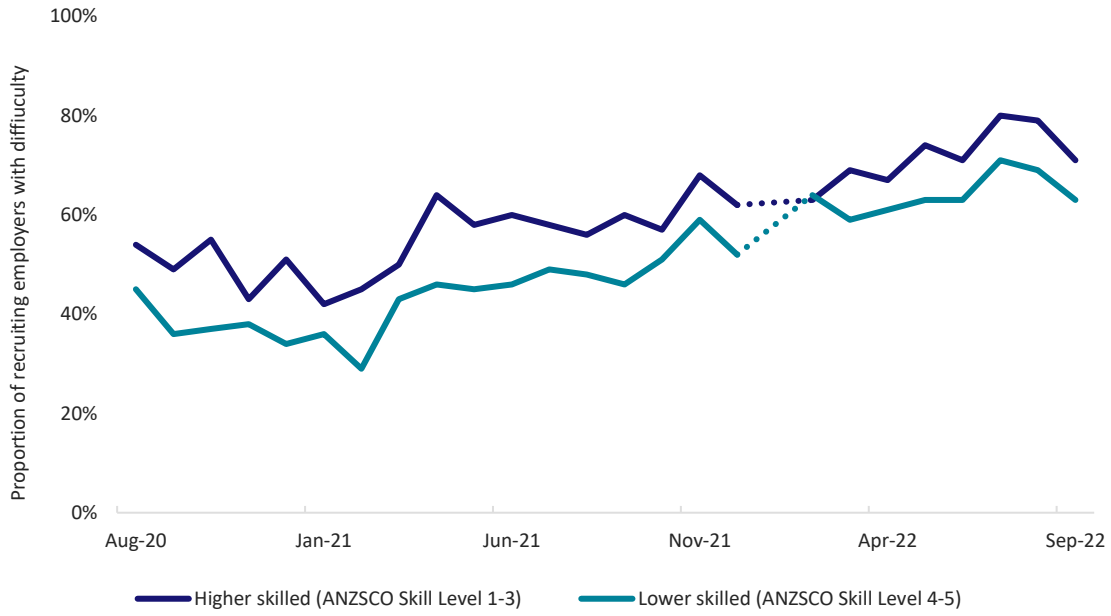
Table 6: Job advertisements by skill level, September 2022

	Sept-22	Change over the year		Pre-COVID–19 comparison	
Skill Level	(no)	(no)	(%)	(no)	(%)
Skill Level 1	96,200	7,100	8.0	28,900	42.9
Skill Level 2	29,800	5,300	21.4	10,700	56.2
Skill Level 3	41,000	8,100	24.5	17,200	72.2
Skill Level 4	78,400	18,600	31.1	36,900	88.8
Skill Level 5	37,200	7,600	25.9	20,600	124.5

Source: NSC Internet Vacancy Index, September 2022, seasonally adjusted data.

Employer survey data show, however, that employers consistently cite recruitment difficulty more often when recruiting for higher skill level occupations, compared with recruitment for lower skill level occupations (Figure 16). This reflects a combination of labour demand and the availability of workers with the right formal qualifications, skills and experience.

Figure 16: Difficulty rate by skill level of occupation (as a proportion of recruiting employers), August 2020 to September 2022



Source: NSC, Recruitment Experiences and Outlook Survey, September 2022.

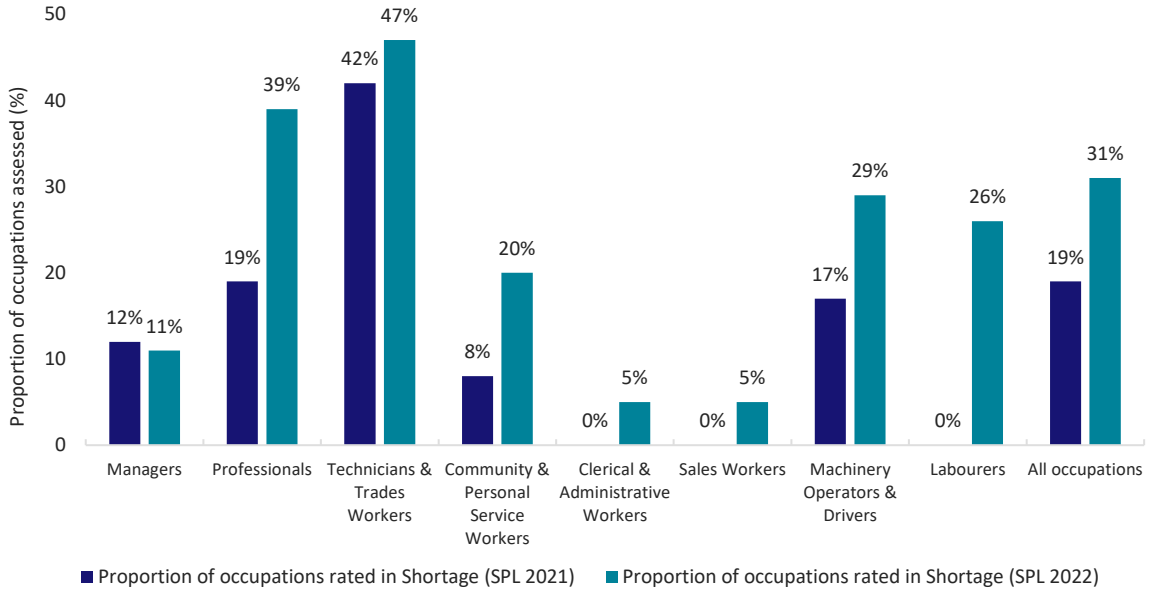
2.2 Skills shortages

The NSC's Skills Priority List (SPL) highlights the impacts of Australia's tight labour market. As detailed in the *2022 Skills Priority List: Key Findings Report*, the proportion of occupations assessed as being in shortage increased from 19 per cent in 2021 (153 out of 799) to 31 per cent in 2022 (286 out of 914).[10]

While the occupations assessed as being in shortage in 2022 represent a diverse mix, analysis by the NSC reveals two distinct patterns. As Figure 17 shows, there has been a pronounced increase in shortages among Professionals, up 20 percentage points over the year. Notwithstanding this increase, shortages remain most acute for Technicians and Trades Workers with nearly half of these occupations assessed as in shortage in 2022.

The importance of vocational education and training in meeting Australia's skills needs is underscored by the fact that over half the occupations in shortage on the NSC's 2022 SPL typically have a VET pathway.

Figure 17: Proportion of occupations in shortage on the 2021 and 2022 SPL, by major occupation group



Source: NSC, 2022 Skills Priority List.

Shortages for Professionals

The overall increase in the proportion of occupations assessed as in shortage in 2022 has stemmed mainly from a tightening in the labour market for Professionals. Indeed, of the 129 occupations newly in shortage in 2022, almost half (61) were Professionals. Data from the Survey of Employers who Recently Advertised (SERA) indicate that the main cause of the shortages among professional occupations was a lack of experienced workers. Of the occupations in the Professionals group that were added to the SPL in 2022, Health Professionals and Education Professionals were among the most common, including medical practitioners, nurses and teachers.

[10] NSC (2022) *2022 Skills Priority List: Key Findings Report*, 6 October 2022.

Skills Priority List (SPL)

The **SPL** provides a detailed view of occupations in shortage, nationally and by state and territory, as well as the future demand for occupations in Australia. The list provides a single source of intelligence on occupations in shortage. While the SPL helps inform advice on the targeting of policy initiatives, it is important to note that it is not the only input into any such advice.

The SPL is released annually as a point-in-time assessment of the labour market. The list and occupation assessments are determined through extensive statistical analysis of the labour market, employer surveys and broad stakeholder engagement with peak bodies, industry groups, professional associations, unions, regional representative bodies and major employers in the Australian labour market, combined with consultations with federal, and state and territory governments.

The use of various sources of evidence and stakeholder consultations ensures the SPL represents a comprehensive assessment of occupational shortages. For further detail on how the 2022 Skills Priority List was produced, please refer to the Skills Priority List Methodology.[11]

The proportion of Health Professional occupations in shortage went up by 47 percentage points in 2022, the largest of any sub-major group. Evidence suggests this increase has been driven mostly by the impacts of the COVID-19 pandemic, including redeployments and burn-out.[12] Reduced migration flows may also have had an impact on shortages here.

The surge in shortages for Professionals over the past year also stems in part from a tightening in the labour market for Education Professionals, including Early Childhood, Primary School, Secondary School and Vocational Education teachers. The NSC's analysis indicates the number of suitable applicants for these occupations more than halved in 2022 (down from 3.8 to 1.6) with the proportion of vacancies filled declining from 86 per cent to 60 per cent.

Shortages for Technicians and Trades Workers

Although shortages for Professionals surged in 2022, they remained most prevalent among Technicians and Trades Workers. This is particularly the case for Skill Level 3 occupations requiring an apprenticeship such as Electricians, Carpenters, Chefs and Motor Mechanics. Analysis by the NSC suggests that the broad tightening of Australia's labour market has not necessarily been the prime driver of these shortages but rather has simply exacerbated shortages that have persisted over time.

[11] NSC (2022) Skills Priority List Methodology.
[12] NSC (2022) *2022 Skills Priority List: Key Findings Report*, 6 October 2022, pp 19-20.

2.3 Key skills needs

While skills shortages are currently observed in a wide range of occupations, there are several key areas of the labour market, notably caring occupations and digital and data occupations, where shortages may be more pertinent. The SPL provides a point–in-time assessment of occupations in shortage. Combining the SPL with other data sets produced by the NSC, such as job vacancies and five-year employment projections provides an estimate of some of the economy's key skills needs.

For example, Table 7 provides a list of the top 20 occupations in demand using:

- the national 2022 SPL skills shortage ratings
- job vacancies data from the IVI (three-month average of internet job vacancies from June to August 2022) and
- projected growth in national employment over the five years to November 2026.

The list is ordered by the number of internet vacancies for each respective occupation.

Table 7: Top 20 occupations in demand

No	Occupation	IVI job ads*
1	Registered Nurses	9,266
2	Software and Applications Programmers	7,841
3	Aged and Disabled Carers	5,101
4	Construction Managers	4,984
5	Child Carers	4,549
6	Motor Mechanics	4,316
7	Retail Managers	4,244
8	Chefs	4,141
9	ICT Business and Systems Analysts	3,830
10	Metal Fitters and Machinists	3,565
11	Cooks	3,438
12	Electricians	3,396
13	Civil Engineering Professionals	3,268
14	Contract, Program and Project Administrators	2,842
15	General Practitioners and Resident Medical Officers	2,306
16	Early Childhood (Pre-primary School) Teachers	2,253
17	Physiotherapists	1,482
18	Mining Engineers	1,048
19	Gardeners	1,038
20	Auditors, Company Secretaries and Corporate Treasurers	868

Note: IVI data are June to Aug 2022 monthly average.
Source: 2022 Skills Priority List, IVI, Five-year employment projections.

This list, like the SPL, represents a diverse mix of occupations including, health care, digital, construction and engineering professionals, as well as traditional trades workers. It is important to recognise, however, that there are many, many more occupations of key significance to the economy and the wellbeing of Australians.

2.4 Regional skills pressures

To help gain a better understanding of regional skills pressures, the NSC has developed an indicator based on the ratio of online job ads (IVI) to employment at the regional level. This regional skills pressures indicator can be combined with findings from the SPL to test current labour demand pressures for occupations on a region-by-region basis.

Nowcast of Employment by Region and Occupation (NERO)

NERO was released by the NSC in July 2021. NERO provides regular monthly updates of employment for 355 occupations across 88 regions, with more than 31,000 observations for any one month.

NERO was developed by the NSC using a methodology called 'nowcasting', best described as 'predicting the present'. NERO is based on machine-learning techniques using a combination of both traditional and real-time labour market data.

Prior to the release of NERO, detailed data of employment by occupation and region were only readily available every five years from the ABS Census of Population and Housing. NERO was developed to address this gap with the purpose of being used in conjunction with data from the ABS and other sources rather than as a stand-alone source.

The NERO data are available for download from the NERO dashboard on the NSC's website. Further information, including updates on developments of the NERO dataset and a methodology paper can be found on the NERO page of the NSC's website.[13]

Occupations with the highest vacancy rates (job ads as a proportion of employment) are heavily concentrated around Mining Engineers and Sheetmetal Trades Workers, with a mix of metropolitan and non-metropolitan areas. Table 8 presents the regional skills pressure indicator for the larger employing occupations that have been assessed as in shortage for the SPL.

It's important to note that some of these occupations and locations report consistently high vacancy rates over time. This can sometimes be a result of greater opportunities for job mobility (leading to a higher number of job advertisements as a result of higher turnover), particularly where it occurs within capital cities that have larger populations and labour forces (providing more opportunities for job switching).

[13] See also S Shamiri , L Ngai, P Lake, Y Shan, A McMillan, T Smith and K Sharma (2022) 'Nowcasting the Australian Labour Market at Disaggregated Levels' *Australian Economic Review*, Vol 55, No 3, pp: 389-404.

Table 8: Top 10 regions/occupations by vacancy rate (September 2022), for occupations in shortage on the 2022 SPL

Region	Occupation	Vacancy Rate (%)
Australian Capital Territory	Construction Managers	22.3
Western Australia - Outback (North)	Mining Engineers	21.9
Latrobe - Gippsland	Enrolled and Mothercraft Nurses	19.5
Latrobe - Gippsland	Occupational Therapists	19.5
Sydney	Sheetmetal Trades Workers	19.3
Melbourne	Sheetmetal Trades Workers	19.2
Western Australia - Outback (South)	Mining Engineers	18.5
Far West and Orana	General Practitioners & Resident Medical Officers	18.0
Newcastle and Lake Macquarie	Mining Engineers	17.4
Melbourne	Cooks	16.4

Note: Vacancy rate is measured as the number of job vacancies for an occupation in a particular region based on IVI, divided by the corresponding level of employment from NERO. List excludes occupations with less than 10 vacancies and less than 100 employed.

Source: NSC, Internet Vacancy Index, September 2022, NSC Nowcast of Employment by Region and Occupation, September 2022, unpublished data.

Occupations that are assessed as in shortage and experiencing high vacancy rates can also be identified within specific regions. Table 9 presents a list of occupations in Newcastle and Lake Macquarie and the Mid-North Coast of New South Wales that are in shortage (based on the 2022 SPL for New South Wales) and that also have high vacancy rates. Only two occupations appear in both lists – Chefs and Cooks – demonstrating the differences that can occur between regions and highlighting the insights available from examining regional level labour market data.

Table 9: Top occupations by vacancy rate (September 2022) for Newcastle and Lake Macquarie and Mid-North Coast New South Wales and assessed as in shortage for New South Wales on the 2022 SPL

Top occupations in Newcastle and Lake Macquarie	Vacancy Rate %	Top occupations in Mid-North Coast New South Wales	Vacancy Rate %
Mining engineers	17.4	Cooks	6.2
Cooks	9.7	Enrolled and Mothercraft Nurses	3.8
Motor Mechanics	5.9	Aged and Disabled Carers	3.0
Chefs	5.8	Chefs	2.9
Child Carers	5.7	Metal Fitters and Machinists	2.7

Note: Vacancy rate is measured as the number of job vacancies for an occupation in each region based on IVI, divided by the corresponding level of employment from NERO. List excludes occupations with less than 10 vacancies and less than 100 employed.

Source: NSC, Internet Vacancy Index, September 2022; NSC Nowcast of Employment by Region and Occupation, September 2022, unpublished data.

Box 5
Skill shortages are not unique to Australia

While methodologies for assessing skills shortages vary between countries, recent international findings suggest skills shortages can be common across economies.

Health sector

International research and analysis suggest there are widespread skill shortages in the health sector. This is consistent with the NSC's 2022 SPL analysis, which found shortages in Australia for a range of medical and health occupations, including general practitioners, cardiologists, surgeons, pathologists registered nurses, enrolled nurses and dentists.

The United States does not release skill shortage research analysis. However, Bureau of Labor Statistics (BLS) employment growth projections shows healthcare occupations and those associated with healthcare (including mental health) will account for seven of the 30 fastest-growing occupations from 2020 to 2030.[14]

Analysis by Eurofound indicates that shortages in nursing occupations in Europe were exacerbated during COVID-19.[15] A more recent report by the European Labour Authority showed similar trends, with shortages being more prevalent in the broader health sector.[16]

Analysis for Ireland and Singapore delivers similar findings for their respective health workforces.[17] The report from Singapore's Skills Future agency also noted that global shortages in healthcare are expected to increase with a growing number of healthcare and community care facilities built as populations age.

The World Health Organization (WHO) recently reported that the global health workforce is estimated to be 65 million, based on data from 194 member states as of 2020.[18] It notes that this reflects growth of 29 per cent since 2016, when it published projections indicating health workforce shortages of between 10 million and 18 million by 2030. The WHO also notes that there is support for revisiting these health workforce projections, as they are based mainly on pre-COVID-19 trends, with the impact of the pandemic on the health and care workforce likely to have been substantial. It warns that two regions – Africa and the Eastern Mediterranean and Middle East – will shoulder an increasing burden of the health workforce shortage, amid growing demand for services.

