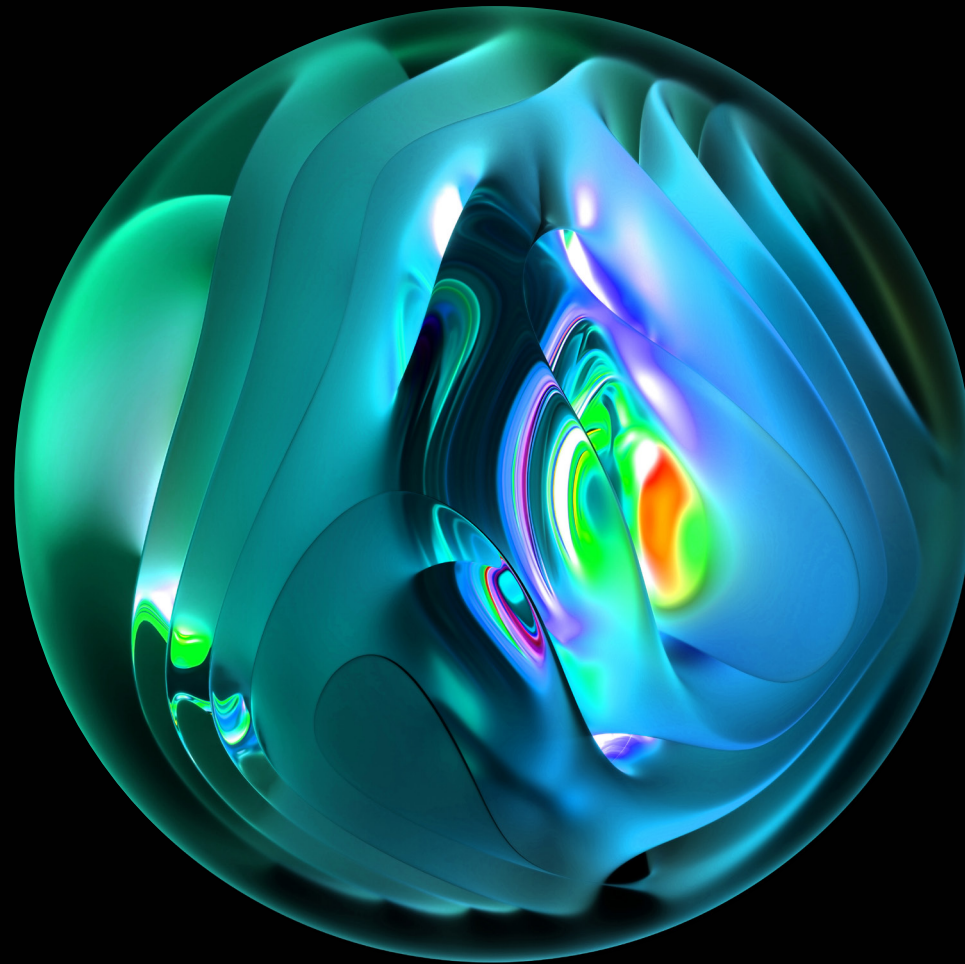


**Deloitte.**



## Australia's Digital Pulse

A new approach to building technology skills

New South Wales edition

**Deloitte**  
**Access Economics**



# Powering Australia's technology brilliance.

ACS is the professional association and largest community for Australia's technology professionals, with more than 47,000 members across business, government and education.

As the trusted leader in the tech sector, we work to accelerate the growth of diverse and highly skilled technology professionals, equipping them with the right skills and knowledge to power Australia. Now and in the future.

We deliver value for our members, businesses and society in four ways.

## Community

We foster an innovative and inclusive community that is dedicated to powering positive change through technology.

**47,000+** **12,000**  
Total members      Event attendees  
a year

## Career

We create career pathways to guide technology professionals and ensure Australia has a pipeline of talent with the right skills and knowledge.

**46** **368**  
Accredited      ACS Google  
universities      Scholarships

## Capability

We set the standard for assessing, developing and recognising the skills and experience of technology professionals.

**11,128+** **44,000**  
Learning      Digital resources  
Accelerator      unique users

## Migration

We assess and support skilled technology migrants to address critical skills shortages, improve diversity and enrich Australia's workforce.

**40,200** **7,107**  
Skilled migrant      ACS Professional  
applicants in      Year graduates in  
2022-23      2022-23

# ACS Australia's Digital Pulse 2023

New South Wales edition

NSW is a national leader in terms of the digital economy. Maintaining leadership will require ensuring tech skills of the workforce match the rapid pace of developments in technologies such as AI, robotics and advanced data analytics. The rapid adoption of these technologies will affect 4.2 million NSW workers and require half a million additional critical technology skills by 2030.

Already outdated digital skills cost NSW large businesses \$1.1 billion per year. This estimate only reflects costs associated with existing employees, with the full opportunity from digital technology likely to be much larger. Building the tech skills needed in NSW will require a new approach.

## Key principles of the new approach



All hands on deck



Skills first



Driving diversity



Lifecycle of learning



Systems approach

# \$60 billion

Projected annual technology investment in NSW in 2030

# 4.2 million

NSW workers who will need some reskilling because new tech will affect at least 20% of work time

# 23,000

New technology workers needed in NSW each year to 2030

# \$1.1 billion

Cost of outdated digital skills for large NSW businesses each year

# NSW will be at the forefront of tech disruption

## NSW is a national leader of tech adoption in Australia

NSW has the largest digital economy in Australia in terms of number of businesses, size of the digital workforce, and investment in technologies. The ICT sector contributed \$50 billion to the NSW economy in FY22 as measured by value add with 30,000 businesses that have headquarters in the state.<sup>1,2</sup>

The importance of digital technology extends across the whole economy. Consider the following:

- The NSW technology workforce reached 348,000 in 2022, with half employed in businesses outside the traditional ICT sector.
- NSW is home to 60% of Australia's Fintech startups, an important digital intensive industry vertical.<sup>3</sup>
- *Research from Deloitte's Generation AI: Ready or not, here we come!* found that NSW had the highest share of current users of Generative AI (53% of workers compared to the national average of 32%), making NSW most likely to face the most imminent rapid changes from this technology in the coming years.
- The NSW economy will experience imminent and extensive disruption from Generative AI with the five industries to be impacted the most by the technology accounting for 33% of the economy.

More broadly, forecasts from the International Data Corporation (IDC) indicate that technology investment in NSW will increase from \$43 billion in 2022 to \$62 billion by 2030.

NSW will account for nearly a third of national investment by 2030.<sup>4</sup>

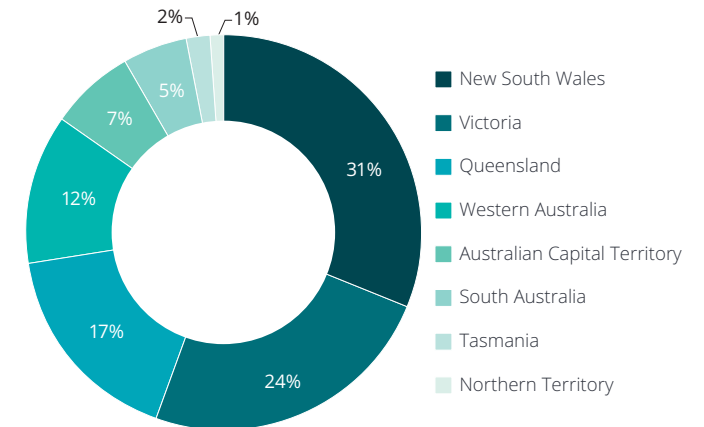
The scope of technology disruption cannot be understated. NSW Productivity Commission modelling shows that adoption of key emerging technologies would see the state's productivity growth increase by 2% a year out to 2050, a rise in productivity levels not seen since the 1990 IT boom, increasing the size the state's economy by 11.8% by 2035.<sup>5</sup>

Beyond productivity, embracing technologies will provide significant dividend in other objectives. For example, the NSW Government has a goal to reduce its emissions by 50% by 2030 and to achieve net zero by 2050. Critical technologies such as AI and advanced data analytics will be crucial in realising this objective by identifying optimal locations for clean energy infrastructure, prioritising investments in sustainable transportation, and streamlining energy distribution.<sup>6,7</sup>

Technologies can also assist the NSW Government in addressing the cost-of-living crisis by improving service delivery and reducing costs. For instance, AI-powered systems can enhance the efficiency and targeting of social support programs by automating eligibility assessments.

