Getting Skills Right

Bridging Talent Shortages in Tech

SKILLS-FIRST HIRING, MICRO-CREDENTIALS AND INCLUSIVE OUTREACH

OECD

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BETTER POLICIES FOR BETTER LIVES

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Foreword

The tech sector is a cornerstone of today's economies, contributing to innovation, productivity and growth across various industries. It drives advancements in artificial intelligence and cybersecurity, which are becoming crucial for both the functioning of businesses and daily life, and it can also contribute to catalysing the transition to net-zero emissions by developing new environment-friendly tools and products. Yet, while the tech sector is rapidly expanding and emerging as a strategic employer, it also faces significant talent shortages, with demand for skilled professionals outpacing supply. Education and training institutions struggle to keep up with industry needs, and the gap is exacerbated by rapid technological advancements requiring specialised knowledge.

Addressing these talent shortages is crucial for sustaining innovation and maintaining economic momentum in today's tech-driven societies. However, both policy makers, employers and training providers face several challenges in tackling this issue. For example, aligning educational and training curricula with the fast-evolving tech landscape has proven challenging for training providers. Furthermore, ensuring equitable access to employment and learning opportunities in the tech sector is a concern, as occupational segregation and stereotyping can limit the potential talent pool. Firms also face important obstacles in recognising non-standard learning pathways during recruitment, which could otherwise expand their talent pool to include candidates without formal qualifications or degrees.

Creating effective policies to bridge talent shortages in tech requires a multifaceted approach and collaboration between governments, education and training institutions, and the private sector. This report focuses, in particular, on three different strategies to address skills shortages: skills-first approaches to hire, train and promote based on skills and not on qualifications or seniority (Chapter 1); micro-credentials for rapid reskilling and upskilling (Chapter 2); and inclusive strategies to reach out to a broader and more diverse set of candidates thus broadening the talent pool (Chapter 3).

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The opinions expressed and arguments employed herein do not necessarily reflect the official views of the OECD member countries or the European Union.

Table of contents

FIGURES

Abbreviations and acronyms

AI	Artificial intelligence
CDTL	Credential Transparency Description Language
ECDL	European Computer Driving Licence
ECTS	European Credit Transfer and Accumulation System
EDSC	European Digital Skills Certificate
ESCO	European Classification of Skills, Competences, Qualifications and Occupations
EU	European Union
FET	Further Education and Training
IBE	Educational Research Institute
ICT	Information and Communications Technology
ILA	Individual Learning Account
IoT	Internet of Things
OECD	Organisation for Economic Co-operation and Development
O*NET	Occupational Information Network
NEET	Neither in Employment nor in Education or Training
NQF	National Qualifications Framework
NZQA	New Zealand Qualifications Authority
NZQCF	New Zealand Qualifications and Credentials Framework
PIAAC	OECD Survey of Adult Skills
QQI	Quality and Qualifications Ireland
SFIA	Skills Framework for the Information Age Foundation
STEM	Science, technology, engineering and mathematics
VET	Vocational education and training
VNFIL	Validation of non-formal and informal learning

Executive summary

Talent shortages are a lose-lose situation for everyone: for firms, they hinder productivity and innovation; for workers, they lead to skills mismatches and reduced job satisfaction; for governments, they reduce competitiveness and economic growth. All stakeholders suffer from lowered efficiency, missed opportunities and heightened economic strain. This is particularly the case in the tech sector, where the demand for highly specialised skills often outstrips the available supply of qualified professionals due to constantly evolving technologies and to unfavourable working conditions for certain groups of workers (such as women and ethnic and racial minorities). Tackling talent shortages in the tech sector effectively requires innovative approaches and collaborative efforts by all stakeholders.

In particular, a skills-first approach to hiring and training can be extremely valuable to address persistent talent shortages. This approach allows companies to adapt more dynamically to changing demands by focusing on the specific skills needed for vacant roles rather than rigid qualifications or experience criteria. The skills-first approach broadens the talent pool by considering candidates with diverse backgrounds, thereby reducing dependency on traditional recruitment pipelines. Skills-first strategies also promote innovation, by valuing workers' capabilities and potentials, and facilitate reskilling and upskilling initiatives, ensuring that the workforce remains relevant and competitive in rapidly evolving markets. Beyond employers, career guidance institutions and education and training providers can benefit from adopting skills-first strategies. Indeed, by focusing on developing specific skills, training institutions can better prepare individuals for the job market, improving their employability and career prospects. Skills-first approaches also allow for more personalised career guidance, where individuals can identify and pursue paths that align with their strengths and interests, rather than predefined career tracks.

Micro-credentials – i.e. small, targeted learning activities that offer a way for learners to retrain and upskill quickly and efficiently – can also help reduce talent shortages, particularly in the tech sector, by providing flexible and rapid skill development. Micro-credentials allow workers to acquire specific, in-demand skills without committing to lengthy degree programmes, thus quickly filling skills gaps. Employers who can adapt to emerging technologies and industry changes can better benefit from a more agile workforce. Micro-credentials support continuous learning, enabling professionals to remain up to speed with the latest advancements. Partnerships between educational institutions and tech companies can ensure that micro-credentials align with real-world industry needs, further bridging the talent gap.

However, introducing innovative ways of hiring and training may not be enough to fill the large talent shortages in the tech sector if this is not accompanied by a shift in mindset. The tech industry grapples with issues of diversity and inclusiveness. Women, workers of racial and ethnic minority backgrounds, youth, and migrants encounter barriers to entry and advancement in technology careers. Overcoming stereotypes about what a tech professional should look like and fostering a more inclusive work culture is crucial for expanding the talent pool. Both companies and governments play critical roles in these efforts. With the support of civil society, governments can promote a more inclusive tech sector by highlighting diverse role models and removing obstacles to education and training for under-represented groups. Businesses, on the other hand, should focus on fostering a more inclusive work culture to attract and retain highly skilled workers with diverse backgrounds.

To tackle talent shortages in the tech sector effectively, the OECD recommends the following key interventions.

Skills-first hiring

- Employers should adopt skills profiling tools and inclusive hiring techniques for recruitment, develop alternative entry pathways, and tie employee progression to skills while fostering lifelong learning.
- Education and training providers should expand programme delivery options to include shorter, more targeted, modular learning options (including micro-credentials) to improve flexibility in adult learning provision and engage social partners in the design of curricula to ensure their relevance.
- Governments should establish an efficient system for the validation of non-formal and informal learning acquired by workers during their working lives, encourage public employment services to match jobseekers to vacancies based on skills rather than qualifications and introduce effective quality assurance systems.

Micro-credentials

- Governments should develop and adopt a hybrid approach that allows for accrediting both programmes and providers of micro-credentials, create online platforms for users to compare courses, expand funding options to cover short training modules, and integrate micro-credentials into National Qualifications Frameworks and validation systems for non-formal and informal learning.
- Education and training providers should establish internal quality standards for micro-credentials, break down course content to identify micro-credential components, and increase data collection to ensure broad participation and assess training outcomes.
- Employers should collaborate with social partners and training providers to design and deliver demand-driven micro-credentials and encourage workers' participation by recognising micro-credentials in career development.

Inclusive outreach

- Employers should broaden recruitment pathways by implementing targeted hiring initiatives for under-represented groups, promoting diverse role models, and adopting inclusive workplace practices to support the progression and retention of women and minorities.
- Governments should collaborate with schools to develop unbiased teaching materials and foster inclusive teaching practices, while working with training providers to address barriers to adult learning and expand funding options for training accessibility of minorities and disadvantaged groups.
- Education and training providers should expand delivery options to increase accessibility, partner with employers for post-training work placements, and develop targeted awareness campaigns to reach out to underserved communities.

1 Skills-first approaches for inclusive and efficient labour markets

Skills-based approaches are growing in popularity as a way to alleviate skills shortages, unlock hidden talent and increase the diversity of the workforce. This chapter describes the challenges of skills-based approaches and includes a set of actions for employers, training providers, social partners and governments looking to implement the approach. The evidence gathered suggests that skills-based approaches require time and investment but, when adopted and implemented successfully, can yield positive results. When embarking on their skills-first journey, organisations can make small and gradual adjustments to their recruitment and hiring practices, training, performance management and leadership style, while governments can strengthen underlying frameworks and systems to support a more inclusive skills-first labour market.

Introduction

A 'skills-based' – or 'skills-first' – approach focuses on skills themselves rather than on how they have been acquired. Organisations that employ this approach prioritise skills, competencies and abilities over education, qualifications and work experience. The concept first emerged in recruitment processes to help alleviate labour shortages by allowing firms improved access to underutilised talent, helping to match workers to roles based on their abilities. Gradually, the approach spread to other firm practices, and wider organisational policies have shifted their focus to employees' skills to support a culture of skills-based career progression and lifelong learning. A skills-based approach is also used nowadays in the development of new training programmes to design and deliver targeted, more future-ready learning programmes, and in career guidance to facilitate better matches between jobseekers and employers.

In recent years, skills-based approaches have been growing in popularity. Take-up of the approach has particularly accelerated post-pandemic, with acute labour shortages challenging many organisations, prompting them to consider more innovative approaches to hiring talent. In 2022, one in four job postings on LinkedIn in the United States did not require a degree, an increase from 15% in 2020 (LinkedIn, 2023[1]). A similar finding applies to jobs ads more broadly, with a sizeable portion of occupations seeing a reduction in degree requirements in recent years (Emsi Burning Glass, 2022[2]). In parallel, more employers are recognising the value of alternative credentials. Many large technology companies have also announced their commitment to prioritise skills over degrees in IT occupations (Emsi Burning Glass, 2022[2]).

In general, support for the approach is strong – about 80% of employers believe in prioritising skills over qualifications in the United States (American Student Assistance and Jobs for the Future, 2022[3]). There is even support for the approach at top levels of government – in early 2021, the United States Government released a memorandum to limit the use of educational requirements in federal contracts of IT service workers (United States Executive Office of the President, 2021[4]). A number of American states – including New Jersey, Maryland, Colorado and Pennsylvania – have recently removed degree requirements for most government jobs. Nonetheless, existing challenges limit a more widespread adoption of the approach.

This chapter describes the benefits and challenges of a skills-based approach and highlights best-practices in organisations across the OECD that are successfully implementing the approach. The evidence gathered points to the fact that organisations pivoting towards a skills-based model should consider hybrid approaches and make small adjustments as they begin their skills-first journey, while governments, training providers, social partners and public employment services should reflect on how they can better support a skills-first labour market. Overall, this chapter presents evidence that skills-based approaches require time and investment but when adopted and implemented successfully, can yield positive results.

Fostering talent through skills-based approaches

Unlocking hidden talent by prioritising skills

Adopting a skills-based hiring approach can help firms access previously underutilised talent. The removal of formal degree requirements for certain roles, recognising non-standard learning pathways and relying on skills-based assessments during recruitment increases opportunities for candidates from non-traditional backgrounds to apply for vacancies. This allows candidates with alternative credentials – who are more often than not from non-traditional backgrounds – to be considered equally to candidates with formal qualifications.

LinkedIn estimates that in roles where women are under-represented, the proportion of women in the talent pool could increase by 24% more than it would for men with a skills-first approach, suggesting that under-representation is not merely due to skills shortages amongst women (LinkedIn, 2023[1]). In the technology,

information and media industry, this figure is 14%. More generally, many employers report difficulties in hiring entry-level talent, but one survey finds that simply removing strict qualification or work experience requirements can immediately boost the pool of applicants, helping to build a true entry-level talent pipeline (Generation, 2023[5]).

Skills-based hiring may be particularly beneficial for younger workers who have less formal work experience. Some evidence suggests that skills-based hiring can increase the talent pool of Gen Z workers (born between 1997 and 2012) even more than for Gen X (born between 1965 and 1980) or Millennials (born between 1981 and 1996), facilitating a quicker transition into the labour market from education (LinkedIn, 2023[1]). A recent survey of employers in the technology sector found that about one-quarter had recently removed education or work experience requirements for entry-level technology roles – a move which will likely benefit younger workers (Generation, 2023[5]). Moreover, other groups like foreign-born individuals may stand to benefit from this approach – newly arrived migrants with international qualifications that have not yet been formally recognised may be able to enter the labour market more quickly upon arrival.

With a skills-based approach, the increase in the global talent pool could be significant. Using a sample of 18 countries, recent estimates suggest as much as 100 million workers could be added to the global workforce through a skills-first approach (World Economic Forum, 2023[6]). Regional estimates suggest that some countries stand to benefit relatively more if skills-based approaches were scaled-up on a larger scale – for example, the talent pool in the United States could increase by almost 20% (LinkedIn, 2023[1]). This is likely because many candidates have the right skills but do not possess a college degree or have not accrued traditional work experience.

Current skills shortages can act as a strong incentive for more firms to adopt a skills-based approach. The technology sector in particular not only has one of the biggest skills shortages right now, but is also expected to have significant shortages in the future with the demand for ICT specialists expected to outstrip supply in the coming years (International Labour Organization, 2020[7]). Across the OECD, cognitive, digital and scientific knowledge skills – skills highly related to technology and STEM careers – are in shortage (OECD, 2023[8]). Firms looking for workers with these skills could benefit greatly from a skills-based hiring approach.

Fostering financial benefits and lifelong learning through a focus on skills

Rather than emphasising formal qualifications and previous job titles, skills-first hiring focuses on assessing whether a candidate has the right skills for the job. By highlighting skills themselves, rather than how they were acquired, firms can acquire better quality matches. Evidence suggests that organisations with skills-first practices are over 60% more likely to achieve positive workplace results – they are more likely to innovate, improve processes to maximise efficiency, and anticipate and respond to change effectively – than firms who have not adopted such practices (Deloitte, 2022[9]).

In addition, workers are also more likely to state that they would be attracted to and remain in an organisation that makes key personnel decisions based on skills and capabilities, rather than job titles and degrees (Deloitte, 2022[9]). Organisations adopting skills-first approaches are more likely to retain high performing employees and deliver a positive and inclusive workplace environment. Survey data indicates that over 90% of employees state that they would stay at a company longer if it invested more in their careers (LinkedIn, 2018[10]). Workers employed under skills-based approaches can be top performers at work with skills being a better predictor of job performance than education or work experience. Furthermore, some employer surveys state that experienced workers without college degrees were often considered just as productive as their college-educated counterparts, and have lower turnover rates, reducing costs for firms (Harvard Business School, 2017[11]).

More generally, skills are strongly linked to firm productivity. Greater gender and cultural diversity in the workplace – particularly at the managerial level – is associated with higher productivity within firms (Criscuolo et al., 2021[12]). Because firms that employ skills-first hiring are more likely to employ staff from diverse backgrounds, they in-turn are likely to reap the financial benefits. Sectors that struggle with diversity issues (such as the STEM industries) can stand to benefit financially from adopting a skills-first approach.

For many firms, a greater focus on skills goes beyond recruitment. Building a skills-based culture also affects workers' career development, performance and progression. Skills-based policies democratise opportunity when progression and promotion decisions are tied to skills rather than tenure or experience, improving employee satisfaction. Firms that prioritise skills and competencies (over other factors like tenure) during promotion decisions may have better quality managers. Better quality leadership, in-turn, affects firm financials, with management quality and level of training linked to firm productivity (Criscuolo et al., 2021[12]). Overall, greater employee satisfaction with progression opportunities builds better, more positive workplace environments.

With a greater focus on skills, firms are also more likely to invest in their employees' learning and development by providing meaningful on-the-job training or expanding opportunities to engage in external training. Building a skills-first culture requires firms to assess and anticipate their skill needs, and appropriately train their workers when they identify skills gaps. This is particularly important in the context of both the green and digital transitions, with firms needing to invest more in training to ensure their workers skills are in-line with changes in future skill requirements. For instance, given the high speed of technological development, ICT specialists will need to participate more frequently in ongoing training than specialists in other fields (International Labour Organization, 2020[7]). Training providers who use a skills-based approach in the development of their learning programmes are also able to design and deliver more relevant, future-focused learning, helping to close skills gaps in the workforce. Moreover, a skills-first culture can alter the way work is conducted within organisations. When encouraged to undertake new tasks and projects to develop their skills, workers continuously learn and strengthen their abilities while they are at work.

Adopting a skills-based strategy

To operationalise a successful skills-based culture and support a lifelong learning mindset, organisations will need to make several changes. Governments can support the work of firms by providing the frameworks and systems necessary for a skills-focused labour market. Case studies and practical examples included in this chapter draw on the results of the *2023 OECD Survey of Skills-Based Approaches* (see Box 1.1 for more details), additional OECD research and bilateral discussions with organisations.

Box 1.1. OECD Survey of Skills-Based Approaches

In July 2023, the OECD launched an online survey on skills-based approaches. Open to organisations in the private and non-profit sector, training providers and trade unions, the purpose of the survey was to understand how institutions use the approach, what changes they made to their practices in order to employ the approach, and any challenges and success factors they identify. For organisations that do not use the approach, a question regarding barriers to adoption was asked. Additionally, training providers were asked whether they believed the adult learning landscape is ready for a skills-based approach. In total, 50 organisations submitted a complete response, of which 42% are in the private sector, 18% are non-profit organisations, 16% are training providers, and 24% are other or not identified.

The main findings of the research are the following:

- Around three-quarters (74%) of all surveyed organisations have heard of the approach and over half (62%) use it. Many organisations use the approach in training and development (33%), while some also use it for hiring and recruitment (17%), and promotion and progression (17%). Some organisations report utilising the approach across almost all areas of their operations (13%).
- When developing the approach, many organisations consulted their existing staff, though a few also reached out to other stakeholders (including other organisations using the approach, training providers, guidance services, and government or employment services).
- For those that employ the approach, organisations report reforming their recruitment processes (for example, through the introduction of assessment centres and online technical or other practical tests) and developing skills-based training programmes for their employees. A few leading organisations report making changes to their employee progression processes including the use of personalised skills development plans.
- Many organisations report a need for staff and leaders to adopt a change of mindset in order to foster greater support for the approach. Organisations recognise that there needs to be greater recognition of skills gained in non-traditional ways, and managers need to better embrace a mindset of continuous learning to successfully adopt the approach.
- Furthermore, training providers believe more can be done to ensure adult learning provision is well-equipped for a skills-first world, including aligning programmes to evolving skill needs and a move towards practical, project-based learning.

Deconstructing job roles based on skills

In order to properly understand the skill needs of their workforce, firms first need to take stock of the current roles offered by their organisation. Firms looking to kick-start their skills-first journey should begin by undertaking a review of the current roles in their organisation to identify which ones may be better suited for a skills-first approach (see Box 1.2). An extensive skills audit will help employers identify which positions may no longer strictly require a qualification. Some roles, particularly entry level positions, may be better suited for the approach than others, and many roles, especially for occupations that have specific licensing or regulatory requirements, will still require qualifications. Thus, firms may need to adopt a hybrid approach, recognising that a skills-based hiring policy complements but does not replace existing recruitment methods.

Box 1.2. A successful skills-first strategy begins with an extensive skill audit

IBM first adopted a skills-based approach in the United States over a decade ago, in response to a shortage of skilled workers in the technology sector. They started with an extensive review of all job descriptions at the company. Human resource leaders at IBM engaged with business units across the company to understand the knowledge and skills required for specific roles, before re-writing job descriptions that emphasised abilities over credentials. They then conducted some proof-of-concept hiring before expanding the approach across the organisation. While at the time almost all roles at IBM required a college degree, now more than half of IBM's job postings in the United States do not include a college requirement and 20% of their American hires do not have a college degree. As a result of this change, IBM now receive 63% more applications from under-represented groups (IBM, 2022[13]; IBM, 2023[14]).

During this process, employers may engage with skills analysis tools to better understand the current and future skill requirements of their workforce. Indeed, across the OECD, many private and public institutions have joined forces in the past few years to forecast skill needs. For instance, in Finland, numerous employers' representatives, trade unions, and training and education providers are part of skills councils, whose role is to forecast how sectoral evolutions will impact skill needs. Firms can build their own internal skills intelligence systems or collaborate with other firms to do so (see Box 1.3). They can also rely on external sources for skills intelligence, such as LinkedIn's Talent Insights, which uses real-time data to provide labour market and skills insights including information on skills trends. It also allows firms to assess the skills of their talent marketplace and helps firms source skilled talent by connecting jobseekers with job posts based on skills information. Publicly provided tools are mentioned in the last section of this chapter.

After job titles are mapped to skill needs, job descriptions for skills-first roles should be re-written to highlight the skills necessary to perform well in a role. When writing skills-based role descriptions, employers may consider utilising a skills framework or taxonomy – internationally recognised ones include the European Skills, Competences and Occupations (ESCO) classification, the Occupational Information Network (O*NET) database, and the World Economic Forum's Global Skills Taxonomy, which builds on both ESCO and O*NET to integrate additional emerging skills (World Economic Forum, 2021[15]). Relevant to the technology sector, the Skills Framework for the Information Age (SFIA) Foundation provides a global skills and competency framework for the digital world.[1] Adopting a common skills taxonomy within a firm allows employers to identify the skills of their workers in a more standardised way and allows them to assess how easily workers can move across different roles within the company. Small and medium-sized firms can particularly benefit from existing frameworks to avoid using limited resources to develop and maintain their own.

Some firms may still require external guidance to better understand how to write a skills-based job description. To fulfil this gap in the market, private consulting firms such as Grads of Life in the United States provide companies with advice on and tools to successfully implement a skills-first strategy. Businesses can consider outsourcing their skills intelligence by utilising existing data-backed taxonomies, such as the one developed by SkyHive. Smaller firms who do not have the resources to do so can consult industry associations who may have existing labour market information to share free of cost. Some non-profit organisations such as Jobs for the Future also provide support for employers looking to scale-up their skills-based policies, including assessment tools for companies to identify their skills-first readiness.

