Deloitte.

acs

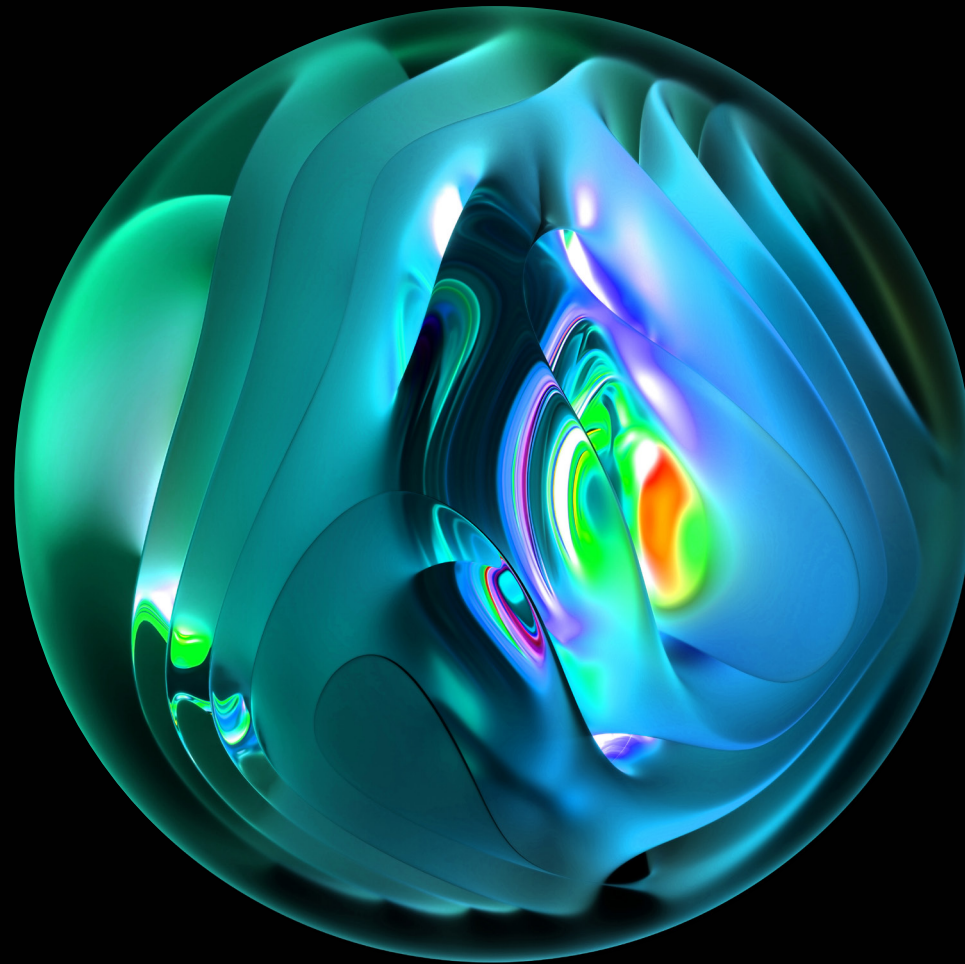## Australia's Digital Pulse

A new approach to building technology skills

Northern Territory 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+
Total members

12,000
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
Accredited universities

368
ACS Google Scholarships

Capability

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

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Learning Accelerator unique users

44,000
Digital resources

Migration

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

40,200
Skilled migrant applicants in 2022—23

7,107
ACS Professional Year graduates in 2022—23

ACS Australia's Digital Pulse 2023

Northern Territory edition

The Northen Territory has a growing technology sector with a strong local telecommunications and data storage industry. As the sector further develops, adapting to critical technologies including artificial intelligence, advanced robotics and the Internet of Things will be essential. The impact of these technologies will be profound affecting over 130,000 workers and requiring 13,700 additional critical technology skills by 2030.

Already outdated digital skills cost Northern Territory businesses $14 million per year. This estimate only reflects costs associated with existing employees, with the full opportunity from digital technology likely to be much larger.
In a world with such rapid technological change, building the tech skills needed in Northern Territory will require a new approach.