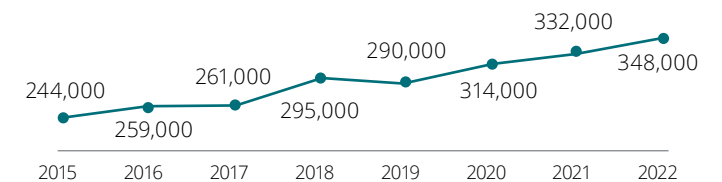
With tech offering solutions to some of the biggest issues facing the state, NSW cannot afford to let the opportunities by developments in tech go by.

## NSW share of national technology investment to 2030



Source: IDC ICT Spend Data Custom Report

## Technology employment in NSW 2015 to 2022



Source: Australian Bureau of Statistics (2023)

## A tech perspective

“NSW is home to some of the tech businesses that are household names like Atlassian and business in other fields on the cutting edge of tech like DetectedX.

NSW owes a lot of its current prosperity to previous waves of innovation, but the latest developments mean the scale of change in coming years will be unprecedented.”



**Bec McConnochie**  
Tech Sector Lead Partner  
Deloitte Australia

# Critical technology will significantly impact the work of 96% of the NSW workforce

## Nearly 4.2 million workers across NSW will be substantially impacted by critical technology

To begin preparing for the incoming disruption, the Australian Government has developed the *List of Critical Technologies in the National Interest*. The most recent edition of *ACS Australia's Digital Pulse* analyses the impact of eight key technologies from this list including AI, additive manufacturing, advanced data analytics, advanced robotics and sensors, additive manufacturing, cyber security, enabling cloud technology, Internet of Things (IoT) and virtual worlds.<sup>1</sup>

To assess the skills needs for these critical technologies, Deloitte Access Economics has analysed a 2,136-task taxonomy of 229 Australian occupations from the National Skills Commission (NSC) and academic research on the impact of these technologies on tasks to understand the potential impact of the critical technologies for the Australia workforce.

This analysis shows that almost all NSW workers (96%) are expected to have at least 20% of their work time affected by critical technologies over the coming years. In total, 75% of all working hours across NSW will be affected.

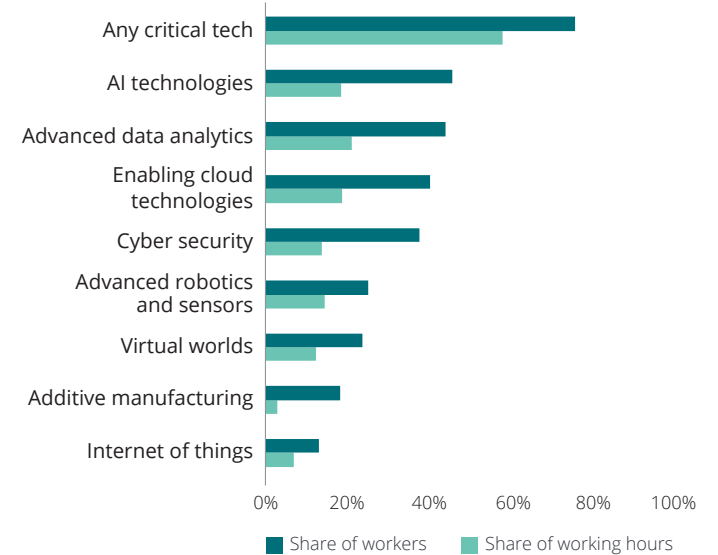
Advanced data analytics and AI technologies will have the largest workforce impact, each affecting the work time of almost two-in-three workers. In total, these technologies will affect 29% and 27% of all working hours in NSW respectively.

While all these workers will be impacted, some jobs face greater changes in skills than others. For example, sales assistants, registered nurses and teachers will all have more than 60% of their work time impacted. More physical roles such as those in hospitality and construction trades are expected to be less exposed to critical technology.

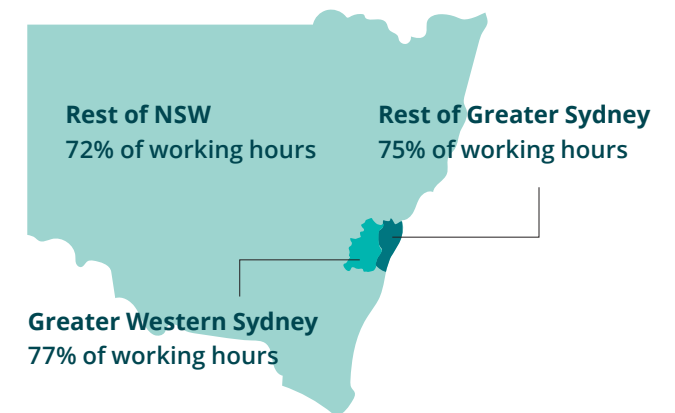
Greater Western Sydney will be the region in NSW most impacted by critical technologies, with 77% of all working hours affected by critical technology. Other regions will also be significantly impacted with 75% of working hours affected in rest of Greater Sydney and 72% across the rest of NSW. Although the impact is proportionally similar across the state, the number of working hours affected is largest in Greater Sydney (excluding the West) accounting for 44% of all affected hours.

Of all the occupations impacted by critical tech, technology workers are among the most impacted with eight out of the top twenty occupations impacted. With two in every five Australian technology workers with critical technology skills being demanded by employers based in NSW, skilling the technology workforce is an important ongoing consideration for NSW.

## Proportion of NSW work hours affected by critical technology



## Affected worktime across NSW



# Knowledge industries, services and traditional industries will have more than 80% of work time impacted

## Ten NSW industries will all have at least 80% of their work time affected by critical technology

A broad range of industries are expected to be affected by critical technology including knowledge industries like financial and professional services, other service-based industries like retail trade and a number of traditional industries such as utilities, mining and construction. Collectively, the top ten impacted industries account for 50% of NSW economy in 2022.

The highly codified information within existing digital infrastructure alongside the highly skilled workforce means that knowledge industries like financial and professional services are likely to experience significant impacts from future waves of critical technologies like data analytics and AI.<sup>1,2</sup>

Already finance businesses are adopting critical tech with Bluesheets providing real-time financial automation solutions to thousands of companies worldwide and XBert providing AI audit and workflow management for bookkeepers and accountants.<sup>3</sup>

Service-based and traditional industries are also facing seismic disruption from critical technologies and may be less prepared for the rapid incoming changes. Other research which compared the data infrastructure of these industries has found relatively lower capabilities in construction, mining and wholesale compared to other industries.<sup>4</sup>

In particular, research in the construction industry found that the most common barrier to adopting digital technologies

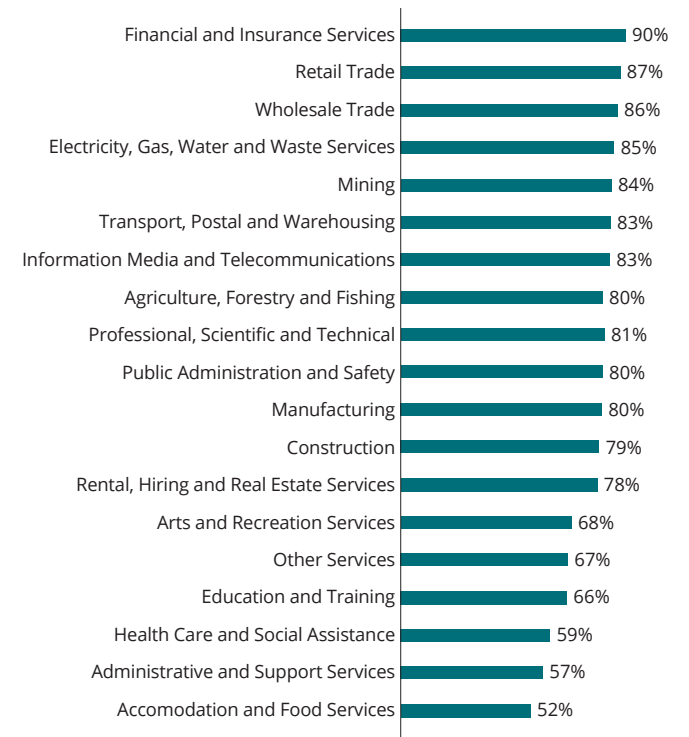
was a lack of digital skills in the workforce. Not addressing this issue could lead to significant challenges for the more than 400,000 people employed in construction in NSW as their industry transforms.

