Digital Skills for Tomorrow, Today

DIGITALS SKILLS AOTEAROA: EDITION THREE

NZTech

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REPORT SERIES

An updated analysis of the Digital Skills landscape of New Zealand.


OMEGA

Acknowledgements

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NZTech is a not-for-profit that provides the voice of the New Zealand technology ecosystem, representing 20 technology associations funded by over 2,000 members, who collectively employ more than ten percent of the New Zealand workforce. These organisations are redefining the world we live in. Our goal is to stimulate an environment where technology provides important social and economic benefits for New Zealand. NZTech's vision is an equitable, sustainable and prosperous Aotearoa New Zealand underpinned by good technology.

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Thank you to our project partners and supporters

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NZTech

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MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA

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FOREWORD

NZTech

In our ever-evolving digital world, the importance of digital skills cannot be overstated. As Aotearoa New Zealand strives to harness the opportunities presented by the digital revolution, it is crucial we equip our workforce with the necessary skills.

Our 3rd edition of the *Digital Skills Aotearoa* report provides valuable insights into the digital skills challenges we face and offers recommendations.

Throughout the research phase of this report, we observed plenty of activity aimed at addressing the digital skills gap. There are numerous initiatives underway and all should be commended for their efforts and recognition of the urgency of the issue. However, despite these initiatives, the statistics have shown little improvement. At all levels, there has been a significant decline in learners engaging in digital technology studies, which flows onto low numbers graduating.

It is evident that we need to move beyond a fragmented approach and embrace a more collaborative and coordinated strategy. It is now abundantly clear that systemic change is required – a transformation that encompasses the collective efforts of industry, government and the education sector.

A resounding takeaway is the need for industry to collaborate within its ranks, reducing fragmentation and fostering a cohesive ecosystem. The magnitude of our challenge demands a united approach where we can pool resources, share knowledge and develop innovative solutions. Collaboration with government and the education sector is also crucial for their support in shaping policies and providing vital infrastructure for effective change.

Graeme Muller
Chief Executive,
NZTech

The recommendations included in this report serve as a roadmap towards a more digitally skilled Aotearoa New Zealand. They encompass a range of strategies aimed at addressing the root causes of the digital skills gap, nurturing talent and fostering an environment for continuous lifelong learning and upskilling. By embracing these recommendations and embarking on a collaborative journey, we still have the potential to lead as a thriving digital nation.

Together, let's rise to the challenge and embark on a collective mission to equip our workforce with digital skills for our digital age. The time for action is now, and by working together, we can create a more equitable, sustainable and prosperous Aotearoa New Zealand underpinned by good tech.

FOREWORD

New Zealand Government

As a creator of weightless exports and high-skill, high-wage jobs, the digital technology sector aligns with the Government's vision for a low-emissions, high-wage economy. Digital technology also enables other sectors of our economy to achieve greater productivity.

Over the past few years, the Government has been working closely alongside the digital tech sector to develop the *Digital Technologies Industry Transformation Plan* (Digital ITP). Data and information from the 2020 report was instrumental in shaping the ITP's focus on skills and talent development. This latest report encompasses updated and expanded research and I am pleased the results confirm that the priorities and objectives of the skills and talent focus area of the Digital ITP are spot-on.

The Government acknowledges that access to skills is constraining further growth of the digital technologies sector. The ITP aims to enhance the domestic supply of skills and talent, through coordinated efforts between the sector and government which will be crucial to effect change. Meanwhile, immigration will remain important to ensure the tech sector can obtain specialist skills that cannot be sourced locally or immediately.

Through Budget 2023, a new funding package will provide just over $27 million to advance digital technology skills and talent activities that are part of the Digital ITP. It aligns with the issues identified in this report for the skills and talent 'pipeline'. This funding will provide greater access to pathways into tech roles, equip more New Zealanders to upskill and reskill, and increase workforce diversity, by enabling more women, Māori, Pacific Peoples, people with disabilities and neurodiverse people, to join the workforce.

Hon Ginny Andersen
Minister for the Digital Economy and Communications

It will not be enough to increase local supply however, and as this report notes, industry needs to step up in attracting, upskilling, and reskilling its workforce, and creating workplaces that are inclusive of diversity and support professional development. Both this report and the ITP recognise that the government, as the largest employer of tech, can lead this change, including by advancing New Zealand's uptake of the Skills Framework for the Information Age (SFIA).

I acknowledge we have a long way to go to see our tech sector workforce increasing and becoming more diverse, but I look forward to continuing to work alongside industry and utilising the insights from this report to help guide us and see a vibrant, high-skilled and innovative sector reach its full potential.

Nāku iti nei

Executive Summary

Globally, demand for people with advanced digital skills continues to grow, with governments and industry keenly aware of the need to fill the skills gaps.

Digitally skilled workers are in high demand. Around the world, companies in the tech industry and other sectors are struggling to fill their open positions. This has led industry leaders and government officials to express concern about the perceived skills shortage. As a result, many countries have begun to develop nationally coordinated approaches to increasing their number of digitally skilled workers. These initiatives include digital apprenticeship programmes, interventions in the education system, and training partnerships for workforce development. Collaboration between governments, industry, civil society and education providers is considered critical to support a strong digital skills pipeline. Some countries are beginning to witness incremental change, but diversity challenges, low levels of student interest, and difficulty filling specialised roles persists in many places.

Despite the turmoil of the past three years – especially the Covid-19 pandemic with its resultant border restrictions and workplace changes, and financial impacts including significant inflation and rising interest rates — Aotearoa New Zealand faces the same challenges. For an industry that relies on immigration to fill a high proportion of senior positions, our pandemic related border closures meant companies have experienced greater difficulty than usual. Even in recent months of economic uncertainty, as some

companies have made redundancies, our research shows skills shortages remain. During the past 12 months, 79 percent of companies polled have faced tech recruitment challenges. As a result, the government and industry have been keenly aware of the urgent need to increase the domestic skill supply.

Aotearoa New Zealand faces three specific challenges – a struggle to fill advanced digital roles that require experience and specific skill, challenges placing early-career tech workers into industry roles and inspiring more rangatahi to consider tech.

As we identified in our 2020 Digital Skills Report, the perceived skills shortage is more accurately described as a skills mismatch. While the stagnant and sometimes decreasing

number of rangatahi studying technology and completing undergraduate degrees in IT-related subjects is concerning, the number of graduates supplemented by immigrants granted visas for IT occupations, should be providing a steady supply of talent to meet ongoing employer demand.

However, our research indicates the greatest unmet demand is for senior workers – people with specific advanced digital skills and experience applying them in a practical setting. These roles cannot be filled by graduates and early-career workers without additional training and practical work experience. As a result of this mismatch, many students and graduates find it difficult to obtain internships and entry-level jobs. This is exacerbated as companies, already faced with a dearth of senior talent, often feel they lack the capacity to train and supervise rangatahi.

Earlier in the skills pipeline, many rangatahi and students leak from the pipeline, discontinuing on tech pathways before making it to the workforce. This happens for a number of reasons, from insufficient understanding of the opportunities available, to a lack of support and culturally-appropriate mentorship for historically underrepresented groups.

Ongoing reliance on immigration and low levels of investment in upskilling existing staff continues.

New Zealand's technology sector is accustomed to filling skill gaps via immigration. However, due to our reliance on outside talent, the pandemic and its ongoing impacts have caused significant and unpredictable strain on the sector. When immigration routes were curtailed by border closures, companies could no longer rely on highly-skilled migrants to fill specialist needs. These unfilled roles meant

many companies were concerned with their ability to grow and prosper. Since borders have reopened, visa numbers for IT-related roles have been steadily increasing again, but have not returned to pre-pandemic levels.

The reliance on immigration has also contributed to a culture where companies rely primarily on migrant talent instead of investing in and upskilling the existing workforce. Research indicates only 32 percent of New Zealand businesses are actively upskilling, which is low compared to 45 percent of businesses across the Asia Pacific region. Training and upskilling requires both a financial and time commitment for employers. However, without it, employees will face slow career progression and employers will experience higher turnover as workers actively seek new opportunities. In recent research, desire for career development and concern that their skills aren't being utilised are two of the top five reasons tech employees cited for changing jobs. Additionally, 59 percent of IT workers say they're considering a move to a new workplace in 2023.

Upskilling and reskilling initiatives are being developed within many companies, along with a growing number of programmes and certifications from independent providers. However, the upskilling landscape remains relatively fragmented, and employer investment in internal upskilling is spotty.

Research reinforces the challenges and highlights their complexity.

To strengthen the skills pipeline, pathways from education to industry must be better aligned to improve diversity and provide

multiple routes into digital technology careers. The issues we identified in our 2020 Digital Skills Report remain relevant, and the findings in this 3rd edition identify a remarkably similar set of issues. Diversity is still a major challenge with women, Māori, and Pacific people significantly underrepresented in our tech sector. Participation levels in NCEA technology subjects continues to decline, with numerous barriers to participation in these courses. Tertiary participation in IT subjects is stabilising after a period of decline, but participation in degree-level programmes continues to fall. Bridging the gap from education to employment is still a challenge for both workers and employers.

However, aside from initiatives like the Digital Technologies Industry Transformation Plan (ITP), we have seen little movement at a systemic level regarding the recommendations made in the 2020 report. By now, there is clear agreement on these critical challenges. To be successful, the solutions must be multifaceted and coordinated at a national and industry-wide level.

More coordination is required throughout the ecosystem, to build advanced digital skills.

The growing number of government and industry initiatives are beginning to slowly fill the gaps in the skills pipeline. From employer-run upskilling programmes to government initiatives that provide support for businesses taking on early-career employees, there are many ways to create development opportunities. However, the current landscape is adhoc, fragmented and insufficient to support the required supply of advanced digital skills.

Better connections and partnerships between industry and education — both universities and other education providers — is vital to developing the ecosystem. This includes strong marketing and clear messaging to rangatahi, defined pathways, easy access to career information, and the ability to earn while learning.

As the biggest employer, there is a large opportunity for the government to take a leadership role in the development of more entry level roles and supporting earn as you learn pathways.

Businesses must also adapt and change to take advantage of a growing local talent pool. In each of our Digital Skills Surveys, industry respondents have stated their companies are impacted by skills shortages, interested in taking on interns, and concerned with workplace diversity. However, little has been done to address the issues. Larger organisations that have developed initiatives to begin addressing the issues are often working alone and this results in a fragmented landscape and limited improvement.

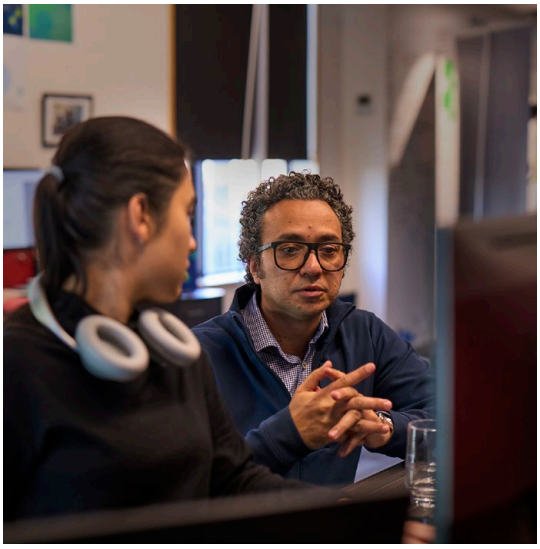
Recommendations

1. Our Collective Response to Digital Skills Challenges needs to Mature Rapidly

- Have a plan - create a digital technology industry workforce plan.
- Set targets - focus on realistic absolute numbers.
- Understand the issues - undertake further deep dive research into specific challenges.
- Use an Industry Standard - rapidly deploy the SFIA framework to enable alignment.

2. Our Largest Employer Must Show Leadership

- Install leadership - responsibility should be entrusted to a senior Government official.
- Create entry level jobs - The Government should establish a wide range of entry level digital roles.
- Enhance the visibility of available support - maintain funding assistance for entry level roles and improve their accessibility.
- Address underlying causes - allocate resources towards ensuring universal internet and device access for all our rangatahi.



3. Industry Must Prioritise Collaboration and Abandon Rhetoric

- Engage in collaborative attraction efforts - work as an industry to support the attraction of rangatahi into tech.
- Collaborate on planning - support and improve workforce planning.
- Collaborate on new pathways - co-design and support work integrated learning.
- Collaborate on a platform - to make it easier to find industry courses, initiatives and information about tech careers.

In summary, to confidently address our skills issue will require systemic changes at such a scale that it will be impossible unless the tech industry and other large employers undertake a more collaborative and aligned approach with the government.

To ensure New Zealand's digital future, collective action and investment is required.

About this Report

This report consolidates data and insights from government, industry and education providers for an updated picture of the digital skills landscape in Aotearoa New Zealand. It has a particular focus on the advanced digital skills needed to support the tech industry and other sectors across the country.

This report *Digital Skills Aotearoa (3rd Edition): Digital Skills for Tomorrow, Today* is the third in the series, following:

- *Digital Skills for a Digital Nation*, published December 2017. This report included industry survey data from 2017 and occupation, immigration and education data up to 2016.
- *Digital Skills Aotearoa: Digital Skills For Our Digital Future*, published December 2020. This report included industry survey data from 2020 and occupation, immigration and education data up to 2019.

This report is a point-in-time snapshot of the digital skills landscape in Aotearoa New Zealand. It is a refresh of the 2020 report, reflecting the significant changes that have occurred since the beginning of the Covid-19 pandemic. The report includes updated data and insights and provides recommendations for government, industry and education providers to further develop the advanced digital skills pipeline.

The data used in this report is from a range of sources. Data on secondary and tertiary education participation was collected from the Ministry of Education (MoE). Employment and immigration data was collected from the Ministry of Business, Innovation and Employment (MBIE). The most recent data for education, employment and immigration is from 2021. Additional data regarding workforce development, internships and employment challenges was collected by a survey administered by the technology sector workforce development council, Toi Mai. This data is supported by information from other local and international reports. The authors have also endeavoured to ensure the data represented is correct.

PART ONE
Exploring Our Digital Skills Landscape

What are Digital Skills?

Digital skills are the skills needed to find, evaluate, utilise, share and create content using information technologies and the internet.

Digital skills exist on a continuum, with most people requiring at least some level of skill to engage in our increasingly digitalised society. For example, the ability to use email, find directions or use online banking. Digital skills can also be significantly more specialised, for example, developing software products or analysing large digital data sets. However, workers across all sectors need a degree of digital skills, especially with more businesses digitising their processes and workflows.

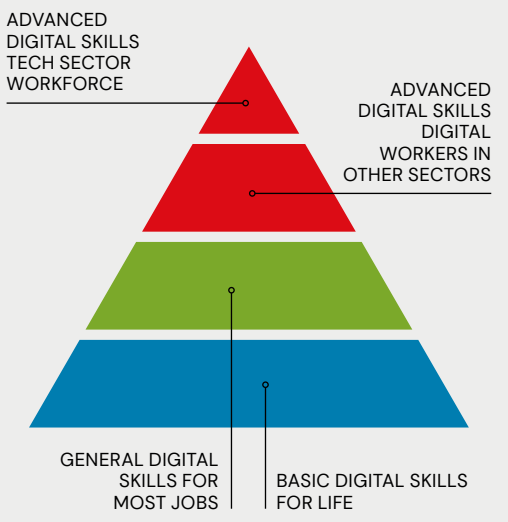
During the early days of the Covid-19 pandemic, there was a mass upskilling of basic digital skills for a large sector of the population as workplace digitalisation was dramatically accelerated. This was coupled with increased reliance on communication technology and education services globally. As the acute aspects of the pandemic have receded, the trend towards remote and hybrid work has proven resilient and is likely to remain a significant workplace trend.[1] Now more than ever, fundamental digital skills are essential for everyday life whether communicating with loved ones, attending work meetings, accessing government services, or finding directions.

For the purpose of this report, we have a significant focus on advanced digital skills and how to grow the availability of advanced digital skills in order to meet industry needs. Building a steady supply of advanced digital skills requires a robust pipeline from basic skills acquisition onwards — all stages of development and training are important.

Defining Advanced Digital Skills

For consistency, we have retained the advanced digital skills definition used in the 2017 and 2020 iterations of this report. Advanced digital skills are those required to **control** and **create** with digital technologies. These skills include software programming, developing algorithms, managing and analysing large amounts of data, implementing and managing digital hardware, networks and information security. These are skills required by the digital technology workforce, not the more general digital skills required by the wider population to operate in an ever increasing digital economy.

FIGURE 1: Digital Skills in Aotearoa



Why are Advanced Digital Skills Critical for Aotearoa New Zealand?

In previous decades, advanced digital skills were primarily the domain of the Information and Communication Technology (ICT) sector, including computers, software, networks and telecommunications. However, today, digital technology impacts almost every sector. Digitalisation and the convergence of technologies is creating entirely new industries, for example agritech, fintech and medtech which have all seen double digit growth in employees in 2022.[2] Together, these factors are creating a huge demand for digital skills, and in particular a hard-to-fill demand for advanced digital skills.

Digital skills are the foundation of a robust digital economy. Without a digitally skilled labour force, Aotearoa New Zealand won't be able to harness opportunities to innovate, grow, or increase the digitalisation of businesses across the country. Across the Asia Pacific region, digitally skilled workers earn 65 percent more than non-digital workers, and digitally-enabled businesses also grow at a faster rate than their non-digital counterparts.[3]

Our challenge of geographical distance can be overcome through weightless digital exports. This ultimately provides strong productive growth, higher wage employment and the creation of large, exporting organisations.[4] The weightless nature of digital exports also reduces the environmental impacts and logistical hurdles related to physically producing and shipping products.[5] To be fair, there are emerging challenges of e-waste and energy consumption still to address. Nevertheless, digitalisation supports other sectors to be more productive and sustainable through innovative products and services, and less carbon-intensive business processes.[6]

> *"Organisations in the Asia Pacific region that employ advanced digital workers – such as software developers or cloud architects – report 2021 annual revenues 150 percent higher than organisations that employ only basic digital workers."*
>
> – AWS Asia Pacific Digital Skills Study

Compared with other Organisation for Economic Co-operation and Development (OECD) member countries, New Zealanders work longer hours and produce less per hour. Economic growth in New Zealand is currently driven by more hours worked and adding people to the workforce – almost half of our 2019-20 gross domestic profit (GDP) growth was accounted for by increases in labour input.[7] If New Zealand does not improve the digital skills of its workforce, we will continue to experience low levels of productivity and less competitive products in global markets.

In addition, companies in the digital technologies sectors will encounter growth challenges if we are unable to increase the supply of advanced digital skills locally. Relying on immigration to fill the majority of roles requires organisations to compete with other countries for top talent in a demanding global market. As we will learn in the next section, all countries are continuing to grapple with these skills challenges. We cannot afford to delay in taking action — quickly addressing these challenges on a local scale is imperative for the success and growth of our economy.

New Zealanders work longer

34.2 *hours per week*

compared with

31.9 *hours per week*

in other OECD countries

New Zealanders produce less

$68 *output per hour*

compared with

$85 *output per hour*

in other OECD countries

CASE STUDY

Supporting jobseekers to develop foundational digital skills for the workplace

Digital Passport is an online platform that aims to make it easy for people to learn foundational digital and soft skills, structured in bite size learning modules. It is funded by the Ministry of Social Development (MSD) and developed and delivered by academyEX.

Through Digital Passport, learners work through short modules at entry, intermediate and advanced levels and gain a badge on completion of each level. They learn about a range of topics including how to stay safe online, an introduction to different social media platforms, and how to use ChatGPT to aid and speed up some writing tasks.

The overall goal of Digital Passport is to help New Zealanders gain meaningful work through the development of digital and soft skills for today's jobs.

It is primarily designed for people who are looking for employment and need some basic digital skills or are first time jobseekers. However, anyone with WIFI access and a digital device can use Digital Passport for free.

In addition to online courses, from 1 July 2023, Digital Passport has also come with further support and encouragement for learners including access to a team of digital support specialists during weekday work hours and regular communications via newsletter and social media. In addition, through academyEX, jobseekers who have completed Digital Passport learning journeys can be connected with potential employers within the SME sector.

The Aotearoa New Zealand Landscape

As described in our 2020 report, the state of New Zealand's advanced digital skills landscape can best be described as a 'leaky pipeline'. While there are many ways to gain the skills and experience required for IT-related jobs in the tech sector and beyond, there are multiple blockages and leaks across the system.

At a Glance

Since the last edition of our digital skills report, the tech sector has undergone significant transformation. The ongoing impact of the pandemic has impacted demand, hiring and immigration. The shift from low interest rates has caused changes in the financial landscape, influencing investment activities, lending practices and the availability of venture capital. This turmoil has been felt globally and has prompted companies to modify their approach to hiring employees. However, despite the evolving economic conditions, there is evidence of continuing strong demand for experienced workers with advanced digital skills across most sectors of the economy.

Currently, New Zealand's talent pipeline still resembles the 'leaky pipeline' we first identified in 2020. The number of ākonga learners studying math and technology subjects continues to decline year after year. This has resulted in low numbers of rangatahi young people flowing into the workforce. Modest increases in the numbers of enrolments in diploma-level courses and an increase in masters and PhD students[8] presents encouraging signs in talent development. Overall, there are significant opportunities to improve the flow of rangatahi from education and into tech employment. This also includes developing further opportunities and incentives to help upskill or reskill workers already employed in other areas. Figure Two (below) shows the complexity of the leaky skills pipeline.

There are many initiatives underway to support the development of advanced digital skills, ranging from training programmes run by large corporates through to initiatives supporting learners and rangatahi from diverse backgrounds. However, since the second edition of this report, there has not been significant improvement in reducing leaks in the pipeline. It is crucial that education providers, government, industry and civil society collaborate and implement interventions to support the development of required digital skills.

The rest of this section provides an overview of the digital skills landscape in New Zealand, primarily addressing demand and supply. These issues are discussed in more detail further in this report.