Key principles of the new approach

All hands on deck	Skills first	Driving diversity	Lifecycle of learning	Systems approach

$2 billion
Projected annual technology investment in NT in 2030

130,000
NT workers who will need some reskilling because new tech will affect at least 20% of work time

13,700
critical tech skills needed in NT by 2030

$14 million
Cost of outdated digital skills for large NT businesses each year

Technology empowers people and the economy in the Northern Territory

Technology in essential social infrastructure in the Northern Territory

The Northern Territory (NT) ICT sector is small but growing. The sector contributed $425 million to the NT economy in FY22, as measured by value add, with over 500 technology businesses headquartered in the region.[1,2]

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

- The NT technology workforce reached over 5,300 in 2022, with more than half employed in businesses outside the traditional ICT sector.

- The technology workforce is growing fast, experiencing almost 10% growth in 2022 and more than 7% annually over the past 5 years.[3]

- The NT economy will experience imminent and extensive disruption from Generative AI with the five industries to be impacted the most by the technology accounting for over $4 billion in total gross value added.[4]

More broadly, forecasts from the International Data Corporation (IDC) indicate that technology investment in NT will increase from $1.5 billion in 2022 to $2 billion by 2030.

However, for the NT technology is about much more than investment and gross state product. Technology is essential social infrastructure for connecting people to government services, employment opportunities and staying connected to people.
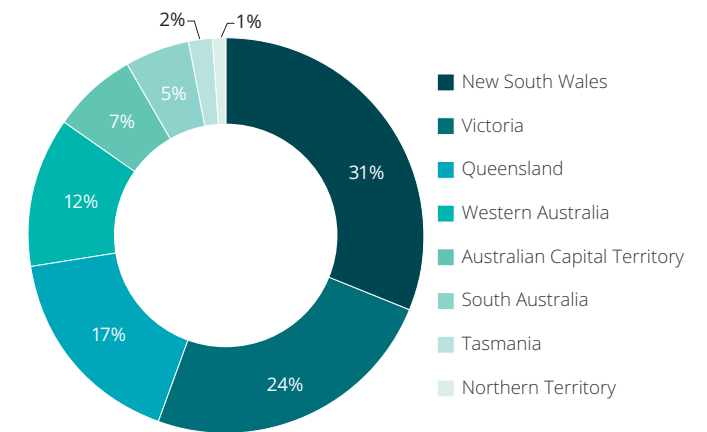
For example, drones are being trialled for the delivery of pharmaceuticals to remote communities. There are hopes that this can be expanded to deliver vaccines and other medical supplies to health professionals in isolated communities which are seasonally cut off by floods.[5] If these trials are successful, more people in remote communities and areas will have access to pharmaceuticals and medical supplies.

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

Government has also worked to improve safety for communities, families and children through automating data transfers between police, justice and corrections, as well as integrating child protection and youth justice digital systems. These digital solutions will provide real time data to give frontline child protection workers the information they need to make decisions regarding the safety of vulnerable children.

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

NT share of national technology investment to 2030

- New South Wales — 31%
- Victoria — 24%
- Queensland — 17%
- Western Australia — 12%
- Australian Capital Territory — 7%
- South Australia — 5%
- Tasmania — 2%
- Northern Territory — 1%

Source: IDC ICT Spend Data Custom Report

Technology employment in the Northern Territory 2015 to 2022

2015	2016	2017	2018	2019	2020	2021	2022
4,529	4,808	3,871	3,461	4,305	4,424	4,889	5,361
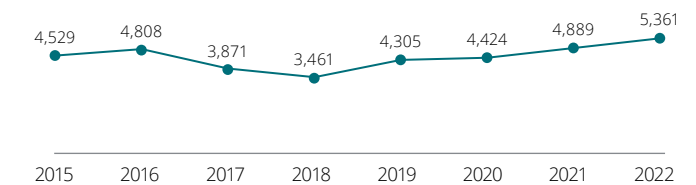
Source: Australian Bureau of Statistics (2023)

An innovation perspective

"The Northern Territory is rich with many natural resources that have contributed to the prosperity of those living here. There are also opportunities from our proximity to South-East Asia that digital technologies can help leverage.

Making the most of these resources and opportunities requires innovative ideas and workforce that can use cutting edge technologies for relevant businesses and industries."