The industry recognises that a focus on building the digital skills of the workforce in industries such as construction will play an important role in ensuring it can keep pace. Programs like the Institute of Applied Technology's Introduction to Digital Skills in Construction are important steps towards building a sufficient level of digital skills in the industry.<sup>5</sup>

Industries with a larger share of the workforce in people and care orientated roles such as nursing, bar attendant and café workers will be relatively less affected than the industries described above. This includes industries such as accommodation and food services, and health care. However, the impact across these industries is still substantial with more than half of all work hours in the least affected industry expected to be affected by critical technology.

With the impacts of critical technology being felt across all industries, competition for workers with critical technology skills will likely be fierce. A focus on upskilling the existing workers in industry specific applications will therefore be key.

## Affected work hours by industry, NSW



Source: Deloitte Access Economics analysis of ABS Census (2023)

# The tech skills challenge for NSW

## NSW will require an additional half a million critical technology skills by 2030

The number and type of skills needed for the technology workforce in 2030 will look vastly different to those in use today. In total, 756,000 skills will be required for critical technologies by 2030, an increase of 543,000 compared to current skills within the NSW workforce

The greatest increase in skills demanded will be for those people skills needed by most workers such as communication and team teamwork skills. Cloud solutions, scripting languages and data science are among the most common technical skills that will be needed in NSW.

The current need for digital skills is not being met. Previous Deloitte Access Economics research suggests that three in five businesses lack the digital skills they require to do business.<sup>1</sup> These out-of-date digital skills come at a cost with \$1.1 billion per year in lost output among large businesses alone.<sup>2</sup> This estimate only reflects costs associated with existing employees, with the full opportunity from digital technology likely to be much larger.

With seismic developments occurring in technology, the potential for rapid change in the skills required across the NSW workforce means the gap in digital skills is likely to grow without significant action. To ensure that NSW's technology skills challenge is met, barriers facing the labour market need to be addressed.

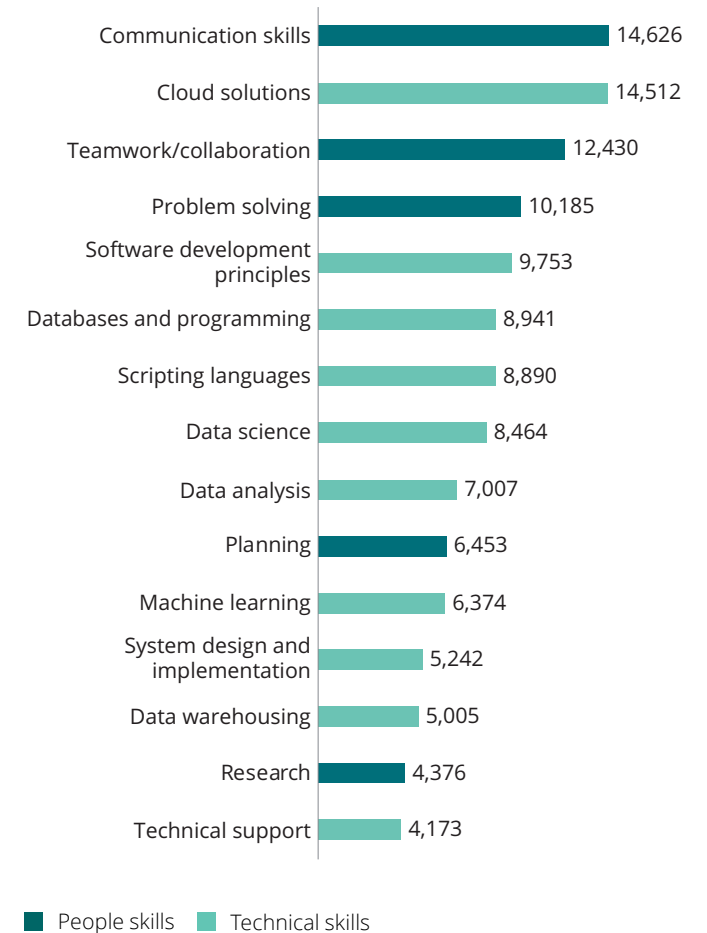
The lack of diversity in tech not only holds back key talent but severely limits the ability to meet our skill needs. Only 29% of people working technology occupations in NSW are women, substantially fewer than in comparable industries such as professional services (46%).<sup>3</sup> NSW also has the lowest share nationally of women enrolled in IT university courses (21%), meaning the gender gap in the NSW tech workforce looks likely to persist.<sup>4</sup>

More generally, decreasing domestic student completions of IT degrees in NSW in 2021 signals an increasing lack of interest in tech among younger generations.<sup>5</sup> This could lead to future generations lacking critical skills needed to build a successful career.

Making sure that skilled jobs are available where people are is another important objective recognised by the NSW Government. Yet skilled tech jobs and tech skills are not equally distributed across NSW. For example, while Greater Western Sydney is a hotspot of technology talent – with over 120,000 technology workers living in the region – less than half of these workers are employed within the region itself.<sup>7</sup>

Not only will NSW need more workers with technology skills, but it will also need workers with a variety of new or emerging technology skills. Skills to work with AI will be some of the most sort after with 216,000 additional AI skills needed by 2030. These include technical skills such as data science, machine learning and deep learning (see page 9).

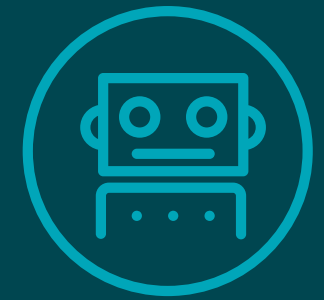
## Additional skills needed by critical technology workers by 2030, NSW



Source: Deloitte Access Economics analysis of ABS Census (2023)



# 2030 skills for Artificial Intelligence, Machine Learning and Natural Language Processing



One of biggest areas of additional skill requirements will come from Artificial Intelligence (AI), Natural Language Processing (NLP), Machine Learning (ML). Annual business investment across Australia in these areas is forecast to jump from less than \$5 billion in 2022 to over \$27 billion by 2030. Business use of these technologies across Australia will grow from less than 1% in 2022 to almost two-thirds by 2030.

## What skills will tech workers need for this enormous change?

Already, we know that the essential technical skills include: Data Science Principles, Data Analytical Thinking, Programming, Scripting Languages, Machine Learning, and Software Development Principles. Workers will also need soft skills such as planning, research, problem-solving, effective communication, collaboration, and teamwork.








## How many extra professionals and how much more skilling will be needed in NSW?

The number of NSW tech workers focusing on AI, ML and NPL is expected to grow from just 6,300 in 2022 to 56,300 by 2030.

The total skill requirement in NSW to support just the core tech workforce is projected to grow 793% from 62,515 in 2022 to 558,192 in 2030. The gap between skills now and in the future is a staggering 215,854 technical and soft skills.

The introduction of these new technologies will also give rise to new job roles, including positions such as AI Ethicist, AI personality designers, algorithm bias auditors, information validators, and AI regulatory roles.