FIGURE 2: The New Zealand digital skills pipeline in 2021

474,709
Primary ākonga learners

351,863
Secondary ākonga learners

50% Female / 21% Māori / 10% Pasifika

SCHOOL

Need to get more ākonga learners excited about digital careers.

Need to improve diversity.

15,356
Year 13 NCEA Technology students

40% Female / 14% Māori / 8% Pasifika

810
International students start IT degrees

TERTIARY STUDY

Need to increase industry engagement with internships and workplace learning.

2,451
IT Visas approved

1,710
Domestic IT degree graduates

24% Female / 5% Māori / 4% Pasifika

Industry hesitant to hire and develop people

Need larger organisations and Government to show leadership and develop more entry level jobs.

308
undertook reskilling by Dev Academy and Mission Ready HQ

Need to provide more reskilling opportunities that can be done while working.

MID-CAREER

Need to introduce more upskilling options.

92,846

SENIOR SPECIALISTS

Area of biggest shortage

Workers in ICT occupations across all sectors in New Zealand

41,544
Year 13 ākonga took NCEA Maths...

15,365
...took NCEA Technology standards.

5,642
...and took NCEA Digital Technology standards.

Tertiary Study

5,655
Ākonga from Secondary School entered Tertiary study in Computer Science, Information Technology or Software Engineering.

1,955
enter Degree Level courses.

24% Female,
7% Māori,
5% Pacific.

10,245 domestic and **3,555** International students enrolled in Degree Level qualifications in Computer Science, Information Technology or Software Engineering.

Education to Employment

5,725
students graduated from tertiary courses at all levels in Computer Science, Information Technology or Software Engineering.

2,640
graduated at Degree Level in Computer Science, Information Technology or Software Engineering.

24% female, 4.5% Māori, 4.2% Pacific

2,438
students completed registration for the Summer of Tech internship programme.

Only **439**
students (18%) were provided internships via the Summer of Tech internship programme.

Demand for Less Technical ICT Jobs Decline

918 systems administrators and ICT support technician jobs were lost in 2021 and the total number of ICT jobs reduced by 91 year to year between 2020 and 2021.

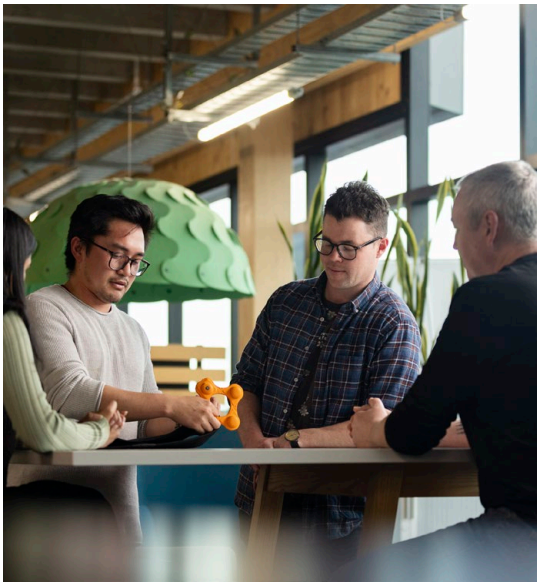
Advanced Digital Skills Still in Demand, But Growth Slows

1,039 new software and application programmers, ICT business and systems analysts and ICT managers in 2021.

Sources: Ministry of Education, Ministry of Business, Innovation and Employment, Immigration NZ, Summer of Tech, Dev Academy, Mission Ready HQ, ICT Grad School.

Demand for Digital Skills Continues to Grow

Demand remains strong for workers with advanced digital skills, with 1,039 new roles created across software and application programmers and ICT managers alone in 2021.[9] Internationally, emerging areas of demand include artificial intelligence (AI), cloud computing and cybersecurity. Similar trends are beginning to emerge locally. However, there is a decrease in demand for some ICT-related jobs, particularly less technical roles, likely because of the negative impact of the Covid-19 pandemic and increasing automation across some job functions. Roles that declined in numbers during 2021 include system administrators and ICT support technicians.[10] There is particularly high demand for experienced practitioners in senior roles, which require experience in the workforce and a range of in-demand soft skills.



> *"To ensure Aotearoa New Zealand transitions to a low-carbon future that is thriving and productive, the tech sector needs support to grow with clear direction and a diverse talent pipeline."*
>
> – The Digital Strategy for Aotearoa

Of the 159 organisations that responded to the 2023 New Zealand Digital Skills Survey, 79 percent have recently faced recruitment challenges.[11] Many employers have identified the challenge of finding skilled IT workers as an ongoing concern, with 96 percent of IT employers in New Zealand expecting the skills shortage to impact their operations in 2023.[12]

Strong demand for advanced digital skills resulting in high pay

The ongoing demand for workers with advanced digital skills means that ICT and other digital roles remain some of the highest paid jobs in Aotearoa. However, despite the demand, the national median for tech salaries remains unchanged since 2021 while the median salary for digital specific roles have increased by two percent.[13]

According to annual research by recruiter Absolute IT, in addition to higher salaries, tech and digital employees receive excellent benefits and high flexibility. Ninety three percent of employers in the sector have staff working either entirely or partly remotely. Working remotely is the top non-financial benefit tech workers prefer from an employer.[14]

Mobility remains relatively high in the ICT field. Fifty nine percent of tech workers say they're considering a move to a new workplace in 2023. This is slightly down from the 64 percent considering a move at the time of

our 2020 report. However, employees remain highly confident in the job market, with 72 percent saying they expect finding a job in their specialty to be as easy or easier than last year.[15] This figure has doubled since 2021, reflecting the tight labour market and strong need for highly skilled employees.

Immigration in demand to fill need for experienced specialists

The specialised nature of many new roles requires employees with workplace experience and advanced skills in specific areas. Historically, immigration has been the primary source of this specialised talent, fulfilling a significant portion of all new digital technology jobs created in recent years. While it is important to grow the local pipeline, immigration will continue to be needed to ensure the right mix of advanced digital skills in the workforce.

ICT Visas Issued

4,896 in 2018 | *2,451* in 2021

In the year to June 2021, the occupation of software engineer received the most ICT-related visa approvals. These numbered 372 out of 2451, or 15 percent. Following the pandemic, total numbers of ICT visas issued are slowly rising again, but are still far from 2018 levels. In 2022, the government opened additional residence pathways for highly skilled digital workers: a straight-to-residence option for specified tech roles that meet a salary threshold, a two-year work-to-residence pathway for highly paid migrants, and the reopening of the Skilled Migrant Category.[16]

Diversity continues to be a challenge across the digital landscape

The digital technologies workforce in New Zealand has a well-documented diversity problem, with women, Māori, Pacific peoples and neurodiverse employees underrepresented. However, responses to the 2023 NZTech Diversity in the Tech Workforce survey indicate improvements. The number of women in digital technology teams is up two percent from the 2020 survey to 29 percent. The proportion of Māori in digital technology teams has lifted 0.7 percent to 4.8 percent, and Pacific peoples are up 1.6 percent to 4.4 percent.[17] Women are particularly underrepresented at higher levels and in leadership roles. Only five percent of tech startup founders, 23 percent of senior executives and 18 percent of board members are women.[18] There is very little data on the number of neurodiverse people within tech employment, however 55 percent of respondents to the 2023 Digital Skills survey indicated they employ neurodiverse people. When asked how many, most respondents indicated it was difficult to exactly quantify how many neurodiverse people they employ due to privacy.

Underrepresented in the digital technology workforce

29% women,
4.8% Māori,
4.4% Pacific people

This indicates there is more to be done to encourage and support diverse students to study ICT-related subjects and ensure workplaces are welcoming and equitable.

Multiple Pathways into Digital Roles

Tech and digital industries are varied and diverse, requiring a broad range of digital skills and other capabilities. The pathways into digital roles are similarly varied, and include traditional education through degree programmes, industry-led short training courses, and reskilling for career-changers. Most of these pathways appropriately encourage some amount of work experience or internship, but these opportunities are consistently difficult to obtain.

Additional avenues into digital roles are especially important as numbers of people taking the traditional routes — secondary school NCEA education and tertiary degree programmes — have been relatively static and in some cases declining. This suggests the need for early promotion and awareness-raising of the opportunities provided by digital careers, and broad digital literacy training for rangatahi and whānau.

Only a small number of ākonga progress from secondary to tertiary technology education

The rate of high school ākonga taking relevant feeder subjects including science, technology and maths, has been reducing each year. Additionally, only a small proportion of those go on to tertiary study in digital and ICT fields. While participation in a subject at the high school level is no indication of interest in tertiary-level study, the sharp drop off indicates more must be done to encourage ākonga to consider pathways into advanced digital technology courses.

Meanwhile, just under two thirds of students studying computer science, information technology or software engineering courses at a tertiary level are enrolled in degree courses. Enrollments in degree study dropped during 2020 and 2021 following a dramatic decrease in international students, due to pandemic related border restrictions. However, domestic participation in IT degrees has remained relatively flat over the past five years at just over 10,000 students.

In 2021, there were

13,795

domestic and international students enrolled in degree level IT qualifications.

Enrollment in more advanced IT qualifications has been growing steadily with participation in masters or PhDs in computer science, information technology and software engineering courses increasing at a 10 percent CAGR between 2017 and 2021. The number of students graduating with these advanced IT qualifications increased by a CAGR of 18 percent in the same time period.[19] Participation in lower level IT qualifications such as diplomas and certificates have been slowly growing at one percent CAGR over the five years from 2017. However, there has been a steady (four percent CAGR) decline in the number of students managing to graduate from IT related diplomas and certificates.

Of students graduating with IT degrees in 2021, 24% were female, 4.5% were Māori and 4.2% were Pacific people.

Of course, there are other pathways to tech careers that do not include degree level IT study at tertiary level. Many rangatahi enter tech and digital fields without a specialist degree, either by taking certificate or diploma-level courses in tech subjects or studying at degree level in adjacent fields like business, engineering or math. A few enter the industry after learning tech skills at a bootcamp or similar non-degree course, either directly from secondary school or later as a second career.

Internships are an effective but underutilised path into digital careers

Internships are a key pathway into employment for learners and graduates seeking technology roles. Most degree-level courses have some work placement or internship element, to help ensure alignment of students' skills with industry needs and provide workplace experience. These are mostly facilitated by education providers themselves, or by external providers, the most significant being Summer of Tech.

However, internships are hard to secure and their management can be challenging for employers. Most tech firms have limited entry level positions, and smaller firms have limited capacity to oversee and mentor interns. Of the employers polled in our 2023 digital skills survey, 46 percent had engaged with digital technology interns in the past year, and 72 percent said there were barriers or challenges to taking on interns and junior staff, with management time and support required cited as the most significant challenge.[20]

Other approaches to skills development continue to emerge

As we noted in the previous editions of this report, multi-year training through a tertiary institution is not the only way for people to gain required skills. There are other approaches that enable learners to take shorter courses at their own pace and gain skills needed for tech roles. However, these courses need to be recognised by employers and paired with a formal assessment of skill proficiency.

Proprietary courses and certifications are offered by many tech companies including Amazon Web Services (AWS), Google, IBM, Microsoft, Salesforce and others. Industry certifications can be an efficient way for learners to improve their skills and self-paced pathways into digital roles. These programmes are responding to evolving technology and adapting much faster than larger state-sanctioned programmes. We have also seen many of these companies offer their expertise, scale and resources entering collaborative partnerships with education providers and in some cases other industry partners. One limitation of taking a solely industry certification-based approach is a potentially limited breadth of knowledge that focuses on specific narrow skills or technologies which can make the future transfer and evolution of skills difficult.

Internationally, there is a trend towards skill-based hiring rather than purely qualification-based approaches (for example, requiring a bachelor's degree). Research carried out by Gallup found that in New Zealand, many organisations are starting to recognise industry-led certifications can help ease hiring challenges.[21] Further adoption of the Skills Framework for the Information Age (SFIA) could aid the move towards a skills-based approach by providing a consistent common language for the skills needed for ICT-related roles.

The Global Skills Landscape

Skills Shortages are a Persistent Global Challenge

Our advanced digital skills pipeline issues are not unique. In our 2017 and 2020 reports, we noted a significant gap between the demand and supply of suitably skilled and trained technology workers globally.

There continues to be a persistent digital skills gap globally, reflecting the increased demand for workers in technology roles, the need for digital skills across all sectors of the economy, and the increasing pace of digital transformation as a result of the pandemic. This section provides an overview of the issues being experienced by other countries, and the types of interventions being implemented. We take a closer look at Asia, Australia, Europe, the United Kingdom (UK) and the United States of America (US). This is an indicative overview and not a comprehensive review.

Globally, while a broad range of advanced digital skills are in demand, there is particular focus on building supply in skills in some areas. This includes artificial intelligence (AI), cloud computing and cybersecurity. In some countries, there is also a focus on building critical soft skills, for example, communication, problem solving and collaboration.

There are a broad range of initiatives to support digital skills pipelines globally. This includes apprenticeships and other on-the-job training, partnerships with industry and academia, re-skilling workers in other sectors and initiatives to support the supply of international talent. Some jurisdictions, including Europe and Australia, have concrete goals for the number of tech workers by 2030, which helps guide their interventions and investment in skills development.

The collaboration between governments, industry, civil society and education providers is considered key to supporting a strong digital skills pipeline. For example, KPMG's annual Global Tech Report 2022 finds that companies can be a key part of the solution to the global talent crisis, by restocking the talent pools available and having outreach programs with tertiary providers to inspire individuals to develop the most in-demand skills.[22]

Research looking at digital skills gaps in a number of countries shows New Zealand is not alone with workers facing barriers to training and reskilling in advanced digital skills in multiple countries. For example, Economist Impact found that in the Asia-Pacific region, "critical challenges continue to pose barriers to upskilling and reskilling, including employee uncertainty about the skills needed, lack

of time, the high cost of courses and a lack of opportunities to apply skills."[23] Another barrier is a lack of understanding of potential tech careers and education pathways.

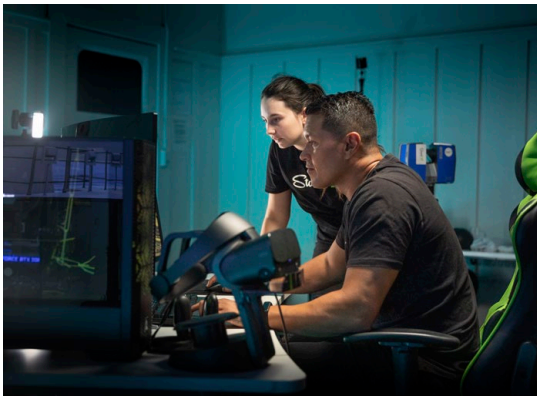
The participation of women and non-binary people is still considerably lower than their male counterparts in all countries. Many initiatives focus on supporting increased gender diversity and representation of other underrepresented minority groups. Other initiatives focus on supporting underserved communities into tech training and subsequent job placements.

In Europe and Australia, there is a significant push on the development of skills more broadly for the future workforce, with skills needed for the digital transformation of the economy being a key part of this. For example, Australia has recently established Jobs and Skills Australia aiming to meet present and future skills needs. The European Union has also launched the European Year of Skills 2023 initiative, to help future-proof Europe's workforce. This initiative is showcasing development opportunities and activities across Europe, including fostering easier recognition of qualifications across borders. Despite continued efforts to support the supply of advanced digital skills, gaps between supply and demand persist. The following section outlines the current state across a number of countries, and a range of initiatives to support digital skills that have been established since the 2020 *Digital Skills Report* was published.

Australia

It is expected the digitisation of the Australian economy, accelerated by the pandemic, will continue to drive significant demand for complex digital skills. This includes skills in AI, machine learning and cybersecurity.[24]

High demand remains for technology workers and supply has not been able to



keep up.[25] In 2022, four of the 20 most in demand occupations were in the tech sector, including software and applications programmers, and ICT business and systems analysts.[26] By 2026, it is expected that Australia's cybersecurity sector will have 3,000 fewer workers than needed.[27] Deloitte Access Economics estimates that the cost of digital skills gaps in Australia's large businesses is AUD$3.1 billion a year.[28]

The Australian Government and Tech Council of Australia has a joint goal of 1.2 million people working in tech roles by 2030. As of February 2023, Australia is on track to meet this goal with 935,000 people currently in its tech workforce, an eight percent increase in the last year.[29] The Australian Computer Society's (ACS) *Digital Pulse Report 2022* noted growth in technology workers in the past year could have been higher if there had not been supply shortages.[30]

A number of pipelines for technology workers have been identified as needing growth. These are people graduating with ICT-related degrees, skilled migrants and people from similar industries being re-skilled.[31]

Examples of Australian initiatives to support digital skills

- The government has committed to implementing a Digital and Tech Skills compact with businesses and unions. This will deliver digital apprenticeships to support workers to "earn while they learn in entry level tech roles."[32] Companies signing the compact will be expected to put a proportion of their new employees through a digital apprenticeship scheme.[33] The Government plans to deliver 1,000 digital apprenticeships in the Australian Public Service over four years.
- Australia's Digital Cadetship Trials are industry-led projects including rapid training programmes for participants along with a job placement over a 4-6 month period. The government has provided $10 million for the project, covering the costs of the programme, training delivery and mentor support. Businesses cover the costs of employment for the cadets. The trials are continuing throughout 2023.[34]
- In its 2022 Budget, the government announced the Small Business Skills and Training Boost which will allow small businesses to deduct an extra 20 percent of expenses incurred for their staff to undertake eligible training courses from registered external providers.[35]
- The Digital Skills Organisation (DSO) is a government-funded, independent organisation founded in 2020 for a three year pilot. It works with employers and training organisations on a new approach to address the country's digital skills shortage. It has developed a Digital Skills Development Model, which moves from

competency-based training to a skills-based model that can adapt more quickly to changing skills needs of workers.[36] The model has three core elements: simplified digital pathways, digital skills standards, and networks of excellence.[37] In late 2022, it was announced the DSO will transition to become a Jobs and Skills Council with responsibility for the Finance, Business and Technology sectors.[38]

- Following a recommendation made by a NSW state commissioned report into the effectiveness of vocational education, TAFE NSW, University of Technology Sydney, Macquarie University and Microsoft co-created a new model of education centred on stackable microskills and microcredentials aligned to the most in-demand roles in cybersecurity, cloud computing, software development, data analytics, and artificial intelligence.[39] Through a careful balance of theory and practice, learners can upskill and reskill online or face to face, earning Microsoft certifications along the way. Attracting more than 16,000 enrolments within the first 6 months of opening, the IAT-D is proving to be an accessible, equitable, and scalable model for learning digital skills toward an entry-level role, to pursue further study, or to boost promotion prospects.
- In response to a critical shortage of Functional Consultants in the labour market, UTS and Microsoft co-created a fully online qualification to prepare learners for this specific role on an accelerated timeline of 8 months. The course combines the rigour and research of UTS academics with the technology and industry expertise of Microsoft and leading technology consulting organisations including Avanade, Capgemini, and EY. Learners from a variety of backgrounds can augment their skill sets in a highly concentrated way, meeting and networking with potential employers throughout the course to help fast-track employment opportunities on graduation.[40]

Europe

The European Commission has a goal of 20 million ICT workers by 2030, with equitable participation of men and women. This goal is part of Europe's Digital Decade, a policy programme with goals and initiatives to support the digital transformation of Europe.[41] In 2021, there were an estimated nine million ICT specialists in the European Union (EU), although these are not evenly spread across countries. Forty six percent of these roles were held by people in three countries - Germany (22.5 percent), France (13.9 percent) and Italy (9.5 percent). Women made up approximately 20 percent of ICT workers and graduates in 2021.[42]

The European Commission Digital Economy and Society Index 2022 identified that all member states face a critical shortage of digital experts, which hampers the development, uptake and use of key emerging digital technologies.[43] The EU's list of most widespread labour shortages includes four software-related occupations: software developers, applications programmers, systems analysts and software applications developers, and analysts not elsewhere classified.[44] Of European companies surveyed by Eurostat in 2021, 55 percent reported difficulties recruiting ICT specialists.[45]

The European Commission has designated 2023 the Year of Skills which aims to help companies, especially small and medium-sized enterprises (SMEs) to address skills shortages and promote a mindset of reskilling and upskilling.[46] There is a particular focus on supporting a digital transition throughout Europe and supporting the goal of 20 million ICT workers by 2030. Two of the most common digital skills challenges for EU members are the "lack of a whole-of-government approach to digital education and training, and difficulties in equipping people with the necessary digital skills". [47]

Examples of European initiatives to support digital skills

- The EU Digital Skills and Jobs Platform fosters expertise in advanced digital skills. It provides access to training and funding opportunities, information about EU and national digital skills initiatives, resources and good practices, and an active community of people working to foster digital talent.[48]
- In April 2023, the European Commission called for a "massive boost in enabling digital education and providing digital skills" and adopted two proposals to address the challenges outlined above.[49] The proposals aim to:
  - put in place key enabling factors for successful digital education and training, including investment, governance and capacity-building.[50]
  - improve the provision of digital skills by calling on member states to take a coherent approach across all levels of education and training.
- During 2023, the European Commission is running a pilot programme to test an EU Certificate of Digital Skills. The Certificate will be a tool to "help people get their digital skills recognised across Europe by employers, governments, training providers and more".[51] The pilot will inform a feasibility study and the aim is to launch the certification in 2024.

United States of America (US)

The Computing Technology Industry Association (CompTIA) estimates there were 9.2 million people employed in tech roles in the US in 2022, an increase of 3.2 percent compared to 2021.[52] According to the US Bureau of Labour Statistics, total employment in computer and IT occupations is projected to increase by 15 percent between 2021 and 2031, with an expected 682,000 new jobs over the next decade. There will also be vacancies due to workers leaving their occupations permanently.[53] Approximately 418,500 vacancies are expected on average per year due to growth and replacement needs.

