In collaboration
with Cognizant

WORLD ECONOMIC FORUM

New Economy Skills: Building AI, Data and Digital Capabilities for Growth

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Foreword

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Technology has long been a catalyst for productivity, innovation and economic growth. Yet its potential can only be realized through people and their ability to adapt, learn and apply new capabilities in a world where technology evolves faster than systems can respond. As artificial intelligence (AI) and data-driven systems continue to reshape global value chains and transform industries and economies, digital fluency and human adaptability have become macroeconomic imperatives.

AI is transforming not only what skills are in demand, but also how they are applied across work and industries to shape the new economy. According to the Forum's *Future of Jobs Report 2025*, advancements in technology, particularly AI and information processing and robotics and automation, are among the most transformative forces shaping the world of work. Technology-related roles are expected to be the fastest-growing roles by 2030, with AI and big data topping the list of fastest-growing skills. This transformation requires new forms of interdisciplinary competencies that enable humans to oversee and collaborate with AI systems. For economies seeking to accelerate growth and innovation, closing the digital skills gap is as critical as investing in infrastructure or capital.

This paper is a collaboration between the World Economic Forum and Cognizant and is the second instalment in *the New Economy Skills* series. It explores the evolving supply and demand of AI, data and digital skills that are set to underpin future economic growth, innovation and resilience. The research examines where skills gaps are emerging, the investments needed to fill them, and specific technology capabilities employers are demanding. It also proposes a call to action for education, workforce and credentialing systems to evolve, ensuring digital skills are learned, effectively applied and recognized through more portable, practical and trusted assessments.

The report underscores the simultaneous challenge posed by rapid technological progress and a labour market facing difficulties in aligning the supply of essential skills with existing demand. Indeed, AI is already revolutionizing not just the skill sets required to power the new economy, but also how existing digital skills are applied.

Amidst this, demand for skills is rocketing, as evidenced by the surge in wages for AI and machine learning roles. Despite incentivizing skill development and soaring demand for digital learning, however, few business leaders believe education systems are effectively preparing workers appropriately, highlighting an urgent need for us all to take decisive action across the entire skills development life cycle.

We hope this instalment in the New Economy Skills series will support public- and private-sector leaders as they navigate technology-driven transformation and invest not only in technology itself, but in the people who enable it, ensuring an inclusive and human-centred digital economy.

Executive summary

Growth and innovation depend not just on technology, but on people's ability to adapt, learn and harness new digital skills.

AI's promise will only be realized if people have the skills to harness it

Generative AI (genAI) and advanced technologies are unlocking new frontiers of growth, but only if people have the skills to harness them. According to Goldman Sachs research,[1] genAI could raise global GDP by 7% (nearly $7 trillion) over a 10-year period. Yet that potential will remain unrealized without a workforce that is fluent in AI, data and digital skills to deploy new technologies effectively. Drawing on data from education industry and workforce technology providers, as well as from a review of existing research and in-depth consultations with experts, this report defines the digital skills needed for the new economy; analyses the global supply and demand of these skills; proposes a framework for effectively assessing, developing and credentialling digital skills; and highlights frontier practices from around the world.

AI is transforming which digital skills are needed and how they are used

AI, data and digital skills are the most exposed to transformation; that is, AI is more likely to change the way these skills are used. In contrast, human-centric skills, are expected to have relatively minimal impact. On average, 68% of digital skills are expected to change in how they're applied, compared to 35% across more human-centric skills. AI and big data skills are over 30 times more likely to see full or hybrid transformation compared to empathy and active listening. These findings do not necessarily mean displacement. They signal a shift in what competence looks like as workers increasingly oversee and collaborate with AI systems.

The market is already rewarding advanced AI and data skills

Wages for AI and machine learning (ML) roles have surged 27% since 2019, reaching nearly $190,000 on average by mid-2025, reversing earlier stagnation and highlighting their market value. Median salaries across digital occupations have generally trended upward, but the increase for AI/ML roles since 2023 is especially pronounced.

The digital skills gap is widening faster than systems can respond

Only two in 10 business leaders believe education systems effectively develop AI and data skills, while four in 10 say the same for technology literacy. Globally, only about 20% of leaders believe their employees are proficient in AI and big data skills, despite anticipated demand growth through 2030. In the EU specifically, nearly 58% of enterprises recruiting information and communication technology (ICT) specialists in 2023 reported difficulties filling roles.

While demand for digital skills learning is soaring (AI and big-data learning now account for one-fifth of all digital learning hours) employer demand is still concentrated in roles such as cybersecurity and network engineering (representing over half of all digital jobs), while roles in AI and ML represent just over 1% of digital employment. Technology literacy is the highest in-demand digital skill, appearing in 34% of all US job postings, while only 2% of job posts ask for AI and big data skills, with most of those posts in technology-intensive sectors like ICT.

Acquiring digital skills takes time, but can be accessible

Programming is the most demanding digital skill to learn at beginner and intermediate levels, while networks and cybersecurity are often the most time-intensive at advanced levels (around 155 hours). AI and big data offer more accessible entry points (beginners can start with as little as 30 hours), but advanced proficiency requires a significant commitment (up to 137 hours).