The WHO's Working for Health 2022-2030 Action Plan notes that "supply shortages, inadequate employment of available graduates in the pool of qualified workers, skill mismatches and suboptimal performance and distribution of workers in the health system" are several of the most pressing challenges facing low- and middle-income countries.[19]

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14 BLS (2021) Employment Projections 2020-2030, Economic News Release, 8 September 2021.
15 Eurofound (2021), *Tackling labour shortages in EU Member States*, Publications Office of the European Union, Luxembourg, 20 July 2021.
16 J McGrath (2021) *Report on Labour Shortages and Surpluses*, European Labour Authority (ELA), November.
17 For Republic of Ireland, see J McNaboe, N Burke, N Condon, AM Hogan, C Shally and D Walls (2021), *National Skills Bulletin 2021*, report by the Skills and Labour Market Research Unit (SLMRU) in SOLAS on behalf of the National Skills Council, October. For Republic of Singapore see Skills Future SG (2021) *Skills demand for the future economy*.
18 WHO (2022), Global Strategy on Human Resources for Health, Workforce 2030: Reporting at Seventy-fifth World Health Assembly, held 22-28 May 2022, Departmental news, 2 June 2022.
19 WHO (2022) Working for Health 2022-2030 Action Plan, p 17, 11 April 2022.

Box 5
Skill shortages are not unique to Australia

ICT, Technology and STEM

A number of economies are also experiencing shortages in information technology (IT), cyber security and related technology skills. NSC analysis has found similar shortages in Australia.

In the European Union (EU), shortages in IT occupations were exacerbated during the pandemic as remote work became more common. In 2021, the European Labour Authority (ELA) reported that shortages in occupations where STEM-related knowledge was important had made those occupations more difficult to recruit for. In Ireland, occupations such as IT project managers, IT product managers and software developers and engineers, were reported to be in shortage.

Other sectors and occupations

The BLS analysis for the US on the fastest growing occupations from 2020 to 2030, indicates fast employment growth for statisticians, information security analysts, and data scientists. In contrast, technological changes facilitating increased automation are expected to result in declining employment for office and administrative support, sales and production occupations.

In Europe, sectors such as hospitality and transport were heavily impacted by the pandemic. International Monetary Fund (IMF) staff analysis suggests these sectors will continue to experience difficulties, as contact-intensive and low paying occupations become less desirable across developed economies.[20]

The Republic of Ireland's analysis of its labour market shows there are shortages for a wide range of other occupations, including analytical chemists; medical scientists; design, process and quality control/assurance engineers; mechanical and electrical engineers; accountants with industry-specific experience; and welders.

[20] IMF (2022) European labor markets and the COVID-19 pandemic: Fallout and the path ahead, Departmental Paper DP/2022/004, 3 March 2022.

Part 3
Emerging skills needs

The NSC's five-year employment projections indicate that jobs growth is expected to be strongest across service industries and in jobs requiring higher level qualifications.

While it is important to assess the changing occupational composition of the labour market, understanding the changes in the skills used within occupations and emerging skills in new occupations is also crucial in understanding skills needs. Mapping the employment projections to the Australian Skills Classification shows the skills clusters with the largest increases in time spent will be: Health and care; Business operations and financial activities; and Communication and collaboration. Those cluster families with the fastest growth are expected to be: Performance evaluation and efficiency improvement; Digital technologies and electronics; and Health and care.

The employment projections have been supplemented in this report with scenario modelling. The Adaptable and Dynamic Economy scenario primarily captures the upside risks to the economy associated with an accelerated pace of digitisation. Here, a number of IT-related occupations with already strong projected employment growth could see even more demand and faster growth. In contrast, the Uncertain World scenario is primarily designed to capture the implications for the Australian economy of downside global risks. A key element of this scenario is the change in preference toward more Australian-made products as a response to supply chain blockages associated with the ongoing impacts of geopolitical uncertainty. Given these risks, employment growth in manufacturing-related occupations may be stronger than projected under the NSC's central scenario. Rounding out the scenarios is Decarbonisation, where stronger growth for occupations such as Electricians, Glaziers and Insulation and Home Improvement Installers is likely over the near term relative to the NSC's central scenario.

As Australia transitions to a net zero carbon economy, new skills and jobs will be required across both traditional and emerging sectors.

In a number of occupations ('Green Enhanced Skills') the broad purpose of the occupation remains the same, but elements of the occupation have changed. For example, truck drivers may be increasingly focused on reducing fuel consumption.

A range of occupations will face growing demand with the shift to a net zero carbon economy ('Green Increased Demand' occupations). These include many conventional jobs like electricians, carpenters, and fitters.

'Green New and Emerging' occupations are jobs that have emerged due to green economy activities and technologies. Many occupations in this category are associated with clean energy specific roles or roles associated with emerging technologies. These occupations represent a range of cutting-edge opportunities presented by decarbonisation, which Australia could harness and grow significantly over time.

3.1 Projected jobs growth over the next five years

The NSC's latest employment projections, covering growth between November 2021 and November 2026, indicate that while jobs growth can be expected across a wide range of industries, job types and skill levels, the strongest growth is likely to occur in services industries and higher skill level jobs.

3.1.1 What industries are expected to drive future employment growth?

Reflecting a diverse and resilient labour market, employment is projected to increase in all 19 broad industries over the five years to November 2026 (Figure 18). In November 2021, employment exceeded pre-COVID-19 levels in 11 of these industries and is projected to exceed this level in a further five industries at the end point of the five-year projections period.[21]

The long-term structural shift in employment towards services industries is projected to continue with four services industries – Health Care and Social Assistance, Professional, Scientific and Technical Services, Education and Training, and Accommodation and Food Services – expected to generate almost two-thirds (or 65.4 per cent) of the total projected employment growth.

Five-year employment projections

Each year, the NSC produces employment projections for the following five years, the latest being the five years to November 2026. These projections are designed to provide a guide to the future direction of the labour market. However, like all such exercises, they are subject to an inherent degree of uncertainty.

The projections have been derived by using a blend of two techniques, namely:

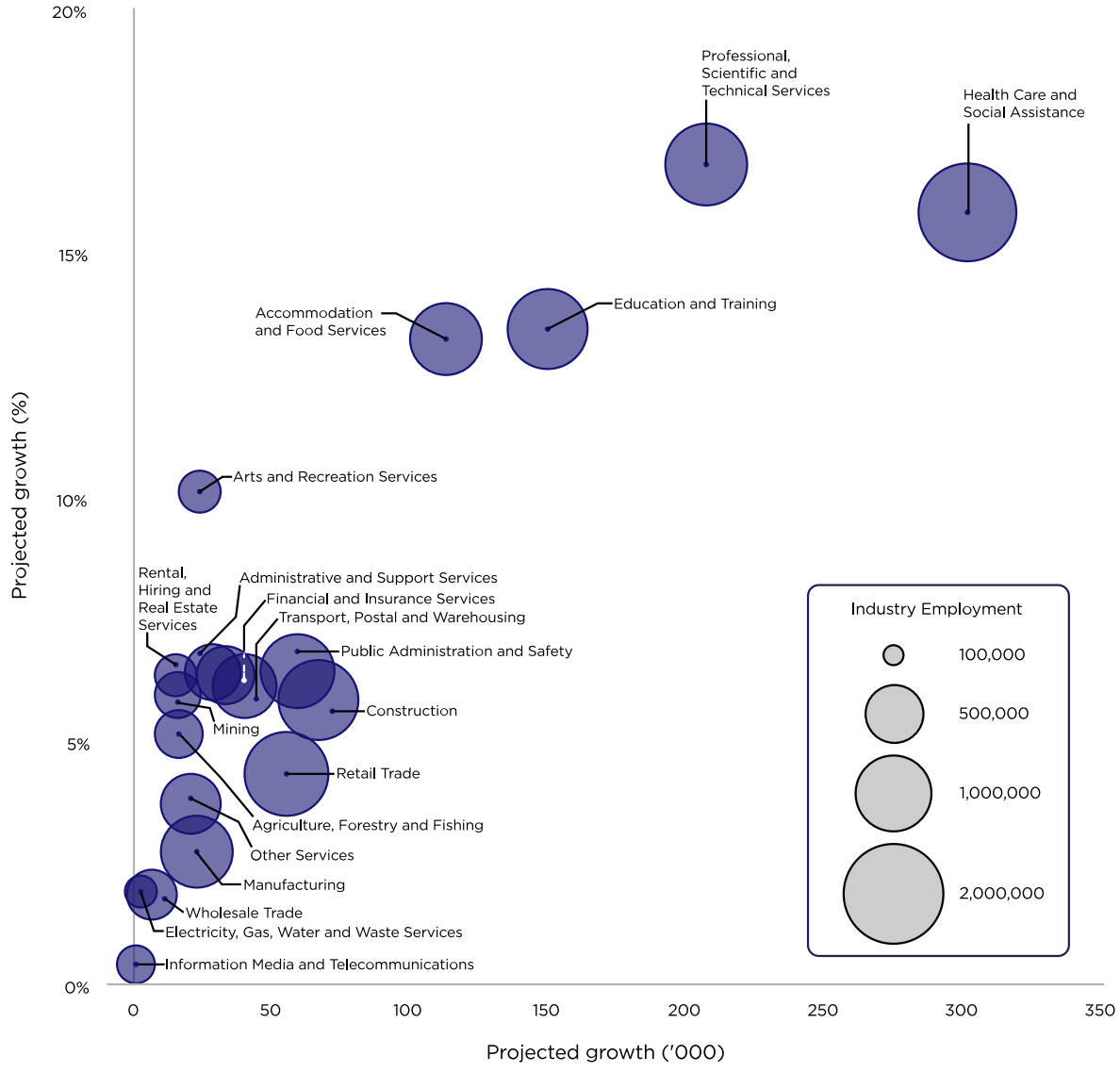
- best practice time series models that summarise the information that is in historical data and convert it into a forecast. The time series projections are made by combining forecasts from autoregressive integrated moving average (ARIMA) and exponential smoothing with damped trend (ESWDT) models, with some adjustments made to take account of research undertaken by the NSC and known future industry developments.
- CGE modelling work the NSC undertook in 2022 with the Victoria University Centre of Policy Studies, to better understand how structural changes in the economy may affect employment growth.

The nature of both exercises means that there will be differences between them. The NSC believes that having a range of techniques assessing future skills trends is one way of mitigating the risks of error inherent in any forecasting exercise.

All efforts have been made to ensure these projections are as accurate as possible, however, the data used is inherently volatile and there are a large number of small series. Further, due to the unprecedented changes in labour market indicators as a result of COVID-19, the ABS had ceased the publication of trend estimates, which have in the past been a key component for the employment projections. Seasonally adjusted data, which are more variable, have been used instead.

[21] It is important to note that the employment projections are a point forecast for November 2026 and provide no data for employment in the intervening five-year period. That is, the recovery path of employment for occupations can only be implied by the NSC's employment projections. Low projected employment growth may indicate a slow recovery. However, it is entirely possible that employment will exceed pre-COVID-19 levels in the five-year period before settling at a lower point as longer-term trends unrelated to COVID-19 impact employment levels.

Figure 18: Projected employment growth by industry, five years to November 2026



Source: NSC 2021 Employment Projections.

3.1.2 Where the job opportunities will be

The importance of the 'Four Cs' (Care, Computing, Cognitive ability and Communication) were highlighted as key skill needs of the future, as identified in the NSC's 2021 *State of Australia's Skills* report. For instance, the care sector occupations Aged and Disabled Carers (up by 74,900 or 28.0 per cent) and Registered Nurses (up by 40,400 or 13.9 per cent) are expected to record the largest and third largest increases in employment over the five years to November 2026, driven by Australia's ageing population and the strong growth projected for the Health Care and Social Assistance industry (Figure 19).

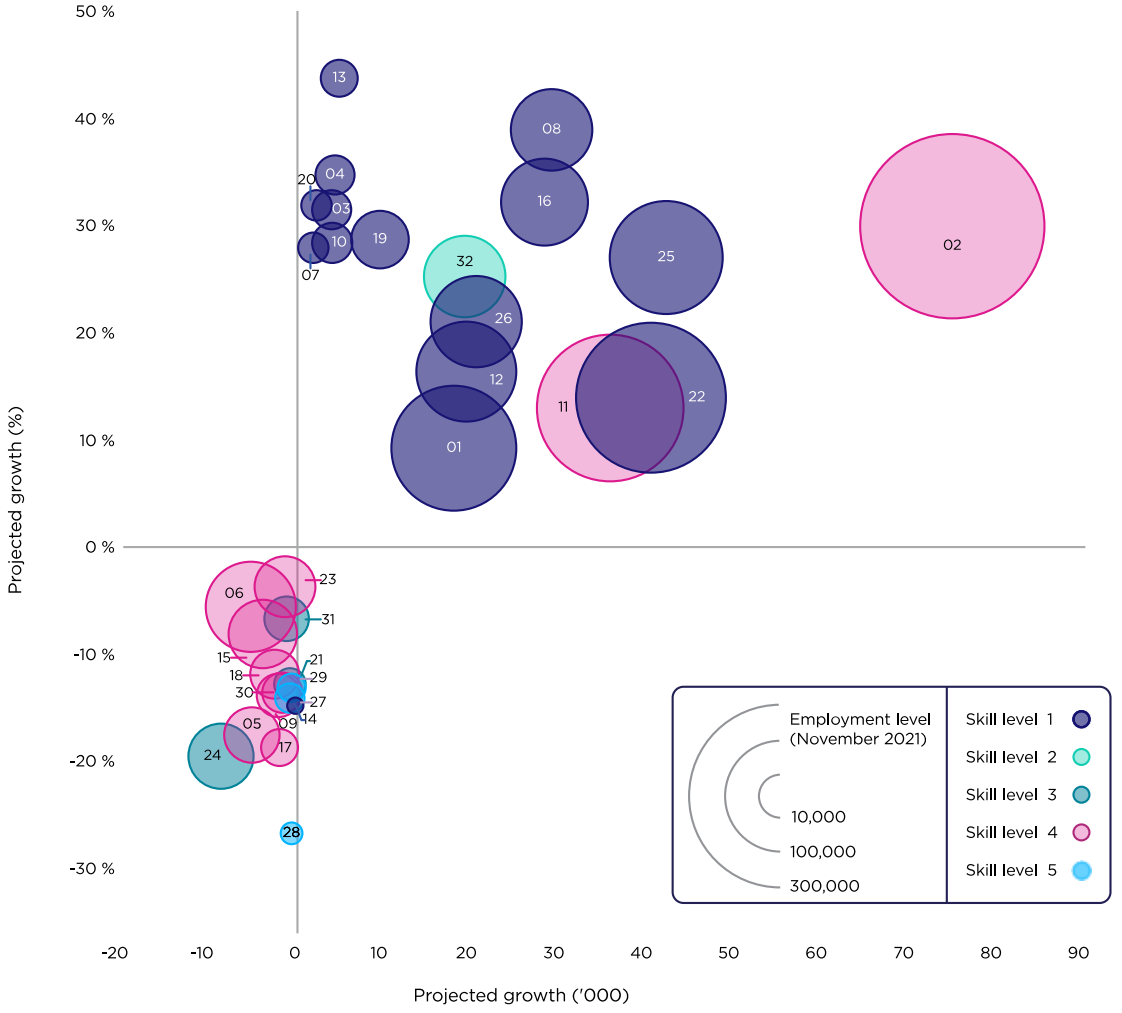
Further, the importance of computing and cognitive skills is evident in the strong employment increases projected for Software and Application Programmers (up by 42,200 or 27.0 per cent), Database and Systems Administrators, and ICT Security Specialists (up by 29,100 or 38.9 per cent) and Management and Organisation Analysts (up by 28,200 or 32.2 per cent). All three of these occupations are among the six occupations with the largest projected increase in employment over the five years to November 2026.

Just 49 of the 358 detailed occupations are projected to record a decline in employment over the five years to November 2026. A number of the occupations that are expected to record the largest decreases in employment have been subject to long-term employment declines and are particularly exposed to structural trends such as automation and globalisation. For instance, Secretaries are expected to record the largest decline in employment over the five years to November 2026 (down by 8,800 or 19.6 per cent), an occupation that has recorded a fall in employment of 78,000 over the last 20 years, the largest of any occupation.

The detailed occupation projections also illustrate the extent to which employment growth is expected to be in highly skilled jobs. Of the 49 occupations that are projected to record a decline in employment over the five years to November 2026, just five (or 10 per cent) are Skill Level 1 occupations, while 10 (or 20 per cent) are Skill Level 5 occupations. In a similar vein, of the 130 occupations that are projected to record employment growth at a faster rate than the average for all occupations, 74 (or 57 per cent) are Skill Level 1 occupations, compared with just seven (or 5 per cent) from Skill Level 5.

That said, it is important to note that there will be many employment opportunities across all skill levels in coming years. Indeed, 42 of the 55 (or 76 per cent) Skill Level 5 occupations are expected to record an increase in employment over the five years to November 2026, while 56 of 71 (or 78.9 per cent) Skill Level 4 occupations are projected to record an increase in employment over the period.