While there have been high-profile layoffs across many large tech companies during 2022 and early 2023, CompTIA estimates that the number of tech roles will grow by around three percent in 2023.[54] Mbula Schoen, Senior Director Analyst at Gartner warned the tech talent crunch is far from over, noting "Current demand for tech talent greatly outstrips supply, which Gartner expects will be the case until at least 2026, based on forecast IT spend."[55] Around 50,000 IT jobs in 2022 were created in states not generally considered tech hubs including South Carolina, Indiana, Alabama, Kansas and Idaho.[56]

Examples of US initiatives to support digital skills

- The Good Jobs Challenge, administered by the US Government's Economic Development Administration, has awarded 32 grants for training partnerships across a range of industries to support innovative approaches to workforce development. This includes 11 grants totalling $182.4 million USD for initiatives that include a focus on information technology workforce development.[57] Many initiatives are led by education institutions partnering with leading technology employers and aim to see more people from diverse backgrounds working in cybersecurity and IT roles.[58]
- The Federal Government has launched the U.S Digital Corps, which provides early-career technology roles and support for fellows across five skills tracks: cybersecurity, data science and analytics, design, product management and software engineering. The programme started with 38 fellows in 2022 and plans to scale significantly in future years. Fellows receive a salary alongside training and mentorships. Groups who are encouraged to participate include recent graduates, career changers and Veterans.[59]

United Kingdom (UK)

There is a significant digital skills gap in the UK, which in 2016 was estimated to cost the economy £63 billion a year in lost potential gross domestic product (GDP).[60] The digital skills gap is still growing, and supply of digital talent is not meeting demand. For example, in May 2022, job vacancies across the UK tech sector were up 191 percent from 2020.[61]

While there is still a skills gap, the education pipeline across IT subjects has been growing steadily in recent years, although this is still not enough to meet demand.[62] There is still a significant gap between participation of female and male students, with female students making up only 21 percent of students taking the General Certificate of Secondary Education (GCSEs) in computer science.[63]

Examples of UK initiatives to support digital skills

The UK's Digital Strategy (2022) has a significant focus on increasing the supply of digitally and tech enabled workers. Focus areas include strengthening the education pipeline, increasing awareness of pathways, collaborating with the private and third sector and attracting global talent.[64] Two of the highlighted initiatives include:

- The UK Digital Skills Council connects academia, government and industry to address current and future demand for digital skills.[65] The Council, co-chaired by the Minister for Tech and the Digital Economy, is encouraging employers to:
- invest in digital upskilling for the existing workforce
- inspire the next generation to see the opportunity of a broad range of digital and careers
- develop inclusive recruitment practices and attract a broad range of diverse candidates into the industry.[66]
- The UK also has a number of immigration routes for tech roles. In 2022, the government announced a new Scale-up Visa to help ensure high-growth

businesses have the skills they need to maintain growth.[67] To qualify, applicants must have a job offer at a scale-up business, meeting the skill and salary requirements. To qualify as a scale-up, businesses must have 20 percent growth in headcount or revenue over three years and have at least 10 employees.[68]

Asia

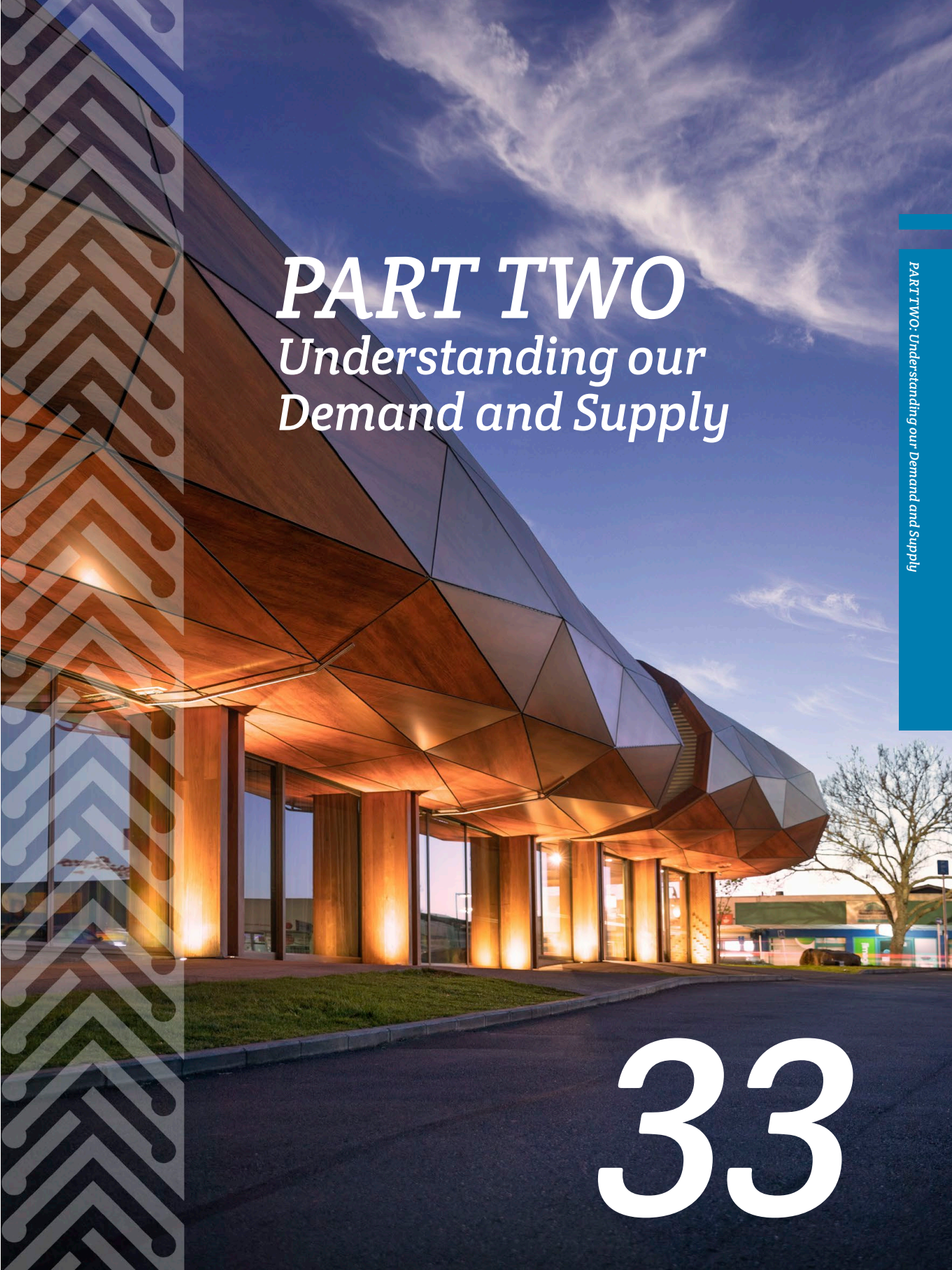
An AWS-commissioned study of digital skills across Asia Pacific and Japan (APJ) found 81.4 million more people will require digital skills training over the next year alone in order to keep pace with technological advancements.[69] In India, the gap between the demand and supply of digital tech talent is projected to increase by 3.5 times by 2026.[70]

In Singapore, skills in cloud, software development and systems and infrastructure in particular have been identified as growing in demand. This reflects how increasingly more businesses are developing digital products and strengthening their IT networks and infrastructure.[71]

In China, the gap between demand and supply of skilled technology workers has been growing for years. In McKinsey's global AI survey of senior business executives, three-quarters of respondents reported challenges hiring data scientists. McKinsey estimates by 2030, demand in China for workers with skills in building AI products will rise from one to six million. Current education and immigration pipelines are expected to only supply one third of the AI talent needed, leading to a shortfall of four million people.[72]

Examples of Asian initiatives to support digital skills

- In 2021, Microsoft launched Code; *Without Barriers* along with 13 partner companies in nine Asia Pacific countries – Singapore, Malaysia, Indonesia, Vietnam, Thailand, Philippines, South Korea, Sri Lanka and Bangladesh.[73] The aim is to help to close the gender gap across the AI, cloud computing and digital technology sectors. Participants complete Microsoft certifications in AI and cloud and secure placements at partner companies, committed to improving diversity in their organisations.
- Singapore has a range of initiatives to support the development of skills for the future workforce, with a particular focus on the digital economy.[74] For example, the TechSkills Accelerator (TeSA) aims to "build and develop a skilled Information and Communications Technology (ICT) workforce for Singapore's digital economy". This includes a number of initiatives which support job placements for recent ICT graduates, the re-skilling of non-ICT workers and the continual upskilling of people already in the ICT workforce.
- FutureSkills Prime in India is a joint initiative between the National Association of Software and Service Companies (Nasscom) and the Ministry for Electronics and Information Technology. It is an online technology skills hub offering professionals and students tools they need to upskill in digital technologies and professional skills. Through FutureSkills Prime, participants can test their skill level before selecting learning content and then earning recognised certifications and micro-credentials.[75]



PART TWO
Understanding our Demand and Supply

Examining our Demand and Supply Mismatch

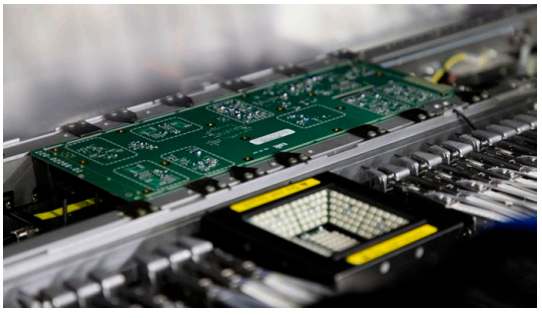
The skills shortage remains an issue of significant concern in Aotearoa New Zealand. This shortage is hampering growth in the local digital and ICT sector, which has the potential to dramatically increase its contribution to the economy and exports. This growth will only occur if skilled workers can be matched with employers who need them.

Since 2020, our tech industry has continued its pattern of growth. Increasing digitisation of businesses and organisations, across all industries, from manufacturing to government has added further demand for highly skilled workers. Unfortunately, the supply and demand mismatch identified in our previous report persists. There is little evidence to show any improvement overall. Some companies and government departments are developing initiatives and strategies to develop talent, and help employers fill gaps. However, these ad-hoc activities are overshadowed by a lack of system-level movement. Collective, large-scale changes are required to facilitate advancement.

For an industry accustomed to filling skill gaps via immigration, the ongoing impacts of the pandemic remain unpredictable. When immigration routes were curtailed by border closures, companies could no longer rely on highly-skilled migrants to fill specialist needs. Since borders have reopened, visa numbers have been steadily increasing but have not returned to pre-pandemic levels.

The urgent need to grow the domestic digital skills pipeline has been acknowledged by the Productivity Commission,[76] the Digital Technologies Industry Transformation Plan (ITP),[77] and many industry groups.

> *"Immigration is essential for a high-skills industry such as Tech, however it's currently at an unsustainable level – more than 50% of new roles are filled via immigration. Other highly skilled industries often operate at 20-25%".*
>
> – Digital Technologies Industry Plan for Skills and Talent[78]



In response to global economic headwinds and despite a recent slowdown in local hiring[79] and layoff announcements,[80] our research shows workers with advanced digital skills remain in high demand. Advanced tech skills are required across most industries and as digitalisation continues to increase, demand is likely to remain robust, regardless of global financial trends.

Forecasting our Future Demand

Our tech sector is made up of more than 20,000 firms, mostly small businesses. Collectively, they contribute around eight percent to GDP.[81]

In 2022, the revenues of the top 200 tech exporters exceeded $15 billion, growing by nine percent ($1.2 billion) in 2021. These companies grew nine times faster than the general New Zealand economy in 2022, delivering consistent and sustainable economic growth during immense global economic uncertainty.[82]

The top 200 Tech exporters are growing

9x faster

than the economy.

The tech and digital sector is playing a significant role in New Zealand's post-pandemic path to recovery. The acute shocks of the pandemic led to border closures, economic volatility and a global downturn in tourism. However, in 2022 tech was the second biggest export earner,[83] placing it in an even more vital position than 2020, when it was the third largest export earner.[84] The sector's breadth of export partners, its ability to absorb economic shocks, and its relatively low ecological impact are all major assets.

The tech sector contributes significantly to regional growth and employment. In 2022, 52 percent of tech workers are in Auckland,

14.1 percent in Wellington, 13.2 percent in Canterbury, with the remaining 20.4 percent spread throughout the regions.[85] Since the pandemic, the rise of remote work and hybrid work has enabled some workers greater flexibility in where they live and how they work. This increased mobility is especially significant for people beyond the larger cities. With considered investment in skills and business support, there are further opportunities for the tech sector to facilitate regional employment and growth.

The tech sector itself is not the only employer of digitally skilled workers. For example, in a recent survey of tech professionals, 29 percent of respondents worked in the public sector.[86] In addition, as other industries undertake digital transformation, digitally skilled workers are increasingly required.

Without exception, digital leaders have cited the skills shortage as a major concern and an impediment to business growth. Workers with advanced digital skills remain in demand, and collective coordination throughout our public and private sectors could help ensure appropriate supply to meet the growing demand.

Despite Recent Financial Turmoil, Demand for Digital Skills Remains High

To understand the current and future demand for digital skills, NZTech and the tech sector workforce development council, Toi Mai, surveyed New Zealand organisations who are hiring tech talent. Survey results were compared with data from the 2020 survey. This was complemented with leadership interviews and drew on additional sources.

A total of 164 responses were received. Respondents were senior managers from a range of employers of digital technology teams. A more detailed breakdown of the survey demographics and methodology are provided in the appendix.

Overview of current skills in demand, and expected to be in demand soon

Globally, the biggest drivers of job growth as a result of digital technologies are likely to be in "big data analytics, climate change and environmental management technologies, and encryption and cybersecurity," says the World Economic Forum (WEF) 2023 Future of Jobs report.[87] In addition, 42 percent of companies surveyed by WEF said training their workers to utilise AI and big data is something they will prioritise.

The advanced digital skills needs of organisations are evolving rapidly. For example, since ChatGPT was released in November 2022, there has been a huge increase in

TABLE 1: Top 10 recruited-for roles in 2022

Role	% of respondents
Software developer	61%
Support, testing and training	53%
Business analyst	43%
Project manager	39%
Software engineer	36%
Management and sales	35%
Architect	35%
Data expert	32%
Consultant	26%
Cybersecurity analyst	22%

Source: New Zealand 2023 Digital Skills Survey, NZTech & Toi Mai. March 2023

the interest in generative AI skills globally, including how prompt engineer skills can be used across a broad range of roles.[88]

In New Zealand, similar high-level trends are emerging in terms of in-demand skills. In 2022 Summer of Tech reported there was an intense interest and availability of roles that related to security and data, and they were expecting similar increases in 2023.[89] Additionally, Microsoft has noted a 65 percent growth in cybersecurity roles without a commensurate increase in the number of people with cybersecurity skills.[90]

High demand for a range of software-related roles still remains. In the 2023 Digital Skills Survey, respondents were asked to identify which roles they are in the process of recruiting for or have recruited during the last 12 months. Software developer was the highest role in demand with 61 percent of respondents recruiting in the last 12 months, followed by software engineer, accounting for 36 percent of respondents. Cybersecurity analysts and data experts also made the top 10 list of recruited roles.

CASE STUDY

Business digitalisation is key to raising New Zealand's productivity, but it will also increase demand for digital skills.

Many small and medium-sized enterprises (SMEs) across all sectors in New Zealand are embarking on their digitalisation journey. This includes using more digital tools and services to streamline their operations and boost productivity.

"While COVID expedited digitalisation rates as Kiwi small businesses swiftly figured out how to run our businesses remotely, there are still phenomenal opportunities for us to take this adoption further. Aotearoa can become a world-leading digital nation and add billions to the economy," says Xero Country Manager Bridget Snelling.[91]

In May 2023, Xero's commissioned report examined what is needed to promote the digitalisation of the economy and small businesses, and the economic benefits this could provide New Zealand.[92] The report found that a 20 percent increase in the number of businesses using cloud-based business tools could lead to an $7.8 billion increase in GDP. [93]

The report shows programmes supporting SMEs on their digitalisation journey, for example Digital Boost are a good start, but more support, training and financial assistance is needed. [94]To harness the productivity opportunity, the report made a number of recommendations to the government. In particular, it found that taking a long-term view, New Zealand needs to promote and financially incentivise the acquisition of digital skills as part of continuous learning in the workforce and education. This digital transition for businesses will lift productivity but it is also increasing demand for digital skills.

High demand for senior and specialist skills

The biggest recruitment challenge, cited by 48 percent of respondents to the 2023 digital skills survey, was finding appropriately skilled people to fill roles.[95] Software developer skills continue to be the most in-demand specialist skill. In response to the ongoing high demand for advanced digital skills, the government announced a number of additional immigration residency pathways to facilitate the entry of additional highly skilled digital workers.[96]

In-demand software skills and programming languages continue to evolve

Development skills continue to evolve with dynamic trends in programming languages and popular software. This results in fluctuating demand for some skills on the rise, while others wane.

This year, respondents cited Python as the most desired programming language skill,[97] outpacing Javascript which was most popular in 2020.[98] Full stack developers were even more in demand, with 36 percent of respondents estimating they would need new talent with full stack skills. AWS and .NET rounded out the top five most needed skill sets.[99] The demand for full stack programmers indicates the importance of broad-based skill sets and understanding of both back-end and client facing websites. The demand for AWS and Azure skills reflects an ongoing shift towards cloud based computing and AI applications, which we were already seeing in 2020. TUANZ's Digital Priorities 2023 report, in conversations with digital leaders also emphasised similar findings. Leaders reported they were increasingly keeping an eye on practical applications of technologies that are becoming more functional and scalable, for instance AI technology.[100]

TABLE 2: Top 10 software development skills needed in coming two year

Software Development Skill	% of respondents
Full Stack	36%
Python	27%
AWS	25%
.NET	25%
Javascript	23%
ML/AI	18%
Azure	14%
React	12%
C++	10%
C#	9%

Source: New Zealand 2023 Digital Skills Survey, NZTech & Toi Mai. March 2023

As these trends continue, there is a need to ensure that educators and students are aware of the market trends, so early-career tech employees will be entering the workforce with appropriate skills.

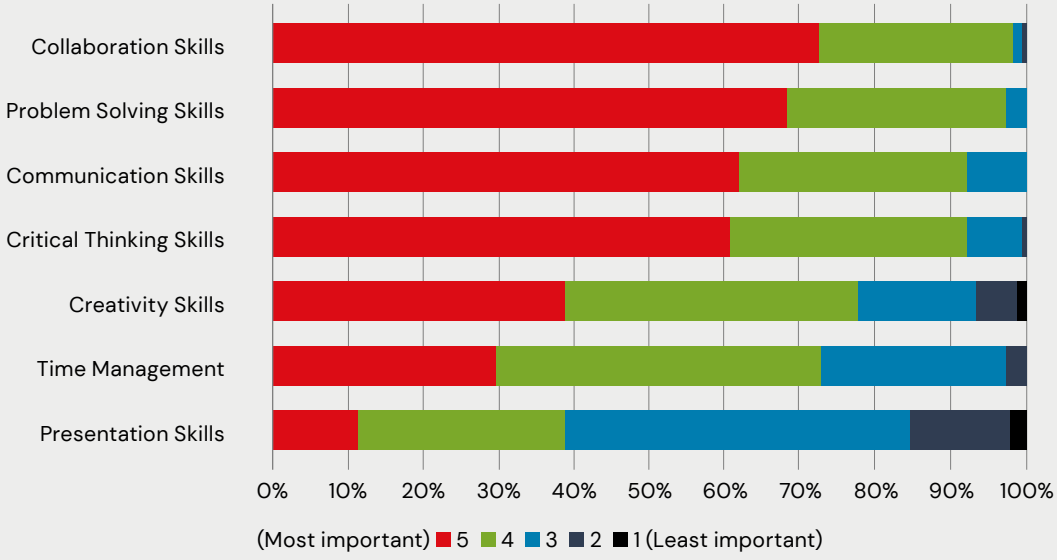
Collaboration skills and other soft skills are highly sought-after

Technical skills like software development and systems engineering are only part of the skills puzzle. Employers also consider the interpersonal attributes or people skills required to succeed in the workplace. These soft skills include adaptability, communication, collaboration, conflict resolution, critical thinking, emotional intelligence, leadership, problem-solving and time management. These capabilities are vital for ensuring teams can innovate, understand stakeholder needs and work together effectively. In 2020, problem-solving skills were the most sought after soft skill, followed by collaboration and then critical thinking and communication.[101]

> *"We've got a lot of really smart technologists, but the one thing that separates the good from the great is sometimes the soft skills — the ability to work as a team, the ability to be collaborative, the ability to get the concepts out of the head and into the room"*
>
> – Digital Skills Survey deep dive interview respondent

In our 2023 survey, collaboration was cited as the most strongly valued, with 74 percent of respondents saying collaboration is extremely important.[102] Problem-solving, critical thinking and communication were also seen as vital, as shown in Figure 3.

FIGURE 3: Importance of Soft Skills



Source: New Zealand 2023 Digital Skills Survey, NZTech & Toi Mai. March 2023

Lack of Investment in Upskilling Staff

Internal mobility is valued by employees

The recent border restrictions and openness to remote work have led to an increase in internal mobility for workers. That is, more firms tended to promote or hire internal staff for roles rather than going on the open market. McKinsey reports that 40 percent of workers surveyed in 2022 were planning to leave their jobs in the near future,[103] but facilitating internal mobility can help reduce this churn and increase job satisfaction. As more young workers enter the tech workforce, opportunities for internal mobility are likely to become even more important. LinkedIn found that Gen Z employees are 47 percent more likely than Gen X to prioritise opportunities to advance within a company.[104] Enabling employees to develop their careers and advance internally requires a commitment to upskilling staff and facilitating ongoing learning,

CASE STUDY

Spark Gigs — fostering internal mobility

Spark has more than 5000 employees, ranging from entry roles to highly specialised digital and IT talent. With such a large workforce, there are many career development and progression routes within the company. However, ensuring people receive the development and training opportunities they need to excel and build skills requires commitment. Acknowledging there are increasingly significant opportunities to tap into the skills and capability of its current workforce, Spark launched Spark Gigs in 2021. The programme develops stronger pathways for internal mobility and mobilises its talent pool across diverse career experiences and portfolios.