Gaurav Sareen
Lead Partner, Global Investment and Innovation Incentives (Gi3)
Deloitte Australia

Critical technology will significantly impact the work of 94% of the Northern Territory workforce

Nearly 130,000 workers across the NT 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 latest 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.[1]

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 NT workers (94%) are expected to have at least 20% of their work time affected by critical technologies over the coming years. In total, 70% of all working hours across the NT 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 respectively affect 26% and 23% of all working hours in the NT.

While a broad range of workers will be impacted by critical technology, some jobs face greater changes in skills than others.

Occupations most affected by critical technology include technology workers who account for eight out of the top twenty impacted occupations. For the NT with a number of technology-based jobs already in its skilled occupation priority list, this is likely to create additional pressures in finding skilled workers and require more focus on how to upskill existing technology workers.

Occupations outside of technology workers will also be impacted. Sales assistants, registered nurses and teachers will all have more than 60% of their work time impacted. While these roles all have some tasks that are less likely to be impacted, administrative and cognitive tasks within these occupations are likely to be made more productive or change entirely.

Manual labour-intensive occupations such as those in hospitality and construction are expected to be less impacted by critical technology relative to other industries. Yet every industries is being transformed by these technologies and strategies to upskill workers in these areas will be important.

Proportion of NT workers and work hours affected by critical technology
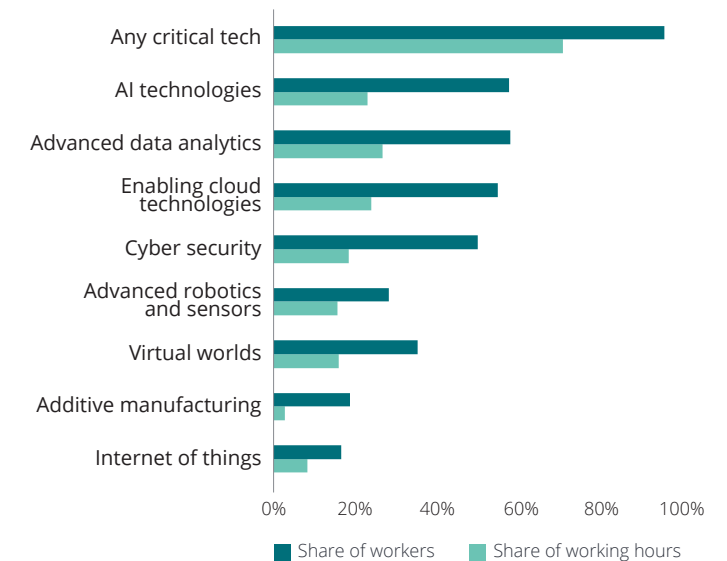
Legend: ■ Share of workers ■ Share of working hours

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

Eight NT 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 several traditional industries such as utilities, mining and construction. Collectively, the top ten impacted industries account for 50% of the Northern Territory economy in 2022.[1]

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.[2,3]

It is more than the typical technology enabled industries that are going to be affected. Service-based and traditional industries are also facing seismic disruption from critical technologies and may be less prepared for the rapid incoming changes. For example, research which compares the data infrastructure of these industries has found relatively lower capabilities in construction, mining and wholesale trade compared to other secotrs.[4]