Box 1.3. Industry collaboration accelerates understanding of skill needs

Unilever and Walmart ran a three-month joint skills pilot programme from December 2020 to February 2021 to understand how the companies can unlock hidden skills, better prepare their workers for the future, and facilitate worker mobility based on skills. With the help of Accenture and SkyHive, part of this work was to identify the skillsets of declining and emerging jobs, how much they overlap, and which skills would need to be acquired for workers to move between roles. Job roles at Unilever and Walmart were broken down into their component parts – roles are viewed as a collection of skills – and after doing so, skill gaps between different roles were found to be less wide that expected; it would only take six months for staff to be reskilled for new roles in different functions (Accenture, 2021[16]). This type of data-backed work helps to eliminate biases regarding job mobility and allows for the expansion of career pathways. Unilever continues to use artificial intelligence to identify the skills their employees have and will need in the future.

When writing job ads, firms should consider the use of anti-bias and inclusivity screening tools. These tools screen for non-inclusive language and can make text recommendations to reduce bias in job postings. The use of such tools encourages inclusive hiring, improving the diversity of the candidate pool. For instance, Gender Decoder is a linguistic decoder that screens text for masculine-coded language. Some tools go beyond job ads, like Textio, which scans text written for performance management purposes to ensure managers provide bias-free and effective feedback to their employees. Moreover, Applied is an ethical recruitment software which provides an inclusive job description tool, alongside their core product offerings which assess candidates' skills and help firms predict their best hire.

Identifying new channels for a better candidate-to-job match

Whilst skills-based approaches help facilitate better employee-employer matches, employers may need to find new ways to find the right talent. Both workers and firms can exploit matching platforms and sites that recommend roles based on skills in order to find their optimal skills match. Some private sector solutions, described in Box 1.4, can facilitate this matching process, though users should be aware that, given such platforms are typically subscription-based (for both employers and workers), only a select pool of roles will be available through such platforms. Jobseekers and employers can also engage with the services of their national or sub-national public employment service – some agencies match people to roles based on skills.

Box 1.4. Linking people to jobs: Subscription-based skills matching platforms

The Workday Skills Cloud is an example of a private sector solution which facilitates skills-based matching of workers to jobs. This cloud-based system leverages a rich database to infer workers' skills and provides skills suggestions. Jobseekers are able to view their skills dashboard, which provides insight into skills they have acquired or lost, and how their skills compare to the skills needed for a particular role. Human resource managers can use the platform to gain insight into skills trends, gaps, and supply and demand.

Abodoo's Skills Passport is a platform that allows individuals to capture and collate information on their technical (hard) skills and transversal (soft) skills, plus other details about their work experience. The Skills Passport comes with an integrated personalised learning engine, where more than 10 000 learning and development programmes across the European Union can be connected and recommended to users based on the career pathways they wish to pursue. Individuals can update their profile with any newly acquired skills each time they undertake a new course. The Skills Passport is

portable, accessible through a unique QR code and remains with the candidate for the duration of their training and employment journey. Users will see job and career matches that are only above a 50% fit for their skills, and other important attributes they seek in a role (such as location, benefits and working model). This feature helps workers identify the most suitable career path based on their current skills and interests. Likewise, employers can see their best skills match (in an anonymised way) and can invite candidates to interview using the platform.

Employers may consider developing specific talent acquisition programmes to find the most suitable employees. These programmes or recruitment campaigns – such as the one described in Box 1.5 – focus on hiring talent with the right skills, even if they have acquired these skills in non-traditional ways. To ensure the success of these programmes however, more employers need to recognise the value of learning acquired through alternative methods. The vast majority of employers in the United States (80%) believe that organisations need more information on how alternative pathways differ from traditional pathways (American Student Assistance and Jobs for the Future, 2022[3]). These firms may thus need to actively engage in seeking out more information to understand how non-degree learning paths build skills. Managers may require personalised coaching and guidance services to tackle pre-conceived perceptions and biases and build their understanding of non-traditional pathways.

Box 1.5. Skills-based recruitment drives help hire diverse talent

Increasingly, more companies are creating alternative recruitment pathways to hire and train diverse workers. Talent acquisition programmes such as Workday's Opportunity Onramps use a skills-based approach to source talent, and provide training, internships and job opportunities to jobseekers from non-traditional backgrounds. The programme expands pathways for individuals who have not undertaken traditional college education but have acquired skills through alternative routes, such as through bootcamp courses. Workday states that 16% of all their 2022 hires for entry to mid-career roles in the United States came through the Opportunity Onramps programme, which sets them on track to achieve their goal of 20% by the end of 2023 (Workday, 2023[17]). Alongside Opportunity Onramps, Workday also has other talent acquisition programmes for untapped talent, including an early career internship for technical roles where they partner with technical training courses to access skilled talent pools. The entire cohort of 2022 early talent interns has since been converted to a full-time position (Workday, 2023[17]).

Adapting recruitment and assessment techniques for skills-first hiring

As firms begin to prioritise candidates' skills over their qualifications, their recruitment practices need to evolve. Traditional screening methods tend to rely heavily on screening for candidates' qualifications or experience and are thus not well suited for skills-based hiring. Instead, firms can broaden the range of their recruitment techniques by exploring the use of practical assessments, group assessment centres, and skills or competency-based interviews. Other inclusive hiring techniques include reviewing portfolios of past work, providing anti-bias training to recruitment panels, using blind CV software and asking applicants to not reveal personal or demographic information on their application (Generation, 2023[5]).

These techniques screen candidates for their capabilities and help employers test for the specific skills that are needed in a role. They are also less likely to invite discrimination and bias – Generation's survey of employers in the technology sector found that when reviewing blind resumes, employers were equally likely to offer an interview to candidates with a degree than to those with a (non-degree) certification

(Generation, 2023[5]). This finding challenges the long-held assumption that candidates with formal qualifications have more skills or are better suited for jobs.

Nonetheless, assessing and validating candidates' skills was reported as the biggest hiring challenge faced by employers trying to implement a skills-based approach in a 2021 private sector survey (McKinsey, 2022[18]). Some employers are thus lacking the confidence to and knowledge of how to design effective assessment methods to validate a candidate's proficiency in certain skills. Some paid, private sector solutions exist – a few examples are noted in Box 1.6 – to help employers embark on their skills-first journey. Some of these solutions are supported by artificial intelligence and may help to assess candidates' skills in an accurate and unbiased manner.

Box 1.6. Subscription-based solutions for talent acquisition and skills assessment

Employers may consider engaging with the services of online platforms to find, hire and assess potential employees. For instance, Vervoe helps firms to develop unique skills assessments and work simulations to predict candidates' job performance, based on their library of over 300 skills assessments. Backed by artificial intelligence, the site grades and ranks candidates based on their performance in the skills tests. CodeSignal provides technical interview and assessment guidance for employers in the technology sector, including the use of coding tests. Their assessment process exposes candidates to a rotating and large set of questions, and together with other anti-cheating mechanisms, aims to ensure rapid and effective technical skill screening. Pymetrics provides employers with a skills-based applicant screening process to identify good skills matches, and a quantitative reasoning assessment for employers looking to fill analytical and finance roles. For workers, it is also a matching platform which links jobseekers with roles based on soft and hard skills matches and provides users with personalised course recommendations to close skills gaps. Furthermore, to support jobseekers in preparing for technical assessments, sites like Interviewing.io facilitate anonymous mock interviews with engineers from top technology companies (e.g. Amazon, Google and Facebook).

Alooba is a start-up founded in 2019 which offers clients a CV screening service and assessments made to test and validate candidates' data and analytics skills. Particularly relevant for employers in technical and quantitative fields, the assessments test and validate candidates' proficiency across 50+ technical skills, including for roles in data science, data analytics and data engineering. The service helps remove unconscious bias from the screening process by objectively pre-screening candidates – candidate cloaking hides applicants' personal information, reducing the likelihood of discrimination and bias during recruitment. Employers can customise their desired candidate skills assessment by integrating their own questions with Alooba's database.

On the worker side, jobseekers will need to prepare for a skills-based hiring process by developing a skills-based CV, and should identify other ways to market their skills, for example through the use of a digital skills product. They may reach out to career guidance services for resume, interview and career advice. Over the past decade or so, several public employment services have started matching jobseekers to vacancies based on skills – for example, this is the case in Belgium and France (see Box 1.7), as well as in Germany, Denmark and the Czech Republic (hereafter 'Czechia') (European Commission, 2014[19]). Skills-based matching has the potential to improve the accuracy of candidate-to-job matches and broadens career pathways for jobseekers who are encouraged to explore the transferability of their skills to new occupations. Public employment services across Europe generally have well-established skills-based profiling and assessment tools which help jobseekers understand their skill sets and skills gaps (European Commission, 2023[20]). Despite these advances, guidance counsellors across OECD countries can be better trained to deliver targeted, skills-based guidance, including advice on how to perform skills-based assessments and interviews, and potentially how to use advanced technology to conduct better skills

matches. Agencies can consider the use of artificial intelligence algorithms – very few across Europe have done so thus far – to better match jobseekers to employers using skills intelligence (European Commission, 2022[21]). A recent OECD report found that around one-half of public employment services across the OECD are employing artificial intelligence to improve their services (Brioscú et al., 2024[22]).

Box 1.7. Public employment services delivering skills-based advice

Over the past few years, Pôle Emploi, the French public employment service, has reduced its reliance on CVs. Whilst jobseekers can still choose to provide their CV to an employer, Pôle Emploi has developed a 'business card' for each jobseeker which showcases their skills, including any detailed technical or soft skills. Skills are at the core of a French jobseeker's profile – career counsellors are guided by a system which matches jobseekers' skills profiles to new job openings. Additionally, in March 2023, Pôle Emploi launched a significant reform of its catalogue of job profiles (called ROME 4.0). Now, job profiles are constructed using a skills-based approach, thereby emphasising the key role that skills, knowledge and abilities play in each occupation. This new format aims to facilitate the transferability of skills across sectors and occupations, stressing how jobseekers can build their careers by focusing on their skills regardless of what their previous field of work was.

Le Forem, the public employment service of Wallonia in Belgium, matches job vacancies with jobseekers using a skills-based approach. Jobseekers engaged with Le Forem's services are asked to provide information about their skills in a particular occupation. Employers are also asked to include details of the skills required for a position in their job advertisements. The agency has transitioned from a system based on job title, experience and expected education, to a more complex, skills-based system, where skill demand and supply is at the centre of the matching process. Based on artificial intelligence technology, Le Forem collects personal characteristics and skills information for each jobseeker, and uses them, combined with skills-based testing, to build the jobseeker's professional profile and skills portfolio. This is used to provide training and career guidance support. The data is available to jobseekers via a secure 'personal space', where jobseekers can also find a tool for an online skills assessment (European Commission, 2023[20]).

Public employment agencies across Europe have been using a range of skills-based assessments and profiling tools for some time. The skills-based assessments procedure conducted by the public employment service in Denmark, for instance, is quite extensive. It involves: 1) a counselling and placement interview (to record vocational, language and soft skills in a placement software); 2) a work placement (which measures vocational skills with the help of an employer or a training institute); and 3) a psychological assessment (used to assess aptitude, motivation, interdisciplinary skills and digital skills). Some agencies utilise assessments for specific skills. For example, Pôle Emploi in France exploits a tool called Pix Emploi to evaluate basic digital skills. Pix Emploi is a short online test with 20 questions based on the EU Digital Competence Framework, focusing on skills like sending and receiving emails, using a text editor, or browsing safely on the internet. Three levels of digital autonomy are defined: very limited, moderate, and autonomous. Based on the outcome of the test, counsellors can propose workshops to help jobseekers use online Pôle Emploi services and can offer basic digital skills training leading to a certification, which they can add to their resume (European Commission, 2023[20]).

Engaging in continuous training to address skills gaps

Adopting a skills-first mindset also calls for a lifelong learning mindset. With the rapid speed of technological change and the transition to a greener economy, skill demands are evolving continuously. Thus, workers should be engaged throughout their lives in reskilling and upskilling programmes to ensure their knowledge, skills and capabilities remain up-to-date. Workers will be especially encouraged to engage in training when employers signal that they value it through a skills-first approach. Skills-first approaches provide a unique opportunity to make training more focused on skills gaps – when training and education providers re-design courses in a more modular, targeted way, learners can train more quickly and flexibly, thus increasing accessibility. More information on how governments can support an inclusive and flexible adult learning system is provided in the final section of this chapter.

Firms may consider re-formulating internal training to be more skills focused. Larger companies, for instance, can consider creating an internal learning platform for workers, akin to the ones described in Box 1.8. Alternatively, firms can provide greater financial assistance for workers looking to undertake external training. Workers and firms may both require external guidance to navigate the variety of training offerings. Some cohorts will require extra assistance in updating their skills profiles to remain competitive – older workers, for instance, who may have years of work experience alongside formal qualifications, may require greater reskilling and upskilling to prepare for a more skills-focused labour market. Alongside the provision of greater training opportunities, employers may need to rethink onboarding processes and the role of mentorship to ensure skills-first hires are well-integrated into the work environment.

Box 1.8. Personalised learning recommendations encourage continual skills development

To support a culture of continuous learning, IBM's internal learning platform provides personalised training recommendations for employees and tracks their progress. Supported by artificial intelligence, recommendations are made based on employees' skills profiles, though the decision to engage in a particular training is ultimately up to the employee. The system offers industry-recognised digital credentials which are portable and can be taken by the worker to their next employer. Each employee at IBM is expected to complete a minimum of 40 hours of professional learning and development in a given year. IBM's learning platform combined with the lifelong learning expectations set by senior management mean that employees generally exceed their annual learning targets – in 2022, staff at IBM completed an average of over 80 hours of training (IBM, 2023[14]).

Agencies in the public sector have also established internal platforms that provide personalised career and training information. For instance, the United States Navy's MilGears platform enables service members and veterans to capture skills acquired through training, education and on-the-job experience. The platform aggregates users' entire record of training and education accomplishments into a single, secure and centralised place. It provides recommended professional growth opportunities and future career pathways tailored to each service member based on their military education, training, credentials and experience. Individuals can log their validated credentials, determine their skills gaps and use their profiles to help plan for their post-military careers. The platform ties skills to the O*NET taxonomy, providing a skills framework that links to jobs across the American economy.

A skills-first labour market extends beyond firms and workers: training providers also have an important role to play to ensure training programmes are adapted to the skill needs of the current and future workforce. Some training providers – such as Generation, as described in Box 1.9 – engage in industry collaboration to ensure programmes and curricula remain updated. Responses provided by training providers to the OECD's Skills-Based Approaches Survey revealed that many providers believe the adult learning landscape is not yet well-equipped for a skills-first world. Whilst progress has been made towards

a skills-focused training environment, there remains a disconnect between what training programmes offer and what employers seek. Industry collaboration when designing programmes is important, as well as a greater emphasis on hands-on, practical training. Training should also be broken-down in a more modular, flexible way to encourage greater participation, with each module addressing specific learning outcomes to ensure programmes are targeted to the right skills (OECD, 2023[23]). Finally, training institutions should conduct regular internal audits of their programmes and establish mechanisms to ensure the delivery of high-quality training.

Box 1.9. Collaborating with industry to deliver relevant skills training

Operating across 18 countries, Generation is a non-profit organisation providing training to prepare jobseekers for employment. Each of its bootcamp-style, 1- to 3.5-month long training programmes is designed to deliver skills training to prepare learners for a specific role or occupation. To ensure its training programmes align with the skills most sought after by employers, Generation engages with employers, industry associations and other experts to identify emerging skills gaps. Based on this feedback from and collaboration with stakeholders, programme offerings are continually refined to ensure they meet industry needs. When designing their programmes, Generation conducts job shadowing to understand the exact needs of a role. Industry experts are consulted again after programmes are designed to ensure key areas for skill development are not missed. Additionally, Generation programmes prioritise hands-on, experiential learning which simulates real-world work environments to provide learners with practical skills that can be quickly applied in the workplace.

Adapting performance management processes to better support career progression based on skills

If skills development is the norm, then promotion and progression decisions can be more easily made based on skill levels and work performance, rather than tenure, experience or job history. Support for this approach is strong – around three-quarters of both workers and business leaders express overall support for evaluating workers based on their skills (Deloitte, 2022[9]). Importantly, career progression based on skills can promote greater equity in workplaces – 80% of workers in a recent survey stated that hiring, pay, promotion, succession and deployment decisions based on skills would reduce bias and improve fairness, while 75% of business executives believed it would help democratise opportunity (Deloitte, 2022[9]).

Under a skills-based approach, the performance appraisal process would include a skills development conversation. Manager feedback should reflect a person's skills, with performance discussions centred largely around how to improve skills gaps. One way to fill skills gaps is to facilitate greater employee mobility across teams and projects, as noted in Box 1.10. Skills-based appraisals provide personalised development advice. Feedback is generally more meaningful and actionable than standard performance or output-based feedback, providing workers with a clearer sense of direction and growth. If companies have re-written job descriptions using a skills language, managers will be able to benchmark workers' performance against the expected skills of each role more easily, providing more open and clearer feedback. This also makes promotion decisions within an organisation more transparent. Moreover, employees can conduct a self-appraisal in this system. Involving workers directly into the performance management system personalises the process and allows managers to respond directly to workers' concerns. Nonetheless, progression decisions tied to skills may not be suitable for all roles and firms will need to understand when its suitable to make these decisions. Managers themselves may also require additional training, guidance and information on how to conduct skills-based appraisals, and more generally to instil a top-down acceptance of a skills-based culture.

Box 1.10. Developing skills through project-based work

Some organisations have developed their own internal systems to facilitate employee mobility. Unilever's "U-Work" internal talent marketplace enables employees to flexibly move between projects and tasks across the organisation, either as a permanent employee or as a "U-Worker" – a worker who is contracted to work on short-term projects but retains a core set of benefits like a permanent employee. The company is increasingly structuring its operations such that work is being divided into projects, tasks and deliverables, allowing the right talent with the right skills to be allocated to projects. Underpinning this system is the belief that each role in the organisation is a collection of skills, rather than a simple job title. To further support skills development, each Unilever employee has an individual plan called "My Future Fit Plan", a skills development framework that connects workers to the company's priority skill needs for current and future roles. Each employee identifies one or more future pathways for themselves and uses their plan to guide their career path and training decisions. Employees also receive personalised learning materials that fit their plan.

The WorkDay Career Hub is a platform where individuals can sign-up for gig work. Individuals can work on specific projects based on the particular skills they would like to develop. Managers can leverage the platform to find suitably skilled workers for temporary or short periods of time. In a recent survey, Workday finds that 95% of gig participants are able to build on existing skills or develop new skills while using their platform. The vast majority of project managers also report that gig hires produce just as good results and are just as efficient as other team members (Workday, 2021[24]), though broader concerns remain about the job security of gig work.

Opportunity Marketplace, offered by SAP, is a talent marketplace which matches people to opportunities and roles based on their skills, interests and preferences. It recommends personalised development opportunities to users and connects them with experiential, on-the-job learning, allowing them to learn new skills or practice their current ones. Beyond work, employees can also be connected to mentorship programmes and training courses. Companies who use this type of software can fill their skills gaps internally whilst simultaneously encouraging a lifelong learning and growth mindset.

Within a skills-based appraisal system, managers may consider rewarding employees when they take actions (such as training) to improve their skills. In this way, part of workers' remuneration would be tied to their skills. Decisions surrounding pay rises and promotions can be assessed through a combination of performance at work, outcomes achieved, and skills displayed or used. Employers may offer workers both a base salary based on their job or role, and a "skills" salary based on the market value of and organisational need for their skills (Deloitte, 2022[9]). Some leading organisations are utilising advanced technology to make more transparent decisions around pay and performance (see Box 1.11). In addition, employers may consider providing non-monetary recognition for skills development, such as through the use of digital credentials to incentivise workers to pursue and complete training and certification.

Box 1.11. Using artificial intelligence to make skills-based pay decisions

To make better pay decisions, IBM uses an AI backed system called CogniPay. Through this system, managers make compensation decisions by evaluating data on employee performance. The system assesses what other employers pay for similar jobs and what the market demand is for similar skills, to ensure workers are receiving competitive salaries. The system also takes into account voluntary attrition of employees with the same skills. IBM estimates that attrition halved after managers began to act on CogniPay recommendations (SHRM, 2019[25]). Beyond pay, IBM has replaced its traditional annual performance review process with a more frequent, coaching-based system which assesses employees' skills growth on a quarterly basis.

Despite the benefits of using AI to make progression and pay decisions, workers' representatives express concern about their potential discriminatory or non-inclusive nature. Workers should consent to their use and unions should be included in the design, development and implementation of such algorithms.

Despite the benefits of skills-based pay, challenges may arise when the skills-based system interacts or conflicts with a qualification- or experience-based remuneration systems. Workers' representatives and trade unions voiced some concern on this issue in the OECD Skills-Based Approaches Survey. Many collective agreements across Europe use workers' qualifications to set wage and benefit scales. The European Trade Union Confederation has expressed concern that only those with formal qualifications will retain traditional protections as set out under collective agreements (Euractiv, 2023[26]). Firms will need to make sure that workers are not penalised for not having a formal qualification, but that, likewise, highly qualified workers with formal qualifications do not receive lower pay than their equally skilled, non-qualified counterparts. Social partners should think carefully about how pay scales and pay rises are determined, and whether a hybrid approach based on a combination of pay, experience, qualifications and performance should be adopted. In general, trade unions have a role to play in addressing skills-based approaches in collective bargaining. Social partners and employers should discuss and negotiate together the ways in which skills-based approaches can advance worker progression and job opportunity.

Adopting a lifelong learning mindset and establishing strong evaluation processes requires leadership support

A lifelong learning mindset begins at the top. Successful implementation of a skills-based approach requires the support of senior management. Employers commonly cite a traditional legacy mindset as the biggest obstacle preventing adoption of a skills-based approach (Deloitte, 2022[9]). Leaders looking to build a skills culture should make active and open commitments to their workforce, and express their support for lifelong learning, which in-turn will encourage more workers to undertake continuous skills development. Even so, implementing the approach will take time and leaders may not see the true value of or benefit from the approach for a while. Employers should remain open to receiving criticism and hold a space for consultation and feedback with their staff to ensure they collect a broad range of opinions as they progress through their skills-first journey.