## Skills sets demanded for AI, NLP, and ML by 2030

-  **Data science**  
33,977+
-  **Machine learning**  
25,483+
-  **Data analysis**  
12,492+
-  **Scripting languages**  
23,984+
-  **Data warehousing**  
11,492+
-  **Databases & programming**  
13,991+
-  **Software development principles**  
17,488+

**50k** Skilled workers needed (2030)

**216k** Skills gap (2030)

**+793%** Growth in skilled workers (2022-2030)

### People skills

Teamwork/collaboration	16,989+
Communication skills	16,989+
Problem Solving	12,991+
Research	10,993+
Planning	7,495+

### Extra skills identified

- Ethical & responsible use of AI
- Critical thinking
- Linear Algebra and Calculus
- Machine Learning
- Deep Learning

Find our detailed skills analysis for seven other critical technologies in the appendix

We note that of all the projections of job and skill needs, this one is most uncertain. Dramatic growth in 2023 could be a sign that the jobs need vastly exceeds the 200,000 projected here for the tech and broader workforce. It will depend significantly on how the technology evolves. If more skills are needed in the development and application of AI, the number will be higher, but if the technology develops so most people can simply use it in software or applications, the core AI development workforce will be more modest.

# New South Wales will need to skill at least 23,000 technology workers per year for Australia to keep up with international peers

## NSW needs to skill at least 23,000 technology workers per year but only 6,200 come through as tech graduates each year

Based on currently available data, Australia will need to spend an additional \$92 billion through to 2030 in critical technologies to be at the forefront of forthcoming disruption. Based on forecast technology investment, this would amount to an additional \$29 billion of critical technology spend in NSW by 2030.

NSW technology workforce has grown strongly to meet the needs of businesses and the economy. The number of technology workers has grown by around 130,000 in the 8 years since the first edition of Australia's Digital Pulse was published.

There were 348,000 people employed in the NSW technology workforce in 2022. Our forecasts suggest an additional 161,000 workers will be required by 2030. That's 23,000 annually. Despite this, NSW is only expected to formally educate 6,200 workers per year over this period (44,000 by 2030).

The number of workers in Australia's technology workforce grows and shrinks based on a number of drivers. These include:

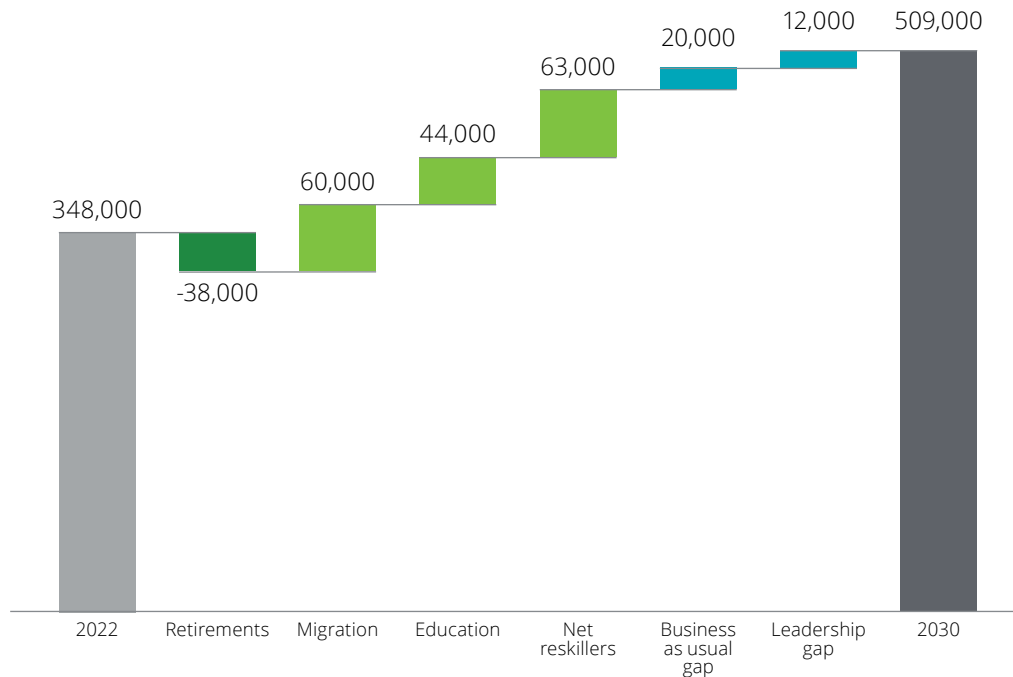
- Retirements capturing those workers expected to leave the labour force through to 2030
- Migration accounting for permanent and temporary workers in the sector

- Education accounting for domestic and international students who work in the tech sector after completing their studies
- Net reskillers accounting for workers coming and going from technology occupations.

Projecting the supply of workers from each of these sources between 2022 and 2030 (chart below) suggests NSW technology sectors expected to reskill an additional

63,000 workers but will need to reach 83,000 to match business-as-usual demand by 2030. This rises to 95,000 workers if Australia was to match levels of spending on critical technology in the USA (proportionate to GDP).

**Projected source of technology workers, 2022-2030**



Source: Deloitte Access Economics (2023)

# Tech workers expect critical technology including AI to significantly disrupt the workforce over the coming years

## Two-thirds of NSW technology workers agree that critical tech will significantly disrupt the technology sector

Like their peers across Australia, tech workers in NSW see the extent of potential disruption in the sector. Most do not think they are ready for the coming change. Less than half (49%) of current technology workers surveyed believe their formal education has equipped them with the skills they need for critical technology.

As well as adapting to change, there is also underutilisation of technology workers who are currently employed. This means finding the best jobs for workers and adding to the likelihood they leave the profession.

Better utilising tech workers in NSW includes ensuring workers have meaningful work for their skills. Based on a technology workforce survey completed for this report, one in five do not agree that their skills are being fully utilised. Workers think that they could have their capabilities and contributions recognised (49%), be given more technical tasks (46%) and be involved in bigger and more complex work (44%).

Many NSW tech workers (38%) also want to work more hours. While systemic barriers such as caring for children or other personal responsibilities are key barriers for these workers, a lack of full-time opportunities is a larger issue in NSW than Australia at large. Addressing workers being stuck in a part-time role that underutilises their time and skills represents a key opportunity for meeting the needs of the future workforce.

## A quarter of NSW tech workers are planning on leaving the sector in the next five years

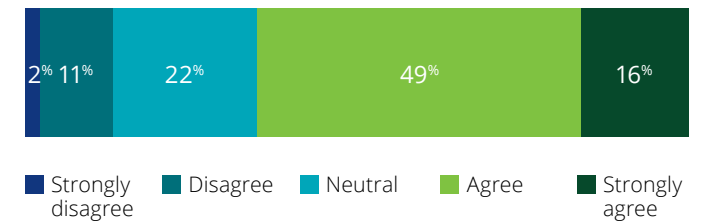
This level of planned exits from the sector highlights the need address the challenges that workers in the sector face. Some of the top reasons for workers wanting to leave the tech sector in NSW include wanting to do something different (35%), for better pay (25%) and a lack of growth opportunities (21%).

While workers leave technology roles, workers also reskill into the sector. Better pay is the leading reason people reskill into the sector across Australia, opportunities for leaning and development (46%) and career growth (42%) are more important in NSW. This is indicative of the existing opportunities and industry leading nature of the local industry.

Our technology workforce survey found that nearly half (49%) of technology workers look to upskill by undertaking self-directed learning through channels such as reading articles and watching video while 43% undertook some mandatory employer provided training.

Salary and career development are top reason for workers wanting to both move into and out of the technology sector. This suggests that while workers are coming into the industry for advancement, they may reach a point where the opportunities in the sector are not apparent. Alternativity, a mismatch between expectations and reality could be contributing to people leaking out overtime.

## Agreement that critical technology will significantly disrupt the technology sector



Source: Technology workforce survey (2023)

## Reasons reskillers move into a technology role in NSW



Source: Technology workforce survey (2023)

## A NSW government perspective

“The NSW Government has a number of world class achievements when it comes to tech like our digital services and our AI Assurance Framework.