For the NT, with a substantial mining industry, this could mean significant change over coming years. Already technology is changing the landscape of the skills in demand for mining roles.
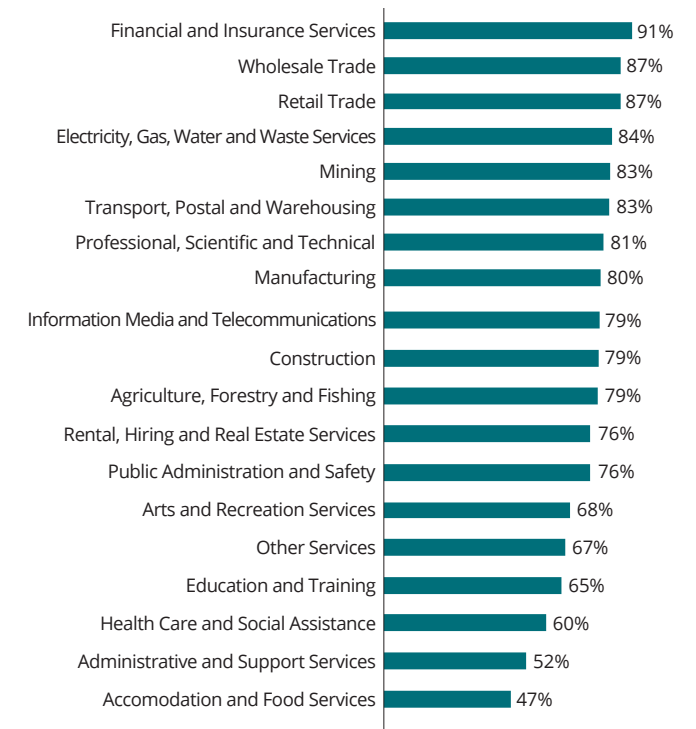
AI, automation and IoT are increasingly being used to improve the productivity of mining operations through self-driving trucks, automated site monitoring and ventilation.[5] These are technologies are also being used to enhancing the safety of legacy mine site management across the NT with remote monitoring equipment being used by mining officers to monitor the status of infrastructure and drones used for examining real-time conditions and creating 3D models to assist with rehabilitation.[6]

The sector recognises that the future of mining operations will be more technology and data-driven.[7] Already, courses such as UQx and CurtinX's *Foundations of Modern Mining Professional Certificate* have a focus on the digital transformation of mining and the impact of new technologies on worker health, safety and wellness.[8]

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 those 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, NT

Industry	%
Financial and Insurance Services	91%
Wholesale Trade	87%
Retail Trade	87%
Electricity, Gas, Water and Waste Services	84%
Mining	83%
Transport, Postal and Warehousing	83%
Professional, Scientific and Technical	81%
Manufacturing	80%
Information Media and Telecommunications	79%
Construction	79%
Agriculture, Forestry and Fishing	79%
Rental, Hiring and Real Estate Services	76%
Public Administration and Safety	76%
Arts and Recreation Services	68%
Other Services	67%
Education and Training	65%
Health Care and Social Assistance	60%
Administrative and Support Services	52%
Accomodation and Food Services	47%

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

The tech skills challenge for the Northern Territory

The NT will require an additional 9,000 critical technology skill 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, 13,700 skills will be required for critical technologies by 2030, an increase of 9,100 compared to current skills within the Northern Territory 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 databases are among the most common technical skills that will be needed.

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.[1] These out-of-date digital skills come at a cost to the NT with $14 million per year in lost output among large businesses alone.[2] 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 NT workforce means the gap in digital skills is likely to grow without significant action. To ensure that NT'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 31% of people working technology occupations in the NT are women, substantially fewer than in comparable industries such as professional services (49%).[3]

The Northern Territory also has **the second lowest national share of women enrolled in IT university courses (25%),** meaning the gender gap in the NT ICT sector looks likely to persist.[4]

Making sure that skilled jobs are available where people are is another important objective recognised by the NT Government. **Yet skilled tech jobs and tech skills are not equally distributed across the NT.** Just under 80% of all NT workers in technology occupations work in Darwin. This represents a higher concentration than jobs generally, with 67% of workers across the NT working in the capital. The public sector, as one employer of technology workers can help lead the way in making technology jobs available to people outside Darwin through remote and flexible work.

Not only will the NT 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 770 additional AI skills needed by 2030. These include technical skills such as data science, machine learning and scripting languages (see page 8).

Additional skills needed by critical technology workers by 2030, NT

Skill	Value
Communication skills	439
Teamwork/collaboration	364
Cloud solutions	335
Problem solving	307
Scripting languages	258
Databases and programming	255
Data analysis	249
Software development principles	226
Planning	195
Data science	175
Data warehousing	161
System design and implementation	140
Data techniques	134
Cybersecurity	132
Machine learning	131

■ People skills ■ Technical skills

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 Northern Territory?

The number of Northern Territory tech workers focusing on AI, ML and NPL is expected to grow from just 30 in 2022 to 290 by 2030.