To track progress, organisations should consider establishing strong frameworks and processes to evaluate their adoption of the approach. If they are not doing so already, employers can begin collecting data on key diversity and evaluation metrics, such as application, interview and hiring rates of diverse candidates, performance of candidates on skills-based assessments, the percentage of staff undertaking new training each year, and retention and attrition rates. Continuous improvement on these metrics will reinforce wider support for the approach. Some organisations with strong evaluation frameworks are

described in Box 1.12. In support of this effort, governments can supply data on equity in education, training and workforce for target sectors. For example, Australia's STEM Equity Monitor provides data on the state of gender equity in STEM in Australia, tracking changes over time in key developmental and career phases to highlight girls' and women's engagement with STEM.

Box 1.12. Evaluating skills-based approaches

IBM has been collecting extensive data since first implementing a skills-based approach over a decade ago. It finds that their skills-based hires are just as skilled and effective as workers hired under traditional models, and that there is no meaningful difference in the cognitive ability assessment scores of graduates with bachelor's degrees and skills-first hires (IBM, 2023[14]). In many ways, skills-first hires often exceed expectations and score quite highly in annual performance reviews (IBM, 2023[14]). IBM is part of the Measurement Working Group of the Multiple Pathways Initiative, which helps organisations align on best practices and develop frameworks and metrics to measure company progress towards adopting skills-based practices (Business Roundtable Multiple Pathways Initiative, 2022[27]).

Generation also has an established data collection system and evaluation process. Through their annual alumni survey – which follows graduates two to six years post-graduation – Generation assesses outcomes across a broad range of measures. They assess for instance the progress of their graduates in the labour market by collecting data on job placement rates at 90 days and 180 days post-graduation, job retention rates at one-year post-placement, and earnings before training and after job placement. Generation finds that after completing one of its bootcamp-style training programmes, almost 90% of graduates find a job within six months, 70% continue to meet their daily financial needs two to six years later, and 40% can save for the future (Generation, 2023[28]). By collecting detailed data on its impact, Generation can more accurately assess the effectiveness of its skills-based methodology and the longer-term impact of its training programmes.

Supporting private sector efforts through broad government actions

Governments can support the efforts of the private sector by establishing the frameworks and systems necessary for a skills-first future. First, governments can work to provide an efficient Validation of non-formal and informal learning (VNFIL) system (this is also referred to as a Recognition of Prior Learning system). A strong VNFIL framework is essential as skills-first approaches scale-up across the labour market, as it allows employers to recognise and validate candidates' skills more easily. Many workers already possess a range of valuable skills acquired informally or non-formally. By engaging with VNFIL processes, they can have these skills validated by a trusted, third-party body. Employers may be more willing to hire workers without formal qualifications if they, instead, have their skills validated by VNFIL bodies. Moreover, through VNFIL procedures, workers can earn credentials or study credits which can then fast-track further training, helping workers to train more flexibly (OECD, 2023[23]; OECD, 2023[29]). In this way, credentials and qualifications can continue to play an important role in a skills-focused labour market.

Alongside an efficient VNFIL system, which validates and recognises learning acquired in non-formal ways, expanding and diversifying the way learners can learn can boost adults' participation in training. Governments and training providers should provide more flexible and modular learning options, and expand delivery methods to include online and asynchronous learning options. Making training more modular requires breaking down programmes into discrete modules, with each module defined by a set of learning outcomes designed to teach specific skills. In this way, programmes are designed with skills in mind, allowing learners to address specific skills gaps when needed. More generally, modular, shorter,

and asynchronous learning provides learners with greater flexibility over when, where and how they learn, and can be an excellent way to boost participation amongst under-represented cohorts (OECD, 2023[23]).

To support firms in conducting skills assessments, the public sector can develop publicly available, free skills analysis tools. Most OECD countries, at the national, regional or sectoral level, conduct these exercises, usually at the public employment service. Box 1.13 provides an example of a social partner being involved in generating skills intelligence for the technology sector. Trade unions should also actively be involved in identifying skill needs and labour market trends. Governments can also contribute to skills knowledge by developing skills-based occupational profiles. For example, the Australian Skills Classification identifies skills for every occupation in the Australian economy, helping employers and workers identify occupations which share common and transferable skills. This type of mapping also supports employers implementing a skills-based hiring strategy to identify skill needs for each of their jobs roles and write skills-based job ads.

Box 1.13. Social partners generating skills intelligence for the tech sector

Social partners and industry associations can be heavily involved in the generation of sectoral-specific skills intelligence. TechNation Canada – Canada's leading national technology industry association – provides information on jobs in the technology sector. Their free Career Finder tool contains information on: 1) Job Availability (the demand for technology-related jobs by region and seniority); 2) Job Title Heatmap (a tool which provides skills trends including emerging and decreasing skills by region); 3) Job Descriptions (provides detailed job descriptions for technology roles to support employers in writing job ads); and 4) Career Pathways (helps workers discover technology career pathways and suggests skills needed to train). Additionally, TechNation has published cybersecurity national occupational standards which can help employers incorporate a language of skills and competencies when re-writing cybersecurity related job descriptions.

Governments also have a role to play to ensure skills are taught, assessed, recognised and valued in a standardised, high-quality way. Skills-based approaches are relatively novel – with more organisations beginning to experiment with and implement the approach, quality assurance is essential. The public sector can ensure a higher standard of training by for example continuing to conduct independent audits of training providers. This will ensure skills-based programmes are designed and delivered effectively and consistently, and will simultaneously help build trust amongst employers and workers who seek alternative learning pathways. Furthermore, developing training regulations and minimum standards establishes baseline requirements that training providers must follow. Governments can also work to establish standardised skills assessment and validation procedures through VNFIL processes.

Detailed recommendations

For employers and social partners

- Employers should engage with skills intelligence tools, inclusive hiring software and skills-based matching platforms when writing job descriptions, advertising positions and finding talent.
- Employers should develop talent acquisition programmes or partner with non-profit organisations and training institutions to develop alternative entry pathways.
- Employers should engage with skills-based assessments and a range of inclusive hiring techniques to expand talent pools and accurately screen for and assess candidate skills.
- Employers should adopt a lifelong learning mindset and seek-out appropriate training opportunities for employees, including through the use of project-based work and facilitating internal worker mobility to expand on-the-job skills development.
- Employers who wish to expand their adoption of skills-based approaches should tie employee progression and promotion decisions to skills, and train managers to ensure they are well-equipped to lead skills-based appraisal conversations.
- Social partners and public employment services should contribute to the generation and dissemination of skills intelligence by identifying skill needs and labour market trends.
- Trade unions should play a greater role in addressing skills-based approaches in collective bargaining agreements and voicing the concerns of workers especially regarding skills-based progression and pay.

For education and training providers

- Training providers should expand programme delivery options to include shorter, more targeted, modular, asynchronous and online learning options to improve flexibility in adult learning provision and boost participation in training, especially amongst under-represented groups.
- Training providers should engage employers and social partners in the design of training courses to ensure curricula remain relevant to industry needs. They can also collaborate with employers to place learners into firms to facilitate better skills matches and improve practical training.
- Training providers should establish internal quality assurance mechanisms to ensure skills-based training is of high standard.

For governments

- Governments should conduct quality assurance of training providers and develop training regulations to maintain minimum training standards.
- Governments should establish an efficient system for the validation of non-formal and informal learning system to facilitate employers' recognition of employees' skills.
- Public employment services should match jobseekers to employers based on skills and can engage with advanced technologies like artificial intelligence to better conduct this matching.
- Public employment services should train their career guidance counsellors on how to write skills-based resumes and conduct skills-based assessments to better service jobseekers.

For all stakeholders

- All stakeholders should expand data collection efforts to better track performance and evaluate the success of skills-based approaches.

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Note

[1] More information on the SFIA Foundation can be found here: https://sfia-online.org/.

2 Building the future of skills development through micro-credentials

Micro-credentials are short, targeted learning activities that offer a way for learners to retrain and upskill quickly and efficiently. This chapter outlines core challenges that limit the effectiveness of micro-credentials and outlines actions that governments, training providers, employers and social partners can take to overcome these challenges. Maximising the potential offered by micro-credentials requires investing in quality assurance mechanisms, supporting outreach efforts and providing access to information about micro-credentials, facilitating integration with existing education frameworks, and making a commitment to data collection and evaluation. A high-quality micro-credential eco-system can help individuals and businesses react quickly to changes in demand for particular skills, which may be especially useful in fast-moving areas such as the tech sector.

Introduction

Credentials are key to highlighting and signalling the skills that individuals have acquired over the course of their lifetimes. While traditional credentials include formal degrees and qualifications, micro-credentials have recently grown in popularity amongst adult learners looking to reskill and upskill quickly and efficiently. Micro-credentials are organised learning activities that award a credential upon completion, where a credential recognises a skill that has been acquired through this learning process and validated through an assessment (OECD, 2023[1]; OECD, 2021[2]). They are typically shorter in duration or workload, more targeted in terms of skills or subject matter, and more flexible in delivery than a traditional degree programme. Definitions of micro-credentials vary, but for the purpose of this chapter, the term micro-credential is used broadly to refer to all short, alternative learning opportunities including those that award certificates and digital badges.

Well-designed micro-credentials can enable learners to retrain and upskill quickly and efficiently. Hence, they have a valuable role to play in keeping up with the rapid pace of change in skill needs. Their modular and targeted nature means that learners can fill specific knowledge gaps or address particular skills shortages in a relatively short amount of time. This is especially useful in the technology sector where the speed of technological advancements requires workers to continually engage in skills development. Moreover, micro-credentials are often delivered in a flexible way, making them a particularly attractive training option for women and minority groups who often face high barriers to participating in training (OECD, 2023[1]). In this way, micro-credentials can help boost the diversity of the workforce.

At the same time, there is much variation in the size and format of micro-credentials, in who offers them and who uses them, and crucially in the quality standards that underpin them. These divergences make it difficult for employers, learners and providers to have confidence in the wide and varied micro-credential landscape and hinder them from tapping into their full potential. Challenges remain in ensuring trust in the micro-credential system. Training providers and governments should work to deliver higher-quality programmes that have been quality assured to facilitate improved recognition and take-up of micro-credentials. Greater awareness efforts and better data collection mechanisms can improve the understanding of and access to micro-credentials, especially amongst under-represented groups. Furthermore, better integration into broader adult learning systems supports transparency and facilitates the use of micro-credentials as complements to formal qualifications.

This chapter describes the challenges limiting the effectiveness of the micro-credential system and provides a set of policy actions that countries, training providers, social partners and employers can take to address each of these challenges. It contains a particular focus on the state of micro-credentials in the technology sector. Nonetheless, the challenges and policy actions described are applicable more broadly. Furthermore, it is important to note that existing rigorous evidence on the nature of micro-credentials, especially in the technology sector, is limited and therefore future work should develop stronger data collection mechanisms to measure and evaluate micro-credentials and their outcomes.

Micro-credentials in the tech sector

Micro-credentials are gradually playing a greater role in the technology sector, with a recent expansion of both the number of providers of micro-credentials and of micro-credential programmes on the market. Credentials offered by the technology sector typically fall outside the scope of formal education and training systems but are nonetheless effective ways for learners to retrain and upskill quickly. The fast pace of technological change, digitalisation and automation is increasingly shifting skill demands and creating new skills gaps for workers. Distinct from other sectors, the technology sector also faces many societal, environmental and legislative changes, such as those arising from the rise in artificial intelligence, which in turn affect training requirements. As a result, when formal education programmes take too long or are

too slow to match market needs, alternative credentials become an advantageous learning option. Curricula of short courses are also easier to update more frequently, to reflect new technologies and industry demands. This aligns with recent work from Canada which finds that while only about 3% of data scientists and software professionals report micro-credentials on their LinkedIn profile, those that do are more likely to list skills, tools and technologies that are more recent, such as machine learning (Dobbs, Abuallail and Lockhart, 2023[3]). This suggests micro-credentials help learners upskill in more novel technologies and newer software.

Some large technology companies have developed micro-certificates available to the general public. For instance, Google, Microsoft and Amazon have established online platforms where learners can complete professional certificate programmes (see Box 2.1 for additional examples). Many of the courses offered in the ICT sector are suitable for beginners and for adults requiring a flexible learning schedule, making them particularly useful learning options for entry-level talent, career switchers or under-represented groups who struggle to participate in adult learning. Certificates offered by these large companies are generally highly valued by employers looking to hire workers in the technology sector, as they are seen as globally recognised achievements (Cedefop, 2022[4]). This may not be the case for less well-known certificates or credentials offered by smaller providers, making it difficult for employers to trust the value of all micro-credentials equally – a challenge noted in the next section.

Technology companies are also using alternative credentials to train their internal workforce. IBM, Microsoft and Adobe, for example, are actively using digital badges to train their workforce (Cedefop, 2022[4]). Digital badges – web-enabled versions of a learner's credentials that can be shared online – are also provided by Dell after an employee completes one of the company's internal training programmes. Similarly, Microsoft provides IT courses and credentials to its employees through Udacity, an online learning platform. Furthermore, Deutsche Telekom has previously used massive open online courses to provide employees across its global operations with training in entrepreneurship, digitisation and design thinking (Cedefop, 2022[4]). More generally, employers looking to adopt a skills-based approach will need to increase their trust in alternative credentials to ensure their workers continually engage in training throughout their working lives.

Box 2.1. Micro-credentials delivered by technology companies can address market needs quickly

Google Career Certificates are professional courses that prepare learners for high-paying and high-growth jobs in fields such as cybersecurity, IT support, data analysis and UX design.[1] No prior educational or work experience is required to start a professional certificate. The training is available on Coursera. Learners can follow the online programme at their own pace, making it a flexible learning option available for all, with course workloads varying between 110 to 200 hours.

IBM's SkillsBuild programme allows learners to earn free digital credentials from IBM and their partners, with many courses lasting only a few hours and offered in multiple languages.[2] Courses are free and span fields such as cybersecurity, data, IT project management and web development. Each digital badge showcases proficiency in a niche skill, allowing employers to identify workers with specific abilities or knowledge areas.

Established in 2018, Microsoft Learn is an online platform offering a wide range of resources for individuals looking to develop their skills and expertise in Microsoft technologies. It provides interactive tutorials, hands-on labs, learning paths and certifications across various Microsoft products and services, including Azure, Office 365, Power Platform, Dynamics 365, and more. While some courses may require a fee for certification exams or premium content, the majority of the learning resources are available at no cost. The platform caters to learners of all levels, from beginners to advanced

professionals, with self-paced learning options and guidance from Microsoft experts. Microsoft Learn aims to empower individuals to acquire in-demand skills, advance their careers, and stay updated with the latest technologies in the Microsoft eco-system.[3]

The French telecommunications company Orange created an e-learning platform called Orange Campus which offers employees courses on data/AI, cybersecurity, management and soft skills. Participants can take basic or advanced modules and gain specialised expertise leading to a certification or diploma. More generally, Orange intends to strengthen its expertise in technology – over the next five years, it aims to double the number of experts working in several key areas of its business, including network virtualisation, cloud, data analysis, artificial intelligence, coding and cybersecurity. Moreover, to help build a technology talent pipeline and support digital skills development across Europe more broadly, Orange Campus is also available to external users. In particular, the company has partnered with Microsoft AI school, along with Simplon and the Grande Ecole du Numérique, to deliver work-related skills training (Orange Newsroom, 2020[5]).

1. More information on Google Career Certificates is available at the following link: https://grow.google/intl/europe/google-career-certificates/ (accessed on 05 January 2024).
2. IBM's SkillsBuild programme can be accessed here: https://skillsbuild.org/ (accessed on 05 January 2024).
3. Microsoft Learn can be accessed here: https://learn.microsoft.com/en-us/ (accessed on 13 February 2024).

To complement the work of individual training providers, many governments provide free or low-cost digital skills training. This is done to ensure populations have at least a basic digital literacy level. Publicly funded, accessible digital skills training is especially beneficial for vulnerable and under-represented groups, who may be more likely to have very low levels of existing digital skills deriving from the digital divide in their access to IT infrastructure and internet (UNESCO, 2023[6]). Furthermore, the outcome of many of these programmes is often an accredited certificate, which helps to signal to potential employers the acquisition of these skills. Basic digital upskilling also supports the eventual entry of more workers into specialised technology fields. Box 2.2 provides examples of government-funded certification of digital skills.

Box 2.2. Digital skills certification across Europe

Between December 2016 and July 2018, 7.4 million digital skills trainings were provided and 1.9 million certifications were delivered as part of the European Union's Digital Skills and Jobs Coalition. Members of the Coalition spanned business, social partners, education and training providers and civil society organisations across Europe. Amongst others, organisations which provided certifications included ECDL Certifications, Microsoft and Certiport, with some organisations even offering learners job placements or internships. From this, national and regional coalitions across European countries have been established to continue promoting and delivering digital skills training. Many coalitions bring together partners across different levels of society, including ICT companies, and collaborate to deliver industry-led training, certify skills, and raise awareness about ICT careers (Europa, 2018[7]).

The European Commission is currently exploring the creation of a European Digital Skills Certificate (EDSC) as a quality label. Currently in pilot phase, the EDSC would put forward an agreed set of quality requirements, alongside facilitating the quick and easy recognition of digital skills by employers, training providers and other stakeholders. The certificate will be based on the European Digital Competence Framework, helping to provide a common understanding of digital competence. The scheme will be complementary to exiting national or international digitals skills certification schemes.[1]

Digital SkillUp is a European Union-funded initiative delivering short online courses in ten European languages.[2] Their goal is to make basic knowledge of emerging technologies available and accessible

to all European citizens and small businesses. The courses are self-paced and mobile-friendly and provide a certificate of completion for students who pass the course.

At a country level, a range of free, accredited courses are available in Northern Ireland through SKILL UP.[3] The short courses are delivered online by local education providers and are open for students from all levels. Courses are linked to priority economic sectors and deliver training in areas identified by industry where high job growth is expected, including in digital skills and green technologies. Likewise, in the United Kingdom, free qualifications are available for adults with low digital skills, under a statutory digital entitlement which has been in-place since August 2020.[4] The entitlement provides cost-free study for UK residents aged 19 years or older who have very low essential digital skills, as assessed by education and training providers. In France, Pix is a public online service for assessing, developing and certifying digital skills.[5] Users can test their level across five areas from the European Digital Competence Framework.[6] Official certification is available after passing a test for each skill and level.

1. More information on the EDSC can be found here: https://ec.europa.eu/commission/presscorner/detail/en/ip_23_2246 and here: https://education.ec.europa.eu/focus-topics/digital-education/action-plan/action-9 (accessed on 11 January 2024).
2. The Digital SkillUp website can be found here: www.digitalskillup.eu/ (accessed on 05 January 2024).
3. More information on Northern Ireland's SKILL UP programme can be found here: www.nidirect.gov.uk/skillup (accessed on 05 January 2024).
4. A description of the UK's statutory digital entitlement including who is eligible and further links to the qualifications approved for funding can be accessed here: www.gov.uk/guidance/free-qualifications-for-adults-with-low-digital-skills (accessed on 05 January 2024).
5. The Pix website can be accessed here: https://pix.fr/ (accessed on 08 January 2024).
6. More information on the framework can be found here: https://joint-research-centre.ec.europa.eu/digcomp/digcomp-framework_en (accessed on 08 January 2024).

Often training providers design and deliver learning opportunities in partnership with other stakeholders including industry leaders, associations and the business sector. In a recent survey, Cedefop found that 14% of VET providers had their micro-credentials delivered by or in partnership with a big technology company like Google or Microsoft (Cedefop, 2022[4]). Besides technology companies, VET providers also commonly partnered with formally recognised education and training providers, employers' organisations and private accredited providers. Outside the formal training sector, many employer organisations (25%) and some employee organisations (7%) also report partnering with big technology companies in the delivering of micro-credentials (Cedefop, 2022[4]). These public-private collaborations can fast-track the design and development of micro-credentials, helping providers deliver more relevant programmes. Box 2.3 provides some examples of collaborative, cross-sector efforts in the technology space.

Box 2.3. Private-public sector collaboration fast-tracks the development of industry-relevant credentials

Some colleges and universities are collaborating with industry to design micro-credential programmes that are up-to-date with industry needs. In 2021, the University of Ottawa in Canada collaborated with FXInnovation, a provider of advanced IT training, to launch a pilot programme called CloudCampus. When it was first launched as a pilot, the programme started with a seven-week micro-credential course which focused on developing cloud skills that are highly sought after by industry. After completion, students receive a certificate to show they are qualified in cloud skills. The programme is an example of how the business sector can work with the educational sector to curate relevant training to better prepare workers for a role in the technology sector (Bharti, 2021[8]).

IBM was one of the first companies to have partnered with a higher education institution, in the delivery of their digital badge programme. Northeastern University in the United States recognises IBM digital badge

credentials and learners can use their badges as credit for a graduate degree programme or certificate. As of 2017, more than half of IBM's badges had been matched to programmes in Northeastern University's academic portfolio. In this way, IBM establishes itself as a leader in integrating learning in the workplace and shows how collaborating with the university sector can expand learning pathways (Northeastern Global News, 2017[9]).

Other companies have worked in partnership with training providers to deliver alternative learning opportunities. For instance, the learning provider Udacity has developed its 'nanodegrees' in partnership with companies such as Facebook, Google, AT&T, Cloudera and Salesforce. Collaborating with well-known companies in the technology sector provides Udacity's credential programmes with greater industry backing. Through industry collaboration, curriculums also remain highly relevant, and programmes deliver in-demand skills (Shen, 2014[10]).

Technology companies have also built relationships directly with the final users and their communities without the involvement of the traditional education and training sector. The Amazon Web Services re/Start initiative provides 12-week, full-time courses leading to certifications in cloud computing to unemployed and under-represented populations.[1] Learners can take an Amazon Web Services Certification exam to receive certification for their skills. The initiative is active in 11 countries (Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Switzerland, the Netherlands, Spain and the United Kingdom) and is delivered in collaboration with a range of national stakeholders and non-profits, such as youth associations and skills development organisations. The programmes are free to the learner and focus on teaching the technical skills required for entry and mid-level roles in cloud computing. The initiative also connects learners with employers and prepares them for the workplace through resume and interview coaching (Cedefop, 2022[4]).