Yet rapid innovation and various technologies combining create vast leaps in capabilities, we can't rely on past success. We must continually strive to be leaders in tech for our local businesses and citizens.”



**Dr. Ian Oppermann**

NSW Chief Data Scientist & UTS  
industry professor

# NSW government has an important role to drive the digital economy

NSW Government has invested heavily to be a leader in digital technology. The NSW Government achieved a 10/10 rating on the Digital Government Readiness Indicator and topped *Intermedium's 2022 Digital Government Maturity Indicator*.<sup>1</sup> These results are a product of the leadership the NSW Government demonstrates through delivery of digital services to NSW residents through digital forms of identification as well as the development of assets such as the digital twin of Western Sydney. The NSW public sector is also a key employer of tech talent with over 21,000 technology workers, making up 8.5% of the public sector workforce.

NSW Government's activities are underpinned by several strategies aimed at developing and enhancing the state's digital capabilities. The *NSW Beyond Digital Strategy* is a whole of government strategy that sets out the Government's vision for a digital NSW by 2030.<sup>2</sup>

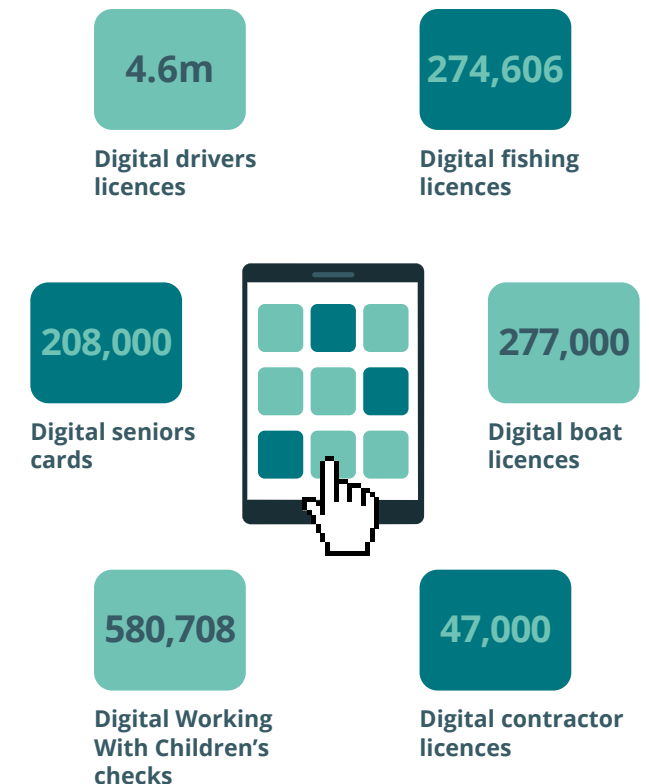
The Digital Restart Fund is the NSW Government's \$2.2 billion fund for digital transformation projects across all government agencies. The Fund focuses on iterative, multi-disciplinary approaches to planning, designing and developing digital products and services in NSW.<sup>3</sup> By 2021, projects funded by the Fund had saved 3,220 working days of customer time and provided \$2.3 billion in economic returns for NSW.<sup>4</sup>

The NSW Skills Board is collaborating with 30 partners including tech companies and education providers to address the skills shortage through the Digital Skills Compact announced in November 2023. The compact involves co-design of a campaign to uplift perceptions about digital careers and improve diversity outcomes. The initiatives will support a 2023-25 Action Plan for digital skills.

In March 2022, the NSW government's *Artificial Intelligence Assurance Framework* came into effect. This Framework is only one of its kind in Australia and is designed to ensure responsible and ethical AI adoption by businesses within the State. This framework sets out guidelines and standards for the development, deployment, and use of AI systems across various government agencies.<sup>5</sup> Its primary focus is to promote transparency, fairness, and accountability in AI practices to build public trust and confidence.

The NSW Government is also exploring other key technologies, commissioning a report to help the government leverage the Metaverse and to mitigate the risks posed by it. The report entitled *Metaverse and the NSW Government* was released in November 2022.<sup>6</sup> The report provide recommendations to enable the NSW Government to proactively plan for and develop infrastructure to enable the safe adoption of the metaverse and its enabling technologies.

## NSW users of digital licences and permits in NSW



## A professional association perspective

“NSW faces a significant tech skills challenge with more people requiring reskilling and businesses needing to push boundaries to retain competitiveness. Getting this right will also be a large opportunity for NSW to lead the way in many innovative products and industries. It is clear the challenge and the opportunity can only be addressed if governments, industry, training entities and tech organisations work together.”



**Josh Griggs**  
Interim CEO  
Australian Computer Society

# How can NSW lead change?

NSW is not on track to develop the technology skills needed to meet the demands of business and the economy. Currently, efforts are fragmented or operate in isolation. In a report for the NSW Skills Board, Accenture identified 74 initiatives already in place. The NSW Productivity Commission also identified four key areas with 24 underlying recommendations to improve technology adoption and skills across the State.<sup>1</sup>

Yet accountability is lacking and the leadership NSW has with the digital economy is in jeopardy without systemic action taken now.

Addressing the skills issue will require a new approach to building tech skills in Australia and NSW. This year's Australia's Digital Pulse outlines five key principles needed to guide individual policies and initiatives. These principles are equally as relevant to NSW and below are some examples about how these principles should be applied within the NSW context.

Using these as our foundation, we have identified three high priority recommendations for NSW to kick start this new approach.

These recommendations align with multiple principles listed below and illustrate how solutions should and can bring about transformative change. The three recommendations are detailed in subsequent pages of this report.



## 01 All hands on deck

We need all actors across both private and public sectors to play a role in addressing the skills challenge in NSW. Combining effort to produce transformational change will be required. In NSW this will require the Government to develop a skills strategy in collaboration with education providers like University of Sydney and New England and major tech employers like Amazon Web Services to outline how skills can be developed.



## 02 Skills first

We have designed our education system to focus on people being ready for roles they could remain in for their entire career with limited reskilling or upskilling. We need to first and foremost identify and build in-demand skills based on critical technologies shaping the NSW economy and society.



## 03 Driving diversity

We need people with the right skills. Excluding or not fully utilising existing talent is not only wrong but imposes significant costs on the NSW economy. NSW's technology workforce has lower representation than the national average in terms of workers aged over 55, First Nations Peoples and people who need assistance. Helping these cohorts build skills and participate fully in the NSW economy and society is critical to realising the benefits of a digital economy.



## 04 Lifecycle of learning

Building a culture of continual skills development is necessary in the face of a declining half-life of skills. In addition, the skill needs of the NSW workforce will change in unforeseeable ways as technologies interact, highlighting the need for continuous learning. For example, quantum computing may require a large increase in coding skills while Generative AI may streamline the need for in-depth knowledge of coding specific knowledge.



## 05 Systems approach

Too often we are working on solving the same problem in silos. Combining our efforts and thinking holistically about our networks, organisations and institutions is necessary to maximise the impact of our initiatives.

# Turning the principles of the new approach into practice in NSW

## Building on the success of *Beyond Digital*



The NSW Beyond Digital Strategy provides a strong foundation for the NSW Government to continue building the digital service delivery.

The Strategy provides goals and targets out to 2030 which are updated with minor revisions each quarter of the year and with major revisions every 18 months. These features contribute to NSW being a digital leader when it comes to service delivery and should be replicated by a skills strategy.

This may include an international review of best practice when it comes to digital service delivery, with lessons being incorporated into the Strategy.

The focus of the Beyond Digital Strategy should continue to focus on maintaining the high standard of NSW digital service delivery. Importantly, the Digital ID rollout should have targets for sign up and use to ensure the benefits of Digital ID for citizens and government agencies will be realised.

Another priority for the Beyond Digital Strategy should be on continuing to support the activities of Cyber Security NSW. Trust in privacy and security of data submitted when interacting with government agencies is essential for broader take-up of digital government services. The important work of Cyber Security NSW should be more broadly promoted through a verification stamp on NSW Government Agencies that have had their systems reviewed.