The total skill requirement in the Northern Territory to support just the core tech workforce is projected to grow 793% from 140 in 2022 to 1,248 in 2030. The gap between skills now and in the future is a staggering 1,109 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
175+

Machine learning
131+

Data analysis
64+

Scripting languages
123+

Data warehousing
59+

Databases & programming
72+

Software development principles
90+

260 Skilled workers needed (2030)

1,100 Skills gap (2030)

+793% Growth in skilled workers (2022–2030)

People skills

Teamwork/collaboration	87+
Communication skills	87+
Problem Solving	67+
Research	56+
Planning	38+

Extra skills identified

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

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

The NT's technology workforce challenge

The NT needs to technology workers with the right skills

Based on currently available data, Australia will need to spend an additional $92 billion through to 2030 on critical technologies to be at the forefront of forthcoming disruption. Based on forecast technology investment, this would amount to an additional $1 billion of critical technology spend in the NT by 2030.

To realise the gains from investment in critical technology, the NT needs enough skilled workers make the most of the technology. While over 5,000 people were employed in the Tasmanian technology workforce in 2022, our forecasts suggest an additional 2,100 workers will be required by 2030 under business-as-usual conditions and 2,300 to keep up with international peers.

Despite this, the NT is only expected to educate an additional 550 workers to the technology workforce through the university and vocational systems over this period. Once overseas immigration is accounted for, the NT will need to reskill at least 1,500 workers into technology roles through to 2030.

It is not only a matter of attracting new workers, but also upskilling existing workers in critical technology skills. However, when it comes to these skills most workers across the NT and Australia 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.[7]**

With a quarter of technology workers planning on leaving the sector in the next five years, skills shortages will remain a challenge. The NT Government and businesses should focus on addressing barriers for workers. Top reasons for wanting to leave the tech sector include wanting to do something different (35%), for better pay (25%) and a lack of growth opportunities (21%).

A focus on better utilising existing technology workers could also overcome skill gaps. Based on a technology workforce survey completed for this report, one in five workers do not agree that their skills are being fully utilised. Across Australia workers think that they could have their capabilities and contributions better recognised (47%), be given more technical tasks (48%) and be involved in bigger and more complex work (34%). Not only does underutilisation mean workers do not finding meaningful full-time work commensurate with their skills, but it adds to the likelihood they leave the profession.

Many tech workers (39%) also want to work more hours. 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. Migrant workers are more likely to report these challenges, suggesting a focus on ensuring assisting these workers into full-time roles could pay dividends.

Agreement that critical technology will significantly disrupt the technology sector

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
4%	11%	22%	49%	16%
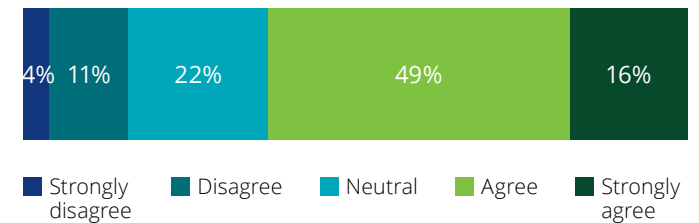
Source: Technology workforce survey (2023)

Technology employment in NT 2022 to 2030

2022	2023	2024	2025	2026	2027	2028	2029	2030
5,361	5,603	5,773	6,038	6,362	6,362	6,672	7,241	7,519
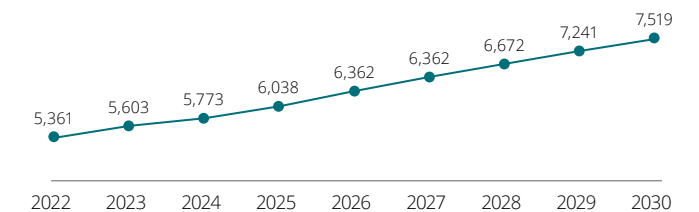
Source: Australian Bureau of Statistics (2023)

The regional digital divide

The NT is a tale of two regions

The NT has one of the most geographically dispersed populations and workforces in Australia. While 67% of people work in the Darwin region, the remainder of the population is spread across a broad range of towns and communities.[1]

Darwin has ambitions to become the 'Terabit Territory'. It is Australia's only capital city with full Fibre to the Premises connection to the National Broadband Network.[2] In 2023, Darwin was connected directly into the Indo-Pacific region through a direct international submarine cable improving redundancy and speed to the city.[3]

Yet connectivity issues remain in areas outside of Darwin with a limited access to reliable, quality and affordable telecommunications coverage. Based on the share of sites with 4G or 5G technology, the NT has the least advanced mobile infrastructure of any jurisdiction in Australia.[4] Additionally, 10% of the NT population is estimated not to be connected the internet.[5]

According to the Australian Digital Inclusion Index, the NT the lowest levels of digital inclusion across Australia (69 compared to the national average of 73).[6] This issue has real impacts for Territorians with a lack of connectivity exacerbate barriers for communities, hindering the delivery of government and human services across health, education and safety.