1. More information can be found here: https://aws.amazon.com/training/restart/ (accessed on 05 January 2024).

Challenges limiting the effectiveness of micro-credentials

Lack of trust in micro-credentials calls for a need to invest in quality assurance

Trust by employers and learners in micro-credentials is one of the most important factors underpinning the quality and integrity of the system. A lack of trust indicates a greater need to invest in quality assurance mechanisms. Significant variation in the quality of existing micro-credentials raises questions related to labour market relevance, usefulness and value. In the technology sector, for instance, the rapid evolution of technologies and skill needs requires that micro-credentials remain up-to-date and relevant. However, due to differences in quality and the lack of agreed standards, not all micro-credentials meet these requirements. Such large heterogeneity often results in scepticism amongst learners and employers about the real-world value of these credentials.

These issues are also compounded by the sheer quantity of courses and providers on the market which can pose challenges to quality assurance. Micro-credentials are increasingly offered by a broad range of providers including industry bodies, private training providers and commercial companies. In Denmark, for instance, many private providers offer credentials that are not quality assured by a public agency due to limited capacities and resources, leading to the mushrooming of credentials on the market (Cedefop, 2022[4]). A similar situation is also observed in Ireland. While having a large variety of offers can provide several advantages, flooding the market and increasing confusion amongst learners is a particular concern in the technology sector, where a significant number of providers appear to offer technology-related credentials.

A recent survey of stakeholders representing employees, students and adult learners shows that trust is subject to factors such as specific characteristics of the micro-credential, reputation and credibility of the issuing body, and the status of formal recognition of the micro-credential by the relevant authorities. According to surveyed participants, the credibility of micro-credentials and of providers, along with their labour market relevance were identified as the most important drivers of trust in micro-credentials. In addition, respondents highlighted the importance of having adequate quality assurance mechanisms in place (Cedefop, 2023[11]). Likewise, when developing the UNESCO definition of micro-credentials, all experts involved in the process agreed that quality assurance is essential (UNESCO, 2022[12]). Moreover, the European Union Council Recommendation on micro-credentials indicates that quality assurance is a key element of trust (Council of the European Union, 2022[13]).

Moreover, a recent survey across the European higher education sector found that about half of surveyed organisations (mostly higher education authorities and quality assurance bodies) rely on internal quality assurance arrangements, and even this is not done so on a consistent basis. A significant share of European countries currently has no quality assurance mechanisms for micro-credentials offered in the higher education sector, with only 16% of organisations currently conducting quality assurance and another 13% developing approaches to do so in the future (ENQA, 2023[14]). Furthermore, almost one-quarter of respondents do not know when they will start to quality assure micro-credentials. This reflects widespread uncertainty surrounding quality assurance of micro-credentials, undermining trust in the system.

Establishing quality assurance mechanisms or improving the applicability of existing mechanisms to micro-credentials would involve defining clear standards, regular monitoring and evaluation of programmes, and ensuring transparency in the outcomes of micro-credentials. Quality assurance is critical not only for protecting learners from investing in sub-par educational products but also for building employers' trust in micro-credentials as valid representations of skills and knowledge. A recent study shows that employers usually have greater trust in accredited learning programmes, however, they often accept non-accredited certificates especially if they signal some specific knowledge, skills and proficiencies (Cedefop, 2022[4]). Social partners also state that they are more likely to accept and trust micro-credentials if standards are set around delivery mode, assessment procedure and duration (ETUCE and ETUC, 2020[15]).

Quality assurance for micro-credentials is not only about maintaining high standards but also about ensuring that these credentials are relevant to the job market and aligned with the needs of employers. It is essential to engage various stakeholders, including social partners, in the design and delivery of micro-credentials to ensure their relevance and effectiveness. The end goal is to make micro-credentials a reliable and recognised tool for up-to-date, quality and industry-relevant learning, accessible to a broader segment of the population.

Furthermore, a lack of trust in micro-credentials means that employers are less likely to recognise their true value. Overlooking workers who have been trained through alternative pathways limits the pool of potential candidates from which employers can hire, making the implementation of skills-based approaches more difficult. When the adult learning system invests in the quality and transparency of micro-credentials, employers are more likely to recognise skills developed via alternative credentials during hiring and value micro-credentials as complements to traditional degrees and diplomas.

The landscape of quality assurance systems in non-formal adult learning varies considerably across OECD countries (OECD, 2021[16]). Three approaches stand out in particular:

1. The regulatory approach which imposes minimum quality requirements that providers need to meet in order to be allowed to operate or access public funds;
2. The advisory approach which uses guidelines and examples of good practices to inspire providers engaging in quality development efforts; and
3. The organic approach which leaves it completely to providers to define their own quality needs.

Depending on country-specific implementation features and governance structures, each approach offers different benefits to the quality provision of non-formal adult learning. Regulation is not always possible or desirable, with many countries currently choosing the advisory or organic approach. The challenge going forward is for countries to identify the type of approach that best suits their market and needs. Many countries moving forward will need to review and adapt their existing mechanisms and approaches to enable and maintain high quality micro-credentials. OECD evidence suggests the importance of establishing a wide and holistic approach, where typical quality assurance tools – such as certifications and evaluations – are complemented with additional support structures such as the validation of prior learning and the involvement of social partners.

Better awareness of micro-credentials can support broader access and take-up

Improving access to accurate and reliable information on micro-credentials can help learners compare options and make better, more informed decisions that impact their learning and career pathways. Lack of awareness in general remains a significant obstacle to more widespread adoption of micro-credentials – in one survey, nearly 60% of respondents were unfamiliar with micro-credentials, with this share rising to nearly 70% for unemployed individuals (Cedefop, 2022[4]). A fragmented micro-credential system in many OECD countries, with many providers and courses on the market, makes it difficult for learners to assess the available options. Courses are advertised on different platforms, usually on the different providers' websites, and the relative benefit of providers and offerings is unknown. Centralised, micro-credential "marketplaces" or hubs are in limited use across countries – this is often because these platforms first require a significant data collection exercise. Greater efforts to gather data on course offerings and centralise this data by displaying offerings for example on a digital platform could greatly improve learner experience.

Particular groups in society may find outreach and awareness efforts especially beneficial to improve their understanding of the benefits of micro-credentials and the available offerings. Engaging under-represented groups can ultimately improve the diversity of learners participating in adult training. Data from the OECD Survey of Adult Skills (PIAAC) indicate that many adults wish to participate in learning but are unable to due to a range of barriers. A lack of time – either due to work or family pressures – is reported as the biggest barrier to adult learning across the board (OECD, 2023[1]). Particular groups may be more likely to report time as a barrier, including women who on average face higher childcare and family responsibilities when compared to men. Shorter learning options such as micro-credentials can support flexible learning and improve participation in training especially amongst diverse learners.

Micro-credentials are a particularly attractive option to boost flexibility in adult learning provision due to their speed and portability, their targeted, low-risk and personalised nature, and their ability to sometimes be stacked with other courses (OECD, 2023[1]). Many modern learners prefer flexible learning pathways, with interest in studying flexibly continuing to increase, particularly in the aftermath of the COVID-19 pandemic. Flexible modes of learning such as blended or online learning can also be more appealing to diverse learners, particularly students with multiple commitments, who live far away or have specific learning requirements (McKenna et al., 2020[17]). Micro-credentials have a range of flexible learning elements and can thus be a key tool in boosting participation in adult learning. Importantly however, under-represented groups need to understand these benefits of micro-credentials and must be first aware of their flexible nature. Greater outreach and communication efforts are required to ensure all groups in society are aware of the flexible and accessible nature of micro-credentials.

Funding is also an important consideration for countries looking to boost the accessibility of micro-credentials. Many micro-credentials, particularly those related to the technology sector, are offered by the private sector, and are thus not subject to public funding. Even micro-credentials developed by higher education institutions generally require paying a fee that is not subsidised, expect by the participant's employer. Micro-credentials also do not attract public funding as they are often not nationally accredited

or registered as a recognised learning opportunity. Integrating micro-credentials into broader learning systems (see below) and quality assuring them can facilitate public funding and thus ease the financial burden on learners. Moreover, employers can be incentivised to provide greater financial support to their workers who wish to engage in training. Ultimately, improved financial arrangements will especially benefit low-wage and low-skilled participants, groups who are the most likely to benefit from micro-credentials.

Integrating micro-credentials into the adult learning system remains a challenge

Integrating micro-credentials into the existing adult learning system presents several challenges, primarily revolving around the recognition and equivalence of these credentials alongside traditional qualifications. To understand how micro-credentials can be better integrated into the broader learning environment, each programme first needs to transparently state its learning outcomes and intended target skills. Currently, there is no consistency even at national level on which information is required when advertising programmes. A common understanding of the level of knowledge and skills that a micro-credential represents would help learners choose the programme that best suits their needs.

Integrating micro-credentials into the broader system may require linking them to National Qualifications Frameworks (NQFs) – hierarchical classifications by which countries organise, recognise and assign value to qualifications. NQFs usually assign levels (and sometimes credit points) based on learning outcomes to each qualification in the hierarchy (Cedefop, 2017[18]). To link micro-credentials to NQFs, an understanding of the credit point value of micro-credentials is required. By specifying credit point values and listing micro-credentials on NQFs learners can more easily understand potential learning pathways after obtaining a micro-credential and reduce uncertainty in course combinations when stacking programmes. Training and education providers will be more likely to recognise the value of micro-credentials and credit learning towards more complex, traditional degrees if the relationship between micro-credentials and other degrees is made clearer. By integrating micro-credentials into the overall learning system, micro-credentials can better complement formal qualifications, and facilitate an easier transition of learners from vocational to higher education (UNESCO, 2022[12]). Nonetheless, linking micro-credentials to NQFs is not always possible as some countries do not have an NQF or have one that covers only part of the education system (UNESCO, 2023[6]).

Another challenging aspect of integrating micro-credentials in the national adult learning framework is how micro-credentials relate to the Validation of non-formal and informal learning (VNFIL) system. Indeed, micro-credentials can themselves be an outcome of VNFIL processes – that is, bodies who conduct VNFIL can choose to award a credential such as a micro-credential to properly validate and recognise the skills acquired by a learner through experience or non-formal learning. This then helps learners better signal their skills to employers or work towards a more traditional qualification, reducing the time and cost of future training.

Practically, integrating micro-credentials into existing educational systems involves modifying administrative and academic processes. This modification might include adapting credit systems to recognise micro-credentials as part of degree pathways, developing new assessment and accreditation methods, and updating curricular frameworks to include or align with micro-credentials. Education and training providers may also need to adapt their internal validation processes to ensure they are effectively assessing the equivalency of micro-credentials. Another challenge going forward will be how higher education and VET bodies integrate micro-credentials into their traditional programme offerings (OECD, 2021[19]). While it is important to note that not every combination of short courses and micro-credentials should automatically lead to a degree, learners could be informed about course and degree prerequisites and guided towards the most viable combinations.

Concerns have been raised about whether micro-credentials should serve as complements to or replacements for traditional qualifications. Social partners in particular have voiced concern that micro-credentials may undermine established VET and higher education systems by replacing formal

qualifications. For instance, in a joint statement, the European Trade Union Confederation and the European Trade Union Committee for Education note that an overreliance on shorter courses like micro-credentials reduces the labour market need for full qualifications. Education is also a public good and, in many countries, higher education is provided to citizens at low or zero costs. Trade unions express that the need to pay for privately delivered micro-credentials may reduce this inherent right to education (ETUCE and ETUC, 2020[15]). Higher education providers across the OECD also support this stance, viewing micro-credentials as valuable complements to – but not substitutes for – traditional degree programmes (OECD, 2021[19]). Therefore, greater transparency around how micro-credentials relate to other qualifications and clarity on how they may interact with the broader learning environment may help negate some of these concerns.

Limited data availability undermines evidence-based policies and programmes

The micro-credential system is marked by a wide range of users, providers and programmes, complicating data collection, analysis and policy making efforts. From higher education institutions offering online courses to private organisations providing specialised training, the landscape is varied. Each provider has different standards, course structures and evaluation criteria, making it challenging to gather consistent, reliable and comprehensive data on micro-credentials. This diversity, whilst enriching the eco-system and providing learners with choice, poses significant difficulties in evaluating the effectiveness, outreach and impact of micro-credentials on a larger scale (Cedefop, 2022[4]).

Lack of evidence on the outcomes and impact of micro-credentials prevents governments from making informed decisions and investments that deliver value for money including on subsidising micro-credentials and whether and how to recognise their credits in formal education. It also prevents learners and employers from assessing and comparing the quality and effectiveness of various micro-credential programmes. Robust data are essential to guide policy makers towards effective and efficient programmes by revealing what works and what does not and to change course when results are sub-optimal. Information on the evaluation of micro-credentials would also benefit firms and learners themselves by helping them understand which programmes are worth their time or the time of their employees. For providers, evaluation can enable them to design micro-credentials in a way that would maximise their impact and attract new learners.

In the absence of a standardised regulatory framework, there is a notable variability in the quality and transparency of micro-credentials. This means that not all micro-credentials are of equal quality: some may offer substantial learning and skill development, while others might provide little real value. Without sound data and evidence, these discrepancies remain unmeasured and unaddressed, and therefore undermine the potential of micro-credentials to facilitate flexible learning and career pathways.

Moreover, unregulated micro-credentials in many countries add to the complexity of collecting robust data and evidence on the take-up rates of micro-credentials. Limited data on take-up rates make it difficult for providers and governments to understand the recipients of micro-credentials and track changes in their outcomes. While some studies indicate that shorter programmes do provide at least a temporary labour-market boost, and stacking micro-credentials may improve prospects in the labour market, evidence on the outcomes of micro-credentials is limited and demands further research (OECD, 2021[2]). Improved data collection on learner outcomes post-study – such as on employment status, income levels or career advancement – could improve understanding of the value of programmes.

In addition, data collection surrounding enrolments and completions disaggregated by socio-demographic characteristics such as age, gender, income and disability status would help providers, employers and policy makers better understand the barriers to accessing micro-credentials. Evidence shows that only four in ten adults across the OECD participate in education and training in any given year, and these numbers are even lower for vulnerable groups, including the low-skilled, older adults and non-native speakers (OECD, 2019[20]). Micro-credentials have the potential to enable vulnerable and under-represented groups

to participate in training by reducing constraints and offering a flexible learning option. In this context, micro-credentials could play a pivotal role to achieve the EU target of reaching 60% of adults participating in training every year by 2030 through enabling learners to update or complete their skill sets in a more flexible and targeted way.

Moreover, a recent study shows that the main recipients of micro-credentials provided by organisations representing employees and employers are usually individuals employed in the organisation's own sector (Cedefop, 2022[4]). This implies that these offerings are more likely to reach those already employed in the sector, possibly overlooking the most vulnerable or disadvantaged learners who are outside these sectors, or workers looking to transition into a new sector. Therefore, better data collection on the diversity of the recipients of micro-credentials could help reveal existing barriers. This data could also underpin more targeted outreach efforts such that training providers can better serve under-represented groups.

Establishing evidence-based micro-credential programmes also relies upon the adoption of a consistent definition of micro-credentials across stakeholders. A lack of a commonly agreed upon definition both within and across many OECD countries makes it difficult for stakeholders to collect data and evaluate the impact of programmes. Uncertainty surrounding definitions can even contribute to confusion at national government levels, with almost one-quarter of national authorities not knowing whether micro-credentials were used in their national context in a recent survey (Cedefop, 2022[4]).

Policy options to improve the micro-credential system

High-quality programmes foster greater trust in micro-credentials

To support the development of successful and trustworthy micro-credential programmes, institutions should reflect on their quality assurance needs and decide on the quality frameworks that best suit their specific governance and market needs. While some stakeholders believe that non-formal qualifications like micro-credentials should not be over-regulated (in order to ensure that courses remain adaptable to changing skills needs), boosting trust in the system may require integrating micro-credentials (at least partially) into the broader learning environment – and doing so may require the development of some formal quality assurance mechanisms. Countries will need to strike a careful balance between regulation and flexibility, such that there is sufficient quality assurance to inspire trust in the system but that providers are still given enough flexibility to develop relevant programmes. Ultimately, each country should decide on the appropriate level of prescriptiveness in the quality assurance of micro-credentials (ENQA, 2023[14]).

On the more regulatory side, countries could establish minimum standards for programmes at the national or sub-national level and courses can be assessed against these benchmarks, with a central body responsible for providing accreditation. However, accrediting each single programme is relatively burdensome, especially for learning institutions offering numerous courses, and could thus limit the speed at which courses can be designed and delivered to learners. Alternatively, countries can accredit providers only, and leave the individual institutions to conduct their own internal quality checks of each programme. This ensures institutions themselves are of high-quality and that they meet minimum teaching standards but cannot guarantee the quality of each programme. The European Union Recommendation on micro-credentials supports this second approach, with its emphasis on the external quality assurance of providers, allowing providers' own internal quality assurance mechanisms to determine the quality of courses.

Countries can also consider adopting a hybrid approach adopting both programme and institutional level accreditation. For instance, in Ireland and New Zealand, institutional level quality assurance is conducted only for the university sector, while programme level accreditation applies elsewhere. In such contexts, learning institutions with institutional-level accreditation should ensure that enough efforts are conducted to undertake an internal evaluation and quality assurance of their non-formal micro-credential offerings.

Box 2.4 provides examples of countries implementing the two approaches – accrediting programmes and accrediting providers.

Box 2.4. Countries can decide between accrediting programmes or accrediting providers

Accrediting programmes

In New Zealand, the national accreditation and recognition of micro-credentials follows a structured process overseen by the New Zealand Qualifications Authority (NZQA). Micro-credentials undergo a thorough assessment to ensure they meet the required quality standards and criteria, mirroring the rigorous accreditation process employed for other, more formal education opportunities. This process includes a comprehensive review of the content, delivery methods, assessment practices and outcomes of the micro-credential, ensuring alignment with industry standards and addressing identified skill needs. Once a micro-credential successfully meets the necessary criteria, it undergoes approval and registration by NZQA, granting it official recognition and credibility within the New Zealand education and training landscape. This standardised accreditation process underscores NZQA's commitment to upholding consistent quality standards across all forms of education and training, reinforcing the integrity and reliability of micro-credentials as valuable learning pathways for individuals and stakeholders alike. Additionally, micro-credentials that have been quality assured by NZQA must be delivered by accredited education and training providers – in this way, New Zealand has a system of both accrediting providers and individual courses.[1]

The Slovak Republic is another example of a country which goes beyond institutional accreditation with its system of accrediting non-formal qualifications, including micro-credentials. Under this system, providers can decide whether to accredit a programme as a whole or by module. According to the accreditation requirements of the Ministry of Education, modules are designed as independent learning units. Therefore, some of these modules meet the criteria for awarding micro-credentials. Providers that are interested in accreditation are advised to follow qualification standards as set out in the Slovak Republic's NQF and are required to submit certain documents when applying for programme certification. Quality-checked programmes are added to a publicly available register of accredited courses, improving visibility and understanding of programme quality. The official register serves to boost awareness of micro-credential offerings and helps to build trust amongst users and stakeholders. Furthermore, a new lifelong learning and counselling strategy adopted in 2021 aims to include accredited qualifications into the NQF as micro-qualifications, an effort which could bring micro-credentials into the formal learning system (Cedefop, 2023[21]).

Accrediting providers

Many European countries have made provider certification and quality labels compulsory in order to receive public funding (OECD, 2021[16]). Hence, the practice of accrediting providers is currently more common. Switzerland's long-standing eduQua certification framework gives adult learning providers a quality label if they meet minimum standards. The eduQua label certifies the entire institution, not its individual courses. Yearly intermediate audits are conducted, and certification lasts three years after which renewal is necessary. The quality label provides institutions with recognition and credibility, allowing them to remain competitive in the education and training market. The system is well-trusted and managed by a central Swiss body which defines the criteria that evaluating bodies use to measure the quality of providers. Standards are in a publicly available manual which defines in detail why the standard has been selected, indicators that can be used to evaluate the standard, and any documents needed for certification processes or audits. These evaluation guidelines are clear, transparent and detailed – they allow different certification agencies to use the same standards to evaluate providers.

France similarly uses a quality label system for professional education providers, including micro-credential providers, called Qualiopi. External quality assurance evaluators, certified by the French Accreditation Committee, are responsible for granting the quality label. During the initial application phase, certifying bodies conduct on-site audits to ensure that providers meet national quality standards and effectively implement them. Subsequent inspections occur one year later to maintain compliance. Non-compliance may lead to suspension or withdrawal of the label. Furthermore, upon expiration of the Qualiopi label after three years, providers undergo a new on-site audit to renew certification for another three years. The existence of a nation-wide and officially recognised label does not only foster trust among learners but also instils confidence in employers. Furthermore, outsourcing and distributing the quality assurance evaluation of the micro-credentials to external partners prevents an overburdening of the national accreditation system and thus allows for a steady flow of newly accredited courses.[2]

1. More information on accreditation rules for micro-credentials in New Zealand can be found here: www2.nzqa.govt.nz/about-us/rules-fees-policies/nzqa-rules/qualification-and-micro-credentials/ (accessed on 13 February 2024).
2. More information on the Qualiopi system in France can be found here: https://travail-emploi.gouv.fr/formation-professionnelle/acteurs-cadre-et-qualite-de-la-formation-professionnelle/article/qualiopi-marque-de-certification-qualite-des-prestataires-de-formation (accessed on 13 February 2024).

Programmes that are designed with standards in mind are more likely to be transparent about their intended learning outcomes and thus are more likely to provide clarification regarding the information conveyed about micro-credentials. Stakeholders – in particular, employers and credit-awarding education institutions – are more likely to recognise learning completed via a micro-credential if standards clearly indicate the learning outcomes achieved. First, training providers can be more precise in their description and advertisement of courses to clarify intended learning outcomes for prospective learners. Furthermore, national authorities could work towards producing a set of guidelines that training providers can follow when advertising their courses, to encourage greater consistency of the type of information that is required. Australia for example has established a set of minimum standards for micro-credentials (see Box 2.5). Whilst not binding, these standards must be observed by providers to be able to issue offerings on the Microcredentials Marketplace (more information on the Marketplace is provided further below).