Spark Gigs is a digital talent marketplace that highlights opportunities available to everyone across the business. It also provides opportunities for upskilling and access to mentorship and connections, democratising access to learning and development opportunities across its talent pool. During the past 12 months, half of Spark's workforce has registered for the platform, resulting in 80 internal opportunities and experiences. The marketplace also facilitates mentorship and reverse mentorships, successfully pairing over 60 mentees with mentors through the platform.

In addition, Spark provides ongoing opportunities for its people to upskill around digital and emerging technology through its certification, accreditation and skills guild offerings. These are delivered in partnership with providers like Microsoft, Udemy and AWS and are designed to meet the particular needs of different parts of the business. Spark is also looking at micro-credentials as a way for its people to increase their digital knowledge outside of their current roles. This will help spark interest in a broader range of roles and help build organisational digital dexterity.

CASE STUDY

Spark accelerators — developing internal capability

To build capability within its workforce and develop its hard-to-fill skills talent pool, Spark is upskilling and cross-skilling through internal internship style programmes. These accelerator programmes aim to develop existing employee talent through an 8-10 week programme combining self-directed learning, classroom training and on-the-job application. The programme also includes wraparound pastoral care and leadership support to enhance learning and integration. Within the last 12 months, Spark has run accelerator pathways in data and automation, software development, and Agile practices.

While this approach enables movement from frontline and entry-level positions into more specialist skill sets, it also empowers team members to retrain or upskill into emerging fields. More than 150 people have applied for placements, 50 have been placed on a pathway, and 20 people placed in new roles. Further accelerators are currently being designed to help develop their talent pool for hard-to-fill skilled roles. Spark is also developing its own **Digital/ Future of Work Skilling** Centre to help ensure it can meet workforce and skilling needs for the future and contribute to the broader step change in digital skills that Aotearoa will benefit from.

both of which are currently underinvested across the New Zealand tech ecosystem.

Employers and employees both interested in upskilling

This year, 76 percent of our survey respondents say they actively create career opportunities for employees. Seventy percent of these respondents report offering one-on-one mentoring for junior employees, while 60 percent offered industry short courses (1-5 days), and 50 percent offered single day, or less, short courses.

However, for intermediate and senior level employees, advancement opportunities most often included mentoring and coaching, support for self-directed growth (including attending courses and events, and undertaking career development opportunities) and offering opportunities to work on meaningful projects and lead initiatives. These activities can all contribute positively to upskilling and encourage staff retention — a recent survey revealed that career development opportunities are the third most important contributor to employee job satisfaction.[105]

The majority of firms surveyed this year, say they would support the reskilling and upskilling of their teams, with only two percent not supporting re- or upskilling. Currently, research indicates that only 32 percent of New Zealand businesses are actively upskilling their workforce, which is low compared to 45 percent of businesses across Asia Pacific,[106] and insufficient to help bridge the skills gap. Employer investment

in re- and upskilling helps build employee capability and helps workers develop more specialist skills that employers need, which may otherwise be filled by immigration. Despite the overwhelming support, a greater collective action is necessary to facilitate comprehensive upskilling within organisations.

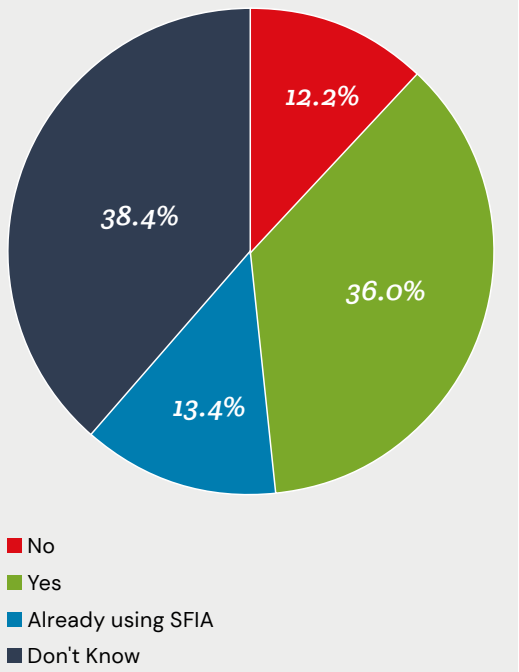
Skills standards and ongoing learning required

To facilitate additional upskilling of employees across the tech ecosystem and ensure the skills being taught reflect industry needs, a more coherent approach across the sector is needed. The Skills Framework for the Information Age (SFIA) is a global skills and competency framework for the digital world, currently in use in over 180 countries. SFIA clearly describes the competencies and skills needed by IT and digital transformation professionals across a number of levels of responsibility.[107] It provides a way for organisations and individuals to assess skills and competencies, measure current capability, and plan for future demand.[108] We suggest raising wider awareness and uptake of the SFIA framework to help facilitate greater collective action.

This year, only 25 percent of our survey respondents are using a digital skills capability framework within their organisation, and only 15 percent reported capability was being measured. Of those tracking capability, most reported using their own system or a skills matrix. When asked if they would consider adopting SFIA within the next year, 36 percent replied yes, 38 percent were unsure, and only 12 percent said no. The high percentage of unsure responses indicates a general lack of awareness or confidence in SFIA. This was emphasised by numerous respondents who stated they do not know what SFIA is or aren't sure if it is relevant to their business.

Increased uptake of the SFIA across the digital technology ecosystem (including tech firms, public sector agencies, tech teams in non-tech businesses and recruiters) will help instill consistency for how digital skills

FIGURE 4: Would you consider adopting SFIA in next 12 months



Source: New Zealand 2023 Digital Skills Survey, NZTech & Toi Mai. March 2023

What is SFIA?

The Skills Framework for the Information Age (SFIA) is a practical resource for people who manage tech workers who develop, implement and protect the data that powers the digital world. The international not-for-profit SFIA Foundation was launched in 2000, but can be traced back to initiatives from the 1980s. It provides a framework of professional skills on one axis and seven levels of responsibility on the other. It describes the skills at various levels of responsibility including autonomy, influence, complexity, business skills and knowledge. The SFIA provides a common language to define skills and expertise in a consistent way. Its universal application means it can be readily applied to technical and non-technical roles.

are described, named and quantified. In addition, the SIFA can enable skills-based hiring decisions, help cross-functional teams communicate and collaborate more effectively, and enable employees to quantify their skills in a purposeful way.

In summary, we see a steadily rising demand for skilled workers in the local tech industry. Despite the turmoil caused by the pandemic and global economic instability, demand for advanced digital skills continues to grow at a relatively steady rate. This is expected to continue with particular demand for skilled workers in AI, big data analytics, cloud applications and cybersecurity.

In theory, this demand can be filled by local supply via university and other training providers, and supplemented by skilled migrants. However, much of the growth in demand is for experienced, senior workers. In addition, due to the fast pace of technological change, tertiary programmes cannot always equip students with the full range of skills required for some roles, so they need to be developed on the job.

This means that what is perceived as a skills shortage could more accurately be described as a skills alignment issue or mismatch. The needs of industry are not being met by the talent available in the local market, which leads

companies to look to immigration to fill many roles. This mismatch was first identified in our 2020 report, but despite efforts from many in the industry and public sector, there has been little improvement. An ongoing, collective effort with clear targets and supporting actions is required to make progress.

Investment in the upskilling of Aotearoa New Zealand's current digital workforce may be a significant pathway to grow the local supply of advanced and specialised skills. People who enter the workforce as graduates value opportunities to develop new skills and capabilities, which can lead to career advancement and better salaries and opportunities. However, New Zealand companies are not currently investing sufficiently in the upskilling of their employees, especially compared with the percentage of businesses upskilling their employees in other comparable countries.

Better understanding of specific digital skills, including increased standardisation, will assist employers and educators in aligning their efforts to help fill the skills mismatch. Systematically adopting the SFIA framework will also help instil consistency for describing and quantifying digital skills.

In the next section, we discuss the current challenges in the local skills supply pipeline, and opportunities to build a more skilled and diverse workforce.

Identifying Challenges and our Supply Opportunities

Demand for digital skills continues to grow globally, with New Zealand employers competing for talent with international companies. Meanwhile, our local digital skills education supply pipeline is leaking, with insufficient numbers to fill demand. However, demand-led growth remains steady, providing an opportunity to create a more robust skills education pipeline.

The Domestic Education Pipeline is Still Decreasing

The education system is integral for developing the technology skills pipeline in Aotearoa New Zealand. It should be possible to fill roles with local talent, but to do so, there needs to be enough rangatahi studying technology subjects at high school and progressing into tertiary study.

These students will need to engage in well aligned education pathways to meet in demand skills. They will also require a diverse range of appropriate opportunities to develop experience and soft skills while training. On completion of their studies, our rangatahi will also need access to entry-level roles and the best support to develop in their careers.

The number of domestic students studying IT subjects at a tertiary level has begun to increase slightly (1% CAGR in 2021, versus -3% CAGR in 2019). However, the total number is still well short of the peak in 2016. Additionally, as a result of the pandemic and decreased international students, the total number of students undertaking tertiary level IT study continues to decline at -1% CAGR.[109]

The diversity of learners is still significantly lacking across technology subjects, in both secondary and tertiary study. Most notably, women, Māori and Pacific peoples remain significantly under-represented.

About the data

In the sections below about secondary and tertiary study, we report on the last five years of available data from 2017 - 2021. The previous Digital Skills Report data is used for comparison for the years 2015 - 2019. More detailed data and methodology for both secondary and tertiary study is included in the appendix.

The continuing decline of tech study at secondary school

In our last report, we noted that despite the 2018 introduction of the new Digital Technologies and Hangarau Matihiko content into The New Zealand Curriculum, there was a five year decline in the number of ākonga learners taking technology subjects at secondary school.

Unfortunately, the trend of declining participation in National Certificate

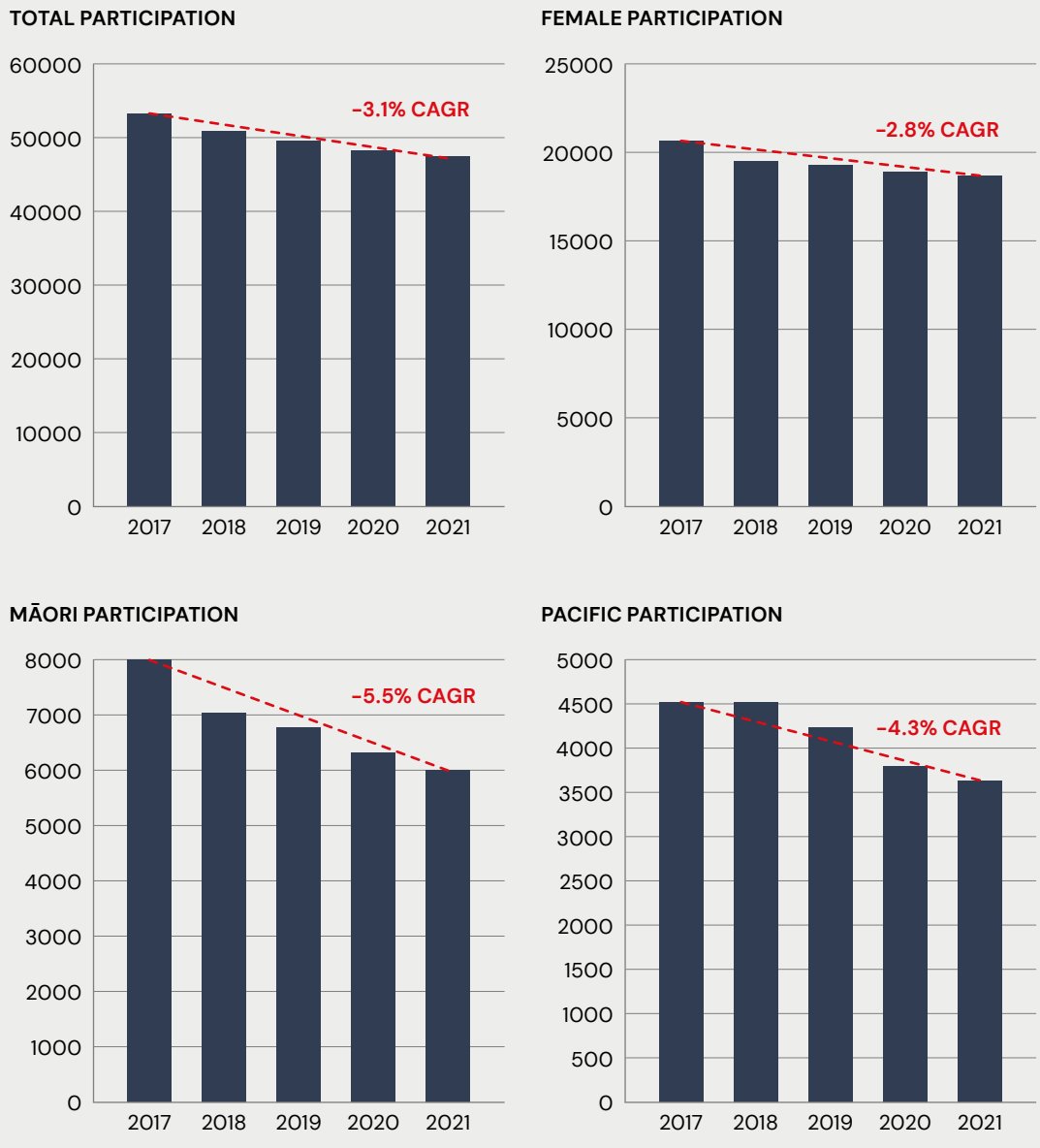
of Education Achievement (NCEA) technology subjects continues. This is despite more ākonga having engaged with computational thinking and digital curriculum outcomes during their time in primary and early secondary education since the last report was published.

Technology standards include mechanical technologies, design and visual communication technologies, digital technologies and processing technologies. The number of learners taking these subjects overall is fairly low – between 2011 and 2020 for example, fewer than four percent of secondary learners took computer science NCEA standards each year and fewer than 10 percent took programming standards.[110]

From 2017-2021, the number of learners taking NCEA technology subjects has declined at a -3.1 percent compound annual growth rate (CAGR). This rate is fairly even between female and male learners. The rate of decline is more pronounced than in the five years to 2019, when there was a -2 percent CAGR.

The participation of Māori and Pacific peoples learners continues to decline, and at a greater rate than previously reported. For the five years to 2021, Māori ākonga participation is declining at -5.5 percent CAGR and Pacific students at -4.3 percent. This is compared to -4 percent and -1 percent CAGR respectively in the last report for the five years to 2019. Notably, for Year 13 Pacific peoples ākonga taking NCEA technology standards, male participation is only declining at -1 percent CAGR, whereas female numbers are declining at -5 percent CAGR.

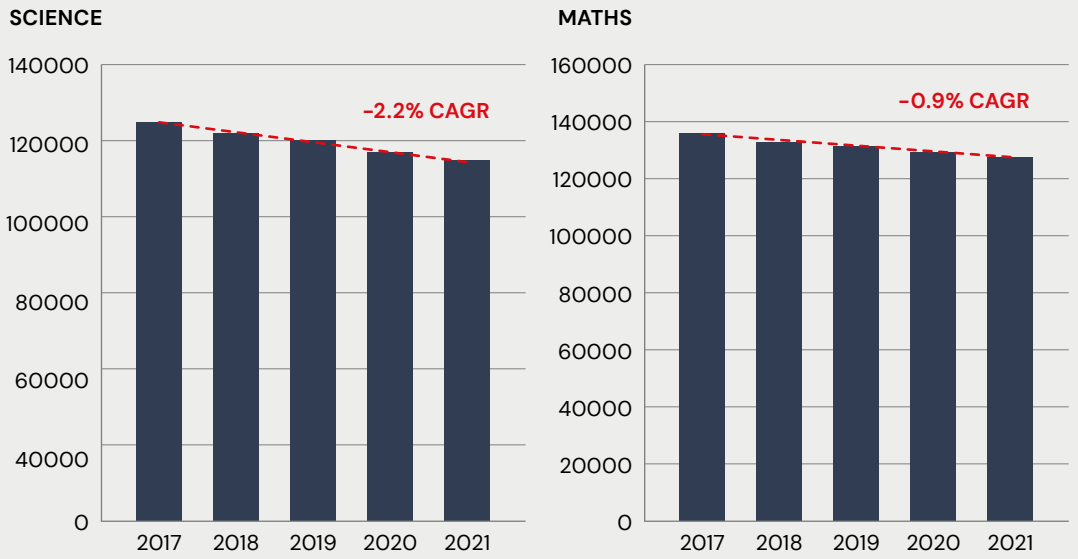
FIGURE 5: NCEA Technology Standards participation, 2017–2021



Source: Ministry of Education, 2023. CAGR by NZTech

Education pathways into technology-related fields typically include study in science, technology and maths (STM). As shown in Figures 5 and 6, the number of participants in these subjects continues to decline. For the five years to 2021, participation in NCEA STM subjects is declining at a rate of -2.2 percent for science, technology at -3.1 percent and -0.9 percent for maths.

FIGURE 6: NCEA Science and Maths Standards participation, 2017 - 2021



Source: Ministry of Education, 2023. CAGR by NZTech

As noted in previous editions, not all rangatahi who study digital technology will embark on a career in technology. However, digital skills have become a vital part of most jobs, whether they are specifically digital or tech roles or not. Learning digital technology skills, especially computational thinking will undoubtedly prepare our rangatahi for greater success in an increasingly digital world.

Participation barriers at NCEA level

To encourage more participation in digital technology at NCEA level, it is important to address the barriers. Research published in 2022 by academics at The University of Otago identified a range of barriers to studying computer science subjects at NCEA level, from the perspective of learners.[111] While this research was focused on computer science specifically, the insights are likely relevant to considering participation barriers more broadly. A range of barriers were identified, including:

- **not all schools offer computer science subjects.** Earlier research identified that

in 2020 for all three NCEA levels, over 50 percent of schools do not offer computer science as a subject.[112]

- **students may prioritise subjects that are required as a prerequisite for university courses.** Computer science not being a prerequisite for computer science degree study was identified as a factor in student attrition, especially in higher levels of NCEA study.
- **a lack of information provided by schools and teachers** about what the standards include and potential career options. Teacher advocacy is a key factor in student retention and "increased and improved training and support opportunities for teachers may increase student recruitment and retention". It was also noted that previous calls for professional development have been made by researchers which have not been fully implemented.
- **a lack of understanding or misperceptions about subjects** can impact learners' decisions. Some learners noted they had limited understanding of the subject before Year 11. This will potentially be addressed over time with the introduction of digital technologies in the curriculum from primary school.
- **access to hardware (for example, computers)** was a factor for some participants and their schools, including access at home. This was particularly identified as a barrier for learners from low socio-ecomonic backgrounds.
- **feelings of isolation or not feeling like they belong in a group was a barrier to female student participation.** The researchers noted, it seems girls who are interested in taking these standards, often don't, because they fear being the minority, or being discriminated against in co-educational schools.[113]

Work is already underway to address some barriers. For example, the Ministry of Education's Discover, Explore, Connect framework for approaching career readiness can be applied to fostering interest and engagement in the tech sector. The framework is a sequence of vocational learning elements that aims to connect rangatahi to their future pathway.[114] In addition, funding has been confirmed for the development of a Domestic Tech Story that aims to inspire more New Zealanders to participate in digital careers.[115]

Tertiary participation is stabilising, but degree numbers are falling.

Analysis of data about information technology, information science, computer science and software engineering participation in the tertiary education system also shows similar

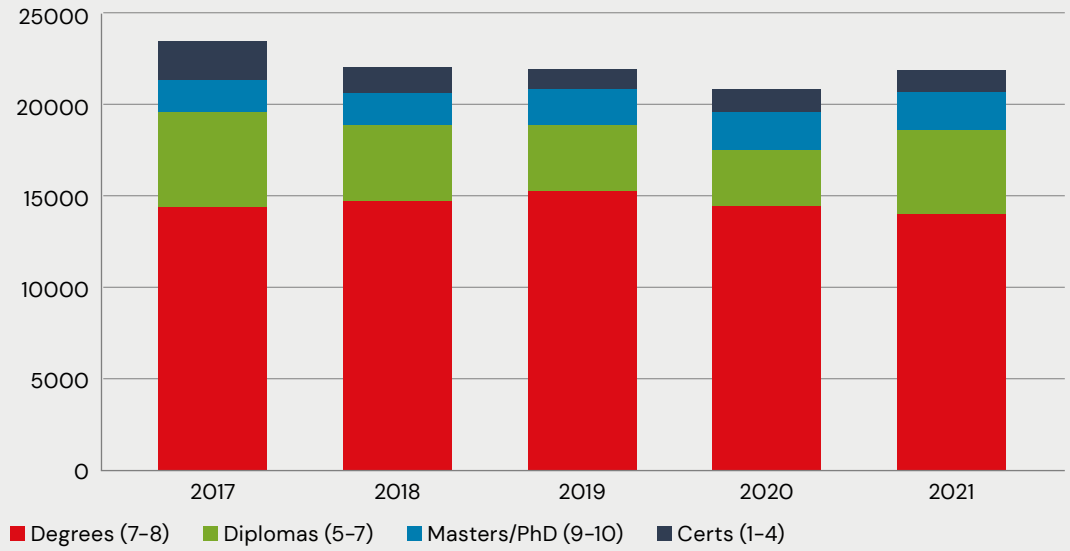
declining enrolment and graduation. In this report, these areas of study are referred to collectively as information technology (IT).

Across all tertiary qualification levels, from Level 1 certificates to Level 10 doctorates, the combined enrollment in IT courses has been declining at a CAGR of -1 percent over the past five years. The rate of decline has slowed since the last report, where there was a CAGR of -2 percent over the five preceding years of enrolment numbers. While there is still a declining rate of student enrolments, the number of overall IT tertiary enrolments in 2021 was the highest they have been since 2017 for all levels of study except degree programmes.