Issues of digital inclusion are acute for First Nations peoples, with a considerable 7.5 percentage points gap between First Nations peoples and non-First Nations peoples.[7] This is more even more severe for First Nations peoples living in remote and very remote communities who experience around a 22 percentage point gap compared with Australians in remote areas more broadly.

A lack of digital connectivity also creates challenges for economic development in regional and remote areas across the NT. For example, industries such as mining, space, defence and agriculture all increasingly rely on strong digital connectivity for their operations.

The growing importance of critical technology risks widening this regional digital divide in the NT. Despite the NT technology sector being concentrated in Darwin, the broad ranging applications of critical technologies could impact a comparable share of total work time in- and outside the greater Darwin area (71% and 69% respectively).[8]

Without taking action, the growth of critical tech may create further barriers as access and skills in these technologies become more important. Government and industry must be proactive in ensuring that the workforce are developing the skills that will be needed in the future.

The NT Government has already taken action to develop digital skills in the Territory. For example, the Northern Territory Government has set up STEM Centre of Excellence in several schools and partnered with Charles Darwin University to engage students about digital careers.[9]

Generative AI impacting First Nations art

Aboriginal and Torres Strait Islander visual arts and crafts markets are strong, dynamic and growing. Total sales exceed $250 million in 2019-20, including at least $35 million in artwork sales and $80 million in sales of merchandise and consumer products.[10]

However, the Productivity Commission estimates that up to 75% of Indigenous-style consumer products in the market are inauthentic (i.e. not created by First Nations artists).[11] These inauthentic products create economic harm for First Nations peoples and pose a threat to an important expression of culture.

Image based generative AI tools risk amplifying this harm by making it easier to produce in "Indigenous-style" art or products. This could facilitate a greater number of dealer passing-off visually appealing designs as authentic First Nations pieces.

There are also concerns about Generative AI relating to Indigenous Data Sovereignty (IDS) of art styles. IDS is the rights of Indigenous peoples to own, control, access and possess their own data.[12] By training on input data that is typically not provided with express permission, Generative AI exclude the input of First Nations peoples and risks the misrepresentation of culture and knowledge.

In recognition of these concerns, the NT Government should advocate for IDS to be considered in the development of Commonwealth Government AI regulation and guidelines.

A professional association perspective

"Digital connectivity and skills is both the problem and solution for many issues in the Northern Territory. The Territory faces significant divides when it comes to digital connectivity that hinder prosperity and living conditions, particularly for remote locations.

If connectivity is improved, the Territory is likely become a more attractive location to work and live."

Josh Griggs
Interim CEO
Australian Computer Society

How can NT lead change?

Digital connectivity and skills in the local workforce need to be improved in the Northern Territory. The NT Government's 2018 *Digital Territory Strategy* aims to enable "Territorians to make the most of digital technology to build connections, reach their potential and succeed in a thriving digital economy". This vision continues in the most recent *Digital Territory Action Plan*

Despite efforts there remains real issues with regional digital connectivity that not only adversely affect people but act as a barrier for economic objectives and priority industries.

Addressing these issues will require a new approach to building tech skills in Australia and the NT. The latest edition of *Australia's Digital Pulse* outlines five key principles needed to guide individual policies and initiatives. These principles are equally as relevant to the NT.

Using these as our foundation, we have identified three high priority recommendations for the NT 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 the NT. Combining effort to produce transformational change will be required.

In the NT this will require government to collaborate with industry and engage with the workforce to ensure that priorities are aligned.

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 NT 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 NT economy.