Countries can alternatively implement “softer”, non-regulatory approaches to quality assurance, primarily through external evaluations and audits. A quality culture can also be fostered through quality awards and prizes. In Finland, for instance, the Ministry of Education and Culture organises a yearly quality award competition for adult education providers with the objective of encouraging learning centres to assess and continuously improve the quality of their activities. The quality award recognises the quality of services, based on performance against predefined criteria determined by an expert committee appointed by the Ministry (OECD, 2021[16]).

Box 2.5. Setting minimum standards makes information more transparent

Australia has established a set of minimum standards in their National Microcredentials Framework. It stipulates essential and recommended criteria, guiding providers in the design of programmes (Department of Education, Skills and Employment, 2021[22]). The framework also helps learners make more informed decisions when choosing micro-credentials. The minimum information required for all micro-credentials include: Title; Provider; Content/description; Learning outcomes; Language; Delivery mode; Date of delivery; Learner effort; Inherent requirements; Price and financial assistance; Assessment; Certification; Credit/other recognition; Quality assurance; and Prerequisite/s. Alongside these essential standards, a list of recommended elements are also noted, which constitute information that may assist a learner in navigating the credential. Furthermore, alternative providers must publish a

"statement of assurance of quality" when they wish to list their programmes on the Microcredentials Marketplace. This statement includes the profile of the provider, a description of the quality assurance process undertaken, and the process for reviewing or updating the micro-credential.

The standards outlined in Australia are similar to those recommended by the Council of the European Union in its recent recommendation on micro-credentials. This document similarly contains a list of mandatory and optional elements to be used when describing a micro-credential. These European standard elements are designed to ensure the consistency of information for all stakeholders. Member States are encouraged to establish their own national standards in-line with this Recommendation (Council of the European Union, 2022[13]).

Another way trust can be fostered is through the development of industry-relevant, employer-backed programmes. Training providers can work with both social partners and employers to design demand-driven programmes. In Denmark, for example, the employer organisation TEKNIQ, alongside the Trade Union for Electricians and the Trade Union of Plumbers and Allied Workers, actively collaborated with public employment services to craft two micro-credential programmes (Cedefop, 2023[11]). The joint effort aimed at enriching the skill sets of long-term unemployed and low-qualified individuals, by equipping them with abilities to become cable and pipe fitters. This collaborative initiative is a direct response to the increasing demand for such skills, notably fuelled by the green transition movement. Similar collaborative efforts could be established in other countries for the technology sector.

Moreover, providers can also establish partnerships with employers by offering learners work placement in partner firms upon completion of or during studies. This type of on-the-job experience provides students with real-world practice and complements the more traditional learning they would have gained during the micro-credential. The security of employment and income post-training also may particularly attract vulnerable groups like the low-income or low-skilled into micro-credential programmes. Box 2.6 provides an example of such a collaboration in the technology sector.

Box 2.6. Private sector collaboration can boost employer support in programmes

The Cisco Networking Academy offers courses covering a wide range of technology-related topics such as cybersecurity, programming and Internet of Things (IoT). The courses, characterised by varying lengths, delivery methods and language options, accommodate diverse proficiency levels. While self-paced courses on NetAcad.com are offered free of charge, the cost of instructor-led classes is determined by individual institutions. Upon successfully completing a course, participants are awarded digital badges and certificates, validating the knowledge and skills they have acquired. With a global presence spanning 190 countries, the Academy has already impacted over 20.5 million individuals since its inception in 1997, and internal survey data finds that 95% of students who took a Cisco certification aligned course between 2005 and 2022 obtained a job and/or a new educational opportunity post-completion.[1] Cisco directly supports learners in finding employment opportunities in the technology sector by connecting students with its network of partner employers. The Talent Bridge programme is an employment programme which connects learners with Cisco's eco-system of partners who are looking to hire qualified technology professionals. Cisco supports learners with a career preparation workshop, an alumni network and career advice.[2] Moreover, Cisco collaborates with the public sector to ensure they deliver trustworthy and industry-relevant training to learners by offering Department of Labor certified apprenticeships.

1. More information on Cisco's Networking Academy can be found here: www.netacad.com/ (accessed on 13 February 2024).
2. Cisco's Talent Bridge programme can be found here: www.netacad.com/careers/talent-bridge (accessed on 13 February 2024).

Accessibility and awareness are key to wider participation

Education and training institutions have a pivotal role to play in spreading awareness and understanding of micro-credentials to facilitate broader take-up. An abundance of available micro-credential offerings and the sometimes-inconsistent language used to describe them may be overwhelming for learners. In this fragmented and expansive market, providers can facilitate easier access to information by publishing their offerings in a way that is consistent with national guidelines or minimum standards. Following common instructions helps providers advertise courses in a clear and consistent way, helping learners better compare and choose courses. Providers can also engage with existing national or international skills taxonomies – such as the European Skills, Competences and Occupations (ESCO) classification, the Occupational Information Network (O*NET) database, or the World Economic Forum's Global Skills Taxonomy – to describe their micro-credential offerings using a consistent, well-recognised language. Other frameworks that have been established by the non-profit sector can also be engaged when describing and advertising courses, such as the one described in Box 2.7.

Box 2.7. A common language to describe credentials improves access to information

Credential Engine is a non-profit organisation based in the United States working to create a clear and consistent informational map of the credential landscape, to help learners find educational pathways. It collects and collates data on credentials from partner training providers into a cloud-based, freely available Credential Registry. The registry uses a common language, the Credential Transparency Description Language (CDTL), which was developed to provide a common language to describe all programmes in their database and thereby make it easier for learners, businesses and researchers to discover and understand various credentials within a common and consistent schema. Furthermore, Credential Engine also operates a Credential Finder platform to help learners discover credentials available to them. Users can filter by credential type, geography, or focus area, and are provided with information on the provider, accreditation, time and financial costs, audience level, and delivery method of any given credential in the registry. This platform combined with Credential Engine's common schema supports learner access to information, expanding understanding.[1]

1. Further information on Credential Engine is available here: https://credentialengine.org/ (accessed on 19 February 2024).

After describing their offerings in a consistent way, providers can work to collate and publish this information on centralised micro-credential marketplaces or hubs. Providers can work with the non-profit sector which has already made progress establishing online platforms (see Box 2.8). These digital platforms help learners access a broader range of offerings, across different providers, helping them compare and choose courses. Some of these platforms go beyond learning and provide ways to validate learners' acquired skills, a particularly advantageous aspect for vulnerable groups who may already have existing skills but are less likely to have engaged in formal training. Complementing this effort by the non-profit sector, several countries have established national micro-credential platforms and registries to bring greater prominence and structure to the expanding micro-credential eco-system (Box 2.9). Governments have an important role to play to centralise the efforts of various providers. Training providers are encouraged to sign-up for these national registries and work with governments to place their offerings on these websites to help learners access a broader range of information on available courses. Finally, providers themselves can simplify their own websites especially regarding the accessibility of their content and language to ensure they are inclusive and easy to navigate.

Box 2.8. Digital platforms and awareness efforts in the non-profit sector support the work of providers and governments

Digital Promise is a global non-profit organisation that has built an eco-system of micro-credentials in partnership with training institutions to personalise professional learning. Its Credential Explorer lets users peruse and filter a large collection of education-focused micro-credentials using intuitive criteria such as the target audience for a credential (e.g. coaches, adult learners, policy makers) or a given topic of interest (e.g. STEM, financial literacy, disability). The user interface displays credentials as nodes in a web, highlighting complementarities between credentials associated with a particular topic and contributing to their stackability. Since 2023, Digital Promise has put together a Badging Coalition, where industry experts and practitioners are conceptualising the design of a new open-source badging solution, which will contribute to the recognition and transferability of users' learning.[1]

Alongside platforms, non-profit organisations can also be instigators of broader awareness efforts. The World Alliance for Micro-credentials is a soon-to-be launched collaborative initiative between European VET associations and experts in a variety of education and training-related fields. Its missions include raising awareness, establishing minimum standards, and facilitating dialogue between authorities and training institutions.

1. Further information on Digital Promise is available here: https://digitalpromise.org/initiative/educator-micro-credentials (accessed on 19 February 2024).

Alongside platforms and websites, providers can extend their outreach efforts to vulnerable groups by for example creating targeted media campaigns to broaden take-up of micro-credentials. To this end, Cisco specifically targets women in IT roles through its "Women Rock-IT" campaign.[1] This initiative works to encourage women and girls' interest in pursuing IT studies and careers by supporting the development of professional networks and targeted outreach via events and publications. Developing partnerships with NGOs specialised in serving disadvantaged groups is a further way to take advantage of these organisations' specialisation and comparative advantage to reach and address the needs of, for example, ethnic minorities, migrants, incarcerated individuals, or those with disabilities.

Box 2.9. Official micro-credential registries promote awareness

MicroCred Seeker (Australia)

Australia launched the Microcredentials Marketplace ("MicroCred Seeker") in 2021, a user-friendly, nationally consistent platform that allows learners, employers and providers to compare short courses. The website presents the full range of available micro-credential options across all training providers and industries in the country. In particular, it displays the course level (from novice to expert), delivery mode (online, on campus and multi-modal) and duration for each course, offering learners a range of choices. The platform also indicates whether a course offers credit points, and whether it is stackable, as some micro-credentials can be combined with other courses offered at either the same or a different provider, facilitating personalised learning pathways. Additional details listed include course fees (and any available discounts), language of instruction, start and end dates, and course details such as syllabus and assessment structure. This type of platform is a significant advancement for learners, who can search and compare micro-credentials offered by registered higher education providers and selected VET organisations and find the most suitable micro-credentials that meet their interest or needs.[1]

Micro-credentials Portal (Canada)

This portal was developed by eCampusOntario with funding from the provincial government and covers micro-credentials offered by universities, colleges and technical institutes in the province of Ontario in Canada. The project has also inspired the province of British Columbia to begin developing a similar initiative. In Ontario, micro-credentials must meet specific criteria. For instance, all those accessible via the portal are less than 12 weeks in duration. The portal also focuses on industries currently experiencing large labour shortages, such as technology, healthcare and manufacturing.[2]

MicroCreds.ie (Ireland)

Micro-credentials offered by universities in Ireland are registered in the MicroCreds.ie portal, where users can filter based on the NQF level, the European Credit Transfer System (ECTS) credit value, university provider, and subject keyword or credential title. Prospective learners using the portal also find out about the duration, delivery mode and cost of a given micro-credential. This platform was created by the Irish Universities Association (IUA) in partnership with several of its founding institutions in order to reduce barriers to lifelong learning, including time constraints and inflexible modes of delivery. The platform, and the dedicated NQF for quality assurance and accredited micro-credentials, were developed in parallel.[3]

Odznaka+ (Poland)

In Poland, the Educational Research Institute (IBE) is implementing the Odznaka+ (Badge+) project – currently in pilot phase – which will create a public register of micro-credentials and digital badges. The IBE ensures the quality of credentials and badges by verifying providers on the registry. The inclusion of micro-credentials on the register will be based on meeting certain requirements, although this process will remain much easier than integrating micro-credentials into Poland's NQF. The Badge+ application also provides users with additional value beyond being a public registry by allowing them to create and share their digital portfolio of credentials and badges (Cedefop, 2023[21]).[4]

1. Further information on MicroCred Seeker is available here: www.microcredseeker.edu.au/ (accessed on 19 February 2024).
2. Further information on the Micro-credentials Portal is available here: https://microlearnontario.ca/ (accessed on 19 February 2024).
3. Further information on MicroCreds.ie is available here: https://microcreds.ie/ (accessed on 19 February 2024).
4. Further information on Odznaka+ is available here: https://odznakaplus.ibe.edu.pl/ (accessed on 19 February 2024).

Beyond raising awareness, access to greater funding can support broader take-up of micro-credentials, especially by low-income individuals, the low-skilled and other vulnerable groups. Yet, across most OECD countries, micro-credentials remain outside of the formal learning sector, and therefore do not attract public funding. Governments can, however, incentivise enrolment in these programmes through the use of individual learning accounts (ILAs), i.e. personal accounts in which training rights are accumulated over time. The accounts provide an individualised budget to spend on training, with resources in the accounts mobilised only if training is undertaken. ILAs, like the ones currently in use in France and in the Netherlands, have been shown to be an effective way to publicly fund non-formal micro-credentials (Box 2.10). In general, given that micro-credentials are likely to be responsive to changing labour market needs by their very nature, subsidies to learners – as opposed to training providers – could be equally effective in steering demand for training towards courses that address emerging shortages (OECD, 2023[1]).

From their side, employers can also play an important role. For example, as part of its Global Skills Initiative, Microsoft has made available USD 20 million in cash grants for non-profit organisations to help people acquire digital skills.[2] One-quarter of this was earmarked for community-based organisations in the United States led by and serving communities of colour.

Box 2.10. Individual learning accounts are a promising new tool to make micro-credentials more accessible

ILAs are useful tool to support flexible learning systems, providing both a vehicle for financial support for learners while letting them make their own decisions regarding how to allocate their educational credits and pursue learning on their own schedules. Such a scheme is well-suited to the short-term, flexible and modular nature of micro-credentials. Furthermore, the accounts can include paid leave days to be used for learning purposes, making training a financially viable option for low earners (OECD, 2023[1]). Training can also be targeted to individuals most in need of reskilling or upskilling or to sectors experiencing skills shortages by increasing the resources in the accounts for members of these groups. In 2022, the European Union adopted a recommendation that Member States should consider establishing ILAs.

Evidence from the French *Compte Personnel de Formation* (CPF) shows that almost 80% of workers have used their allotted budget to attend short training programmes (less than 100 hours), suggesting their potential strong applicability to micro-credentials (Perez and Vourc'h, 2020[23]). Alongside France – who was the first in Europe to establish an ILA – the Netherlands also recently introduced an ILA: the *Stimulans Arbeidsmarktpositie* (STAP). The Dutch public individual learning and development account was launched in March 2022 as a way to boost adult learning. Individuals in the labour force can apply for a subsidy of up to EUR 1 000 to cover their personal development and employability training costs. The programme replaces the previous system of tax deductions for educational expenses (European Commission, 2022[24]).

Integrating micro-credentials into adult learning systems facilitates recognition and expands learning pathways

Policy makers can consider explicitly integrating micro-credentials into their broader adult learning system to facilitate greater recognition of this type of learning. One way they can do this is by directly linking micro-credentials to an NQF as a way to support integration. This will first require authorities to assess whether it is appropriate for their NQF to be expanded to cover the non-formal learning sector. For instance, some countries do not have an NQF that currently covers the entire adult learning system, such as the United States. Czechia and Switzerland currently have separate frameworks for vocational and higher education qualifications (Cedefop, 2017[18]). Therefore, efforts may first need to be established to create a single NQF that spans across the higher education, VET and non-formal sectors. While the European Union supports broader integration, it leaves final decisions to integrate micro-credentials in regional and national frameworks to national authorities or institutions in accordance with their national circumstances (Council of the European Union, 2022[13]). Therefore, linking micro-credentials to NQFs may not be possible in every country, which necessitates the adoption of other measures to support integration.

For countries that decide to integrate micro-credentials into their NQF, an understanding of the credit point value of micro-credentials is first required. New Zealand and Ireland are two countries where micro-credentials are integrated into the NQF (Box 2.11). Micro-credentials are first designated credit point values and then assigned to levels on the NQF. They can be taught at multiple levels of an NQF based on their relationship to other qualifications. Each qualification level of an NQF is also typically associated with a set of learning outcomes and competences, which facilitates learner mobility by allowing learners to move between institutions, levels and programmes (Martin and Godonoga, 2020[25]).

The process of integrating credentials into national frameworks complements strong quality assurance mechanisms. Listing all types of credentials and qualifications on an NQF is a comprehensive task, but it does allow learners to better understand their potential learning pathways, and supports the development of more flexible learning, as individuals can consider alternative pathways to achieving higher degrees.

Box 2.11. Linking micro-credentials to National Qualification Frameworks supports recognition, transparency, and integration

New Zealand's NQF comprises ten qualification levels of increasing complexity, from Level 1 certificates to Level 10 doctoral degrees. Each level is defined by a set of learning outcomes and credit requirements. The credit requirements indicate how many credit points are needed to achieve a qualification. For example, a bachelor's degree requires a minimum of 360 credits from Levels 5 to 7, with a minimum of 72 credits from Level 7 or above. Micro-credentials that have been quality assured by the New Zealand Qualifications Authority (NZQA) are listed on the New Zealand Qualifications and Credentials Framework (NZQCF). Micro-credentials on the NZQCF take between 1 and 40 credit values and are taught at all levels of the NZQCF, highlighting the strength of New Zealand's system in terms of integration. By listing them on the NZQCF, the framework allows micro-credentials to be compared to other qualifications. The framework sets out clearly how qualifications relate to each other (e.g. which qualifications can provide entry to another qualification) and in this way supports pathways from micro-credentials to higher-level qualifications (New Zealand Qualifications Authority, 2016[26]).

Under the MicroCreds initiative, Ireland is one of the first European countries on its way to establishing a coherent national framework for quality assured and accredited micro-credentials. A new Further Education and Training (FET) Micro-Qualifications model was launched in January 2024 by SOLAS, the national agency responsible for VET and adult learning in Ireland. The new model includes 24 micro-qualifications that will be mapped to the NQF. All programmes are fully accredited and lead to a Level 4, 5 and 6 Special Purpose Awards on the NQF (i.e. narrowly defined achievement awards), helping to secure national recognition of the micro-credentials. The micro-qualifications are co-designed with industry and are accredited by the Quality and Qualifications Ireland (QQI), the national regulatory body responsible for the quality and integrity of Ireland's further and higher education system. The QQI validates courses and formal qualifications included in the NQF.[1] The FET micro-qualifications are delivered flexibly in in-person, blended and online formats, taught on a part-time basis at very little or no financial cost to individuals, and are in priority skill areas such as in the digital and green fields. The model – in particular, the new initiative of listing the FET micro-credentials on the NQF – will facilitate greater recognition of and trust in these qualifications.[2]

1. Traditional and technical universities are granted credential-awarding powers and are responsible for the quality assurance of their own programmes. Thus, QQI only evaluates these providers at the institutional level, while they examine programmes for other providers, most notably private independent providers.
2. More information on the new FET micro-credential model in Ireland can be found here: www.solas.ie/news-media/Press-release-new-fet-micro-qualification-courses-to-address-skills-needs-of-the-irish-workforce-launched-by-ministers-harris-and-richmond/ (accessed on 14 February 2024).

Micro-credentials can also be integrated into broader adult learning systems through the validation of non-formal and informal learning (VNFIL) system (also called recognition of prior learning, RPL). Indeed, micro-credentials can themselves be an outcome of VNFIL processes or they can be recognised as credits towards other qualifications. As an outcome of VNFIL, validating bodies can use the learning outcomes as set-out either in national standards for quality assurance or in the NQF (for countries that have listed micro-credentials on their NQF) to conduct the validation process. These bodies can choose to award a credential like a micro-credential to recognise and validate skills that may have been acquired in non-formal and

informal ways (e.g. through life experience or on-the-job training – see Box 2.12). Receiving a micro-credential as an outcome of VNFIL allows learners to signal their skills to employers and can help them work towards a more traditional qualification, reducing the overall time and cost of future training and supporting more flexible adult learning pathways (OECD, 2023[1]).

Box 2.12. Micro-credentials can be awarded to validate non-formal learning

In the Netherlands, the *edubadge* pilot programme for tertiary education awards students a secure, electronically issued digital certification of skill. The programme is run by SURF, a co-operative association of Dutch educational and research institutions, and the agency co-ordinating the Dutch Microcredentials pilot. With an *edubadge*, learners have proof of the knowledge and skill they may have acquired either formally or non-formally (e.g. through extracurricular activities). The digital certificates, some of which are micro-credentials, are awarded by a verified issuing organisation across VET and higher education. The single, national platform allows *edubadges* to be compared, exchanged and combined, facilitating mobility between programmes. Teaching institutions themselves develop their own *edubadges* and award the credential to a learner if they meet the criteria of learning outcomes. External parties (e.g. employers) can view the shared *edubadges* and verify their authenticity. By digitalising the VNFIL process and creating a single platform, the Netherlands supports greater trust in and recognition of micro-credentials.[1]

1. More information on the Dutch *edubadge* platform can be found here: www.surf.nl/en/services/edubadges (accessed 20 February 2024).

Rather than an outcome, micro-credentials can also be an input of the VNFIL process. That is, individuals may seek credit value for learning acquired during a micro-credential in the process of working towards another qualification, often a more formal or higher-level degree, particularly in systems where micro-credentials are not yet linked to the NQF. In this way, education and training institutions themselves can conduct their own VNFIL process to recognise prior learning, award credits, or provide exemptions from admission prerequisites. This may require education and training providers to adapt their internal validation processes to ensure they are effectively assessing the equivalency of micro-credentials (OECD, 2021[19]). Providers are encouraged to reform their admissions policies to allow for more flexible admissions pathways, by for example establishing alternative sets of criteria that allow individuals to enter formal education (OECD, 2023[1]). Importantly, micro-credentials can also act as a proof of evidence that an individual has acquired certain skills to directly obtain a validation certificate to be used in the labour market.