## Building on the NSW Digital Skills Compact and Action Plan



Technology skills are evolving rapidly and NSW will need to build efforts through the Digital Skills Compact and Action Plan 2023-25.

A national digital skills strategy and underlying State and Territory strategies were recommended in the 2023 edition of ACS Australia's Digital Pulse this year and NSW Skills Board has since announced the NSW Digital Skills Compact in November 2023 which involves collaborating with 30 partners including tech organisations and education providers. The initiatives implemented by the Digital Skills Compact will feed into an Action Plan for 2023-25.

While the Digital Skills Compact and Action Plan are still in their nascent, there are clear lessons to ensure Compact is successful. The NSW Beyond Digital Strategy, with its regular updates provides a useful model as it is regularly updated to reflect progress and recent developments. In addition, the Beyond Digital Strategy sets objectives and goals out to 2030 and while the Action Plan is being trialled, it should transition to a more medium-term plan out to 2030.

The Digital Skills compact should leverage identify existing programs that could be scaled up and prioritise initiatives that have been previously recommended such as those included in recent research by the NSW Skills Board and the NSW Productivity Commission. Measures should be implemented to evaluate the success of scaling up initiatives to determine future priorities. Without initiatives being implemented effectively, there will be no better skills outcomes or economic benefits from greater tech adoption in NSW.



## Building tech hubs in regional NSW to bridge the digital skills divide



Making sure the benefits of technology are evenly distributed will be an imperative to prevent divide opening up across the state.

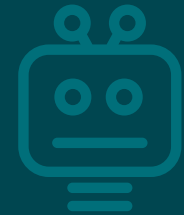
Greater Western Sydney will be the geography in NSW most impacted by the increasing adoption critical technologies yet has half the number of tech jobs as tech workers in the region. In regional NSW, 72% of working hours will be impacted by critical technologies. Yet the Australian Digital Inclusion Index suggests that digital skills and access in regional NSW are lower than in metropolitan areas.

Both Greater Western Sydney and Regional NSW would benefit from greater tech skills training and employment opportunities. The NSW government should develop additional tech precincts based on tax or regulatory incentives to encourage businesses and education providers to consider these location.

The Western Sydney Aerotrpolis provides a prime example of a new precinct that combine innovative industry precincts with education facilities. The Aerotrpolis combines an Advance Manufacturing Research Facility and a New Education and Training Model in close proximity to one another to ensure there is collaboration between industry and education. The location of the precinct to significant new infrastructure has also contributed to its success.

The NSW Government will need to identify areas where these tech hubs would most likely succeed with multiple criteria for consideration including population, affected occupations and potential infrastructure projects.

## Building on the AI Assurance Framework with an AI Adoption Framework



Over half (53%) of NSW workers have used Generative AI, the highest share of any Australian jurisdiction. The NSW economy is also mostly comprised of industries were identified by the Generation AI report that face the most imminent impact from AI – including finance, professional services, IT, education and wholesale trade. In fact, 33% or \$215 billion of the NSW economy is comprised of these five industries

The NSW Government's Artificial Intelligence Assurance Framework provides a framework for responsible and ethical AI adoption in the state. The AI Assurance Framework should be extended to encourage with an AI Adoption Framework that promotes adoption of AI across NSW businesses and organisations. This Adoption Framework could leverage the NSW Business Bureau mentioned in the most recent state budget.

The Adoption Framework should identify common use cases by industry and best practice for trialling AI organisations. The framework should take into consideration the likelihood a high share of employers may be using AI without the knowledge of employers. Once the framework has been developed, a public information campaign encouraging use of the framework should be used to promote awareness and use of the AI in businesses with awards celebrating most impactful use cases.

Priority should be given to industries that face the most imminent or greater disruption from AI as identified by the Generation AI report. The framework should be developed in concert with industry experts and associations to make sure appropriate investment are made and skills developed in parts of the workforce that may require assistance developing the necessary skills.

# About this report

This report is a companion report to the ACS Australia's Digital Pulse written by Deloitte Access Economics for the ACS. As such, this report should be read in conjunction with the national *ACS Australia's Digital Pulse*, which can be viewed [here](#).

This report, like the national report, focuses on eight critical technologies based on the Australian Government's *List of Critical Technologies in the National Interest* which identifies 63 key technologies within 7 fields that will have the greatest impact on Australia.

These critical technologies will profoundly impact the NSW economy and labour market. This report has collated a variety of data sources to provide an analysis on the impact of these technologies on the NSW tech workforce.

The research notes that while the technology workforce in NSW has grown strongly, there are risks to achieving the required growth in skills and people.

The analysis in this report is informed by the following data sources:

- Forecasts from the International Data Corporation (IDC) on investment spending in Artificial Intelligence (AI), cyber security, cloud computing, Internet of Things (IoT), big data and analytics, and Virtual Worlds in Australia, Japan and USA
- Lightcast data based on 265,000 technology worker job advertisements in Australia and the required skills for each role, with data extending from 2021 to 2023

- Data from the Australian Bureau of Statistics, both publicly available and from a customised data request as well as other reports and statistics from Australian government sources.

A detailed methodology assumptions and caveats for the figures produced in this report and the national report are available in the appendix of the national report.

The analysis contained in this report around technology workforce has been calculated using ABS occupation and industry classifications, based on the methodology used in previous editions of Australia's Digital Pulse. This methodology draws upon definitions and nomenclature developed by Centre for Innovative Industries Economic Research (CIIER) lead researcher Ian Dennis FACS, and used in the ACS's 2008 to 2013 statistical compendiums and other CIIER analysis.



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# **Appendix A: Technology workforce skill impacts from critical technologies in New South Wales**

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# 2030 skills for advanced data analytics



One of the biggest areas of additional skill requirements will come from advanced data analytics. Annual business investment in Australia in these areas is forecast to jump from \$8 billion in 2022 to \$15 billion by 2030. Business use of these technologies will grow from less than 5% in 2022 to more than half by 2030 nationally.

## What skills will tech workers need for this enormous change?








The essential technical skills needed for advanced data analytics workers include: Data analysis, Data techniques, Scripting languages, Big data, Databases and programming, and Data warehousing. Workers will also need soft skills such as planning, research, problem-solving, effective communication, collaboration, and teamwork.

## How many extra professionals and how much more skilling will be needed in NSW?

The number of NSW tech workers with skills in advanced data analytics is expected to grow from 21,000 in 2022 to 58,500 by 2030.

The total skill requirement to support just the core tech workforce in NSW is projected to grow 179% from 71,147 in 2022 to 198,431 in 2030. The gap between skills now and in the future is a sizable 127,285 technical and soft skills.

## Skills sets demanded for advanced data analytics by 2030

-  **Data analysis**  
15,019+
-  **Data techniques**  
10,889+
-  **Big data**  
9,762+
-  **Scripting languages**  
10,138+
-  **Data warehousing**  
8,260+
-  **Databases & programming**  
9,762+
-  **Database administration**  
8,636 +

**38k** Skilled workers needed (2030)

**127k** Skills gap (2030)

**+179%** Growth in skilled workers (2030)

### People skills

Communication skills	13,141+
Teamwork/collaboration	10,889+
Problem Solving	9,762+
Planning	6,383+
Research	6,008+

### Extra skills identified

Linear Algebra and Calculus  
Machine Learning  
Critical thinking

# 2030 skills for cyber security



One of the most important areas of additional skill requirements will come from cyber security. Annual business investment in Australia in these areas is forecast to jump from slightly more than \$9 billion in 2022 to \$15 billion by 2030. Business use of these technologies across Australia will grow from less than 63% in 2022 to 78% by 2030.

## What skills will tech workers need for this enormous change?







Already, we know that the essential technical skills include: Cyber security, System design and implementation, Information security, Network configuration, Cloud solutions and Software development principles. Workers will also need soft skills such as planning, stakeholder management, problem-solving, effective communication, collaboration, and teamwork.