NT's technology workforce has lower representation of women compared to other sectors Helping these cohorts build skills and participate fully in the NT 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 Victorian 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 the NT

Supporting a liveable territory through improved connectivity

The NT Government aims to grow the territory's population to 300,000 by 2030. The *Territory Economic Reconstruction Commission* report recognises that attracting and retaining people living in the Territory relies on liveable community where it easy and comfortable to carry out day-to-day life.[1]

Digital connectivity is an essential component to improving liveability.[2] Currently, Territorians experience the lowest levels of digital inclusion in Australia driven by a lack of access for regional and remote populations.[3] The NT Government is seeking to address this issues with the *NT Infrastructure Strategy 2022* identifying digital connectivity and equitable access as a priority.

There is an important role for Investment Territory to attract major digital investments to the NT. The government has already acted by installing mobile hotspots in some regional and remote areas and delivering NBN fibre-to-the premises to select communities.[4]

Investments in key digital infrastructure such as subsea cables and data centres have the potential to transform digital capacity in the NT. A key consideration in analysing such investment is how they can be facilitated in a way that creates jobs but maximises the dividend from digital investments. For example, different landing spots and pathways may assist in addressing the regional divide as well as improving capacity for regional areas.

There may be infrastructure solutions that suit the unique NT context such as Low Earth Orbit Satellites, which could assist in maximising broadband access in regional areas and certain industry applications.

Improving the productivity of priority industries

The Northern Territory Government has an ambition to growing the economy to $40 billion by 2030.[5] A Deloitte study identified maritime, agribusiness, minerals, oil and gas as priority industries to reach this target. Defence is another priority industry for the Northern Territory with significant assets and investment. Critical technologies will be a key enabler for these industries. This means that improving digital connectivity across the NT, particularly for these industries, would produce significant benefits for the NT economy.

There is evidence that both mining and agriculture may be not ready to digitally transform compared to other industries which could hold back the ability of Northern Territory to developments in critical technologies. For example, a study by Deloitte Access Economics on uptake of 5G mobile networks found agriculture had the lowest share of businesses with connections and applications using 5G.[7]

Similarly, Deloitte's Generation AI report found that mining and ariculture was facing a longer timeframe to realising the benefits of the technology compared to other service-based industries due to slower adoption of this technology by the mining and agriculture workforce.[8]

Increasing the use of critical technologies in key industries could involve direct incentives to uptake the technology and encourage greater upskilling for workers in that industry. As the NT digital economy matures, it will be important to grow business capabilities and skills in the tech workforce hand-in-hand.

Supporting emerging workforce opportunities

Investment in Darwin's digital connectivity can also help to promote emerging industries such the space sector and clean energy sector. The NT space industry is current small but has experienced rapid growth in capability, output, and reputation. In 2022, the Arnhem Space Centre in Nhulunbuy became the first commercial spaceport to host a NASA launch outside of the United States.[9] The Middle Arm Sustainable Development Precinct also demonstrates the commitment of the Northern Territory Government to advanced manufacturing and low emission energy and fuels.

Greater connectivity and building skills in the local workforce will support the development of these burgeoning industries. The presence of these increasingly digital intensive industries will also require enhancing cybersecurity capabilities.

Reducing barriers for these industries will have important flow-on benefits to the broader economy and digitising other industries. For example, the application of space technology could improve the productivity of the mining sector due to more efficient exploration for critical minerals.

Commencement of regular space launch from the Arnhem Space Centre in Nhulunbuy will be a valuable addition to the East Arnhem community as Rio Tinto's Gove bauxite mining and processing mine comes to an end by 2030, providing new avenues for employment and economic activity in the region.

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 NT 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 NT 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 the NT

2030 skills for advanced data analytics

One of 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 the Northern Territory?

The number of Northern Territory tech workers with skills in advanced data analytics is expected to grow from 260 in 2022 to 720 by 2030.

The total skill requirement to support just the core tech workforce in the Northern Territory is projected to grow 179% from 876 in 2022 to 2,243 in 2030. The gap between skills now and in the future is a sizable 1,567 technical and soft skills.

Skills sets demanded for advanced data analytics by 2030

Data analysis
185+

Data techniques
134+

Big data
120+

Scripting languages
125+

Data warehousing
102+

Databases & programming
120+

Database administration
106+

500 Skilled workers needed (2030)

1,500 Skills gap (2030)

+179% Growth in skilled workers (2030)

People skills

Communication skills	162+
Teamwork/collaboration	134+
Problem Solving	120+
Planning	79+
Research	74+

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 the Northern Territory?