Moreover, universities and VET providers can consider ways to directly integrate micro-credentials into their curricula. Modularising programmes – such that a micro-credential could be one module of a formal qualification – or more generally using micro-credentials to complement degree programmes can support integration into formal systems. As also suggested by the Council of the European Union (2022[13]), providers could publish catalogues of their micro-credentials, and where relevant, publish their policy on recognition and validation of non-formal learning to facilitate a clearer understanding of admission policies and learning pathways. A clearer understanding of how micro-credentials relate to other qualifications – either through an NQF or the VNFIL process – can help ease concerns that these credentials will replace formal qualifications. Instead, integrating them into formal systems highlights their usefulness as complements to, and not substitutes for, formal qualifications (ETUCE and ETUC, 2020[15])

An effective micro-credential eco-system must be underpinned by a commitment to collect data and evaluate programmes

Improved data collection efforts by both training providers and governments will help to highlight the effectiveness of micro-credentials as an educational tool and improve trust. Providers need to understand who their learners are – including for example, their educational, employment and demographic background, and their aspirations for completing a micro-credential – which can in turn help them to extend and improve outreach efforts. Providers should thus improve their data collection efforts to better understand learner profiles, and where appropriate, tailor their advertising, outreach and media campaigns to better attract and retain under-represented cohorts. Bundling metadata on micro-credentials into digital badges – including information like who designed the credential and what knowledge a learner must demonstrate to earn a credential – can reinforce the recognition of and trust in digital badges while simultaneously improving the data environment without impinging upon individual data privacy.

In addition to hard data, qualitative feedback from learners is highly valuable to signal to providers and to prospective learners the strengths and weaknesses of a given credential. Micro-credential providers should incorporate data collection and assessment practices into the design of their programmes to continuously improve the quality and accessibility of their credentials. In Singapore's MySkillsFuture platform, for example, participants who complete training can leave feedback on the quality and economic impact of their training that is made available to prospective matriculants (OECD, 2023[27]).[3] Partners within industry can also be involved in evaluation and revision in the same way that they are involved in generating curricula. There is a role for both the public and the private sector to undertake initiatives to conduct internal evaluations to ensure the ongoing relevance of micro-credentials being offered.

Moreover, providers should engage in data collection on the impact of programmes to improve the quality of their micro-credentials. This evaluation complements providers' internal efforts to maintain high quality standards and will further boost engagement in programmes, as learners better understand how effective micro-credentials are in achieving their stated aims. Adequately understanding the value of micro-credentials requires knowing where learners come from and where they go after completing training. Follow-up on the labour market outcomes of learners who complete (and do not complete) training is imperative to assess the potential value for prospective learners. Ideally, this follow-up would include not only the first job placement, but also information on longer-term career trajectories. It is also important for governments to establish clear data collection practices and standards for micro-credential designers and providers. Data on effectiveness can support arguments for greater public funding of micro-credentials and can be used to direct public support toward sectors and segments of the population who most stand to benefit. Academics and researchers can take-up a greater role here as well, by providing the necessary rigorous evaluation of programmes and policies. Important legal considerations regarding data privacy need to be considered as firms establish their data infrastructure and governments centralise data efforts.

As part of this data collection exercise, countries should agree on a consistent definition of micro-credentials. A clear definition will help evaluation and policy making efforts. Going forward, countries are encouraged to adopt existing definitions, such as the one set-out by the Council of the European Union (Box 2.13) or to create their own to improve transparency and aid evaluation efforts. Member States in Europe are being urged to align national definitions to European Union standards. Going forward, countries should establish clear definitions at the national level or adopt international definitions where possible. Efforts can also be made to settle distinctions between micro-credentials and other forms of alternative credentials, with many countries using the term interchangeably with other terms (Brown et al., 2021[28]; Cedefop, 2022[4]; Kato, Galán-Muros and Weko, 2020[29]; OECD, 2021[2]).

Box 2.13. Adoption of a consistent definition would help to support evaluation efforts

In its 2022 Recommendation on a European approach to micro-credentials for lifelong learning and employability, the Council of the European Union (2022[13]) defines a micro-credential as:

> *…the record of the learning outcomes that a learner has acquired following a small volume of learning. These learning outcomes will have been assessed against transparent and clearly defined criteria. Learning experiences leading to micro-credentials are designed to provide the learner with specific knowledge, skills and competences that respond to societal, personal, cultural, or labour market needs. Micro-credentials are owned by the learner, can be shared and are portable. They may be stand-alone or combined into larger credentials. They are underpinned by quality assurance following agreed standards in the relevant sector or area of activity.*

More generally, outside of the European Union, countries may consider other international reference points when formulating their own definition. UNESCO (2022[12]) has developed a generic definition of micro-credentials based on the contributions of a global expert panel. They note that their proposed definition should not replace national or regional definitions and is instead intended to serve as an international reference point. It states that:

> *A micro-credential: is a record of focused learning achievement verifying what the learner knows, understands or can do; includes assessment based on clearly defined standards and is awarded by a trusted provider; has standalone value and may also contribute to or complement other micro-credentials or macro-credentials, including through recognition of prior learning; meets the standards required by relevant quality assurance.*

Detailed recommendations

For governments

- Governments should adopt a quality assurance framework for micro-credentials that meets their needs in terms of accrediting programmes and/or providers.
- Governments should support the creation of online platforms or marketplaces that allow prospective users to compare available micro-credentials across a common set of criteria.
- Governments should create a set of guidelines or minimum standards for training providers to encourage greater consistency of information and help providers in their course design.
- Governments should expand funding options, including through targeted subsidies and Individual Learning Accounts, to boost participation in training amongst vulnerable groups.
- Governments should expand National Qualifications Frameworks to cover the non-formal adult learning sector, and, where needed, integrate multiple frameworks into a single, holistic framework to support flexible learning pathways.
- Governments should better integrate micro-credentials into national validation of non-formal and informal learning systems to improve the recognition of prior learning acquired non-formally or informally.
- Governments should adopt a clear and consistent definition of micro-credentials, following international standards where possible.
- Governments should work with providers, social partners and academics to assess the effectiveness of programmes to better inform policy making.

For education and training providers

- Education and training providers should support the work of governments by establishing their own micro-credential catalogues and contribute to national registries where possible.
- Education and training providers should follow government guidelines when designing, describing and advertising programmes.
- Education and training providers should establish internal minimum quality standards for micro-credentials and conduct their own quality assurance. Providers should regularly evaluate and audit their micro-credential offerings and update curricula when needed to ensure programmes remain high-quality and industry relevant.
- Education and training providers should reform their admissions policies to allow for alternate admissions pathways.
- Education and training providers should modularise programmes and integrate micro-credentials into curricula to encourage the mindset that micro-credentials are complementary to more traditional degree programmes.
- Education and training providers should increase data collection efforts to better understand learner profiles and the impact of their programmes.

For employers and social partners

- Employers and social partners should work with training providers to foster greater acceptance and recognition of micro-credentials by designing and delivering demand-driven programmes.
- Employers and social partners should encourage workers to engage in training and provide financial support where possible.

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Notes

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3 Inclusive outreach strategies for a more diverse tech workforce

The tech sector struggles with a diversity problem. As one of the industries facing the highest skills shortages, the tech sector can stand to benefit from a more diverse and inclusive approach to training, recruiting and retaining under-represented talent. Women, people of racial and ethnic minority backgrounds, youth and migrants all face unique barriers to entering and progressing in technical careers. This chapter describes these barriers and proposes a range of actions that businesses, governments and civil society can take to build a more diverse tech sector. By addressing stereotypes, removing obstacles to training and building a more inclusive work culture, all stakeholders can work together to secure a more prosperous and productive tech workforce.

Introduction

The technology sector struggles with a significant diversity and inclusion problem – women, people of racial and ethnic minority backgrounds, youth and migrants are all under-represented and face unique challenges in accessing jobs in the sector.[1] Differences in interests, abilities and aspirations widen with age, with a lack of role models particularly in childhood and adolescence discouraging many students from pursuing a career in technology. Barriers to training in adulthood affect some groups more than others and prevent workers from adequately preparing for current and future skill needs. Existing discrimination and bias, especially during recruitment, and a lack of career guidance and information about training options restricts career pathways and entry into the sector. Finally, unfavourable working conditions including a lack of flexibility and a harsh working culture affects progression, promotion and retention prospects for diverse workers.

Whilst progress has been made in recent years, greater action is required in order to secure a more inclusive and diverse workforce. Stakeholders need to work together to address a range of barriers and improve representation in technology and technical roles. Unlocking a more diverse workforce not only improves inclusivity and representation but can also help to alleviate labour shortages. By tapping into a more diverse workforce, employers can expand their talent pool and help to fill skills shortages, which are especially prominent in the technology sector (International Labour Organization, 2020[1]). By retaining a more diverse workforce, employers can reap the financial gains, with gender and cultural diversity strongly associated with firm productivity (Criscuolo et al., 2021[2]). By prioritising skills and supporting a lifelong learning, businesses can attract and keep more diverse employees, and by addressing structural barriers in school and in adult training, governments and civil society can support a more inclusive technology future.

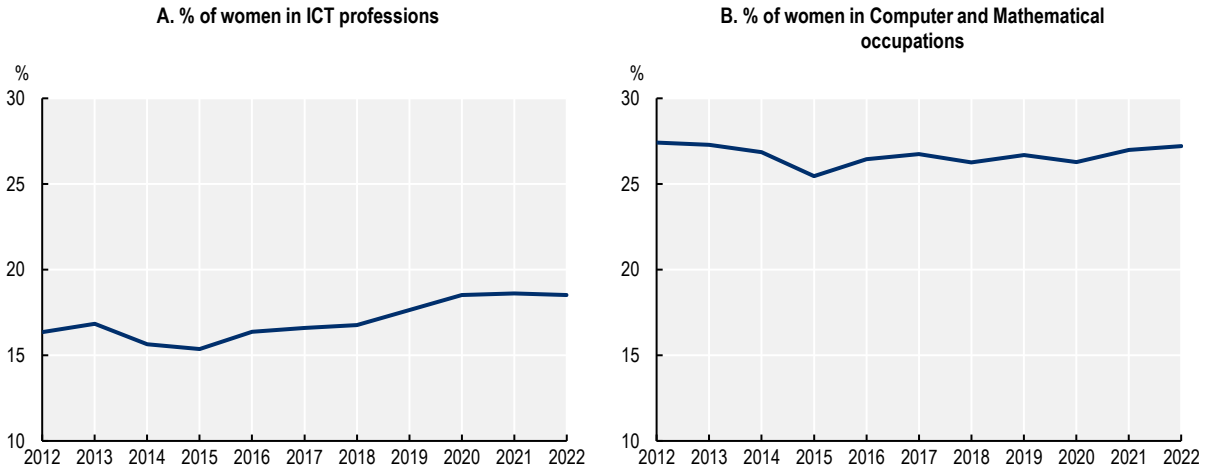
This chapter presents an overview of the state of under-representation in the technology sector, with a particular focus on European and American data, and from a gender, race and ethnicity, age and migrant status perspective. It identifies the barriers to full representation and proposes a range of approaches to address these barriers. The evidence gathered suggests that, with the support of governments, employers, trade unions and training providers, the technology sector can achieve a more diverse and inclusive workforce.

Under-representation in tech

Women

In both the European Union and the United States, women are less likely to work in fields related to technology. In Europe, only 18% of ICT specialists are women in 2022 (Panel A of Figure 3.1). Similarly, in the United States men still make up 73% of computer and mathematical professions, leaving women to hold only 27% of these jobs (Panel B of Figure 3.1). Despite the difficulties in comparing across the two regions, little progress has been made over the past decade, with the proportion of women in these occupations increasing only slightly since 2012 in Europe and remaining stagnant in the United States.

Figure 3.1. Women still represent a small proportion of technology professionals



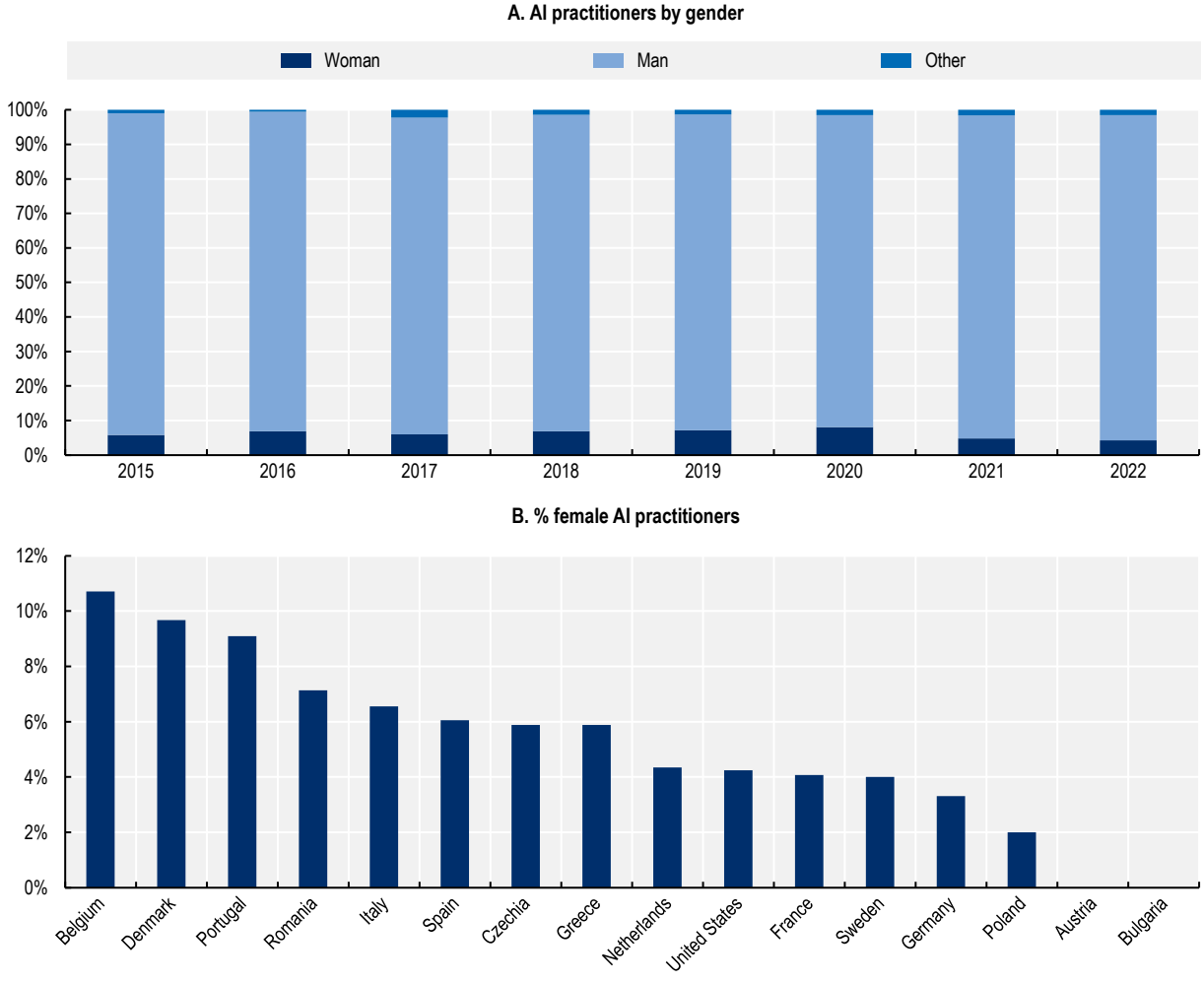
Note: Occupations in the two panels are not directly comparable.
Source: EU Labour Force Survey (EU-LFS) and Current Population Survey (CPS).

Despite this under-representation, some gains have been made over recent years amongst the broader STEM profession. In the United States, women have been entering the STEM workforce at a faster rate than men – between 2011 and 2021, the number of women in STEM increased by 31%, while the number of men grew by only 15% (National Center for Science and Engineering Statistics, 2023[3]). This data is encouraging as it shows that diversity within the STEM profession has been improving over the past decade, with more recent entrants into the profession being women. Nonetheless, greater improvements can still be made, particularly amongst specialised sub-fields of STEM.

Indeed, under-representation is especially pronounced in highly technical, frontier fields. Exploiting a longitudinal survey conducted on AI practitioners registered in the Stackoverflow platform, OECD.AI (2023[4]) finds that the proportion of women has remained relatively stable over the past decade, fluctuating between 5% and 8% of data scientists and machine learning experts (Panel A of Figure 3.2). There are also large differences between countries – for example, in 2022, women represented around 10% of AI practitioners in Belgium and Denmark, compared to 4% in the United States and they were virtually not represented in countries such as Austria and Bulgaria (Panel B of Figure 3.2).

Under-representation in the labour market partly reflects under-representation in science-related tertiary education – the share of female STEM graduates is only 33% in the European Union and 34% in the United States (World Bank, 2020[5]).[2] Globally, female ICT graduates make up only 1.7% of all graduates, compared to 8.2% for men (World Economic Forum, 2022[6]). Furthermore, men are more than twice as likely than women to report that they have technology skills on their LinkedIn profile (World Economic Forum, 2020[7]).

Figure 3.2. Women are heavily under-represented among AI practitioners



Note: In-line with the OECD.AI methodology, AI practitioners consist of respondents identifying themselves as either a 'data scientist' or a 'machine learning expert' in the annual Stackoverflow survey. More information on the methodology is available here: https://oecd.ai/en/stackoverflow-survey-data. Panel B refers to 2022.
Source: OECD elaborations based on OECD.AI (2023[4]), Visualisations powered by Tableau using data from Stackoverflow – The OECD Artificial Intelligence Policy Observatory, https://oecd.ai/en/.

Racial and ethnic groups

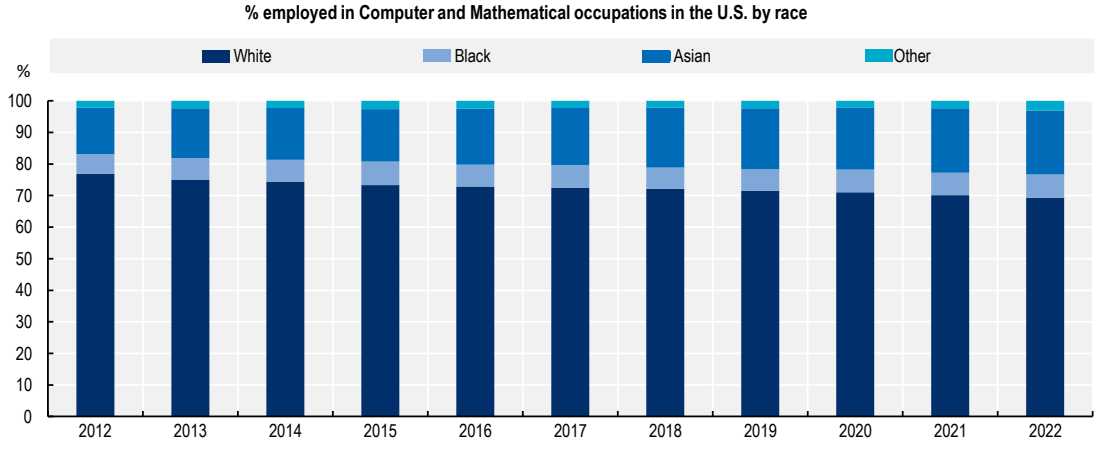
Some racial and ethnic groups are particularly under-represented in technology and STEM fields. In the United States, only 9% of STEM jobs go to Black Americans and 8% go to Hispanic Americans (Pew Research Center, 2021[8]).[3] Under-representation is higher when gender, and race and/or ethnicity are compounded, underscoring the importance of an intersectional approach. Women of colour in the United States (Black, Latinx, and American Indian women) make up only 5% of the technology industry (Emsi Burning Glass, 2022[9]).

Black and Hispanic Americans are also under-represented amongst STEM college graduates. In 2018, Black Americans earned 7% and Hispanic Americans earned 12% of STEM bachelor's degrees. This is in comparison to white Americans who earned 62% of all STEM bachelor's degrees. Racial and ethnic under-representation is even worse amongst the pool of STEM masters and doctoral degrees. Interestingly, Black

women vastly outnumber Black men in all STEM degrees, reflecting a general trend of Black women attaining higher levels of education than Black men in the United States (Pew Research Center, 2021[8]).

Specifically, amongst the computer and mathematical occupations in the United States, white Americans are still vastly over-represented. This is despite some progress over the last decade, with the proportion of white Americans working in this occupation decreasing from 77% to 69% from 2012 to 2020. This decrease is largely due to a rise in workers who identify as Asian (from 15% to 20% in the same timeframe), with minor increases in the shares of Black Americans and those of other minority backgrounds (Figure 3.3).

Figure 3.3. Racial diversity remains a challenge in the American technology sector



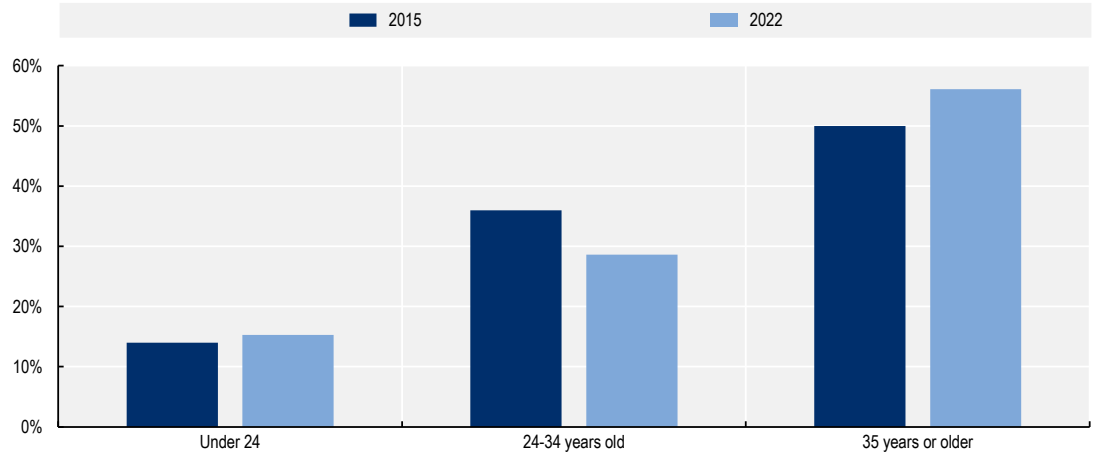
Source: Current Population Survey (CPS).