Our previous report found a significant decline in enrolments in certificate-level courses (-20 percent CAGR) and sub-degree diploma courses (-15 percent CAGR) over the five years to 2019. In our most recent data, there continues to be a decline, but this has flattened considerably. For 2017-2021, there is a -6 percent CAGR for certificate level courses and -3 percent CAGR for sub-degree diplomas. While this is a positive trend, the numbers of enrolments in IT certificate courses are still less than half than what they were in 2015. This reflects limited industry demand for lower level IT skills.

Enrolments in postgraduate masters and PhD programs continue to increase year-on-year, with a 10 percent CAGR during the past five years, although this has slowed from the last report where there was a CAGR of 19 percent.

FIGURE 7: Enrolments in information technology courses, by qualification level, 2017 - 2021



Source: Ministry of Education 2023

In 2021, there were 880 more enrolments in IT postgraduate study than there were in 2015. While this growth is positive, in order for these graduates to remain in Aotearoa's talent pool, there must be roles available to match their skill level and salary expectations.

The number of people enrolled in IT degree programmes decreased in both 2020 and 2021. There was a CAGR of -1 percent for the five years to 2021, in contrast to the three percent CAGR noted in the previous report. While enrolments increased steadily between 2017 and 2019, they dropped during 2020 and 2021. Despite this, the number of domestic students stayed steady, with a CAGR of 0 percent. The decrease in international enrolments during 2020 and 2021 can most likely be attributed to the inability for many international students to enter New Zealand due to pandemic related border restrictions. We expect this decline will have a limited impact on the talent pipeline for domestic tech-related roles, reflecting how many of these international students leave New Zealand upon graduation.

While there has been a decrease in degree enrolment numbers, IT degree courses continue to have significantly more students than other levels of study. There were 13,795 degree enrolments in 2021, compared to a combined 8,250 enrollments across the certificate, diploma and postgraduate programmes for the same period.

In 2021, there were 21,570 students enrolled in tertiary level IT courses. However, as these include multi-year courses, a smaller number of students graduate each year. In 2021, 2,640 students graduated across all levels, over half of these in computer science.

Across all subjects, there was a -3 percent CAGR for IT degree graduates over the past five years. In the years between 2015 - 2019 the CAGR was six percent. There was a notable drop-off in graduation numbers for international students, in particular during 2021, again reflecting border closures.

There continues to be far less participation in tertiary study by female and non-binary students compared to their male counterparts. For example, between 2015 and 2021, the number of female IT graduates only increased two percent to 24 percent (635 students). In 2021, gender diverse students were 0.2 percent of total IT degree graduates, or five students (all in computer science).

In 2021, there were 120 Māori graduates (4.5 percent), down from 4.6 percent in 2019. At the same time, there were 110 Pacific peoples graduates (4.2 percent), up from 2.6 percent in 2019. By comparison, there were 1,530 degree graduates of Asian descent and 990 degree graduates of European backgrounds.

Digital Skills Challenges Start Early

Building the Aotearoa New Zealand pipeline of skilled, diverse tech workers starts well before secondary school. Fundamental issues around digital inclusion mean many rangatahi are missing early opportunities to gain digital skills and build an understanding of technology and IT as a potential career path. Access, skills, and motivation (understanding how the internet and digital technologies can be beneficial to individuals and communities) are three of the pillars of digital inclusion.[116]

The Crown-owned technology company, Network for Learning (N4L), which connects

schools and kura to faster, safer internet, reports there are still thousands of students living without internet access at home, and even more without a device that isn't a mobile phone.[117] In 2021, ten percent of schools said that less than half their students can access the internet at home, while 24 percent of schools say that less than half their students can access non-mobile phone devices at home.[118] Students at lower decile schools and smaller schools were more likely to lack access. Pacific peoples learners (secondary school age) are least likely to have at-home internet access, whereas Pākehā students are most likely.[119]

With limited internet connectivity and device access, it is harder for rangatahi to gain fundamental digital skills. This in turn challenges their ability to enter into and succeed at digital and tech qualifications.

The Diversity Opportunity

Throughout efforts to grow Aotearoa New Zealand's supply of skilled tech workers, there is a significant opportunity to increase the diversity of our tech and digital workforces — and significant risks if we fail to do so. Currently, the reliance on immigration to fill advanced digital roles means many digital technology teams are relatively diverse in terms of race and ethnic background. However, the makeup of our tech workforce does not reflect our population, with women, Māori, Pacific peoples, disabled and neurodiverse and non-binary people significantly underrepresented.

This lack of diversity is a longstanding challenge with significant negative impacts. However, it presents a large opportunity to bring new and more diverse participants into the tech workforce, helping fill the skills shortage while also making tech and digital teams more inclusive. Businesses and the government will need dedicated investment and commitment to make this happen.

The gender gap

The number of women working in digital technology roles has risen slightly to 29 percent,[120] only two percent higher than

TABLE 3: Diversity shortfalls

	All Students Yrs 11–13		NCEA Technology Yrs 11–13		IT Degree Graduates		Digital Tech Workforce	
	2015	2021	2015	2021	2015	2021	2015	2021
Female	50%	50%	41%	40%	22%	24%	27%	29%
Māori	20%	21%	15%	14%	3.8%	4.5%	4.1%	4.8%
Pasifika	9%	10%	8%	8%	3.6%	4.2%	2.8%	4.4%

Source: Ministry of Education, Ministry of Business, Innovation and Employment, NZTech.

what we saw in our 2020 survey. Women are significantly underrepresented in these roles compared with national demographics, which currently indicate women make up 50.4 percent of the population.[121] Globally, the number of women in the labour force reached a record high in the fourth quarter of 2022 (since OECD reporting began in 2008),[122] presenting a significant opportunity for more women to be trained or upskilled.

Recent research from Absolute IT indicates women tend to be especially underrepresented in leadership roles, with women making up only five percent of tech startup founders, 23 percent of senior executives, and 18 percent of board members.[123] This lack of women in senior roles means women tech employees may have a harder time finding mentors and role models in the industry, and may be less likely to progress or remain in the industry.

In 2022, the gender pay gap in New Zealand was 9.2 percent.[124] While this gap has reduced since 1998, it has stalled in the last decade. Recent research found men in digital and tech roles typically earned 12 percent more on average in contractor rates, and nine percent more in salaried roles, than women[125] — a slightly larger gender gap than the workforce overall. Internationally, research indicates more than 50 percent of women who join the tech industry are likely to quit before age 35,[126] leading to fewer women in senior roles and fewer women gaining the economic benefits of senior tech salaries.

Low rates of Māori and Pacific peoples IT career participation

Māori and Pacific peoples are also greatly underrepresented in the local tech and digital industry. Respondents to the 2023 NZTech Diversity in the Tech Workforce

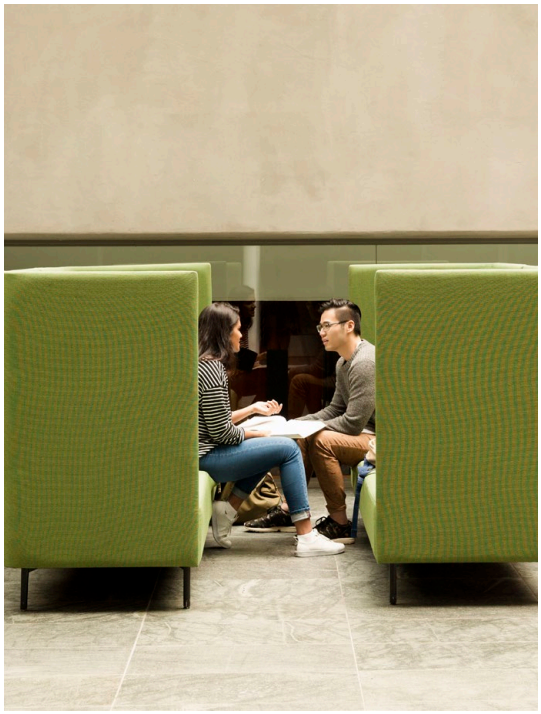
Survey indicate that 4.8 percent of their digital technology teams are Māori, and 4.1 percent are Pacific peoples.[127] This is an improvement from 2020, where 4.1 percent were Māori and 2.8 Pacific peoples. In the 2023 Digital Skills survey 51 percent of respondents say they have no Māori employees in their digital technology teams, and 60 percent say they have no Pacific peoples. While many firms have small digital teams, these low rates of Māori and Pacific peoples employees are still a concern.[128]

An issue with broad scope and implications

We acknowledge diversity extends beyond gender and ethnic representation and also encompasses age, disability status, gender identity, neurodiversity, religion, sexual orientation, socioeconomic background and more. Building digital teams that have a diversity of backgrounds, approaches, and lenses through which they view the world certainly helps companies to better meet the needs of their customers and drive innovation and growth.

Respondents to our 2023 survey reported relatively low rates of disabled and neurodivergent team members in digital roles, with 60 percent not knowingly employing disabled digital team members, and 45 percent with no known neurodivergent digital team members. A not insignificant minority of digital teams stated they have between one and five neurodiverse workers, perhaps reflecting the increased acceptance of neurodiversity, especially in tech spaces.

However, we are aware these numbers may not fully reflect the disabilities and neurodiversity of the tech workforce. People are not



compelled to report their neurodiversity or disability status to employers, nor is it legal for employers to require employees to provide this information unless it pertains to their ability to carry out their job.[129] This also includes information regarding ethnic and gender identity. This data may be based on employer assumptions or self reporting and should only be considered indicative.

For employers, increasing diversity is also important for competitiveness and business success. Research from McKinsey shows companies with more women executives tended to perform better than those with fewer women executives. The most gender-diverse companies have a 48 percent higher likelihood of outperformance than the least

gender-diverse companies.[130] The numbers were equally compelling for ethnic and culturally diverse companies too. In 2019, companies in the top quartile of ethnic and cultural diversity outperformed those in the bottom quartile by 36 percent in profitability.[131]

Beyond improved company performance, diverse tech workforces also have positive implications for the products and services being built and deployed. Diversity of thought ensures products and services a company is designing are more likely to be inclusive. For example, product designers with lived experience of disability, are less likely to replicate the pattern of designing digital tools only for the majority of users with perceived 'normal' needs, excluding those with accessibility challenges.[132]

The key to realising the social and economic benefits of diversity is ensuring a culture of inclusion and fostering a sense of belonging for all employees. Not only should companies have robust policies preventing discrimination and harassment, they should also avoid unconscious bias. They must also take proactive steps to ensure their workplace is safe, welcoming, and culturally relevant for people with a wide range of lived experience.

Beyond diversity awareness to strategies and policies

Now is the time to move beyond diversity awareness and ensure the diversity of workplaces through policies. This year's survey found 59 percent of respondents had a diversity policy in place. Others reported "we don't have a strict diversity policy, but diversity is part of our core values and therefore we build this into all aspects of recruitment, culture and team development," and "we would welcome support to the sector to increase diversity."

This widespread attention to workforce diversity is positive, but must be supported throughout the training and workplace ecosystems.

Supporting diversity begins early, with educators, whānau and communities all playing a pivotal role in increasing the visibility of digital tech opportunities.

> *"One of the key blockers to minority groups getting into technology is a lack of visibility and access to technology at a young age."*
>
> – Digital Skills Survey deep dive interview respondent

It is also important for businesses to have processes and policies in place to support diverse candidates applying for, and staying in roles.

For example, Employment New Zealand provides guidance to businesses about employing disabled people and considerations to make. This includes ensuring application information is accessible, focusing on the ability of the candidate to carry out the essential parts of a role, providing appropriate accommodations and using effective interviewing techniques.[133] Another approach to ensure a diverse range of candidates in the application pool may include active outreach for potential candidates.

The Māori-owned Tech Ecosystem

There are numerous factors influencing the participation and success of Māori in Aotearoa New Zealand's tech sector. Ensuring opportunities and resources for advanced digital skills training requires a broad range of efforts.

Research shows the key enablers to foster a sense of belonging include enhancing Māori leadership and profile, creating culturally safe and literate workplaces, and providing culturally anchored support networks in tech firms.[134]

Along with ensuring companies continue to foster Māori tech talent, Māori-owned tech companies also play a significant role in representation.

There are currently around 72 Māori-owned tech companies in Aotearoa.[135] These range from small or early-stage companies with low revenues and limited access to the right technology skills, up to large and mature companies that employ significant numbers of people and have a sustained business model. Overall, the six Māori tech companies that are on the list of the top-200 largest tech companies in New Zealand brought in 196.3 million in revenue in 2022, up 17.74 percent from 2021.[136] For many Māori-owned businesses, the focus extends well beyond profits, to an interest in "purpose, people and te taiao".[137] Te Taiao is the environment around and including us. It includes whenua land, wai water, āhuarangi climate and koiora living communities.These aspects contribute significantly to employee wellbeing and positive social impact.

A higher proportion of Māori tech workforces are grown within Māori-owned companies than anywhere else.[138] One survey respondent from a Māori-owned company noted that growing their Māori workforce was a priority.[139] Another noted their company employs 90 percent Māori workers, with an emphasis on being better kaitiaki of rangatahi Māori and attracting older Māori tech workers with excellent skills "who wish to bring themselves 100% to their workplace". [140]

72 companies

1,310	*669*	*36*	*81%*
People employed by Māori tech companies	Combined years of business experience	Years is the oldest company	Are micro or small businesses

The 9 top earners

$5m-$73m	*89%*	*100%*	*78%*
Revenue range of the top 9 companies	Operate internationally	Operate in the top 4 global trend areas	Are medium & large businesses

Source: : Toi Hangarau: A Report on Māori-owned Technology Companies 2023

Education to Employment Challenges

Ensuring an adequate supply of students at a tertiary level is only one aspect of solving the skills shortage. Without additional experience, IT graduates are often considered underprepared by potential employers. Many survey respondents noted the need for practical work experience, soft skills and business knowledge in order to thrive in digital roles. This section explores the key challenges and opportunities to expand internship programmes, and foster digital apprenticeships and traineeships.

> *"Often traditional education organisations can teach the fundamentals correctly, but completely fail when it comes to helping students with implementation and actually building/creating output. So many people we come across are on-paper-smart, but really struggle to execute when in the arena."*
>
> — Digital Skills survey respondent

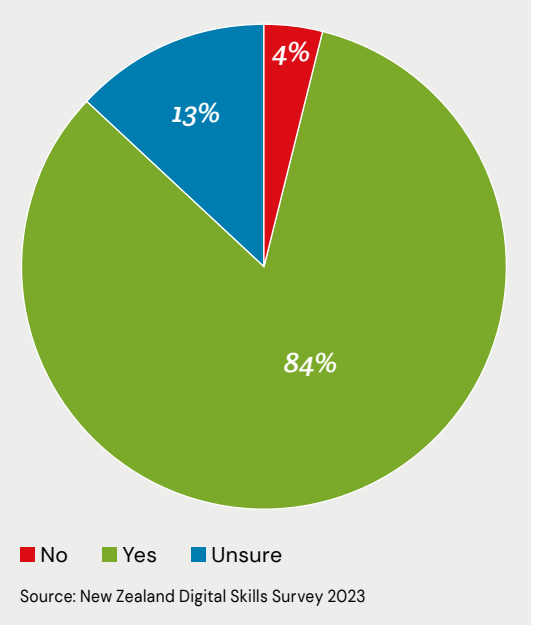
Nurturing work-ready graduates

Businesses often report their needs for skilled and experienced employees cannot be adequately met by new graduates. Survey respondents expressed concerns that university graduates were not up to date with contemporary business practices and workflows, or lacking a sense of everyday work routines. This is not a new problem — similar issues were reported in previous surveys.

The digital technologies ITP has identified building and enhancing pathways into digital tech careers as a priority area. Actions include "Developing work-integrated pathway programmes, prototypes and models initially focused at Level 5-7 education and training (including short courses and micro-credentials) and supporting tailored approaches targeted at raising diversity."[141]

Our survey respondents were generally in favor of more blended options, including micro-credentials and other forms of work-integrated learning. These avenues will help ensure graduates and junior employees are equipped with the required skills. Eighty four percent of respondents were also in favour of creating qualifications that include work-integrated learning or apprenticeships, with only four percent not in favour.

FIGURE 8: Support for work integrated learning or apprenticeships



Source: New Zealand Digital Skills Survey 2023

Blended pathways to employment can include internships undertaken during or immediately following a course of study, and apprenticeships or traineeships that blend on the job training with vocational study as an alternative pathway into the technology industry. An integrated work experience will also help strengthen the pipeline by offering employers better resources to support staff entering the workforce. The digital technologies ITP includes "Providing guidance and resources (e.g. playbooks, good practice advice, templates and training)" for employers to support junior staff as another action to enhance the skills and talent pipeline.[142]

Underutilised internships

Internships are a key way for students to gain practical work experience in a business setting. Currently, most courses require some form of internship, meaning there are many students looking for internship opportunities each year. Internships are facilitated by either education providers, external providers or independent programmes run by organisations. External provider the Summer of Tech, is the country's biggest internship placement organisation. However, not all students are able to secure internships and many companies do not utilise interns on a regular basis due to perceived constraints such as resource requirements and costs.

The percentage of organisations reporting they have taken on interns has increased since our last report, indicating a growing understanding of their value. In our 2021 report, at least 42 percent of respondents had never taken on an intern, and only 15 percent had used the Summer of Tech programme. In 2023, 46 percent of respondents had engaged with interns during the last year, and two thirds of these respondents said they had gone on to employ one or more of their interns from the past year.[143]

There is moderate awareness among respondents of the various programmes that help place interns. Sixty two percent of respondents are aware of Summer of Tech, 53 percent are aware of university ICT grad school internship programmes, and 40 percent were aware of other internship programmes. A lower number have used these programmes — 19 percent had used Summer of Tech programmes and 26 percent had used ICT grad school programmes.[144]

In 2022, Summer of Tech placed 439 interns out of a total of 2,438 students and graduates registered with their programme. This 18 percent placement rate reflects an increase over 2021, likely due to lower registration numbers in 2022 and the fact that Summer of Tech ran recruitment seasons in March and June, as well as their regular September drive.[145]

Around *80%*
of Summer of Tech interns are on-hired by their employer following their internship.

However, according to Summer of Tech, the rate at which interns are on-hired by their employer is very high, with consistently around 80 percent of interns on-hired by their employer.[146] Interns and employers both report satisfaction and value from internships, with 98 percent of employers noting that interns are either extremely, very or somewhat valuable.[147]

CASE STUDY

Rise at HCLTech fast-tracks tech careers

Rise at HCLTech is a 12-month pilot programme in Hamilton which aims to provide job seekers and people returning to work with the skills and experience they need to start or fast-track a career in technology. It is a joint pilot between HCLTech, a global technology company that has been operating in New Zealand since 1999, and the Ministry of Social Development (MSD) in Hamilton. The programme also has support from the wider government, business and education sectors in the Waikato.

The two part programme commences with three months of free online modules and virtual instructor-led training including IT essentials, ethics and business communications. Participants then spend nine months in a paid, part-time digital apprenticeship at HCLTech where they receive stream specific skills and on-the-job training. During this phase they are also supported with pastoral care.

The first intake of more than a dozen students are part way through their paid apprenticeships at HCLTech Hamilton headquarters. The programme focuses on providing opportunities for those currently underrepresented, including women, Māori and Pacific people.

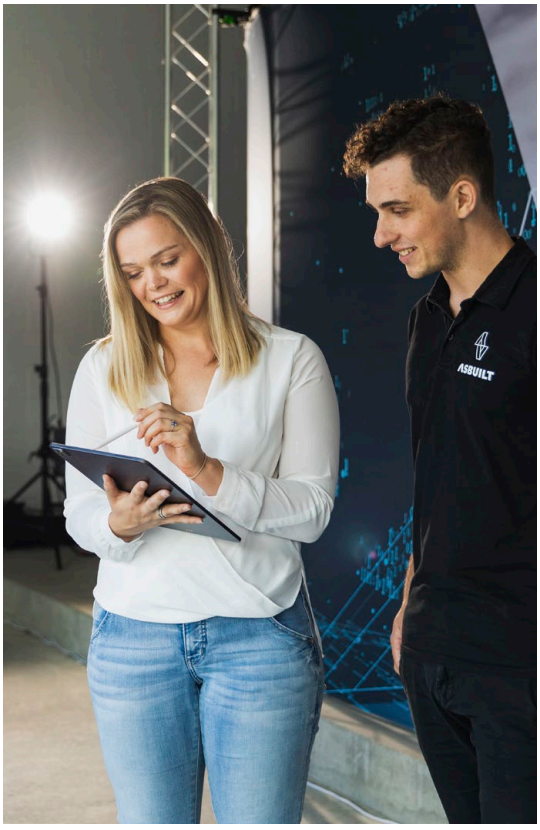
HCLTech's Country Head for Australia and New Zealand, Michael Horton, said the pilot programme demonstrated the government's willingness to work with industry partners to create solutions.

"Rise at HCLTech provides a solution to a real world problem: it enables someone with even limited IT skills to be job-ready within a year. That's a powerful proposition and one that was immediately recognised by a range of stakeholders, including the Ministry of Social Development, the education and business sectors, and HCLTech's New Zealand clients," he says.

When the pilot is completed in late 2023, HCLTech and its partners will assess the programme outcomes and explore opportunities for its expansion.

Commercial benefits and barriers in taking on interns

Employers overall have expressed the need for junior employees to gain real world experience, and internships undertaken as part of (or immediately following) a training course is a valuable way of enabling this. Interns are also valued by employers, with 82 percent of 2023 survey respondents saying interns should be paid, and only five percent saying they shouldn't be paid.[148] The leading industry groups, NZTech and IT Professionals advocate for paid internships to ensure equity in the system.