Figure 19: Projected employment changes by occupation and skill level ('000s and percentage growth) – selected occupations



- 01 Accountants
- 02 Aged and Disabled Carers
- 03 Air Transport Professionals
- 04 Audiologists and Speech Pathologists/Therapists
- 05 Bank Workers
- 06 Bookkeepers
- 07 Complementary Health Therapists
- 08 Database and Systems Administrators, and ICT Security Specialists
- 09 Engineering Production Workers
- 10 Fashion, Industrial and Jewellery Designers
- 11 General Clerks
- 12 Human Resource Managers
- 13 ICT Support and Test Engineers
- 14 ICT Trainers
- 15 Keyboard Operators
- 16 Management and Organisation Analysts
- 17 Other Machine Operators
- 18 Other Stationary Plant Operators
- 19 Physiotherapists
- 20 Podiatrists
- 21 Printers
- 22 Registered Nurses
- 23 Retail Supervisors
- 24 Secretaries
- 25 Software and Applications Programmers
- 26 Solicitors
- 27 Street Vendors and Related Salespersons
- 28 Telemarketers
- 29 Timber and Wood Process Workers
- 30 Tourism and Travel Advisers
- 31 Wall and Floor Tilers
- 32 Welfare Support Workers

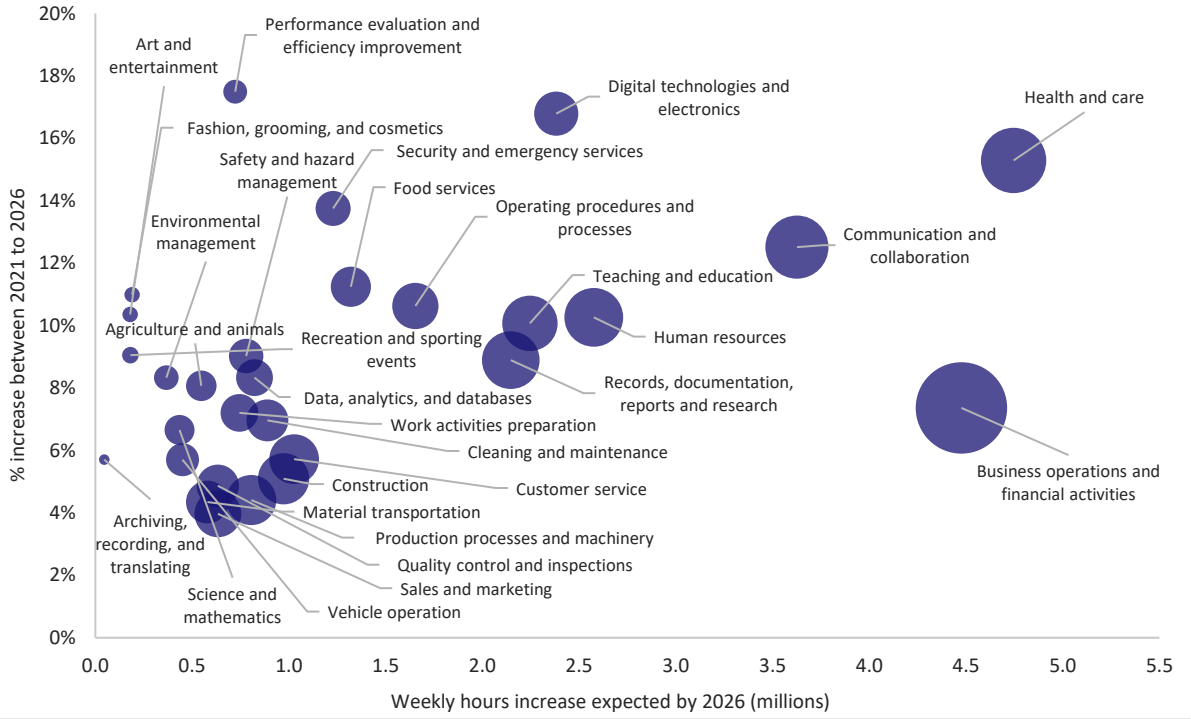
Source: NSC, 2021 Employment Projections.

3.2 Five-year skills outlook

By mapping the five-year employment projections to the Australian Skills Classification, the NSC has produced five-year skills projections. These projections show the number of additional hours per week expected to be spent on each of the skills clusters in the workforce.

Figure 20 shows the demand for skills at the cluster family level (the highest level) on two dimensions – the percentage increase projected between 2021-2026 (on the vertical axis) and the number of additional hours per week expected to be spent on each skills cluster across the workforce from 2021-2026 (on the horizontal axis). The size of each bubble represents the number of hours Australians currently spend on each family in a week.

Figure 20: Demand for skills by skills cluster family, projected growth from 2021 to 2026, millions of hours worked



Source: NSC 2021 Employment Projections; NSC Australian Skills Classification, unpublished data.

The Health and care skills cluster family is expected to see the largest increase in hours worked (an additional 4.7 million) over the five years to 2026, as well as the third fastest expected growth of 15 per cent. Many of these additional hours will come from frontline medical staff and the care and support workforce who make the most extensive use of these skills in their day-to-day work.

The largest bubble is the Business operations and financial activities skills cluster family, with 225 occupations in the labour market using skills from this cluster family in their day-to-day work, but for only a small amount of time in their day. This has the second largest increase in hours worked (an additional 4.4 million) over the five years to 2026, but the growth rate is low at 7.3 per cent.

Australian Skills Classification (ASC)

The ASC helps define the skills that underpin jobs in Australia. The ASC adds a new layer of information to existing data about occupations or qualifications, facilitating new skills-based approaches to workforce and talent strategies, learning and development, and policy.

The ASC identifies three types of skills for every occupation:

- ***Core competencies*** are common to all jobs. They describe a set of non-specialist skills gained through schooling and life experience, which provide a base to further develop skills and specialities. Currently there are different popular terms for core competencies, including 'employability skills', 'foundation skills' and 'core skills'. The ASC identifies 10 core competencies common to every occupation in Australia. For example, teamwork, numeracy and problem solving.
- ***Specialist tasks*** describe day-to-day work within an occupation. While specialist tasks can be transferable across occupations and sectors, unlike core competencies, they are not universal. Specialist tasks are useful for differentiating occupations. The ASC can also show where another occupation utilises the same specialist tasks.
- ***Technology tools*** are the hardware and software, used within an occupation. Understanding the technology used within an occupation can provide a more wholistic understanding of the skills required to undertake a job beyond day-to-day tasks. The ASC describes software, hardware and equipment types or categories used within occupations rather than specific packages or products.

The ASC groups similar specialist tasks together into **skills clusters**. These are tasks that are broadly transferable —if you can do one task in the cluster, you can likely do the others. It is important to note here that the ASC is largely context-agnostic and as such, does not identify the pre-requisite qualifications, credentials, knowledge or experience required to undertake a job.

The skills clusters are grouped once more into **skills cluster families**. These are made up of related skills clusters, but importantly at this level, do not rely on the same underlying assumption about the ability to undertake all skills within them.

The ASC was released in March 2021. It is accessible through an interactive interface or can be downloaded as a dataset in an Excel file from the NSC's website. The uptake and integration of the ASC into skills-based approaches to policy, recruitment and training is bringing to life the NSC's vision for the ASC to become a 'common language' for skills in Australia.

The need for Digital technologies and electronics skills will remain strong with an additional 2.4 million hours per week to be spent on these skills between now and 2026 (and with the second fastest expected growth of 16 per cent). These skills are most intensively used in IT roles, such as Software and Application Programmers, which includes Software Engineers, Testers, and Developer Programmers. Just under 40 per cent (or 921,000) of the additional hours per week spent on Digital technologies and electronics will be worked by people in these occupations.

While no skills cluster family is expected to take less time in absolute terms over the next five years, there are some which will decrease in importance. The four slowest growing families are Sales and marketing (3.9 per cent) followed by Material transportation (4.3 per cent), then Production processes and machinery (4.4 per cent) and Quality control and inspections (4.8 per cent). A look over the previous five years suggests the share of time spent on skills in these cluster families has been declining for some time, reflecting broader structural change occurring in the labour market.

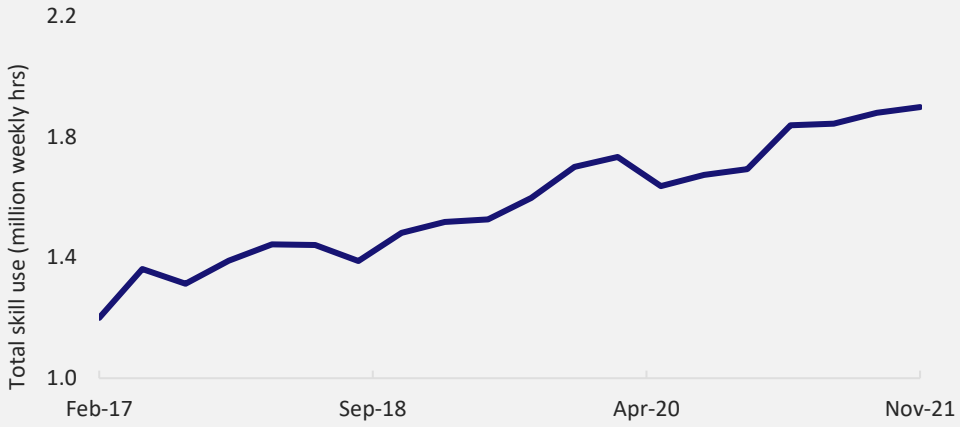
Skills from the Digital technologies and electronics, Health and care, Communicate and collaborate, Business operations and financial activities, and Teaching and education cluster families feature prominently in the top 30 skills clusters with the largest projected growth, by total hours per week, over the five years to 2026 (Figure 22).

The analysis affirms the importance of communication skills for most occupations with the Communicate and collaborate skills cluster expected to see the largest growth (1.4 million additional hours per week by 2026, an increase of 12.4 per cent). The Support diversity and Inclusion skills cluster, which was added to the ASC this year, is also expected to see a rapid increase in hours worked of 26 per cent (Box 6).

Box 6
Case study on Support diversity and inclusion skills cluster

The Support diversity and inclusion skills cluster involves understanding cultural and accessibility needs of a diverse community and acting as an advocate or communicator for those needs. The cluster is notable for its considerable growth in weekly hours over recent years. Total weekly hours worked was about 55 per cent higher in November 2021 than it was at the same time in 2017, or equivalent to about 675,000 more hours.

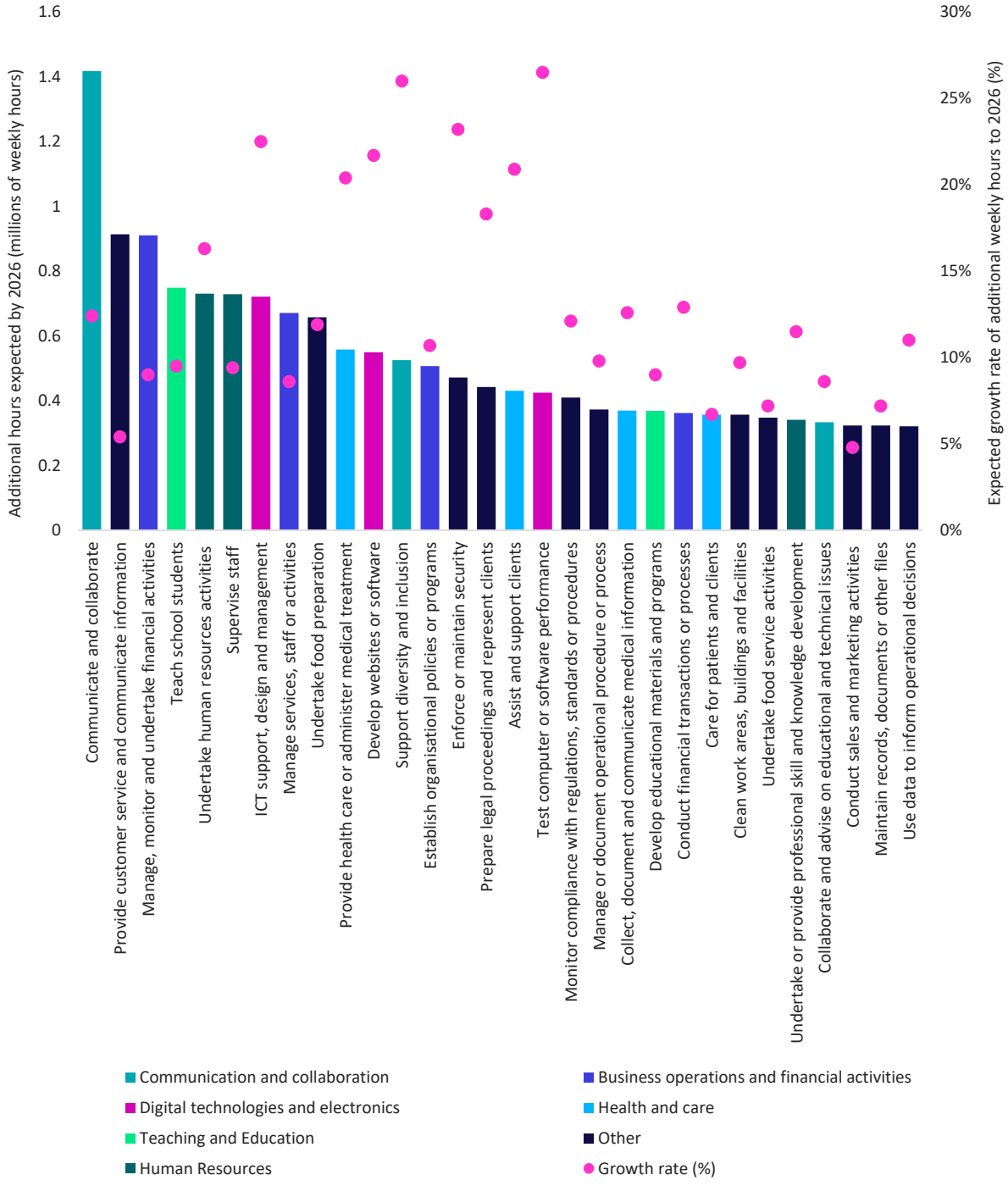
Figure 21: Support diversity and inclusion cluster, total weekly hours (2017-2021)



Source: NSC 2021 Employment Projections; NSC Australian Skills Classification, unpublished data.

Our projections show growth in these skills is set to continue with an increase of 26 per cent, or an additional 525,000 weekly hours expected by 2026.

Figure 22: Skills clusters with the largest projected growth from 2021 to 2026, by total hours per week



Source: NSC 2021 Employment Projections, NSC Australian Skills Classification, unpublished data.

The Provide customer service and communicate information skills cluster is expected to see the second largest growth (913,800 additional hours per week by 2026, an increase of 5.4 per cent). This skills cluster is used in 115 service-oriented occupations in the labour market. Skills clusters from the Human resources family, Undertake human resource activities and Supervise staff are in the top six skills clusters, largely because they are used to a small degree by a large range of occupations.

In the Digital technologies and electronics family, the ICT support, design and management skills cluster will contribute an extra 721,000 hours per week by 2026, an increase of over a fifth on its current use. Use of the Develop websites or software skills cluster is projected to increase by around 549,000 hours each week, an increase of 20.1 per cent. Operate and maintain computers will increase by 310,000, an increase of 14 per cent. The combination of large increases in hours worked across the economy and strong growth rates affirms the importance of digital technology skills across a range of occupations.

Two skills in the top 30 belong to the Teaching and education family; the largest increase in hours will be seen for Teach school students, which is expected to need an additional 748,000 workforce hours per week, an increase of 9.5 per cent, as well as Develop educational materials and programs (an increase of 368,000 weekly hours).

Four skills clusters from the Health and care family emerge in the top 30. The skills cluster Provide health care or administer medical treatment will contribute 557,500 additional hours per week, which is an increase of 20.4 per cent on current levels. The skills cluster Assist and support clients is the next highest within this family contributing an additional 430,500 additional hours per week, an increase of 20.9 per cent on current levels.

Considering the growth rate of skills clusters over the five years from 2021 to 2026 provides a picture of skills that are growing faster than others regardless of the amount of time spent on them across the labour market. Skills clusters from the Health and care family continue to dominate. However, the skills clusters growing the most are different, with more niche skills of Provide alternative medicine treatments (29.5 per cent) and Perform drug screening (25.3 per cent) being in the top four overall. More general Health and care skills such as Assist individuals with accessibility needs (22.9 per cent) and Develop and fit medical assistive devices (22.1 per cent) are still in the top 10 overall, possibly reflecting recent demand from services being provided as part of the National Disability Insurance Scheme.

Three skills in the top 10 fastest growing skills clusters are from the Digital Technologies and electronics family, including Test computer or software performance (26.2 per cent), Resolve computer applications or systems issues (25 per cent) and ICT support, design and management (22.5 per cent). There are skills from ‘other’ skills cluster families that are related to the growth of digital technologies such as Research, evaluate or design new technologies (22.1 per cent) and Develop procedures for communication and data management (19 per cent).

3.3 Labour demand under alternative scenarios

The NSC's five-year employment projections discussed previously are a key source of information on jobs and skills demand over a five-year horizon. There is, however, a range of uncertainty around any such forecasting exercise. Therefore, it can be useful to consider alternative scenarios that may alter existing labour market trajectories. To this end, the NSC recently partnered with the Centre of Policy Studies (CoPS) at Victoria University to produce additional projections of Australia's emerging occupation and skills needs, based on economic modelling of three scenarios.