## How many extra professionals and how much more skilling will be needed in NSW?

The number of NSW tech workers focusing on cyber security is expected to grow from 9,000 in 2022 to 17,500 by 2030.

The total skill requirement to support just the core tech workforce in NSW is projected to grow 94% from 30,080 in 2022 to 58,372 in 2030. The gap between skills now and in the future is a substantial 28,292 technical and soft skills.

## Skills sets demanded for cyber security by 2030

-  **Cyber security**  
6,841+
-  **Network configuration**  
1,774 +
-  **Cloud solutions**  
1,689 +
-  **General networking**  
1,689 +
-  **Information security**  
1,858 +
-  **Software development principles**  
1,436+
-  **System design & implementation**  
2,027 +

**8,400** Skilled workers needed (2030)

**28k** Skills gap (2030)

**+94%** Growth in skilled workers (2022–2030)

### People skills

Communication skills	3,209+
Teamwork/collaboration	2,196+
Problem Solving	1,858+
Planning	1,351+
Stakeholder management	1,013+

### Extra skills identified

Forensics and incident analysis  
Cloud security  
Adaptability and continuous learning

# 2030 skills for enabling cloud technology



One of the largest and most fundamental skilling needs over the coming years is in enabling cloud technology. Annual business investment in Australia in these areas is forecast to jump from almost \$21 billion in 2022 to \$41 billion by 2030. Business use of these technologies will grow from 59% in 2022 to 84% by 2030 across Australia.

## What skills will tech workers need for this enormous change?

Enabling cloud technology will require a broad set essential technical skills include: Cloud solutions, Software development principles, System design and implementation, Operating systems, Network configuration and Databases and programming. Workers will also need soft skills such as planning, research, problem-solving, effective communication, troubleshooting, and teamwork.








## How many extra professionals and how much more skilling will be needed in NSW?

The number of NSW tech workers with skills in cloud technology is expected to grow from an already sizable 19,700 in 2022 to 60,500 by 2030.

The total skill requirement to support just the core tech workforce in NSW is projected to grow 206% from 75,610 in 2022 to 231,558 in 2030. The gap between skills now and in the future is a substantial 155,948 technical and soft skills.

To date, the relationship between business investment in and adoption of cloud has generated significant jobs and skill needs. We note that this relationship could shift considerably by 2030, with businesses able to achieve similar outcomes with fewer cloud specialists. If there is a big change, that will mean these projections overstate the jobs and skill needs.

## Skills sets demanded for cloud technology by 2030

-  **Network configuration**  
8,144+
-  **Operating systems**  
8,958+
-  **Technical support**  
9,772+
-  **Cloud solutions**  
38,274+
-  **System design & implementation**  
11,808+
-  **Databases & programming**  
8,144+
-  **Software development principles**  
8,144+

41k

Skilled workers needed  
(2030)

156k

Skills gap  
(2030)

+206%

Growth in skilled  
workers (2022-2030)

### People skills

Communication skills	14,658+
Teamwork/collaboration	11,402+
Problem Solving	9,772+
Troubleshooting	8,551+
Planning	6,108+

### Extra skills identified

- Cost optimisation
- Data management
- Service selection
- Collaboration & communication

# 2030 skills for Internet of Things



Continued proliferation of the Internet of Things will grow the skill requirements for technology workers involved in this technology. Annual business investment in these areas is forecast to jump from less than \$20 billion in 2022 to over \$34 billion by 2030 nationally. Business use of these technologies across the country will grow from less than 6% in 2022 to almost half by 2030.

## What skills will tech workers need for this enormous change?






Already, we know that the essential technical skills include Software development principles, Scripting languages, System design and implementation, Cloud solutions and General networking. Workers will also need soft skills such as planning, research, problem-solving, effective communication, project management, and teamwork.

## How many extra professionals and how much more skilling will be needed in NSW?

The number of NSW tech workers focusing on the Internet of Things is expected to grow from 1,400 in 2022 to 3,600 by 2030.

The total skill requirement to support just the core tech workforce in NSW is projected to grow 156% from 5,249 in 2022 to 13,424 in 2030. The gap between skills now and in the future is 8,175 technical and soft skills.

## Skills sets demanded for Internet of Things by 2030

-  **Internet of Things**  
1,973+
-  **General networking**  
351+
-  **Technical support**  
373+
-  **Scripting languages**  
592+
-  **Cloud solutions**  
460+
-  **Software development principles**  
833+
-  **System design & implementation**  
570+

**8,200** Skilled workers needed (2030)

**8,175** Skills gap (2030)

**+156%** Growth in skilled workers (2022-2030)

### People skills

Communication skills	877+
Teamwork/collaboration	723+
Problem Solving	526+
Project management	285+
Planning	285+

### Extra skills identified

- Hardware
- Networking
- Remote Sensing
- Security

Source: Deloitte Access Economics analysis based on Lightcast (2023) & IDC (2023)



# 2030 skills for virtual worlds



Virtual worlds technology including augmented and virtual reality will experience continued growth over the coming years. Annual business investment in Australia in these areas is forecast to jump from about \$267 million in 2022 to \$1 billion by 2030. Business use of these technologies will grow from less than 1% in 2022 to almost one-quarter of businesses in Australia by 2030.

## What skills will tech workers need for this enormous change?








Essential technical skills for virtual worlds include: Drafting and engineers design, Graphic and visual design software, Animation and game design, Software development principles and Social media. Workers will also need soft skills such as planning, research, problem-solving, effective communication, collaboration, and teamwork.

## How many extra professionals and how much more skilling will be needed in NSW?

The number of NSW tech workers with skills in virtual worlds is expected to grow from just 200 in 2022 to 1,400 by 2030.

The total skill requirement to support just the core tech workforce in NSW is projected to grow from 720 in 2022 to 5,316 in 2030. The gap between skills now and in the future is a total of 4,596 technical and soft skills.

## Skills sets demanded for virtual worlds by 2030

-  **Graphic design software**  
580+
-  **Visual design production**  
190+
-  **Visual design**  
367+
-  **Social media**  
190+
-  **Software dev principles**  
237+
-  **Animation &**  
**545+**
-  **Drafting & engineers design**  
912+

1,200

**Skilled workers needed**  
(2030)

4,596

**Skills gap**  
(2030)

+639%

**Growth in skilled workers** (2022-2030)

### People skills

Communication skills	403+
Teamwork/collaboration	379+
Organisational skills	178+
Detail-oriented	201+
Planning	237+

### Extra skills identified

- 3D modelling and design
- User Interface/ User Experience
- Sensor technologies
- Adaptability to change

# 2030 skills for additive manufacturing (including 3D printing)



The expected growth and size of the technology workforce involved in additive manufacturing is comparatively modest. Annual business investment in these areas across Australia is forecast to jump from \$317 million in 2022 to \$434 million by 2030. Business use of these technologies is currently around 2%, in Australia.

## What skills will tech workers need for this enormous change?


For additive manufacturing the essential technical skills include: Drafting and engineers design, Robotics, System design and implementation, Software development principles and Mechanical engineering. Workers will also need soft skills such as research, effective communication, technical support, problem-solving, collaboration, and teamwork.


## How many extra professionals and how much more skilling will be needed in NSW?


The number of tech workers focusing on additive manufacturing is expected to grow slightly from 40 in 2022 to 100 by 2030.


In observing that these numbers appear low, it is important to note that they are simply the tech workers involved with the development of the technology. Additive manufacturing could have dramatic impacts on the manufacturing (and other) workforces and be used by a great many workers.