Not every region or industry is progressing equally

The findings in this report reveal significant disparities in how digital transformation is unfolding across sectors. Advanced digital expertise is highly in-demand primarily in technology-intensive industries (IT, digital communications, automotive and aerospace), with limited demand elsewhere (accommodation, food and leisure), a pattern that risks widening digital divides across industries and limiting innovation.

Regional differences are also stark: Northern America leads in AI and analytics skill development, while Latin America and the Caribbean as well as Sub-Saharan Africa report higher strengths in human-centric skills like collaboration and management but lower confidence in digital skills development.

The path forward: investing in breadth and depth of digital capability

As AI continues to transform the skills required for the workforce, two priorities have emerged:

1. Expand advanced AI and data capabilities to manage, interpret and oversee intelligent systems.

2. Strengthen foundational digital fluency so workers can adapt tools to real-world challenges.

Best practices to address these priorities include creating meaningful, portable credentials that travel across education and employment systems; setting shared standards for digital skills; and assessing digital skills through real-world application.

Introduction

Digital skills are now essential for economic growth and global competitiveness, yet persistent shortages and challenges in education and credentialing threaten progress and innovation.

The world is moving through an era defined by rapid technological change. As new innovations, particularly AI, reshape jobs, industries and economies, equipping people with the right skills is more important than ever for global competitiveness and societal progress.

These skills represent not only one of today's greatest catalysts for growth, but also a critical pathway for all workers to thrive in an increasingly digital and interconnected world. Today, however, critical digital skills shortages mire economies across the globe. While technology will be the main engine of business transformation in the next five years, the *Future of Jobs Report* shows that 63% of employers view skills gaps as the biggest barrier to progress.

Recent research in the United Kingdom from the Centre for Economic and Business Research suggests a digital skills shortage is holding back £23 billion in growth.[2] A Eurostat survey noted that in 2023, 57.5% of EU enterprises that recruited or tried to recruit ICT specialists had difficulties in filling the roles.[3] Meanwhile, a study from the World Bank believes jobs requiring digital skills will hit 230 million across Sub-Saharan Africa, pointing to significant economic growth to the tune of $130 billion in revenue.[4]

Across the globe, demand for digital skills is outstripping supply. And without significant investment and reform this gap will widen, particularly as organizations race to implement AI and other advanced technologies. Emphasizing this, a study from Cognizant ranked the availability of skills and talent as the leading inhibitor to AI adoption in 23 countries.[5]

Digital skilling, then, is at a crossroads: it can become one of the greatest accelerators of economic growth, or its greatest inhibitor. A principal challenge is that education systems and organizations worldwide lack the tools to effectively assess, develop and credential these vital capabilities, constrained by infrastructure that has not kept pace with rapid technological change. This report examines the supply and demand of digital, data and AI skills, and provides guidance for businesses, educators and policy-makers on how to strengthen their development, assessment and credentialing so that individuals, businesses and economies remain competitive and drive progress. Insights are grounded in extensive research and multistakeholder consultation, integrating perspectives from business, education and policy.

It is the second instalment of the *New Economy Skills* series, which explores the capabilities that will enable individuals to adapt to change and power sustainable growth, innovation and competitiveness in a rapidly evolving world.

1 The AI, data and digital skills landscape

Demand for AI, data and digital skills is soaring, but patchy education, uneven access and variable teacher readiness are leaving global gaps in workforce preparedness unresolved.

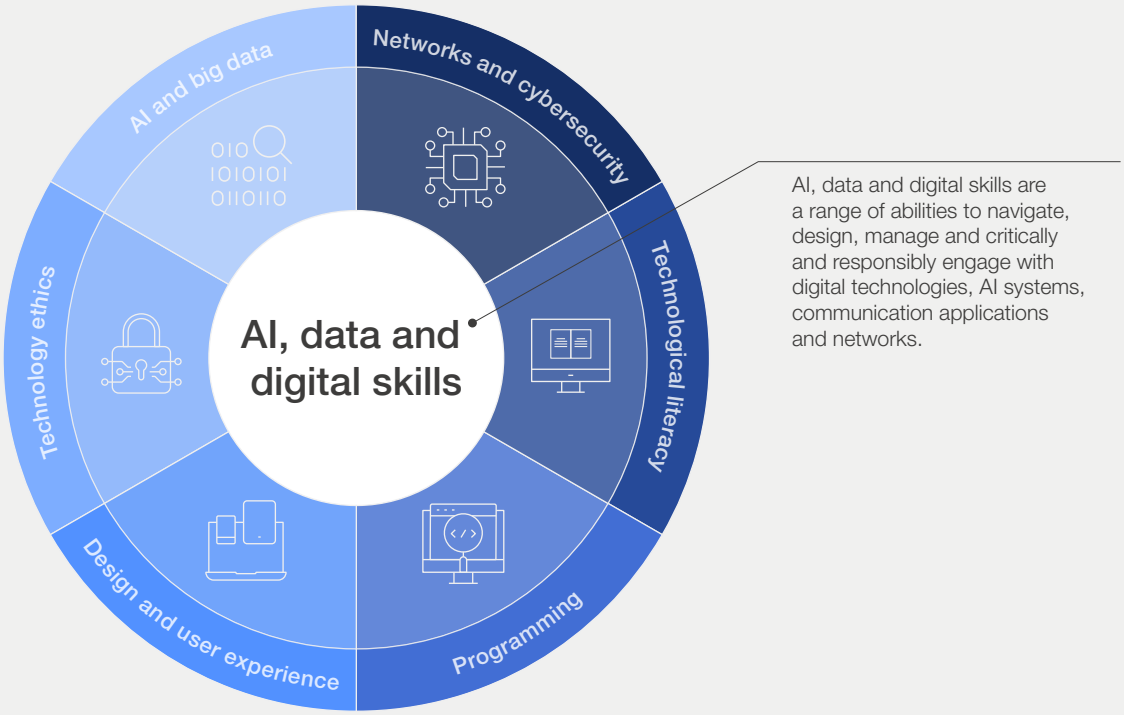
1.1 What are AI, data and digital skills?