Youth, and those Not in Employment, Education or Training (NEET)

Young people are generally well-represented in technology roles. For instance, around one-third of ICT specialists in the European Union are aged 15-34 (Eurostat, 2023[10]). Furthermore, opportunities for youth in technology are growing with an employer survey finding that 86% of employers are hiring mostly at the entry-level for technology positions (Generation, 2023[11]). Whether the proportion of youth working in the technology sector has increased or not over the last decade is still unclear, and heavily depends on the definitions and data under examination. For example, OECD.AI data suggest that, while young people represent a large share of AI practitioners, the proportion of 24-34 year-old AI specialists has declined between 2015 and 2022 (Figure 3.4). On the other hand, according to the International Labour Organization (2022[12]) the share of young people working in digitally intense sectors more broadly is growing faster than the share for older workers.

In the current context of high shortages, when the need to consider a broader range of profiles is high, young people who are currently Neither in Employment nor in Education or Training (NEET) represent a pool of untapped talent. However, NEET youth tend to lack the skills and qualifications required in the technology sector. Specific NEET groups may face additional barriers – women for example are more likely to be NEET, with 18.4% of 20-24 year-old women across the OECD NEET in 2021, compared to 15.2% of men (OECD, 2024[13]). Young workers who have had experience in automatable jobs are more likely to have NEET status (International Labour Organization, 2020[14]). These groups may thus feel less prepared for new jobs and tasks brought about by technological changes and may require extra support and second chance options to re-engage with education, training and the labour market.

Figure 3.4. Young people are well-represented among AI practitioners



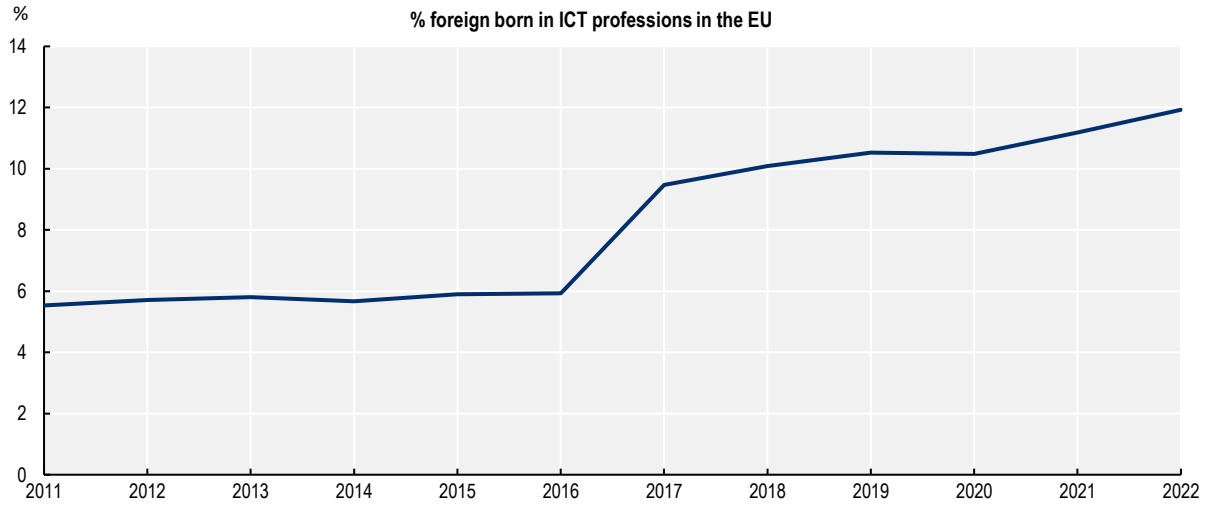
Note: In-line with the OECD.AI methodology, AI practitioners consist of respondents identifying themselves as either a 'data scientist' or a 'machine learning expert' in the annual Stackoverflow survey. More information on the methodology is available here: https://oecd.ai/en/stackoverflow-survey-data.
Source: OECD elaborations based on OECD.AI (2023[4]), Visualisations powered by Tableau using data from Stackoverflow – The OECD Artificial Intelligence Policy Observatory, https://oecd.ai/en/.

Migrants

Evidence on the representation of migrants in the technology sector is mixed. Some studies show that foreign-born adults tend to select into less skilled and lower paid roles, including in the technology sector. For instance, foreign-born workers in Europe are over-represented in jobs that provide services on digital platforms (Urzì Brancati, Pesole and Fernández-Macías, 2022[15]). These jobs are typically less attractive than other roles in the technology sector as they are temporary, lower paid and less skilled. However, there is also evidence that high-skilled migrants are over-represented in high-skilled occupations, especially in countries that facilitate cross-border mobility and migration of high-skilled workers. Foreign-born workers in the United States hold more than half of the creative IT jobs located in metropolitan areas (where IT innovation clusters are located) (Otoiu and Titan, 2017[16]).

Nonetheless, data from the European Union Labour Force Survey shows that there have been significant improvements in the representation of migrants and foreign-born workers in the technology sector over the last decade. The share of non-native-born workers – those that are not born in the same country they reside in at the time of the survey – in the ICT profession doubled between 2012 and 2022, from 6% to 12% (Figure 3.5). This suggests progress has been made though greater research is needed to understand the types of technology roles migrants enter into.

Figure 3.5. The representation of foreign-born ICT professionals in the EU has increased over the last decade



Source: EU Labour Force Survey (EU-LFS).

Barriers to more diversity in the tech sector

Gender differences in interests, aptitudes and aspirations widen with age

At an early age, boys and girls tend to display similar interests and aptitudes in school. Data collected from 15-year-olds in the OECD's Programme for International Student Assessment show boys and girls perform similarly in science and mathematics tests, with girls even outperforming boys in some countries (OECD, 2018[17]; OECD, 2019[18]).[4] This suggests a pipeline issue: at some point, girls are discouraged from scientific careers. Furthermore, boys are generally over-represented at the top of the performance distribution in science and mathematics, suggesting that while on average across the OECD girls perform better in these tests, there are fewer high performers (OECD, 2019[18]). This reinforces the belief that girls need to perform extremely well in order to feel confident in their abilities.

Relatedly, girls tend to be more negative about their abilities in scientific domains which dampens their aspirations. Across OECD countries, only 1% of girls report that they want to work in ICT-related occupations, compared to 8% of boys, with the gender gap in terms of interest in these occupations widening over the past few years. Furthermore, the proportion of boys reporting that they expect to work as professionals who use science and engineering training is double that for girls. This is the case even for top performing girls. Finally, gender differences in attitudes towards competition appear to be formed early, with girls less likely than boys to report positive attitudes towards competition and a greater fear of failure (OECD, 2019[18]).

Unlike differences by gender, differences in mathematics and science performance between native-born and foreign-born students are large from a young age. Across the OECD, students born in a country different from their test country perform worse in mathematics and science tests compared to native-born students. Students who primarily speak another language at home also perform substantially worse than native students (OECD, 2018[17]).

A lack of role models discourages some socio-demographic groups from choosing careers in tech

Growing up, young girls are more likely to see men in high-profile, leadership roles in technology, media and STEM fields. Specifically in the ICT sector – one of the highest venture capital funded sectors worldwide – only 2.7% of women start businesses, compared to 4.7% of men (Global Entrepreneurship Monitor, 2022[19]). As of 2022, only 24% of global technology leadership roles were held by women (World Economic Forum, 2022[6]).

A lack of exposure to successful and relatable role models has been shown to impact girls' subject choices, ultimately affecting their choice of career. Exposure to more female mathematics and science teachers in high school increases a girl's choice to enrol in and graduate from a STEM-related university degree (Bottia et al., 2015[20]). Women exposed to female STEM teachers in introductory college classes are more likely to complete a major in STEM (Carrell, Page and West, 2010[21]). Furthermore, a large-scale field experiment in France found that even one-hour of exposure to a female role model with a background in science increased the probability of Grade 12 girls enrolling in selective STEM programmes in higher education by 20% to 30% (Breda et al., 2020[22]). Results are largely due to an improvement in girls' aspirations for science-related careers, in-line with other evidence highlighting how exposure to female leaders in the public domain positively shapes girls' aspirations (Beaman et al., 2012[23]). Role model effects also appear to be the largest for female students who are strong in mathematics, suggesting high-achieving girls are more likely to see themselves succeeding in a STEM career (Bottia et al., 2015[20]; Breda et al., 2020[22]). More generally, women who admire famous women in business, politics, or science are more likely to participate in the labour market, work in male-dominated industries like STEM and take on managerial positions (Chhaochharia, Du and Niessen-Ruenzi, 2022[24]).

Role model effects tend to be a particular challenge in technical and male-dominated fields, which are also highly competitive. Some evidence indicates that women are more likely to enter competitive environments when they are exposed to strong female role models (Meier, Niessen-Ruenzi and Ruenzi, 2017[25]). Thus, exposure to successful women in competitive industries, and to women in management positions, may impact women's choices to choose high-pressure careers.

Moreover, girls of racial and ethnic minority backgrounds may be more susceptible to role model effects, given the lack of both gender and racially and ethnically diverse leaders in technology. Some evidence supports this finding that exposure to both Black and non-Black role models increased feelings of belonging and trust in STEM environments (Johnson et al., 2019[26]).

Barriers to training limit adults' digital upskilling capabilities

Across the OECD, women and men tend to display similar levels of basic digital skills. On average, 28% of women and 32% of men score high in problem solving in technology-rich environments in the OECD Survey of Adult Skills (PIAAC). However, men on average tend to have more advanced digital skills like coding (European Commission, 2018[27]). Among 16-24 year-olds in the European Union, 18% of men can write code in a programming language, while the rate for women is half this at 9% (OECD, 2023[28]). As adults, women are also less likely to develop their digital skills. In Europe, 18% of women undertook some form of training to improve their digital skills in 2018, less than men at 22% (European Institute for Gender Equality, 2021[29]).

Young people of both genders will require greater digital upskilling to prepare for the future of work. Post COVID-19, young people report a greater interest in technology careers (e.g. those related to cloud computing and internet of things), and a desire to undertake more technical training to prepare for a more technologically and digitally focused world (Tallo, 2020[30]). Whilst young people are generally optimistic about technology, almost half of people aged 18-24 fear their skills and knowledge will not be in demand in the future, and do not feel ready for the future world of work. Young women report feeling slightly less

confident about their readiness in terms of skills than young men, while young people who are NEET are also slightly more negative about their future job prospects (World Skills and OECD, 2019[31]).

Upskilling will be essential to level these differences in digital skills. Whilst OECD data from the Survey of Adult Skills suggest that women and men participate equally in adult learning and education, women on average face different barriers to training relative to men. OECD analysis finds that of those who wished to but did not participate in adult learning, women were significantly more likely than men to report that a lack of time due to childcare or family responsibilities prevented them from participating. Men, conversely, were more likely to report they were too busy at work. As women are the primary caregivers in households in the United States and across Europe, the provision of greater flexible learning options can improve women's participation in training (OECD, 2023[32]).

Discrimination at hiring and a lack of information restrict career pathways

Discrimination and bias continue to pervade recruitment and hiring processes in the technology and STEM field (Friedmann and Efrat-Treister, 2022[33]). This means women and candidates belonging to other under-represented groups are less likely to enter the technology sector, even when they have the skills. For those who do manage to enter the field, many begin in entry-level, non-technical positions. Women in ICT tend to concentrate in less well-paid occupations like project managers, rather than positions such as software development (International Labour Organization, 2018[34]).

Gender-biased career guidance and a general lack of information regarding technology careers also restricts women's choices regarding study and work. Evidence from six OECD countries suggests that women on average reach out to a career guidance advisor less than men (OECD, 2021[35]). Even when women access support, they may be confronted with gender-insensitive information. Guidance services may rely on their own stereotypes and biases when providing study and career advice, effectively discouraging certain groups from pursuing these careers. Only four in ten women feel encouraged to consider a job in technology or IT in the United States, with 44% never given any information or resources about technology careers (compared to 33% of men) (Wiley Edge, 2021[36]).

Furthermore, certain groups in society may simply have less information about careers in technology. One study shows that across 191 countries, women were less likely to be exposed to STEM-related advertisements on social media. Female Facebook users were less likely than male users to see ads for job opportunities and training in STEM fields (Lambrecht and Tucker, 2016[37]). As a result, women are less knowledgeable about and less aware of opportunities in technical fields, and may thus require greater support from guidance services.

Given the fast-changing nature of work, young people need access to accurate information about study and career choices. Over 70% of young people aged 18-24 state that they would like more help finding a job while in school, and would welcome greater career guidance (World Skills and OECD, 2019[31]). In fact, one in ten students in the United States do not receive any career guidance (World Skills and OECD, 2019[31]). This is worrying as many young people, particularly those with NEET status, are unable to identify which skills they need for future employment opportunities.

Unfavourable working conditions affect progression, promotion and retention

Unfavourable working conditions in demanding sectors like technology and STEM discourage women from choosing jobs in these sectors and prevent the women that do choose these careers from advancing into management positions. Gender pay gaps in STEM fields are persistent – in 2019, women earned less than men in 69 of the 70 detailed STEM occupations as reported by the United States Census Bureau (United States Census Bureau, 2021[38]). Across the European Union, the gender pay gap among ICT professionals and technicians is 11% (European Institute for Gender Equality, 2019[39]).[5] Evidence from Spain suggests that the pay gap and the prevalence of discrimination widens as women advance higher

up the pay scale in ICT professions, and in sectors that depend more on ICT (which by extension are more male-dominated) (Segovia-Pérez et al., 2019[40]). Sizeable pay gaps also exist along racial and ethnic lines, with Black Americans earning 78% and Hispanic Americans earning 83% of the earnings of white Americans in STEM fields (Pew Research Center, 2021[8]).

At a broader, structural labour market level, high childcare costs, a lack of adequate paid paternal leave and conservative gender roles create an unequal care burden which disproportionately impacts women's progression in almost every field (Kleven et al., 2019[41]). However, the competitive and demanding nature of careers in technology and STEM are an additional barrier for women. In certain industries like STEM, pay is often linked to working hours with monetary penalties attached to flexible working schedules (Goldin, 2014[42]).

Additionally, STEM workplace culture can be perceived as harsh, demanding and heavily male-dominated. Almost 70% of 18-28 year-old technology workers in the United States have felt uncomfortable in a job because of their gender, ethnicity, socio-economic background or neurodevelopmental condition, and half had or wanted to leave a technology job because of how uncomfortable the company culture made them feel. Black and Hispanic workers in technology companies are the most likely to report that they did not feel welcomed by their colleagues and that they actively dislike their company's culture (Wiley Edge, 2021[36]).

Within the ICT and technology field, promotion pathways often differ by gender, with more women than men assigned to non-technical or non-managerial pathways. Issues with progression are often related to a significant retention issue, with women exiting these sectors at a higher rate than men. Women in technology professions are also promoted to senior management roles at a much slower rate than women in other industries – only 52 women are promoted to technology manager for every 100 men, versus 86 women for every 100 men for overall managerial roles (McKinsey, 2022[43]). Slower promotion rates discourage women and minorities from remaining in the technology sector, ultimately contributing to their attrition.

Successful strategies to increase diversity

A holistic approach to increasing diversity in the technology sector is required to address the broad range of barriers described above. Certainly, employers play a central role in boosting the diversity of their workforce. Businesses should promote change in their workplace practices by removing bias at hiring, actively addressing discriminatory workplace culture, and improving the quality of the working environment to attract and retain more diverse talent. However, other relevant stakeholders, including governments, workers' representatives, training providers and civil society organisations, should also contribute. Governments, for example, should improve the quality of career guidance and encourage greater participation in training to foster advanced digital skills in-line with labour market needs, while learning institutions should improve teaching methods and promote more diverse role models in school. Case studies and practical examples included in this chapter draw on desk research, bilateral discussions with relevant stakeholders and the results of the 2023 OECD Call for Innovations, which was launched in July 2023 to collect innovative experiences aimed at improving diversity in the technology sector.

How businesses can build a more diverse technology sector

Expanding recruitment pathways to boost diversity

Employers must foster a more diverse technology workforce by making changes to their recruitment and hiring processes. Many applicants with diverse backgrounds already have the skills required to enter technology roles; however, traditional screening and assessment techniques, and an over-reliance on

qualifications mean that many are not considered for jobs. Employers should boost the diversity of their talent pool by adopting skills-based approaches during recruitment, looking for candidates with the required skills regardless of how they have been acquired. A greater use of skills-based hiring in the labour market can expand talent pools across several technology-related industries and encourage the hiring of more women, young people, and racially and ethnically diverse workers (LinkedIn, 2023[44]). Whilst more progress is needed, some companies in the technology sector have already adapted their recruitment practices to be more inclusive, by for example ensuring diversity of recruitment panels, reducing biased language in job ads, using blind resumes, and using skills-based assessments (Generation, 2023[11]).

Additionally, businesses should engage directly with organisations that connect them with students and jobseekers from disadvantaged backgrounds. They can reach out to and partner with intermediary organisations which help connect the private sector with entry-level talent from diverse backgrounds. Targeted recruitment drives are designed to train and hire under-represented groups and are a good way to engage interested individuals early on in their careers (see Box 3.1). Businesses should also engage directly with training providers, such as those that offer technical bootcamp training services. These programmes build hard skills and help prepare learners for a role in the technology sector. Ultimately, the earlier the private sector engages directly with learners in the technology space, the more likely they are to attract highly skilled candidates with diverse backgrounds.

Box 3.1. Building a more diverse technology talent pipeline through targeted training and recruitment drives

Break Through Tech's "Sprinternship" programme provides women and non-binary computer science college students in the United States with a paid micro-internship in the technology sector. The three-week internship is offered to first- and second-year students from large, public universities, many of whom are women from racial or ethnic minority backgrounds. Their dedicated computing and AI offerings include a project-based deliverable and industry immersion activities to help students gain a better understanding of the nature of a job in the technology sector while helping them to build relevant technical skills. Technology companies who participate in the programme are able to expand the diversity of their hiring pipeline by gaining meaningful exposure to a group of interns that often falls outside their traditional recruitment scope. Many participants in the "Sprinternship" programme are offered paid summer internships, a key step on the way to a full-time job in the technology sector.

IBM's Pathways in Technology (P-TECH) programme is a public education model serving under-represented communities in 28 countries. In the United States, 40% of participants are young women and 90% are Hispanic or African American (IBM, 2020[45]). By integrating high school and college coursework, participants earn both a high school diploma and a cost-free, industry-recognised associate degree in six years. Graduates are first in-line for entry-level job openings at IBM. The programme expands pathways into technology jobs and makes a career in technology more accessible.

Leaders in the technology sector should also develop targeted outreach initiatives and media campaigns in the hope of attracting more diverse talent into the sector. Successful female technology leaders can promote careers in technology by engaging with younger generations as their mentors and coaches (see Box 3.2). Businesses can showcase the benefits of working in the technology sector and create greater awareness of careers in the sector by developing their own targeted awareness and media campaigns for underserved communities. The L'Oréal-UNESCO For Women in Science Program, for instance, promotes the representation of women in science globally. In Australia and New Zealand, L'Oréal-UNESCO Women in Science Fellowships were launched in 2007, with the initiative celebrating five women in science each year for their scientific excellence. The Fellowships programme supports women to continue their research with an AUD 25 000 reward and provides media training and a platform to showcase their cutting-edge

research, in an effort to inspire more girls and women to enter the scientific field (Department of Industry, Science and Resources, 2024[46]).

Box 3.2. Mentor initiatives and media campaigns inspire the next generation

Female leaders in the technology sector can inspire a new generation of girls and women to enter technology-related fields by joining and participating in coaching and mentorship networks. FemTech Association Asia, founded in 2021, is the region's first and largest industry network for FemTech founders, professionals and investors. The association provides visibility to female-led businesses in women's health and technology. By becoming a member of the association, female professionals can access community networking events, industry and region-specific thought leadership and advisory services. In this way, FemTech Association Asia helps make the global technology start-up pool in Asia more diverse.

Google for Startups Accelerator: Women Founders is a 10-week digital accelerator programme for women technology entrepreneurs across the United States and Canada. The programme is open to women who have launched a technology business and have acquired seed funding. The aim of the programme is to provide mentorship, technical project support and deep-dive workshops to help accelerate the growth of high-potential female-founded businesses in the technology sector.

FIRST Robotics (For Inspiration and Recognition of Science and Technology), a non-profit initiative based in the United States, works to inspire children to pursue STEM education and careers. FIRST Robotics has reached over 3.2 million students worldwide since its inception in 1989.[1] Its annual robotics competition engages high school students and provides them with hands-on learning.

Media campaigns can also be useful to spread broad awareness. Deloitte, for instance, has launched "Women in Cyber", an awareness campaign designed to entice more women into careers in cyber-professions.[2] The BNP Paribas Group has various initiatives spanning across France, Italy and Türkiye, and aims to reach its 37% women in IT target by the end of 2024 (compared to 32% in 2022).[3]

1. See here: www.firstinspires.org/about/at-a-glance (accessed 22 February 2024).
2. See here: www.deloitte.com/global/en/about/people/people-stories/deloitte-women-in-cyber.html (accessed 22 February 2024).
3. See here: https://group.bnpparibas/en/news/bringing-women-closer-to-tech-our-challenge-for-equality-and-performance (accessed 22 February 2024).

Building an inclusive work culture to attract and retain highly skilled candidates with diverse backgrounds

Firms have a responsibility to make a career in the technology sector more attractive by improving the working environment and making it more inclusive. Notably, they should promote greater pay transparency as a way to reduce the gender pay gap in technical roles. Across the board, 21 out of the 38 OECD countries (55%) mandate systematic, regular gender wage gap reporting by private sector firms (OECD, 2023[47]). Greater pay transparency increases competitiveness amongst firms by allowing employees to compare their own salary packages to firm benchmarks. Sharing information about average wages within firms can support underpaid workers to negotiate up their wage (OECD, 2023[47]; OECD, 2021[48]). Alongside transparency surrounding pay, firms should also disclose other gender and race disaggregated data (such as the percentage of diverse employees) in their annual reports, and more generally their diversity and inclusion goals. This can help firms, particularly larger, publicly listed companies, remain accountable for their diversity and inclusion targets. Big technology firms like Microsoft, Intel and Salesforce even tie the cash bonuses of their senior executives to performance on diversity

metrics to ensure leaders are held directly accountable for attaining diversity goals (Payscale, 2019[49]; Unleash, 2022[50]).