3.3.1 Three alternatives to the NSC's central scenario

The economic modelling of the alternative scenarios was conducted using the Victoria University Employment Forecasts (VUEF) model. The VUEF is a dynamic computable general equilibrium (CGE) model that simulates adjustments of the Australian economy under different assumption-based scenarios, mapping the potential labour market impacts at detailed levels of employment. Using the VUEF model, CoPS ran simulations for the following three alternative scenarios:

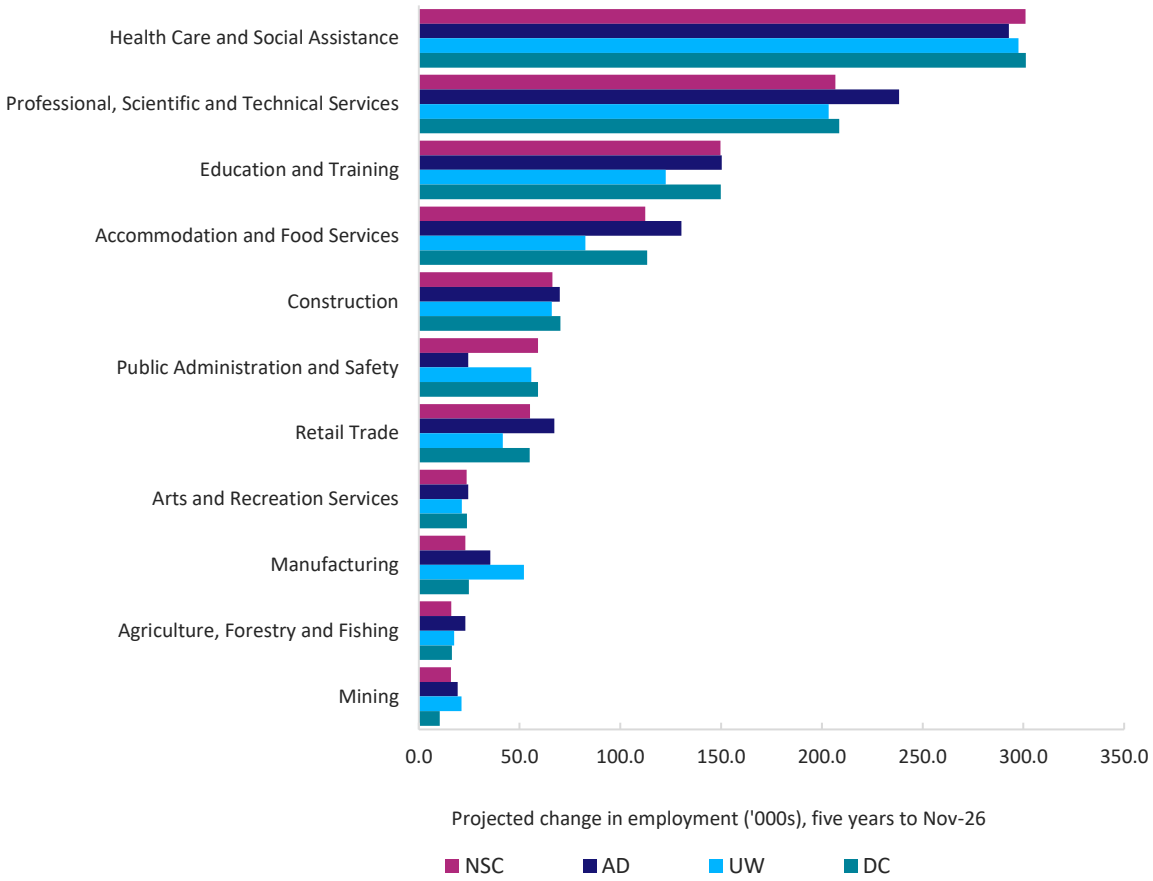
- ***Adaptable and Dynamic economy (AD):*** The recovery from the pandemic stimulates economic activity with increased consumption boosting employment across industries, particularly in Accommodation and Food Services and Retail Trade. A tight labour market and reduced migration flows prompts wage rises that induce firms to substitute capital for labour, boosting demand and employment in digital and IT-related industries.
- ***Uncertain World (UW***): Inflation leads to weaker consumption and investment and a depreciation of the exchange rate, with export volumes increasing to pay for more expensive imports. The higher price of imports boosts local import-competing industries which, coupled with a preference shift to Australian-made products brought on by supply chain disruptions, boosts manufacturing employment. Despite the depreciation of the exchange rate, tourism and education exports fall due to geopolitical uncertainties.
- ***Decarbonisation (DC)*****:** This scenario seeks to capture the initial impacts of the transition to a net zero economy, recognising that this transition will take much longer to complete than the simulation period of 4-5 years and hence the larger impacts fall outside the period considered in this analysis.

The results from the modelling for each of these scenarios were applied to the NSC's employment projections for the five years to November 2026, taken as the base case or central scenario for comparative analysis.

3.3.2 The structure of the labour market is unlikely to change significantly in the near term

The NSC's analysis of the modelling results indicate that the long-term industry composition of the labour market is not projected to substantially differ across the three scenarios and the base case five-year employment projections (Figure 23). That is, employment growth is likely to be dominated by the four service industries, led by Health Care and Social Assistance, followed by Professional Scientific and Technical Services, Education and Training, and Accommodation and Food Services.

Figure 23: Projected change in employment ('000s), selected industries, five years to November 2026

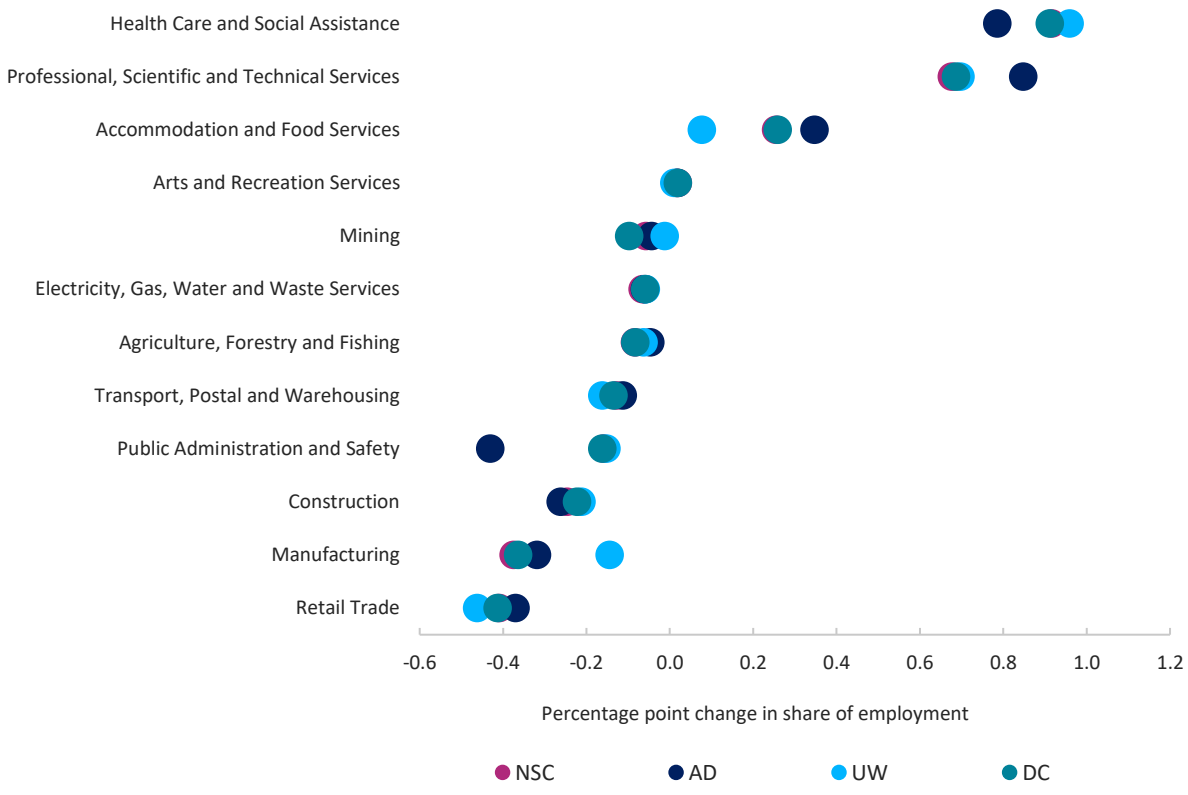


Source: NSC 2021 Employment Projections and NSC scenario modelling conducted in partnership with the Centre of Policy Studies, Victoria University.

While the overall structure of the labour market is not projected to differ substantially across the scenarios and the base-case projections, some industries may be impacted more than others depending on the scenario (Figure 24). For example:

- Under all scenarios the share of employment for Professional, Scientific and Technical Services is expected to increase and the share of employment for Public Administration and Safety is projected to decline. However, these movements are larger under the Adaptable and Dynamic Economy scenario.
- The implications of Decarbonisation are less clear as the modelling reflects only the start of the transition with the impacts expected to unfold over a period that extends beyond the five-year scope of the modelling. (Please note that a further examination of the transition to a green economy and the potential impacts on skills needs is provided in the following section of this report.)
- Uncertain World scenario considers, among other things, a change in preference for Australian-made products as a response to supply chain blockages associated with the ongoing impacts of the pandemic and geopolitical uncertainty. Given these risks, employment growth in manufacturing-related occupations may be stronger than projected under the NSC's central scenario. Conversely, employment levels in Accommodation and Food Services are lower under this scenario.

Figure 24: Projected percentage point change in industry share of employment, by scenario, five years to November 2026

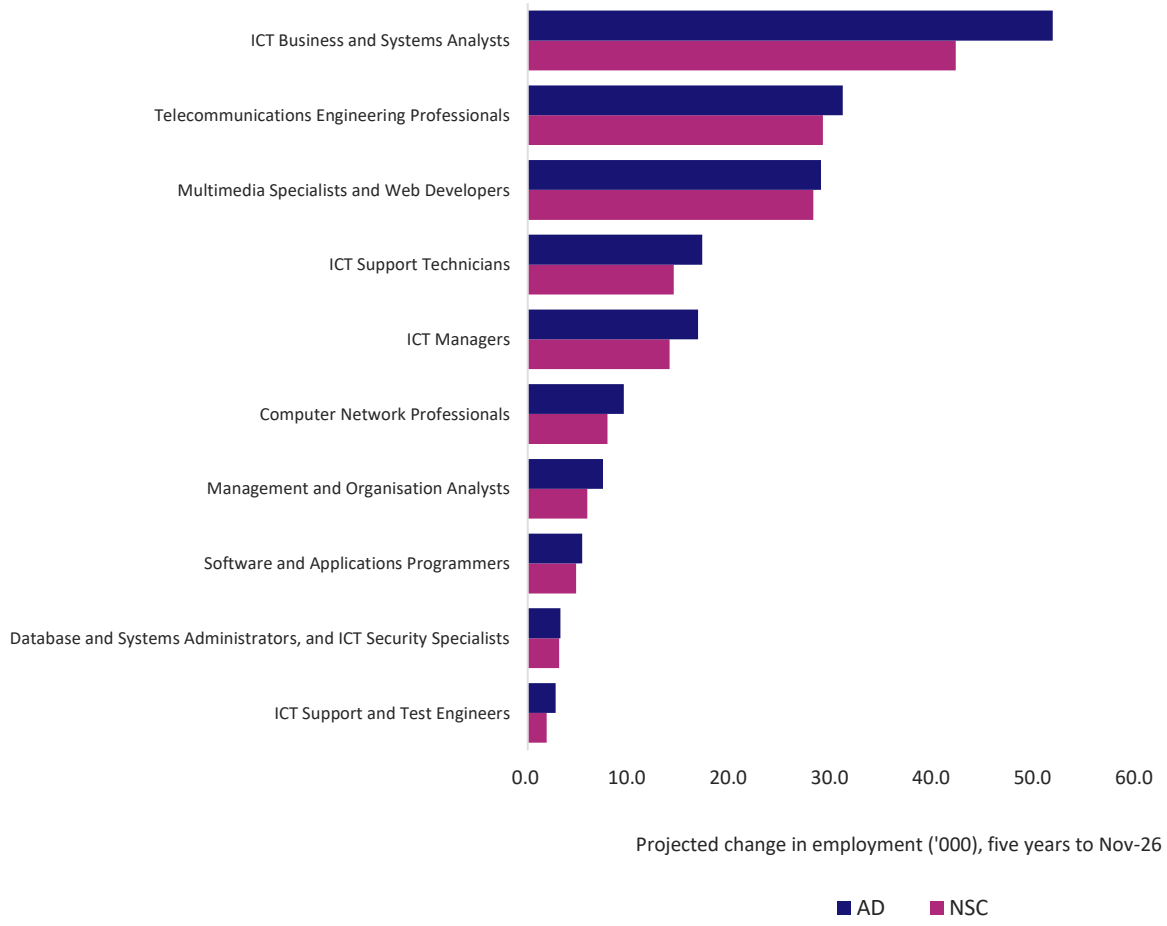


Source: NSC 2021 Employment Projections and NSC scenario modelling conducted in partnership with the Centre of Policy Studies, Victoria University.

3.3.3 Differences in potential outcomes across the scenarios

Scenario modelling is useful not only in highlighting common threads across different outcomes, but also in highlighting differences. In this regard the Adaptable and Dynamic Economy scenario primarily captures the upside risks to the economy that can be associated with the recovery from the pandemic and, in particular, an accelerated pace of digitisation. The modelling results indicate that a number of IT-related occupations with already strong projected employment growth could see even more demand and faster growth (as illustrated in Figure 25).

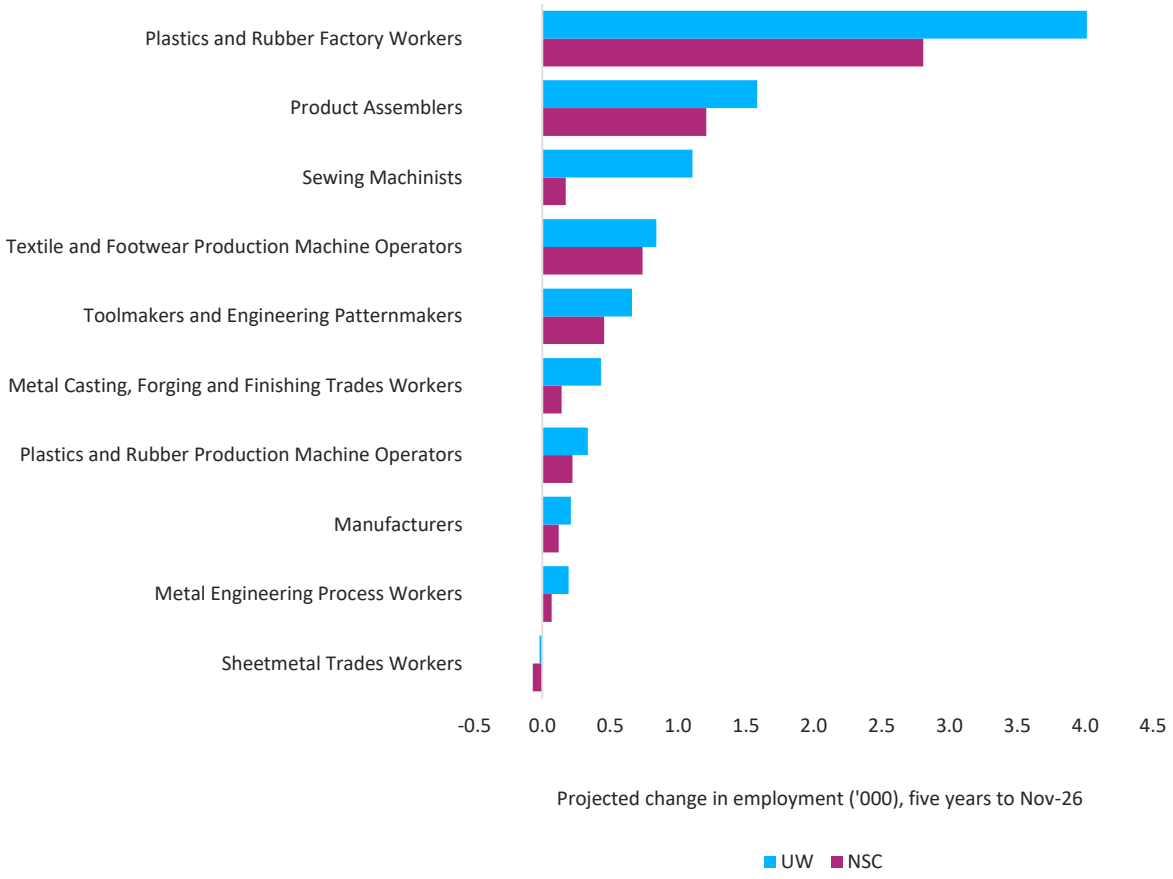
Figure 25: Projected employment growth ('000) in digital and IT-related occupations under the AD scenario compared with the NSC's central scenario



Source: NSC 2021 Employment Projections and NSC scenario modelling conducted in partnership with the Centre of Policy Studies, Victoria University.

In contrast, the Uncertain World scenario is primarily designed to capture downside risks. A key element of this scenario is the change in preference for Australian-made products as a response to supply chain blockages associated with the ongoing impacts of the pandemic and geopolitical uncertainty. Figure 26 shows that given these risks, employment growth in manufacturing-related occupations may be stronger than projected under the NSC's central scenario.

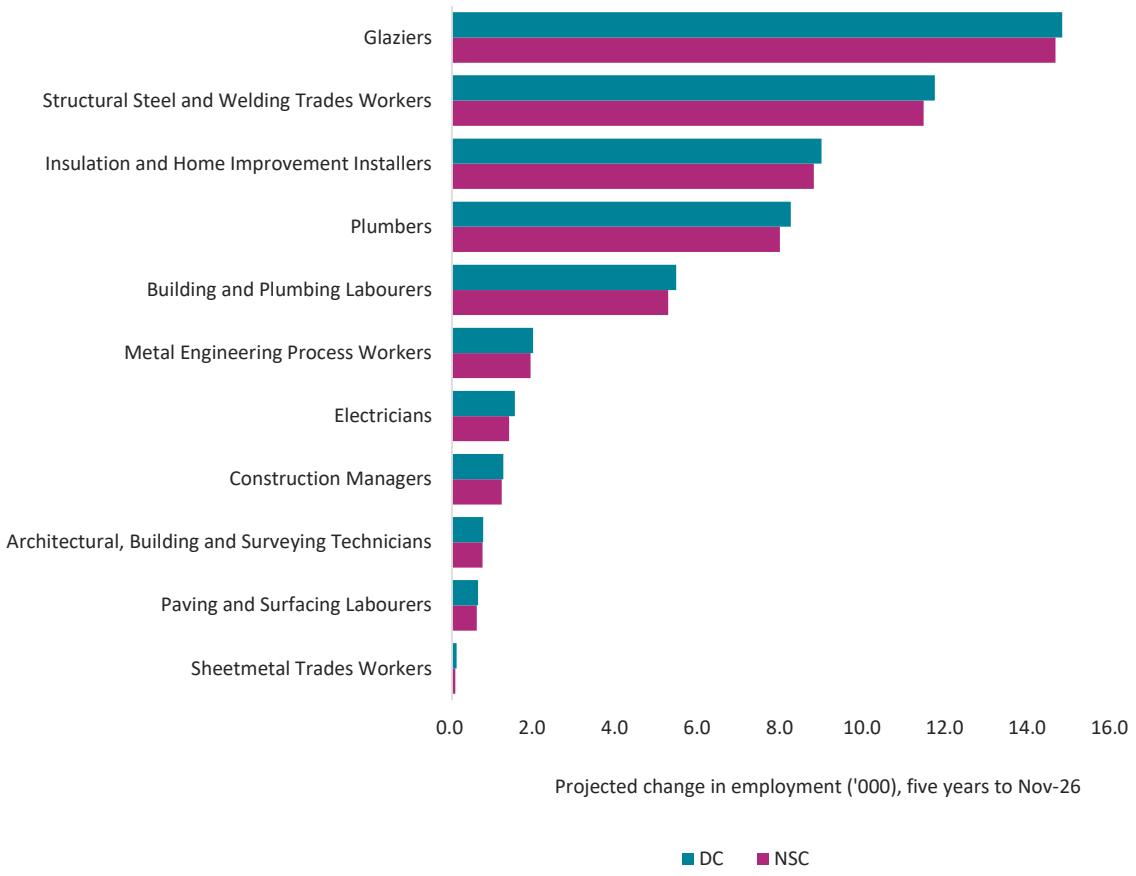
Figure 26: Projected employment growth ('000) in manufacturing related occupations under the UW scenario compared with the NSC's central scenario



Source: NSC 2022 Employment Projections and NSC scenario modelling conducted in partnership with the Centre of Policy Studies, Victoria University.