> *"Internships provide a valuable pathway for the interns to gain/ demonstrate this capability and for organisations to develop these capabilities in-house from those with good knowledge."*
>
> — Digital Skills survey respondent

However, while employers perceive great value they also report numerous barriers for internships. The cost to companies is cited as a significant concern, in terms of both overhead and management/ supervision needs. Summer of Tech noted interns were paid an average of $27.41 per hour, up by 16 percent since 2019.[149]

Companies also reported the time needed to onboard interns can impact daily work and product delivery, and that supervision requirements can be onerous. Despite the long term benefits of interns, there is a cost to companies in the short term. Small companies also noted it was demanding to find the capacity to train and supervise interns. Finding well-matched interns and ensuring there was appropriate and substantive work for them was also a challenge.

Overall, survey respondents were very positive about internships as a tool to bridge the skills gap between training courses and real world experience. A number of respondents also noted that additional support would make it easier and more appealing to take on interns. For example, a centralised programme to provide guidance and help offset the financial burden would make it easier and more appealing to take on interns.[150]

CASE STUDY

Summer of Tech provides pathways for students and recent graduates

Summer of Tech was founded in 2006 by a group of startups eager to engage students over summer for web and software development projects. Originally a programme designed to connect companies with inexpensive junior talent, Summer of Tech has grown into a significant programme that helps hundreds of students every year to gain practical work experience (and get paid!).

In addition, internship opportunities are only one aspect of the Summer of Tech programme. Career bootcamp sessions give potential interns training in CV preparation and mock interviews, and industry professionals offer advice about career paths in the tech industry.

In 2022, 6000 students and graduates registered with Summer of Tech, with 2438 of these completing their registration and having a live profile.

Of those who participated in 2022, 439 were placed in internships — a far higher proportion than the year before. A high percentage (75-80 percent) of interns were retained in their roles beyond the internship. Summer of Tech noted somewhat sporadic engagement in 2022, likely due to a number of factors including ongoing Covid-19 impacts and students' need to balance school and work during a time when cost of living was rising steeply.

As reflected elsewhere in this report, placing interns can be challenging. Summer of Tech noted that in 2022, the hiring landscape was affected by the lack of intermediate and senior staff to mentor juniors, and budgetary concerns due to effects of Covid-19 and the cost of living crisis.

Callaghan Innovation's Research and Development (R&D) Experience Grants are an example of a programme providing funding support to enable more businesses to employ tertiary-level students. The Experience Grants are available to businesses considering engaging recent graduates in science, technology, engineering, design or business on research and development projects. This includes many digital and ICT grads, although not all businesses in the tech industry are eligible. The grants provide funding of $9,460 (plus GST) for 400 hours of full-time work per intern, and ensure students receive a minimum of $23.65 per hour.[151]

Expanding the availability of internship grant schemes to enable businesses not engaged in R&D to obtain funding would likely help increase the uptake of internships. This type of simplified internship grant could be administered by an organisation like Summer of Tech. Based on our research and survey respondents, it is likely an expanded grant programme would result in an increase in the number of experienced and work-ready graduates entering the workforce. In the

follow up Deep Dive interview with a survey respondent from a major New Zealand tech firm, they emphasised the importance of Experience Grants, and the potential for expanding this or other similar programmes.

> *"What enabled it for us initially in taking on Summer of Tech graduates, was the fact that Callaghan Innovation pays for their wages over the ten week period while they're an intern. What's unfortunate is that this only funds people who are, I think, NCEA level seven and above ... there's no funding for people who are a bit more marginal, who we would like to support, but there is no funding in place for them."*
>
> – Digital Skills Survey deep dive interview respondent

The Ministry of Social Development (MSD), also offers a range of support to employers requiring skilled employees.[152] For example, Flexi-Wage is a programme which helps employers hire staff and ensure they have the skills they need for the job. Depending on the support needed, employers can get a wage contribution of $276 a week (including GST) for 24 or 36 weeks. There is also ongoing support and training provided if it is required. Unfortunately, only two percent of survey respondents were aware of MSD grants to support organisations hiring more entry level people and less than one percent were aware of the availability of Work and Income (WINZ) support.

Public sector graduate programmes have potential, but currently lack scale

There are a number of tech and data-related graduate programmes across government agencies that provide entry-level roles and support to people who have recently finished study, including:

- the GovtTechTalent grad programme, administered by the Department of Internal Affairs, with participants undertaking eight month placements across three different government agencies[153]
- the Analytics and Research in Government (ARG) graduate programme was piloted by StatsNZ in 2022, and is being moved to a permanent programme[154]
- the GCSB runs an annual Graduate Programme for people with technical skill and interest across a number of IT specialties.[155]

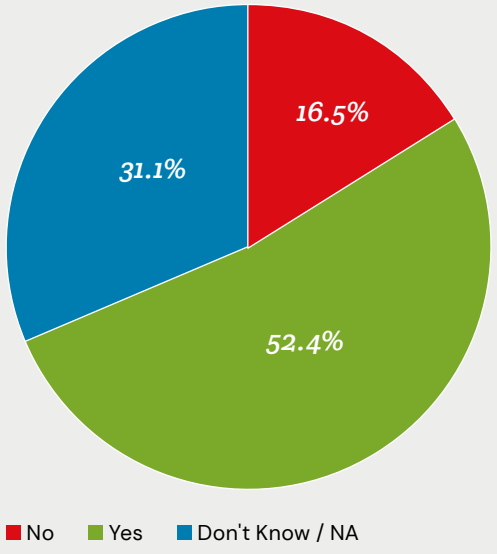
While these graduate programmes cover a broad range of data and tech roles, the scale is fairly small – for example, GovtTechTalent cohorts for the seven years of the programme have had about 20 graduates, and fewer than 10 agencies have signed up. However, with additional funding and a joined up approach across agencies, there could be significant opportunities to scale these programmes.

Making digital apprenticeships a reality

In our 2020 report, one proposal to help meet the demand for more experienced junior employees was a coordinated, national apprenticeship programme targeted at tech professions. This could alternately be framed as a traineeship programme. Although traineeships and apprenticeships

are generally similar, in some industries apprenticeships are longer in duration and more structured. This apprenticeship concept was widely supported by our survey respondents in 2020, and was reflected in the report's recommendation to develop digital apprenticeship pathways. However, little progress has been made on specific digital apprenticeships since the report's publication.

FIGURE 9: Would you hire an apprentice in next 12 months



Source: New Zealand Digital Skills Survey 2023

In our 2023 survey, we again asked respondents for their interest in and appetite for digital apprenticeships. Overall, people expressed keen interest in apprenticeships and other integrated learning options. Some noted similar reservations to those expressed regarding internships — apprenticeships would be more challenging for small companies.[156] Fifty two percent of respondents said they would hire an apprentice in the next year if it was available as an option.

> *"Tech desperately needs apprenticeships. We have hired grads who have spent three years in a tech course and don't know what an API is. They're being taught outdated technology and poor processes and standards. Additionally, a three-year degree before you can start making money kills diversity in the industry. If you are a person who needs to support your whānau, three years is going to drive you out of the industry."*
>
> — Digital Skills survey respondent

Apprenticeships or traineeships would help ensure that training is better aligned to industry needs, and learning is aligned with relevant on-the-job experience. As one respondent noted, an industry-led apprenticeship model may also provide a pathway for a more diverse group of employees to enter the tech workforce, as it would allow apprentices to earn while they learn rather than spending months or years as an unpaid student.

> *"Some people are more suited to hands-on learning rather than academic learning"*
>
> — Digital Skills survey respondent

To support the creation of viable digital apprenticeships additional support and clarity

CASE STUDY

A collaborative approach to closing the cybersecurity skills and diversity gaps

In 2023, TupuToa, Te Pūkenga New Zealand Institute of Skills and Technology and Microsoft launched a joint initiative to help address the significant need for cybersecurity experts in New Zealand and boost Māori and Pacific participation in the tech sector. The initiative trains Māori and Pacific students in cybersecurity skills, preparing them for a career in the industry.

The first cohort of 30 Māori and Pacific students started their journey in April 2023. In future, the cybersecurity micro-credentials offered by Te Pūkenga will be open to all learners. During the training, Tauira learn on-campus and in the workplace over a six month period. Through Te Pūkenga, they will take newly developed curriculum which includes a range of topics: network security, cyber-security management, ethical hacking and testing, cryptography, information system security and cybersecurity data analysis. Tauira will also receive wrap-around pastoral care from TupuToa, including career preparedness workshops and industry exposure with TupuToa partners. Microsoft is on board as an enabler for the collaboration, and some of its credentials are included as part of the training program.

The initiative has also been welcomed by the Ministry of Social Development.

"This programme provides an opportunity for people to upskill and move into skilled employment, and we are proud to be supporting Te Pūkenga with this new endeavour," said Mark Goldsmith, Regional Commissioner for Auckland Central/East.

Tokona Te Raki and Te Whatu Ora were invited to bring participants on to the training which would help further research being conducted by Tokona te Raki, for a separate research project, funded by MBIE; He Manu Kurutao. This initiative will help address the significant need for cybersecurity experts in New Zealand and boost Māori and Pacific participation in the tech sector.

Future cohorts of Māori and Pacific will have the opportunity through TupuToa to participate in any future programmes.

This innovative approach to upskilling and supporting Tauira recognises that collaboration between industry, NGOs, government and training providers is needed to address the digital skills and diversity gaps in Aotearoa New Zealand.

for employers on their responsibilities will likely be required. Thirty five percent of respondents suggested funding support including tax incentives, subsidies, or grants would be needed for them to consider employing an apprentice. Others noted a managed programme of support or pastoral care for apprentices would be beneficial, and guidance on how to manage apprentices and what they should be learning would be helpful.[157]

Some government support is readily available for employers engaging apprentices. For example, the Apprenticeship Boost programme, administered by WINZ, pays eligible employers $500 a month (ex GST) to assist the employment and retention of apprentices. This programme is available until the end of 2024 however it is currently not available to IT employers for entry-level staff.

Balancing Reliance on Immigration

The impacts of the pandemic clearly illustrated that relying exclusively on immigration to fill the majority of tech roles is not viable. Digital skills are highly mobile and historically, local organisations have been able to access the required talent from the global pool of tech workers. However, overreliance on immigration means global events like the recent pandemic and the subsequent border restrictions can easily disrupt the availability of tech talent, and threaten the ability of local companies to fill necessary positions. In addition, reliance on skilled foreign workers can also result in an underinvestment in local tech talent.

In its Aotearoa's *Digital Priorities in 2023* report, TUANZ notes the influx of digital skills from migrants and returning New Zealanders that digital leaders expected after international borders reopened did not come to fruition.[158]

"Even though the visas are coming and the people are coming from offshore, it's still a slow process to find talent and get them here," KPMG Cyber security Services Partner Philip Whitmore told TUANZ.[159]

Given the current landscape, New Zealand should balance the ongoing need for skilled migrants with a focus on developing critical skills domestically. Balance is important — immigration is still valuable, not only for the specialised skills it can provide. Migrants bring new knowledge and connections to global networks, and increase Aotearoa's population and cultural diversity. The digital technologies ITP reflects this dual need, noting "there will always be specialist skills that cannot be sourced locally. Immigration will therefore remain important to ensure the tech sector can grow and thrive."[160]

"For [the] digital sector it would be useful to decrease work visa process timing, to hire more experienced staff from overseas, who can share their experience with local staff."

— Digital Skills survey respondent

To help address skill shortages, the government opened additional residence pathways in 2022 to facilitate the entry of highly skilled digital workers: the Green List, a straight-to-residence option for specified tech roles that meet a salary threshold; a two-year work-to-residence pathway for highly paid migrants; and the reopening of the Skilled Migrant Category.[161] However, both government and industry agree increased immigration must occur in concert alongside the development and upskilling of domestic tech talent.

Alternative Pathways

Degree programmes are an essential component of the tech education ecosystem. However, as previously noted, not all people who could excel in tech careers are well suited to tertiary study, either because they prefer hands-on learning or because the resources required to complete a degree programme is not an option for them.

The focus on traditional education pathways can prevent students, funders, and government from considering and investing in alternative pathways. Shorter programmes, including boot camps and micro-credentials, can be effective routes to developing digital skills.

Increasingly, employers are recognising non-degree certifications and training. In recent Gallup research, 71 percent of employers said digital certifications or training courses are acceptable substitutes for a bachelor's degree. [162]

Dev Academy Aotearoa is an industry-driven education programme that trains people as developers through an intensive 17 week bootcamp course. As a hybrid programme,

CASE STUDY

3 Bags Full: opening tech pathways for rangatahi and career-changers

A simple question launched 3 Bags Full (3BF): why aren't there more Māori and Pacific workers thriving in the digital and tech sectors? The 3BF founders are aware of the challenges facing Māori and Pacific rangatahi and career-changers considering the tech industry. Its programme provides mentoring support, and facilitates job placements where they can succeed and grow. In 2022, 3BF programmes assisted 54 people into new tech careers with salaries ranging between $51,000 – $83,600.

Their approach considers the factors preventing Māori and Pacific rangatahi from entering tech careers, and helps bridge these gaps in culturally-specific and holistic ways. Acknowledging that for many rangatahi, making money to support their whanau can take priority over education and career planning, 3BF built an 'earn while you learn' programme.

Participants in MSD's Sisters in Tech programme, delivered in partnership with 3BF, Microsoft and NZTech, illustrates the power of wraparound support for those who may otherwise not have considered the possibility of working in tech.

"There's a community feeling, unlike normal recruitment companies" said one wahine after completing a law degree but unable to gain employment. Another, who entered the programme after a long stretch of unemployment, said it "isn't just a tech programme or a work activity from MSD... It is a stepping stone to move forward in my journey of self-discovery."

it enables students to build foundation skills through remote study before attending an intensive in-person nine week course.

Dev Academy also focuses on soft skills and ethics, producing job-ready graduates. To date, they cite an 86 percent employment rate in 2023.[163] Dev Academy's graduating cohort tends to be more diverse than the industry, with 43 percent of 2022 graduates being women, 14.6 percent Māori and 4.2 percent Pacific peoples. These numbers reflect the significant impact of the Targeted Training and Apprenticeship Fund (TTAF).[164]

TTAF ran from mid 2020 until the end of 2022, and made a range of training and apprenticeship programmes at sub-degree level free for learners in specific industries.[165]

To meet the skills needed to thrive in this changing world, businesses will need to ensure they can upskill their staff to use new technologies, and education programmes will need to ensure they are evolving to teach newly relevant skills.

CASE STUDY

AWS re/Start

The AWS re/Start[172] free workforce development programme was launched in New Zealand in March 2021 and prepares unemployed and underemployed learners for entry-level cloud computing careers. AWS collaborates with Te Pūkenga to deliver the program locally. Around the world, AWS re/Start connects over 98 percent of graduates with job interview opportunities. Both public and private sector Kiwi organisations have provided internships and employed graduates from the program. This includes Auckland Council, Datacom, KiwiRail, Ministry of Business, Innovation and Employment, Ministry of Social Development, and Spark Business Group.

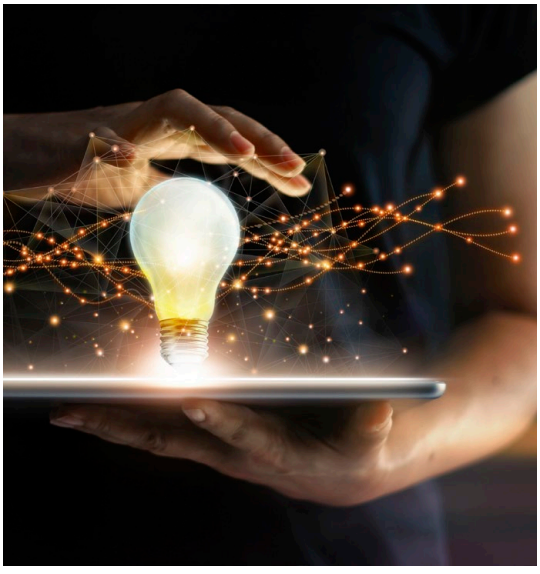
In March 2023, AWS and Te Pūkenga launched AWS re/Start Associate, a new track under the AWS re/Start program, to help unemployed and underemployed IT professionals to modernise their skills and pivot to mid-level cloud careers. AWS re/Start is helping close Aotearoa's skills gap by helping Kiwis to launch cloud careers, organisations to increase their competitive edge, and communities – especially Māori and Pasifika – to thrive and grow.

AWS also runs free programmes such as AWS Hāpori Wahine,[173] a 4-week initiative for women to build cloud skills to prepare individuals for entry-level cloud jobs. The impact of such programmes is real – Hamilton mum and AWS Hāpori Wahine graduate Tori Newing,[174] and former construction worker and AWS re/Start graduate Ash Foster,[175] are both now pursuing careers in tech. AWS also supports initiatives such as Indigitech, which provides low decile schools with free access to online learning software on science, technology, engineering, and mathematics (STEM) and coding topics.

Supporting career-changers

Reskilling provides opportunities for mature workers and career-changers to enter the tech industry for the first time. However, it tends to be more intensive and expensive, as it requires more comprehensive training so people can successfully transition to entirely new roles in new sectors. The loss of opportunity to be in work, and the cost of course fees, are barriers in this context.

Accelerator programme Mission Ready HQ provides numerous case studies of students who successfully transitioned into digital careers from the humanities, service roles, and full-time care work.[166] In 2022 through its accelerator programmes, Mission Ready HQ trained 400 students in digital tech pathways (up from 100 in 2021), offering upskilling for people with existing coding and tech experience and reskilling for people coming from other careers, leading to 86 percent of graduating students finding employment in the industry within six months.[167] Another leading provider of reskilling, Dev Academy, graduated 335 students in 2022, up from 208 in 2021, demonstrating an increasing demand for reskilling into digital technology careers.[168]



Upskilling presents more immediate opportunities to move people into high-demand roles or adjacent roles, and to offer employees the opportunity to find more career fulfillment or earn higher salaries. Upskilling can be self-directed, for instance through LinkedIn Learning, which offers thousands of short online courses taught by real-world professionals. The Ministry for Social Development (MSD) and industry partners offer free LinkedIn Learning licenses to jobseekers, with at least 3500 platform licenses issued so far.[169]

However, workplaces can also benefit greatly by upskilling their workforces. In recent research, desire for career development and concern that their skills aren't being utilised are two of the top five reasons tech employees cited for changing jobs,[170] which indicates that offering opportunities for upskilling can also help slow down job churn and help with employee retention.

Respondents to our 2023 survey expressed a high degree of interest — 85 percent — in supporting the upskilling and reskilling of staff. Seventy percent cited training and development opportunities like courses and workshops as a way they would support reskilling and upskilling.[171] We suggest that a nationally coordinated approach to IT upskilling, including the use of the SFIA framework, would make a significant

contribution to filling the demand for advanced skills and ensuring domestic workers have opportunities to advance their careers. This approach may need to include funding or financial support for employers to upskill their current workers, or guidance to help ensure workers are gaining the skills most likely to be needed in the tech workforce of tomorrow.

Industry-Government cooperation can be impactful

The technology industry has set ambitious skilling goals in Aotearoa and there are some examples of cooperation with the government on aligning shared goals. For example, in collaboration with the New Zealand government, AWS intends to provide cloud skills training opportunities to 100,000 Kiwis over five years through a range of local and global training programmes. While undertaking this workforce development they will identify opportunities to drive greater diversity in the technology sector by training underrepresented communities including women, Māori and Pacific Peoples. Future areas of collaboration include recognising industry-led skilling programmes within the National Certificate of Educational Achievement (NCEA) and aligning them with Skills Framework for the Information Age (SFIA). There are also further examples of industry (including beyond the tech sector) and government working together to improve Aotearoa's digital literacy and cybersecurity capabilities, for example the Cyber Skills Aotearoa programme, available in New Zealand schools.

In summary, despite a growing array of initiatives and programmes designed to increase the domestic supply of skilled digital workers, there is still insufficient supply to meet the demand. The leaky pipeline means many learners drop off digital pathways before gaining employment.

In 2023, the supply challenges are similar to those reported in 2020. Broad public awareness of the skills shortage and the increasing range of interventions designed to bring more people into tech careers are encouraging. However, the skills support ecosystem remains ad hoc and fragmented, requiring collective action to make an impact. The recent release of the Digital Technologies ITP reflects a government focus on digital skills and an investment in programmes and initiatives to help build New Zealand's digital landscape and skills pipeline.

The evidence clearly shows further coordination and investment is required to secure our domestic skills pipeline. The lack of movement since our last report indicates that incremental efforts are not sufficient. A strong digital skills pipeline is needed to enable our tech companies to grow and mature.

As stated in 2020, collaboration between industry, education and government is essential. Government funding is necessary, but companies also need to invest in upskilling and recruit entry-level staff. Co-funded skills initiatives including those featured in our case studies are encouraging and should be developed further. Overall, the fast pace and scale of digitalisation and broad uptake of cloud and AI technologies requires a coordinated approach to growing Aotearoa New Zealand's skills pipeline.

PART THREE
Enabling Aotearoa's Future

Conclusions

We know why we need to improve the digital skills pipeline. We know the economic and social benefits of creating a strong vibrant tech ecosystem that is creating jobs, growing exports and lifting productivity. We even know the challenges and where to focus our efforts. We have seen a growing number of initiatives trying to 'solve' the problem but the data hasn't improved.

The digital skills problem is complex, national and system wide, and now we know that it will require coordinated effort and collaboration between industry, government and education.

It is time to end the rhetoric, double down on what is working, and take a much more coordinated and collaborative approach. Instead of everyone coming up with their own individual solutions to solve the skills mismatch, it is time for large national coordinated initiatives that are supported by industry and government together.

The launch of the Government's *Digital Technologies Industry Transformation Plan* (ITP) in May 2023 indicated a commitment to collaboration between industry and government to drive transformative change for the digital sector. It lays out four immediate focus areas for action and investment to support the digital sector and economy, one of which is "enhancing the skills and talent pipeline." Recommendations and findings from the 2020 *Digital Skills Aotearoa: Digital Skills For Our Digital Future* report fed into the ITP process, with recommendations from the Digital Skills report around skills needs and actions reflected in the ITP.[176] The Government further committed to supporting improvement in digital skills pathways by announcing an additional $27 million in Budget 2023 to support digital skills initiatives in the ITP. [177]

The introduction of a Workforce Development Council for tech and creative industries, Toi Mai, brings additional maturity to the system. The Digital Skills survey respondents show an increasing industry desire to engage in solutions to help build a stronger and more diverse domestic workforce. Yet for most small and medium businesses the financial and resource barriers are real. Therefore it is time for leadership from both Government and the leading employers of digital talent in Aotearoa New Zealand.