Deliberate and transparent commitments by senior leadership help to build a more inclusive work culture and attract more diverse candidates. Salesforce, for instance, have instated a Chief Equality Officer role, in-charge of leading the company's global equality efforts. Apple, Google, Microsoft and Meta also all have Chief Diversity Officers. A senior leadership role with an explicit focus on equality and/or diversity signals to potential employees that the firm is working towards building a more inclusive internal culture. Firms can also consider the use of non-compulsory targets or goals to signal their commitments to diversity. In the technology sector, Accenture, for example, publicly announced their goal to achieve a gender balanced workforce by 2025 (Accenture, 2017[51]). These public commitments, alongside regular and transparent reporting of performance metrics, as noted above, help keep firms accountable.

Businesses should implement a range of other workplace practices to foster a more inclusive culture. Unconscious bias training, particularly for managers, helps to address underlying bias and can prove especially effective ahead of conducting any recruitment. Broader diversity and inclusion training modules can be offered to all staff. Firms can employ a zero-tolerance policy against harassment, discrimination and abuse. To increase retention, early-tenure promotions can especially reward women and minorities in technical roles, further supporting their career progression in the technology profession. Businesses can also facilitate better retention and employee work-life balance by providing flexible work options by default, rather than through an opt-in model, to help reduce stigma and increase acceptance around taking-up flexible work. Finally, to encourage the involvement of fathers in care work and retain mothers' ties to the workplace, businesses should embody a culture of encouraging new fathers to take paternal leave where available.

Labels that reward employers who foster a diversity culture at work are becoming more common. A number of countries – like Australia, Spain and Portugal – give out annual business awards to reward leadership in the diversity space (OECD, 2020[52]). Specific to the technology sector, a diversity charter which certifies firms that have good gender equality practices has been shown to inspire more gender-equal practices in the IT profession, a similar practice to accrediting firms based on their diversity and inclusion success (see Box 3.3). This type of public certification or labelling process encourages more technology firms to make gradual improvements to their workplace culture in order to raise their visibility and attract better, more diverse talent.

Box 3.3. Public commitments to gender equality are a signal of a strong workplace culture

DiversIT Charter's certification process awards technology companies across Europe with a Bronze, Silver or Gold label based on their level of commitment to advancing gender equality in the ICT profession. Gold level certification is reserved for companies that have implemented several best practices and have made gender equality a top priority in their organisation for some time. Firms are assessed based on a framework and need to apply for re-certification every five years to keep their label. In this way, DiversIT Charter helps certified companies across Europe to attract like-minded, high-quality and diverse employees.

In Australia, Project F accredits organisations that have gender-equitable workplaces. Project F tracks the progress of accredited organisations and provides guidance, helping them to work towards higher levels of accreditation. Organisations accredited by Project F have seen increases in hiring, promotions, employee engagement and, in some cases, reduced attrition. Start-ups can also receive Gender Equity Toolkits to help them build equitable workplaces. Project F aims to address stereotypes unique to the technology sector that impact women's ability to remain and progress in technology jobs. Technology companies like Canva have received a Project F accreditation.[1]

1. See here for more information: https://projectf.com.au/ (accessed 22 February 2024).

How governments and civil society can support a more inclusive and resilient tech future

Addressing stereotypes and promoting inclusion in tech begins in school

Stereotypes of what a scientist or an IT specialist should look like are formed early, in school. To eradicate these stereotypes, policy makers can put in place a range of actions. Several OECD countries have recently implemented policies to encourage gender equality in school curricula and teaching materials. Sweden, for instance, revised its preschool curriculum in 2018 to explicitly address and challenge gender stereotypes that restrict children's development and choices (Brussino and McBrien, 2022[53]). In Chile, a pillar of the "National policy for gender equality in STEM" focuses on eliminating gender stereotypes in STEM education from an early age (OECD, 2023[47]).

Learning tools have been developed to help teachers eliminate gender bias from their teaching practices and promote gender equality through teaching. For example, training colleges in Korea are required to offer courses on gender equality in their learning programmes for prospective teachers. Other OECD countries have involved teachers specifically in encouraging more girls to study STEM subjects. For example, Luxembourg launched a training tool called "Gender4STEM Teaching Assistant" in 2019, which helps teachers assess and improve their gendered education practices. Depending on the teacher's profile, the tool recommends learning content to better manage gender diversity in the classroom (Gender4STEM, 2019[54]). In Australia, the Girls in STEM Toolkit and Future You have developed targeted resources to support teachers and parents to engage young women and girls in STEM learning and career pathways. Efforts are underway to better integrate this toolkit with other existing resources to support teachers.[6]

Schools can also play a crucial role in broadening students' perspectives on diverse career opportunities, through better career guidance and information, regular career talks, and workplace visits. Initiating career guidance at an early stage is essential to prevent the development of discriminatory stereotypes, as ideas about career trajectories form as early as in primary school (Archer, DeWitt and Wong, 2013[55]). To address this, schools in Denmark organise "girls' day" events for fifth-grade students, promoting professions where women are under-represented – notably STEM – and incorporating interactive activities with the active participation of firms (OECD, 2023[47]). School career guidance counsellors can work with public employment services to access relevant training and career information to then pass on to students. Civil society, in particular non-profit organisations, can support the work of governments by providing more targeted and local solutions to stereotyping (see Box 3.4). Higher education institutions can also work with high schools to expose younger students to college-life by diversifying entry pathways into formal education (see Box 3.5).

Box 3.4. Non-profit organisations can support the work of governments to tackle misinformation and gender stereotyping

Bioinformatika is a European non-profit organisation that provides free educational content and training programmes to youth in the field of bioinformatics – i.e. the storage, retrieval and analysis of biological data. Their initiative "Bioinforming the Youth" targets young people across Europe, particularly in the Western Balkans, and three-quarters of participants are young girls and women. The organisation aims to educate, empower and inspire young people to choose a career in science. The initiative was created in response to the growing need for greater promotion of science amongst youth. The organisation provides free and accessible online resources and offers training courses for high school and university students, where participants can gain hands-on experience in bioinformatics tools and techniques. In this way, Bioinformatika helps reduce misinformation and stereotypes about careers in science and provides a positive role model to young girls and women through the use of female professionals and trainers.

Box 3.5. Dual enrolment programmes connect high school students to community colleges

Community colleges in the United States have started to offer free dual enrolment programmes to high school students – particularly students from remote, low-income or vulnerable communities – allowing them to enrol into college-level courses while they complete high school. By expanding entry pathways into college and allowing students early exposure to college-life, these programmes help the youth more easily envisage a future where they go onto further training. Some colleges offer dual enrolment in technical fields relevant for the technology sector. For instance, MiraCosta in California offers a dual enrolment class for bio-manufacturing within a predominantly Latinx and underserved school district. Wake Tech, a technical community college in North Carolina, and Lorain County community college in Ohio are other examples of colleges that offer dual enrolment.

Governments can also promote examples of successful role models in science and technology by supporting the creation and development of new, female-founded technology start-ups (see Box 3.6). They can also consider developing broad-based, national media campaigns and other approaches to boost awareness. For example, the Australian Government funds the "Superstars of STEM" program, which aims to increase the media visibility of diverse STEM professionals to inspire the next generation.[7] Finally, governments may consider developing a national action plan or a set of guidelines for employers who hire STEM and/or technology workers, to help workplaces become more inclusive. Importantly, these toolkits can be adopted by smaller and medium enterprises, ensuring that not only large firms reap the benefits of becoming more inclusive.

Box 3.6. Fostering a new generation of female role models by supporting female-founded technology businesses

In recognition of the severe under-representation of women in the technology industry and the limited venture capital funding offered to women-led companies, the European Commission is providing financial support to female-led technology start-ups. Some 50 beneficiaries were involved in a pilot of the scheme in 2021, with a full initiative launched since then. Alongside mentoring and coaching support, grants of EUR 75 000 are offered to early-stage deep-technology startups founded or co-founded by women in Europe. Grants help fund initial innovation, research and development processes and support the overall growth of companies. This type of funding model promotes female leadership in the deep-technology industry to build fairer, more inclusive technology innovations, while successful female leaders serve as role models for future generations of girls and women.

Removing obstacles to adult training helps foster skills for under-represented groups

According to data from the OECD Survey of Adult Skills, women are more likely to cite family responsibilities and high costs as barriers to participation in adult education and training. Making courses shorter and more flexible, for instance through the provision of online training provision, can help address time constraints. Governments and training providers – both in the public and private sector – should make adult learning provision more flexible with regards to when, where and how adults can learn. Covering the indirect costs of training can also help increase participation amongst women (OECD, 2023[32]), particularly amongst those who accumulate disadvantage and are also low-skilled or hold low-wage jobs.

To make adult learning provision more adapted to the needs of adults and address time constraints, provision needs to be more modular and course delivery methods should include online and asynchronous options. Short courses, such as those that award micro-credentials, allow learners to address skills gaps in a timely and effective manner. Some of these courses provide learners with the option to learn at their own pace, or at least at a location and time that suits them, making them extremely useful for under-represented groups with significant time constraints (OECD, 2023[32]). Over the past several years, micro-credentials in the technology sector have grown significantly, with more providers offering short courses, many at an entry-level. Some examples can be found in Box 3.7.

Box 3.7. Delivering digital credentials to quickly prepare workers for a future in technology

Some large technology companies have developed a broad range of micro-credentials and certificates that provide adults with technology and digital skills. For instance, Google and Microsoft have an established online professional certificate programmes with courses offered in the ICT sector, many of which are suitable for beginners and for adults requiring a flexible learning schedule. Dell offers digital badges – i.e. a web-enabled version of a learner's credentials that can be shared online – after completion of the company's training programme. Finally, IBM's SkillsBuild programme allows learners to earn free digital credentials from IBM and their partners, with many courses lasting only a few hours and offered in multiple languages.[1]

1. More information on the mentioned programmes can be found at: www.coursera.org/professional-certificates; https://education.dell.com/content/emc/en-us/home/certification-overview/digital-badge.html; https://skillsbuild.org/students/digital-credentials (accessed 29 February 2024).

Education and training providers should establish targeted efforts to reduce barriers to training that are specifically faced by vulnerable groups. Community colleges in the United States for example have developed programmes that target underserved communities. These programmes offer students opportunities to earn an income while they train and work, helping to reduce financial barriers to training and thereby boosting participation amongst low-income groups (Box 3.8). Other efforts have been made to reduce other barriers to training – for example, by placing training in locations that are easily accessible by vulnerable communities, removing the cost of travelling to and from training centres.

Box 3.8. Removing barriers to training for vulnerable groups supports participation

Several community colleges in the United States have Learn and Earn programmes which allow students to work in a career field related to their study field while being paid. Employers who partner with these community colleges are required to pay students. Lorain County Community College has a Learn and Earn programme, which has been successful in increasing the number of women and under-represented minority students in the manufacturing and IT areas. In their micro-electronics programme, for example, which uses a paid work-based learning model, over 20% of participants come from under-represented backgrounds and 25% are women. Similarly, Wake Tech college offers paid apprenticeships and internships. Students gain professional experience and a business network without giving up a paid job. These type of Learn and Earn models are especially beneficial for vulnerable, low-income groups who need an income while they study, and would have potentially otherwise forgone study for paid work.

Alongside reducing financial barriers to training, new place-based learning models are being adopted in the United States to reduce time and geographical access barriers. These more innovative teaching

approaches are designed for adult learning providers to be more proximate to the communities they are designed to serve, ensuring all students regardless of background have access to training. For instance, the Broward College in Florida is a proponent of this approach. They place educators within underserved communities, for example in recreation centres and libraries, to ensure students are closer in proximity to teaching centres.

Short, bootcamp-style programmes have been an increasingly popular way to learn new technology skills in a short amount of time, making them particularly viable training options for time-constrained learners. In 2020, France, Spain, Belgium and Poland joined forces under the "GirlsInSTEM" project to organise bootcamps for girls to engage with the STEM field (OECD, 2023[47]). Community colleges in the United States also run accessible bootcamps, such as Montgomery College's free, four-week biotechnology bootcamp. Some technology bootcamps specifically target women and other minorities, helping to boost digital and technology skills amongst under-represented groups. Moreover, mentoring, coaching and networking events are sometimes offered to learners who participate in these programmes. In this way, exposure to successful professionals in STEM and technology reinforces a positive role model effect for women and minorities. Box 3.9 provides examples of some non-profit organisations running technology bootcamps.

Box 3.9. Bootcamps help prepare women and other minorities for a future in the technology sector

It is increasingly popular for learners and jobseekers to attend short, bootcamp-style programmes, designed to boost their technical knowledge and skills, and prepare them for a role in the technology sector. Many of the organisations offering bootcamps target their services to girls and women, and other under-represented groups in technology. Laboratoria, for instance, offers technical bootcamps for women across Latin America. The programme prepares women who have no prior experience in technology with skills in web development or UX-design. Following the bootcamp, graduates are connected to quality jobs in the technology sector. In the United States, the non-profit organisation Black Girls Code specifically targets African American girls and women. By partnering with schools, local organisations and volunteers, the organisation offers in-person and virtual computer programming education for girls and women of colour aged 7-25 years-old. Other organisations such as PyLadies function more as a community, where women and others from under-represented backgrounds can join a like-minded global network interested in building their knowledge of technology careers. PyLadies hosts various informal networking and mentoring events to educate, inspire and encourage more women to participate in open-source coding. These events are especially appreciated by beginners requiring basic information (i.e. entry-level talent or career-switchers).

Governments should expand funding options and boost financial incentives to encourage greater participation in training. Making learning more affordable will especially help reduce barriers to training for low-skilled and low-income groups, individuals who particularly struggle to enter technology professions. In 2022, the European Union adopted a recommendation that Member States should consider establishing Individual Learning Accounts (ILAs). These personal accounts provide adults with an individualised budget to spend on training and can include paid days of leave for learning purposes, making training a financially viable option for low earners (OECD, 2023[32]). Evidence from France's experience with its own Personal Training Account (*Compte Personnel de Formation*) shows that almost 80% of workers used their allotted budget to attend short training programmes (less than 100 hours) (Perez and Vourc'h, 2020[56]).

Governments can also enact policies to support adult learning by covering the indirect cost of training. One of the largest indirect costs for women is the cost related to childcare. Several OECD countries have

schemes to cover the cost of childcare and other additional costs for adult learners. In Ireland, for example, under the Childcare Employment and Training Support scheme, adult learners can qualify for a subsidised childcare place. In Austria, the public employment service covers the costs of training, including the cost of learning materials, clothing, accommodation and a family allowance, for jobseekers and low-wage workers. Allowances for childcare are also common in training that targets single parents. Where possible, employers themselves should encourage their workers to engage in training and should financially support them by providing, for example, additional days of leave to be used for training or funding the cost of training directly.

Additionally, policy makers should adopt targeted schemes to boost participation amongst specific vulnerable groups. OECD countries use – to a varying extent – subsidies, vouchers and tax exemptions to incentivise training (OECD, 2022[57]). For instance, Lithuania's Competence Voucher system supports employers with a voucher for purchasing training services for their workers which can be used to develop skills relevant to priority technologies, equipment, hardware and software (Cedefop, 2018[58]; OECD, 2022[57]). Countries also provide free or low-cost digital skills training for especially vulnerable groups. The non-profit sector can further support the work of governments in reaching under-represented groups by developing targeted training programmes – such as the one described in Box 3.10, designed to boost migrants' participation in technology training.

Box 3.10. Supporting technology training and digital upskilling of vulnerable groups

Various European Governments support innovation and digitalisation in the economy through voucher schemes – these range from vouchers to micro, small and medium-sized enterprises who make investments in specific software or machinery, to training vouchers designed to lower the cost of digital upskilling (European Commission, 2019[59]). For instance, Finland launched a training voucher in 2018 to strengthen basic digital skills of adults, and particularly targets the low-skilled, unemployed or those at risk of unemployment, pensioners, the elderly, job changers and immigrants (European Commission, 2019[59]). Estonia's DigiABC programme, which ran from 2017-20, provided fully funded digital skills training for low-skilled workers in manufacturing (OECD, 2022[57]). Furthermore, the three-year Digital Skills for Integration and Active Citizenship project co-funded by the Erasmus+ programme of the European Union is an example of a cross-border programme which aimed to improve the digital skills of migrants, refugees and asylum seekers (European Union, 2022[60]). Making basic digital skills training available to a wider population will support broader ICT knowledge and skills development and may help more diverse populations ultimately find entry-level work in the technology sector.

Based in Germany, SocialBee is an NGO providing migrant and refugee integration services. Alongside a more holistic integration approach, SocialBee offers qualification programmes – including a dedicated technology programme – to newly arrived migrants and refugees. The non-profit organisation provides soft and hard skill training for 2 to 3 months to prepare learners for the German labour market ahead of their work placement, where they are placed with partner companies. The dedicated technology programme – called "Changemakers" – is delivered in co-operation with SAP. Participants receive soft skill training provided by SocialBee, and hard skill training relevant to the technology sector by SAP. In the end, participants can receive certification for completion of SAP modules, and gain practical work experience at SAP or at another partner company working in the technology sector. In this way, SocialBee creates equal opportunities for migrants and refugees while also supporting the technology sector to fill important roles. SocialBee follows migrants for 12 months after job placement, providing continued support where needed. More generally, holistic wrap-around services – including visa, legal and accommodation services, and language courses – help to successfully integrate migrants into their new community. SocialBee finds that 90% of participants are still in their job eight months after completing their programme.

Detailed recommendations

For employers and social partners

- Employers should broaden pathways for recruitment into the technology sector by applying skills-based approaches and implementing targeted recruitment initiatives in order to attract and hire more diverse talent.
- Employers and social partners should put in place a range of inclusive workplace practices to address unconscious bias, fight overt discrimination, and support the progression and retention of women and minorities in technology professions. This includes mandating diversity on recruitment panels, delivering unconscious bias training and providing mentors.
- Employers and social partners should encourage workers to engage with external training opportunities and deliver more on-the job training, providing funding support where possible.
- Employers should collaborate with learning institutions in the development and delivery of training programmes, and engage with skills-first methods by partnering with providers to offer post-training work placements.
- Employers and social partners should promote improved transparency in working conditions by increasing data collection efforts regarding diversity and performance metrics. Senior leadership should make active and clear commitments to improving diversity and inclusion.

For governments

- Governments should work with schools to develop unbiased teaching materials and foster less discriminatory teaching practices to address stereotypes about technology careers that are formed at an early age.
- Governments should co-operate with education and training providers to address the numerous obstacles to adult participation in learning opportunities, for example by fostering the adoption of more flexible learning content or expanding funding options to make training more accessible to minority groups.

For education and training providers

- Education and training providers should make learning programmes shorter and more modular, expand delivery options to increase accessibility, and encourage participation amongst a wider group of adult learners.
- The non-profit sector should support the work of training providers by offering targeted, ‘bootcamp’ style programmes for diverse learners.

For all stakeholders

- All stakeholders – schools, public employment services, governments, the non-profit sector, social partners and employers – should actively promote successful role models for women and minorities in the technology sector, and provide greater access to training and career information related to professions in technology.
- All stakeholders should understand their local diversity issues and develop targeted awareness campaigns to reach out to underserved communities to highlight the benefits of working in the technology sector.

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Notes

[1] Reference to 'the technology sector' in this chapter is done so to denote the Science, Technology, Engineering and Mathematics (STEM) industry, the Information and Communications Technology (ICT) industry, and technical roles in other industries.

[2] OECD calculations for the European Union based on data by country. Calculations take latest available year of data in the World Bank's Gender Data Portal. For most countries this is 2016 or 2017.

[3] These shares are lower than each group's respective share in the total workforce – Black Americans constitute 11% and Hispanic Americans constitute 17% of the total American workforce. Conversely, white Americans are over-represented in STEM roles, making up 67% of positions while only constituting 63% of the total workforce.

[4] Across OECD countries, girls slightly outperform boys in Finland, Iceland, Israel, Lithuania, Norway, Sweden in mathematics, and in Canada, Czechia, Denmark, Estonia, Finland, Germany, Greece, Iceland,

Ireland, Israel, Latvia, Lithuania, Luxembourg, the Netherlands, the Slovak Republic, Slovenia, Sweden, Türkiye in science (OECD, 2018[17]).

[5] The European Institute for Gender Equality adopts Eurostat's conventional definition of the gender pay gap as the gender gap in net monthly earnings.

[6] The Girls in STEM Toolkit can be accessed here: www.thegist.edu.au/ (accessed 14 August 2024).

[7] The Superstars of STEM campaign can be accessed here: https://scienceandtechnologyaustralia.org.au/what-we-do/superstars-of-stem/ (accessed 14 August 2024).

Getting Skills Right

Bridging Talent Shortages in Tech

SKILLS-FIRST HIRING, MICRO-CREDENTIALS AND INCLUSIVE OUTREACH

Talent shortages in the tech sector pose significant challenges for firms, workers and governments, hindering productivity, innovation, job satisfaction and economic growth. To address these shortages, this report emphasises the importance of a comprehensive, multi-stakeholder strategy based on innovative policy actions. This includes adopting skills-first approaches to hiring, which prioritise specific skills over traditional qualifications, expanding talent pools and enabling employers to adapt more dynamically to evolving technological demands. Additionally, the promotion of micro-credentials is highlighted as a crucial tool for facilitating rapid skill development tailored to current industry needs, thereby supporting continuous learning and workforce agility. Furthermore, fostering inclusivity in the tech sector is essential. The report advocates for inclusive initiatives that broaden the talent pool by addressing barriers faced by under-represented groups, including women, minorities, youth and migrants. The report emphasises that successful implementation of these strategies requires robust collaboration among governments, education and training institutions, and the private sector. It draws on exemplary practices from various OECD countries to illustrate effective approaches to fostering such collaboration, ensuring sustainable solutions to alleviate talent shortages in the tech sector globally.

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