Rounding out the combination of alternatives to the current status quo is the Decarbonisation scenario. The key elements of this scenario are the shifts towards construction and manufacturing-related activities associated with the move towards clean energy, including the manufacture, construction and installation of wind turbines, solar panels and batteries, as well as the build of electric vehicle charging stations. As Figure 27 shows decarbonisation can be expected to see stronger growth for occupations such as Electricians, Glaziers and Insulation and Home Improvement Installers than under the NSC's central scenario.

Figure 27: Projected employment growth in construction and manufacturing-related occupations under DC scenario compared with the NSC's central scenario



Source: NSC 2021 Employment Projections and NSC scenario modelling conducted in partnership with the Centre of Policy Studies, Victoria University.

3.4 Skills and jobs for a net zero carbon economy

As Australia transitions to a net zero carbon economy, new skills and jobs will be required across both traditional and emerging sectors. The NSC is using a mix of labour force data and web scraped job advertisement data to identify the occupations, industries, and skills Australia will need as we address climate change. This section provides initial results from this work.

3.4.1 Defining the green economy

While there is global interest in 'green jobs', there is no universally accepted definition of the sector. As a starting point this analysis uses a definition developed by the National Center for O*NET Development (O*NET), the USA's primary source of occupational information:

> *Economic activity related to reducing the use of fossil fuels, decreasing pollution and greenhouse gas emissions, increasing the efficiency of energy usage, recycling materials, and developing and adopting renewable sources of energy.*[22]

The definition takes a lifecycle view of decarbonisation and is not limited to the energy generation industry alone. Green occupations are those linked to twelve sectors, including:

> *Renewable Energy Generation, Energy Efficiency, Energy Trading, Research, Design and Consulting, Agriculture and Forestry, Recycling and Waste Reduction, Transportation, Green Construction, Energy and Carbon Capture, Environment Protection, Manufacturing, Governmental and Regulatory Administration.*

These definitions have been used to identify green occupations, industries, and skills. As indicated in Figure 28 these separate but overlapping categories allow green jobs to be quantified more precisely than each category would allow alone. For example, Electrical Engineer is considered a green occupation, with more likely to be needed as Australia electrifies and upgrades infrastructures; however, not all Electrical Engineers are employed in green industries.

Using a mix of Natural Language Processing techniques and traditional labour market analysis, three different green economy studies with application to the Australian labour market context were used to support the analysis undertaken in this section of the report.[23]

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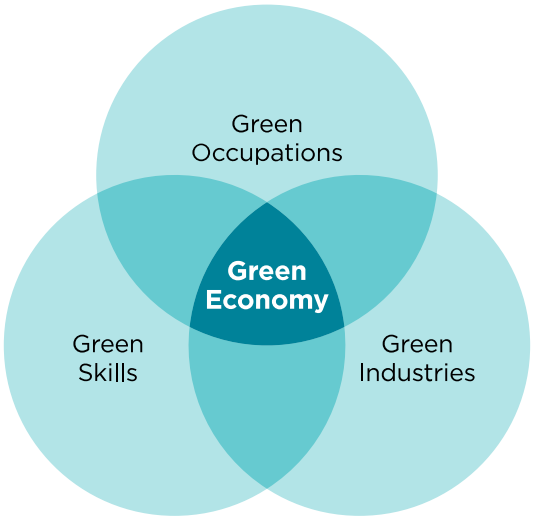
[22] National Center for O*Net Development (2009) Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations, prepared for US Department of Labor, February 2009.

[23] The three studies were: National Center for O*Net Development (2009) Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations, prepared for US Department of Labor, February 2009; O*NET Green Task Development Project, National Center for O*NET Development, November 2010; Measuring Green Jobs, US Bureau of Labor Statistics, 2013.

Figure 28: Defining the green economy



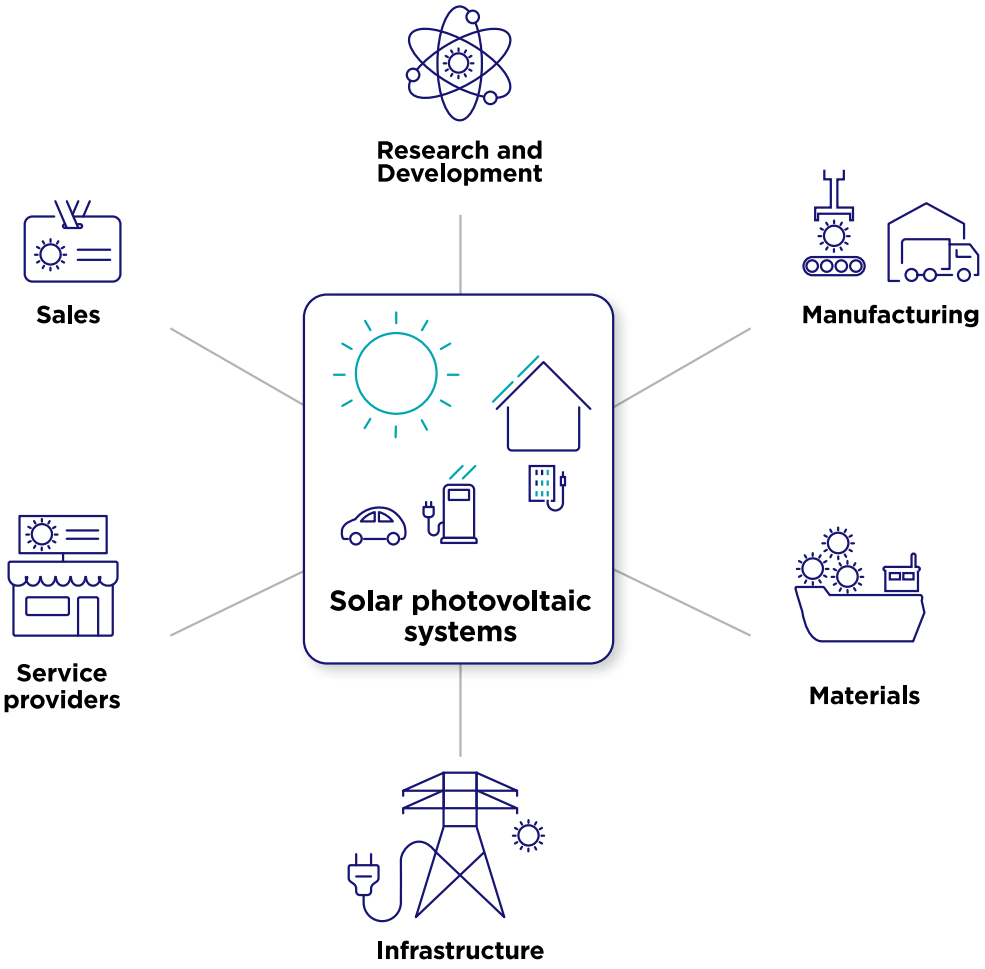
3.4.2 Green industries

The NSC identified 99 out of 213 industry groups at the 3-digit level of the Australian and New Zealand Standard Industrial Classification (ANZSIC) as being involved in the green value chain. The large number of industry groups reflects the diversity of organisations involved in supply, distribution and use of green goods and services. These industries encompass a wide variety of economic sectors, including Nursery and Floriculture Production; Electrical Equipment Manufacturing; Electricity Generation, Transmission, Distribution and On-selling; Building Installation Services; Hardware, Building and Garden Supplies Retailing; Rail Freight Transport; Scientific Research Services and Automotive Repair and Maintenance.[24]

Figure 29 gives an indication of the industry groups involved in the supply chain for solar photovoltaic (PV) systems.

[24] US Bureau of Labor Statistics (2013) Measuring Green Jobs.

Figure 29: Solar photovoltaic systems supply chain

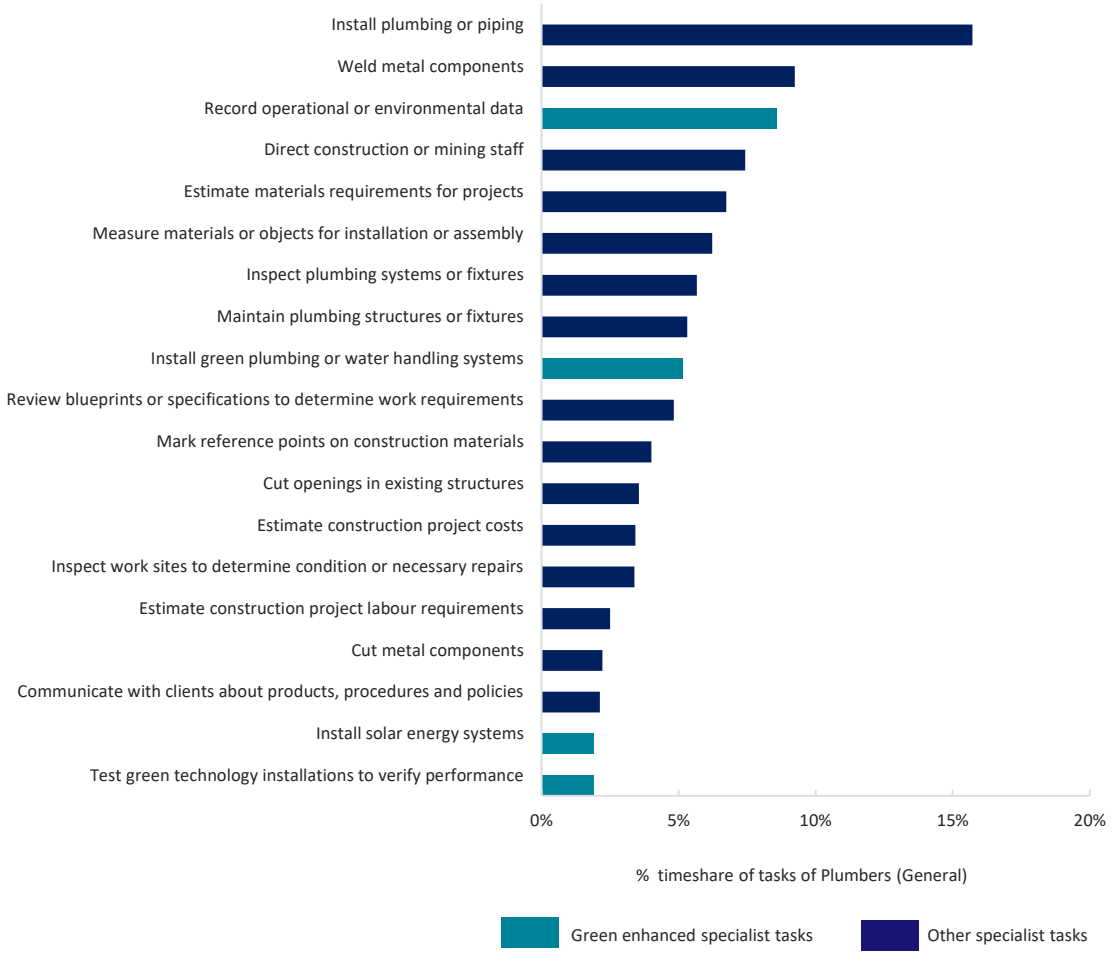


3.4.3 Green skills

The NSC mapped green tasks to Specialist Tasks in the Australian Skills Classification (ASC), identifying 97 green-specific tasks. This allowed for an examination of the green skills within occupations and to refine the occupation mapping outlined below. Green skills are as diverse as the occupations that require them and include for example: 'Research sustainable agricultural processes or practices', 'Analyse geological or geographical data', 'Service green vehicles'; and 'Advise others about environmental management or conservation'.

The ASC sets out the proportion of time spent using different skills in each occupation. This provides a basis for looking at the amount of time spent on green skills across the Australian workforce. Figure 30 shows the share of time that Plumbers spend using different skills. Plumbers require green skills relating to Recording environmental data and Installing and testing green systems; but spend more time on traditional skills like Installing plumbing and Welding metal components.

Figure 30: Plumbers (general) specialist tasks timeshares



Source: NSC Analysis; NSC Australian Skills Classification (2022).

3.4.4 Green occupations

As set out in Figure 31, green occupations can be grouped into three categories, depending on the level of direct involvement in environmental work:[25]

- Green increased demand occupations – have not experienced a great deal of change but are likely to grow due to the shift to a net zero carbon economy.
- Green enhanced skills occupations – are seeing changes in tasks and competencies.
- Green new and emerging occupations – have emerged specifically to meet the needs of the green economy.

Figure 31: Green jobs categories

Green Increased Demand	Green Enhanced Skills	Green New/Emerging
Where the work context may change (expected increase in demand generally), but the tasks, knowledge, skills and abilities generally do not. Example occupations: – Electricians – Structural Steel Erector – Fitter	Where the occupation's purposes remain the same, but tasks, skills, knowledge, and external elements, such as credentials, have been altered. Example occupations: – Plumber – Sales and marketing manager – Civil Engineer	Where the demand of green economy and technologies have created the need for unique work and worker requirements. Example occupations: – Recycle Worker – Sustainability specialists – Environmental Research Scientist

Source: NSC Analysis, O*NET (2019).

The NSC's mapping identified 241 Green Occupations across all three categories:

- 103 Green increased demand occupations
- 117 Green enhanced skills occupations
- 21 Green new and emerging occupations

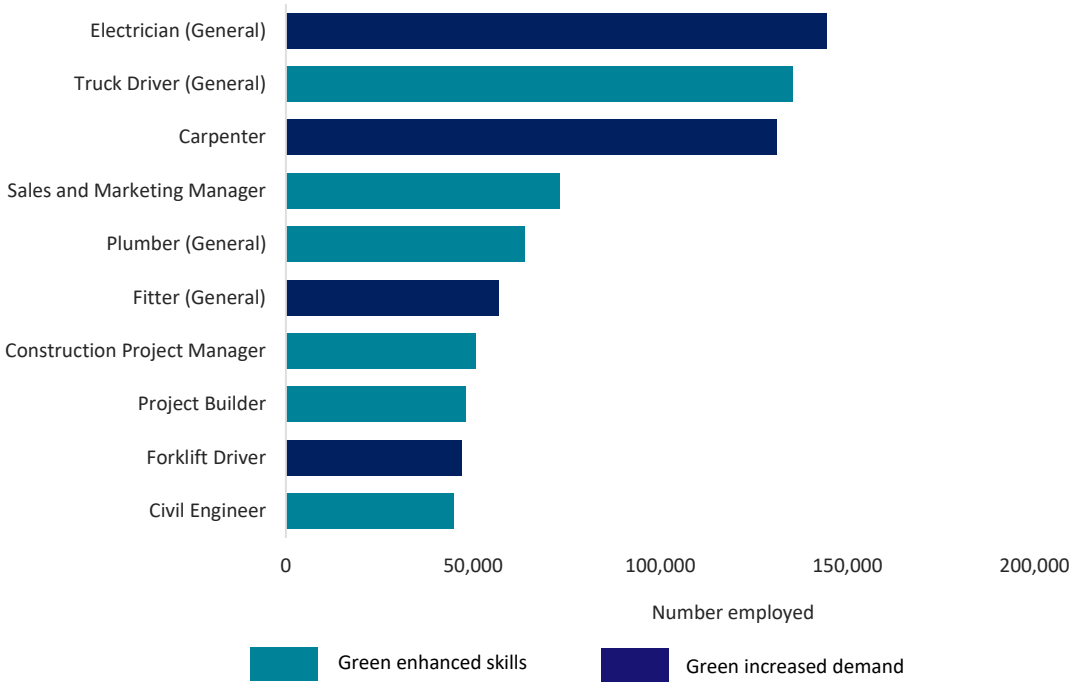
Almost half of the green workers identified are in occupations classified as Green Enhanced Skills, 41 per cent are in occupations that are set to increase in demand, and 2.8 per cent are in the New and Emerging green occupations category.

[25] National Center for O*Net Development (2009) Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations, prepared for US Department of Labor, February 2009.

3.4.4.1 Green increased demand

Some of the most common jobs in the green workforce are conventional jobs that Australians will rely on more as the economy changes (Figure 32). There will be increased demand for Electricians, Carpenters and Fitters due to electrification, the growth in sustainable construction and the development of alternative energy systems.