## Skills sets demanded for additive manufacturing by 2030


 **Drafting and design**  
61+


 **Operating systems**  
9+

 **Robotics**  
22+

 **Test automation**  
9+

 **Mechanical engineering**  
13+

 **Software dev principles**  
13+

 **System design & implementation**  
18+

**60** Skilled workers needed (2030)

**270** Skills gap (2030)

**+156%** Growth in skilled workers (2022-2030)

### People skills

Research 23+  
Communication skills 21+  
Problem solving 15+  
Teamwork/collaboration 13+

### Extra skills identified

CAD modelling  
Material selection  
Production and business development  
Patent law

# 2030 skills for high-performance computing



An early technology expected to grow other the coming years, high-performance computing (HPC) skills will begin to be need in the technology workforce. Annual business investment nationally in these areas is forecast to jump from less than \$349 million in 2022 to over \$699 million by 2030.

## What skills will tech workers need for this enormous change?

Some of the essential technical skills for HPC workers include: Programming principles, Scripting languages, Software development principles and Operating systems. Workers will also need soft skills such as planning, research, problem-solving, effective communication, collaboration, and teamwork.


## How many extra professionals and how much more skilling will be needed in NSW?


The number of NSW tech workers focusing on HPC is expected to grow slightly from 60 in 2022 to 210 by 2030.

The total skill requirement to support just the core tech workforce is projected to grow 268% from 280 in 2022 to 1,029 in 2030. The gap between skills now and in the future is a 749 technical and soft skills.

## Skills sets demanded for high-performance computing by 2030

 **Programming languages**  
232+

 **Systems administration**  
45+

 **Operating systems**  
62+

 **Scripting languages**  
72+

 **Technical support**  
65+

 **Programming principles**  
151+

 **Software development principles**  
66+

150

**Skilled workers needed**  
(2030)

749

**Skills gap**  
(2030)

+268%

**Growth in skilled workers** (2022-2030)

### People skills

Teamwork/collaboration	45+
Communication skills	45+
Problem solving	27+
Research	81+
Planning	26+

### Extra skills identified

Parallel Programming  
Algorithm Optimisation  
Graphics Processing Unit (GPU) programming & accelerators

# 2030 skills for advanced robotics and sensors



Advanced robotics and sensors comprises a small share of the overall technology workforce skilled in critical technology. Annual business investment in Australia in these areas is forecast to stay steady at around \$1 billion a year between 2022 and 2030. Business use of these technologies will grow from around 1% in 2022 to 15% by 2030 nationally.

## What skills will tech workers need for this enormous change?

Already, we know that the essential technical skills include: Robotics, Software development principles, Scripting languages, Programming languages and Imaging. Workers will also need soft skills such as planning, research, problem-solving, effective communication, collaboration, and teamwork.

## How many extra professionals and how much more skilling will be needed in NSW?

The number of NSW tech workers focusing on advanced robotics and sensors is expected to grow slightly from 940 in 2022 to 1,400 by 2030.

The total skill requirement to support just the core tech workforce in NSW is projected to grow 44% from 2022 to 2030.

The robotics and sensors skills projections are much smaller than other areas of critical technology. This reflects an assumption that robotics and sensors' most profound impacts will be on complementing work and as a tool used by workers, more so than the number of tech workers directly involved in developing the technology. As the projections are off a relatively low base, they are more uncertain.

## Skills sets demanded for robotics and sensors by 2030



**Robotics**  
340+



**Mechanical engineering**  
84+



**Imaging**  
88+



**Scripting languages**  
122+



**Programming languages**  
92+



**Software development principles**  
130+



**System design & implementation**  
168+

420

**Skilled workers needed**  
(2030)

1,586

**Skills gap**  
(2030)

+44%

**Growth in skilled workers**  
(2022–2030)

### People skills

Communication skills	143+
Teamwork/Collaboration	109+
Problem solving	92+
Planning	80+
Research	67+

### Extra skills identified

- Mechatronics
- Electronics and hardware integration
- Kinematics and Dynamics

Source: Deloitte Access Economics analysis based on Lightcast (2023) & IDC (2023)

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# **Appendix B: NSW traditional technology workforce**

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## Technology employment forecasts by occupation grouping, NSW, 2022-2030

Occupation group	2022	2030	Average annual growth
ICT Management and Operations	107,365	162,915	5.4%
ICT Technical and Professional	131,229	189,947	4.7%
ICT Sales	13,832	14,526	0.6%
ICT Trades	32,617	44,910	4.1%
Electronic trades and professional	1,338	1,577	2.1%
ICT Industry Admin and Logistics Support	61,597	82,481	3.7%
<b>Total ICT workers</b>	<b>347,977</b>	<b>496,357</b>	<b>4.5%</b>

## Government funded VET subject enrolment in IT field of education in NSW, 2016-2021

Qualification	2016	2017	2018	2019	2020	2021
Diploma or above	8,662	7,102	8,477	10,438	9,387	6,743
Certificate IV	5,218	5,595	5,511	5,147	4,553	5,334
Certificate III	6,100	5,700	4,658	3,902	4,288	5,608
Certificate II	1,314	1,044	1,010	855	799	749
Certificate I	1,533	1,524	2,308	4,108	3,507	2,493

## Technology employment by industry, NSW

Industry	Employment
Agriculture, Forestry and Fishing	557
Mining	511
Manufacturing	9,224
Electricity, Gas, Water and Waste Services	2,754
Construction	2,890
Wholesale Trade	7,686
Retail Trade	11,758
Accommodation and Food Services	2,178
Transport, Postal and Warehousing	5,148
Rest of Information Media and Telecommunications	5,276
Financial and Insurance Services	35,252
Agriculture, Forestry and Fishing	557
Rental, Hiring and Real Estate Services	1,642
Rest of Professional, Scientific and Technical Services	42,423
Administrative and Support Services	2,700
Public Administration and Safety	21,271
Education and Training	7,610
Health Care and Social Assistance	6,887
Arts and Recreation Services	2,934
Other Services	6,284
Telecommunications Services	32,619
Internet Service Providers, Web Search Portals and Data Processing Services	3,113
Computer System Design and Related Services	137,260
<b>Total ICT workers</b>	<b>347,977</b>

## Domestic enrolments and completions in IT degrees in NSW, 2001 to 2021

	Course enrolments		Course completion	
	Undergraduate	Postgraduate	Undergraduate	Postgraduate
2001	10,048	2,285	1,489	837
2002	9,984	2,363	1,874	988
2003	9,638	2,380	1,805	647
2004	8,389	2,329	1,579	563
2005	7,426	2,147	1,615	609
2006	6,432	1,939	1,177	513
2007	6,074	1,803	1,158	496
2008	5,674	1,677	1,139	454
2009	5,659	1,732	958	452
2010	5,866	1,802	900	458
2011	6,360	1,898	1,070	488
2012	6,977	1,940	1,103	480
2013	7,301	1,860	1,220	487
2014	8,028	1,910	1,178	527
2015	9,121	1,917	1,368	460
2016	9,034	2,139	1,385	557
2017	9,469	2,438	1,598	629
2018	10,048	2,614	1,708	635
2019	10,509	2,758	1,803	704
2020	11,817	3,390	2,114	1,092
2021	13,056	3,881	1,999	1,117

## International enrolments and completions in IT degrees in NSW, 2001 to 2021

	Course enrolments		Course completion	
	Undergraduate	Postgraduate	Undergraduate	Postgraduate
2001	4,120	2,397	565	706
2002	5,168	2,916	859	1,114
2003	5,386	2,623	1,269	1,108
2004	4,750	2,365	1,310	900
2005	4,056	2,440	1,418	1,240
2006	3,582	2,111	1,270	1,090
2007	3,575	2,027	1,146	823
2008	3,764	2,201	1,032	886
2009	4,153	2,537	1,181	1,009
2010	4,073	2,564	1,372	1,148
2011	3,929	2,214	1,243	1,095
2012	3,785	2,054	1,033	782
2013	3,658	2,441	1,017	811
2014	3,640	3,047	957	908
2015	3,888	3,648	891	1,038
2016	4,655	5,291	966	1,296
2017	5,894	7,759	1,094	1,602
2018	7,808	9,647	1,431	2,935
2019	10,627	10,912	1,787	3,416
2020	11,965	9,912	2,282	3,904
2021	12,301	7,914	2,936	4,162



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