The number of Northern Territory tech workers focusing on cyber security is expected to grow from 170 in 2022 to 340 by 2030.

The total skill requirement to support just the core tech workforce in the Northern Territory is projected to grow 94% from 578 in 2022 to 1,123 in 2030. The gap between skills now and in the future is a substantial 544 technical and soft skills.

Skills sets demanded for cyber security by 2030

Cyber security
5,179+

Network configuration
1,343 +

Cloud solutions
1,279+

General networking
1,279+

Information security
1,407+

Software development principles
1,087+

System design & implementation
1,534+

160 Skilled workers needed (2030)

550 Skills gap (2030)

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

People skills

Communication skills	62+
Teamwork/collaboration	42+
Problem Solving	36+
Planning	26+
Stakeholder management	19+

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 the Northern Territory?

The number of Northern Territory tech workers with skills in cloud technology is expected to grow from an already sizable 150 in 2022 to 500 by 2030.

The total skill requirement to support just the core tech workforce in the Northern Territory is projected to grow 206% from 582 in 2022 to 1,782 in 2030. The gap between skills now and in the future is a substantial 1,200 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
63+

Operating systems
69+

Technical support
75+

Cloud solutions
295+

System design & implementation
91+

Databases & programming
63+

Software development principles
94+

300 Skilled workers needed (2030)

1,200 Skills gap (2030)

+206% Growth in skilled workers (2022-2030)

People skills

Communication skills	113+
Teamwork/collaboration	88+
Problem Solving	75+
Troubleshooting	66+
Planning	47+

Extra skills identified

Cost optimisation
Data management
Service selection
Collaboration & communication

Appendix B: NT traditional technology workforce

Technology employment forecasts by occupation grouping, NT, 2022 to 2030

Occupation group	2022	2030	Average annual growth
ICT Management and Operations	2,359	3,446	4.8%
ICT Technical and Professional	1,910	2,794	4.9%
ICT Sales	112	171	5.4%
ICT Trades	539	621	1.8%
Electronic trades and professional	7	9	1.7%
ICT Industry Admin and Logistics Support	433	479	1.3%
Total ICT workers	**5,361**	**7,519**	**4.3%**

Government funded VET subject enrolment in IT field of education in NT, 2016-2022

Qualification	2016	2017	2018	2019	2020	2021	2022
Diploma or above	4	2	11	34	39	26	3
Certificate IV	31	24	39	65	44	50	12
Certificate III	79	86	69	68	52	52	52
Certificate II	83	62	83	50	55	37	35
Certificate I	80	86	60	19	3	3	0

Domestic enrolments and completions in IT degrees in NT, 2001 to 2021

	Course enrolments		Course completion	
	Undergraduate	Postgraduate	Undergraduate	Postgraduate
2001	277	46	27	12
2002	246	54	33	20
2003	222	33	36	16
2004	177	21	30	9
2005	142	13	19	3
2006	167	10	14	9
2007	161	21	21	5
2008	120	6	23	0
2009	112	12	9	2
2010	117	18	12	5
2011	158	24	10	2
2012	145	15	29	9
2013	123	7	9	4
2014	114	10	9	0
2015	116	7	17	2
2016	97	14	19	0
2017	97	12	9	0
2018	116	14	13	2
2019	145	42	7	0
2020	140	39	14	8
2021	134	29	20	13

International enrolments and completions in IT degrees in NT, 2001 to 2021

	Course enrolments		Course completion	
	Undergraduate	Postgraduate	Undergraduate	Postgraduate
2001	21	31	3	25
2002	11	34	0	18
2003	10	44	0	12
2004	10	19	0	3
2005	15	6	4	2
2006	12	8	2	2
2007	20	15	6	4
2008	20	8	11	6
2009	25	14	3	0
2010	35	13	12	4
2011	63	30	10	21
2012	71	23	13	12
2013	77	21	17	3
2014	86	37	14	3
2015	85	35	18	5
2016	89	48	15	16
2017	109	64	14	17
2018	124	71	19	22
2019	145	102	24	30
2020	187	143	53	44
2021	161	173	51	58

Deloitte.