Figure 32: Green occupations by employment size



Source: NSC Analysis; Longitudinal Labour Force Survey (May-2021 to May-2022) 12-month average employment.

3.4.4.2 Green enhanced skills

Green enhanced skills are also prominent among Australia's high employing occupations. The largest of these are Truck Driver, Sales and Marketing Manager and Plumber.

There are new skill requirements for Truck Drivers, due to the need to reduce fuel consumption and emissions like, 'Choosing optimal transportation speeds', and 'Adjusting routes and speeds'.[26] Truck Drivers will also directly support the green economy through the transportation of hydrogen, wind turbine components, and solar panel infrastructure.[27,28]

Sales and marketing managers in green industries have green enhanced skills including 'Develop marketing plans or strategies for environmental initiatives' and 'Develop sustainable organisational policies or practices'.

[26] NSC, Australian Skills Classification (2022).
[27] Clean Energy Council (2022), *Skilling the Energy Transition*, 25 August 2022.
[28] Price Waterhouse Coopers (2022), *Developing Australia's Hydrogen Workforce*.

As shown previously, in Figure 30, Plumbers require new green skills including 'Install green plumbing or water handling systems', 'Install solar energy systems' (such as PV solar hot water systems) and 'Test green technology installations to verify performance'.

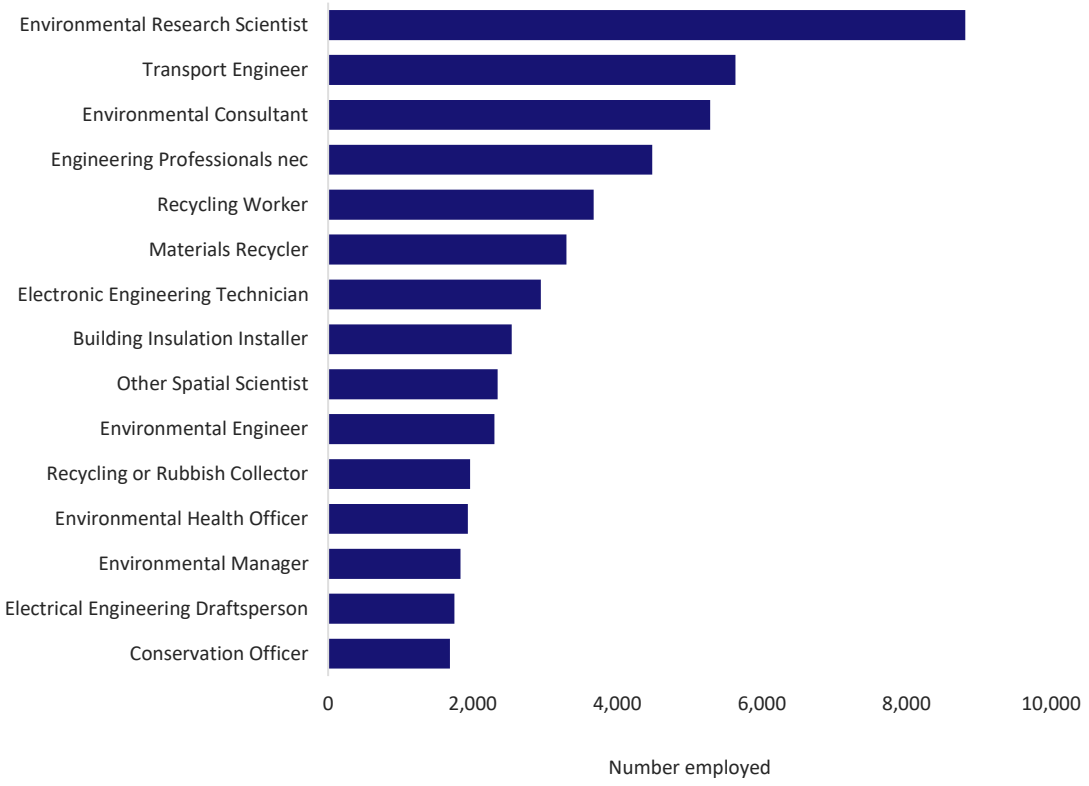
3.4.4.3 Green new and emerging occupations

Green new and emerging occupations are jobs that have emerged due to green economy activities and technologies. This category encompasses a diverse range of work at the frontier of the green economy.

Green new and emerging occupations in official statistics

While all the green new and emerging occupations emerged specifically to meet the needs of the green economy, some are more established in the Australian labour market than others. Occupations such as Environmental Research Scientist, Transport Engineer and Environmental Consultant are well recognised and described in Australia's official occupation taxonomy, the Australian and New Zealand Standard Classification of Occupations (ANZSCO). Information on these occupations is collected through official statistics. Figure 33 shows the largest employing Green new and emerging occupations in green industries in Australia, according to the Longitudinal Labour Force Survey. [29]

Figure 33: Top 15 green new and emerging jobs in ANZSCO



Source: NSC Analysis; Longitudinal Labour Force Survey (May-2021 to May-2022) 12-month average employment.

[29] As noted above, industry groups are approximate and more granular data is required.

Box 7
Case study on Environmental Research Scientist

Environmental Research Scientists study and develop policies and plans for the control of factors which may produce pollution, imbalance in or degradation of the environment.

Main tasks

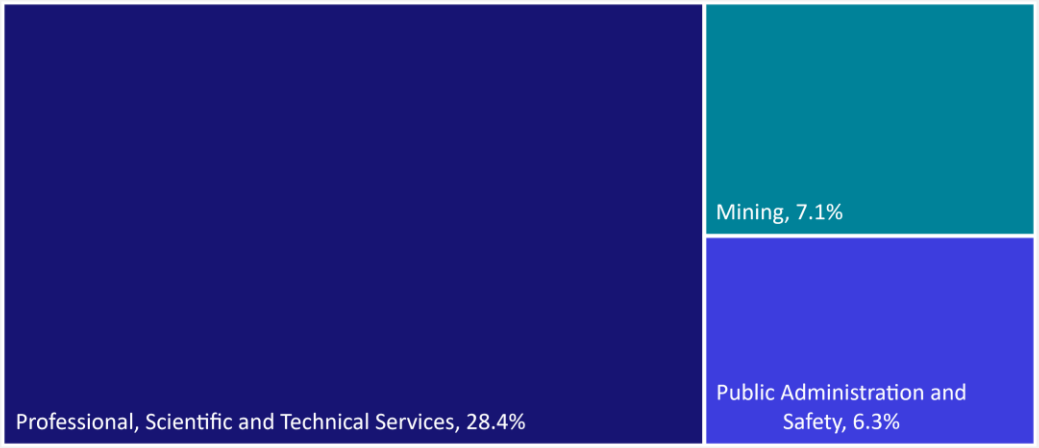
Environmental Research Scientists apply their knowledge of science, mathematics, data, and analytics to identify and minimise sources of hazards that affect the environment or public health, including climate change. Their research involves collecting, synthesising, studying, reporting, and recommending action based on environmental data. Such tasks are applied in a range of roles that include:

- developing and evaluating the goals and outcomes of land, habitat, wildlife, and fisheries management plans
- conducting environmental impact assessments for development projects
- monitoring the effects of climate change, pollution or land degradation and recommend means of prevention or control.

Labour demand

Data from online job advertisements indicate that demand for Environmental Research Scientists primarily stems from the Professional, Scientific and Technical Services, Mining and Public Administration and Safety industries.

Figure 34: The top three industries seeking environmental research scientists by percentage of online job advertisements

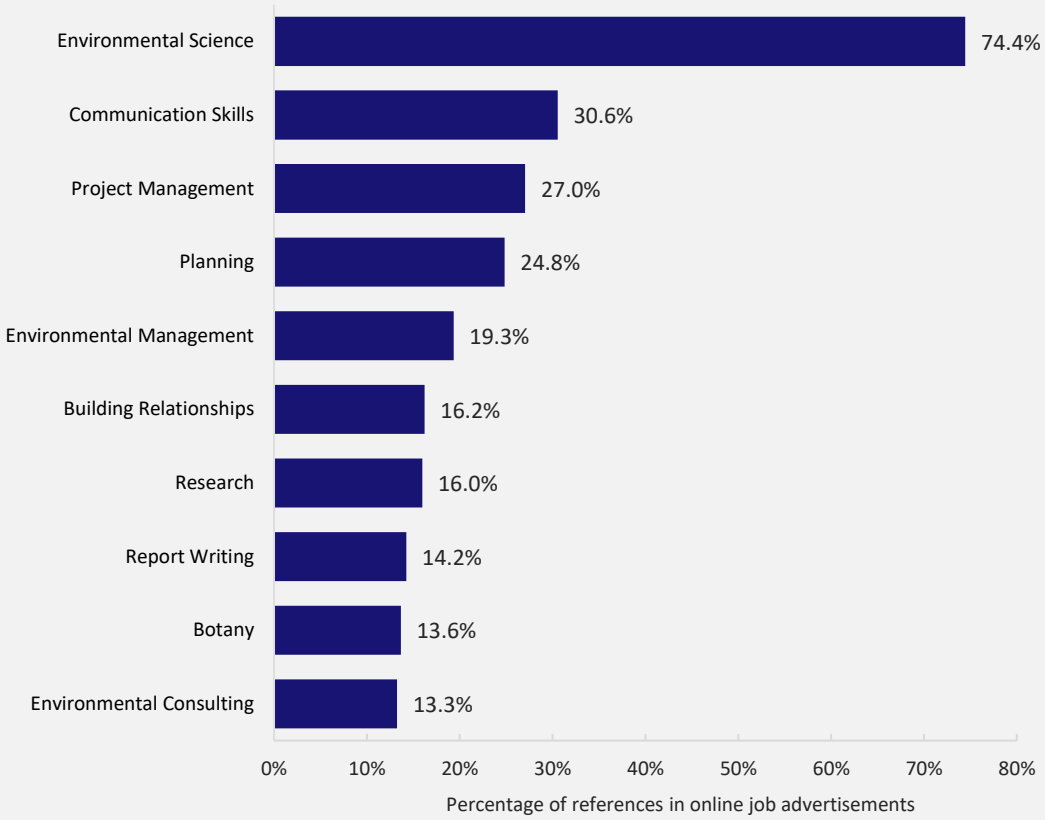


Source: Lightcast data, 2022, NSC analysis. Note Lightcast figures are based on jobs advertisements that feature the terms 'Environmental Research Scientist' and 'Ecologist'.

Box 7
Case study on Environmental Research Scientist

The qualifications that are most requested in online Environmental Research Scientist job advertisements are at degree level or above. They include specialised tertiary education in transport and civil engineering, as well as general skills related to project planning and management.

Figure 35: Top 10 capabilities and required training for Environmental Research Scientists

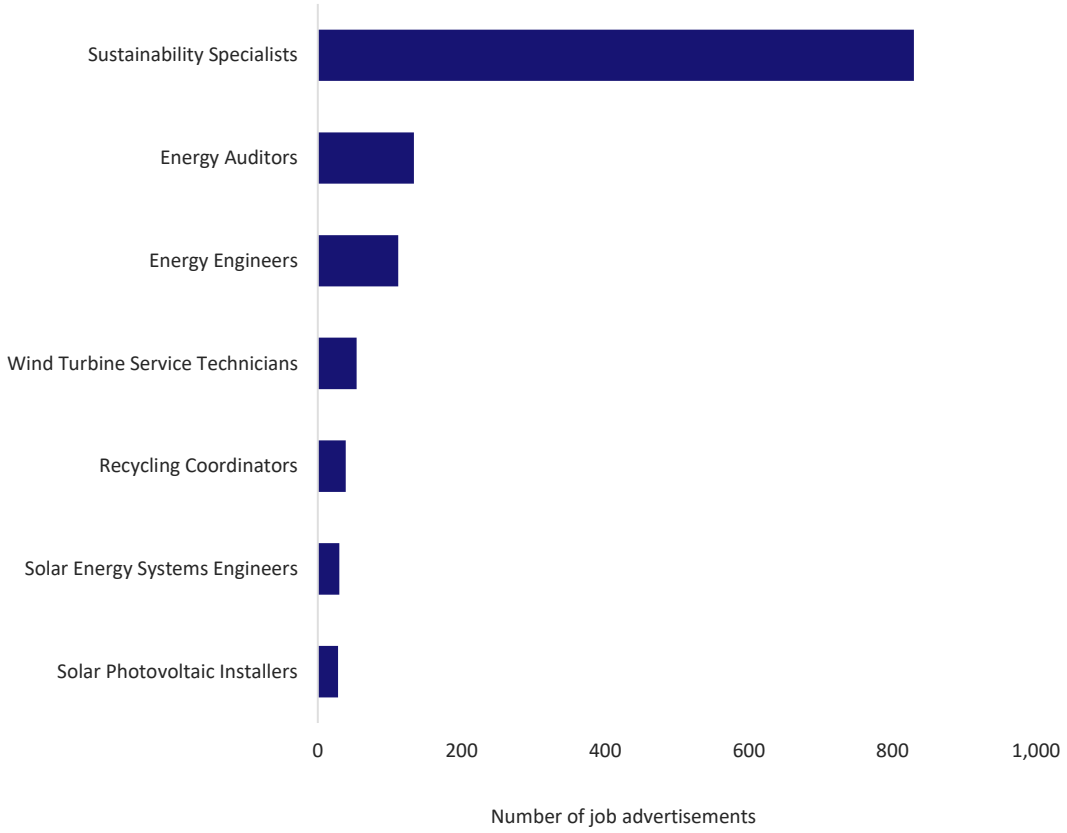


Source: Lightcast data, 2022, NSC analysis.

Leading-edge, green, new and emerging occupations

A second group of Green New and Emerging occupations are clearly visible in online job advertisement data but are not yet individually described in ANZSCO. These leading-edge green roles are not counted independently in official statistics and are therefore difficult to quantify, but internet job listings provide an indication of labour market demand. Figure 36 shows the most frequently advertised leading-edge Green New and Emerging occupations over the 12 months to May 2022.

Figure 36: Green new and emerging jobs not described in ANZSCO but identified in Australian job advertisements



Source: Lightcast job advertisement data (May 2021 – May 2022).

The emergence of occupations like Recycling Coordinator and Sustainability Specialist indicates an increasing acknowledgment of the complexity of supporting a healthy environment across multiple indicators (Table 10). While front line recycling workers have been included in ANZSCO for some time (as the occupation Recycling or Rubbish Collector) the sophistication of the circular economy now warrants a more senior, management level occupation.

Table 10: Description of leading-edge green roles

Role	Description
Sustainability Specialists	Address organisational sustainability issues, such as waste stream management, green building practices, and green procurement plans.
Energy Auditors	Conduct energy assessments of buildings, building systems, or process systems.[30]
Energy Engineers	Design, develop, or evaluate energy-related projects or programs to reduce energy costs or improve energy efficiency during the designing, building, or remodelling stages of construction.
Wind Turbine Service Technicians	Inspect, diagnose, adjust, or repair wind turbines by resolving electrical, mechanical, and hydraulic malfunctions; may be required to perform some physically demanding tasks, such as heavy lifting and climbing to extreme heights.[31]
Recycling Coordinators	Supervise recycling programs for municipal governments or private firms. Supervising recycling technicians, community service workers, or other recycling operations employees or volunteers. Providing training to recycling technicians or community service workers on topics such as safety, solid waste processing, or general recycling operations.
Solar Energy Systems Engineers	Perform site-specific engineering analysis or evaluation of energy efficiency and solar projects involving residential, commercial, or industrial customers. Design solar domestic hot water and space heating systems for new and existing structures, applying knowledge of structural energy requirements, local climates, solar technology, and thermodynamics.
Solar Photovoltaic Installers	Assembles, installs, or maintains solar photovoltaic (PV) systems on roofs or other structures in compliance with site assessment and schematics.[32]

[30] Energy Assessor is included in ANZSCO as part of an occupation called 'Architectural, Building and Surveying Technicians not elsewhere classified'. This occupation also includes Roof Truss Detailer and Structural Steel Detailer.

[31] Wind Turbine Technician is included in ANZSCO as a specialisation of the broader occupation of 'Power Generation Plant Operator', as a result Wind Turbine Technicians are not counted independently in official statistics.

[32] Solar Installer' is included in ANZSCO as a subset of the broader occupation of 'Electrician (General). as a result, Solar Installers are not counted independently in official statistics.

Box 8
Case study on Recycling Coordinator

Recycling coordinators manage curb side and drop-off recycling programs for local governments or private firms.

Main tasks

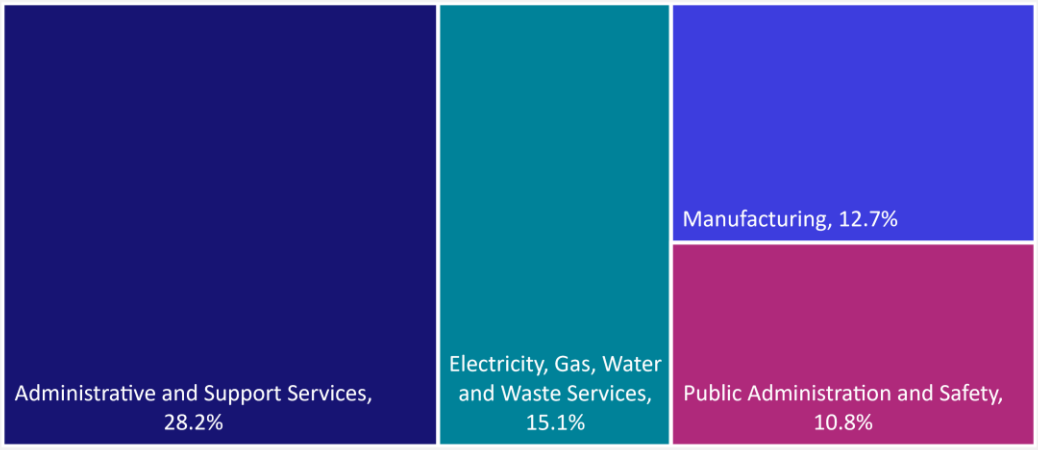
Recycling Coordinators ensure organisations are compliant with community ordinances through tasks such as:

- maintaining logs of recycling materials received or shipped to processing companies
- supervising recycling technicians, community service workers, or other recycling operations employees or volunteers
- providing training to recycling technicians or community service workers on topics such as safety, solid waste processing, or general recycling operations.