Key Recommendations

This study was undertaken as part of the Government's Digital Technologies Industry Transformation Plan to provide current data to help identify the best ways to address reported skills shortages so the sector and the general economy can continue to grow and prosper. The report makes the following recommendations:

#1 Our Collective Response to Digital Skills Challenges needs to Mature Rapidly

For several decades there have been reported IT and digital skills shortages, both locally and internationally. There have been several reports on the subject and many initiatives developed to address various aspects of the challenge. The New Zealand Digital Skills report (2017) aggregated the data and initiatives for the first time and quantified the challenge. The second edition (2020) identified the key pain points and tried to target industry, education and Government action. This third edition (2023) finds that even though effort, money and resourcing is being applied to the various challenges, little has changed. The fragmented ad hoc approach is hindering the outcome. It is time for a more mature approach including workforce planning and appropriate investment.

1.1 HAVE A PLAN
- create a digital technology industry workforce plan

WHY? Money and resources are currently being deployed by Government agencies and businesses to address digital skills shortages to little effect. The Digital Skills Aotearoa report series has gathered a small sample of respondents for useful insights, however a more regular, statistically significant sample will provide accurate and timely information required to respond quickly to this nationally important skills shortage. This information can be used to inform a coordinated national digital skills workforce development plan.

RECOMMENDATION: Invest in a detailed and significant approach to workforce planning, collecting official skills data annually from all large digital tech employers and a statistically significant sample of the tech sector to enable accurate and timely interventions. Challenge traditional data collection methods, for example, can the data be collected digitally in real-time?

WHO? This should be conducted at least annually, led by Toi Mai, with coordination and support from NZTech on behalf of the industry and the Ministry of Business, Innovation and Employment (MBIE) in alignment with the Digital Tech ITP.

1.2 SET TARGETS
- focus on realistic absolute numbers

WHY? The Government and Industry should agree and set targets for the digital technology workforce and education pipeline, including student participation, aspirational job growth and alignment with population demographics.

These targets should be absolute numbers not percentages. The issue with using percentages is a seemingly positive improvement which isn't significant in real terms. For example, an 80 percent increase in Māori IT degree graduates, is only an additional 96 graduates. However, assuming the growth rate for digital technology jobs continues, and we hope

Māori participation grows to be equivalent to population demographics, by 2040 there would need to be approximately 60,000 additional Māori in digital tech jobs. This means that over the next 17 years we need approximately 3,360 additional Māori completing relevant post secondary school training in digital technology every year.

RECOMMENDATION: Create realistic and shared targets for the total numbers required to improve the diversity of the digital workforce. Set realistic longer-term job growth targets to calculate the actual change required in the next two to three years. Then ensure every Government funded digital skills initiative is aligned to the relevant targets to ensure sufficient initiatives are underway to reach the goals.

WHO? Coordinated by Toi Mai, in collaboration with MBIE, NZTech and Te Matarau.

1.3 UNDERSTAND THE ISSUES - undertake further deep dive research into specific challenges

WHY? Previous editions of this report have identified low levels of participation of Māori and Pacific rangatahi in NCEA subjects as pathways into digital technology careers. The fact that the participation rates continue to decline shows a problematic dynamic that needs to be better understood. If there is a lack of diversity in the early stages it will be increasingly difficult to develop a diverse workforce in the coming years.

RECOMMENDATION: In addition to regular updates of the broader Digital Skills Aotearoa research, deep dive research is recommended to better understand the low participation rates, especially of Māori and Pacific rangatahi. This research will need to draw on qualitative expert insights from the under-represented communities, rangatahi and teachers. It could aim to identify outlier schools where there are better participation rates and try to establish what learnings can be shared with the broader school community.

WHO? New Zealand Qualifications Authority (NZQA) analysis of the captured NCEA data in collaboration with the Ministry of Education (MoE), and specialist expertise input.

1.4 USE AN INDUSTRY STANDARD - rapidly deploy the SFIA framework to enable alignment

WHY? The market continues to discuss skills shortages by job titles, not skills. In turn, this hinders the education system's ability to respond and for individuals/organisations to develop upskilling and career progression effectively. The international standard and framework for describing skills, the Skills Framework for the Information Age (SFIA), has been previously identified as best practice and the Government has invested in a national license allowing all education providers and employers to use the standard free of charge. However, this research has found continuing low levels of understanding of its value or a standard way of defining required skills. To increase the use of the SFIA will require decisive action by the Government and an awareness and education programme for digital tech employers.

RECOMMENDATION: Drive SFIA into the market to enable better planning and response to skills challenges through the use of a

standard focused on skills, not job titles. This will require several initiatives, including:

- mandated commitment from public sector IT employers to drive SFIA across all IT teams and potentially extend this requirement to external contractors and suppliers to help accelerate uptake in the rest of the market;
- investment in the development of simple tools for smaller organisations to help them easily use the SFIA to support career development plans and recruitment;
- encouraging larger employers with existing career development frameworks to map their systems against SFIA;
- development of a SFIA network, or Friends of SFIA industry/Government/education group to help champion the benefits of using the standard;
- completing the mapping of relevant education courses and pathways to SFIA, including all current and future micro-credentials.

WHO? Ministry of Education (MoE), Tertiary Education Commission (TEC) and Te Pukenga for course, qualification and pathway mapping. MBIE with the support of IT Professionals New Zealand and NZTech for industry uptake and championing the standard. Department of Internal Affairs (DIA) for Government uptake.

#2 Our Largest Employer Must Show Leadership

The New Zealand Government is the largest employer of people with advanced digital skills in Aotearoa New Zealand. However, as an employer, there has been little proactive involvement in helping address digital skills shortages or mismatches. There are multiple agencies with hundreds of staff in their IT teams and some with more than one thousand employees. However, the GovTechTalent programme only takes 20 graduates a year and is supported by only 10 agencies. There is also very little evidence of entry level roles being created and supported by public sector agencies.

The Government has policy and investment levers, unlike any business, that it can use to ensure the future of our workforce. The growth of digital technology jobs presents a once in a lifetime opportunity to lift our people into higher paying jobs. However, to achieve this, the foundations must be in place to provide all New Zealanders with the opportunity to participate. The Government needs to commit alongside large industry players to the creation of entry level roles proportional to the size of their workforce.

2.1 INSTALL LEADERSHIP - responsibility should be entrusted to a senior Government official

WHY? The research clearly shows how important digital skills are for the future of our economy and society. However, several years since first identified, there has been limited action to address the issue. The Government has a responsibility to take an active role, both as the largest employer and as a coordinator of resources and policy that will create a more equitable and prosperous future for all New Zealanders. Without leadership and accountability, it will be challenging to make measurable progress on this complex issue.

RECOMMENDATION: The Government should identify a senior leader, responsible for solving the digital skills conundrum. They could Chair the Digital Skills Forum which is being relaunched through funding from the Digital Tech ITP to unite industry, education and Government and use this forum to implement a coordinated plan.

WHO? MBIE

2.2 CREATE ENTRY LEVEL JOBS
- The Government should establish a wide range of entry level digital roles

WHY? The research continues to highlight the demand mismatch for those with advanced skills and experience, while our IT graduates struggle to find entry level jobs to allow them to gain experience. The research also shows that while firms conceptually support more work integrated learning, internships and apprenticeship style pathways, the reality is these come with a significant cost to businesses. Government agencies, without a profit motive, if provided sufficient resources, could dramatically increase the number of available entry level roles. Alongside large industry players, the Government also needs to commit to the creation of entry level roles proportional to the size of their workforce.

RECOMMENDATION: Public sector IT employers should take the lead in co-designing and deploying earn as you learn pathways, creating entry level roles and using SFIA. The Government should mandate specific targets for agencies for the creation of entry level roles and work integrated learning roles relative to at least their proportionate scale as employers.

WHO? Led by the DIA with endorsement of the Digital Ministers Group and Cabinet funding. Supported by Te Pukenga and Industry.

2.3 ENHANCE THE VISIBILITY OF AVAILABLE SUPPORT
- maintain funding assistance for entry level roles and improve their accessibility.

WHY? A key challenge in developing a stronger domestic pipeline of advanced digital skills is the mismatch between the employer's needs of experienced workers and the difficulty for students in gaining experience. While there is support for workplace learning, businesses often struggle to participate due to the significant cost of developing and supporting entry level roles. It is no surprise that where initiatives are in place to reduce this cost, businesses have engaged with excellent results.

There are several funding opportunities but our research indicates most employers are unaware of them. Additionally, where particular programmes are shown to deliver results aligned with improving the digital skills pipeline they could be re-introduced or expanded.

RECOMMENDATION? Aggregate the opportunities for support for taking on entry level workers and ensure this is easily accessible for employers. The Digital Skills Forum could fulfill the role of aggregator and sign-post employers to a range of options. Industry bodies, including NZTech and IT Professionals could also amplify the messaging through their own channels. Additional recommendations include:

- expand the Callaghan Innovation student grant and allow grants to be managed via the Summer of Tech internship programme

to incentivise greater uptake of internships.

- re-introduce the Targeted Training and Apprenticeship Fund (TTAF) or some form of equivalent support mechanism to help attract more diversity into earn as you learn pathways via courses through providers such as Dev Academy and other private tertiary institutions.
- aggregate and expose support from other agencies such as the Ministry of Social Development (MSD) for people returning to work or reskilling.

WHO? MBIE, Callaghan Innovation and Summer of Tech for student grants, TEC for some form of targeted training funding and MSD for work and income support.

2.4 ADDRESS UNDERLYING CAUSES - allocate resources towards ensuring universal internet and device access for all our rangatahi.

WHY? Many rangatahi are missing early opportunities to gain digital skills and build an understanding of tech as a potential career path. To build a diverse domestic skills pipeline we need to address the underlying causes of why Māori and Pacific rangatahi are least likely to engage with digital study and are at higher risk of digital exclusion. Early exposure to digital skills increases the likelihood of students taking digital tech pathways. However, one of the key issues is a lack of access to digital tools for learning.

RECOMMENDATION? Address one of the underlying causes of lower participation of Māori and Pacific rangatahi by ensuring all ākonga have appropriate access to digital tools and internet access for learning at school, at home and in their communities.

WHO? DIA and/or MBIE, with support from N4L.

#3 Industry Must Prioritise Collaboration and abandon Rhetoric

For more than a decade digital skills shortages have been reported. Surveys continue to document the industry saying it is a major problem and they would support initiatives such as internships or programmes to improve the diversity of the workforce. However, little has been done to address the issue. Larger organisations that have developed initiatives are often working alone and this has fragmented the sector's efforts, resulting in little or no systemic improvement for the past decade.

3.1 ENGAGE IN COLLABORATIVE ATTRACTION EFFORTS - work as an industry to support the attraction of rangatahi into tech

WHY? A number of large tech employers have deployed initiatives aspiring to attract more rangatahi into tech career pathways with most targeting underrepresented groups such as Māori and Pacific Peoples. However, the evidence shows this is insufficient to effect broader change. While it is a very positive experience for the small number of individuals involved, the majority miss out on the opportunity and there is no systemic change. A collaborative and coordinated approach will have greater potential impact.

This won't prevent individual firms from introducing their own initiatives, however it may provide better access for smaller employers to leverage their efforts.

RECOMMENDATION: Tech employers from across the sector and firms with large IT teams must collaborate with and contribute to the Government's national campaign for attracting more rangatahi toward tech career pathways - Domestic Tech Story.

WHO? All significant employers of digital technology workers including tech firms, large corporations and Government agencies.

3.2 COLLABORATE ON PLANNING - support and improve workforce planning

WHY? The demand for digital skills continues to change and evolve, with new emerging technologies and some skills decreasing in demand due to automation. There is currently no process for sharing the increased needs of tech employers to the Government or education system. In turn, this challenges the system to develop an appropriate and responsive domestic skills pipeline.

Additionally, businesses have an important role in upskilling and reskilling people to meet their workforce needs. Currently most upskilling is ad hoc and self-learnt. Better workforce planning by major employers as part of a nationwide workforce planning system would enable faster development of appropriate training to support upskilling.

RECOMMENDATION: Major tech employers should collaborate with the tech sector workforce development council, Toi Mai, to design modern tech approaches to workforce planning. Moving beyond an occasional survey of only a couple of hundred employers toward a more real-time system that captures insights faster from a more significant proportion of the tech workforce.

To support coordinated industry planning, and to help businesses understand their own current and future skills needs better, tech employers should embrace the SFIA framework. This will help develop career pathways and invest in upskilling their own staff while enabling a standard for data collection to support national workforce planning. Organisations that already have their own workforce development systems can map these against SFIA to enable better collaboration.

WHO? All significant employers of digital technology workers in collaboration with Toi Mai.

3.3 COLLABORATE ON NEW PATHWAYS - co-design and support work integrated learning

WHY? The research clearly shows that one of the main underlying causes of low participation from underrepresented groups including women is the challenge of years spent developing skills without an income. Internationally, it has been shown that work integrated learning such as digital apprenticeships open new pathways leading to better participation.

In New Zealand, where pilots or trials have been conducted, it appears the demand for work integrated learning opportunities from rangatahi far exceeds the number of roles being made available by tech

employers. To solve the diversity challenge and to develop a more robust local talent pipeline will require employers adapting their businesses to support entry level positions.

RECOMMENDATION: The largest tech employers, including Government agencies, should consider opportunities to support the design, development and deployment of new work integrated learning pathways. Tech employers should also collaborate and co-design best practices and support mechanisms for entry level talent.

WHO? Initially all large tech employers. Over time, once support mechanisms are in place smaller employers will be better able to develop entry level and work integrated learning positions.

3.4 COLLABORATE ON A PLATFORM - to make it easier to find industry courses, initiatives and information about tech careers

WHY? There is an enormous amount of information available about tech courses, but it is difficult to find, compare and trust. Most large tech firms have a variety of free and paid courses available for upskilling. In Australia the industry has collaborated on a platform where all of the major tech firms place information about career pathways and courses available. This can then be collaboratively marketed to make it easier for people to learn about all the available options.

RECOMMENDATION: The industry should collaborate and develop a simple website to co-promote digital technology pathways and available courses.

WHO? Large tech firms with industry courses

Appendix

Methodology

During January and February of 2023 NZTech with Toi Mai, the Workforce Development Council for the tech and creative sectors, surveyed the tech sector, large corporate IT departments and large government agencies on their current and perceived future digital skills needs, current open roles, approaches to diversity and internships.

The 2023 Digital Skills Survey was developed based on the 2020 and 2017 survey questions. For the purposes of the Digital Skills Survey, 'information technology' and 'digital' are used interchangeably and to describe the application of computing.

The survey was conducted as an online survey. It was promoted to the senior management of organisations that employ an IT or digital team. The survey was promoted to the membership and subscriber bases of NZTech, IT Professionals and other New Zealand tech associations. It was also promoted to the Government CIO Forum and through NZTech's Techweek partner channels.

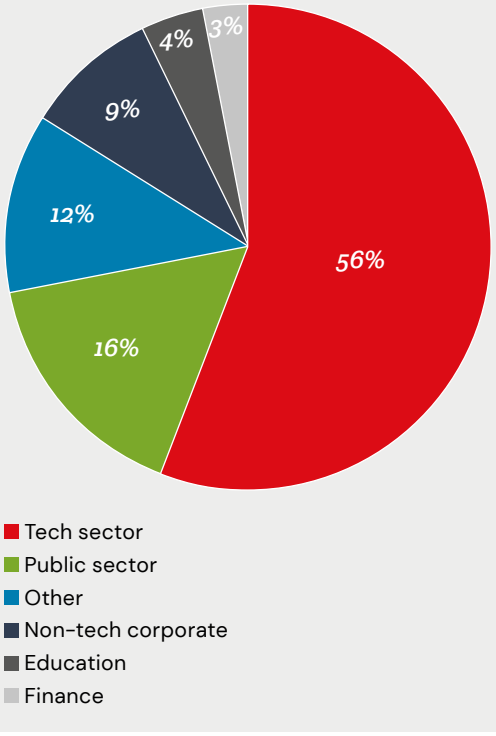
Following the online survey, Toi Mai began undertaking deep dive interviews with senior leaders of a range of large tech employers. The qualitative insights are interwoven into the report.

Survey Demographics

A total of 164 responses were received. The respondents were senior executives with 47 percent being Chief Executives, Directors or Managing Directors and a further 29 percent being Chief Technology, Digital, Operating or Information Officers.

The majority of the respondents were from tech firms, accounting for 56 percent of

FIGURE 10: Survey respondents by job title and sector



respondents. The remaining 44 percent were made up of large non-tech corporates (9 percent), public sector organisations (16 percent), financial institutions (3 percent), educational institutions (4 percent) and others (2 percent).

2023 NZTech Diversity in the Tech Workforce Survey

While analysing the 2023 Digital Skills Survey it was observed that an error in the question format made it impossible to calculate the proportion of women, Māori and Pasifika in the digital technology workforce. The survey poll was created in Survey Monkey and promoted online via multiple channels. This mini-survey collected 90 responses across the week it was live and has enabled us to estimate the diversity proportions for comparison with the 2020 research.

Categorising Roles and Skills

The survey asked respondents about their current open roles and recently hired roles to gauge against the specific skills they perceived that they had and would need in the future. The list of skills used was the same as the 2020 and 2017 surveys, which were informed by the Skills for the Information Age (SFIA) standards.

Open and recently hired roles and anticipated roles were collected as free-type to capture the actual role names firms were using to attract candidates. These were reviewed and grouped under the closest standard role types such as software developer, business analyst etc.

Additional Data

Secondary School Participation Data

The following tables provide data on the number of students participating in NCEA standards most relevant to digital skills as defined by the report authors.

The data in this report looks across a five year period from 2017 to 2021 and includes breakdowns on female, Māori and Pasifika participation. The tables include an analysis of all Year 11-13 students in the New Zealand domestic student population, consistent with the enrolment-based NCEA statistics measure. Participation is defined as being assessed in standards totaling 14 credits, cumulatively (i.e. includes results gained in prior years), for each given year. The standards assessed include achievement standards, standard levels 1-3, from subjects in the Science, Technology and Mathematics (STM) subjects only.

The Standards were sourced from the New Zealand Directory of Standards (DAS) and include:

- Technology/Construction and mechanical technologies
- Technology/Design and visual communication
- Technology/Digital technologies
- Technology/Processing technologies
- Technology/Hangarau
- Mathematics/Calculus
- Mathematics/Statistics
- Mathematics/Pangarau
- Science/Agriculture and Horticulture
- Science/Biology
- Science/Chemistry
- Science/Earth space science
- Science/Physics
- Science/Putaiao
- Science/Education sustainability

A student may identify with up to three ethnicities. A student will be counted once for each ethnic group that they identify with, but only once in total. Therefore the sum of individual ethnicities will likely exceed the total number of students.

This data was provided by the Ministry of Education in March 2023. The compound annual growth rates (CAGR) has been calculated by NZTech.

TABLE 4: Number of students taking NCEA Technology Standards by year and gender, 2017–2021

		2017	2018	2019	2020	2021	CAGR
Year 11	Female	6093	5895	5753	5151	5247	–3%
	Male	9809	9586	8952	8163	7805	–4%
	Total Year 11	**15902**	**15481**	**14705**	**13314**	**13052**	**–4%**
Year 12	Female	7060	6788	6664	6523	6182	–3%
	Male	11388	10905	10665	10107	9703	–3%
	Total Year 12	**18448**	**17693**	**17329**	**16630**	**15885**	**–3%**
Year 13	Female	7406	6693	6558	6381	6373	–3%
	Male	10083	9869	9442	9413	8992	–2%
	Total Year 13	**17489**	**16562**	**16000**	**15794**	**15365**	**–3%**
	Female	20559	19376	18975	18055	17802	–3%
	Male	31280	30360	29059	27683	26500	–3%
Combined Participation		**51839**	**49736**	**48034**	**45738**	**44302**	**–3%**

Source: Ministry of Education data supplied March 2023; CAGR calculated by NZTech

TABLE 5: Number of Māori students taking NCEA Technology Standards by year and gender, 2017–2021

		2017	2018	2019	2020	2021	CAGR
Year 11	Female	908	815	727	723	750	–4%
	Male	1479	1337	1253	1046	1041	–7%
	Total Year 11	**2387**	**2152**	**1980**	**1769**	**1791**	**–6%**
Year 12	Female	1080	1025	958	880	893	–4%
	Male	1856	1683	1523	1445	1284	–7%
	Total Year 12	**2936**	**2708**	**2481**	**2325**	**2177**	**–6%**
Year 13	Female	1199	974	962	902	854	–7%
	Male	1460	1481	1405	1265	1205	–4%
	Total Year 13	**2659**	**2455**	**2367**	**2167**	**2059**	**–5%**
	Female	3187	2814	2647	2505	2497	–5%
	Male	4795	4501	4181	3756	3530	–6%
Combined Participation		**7982**	**7315**	**6828**	**6261**	**6027**	**–5%**

Source: Ministry of Education data supplied March 2023; CAGR calculated by NZTech

TABLE 6: Number of Pacific students taking NCEA Technology Standards by year and gender, 2017–2021

		2017	2018	2019	2020	2021	CAGR
Year 11	Female	467	429	403	386	344	-6%
	Male	848	843	751	618	609	-6%
	Total Year 11	**1315**	**1272**	**1154**	**1004**	**953**	**-6%**
Year 12	Female	642	579	538	481	487	-5%
	Male	997	1020	962	902	839	-3%
	Total Year 12	**1639**	**1599**	**1500**	**1383**	**1326**	**-4%**
Year 13	Female	673	664	585	539	508	-5%
	Male	927	966	968	922	871	-1%
	Total Year 13	**1600**	**1630**	**1553**	**1461**	**1379**	**-3%**
	Female	1782	1672	1526	1406	1339	-6%
	Male	2772	2829	2681	2442	2319	-4%
Combined Participation		**4554**	**4501**	**4207**	**3848**	**3658**	**-4%**

Source: Ministry of Education data supplied March 2023; CAGR calculated by NZTech

TABLE 7: Number of students participating in NCEA Science, Technology and Maths, 2017–2021

		2017	2018	2019	2020	2021	CAGR
Science	Female	65319	63226	62063	59046	57830	-2%
	Māori	23740	22950	22061	21040	20703	-3%
	Pacific	13444	13365	13420	12915	12546	-1%
	Total	**126591**	**123091**	**120403**	**115889**	**113106**	**-2%**
Technology	Female	20559	19376	18975	18055	17802	-3%
	Māori	7982	7315	6828	6261	6027	-5%
	Pacific	4554	4501	4207	3848	3658	-4%
	Total	**51839**	**49736**	**48034**	**45738**	**44302**	**-3%**
Maths	Female	68675	67081	66705	65415	65015	-1%
	Māori	25885	25137	24692	24372	24506	-1%
	Pacific	16228	16143	16245	16044	15815	-1%
	Total	**134387**	**131442**	**129997**	**128849**	**128186**	**-1%**
STM	Female	73664	72022	71391	70253	70211	-1%
	Māori	29625	28786	28051	27786	28151	-1%
	Pacific	17692	17631	17573	17424	17426	0%
	Total	**144382**	**141485**	**139674**	**138744**	**138757**	**-1%**

Source: Ministry of Education data supplied March 2023; CAGR calculated by NZTech

Tertiary Study Participation and Achievement Data

The following data has been provided by the Ministry of Education based on data supplied by tertiary education providers via the Single Data Return Process.