Labour demand

Recycling Coordinator is categorised as an O*NET occupation in the US, but it is not listed separately in ANZSCO. Its role as a green new and emerging job was gleaned by researching its occupation profile in O*Net and job titles with equivalent skills and tasks ('Recycling Operator', 'Recycling Manager', 'Recycling Director', and 'Recycling Coordinator') in Australian job advertisements.

Figure 37: Four largest industries seeking recycling coordinators by percentage of online job advertisements

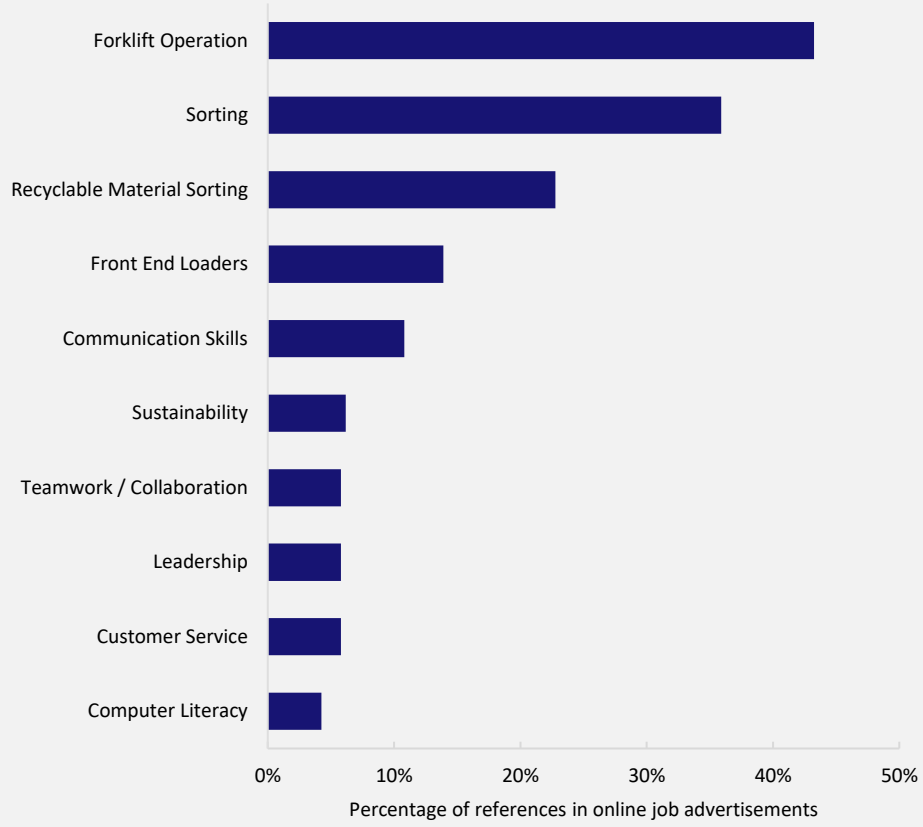


Source: Lightcast data, 2022, NSC analysis.

Box 8
Case study on Recycling Coordinator

Job advertisements for the alternative job titles largely stem from Administrative and Support Services, as well as the Manufacturing, Public Administration and Safety and Electricity, Gas, Water and Waste industries. Demand for the roles therefore largely derives from private businesses, among which are firms endeavouring to reduce their environmental impact and meet new environmental standards. They may rely upon recycling coordinators to plan, design, manage and report on their recycling activities

Figure 38: Top 10 capabilities and required training for Recycling Coordinator



Source: Lightcast data, 2022, NSC analysis.

The job advertisement data suggests that Recycling Operator, Recycling Manager, Recycling Director, and Recycling Coordinator are occupations that do not generally require specific tertiary qualifications. However, hands-on experience and technical knowledge in logistical operations and management appear to be highly desired. Some of the relevant tasks may require tertiary certification, such as forklift operations.

Nascent market opportunities in green new and emerging occupations

Finally, there is a group of Green New and Emerging occupations which are identified in international taxonomies, such as O*NET, but are not currently defined in ANZSCO and have limited or no labour market demand visible in Australian online job advertisements. Forty-nine of the total 87 O*NET occupations identified as Green New and Emerging fall in this category.

The occupations in this category are mainly associated with clean energy specific roles, such as Hydroelectric Plant Technicians and Managers, Biomass Production Managers, Wind Engineers, Geothermal Technicians, Biofuel Engineers and Technicians and Methane/Landfill Gas Collection Systems Specialists. The category also includes emerging technology roles, such as Nanotechnologists, Photonics Technicians, Remote Sensing Scientists, Industrial Ecologists and Robotics Technicians. Green new and emerging jobs in enabling industries are also identified, such as Climate Change Analysts, Energy Brokers, Environmental Economists, Solar Sales Representatives and Brownfield Redevelopment Specialists.

Demand for these jobs in Australia appears to be subdued currently. That said, many of these occupations represent a range of cutting-edge economic opportunities presented by decarbonisation, which Australia could harness and grow significantly over time.

Box 9
Case study on Nanotechnology Engineering Technicians

Nanotechnology Engineering Technicians and Technologists implement production processes and operate commercial-scale production equipment to produce, test, or modify materials, devices, or systems of unique molecular or macromolecular composition.

Nanotechnology is applied in many sectors of the economy. The technicians who work in the field are responsible for one or more of the following tasks, among many others:

- operate nanotechnology compounding, testing, processing, or production equipment in accordance with appropriate standard operating procedures, good manufacturing practices, hazardous material restrictions, or health and safety requirements
- collaborate with scientists or engineers to design or conduct experiments for the development of nanotechnology materials, components, devices, or systems.

Nanotechnology engineering technicians are employed to help improve the environmental sustainability of existing industrial processes and produce clean outputs of their own which minimise environmental and public health risks. Their application of 'green nanotechnology' uses the principles of 'green chemistry' and 'green engineering' to generate sustainable nanoproducts and nanomaterials with low energy consumption, renewable inputs wherever possible, and minimal to no use of toxic ingredients.

Such work is applied, for instance, to research and make nanoproducts and nanomaterials that are used in the production of energy-efficient fuel cells and solar panel components, and the treatment of groundwater pollutants.

Most labour market demand for nanotechnology engineering technicians is thus likely to stem from sectors that work directly with scientific and technical research (Professional, Scientific and Technical Services) and possibly the Mining and Manufacturing industries. The nature of the work is commensurate with degree level training in engineering and sciences such as biology and chemistry.

Part 4
Skills of the future

Last year's edition of this report argued that key to assessing future skills needs is not a rigid focus on a specific forecast or number, but a sense of what the big picture dynamics at play are. Understanding the bigger picture dynamics and focussing on the portfolio of skills the economy might need in response to them, provides a solid basis for assessing future skills needs.

With that in mind, this assessment of Australia's future skills needs uses CSIRO's 2022 report *Our Future World* and the seven megatrends identified in that report as a base.[33] CSIRO defines megatrends as trajectories of change that typically unfold over years or decades and have the potential for substantial and transformative impact. The seven global megatrends are: Adapting to climate change; Leaner, cleaner and greener; The escalating health imperative; Geopolitical shifts; Diving into digital; Increasingly autonomous; and Unlocking the human dimension. CSIRO outlined these megatrends and their report as part of the Government's recent Jobs and Skills Summit.

Across each of the megatrends some of the key skills associated with each trend have been identified by the NSC, linking the megatrends to the skills clusters and technology tools contained in the Australian Skills Classification.

The megatrends broadly underscore the importance of the 'Four Cs' identified in last year's report, namely: Care, Computing, Cognitive ability and Communication. That said, the megatrends also clearly identify a fifth 'C': Climate. That is, the broad set of skills required to transition to a net zero carbon economy and respond to the impacts of climate change.

While not encompassing all the economy's future skills needs, the Five Cs do point to a range of skills likely to underpin many of the jobs of the future.

- *Care* – the group of skills that provide care and support; and responds to demographic change (such as the ageing of the population) and healthcare needs.
- *Computing* – a group of skills needed to respond to the digital world and the increasing use of digital technologies across the entire economy.
- *Cognitive abilities* – the group of advanced reasoning and higher order skills computers cannot easily replace, especially non-routine cognitive skills.
- *Communication* – the group of skills needed to collaborate and engage within and across workplaces.
- *Climate* – the range of skills required to transition to a net zero carbon economy and respond to the impacts of climate change.

[33] CSIRO (2022) *Our Future World: Global megatrends impacting the way we live over coming decades*, July 2022.

4.1 Adapting to changing climate

"Extreme and unprecedented weather events are increasing in their frequency and scale of impact. Current climate forecasts predict that we are likely to experience extreme weather conditions that exceed the bounds of historical norms and concurrent climate hazards are likely to compound the overall climate risk for sectors and regions. Adapting the healthcare system, critical infrastructure and settlement patterns to climate change and extreme weather conditions will become a growing reality for many countries in the years and decades to come. This megatrend speaks to the new ways of operating that organisations and communities will need to adapt to in the face of a changing climate."

Source: CSIRO (2022).

The first megatrend examines the impacts of climate change on both the natural and built environments, as well as the impact of climate change on human health. The 2019-20 bushfires and three La Niña events over the past few years have underscored a number of elements related to this megatrend.

The first of these elements is the cost of natural disasters – both financial and the cost to biodiversity. CSIRO notes the most recent World Economic Forum's *Global Risk Report* identifies extreme weather, climate action failure, human environmental damage and biodiversity loss among the top 10 global risks. CSIRO adds there is a critical role for science and technology in developing solutions to enhance disaster preparedness and manage climate change impacts.

Second, associated with the direct cost, is the challenge and increasing cost of insuring against climate change. The ongoing impacts of climate change are likely to present challenges for insurers as they seek to appropriately price climate-related risks (and will likely see an ongoing need for climate change risk analysis skills). CSIRO cite Insurance Council of Australia estimates that a minimum of $30 billion will need to be invested to protect coastal properties from sea level rises (construction, engineering and related environmental assessment skills) and some communities will need to retreat to less hazardous regions (which could also give rise to construction needs).

Third, the floods that have occurred through the course of 2022 have clearly shown the impact that more extreme weather events have on infrastructure, such as roads. Extreme high temperatures can also see railways expand and buckle, increasing operational and maintenance costs (and hence skills required to undertake remedial or reconstruction work).

There will also be health impacts from climate change. In fact, CSIRO notes that heat-related deaths are predicted to grow by 60.5 per cent or more across major Australian capital cities from 2020 to 2050, noting that this is likely a conservative estimate. Health and care skills will be needed to respond to these impacts, including improving heat-related health metrics and heat governance.

Some ASC skills clusters/technology tools associated with this megatrend:

Assess areas and conditions for risks and hazards / Environmental impact reduction planning / Advise on environmental conservation / Develop and maintain emergency plans / Administer insurance or compensation programs

4.2 Leaner, cleaner and greener

"As the size of the global population continues to grow and as more people transition from lower to higher income brackets, there will be escalating pressures placed on finite food, water, mineral and energy resources. At the same time, these constraints are driving cutting-edge innovations that aim to do more with less, achieve carbon neutrality, reduce biodiversity loss and address the global waste challenge. This megatrend explores the opportunities pushing us towards a more sustainable horizon and the importance of science, technology and innovation in helping organisations to operate within much tighter envelopes."

Source: CSIRO (2022).

As discussed in the previous megatrend, action on climate change and the environment heightens the importance of striving for a sustainable future. The equation for sustainability seems simple – make more from less. The less resources we require to maximise production, the less energy we will need to process these resources and the less of an impact we will have on the natural world. Applying this 'simple' equation to the real world is complex – but it will largely be driven by our capacity to innovate.

Sustainability will spur on new and emerging industries and business practices, both of which will require new skills. A previous study by the NSC found that 'Solar Installers' and 'Wind Turbine Technicians' were emerging occupations with a new mix of required skills compared to similar traditional occupations due to trends driven by sustainability[34]. As a result of this study, the ABS has recently updated ANZSCO to add Solar installers as a specialisation of Electricians (General) and Wind Turbine Technicians as a specialisation of Power Generation Plant Operators[35].

As outlined elsewhere in this report, NSC analysis has found that there are potentially more green jobs that have emerged in recent years which are not currently represented in ANZSCO. For example, the need for the role of Recycling Coordinator has been identified to transform how we make and use products and what we do with the materials afterwards to create a thriving circular economy. Other leading-edge occupations like Nanotechnology Engineering Technicians are vital to help improve the environmental sustainability of existing industrial processes and produce clean outputs of their own which minimise environmental and public health risks.

As new green jobs continue to emerge and become prominent, there are existing occupations in the labour market that may experience an enhancement of 'green' skills. For these occupations such as Civil Engineers and Supply and Distribution Managers, their overall purpose may not change, but the tasks, skills and knowledge required may.

Looking forward, Australia is well positioned to capture the opportunities of cleaner sources of energy. The CSIRO notes "The 2030 outlook for Australian commodities suggests that demand for steel, zinc, copper, aluminium, rare earth elements, lithium, uranium and nickel will continue to grow. This demand is fuelled by rising population and income levels, urbanisation and the consumption of electronics, as well as the transition to zero-emissions technologies."

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34 NSC (2020) *Emerging Occupation: How new skills are changing Australian jobs*, 26 August 2020.
35 ABS (2021) *Australian and New Zealand Standard Classification of Occupations*, 23 November 2021.

We can infer from this that the growing demand for minerals for electrification and energy storage may not only create traditional jobs in mining and the trades but may indirectly boost demand for Science, Technology, Engineering and Mathematics (STEM)-related jobs as we research and develop innovative ways to extract resources at a faster pace. Ensuring efficiencies in our mining industry will be crucial to maintain our competitive advantage.

NSC analysis has found that jobs in STEM will grow twice as fast as non-STEM jobs[36]. When comparing this to the NSC's recent analysis on green jobs, the most prominent occupations among the top 15 new and emerging green jobs are among the sciences and engineering, such as Environmental Research Scientists, Transport Engineers and Environmental Consultants.

The conclusion to draw from this megatrend is that a leaner, cleaner and greener future will create new and emerging jobs and also transform existing occupations to enable sustainable industry practices. This emergence and transformation will not be isolated to a select group of occupations or industries – it will impact the whole economy. This megatrend also emphasises that we cannot capture long-term opportunities in a sustainable future by simply working more intensively with our existing skills mix to maximise our outputs. We need to work smarter to ensure we make more from less. To achieve this, our economy needs to adapt to different skill sets and develop more efficient ways to get the most out of our resources.

Some ASC skills clusters/technology tools associated with this megatrend:

Undertake environmental and sustainability research / Undertake environmental sustainability planning or activities / Undertake scientific research or activities / Design or install sustainable processes and systems / Research, evaluate or design new technologies

[36] NSC (2022), Employment Outlook: Industry and occupation trends over the five years to November 2026, March 2022.

4.3 The escalating health imperative

"Healthcare expenditure continues to show an upwards trajectory and this trend will likely be exacerbated as global populations age and as new health challenges emerge (e.g. antimicrobial resistance, future pandemics). The COVID-19 pandemic has revealed and intensified existing health challenges around the burden of chronic illness and mental health difficulties. But it has also emphasised the importance of social and economic determinants of health. This megatrend highlights the opportunities provided by preventative health and precision health in supporting better health outcomes for all Australians."

Source: CSIRO (2022).

This megatrend considers the rising costs of health care given longer-term trends such as an ageing population, longer life expectancy and lower fertility rates. Reflecting these trends the NSC's most recent employment projections indicate that Health Care and Social Assistance is projected to make the largest contribution to employment growth – increasing by 301,000 or 15.8 percent – over the five years to 2026.

CSIRO notes part of the rising cost in health care is attributed to the burden of disease rising across the globe. The NSC's 2021 report *State of Australia's Skills 2021 – now and into the future* reflected this development with skills like Patient Care, Primary Care and Telehealth trending, meaning they are growing in frequency compared to other skills. Further NSC analysis shows primary health care skills like 'Provide health care or administer medical treatment' and 'Monitor and evaluate patient treatment' are expected to see a strong increase in demand.

As awareness of mental health issues rises an ability to engage with staff and clients on these issues will be increasingly required for a wider range of roles in the labour market. NSC analysis indicates, for example, in 2012 only 8 per cent of on-line job vacancies for Student Counsellors mentioned mental health skills, compared with 39 per cent in 2020.[37]

Another element of this megatrend identified by CSIRO was the promise of precision health – the emergence of digital technologies changing the emphasis from treating illness to keeping people healthy by better predicting and delaying the onset of chronic disease.

According to CSIRO *"Australia has an opportunity to build a healthier and wealthier Australia by harnessing its world-class expertise in medical research, digital health and agri-food and medical technologies, to help lead global advances in precision health"*. To embrace this opportunity Australia will need to invest in the skills that underpin precision health such as predictive analytics, artificial intelligence, and biosensors. These skills are also in demand across many sectors of the labour market.

Some ASC skills clusters/technology tools associated with this megatrend:

Care for patients and clients / Provide community health programs / Analyse medical research and data / Undertake biological research / Care for patients and clients using psychological therapies and supports

[37] NSC analysis and Burning Glass Technologies (2021).