These tables present data relating to the predominant field(s) of study of students enrolled and completing qualifications at tertiary education providers. This data looks at all the courses studied within a qualification to determine a student's predominant field(s) of study. It indicates the number of students taking or completing IT qualifications.

To calculate IT as a collective we have included computer science, information systems and information technology from the Information Technology and Computer Science schools plus software engineering subjects from the Engineering schools. The data is for formal study in government-funded tertiary provider-based study and only includes enrolments or completions for the following New Zealand Standard Classification of Education (NZSCED) categories: Narrow fields 0201, 0203, 0299 and detailed fields 031303, 031305 and 031307. These four groups define the IT groups in this data. Enrolments in other fields of study are excluded, so the enrolment numbers here may not match other published data.

Enrolment data relates to students enrolled at any time during the year with a tertiary education provider in formal qualifications of greater than 0.03 EFTS (more than one week's full-time duration) and excludes all non-formal learning and on-job industry training.

Given the predominant pathway into digital technology careers is via degree qualifications, the qualifications data has been clustered to better expose degree level participation and completion. Qualifications have been clustered as Certificates (covering qualification levels 1 to 4), Diplomas (covering sub-degree qualification levels 5 to 7), Degrees (covering level 7 degree qualifications and level 8 honours degrees

and postgraduate certificates), Masters/ PhD's (covering qualification levels 9 to 10).

Additional notes on the data:

- The data includes those private training establishments that received Student Achievement Component funding, and/ or had students with student loans or allowances, and/or Youth Guarantee programmes.
- Students are counted in each field of study they enrol in or complete, so the sum of the various fields may not add to the total.
- Students are counted in each qualification type/NZQF level they enrol in or complete, so the sum of the various levels may not add to the total.
- Students are counted in each ethnic group they identify with, so the sum of the various ethnic groups may not add to the total.
- Students age is based on age as at 31 December each year.
- International students are those studying here without New Zealand/Australian citizenship or permanent residence status. Students studying off-shore at tertiary education providers that are registered in New Zealand are considered international students unless they hold New Zealand citizenship.
- Data in these tables, including totals, have been rounded to the nearest 5 to protect the privacy of individuals, so the sum of individual counts may not add to the total.
- ''nfd' or 'Not further defined' covers general responses such as "engineering", where it is not possible to assign to a more specific field.
- 'Mixed' relates to study that covers several of the fields in the group, where it is not possible or appropriate to separate them.
- ''nec' or not elsewhere classified covers specific fields of study other than those listed for that group.

Information Technology Enrolments

TABLE 8: Number of students enrolled in IT qualifications, by qualification, 2021

	Certs (1-4)	Diplomas (5-7)	Degrees (7-8)	Masters/PhD (9-10)	Total
Computer science	490	2910	8770	1415	13425
Information systems	200	665	4175	710	5680
Software engineering	10	80	2265	105	2460
Other info tech	835	1325	795	275	3185
Total	**1410**	**4500**	**13795**	**2340**	**21570**

Source: Ministry of Education data supplied March 2023

TABLE 9: Number of students enrolled in degree level IT qualifications by ethnicity, 2021

	European	Māori	Pacific Peoples	Asian	Other	Unknown	Total
Computer science	**3665**	**505**	**420**	**4580**	**465**	**50**	**8770**
Information systems	1920	300	210	1905	220	45	4175
Software engineering	1095	115	100	1090	120	15	2265
Other information technology	365	65	35	330	70	5	795
Total	**6055**	**835**	**680**	**6865**	**755**	**95**	**13795**
	44%	**6%**	**5%**	**50%**	**5%**		

Source: Ministry of Education data supplied March 2023

TABLE 10: Number of students enrolled in degree level IT qualifications by gender, 2021

	Gender Diverse	Female	Male	Total
Computer science	45	2120	6605	8770
Information systems	5	1245	2925	4175
Software engineering	5	415	1850	2265
Other information technology	0	200	595	795
Total	**50**	**3510**	**10235**	**13795**
	0.4%	**25%**	**74%**	

Source: Ministry of Education data supplied March 2023

TABLE 11: Number of students enrolled in degree level IT qualifications by age, 2021

	Under 18 years	18–19 years	20–24 years	25–39 years	40 years & over	Total
Computer science	40	1500	5065	1855	305	8770
Information systems	0	400	2300	1205	265	4175
Software engineering	5	395	1575	270	25	2265
Other information technology		40	355	315	85	795
Total	**45**	**2150**	**7955**	**3065**	**585**	**13795**
	0.3%	**16%**	**58%**	**22%**	**4%**	

Source: Ministry of Education data supplied March 2023

TABLE 12: Number of students enrolled in IT qualifications, by field of study and level, 2021

	Certs (1-4)	Diplomas (5-7)	Bachelors (7-8)	Masters/ PhD (9-10)	Total
Algorithms		20	290	5	315
Artificial Intelligence	15	0	255	100	370
Compiler Construction	105		5		110
Computational Theory			240	0	245
Computer Applications and Programming	235	1440	5175	370	7175
Computer Science nec, mixed or nfd	10	945	3410	945	5295
Data Structures	0	0	45	70	115
Formal Language Theory		5	260		270
Multimedia Computing Science	85	105	465	15	670
Networks and Communications	65	400	655	45	1160
Operating Systems	0	440	205		645
Total Computer Science	490	2910	8770	1415	13425
Conceptual Modelling		25	165	20	215
Database Management		70	400	25	490
Decision Support Systems			165	35	200
Information Systems nec, mixed or nfd	80	205	2095	610	2965
Systems Analysis and Design	195	475	1710	90	2440
Total Information Systems	200	665	4175	710	5680
Communications Technologies			20	0	25
Computer Engineering	10	50	1905	100	2065
Electronic Engineering	0	35	560	0	595
Total Software Engineering	10	80	2265	105	2460
Information Technology nec, mixed or nfd	835	1180	590	240	2805
Security Science	0	145	220	60	425
Total Other Info Tech	**835**	**1325**	**795**	**275**	**3185**
Total	**1410**	**4500**	**13795**	**2340**	**21570**

Source: Ministry of Education data supplied March 2023

TABLE 13: Number of students enrolled in IT qualifications, by qualification level, 2017-2021

	2017	2018	2019	2020	2021	CAGR
Certs (1-4)	830	400	440	360	490	-10%
Diplomas (5-7)	3530	2485	2055	1925	2910	-4%
Degrees (7-8)	8150	8645	8885	8685	8770	1%
Masters/PhD (9-10)	725	915	1070	1235	1415	14%
Total Computer Science	**13045**	**12295**	**12285**	**12090**	**13425**	**1%**
Certs (1-4)	215	290	180	200	200	-1%
Diplomas (5-7)	1310	1185	1005	800	665	-13%
Degrees (7-8)	5435	5560	5580	5005	4175	-5%
Masters/PhD (9-10)	475	535	630	690	710	8%
Total Information Systems	**7365**	**7520**	**7355**	**6645**	**5680**	**-5%**
Certs (1-4)	70	30	10	15	10	-32%
Diplomas (5-7)	215	75	70	70	80	-18%
Degrees (7-8)	2570	2440	2505	2305	2265	-2%
Masters/PhD (9-10)	125	110	135	145	105	-3%
Total Software Engineering	**2970**	**2655**	**2720**	**2530**	**2460**	**-4%**
Certs (1-4)	1255	745	720	625	835	-8%
Diplomas (5-7)	885	955	950	840	1325	8%
Degrees (7-8)	1095	1110	900	1050	795	-6%
Masters/PhD (9-10)	230	280	330	370	275	4%
Total Other Info Tech	**3425**	**3040**	**2845**	**2840**	**3185**	**-1%**
Total	**22510**	**21360**	**21425**	**20510**	**21570**	**-1%**
Total Certs (1-4)	1900	1340	1225	1125	1410	-6%
Total Diplomas (5-7)	5235	3940	3420	3110	4500	-3%
Total Degrees (7-8)	14455	14820	15150	14335	13795	-1%
Total Masters/PhD (9-10)	1460	1730	2060	2295	2340	10%

Source: Ministry of Education data supplied March 2023; CAGR calculated by NZTech

TABLE 14: Number of domestic and international students enrolled in degree level IT qualifications, 2017-2021

	2017	2018	2019	2020	2021	CAGR
Domestic	6100	6285	6210	6085	6380	1%
International	2050	2360	2680	2600	2390	3%
Total Computer Science	**8150**	**8645**	**8885**	**8685**	**8770**	**1%**
Domestic	3355	3310	3180	3045	2845	-3%
International	2085	2250	2395	1960	1330	-9%
Total Information Systems	**5435**	**5560**	**5580**	**5005**	**4175**	**-5%**
Domestic	2210	2100	2150	1995	2005	-2%
International	365	345	355	310	260	-7%
Total Software Engineering	**2570**	**2440**	**2505**	**2305**	**2265**	**-2%**
Domestic	570	560	430	520	570	0%
International	525	550	470	530	225	-16%
Total Other Info Tech	**1095**	**1110**	**900**	**1050**	**795**	**-6%**
Domestic	10400	10350	10255	10005	10245	0%
International	4055	4470	4895	4330	3555	-3%
Total	**14455**	**14820**	**15150**	**14335**	**13795**	**-1%**

Source: Ministry of Education data supplied March 2023; CAGR calculated by NZTech

Information Technology Graduates

TABLE 15: Number of graduates by predominant field of study and qualification level, 2021

	Certs (1-4)	Diplomas (5-7)	Degrees (7-8)	Masters/ PhD (9-10)	Total
Computer science	185	1095	1535	470	3355
Information systems	110	275	865	200	1450
Software engineering		10	400	25	435
Other info tech	295	500	285	165	1245
Total	**545**	**1675**	**2640**	**810**	**5725**

Source: Ministry of Education data supplied March 2023

TABLE 16: Number of students graduating with degree level IT qualifications by ethnicity, 2021

	European	Māori	Pacific Peoples	Asian	Other	Unknown	Total
Computer science	525	60	65	930	75	10	1535
Information systems	355	50	50	425	50	15	865
Software engineering	195	20	10	195	20	10	400
Other info tech	100	20	5	165	20	0	285
Total	**950**	**120**	**110**	**1530**	**145**	**25**	**2640**
	36%	4.5%	4.2%	58%	5.5%		

Source: Ministry of Education data supplied March 2023

TABLE 17: Number of students graduating with degree level IT qualifications by gender, 2021

	Gender Diverse	Female	Male	Total
Computer science	5	360	1165	1535
Information systems		225	640	865
Software engineering		70	325	400
Other information technology		80	205	285
Total	**5**	**635**	**2000**	**2640**
	0.2%	24%	76%	

Source: Ministry of Education data supplied March 2023

TABLE 18: Number of students graduating with degree level IT qualifications by age, 2021

	18–19 years	20–24 years	25–39 years	40 years & over	Total
Computer science	5	990	480	60	1535
Information systems		505	310	55	865
Software engineering		315	75	5	400
Other information technology	5	135	120	25	285
Total	**5**	**1710**	**815**	**110**	**2640**
	0.2%	65%	31%	4%	

Source: Ministry of Education data supplied March 2023

TABLE 19: Number of students graduating with IT qualifications, by detailed field of study, 2021

	Certs (1–4)	Diplomas (5–7)	Bachelors (7–8)	Masters/ PhD (9–10)	Total
Algorithms			15		15
Artificial Intelligence		0	80	10	90
Compiler Construction	35		0		35
Computational Theory			35		35
Computer Applications and Programming	95	665	665	125	1635
Computer Science nec, mixed or nfd	10	160	815	365	1350
Data Structures			10	25	35
Formal Language Theory		5	15		15
Multimedia Computing Science	45	40	50	0	135
Networks and Communications	0	215	200	0	420
Operating Systems	0	105	15		120
Total Computer Science	**185**	**1095**	**1535**	**470**	**3355**
Conceptual Modelling		0	5		10
Database Management		40	55		95
Decision Support Systems			35	5	35
Information Systems nec, mixed or nfd	60	95	510	200	860
Systems Analysis and Design	110	205	365	25	705
Total Information Systems	**110**	**275**	**865**	**200**	**1450**
Communications Technologies			10		10
Computer Engineering		10	360	25	390
Electronic Engineering		5	100		105
Total Software Engineering		**10**	**400**	**25**	**435**
Information Technology nec, mixed or nfd	295	470	230	160	1155
Security Science		30	65	20	115
Total Other Info Tech	295	500	285	165	1245
Total	**545**	**1675**	**2640**	**810**	**5725**

Source: Ministry of Education data supplied March 2023

TABLE 20: Number of students graduating with IT qualifications by qualification level, 2017–2021

	2017	2018	2019	2020	2021	CAGR
Certs (1–4)	365	130	155	130	185	-13%
Diplomas (5–7)	1685	1250	905	980	1095	-8%
Degrees (7–8)	1625	1740	1765	1780	1535	-1%
Masters/PhD (9–10)	180	255	305	385	470	21%
Total Computer Science	**3850**	**3365**	**3120**	**3310**	**3355**	**-3%**
Certs (1–4)	80	150	80	80	110	7%
Diplomas (5–7)	480	420	345	390	275	-11%
Degrees (7–8)	1470	1690	1520	1550	865	-10%
Masters/PhD (9–10)	95	140	160	215	200	16%
Total Information Systems	**2125**	**2395**	**2095**	**2235**	**1450**	**-7%**
Certs (1–4)	15	15	0			-100%
Diplomas (5–7)	105	35	20	15	10	-38%
Degrees (7–8)	430	455	410	415	400	-1%
Masters/PhD (9–10)	35	40	45	55	25	-7%
Total Software Engineering	**585**	**545**	**475**	**490**	**435**	**-6%**
Certs (1–4)	510	330	245	210	295	-10%
Diplomas (5–7)	445	475	400	460	500	2%
Degrees (7–8)	420	410	430	395	285	-7%
Masters/PhD (9–10)	65	110	110	130	165	20%
Total Other Info Tech	**1435**	**1315**	**1175**	**1190**	**1245**	**-3%**
Total	**6685**	**6450**	**5865**	**6060**	**5725**	**-3%**
Total Certs (1–4)	750	580	450	395	545	-6%
Total Diplomas (5–7)	2450	1900	1500	1600	1675	-7%
Total Degrees (7–8)	3150	3480	3355	3295	2640	-3%
Total Masters/PhD (9–10)	360	515	585	745	810	18%

Source: Ministry of Education data supplied March 2023; CAGR calculated by NZTech

TABLE 21: Number of domestic and international students graduating with degree level IT qualifications, 2015-2019

	2017	2018	2019	2020	2021	CAGR
Domestic	1005	1015	1005	935	980	-1%
International	620	725	760	850	550	-2%
Total Computer Science	**1625**	**1740**	**1765**	**1780**	**1535**	**-1%**
Domestic	625	725	670	620	555	-2%
International	845	965	850	930	310	-18%
Total Information Systems	**1470**	**1690**	**1520**	**1550**	**865**	**-10%**
Domestic	350	375	345	340	340	-1%
International	80	85	60	80	60	-6%
Total Software Engineering	**430**	**455**	**410**	**415**	**400**	**-1%**
Domestic	185	155	125	105	155	-3%
International	235	250	300	290	130	-11%
Total Other Info Tech	**420**	**410**	**430**	**395**	**285**	**-7%**
Domestic	1795	1925	1815	1715	1710	-1%
International	1355	1555	1540	1585	930	-7%
Total	**3150**	**3480**	**3355**	**3295**	**2640**	**-3%**

Source: Ministry of Education data supplied March 2023; CAGR calculated by NZTech

ICT Occupations Data

IT Occupations Data is collected through the New Zealand Government's Household Economic Survey (HES). HES is an annual survey that collects a comprehensive range of statistics relating to household income and expenditure, and demographic information on households and individuals in New Zealand. The survey provides indicators on how personal and household income, housing costs, and living standards have changed over time.

The survey runs every year, from 1 July to 30 June of the following year. It covers people aged 15 years and over (15+) who usually live in New Zealand permanent private dwellings. Households selected for the survey are sampled from rural and urban areas throughout New Zealand on a statistically representative basis. Information is obtained for every household member who is 15+.

The table below provides detailed employment estimates, calculated by the Ministry of Business, Innovation and Employment in March 2023 from the Household Labour Force Survey and the Linked Employer-Employee Data (LEED) translated into occupational employment using census based occupational shares.

TABLE 22: Number of people in New Zealand in ICT occupations by type, 2017–2021

	2017	2018	2019	2020	2021	CAGR
Computer Network Professionals	2266	2289	2325	2303	2267	0%
Database and Systems Administrators, and ICT Security Specialists	4761	4477	4365	4199	3934	-4%
Electronic Engineering Draftspersons and Technicians	2079	2252	2424	2570	2653	5%
Electronics Engineers	840	832	822	811	807	-1%
Electronics Trades Workers	2657	2663	2690	2736	2722	0%
ICT Business and Systems Analysts	15175	16067	17135	17740	17869	3%
ICT Managers	10328	11267	12262	12992	13397	5%
ICT Sales Assistants	134	116	103	89	76	-11%
ICT Sales Professionals	1095	1041	1020	966	891	-4%
ICT Support and Test Engineers	1656	1670	1730	1769	1774	1%
ICT Support Technicians	5797	5095	4514	3877	3224	-11%
ICT Trainers	472	430	405	374	331	-7%
Multimedia Designer	289	286	290	295	294	0%
Multimedia Specialists and Web Developers	2946	3024	3161	3208	3160	1%
Software and Applications Programmers	27273	28938	30901	32113	32618	4%
Telecommunications Engineering Professionals	1887	2064	2150	2177	2197	3%
Telecommunications Technical Specialists	163	189	215	238	249	9%
Telecommunications Trades Workers	3182	3256	3367	3234	3164	0%
Web Designers	1173	1194	1235	1246	1219	1%
Total	**84173**	**87150**	**91114**	**92937**	**92846**	**2%**

Source: ICT Occupations Calculations, Ministry of Business, Innovation and Employment, March 2023. CAGR calculated by NZTech

ICT Visa Approvals Data

Immigration New Zealand publishes an annual report on occupations of principal applicants for approved work visas. This report summarises the occupations of principal applicants approved residence under the Skilled Migrant Category (SMC) or the 1995 General Skills policy. Occupations are presented as per the NZSCO (New Zealand Standard Classification of Occupations) or ANZSCO (Australia & New Zealand Standard Classification of Occupations) groupings. The dates are Government financial years, so the 2021 data in the table below are all approved applications between 1 July 2020 and 30 June 2021.

TABLE 23: Number of approved ICT work visas, 2017 - 2022

ICT Visa Category	2017	2018	2019	2020	2021	CAGR
Computer Network and Systems Engineer	161	121	130	81	93	-10%
Database Administrator	83	79	62	42	49	-10%
ICT Account Manager	55	61	61	37	49	-2%
ICT Business Analyst	373	415	375	331	190	-13%
ICT Business Development Manager	77	79	55	50	44	-11%
ICT Customer Support Officer	478	547	326	281	356	-6%
ICT Managers nec	61	72	51	57	26	-16%
ICT Project Manager	230	234	182	146	79	-19%
ICT Quality Assurance Engineer	33	38	36	27	40	4%
ICT Sales Assistant	28	43	51	32	20	-7%
ICT Sales Representative	140	133	59	44	63	-15%
ICT Security Specialist	61	75	58	53	54	-2%
ICT Support Engineer	134	115	105	92	111	-4%
ICT Support Technicians nec	523	513	295	214	209	-17%
ICT Support and Test Engineers nec	48	46	41	43	18	-18%
ICT Systems Test Engineer	203	213	134	123	83	-16%
ICT Trainer	26	57	21	5	11	-16%
Mulitmedia Designer	65	58	37	20	42	-8%
Multimedia Specialist	477	586	452	277	241	-13%
Software Engineer	791	817	694	465	372	-14%
Software Tester	115	135	138	73	81	-7%
Software and Applications Programmers nec	110	119	84	68	38	-19%
Web Administrator	64	85	38	29	30	-14%
Web Designer	42	52	49	33	30	-7%
Web Developer	218	203	149	120	122	-11%
Total	**4596**	**4896**	**3683**	**2743**	**2451**	**-12%**

Source: Ministry of Business, Innovation and Employment, March 2023. CAGR calculated by NZTech

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