4.4 Geopolitical shifts

"Recent geopolitical developments are likely to have long-lasting impacts. The Ukraine crisis and ongoing tensions in the Asia-Pacific region pose challenges for democratic countries with advanced economies seeking to ensure peace and stability. These events have led to record-level defence spending, in Australia and globally, and increasing collaboration and cooperation across matters of security, technology and defence capability. This megatrend explores the implications of emerging geopolitical shifts relating to science, technology, trade, supply chains and defence strategy."

Source: CSIRO (2022).

This megatrend considers the impact of geopolitical developments, emerging defence technologies, a desire among many economies to 'beef-up' supply chain resilience and the increasing importance of cybersecurity in the face of growing online threats.

Past work by the NSC has examined elements of this mega trend. For example, the NSC's December 2020 report *The shape of Australia's post-COVID–19 workforce* noted an extended pandemic which if it had kept Australian borders closed well into 2022 could see pressures on supply chains divert resources into locally manufactured goods.

Similarly, as detailed in Chapter 3, the more recent modelling conducted for the NSC found that in an 'Uncertain World' scenario supply chain disruptions induce a change in preferences to Australian made products which would see higher levels of employment in manufacturing relative to the NSC's base case projections.

CSIRO notes that: "In the future, it is plausible that we will see Australian households, industries and governments place greater emphasis on sovereign capability and local supply chains (especially for critical goods and services), along with efforts to build more resilient supply chains that are capable of handling a broader range of disruptive events".

Of interest might be how Australia chooses to do this. In this regard CSIRO argues that "enhancing the uptake of agile manufacturing approaches, leveraging artificial intelligence (AI), robotics and other technologies, could enable Australian manufacturers to dynamically respond to market changes in a cost-effective manner."

Such an approach would speak to higher end digital, CAD, 3D printing, robotics and AI skills – a capital and technology driven approach to sovereign capability. Such an approach would also imply – as has been the case for some time – that greater output need not necessarily be associated with an increase in employment in the 'traditional' manufacturing industry (as defined in ABS data). Rather it could well be reflected in a diverse range of other industries and occupations.[38]

Other elements of this megatrend are likely to give rise to similar skills needs, such as rising investments in defence capability and emerging defence technologies. The emerging defence technologies noted by CSIRO include "high-speed, variable-trajectory and precise-targeting missiles; artificial intelligence (AI) and advanced autonomous systems; and cyber/information warfare". These technologies again speak to advanced digital skills, precision manufacturing techniques and AI/automation (including the ethical considerations associated with increasing use of AI and automation).

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[38] This is consistent with the 'Smile Curve', which is a visual representation of value added along a production cycle. In taking advantage of global value chains, Australia's manufacturers have retained proportionally more high-value-added activities, such as research and development and marketing, which are typically undertaken before and after the physical manufacture and assembly of a product. See for example, Department of Industry, Innovation and Science *Industry Insights: 2/2018 Globalising Australia*, Chapter 3, Manufacturing and the smile curve.

CSIRO notes that “Australia’s vulnerability to [cyber] attacks has increased during the COVID–19 pandemic as more people work, study and access services online. A significant and growing number of attacks are targeting our critical infrastructure”. It is likely that cybersecurity skills will become an increasingly core part of every Australian’s baseline digital skills. Such a statement is not meant to deny the advanced skills that cybersecurity professionals need – especially given the references that CSIRO makes to “cybercrime, cyberterrorism and cyberwarfare”. Rather it reflects the need for all of us to adopt good cybersecurity practices.

Finally, this megatrend also canvases a return to global connectivity and cites forecasts from the International Air Transport Association that predict air passenger travel surpassing 2019 levels by 2023, with the quickest recovery in regions with large domestic markets. The NSC’s 2020 *The shape of Australia’s post-COVID–19 workforce* report made a similar point where it noted that while “employment for Air Transport Professionals declined by 20.4 per cent between February and May [2020] … this occupation is still expected to grow by 4.8 per cent over the period Q1 2020 to Q1 2025, demonstrating its longer-term resilience”. Indeed, the strong recovery in this sector to date has seen significant pressure placed on employees and employers as borders have re-opened.

Some ASC skills clusters/technology tools associated with this megatrend:

Operations research and management / Improve operational performance/ Design or assemble equipment and systems / Investigate illegal activities or maintain security / Teach others to use computer technology / Network security and virtual private network software / Computer Aided Manufacturing (CAM)

4.5 Diving into digital

"The rapid adoption of digital and data technologies in recent times has meant that many sectors and organisations have experienced years' worth of digital transformation in the space of months. This is evident in the growth in online retail, remote working, telehealth, virtual education, digital currencies and data-driven organisations. While this progress has been significant, experts predict that this is just the tip of the iceberg, with the vast majority of digitisation yet to occur. This megatrend details the next wave of digitisation for organisations and the opportunities enabled by digital and data technologies."

Source: CSIRO (2022).

NSC analysis of job advertisement data has found that data and digital skills are among the fastest emerging skills in the economy[39]. More importantly, the growing demand for digital and data skills is impacting a range of occupations, not just ICT occupations.

CSIRO notes "Many organisations are increasingly realising the value of big data. A 2021 study of 85 Fortune 1000 businesses found that 96 per cent benefited from using big data and data-driven decision making, and a separate study found companies that use customer analytics are twice as likely to generate above-average profits than those who do not." Skills related to data, analytics and databases are emerging in non-ICT occupations across various skills levels such as Environmental Managers, Industrial Engineers and Product Testers[40].

As noted above, industries will continue to invest in data capabilities due to the realisation of increased productivity and profitability, which will result in the growing demand for skills in data and digital technologies. NSC analysis highlights the demand for digital technologies and electronics skills are projected to grow by 16 per cent or 2.3 million additional work hours per week between now and 2026[41].

One of the most obvious sectors impacted by accelerated digitisation over the last two years has been healthcare, with telehealth (for example) becoming more mainstream in health service delivery. CSIRO notes, "COVID–19 has fast-tracked the integration of digital health initiatives into routine healthcare management and delivery. In March 2020, subsidised telehealth services were temporarily expanded to all Australians, resulting in a rapid uptake, with 56 million telehealth consultations conducted in Australia from 13 March 2020 to 21 April 2021."

The practice of telehealth requires health care professionals to use additional skills to navigate audio and video conferencing on software platforms such as Microsoft Teams, Skype and Zoom. Audio and video conferencing software is an emerging skill in many occupations including General Practitioners, Dietitians and Speech Pathologists. As we continue to recognise the benefits of telehealth and its ability to improve access to healthcare, the demand for digital skills and the level of proficiency in digital literacy required for health care professionals will continue to increase over the next decade.

The conclusion to draw from this megatrend is that an increasingly digital world will demand a workforce of new and emerging occupations specialised in digital transformation and data-driven business practices.

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39 NSC (2022) *Digital skills in the Australian and international economies*, March 2022.
40 NSC (2022) Australian Skills Classification, Version 2.1, September 2022.
41 NSC analysis of employment projections (2021-2026) and the Australian Skills Classification.

That said, digitisation will also impact most, if not all occupations in the labour market through task change or the addition of new tasks in the daily routine of workers. Diving into a digital world will continue to pay dividends in improving productivity and economic growth as it has with technological change observed over centuries. However, capitalising on these opportunities will require a workforce that is well equipped with the skills to use new and emerging technologies and workers that can operate effectively in increasingly digitised workplaces.

Some ASC skills clusters/technology tools associated with this megatrend:

Use data to inform operational decisions / Prepare information or website content / Undertake research and analyse data / ICT support, design and management / Operate and maintain computers / Social media platforms / Audio and video conferencing software

4.6 Increasingly autonomous

"We have seen astonishing improvements in the ability of software and machines to solve problems and perform complex tasks without explicit human guidance. This is driven by ongoing scientific breakthroughs in artificial intelligence (AI) and global investments in technology-driven research and development (R&D). Today, practically all industry sectors and policy spheres in all regions of the world are increasingly adopting AI technology and developing their AI capabilities. This megatrend unpacks how AI and related science, research and technology capabilities are helping to boost productivity and solve humanity's greatest challenges and the socio-economic considerations of these technology developments."

Source: CSIRO (2022).

The impact of automation on occupations has sparked both fear and enthusiasm since the beginning of the industrial revolution. As the former Governor of the Reserve Bank of Australia, Glenn Stevens put it:

> *There are no prizes for guessing that the share of services in most economies will continue to increase. Health and aged care are obvious areas for expansion – another effect of demographics. It may be that jobs will be 'robotised'. But on the other hand, in the long run we may need that to some extent. Demographic factors suggest strongly that, all other things equal, the problem isn't going to be a shortage of jobs, but instead a shortage of workers.*[42]

Over time, advances in AI will make more complex tasks automatable including those that are cognitive and dexterous. The growing scale of automation will risk making some of today's jobs and tasks redundant, or at least, significantly different, while potentially creating new jobs with additional tasks that cannot easily be replicated by software and machines.

NSC analysis using a skill-based automation model has found that the most automatable skills defined in the ASC are those that are manual, repetitive, and labour intensive[43]. These include skill clusters such as 'Operate textile production equipment', 'Sort and distribute mail', and 'Prepare work pieces for production, assembly or processing'.

The skill clusters which are the least automatable are those that are 'human' and not easily replicated by current autonomous technology such as 'Research and write in areas of expertise', 'Resolve human resources issues' and 'Provide counselling' (Table 11). These skills are highly cognitive and require either critical thinking, creativity, communication, and collaboration. As routine manual tasks continue to be automated through the advances of AI, non-routine cognitive tasks will gradually grow in importance.

Highly skilled occupations such as managerial, professional, and creative occupations are the least likely to be automated given they are predominantly required to undertake tasks that are highly cognitive compared to lower skill level occupations which are mostly manual and labour intensive such as labourers, machine operators and administrative and clerical workers.

Over the past 20 years, the fastest growing occupations such as those in health and community services have been relatively less automatable compared to occupations that have experienced slower growth or decline, such as those in manufacturing and agriculture.

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42 G Stevens, The Long Run, Address to the Australian Business Economists Annual Dinner, 24 November 2015.
43 NSC (2022) Occupation automatability dataset (Unpublished).

However, some potentially highly automatable jobs such as those in transport and logistics may continue to be in demand and not displaced completely by software and machines. It may be that technology will gradually augment day-to-day tasks and change the skills required in these occupations as we work alongside software and autonomous technologies.

Table 11: Australian Skills Classification skill cluster families that are most and least likely to be automated

Most automatable	*Least automatable*
Material transportation	Teaching and education
Work activities preparation	Art and entertainment
Production processes and machinery	Recreation and sporting events
Cleaning and maintenance	Environmental management
Agriculture and animals	Human resources

Source: NSC analysis 2022.

It is important to note that the impacts of automation across the economy will not be uniform and will vary across regions, industries, occupations and cohorts. Successfully managing structural change in the labour market will remain important over time.

Some ASC skills clusters/technology tools associated with this megatrend:

Test computer or software performance / Research, evaluate or design new technologies / Develop websites or software / ICT support, design and management / Undertake engineering research / Industrial control and automation software / Automated vehicle guidance

4.7 Unlocking the human dimension

"Emerging social trends have heightened the influence of human perspectives and experiences on future community, business, technology and policy decisions. Consumers are demanding increased transparency from organisations, governments and scientists to maintain their trust, and there are concerns around the spread of misinformation. The rapid rate of change associated with technology is also driving new considerations around ethical design and deployment. This megatrend highlights the social drivers influencing future consumer, citizen and employee behaviours."

Source: CSIRO (2022).

Underpinning many of the drivers outlined above is the rate of information flow and the way communication between individuals and organisations is evolving. The convergence of mobile, social, cloud and big data technologies has expanded individuals' access to information.[44] Yet it has also become increasingly difficult to communicate complex messages to the public, while social media platforms can potentially aid in the spread of misinformation.

The important role of communication and interpersonal skills is reflected in the skills demanded by employers in the Australian labour market[45]. For example, in the Australian Skills Classification, specialist tasks in the Communication and collaboration, Human resources and Customer service skills cluster families are some of the most transferable skills.

Past NSC analysis also highlights the importance of core competencies or what can also be considered employability skills.[46] These include oral communication, digital engagement, problem solving, showing initiative and teamwork. These are competencies required by all jobs.

That's also true when looking to the future. High levels of proficiency in core competencies are associated with a lower chance of automation. In other words, jobs that require a low level of proficiency in a core competency are generally more likely to be automated. An example of this could be a simple customer service script that can be delivered by a chatbot.

On the other hand, previous NSC analysis has found that jobs requiring very high-level oral communication and writing skills are the least likely to be automated. This finding – and the importance of communication skills to a range of jobs – sits behind the NSC's view that communication will be a core skill of the future.

A conclusion from this megatrend is the future of how we interact with one another will be shaped by other megatrends in digital and technology, geopolitical shifts and a changing climate. These transformative shifts will place a greater emphasis on the establishment of social governance frameworks to work together to adapt to challenges in the short-term while being on the front foot to capitalise on the opportunities in the long-term.

Unlocking the human dimension will place a greater emphasis on collaboration, negotiation, and teamwork as the base skills for all workers as government and industries work towards a future of social cohesion, inclusivity, and sustainability.

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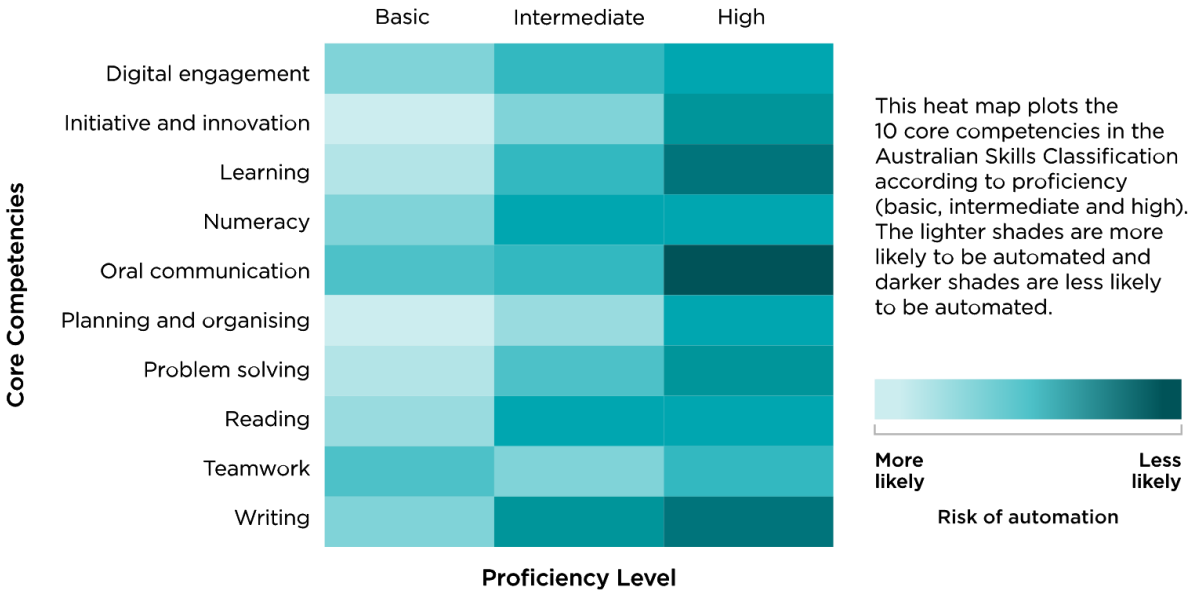
44 Venkatachalam S (2014) *Five things that make you an empowered consumer*, World Economic Forum, 9 November 2014.
45 NSC (2022*)* Australian Skills Classification, Version 2.1, September 2022.
46 NSC (2021) *State of Australia's Skills 2021: now and into the future*, December 2021.

Figure 39: Automatability score versus core competency and proficiency levels



Source: NSC analysis, 2021.

Some ASC skills clusters/technology tools associated with this megatrend:

Communicate with colleagues / Collaborate with stakeholders / Undertake dispute resolution / Undertake human resources activities / Support diversity and inclusion

4.8 The Five Cs of future workforce skills needs

The megatrends identified by the CSIRO's strategic foresight study reflect the forces that will shape the future of our economy.

In assessing these megatrends, skills clusters from the Australian Skills Classification that could be associated with each trend have been identified and shown below in a word cloud. While not a precise science it shows the importance of a range of words, representing skills, across all the megatrends. The importance of ICT, systems and design thinking, sustainability and environmental management, impact reduction practices, engineering research, automation, and supporting each other and the community feature strongly.

Many of the megatrends themselves lend support to the Four Cs outlined in last year's report (Care, Computing, Cognitive abilities and Communication). That said, the megatrends and word cloud shown above also very clearly point to the need for a fifth C, namely 'Climate'. That is, the very broad range of skills required to transition to a net zero carbon economy and respond to the impacts of climate change.

As noted elsewhere in this report there are a range of occupations that have emerged due to green economy activities and technologies. Many occupations in this category are associated with clean energy specific roles or roles associated with emerging technologies. These occupations represent a range of cutting-edge opportunities presented by decarbonisation, which Australia could harness and grow significantly over time.

While not inclusive of all the economy's future skills needs, the Five Cs do highlight broad trends and skills that are likely to shape our future labour market.

- *Care* – the group of skills that provide care and support; and responds to demographic change (such as the ageing of the population) and healthcare needs.
- *Computing* – a group of skills needed to respond to the digital world and the increasing use of digital technologies across the entire economy.
- *Cognitive abilities* – the group of advanced reasoning and higher order skills computers cannot easily replace, especially non-routine cognitive skills.
- *Communication* – the group of skills needed to collaborate and engage within and across workplaces.
- *Climate* – the range of skills required to transition to a net zero carbon economy and respond to the impacts of climate change.

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