AI, data, and digital skills are now fundamental for thriving in the modern workforce. They help enable individuals to confidently navigate, design, manage and interact responsibly with digital technologies, AI systems, communication tools and interconnected networks. Core competencies in this area include proficiency in AI and big data analytics, which equip individuals to analyse and get insights from complex data sets to drive informed decision-making. Networks and cybersecurity skills ensure safe and effective management of digital infrastructure, while technological literacy empowers people to adapt to rapid technological change (Figure 1).

Expertise in digital design and user experience is becoming increasingly important, allowing professionals to create intuitive and accessible digital solutions. Programming skills, ranging from basic coding to advanced software development, underpin the ability to build, maintain and enhance digital systems and applications. All these skills are essential not only for technology-focused roles, but across all sectors as digital transformation accelerates.

This report underscores the significance of specialist AI, data and digital skills to navigate increasingly complex technological systems. However, it also emphasizes the need for foundational technology literacy across all roles to achieve success in today's labour market. In a world of constant technological change, the ability to communicate clearly, adapt quickly and continually acquire digital skills is essential. Mastery of these skills helps individuals remain relevant and competitive, and empowers them to respond proactively to emerging technologies and new ways of working.

FIGURE 1 **AI, data and digital skills**



1.2 Supply and demand of AI, data and digital skills

Today, as societies become increasingly digital, the ability to understand and work with technology is no longer confined to technical specialists; it is a foundational requirement for all. AI, data and digital skills requirements will flow into every aspect of our working and personal lives. However, the development of digital skills is far from uniform across the globe, and as a key catalyst for future economic growth, education systems today have a critical role to play.

The talent pipeline: AI, data and digital skill development lags behind

Across the globe, digital skills are widely regarded as being instrumental to economic development. However, the integration of digital technologies within education systems remains uneven. There is insufficient global, and often national, alignment on how to define digital skills. over half of countries According to a UNESCO report, over half of countries have not yet established digital skills standards. While some countries are beginning to establish the digital competencies they wish to prioritize in curricula and assessment frameworks, these competencies are frequently developed by primarily commercial entities. As a result, skill definitions often reflect proprietary technologies and vendor-specific ecosystems, rather than a comprehensive, interoperable framework that serves the broader needs of learners, industries and societies. Efforts like those led by TeachAI, however, are emerging to bring together education, non-profit and technology leaders to support governments and educators in aligning on and integrating a shared definition of AI literacy into childhood education worldwide.

Implementing technology in classrooms and teacher training lacks consistency. Many students have limited opportunities to engage with digital tools in educational settings; even in high-income countries, only approximately 10% of 15-year-olds use digital devices for mathematics and science for more than an hour per week. Moreover, teachers often report feeling inadequately prepared and lack confidence when integrating technology into their instruction. Only half of countries have set standards for teacher ICT competency development.

These inconsistencies have not gone unnoticed by employers, who continue to identify significant disparities in how education systems cultivate digital skills across regions. Data from the World Economic Forum's Executive Opinion Survey 2025 reveals just two out of every 10 business leaders believe education systems effectively develop AI and data skills, and four out of 10 say the same for technology literacy.

Globally, the picture is more nuanced. Northern America, Central Asia, and the Middle East and North Africa (MENA) express particularly strong confidence in their education systems' capacity to nurture AI and analytics abilities. Meanwhile, South Asia, South-Eastern Asia, and Oceania are most assured in the development of networks and cybersecurity expertise, with South-East Asia, South Asia, and MENA also highlighting more positive views of technology literacy among students.

In contrast, leaders in Eastern Asia and Latin America and the Caribbean tend to rate human-centric skills more highly. In Sub-Saharan Africa, skills like resilience, creativity, curiosity, lifelong learning and teamwork are rated above the global average. Indeed, regions less confident in their digital skills development tend to report relative strengths in other areas, like collaboration and management. Yet, leaders in Northern America, while comparatively positive about AI and analytics skill development, tend to rate resilience and lifelong learning lower.

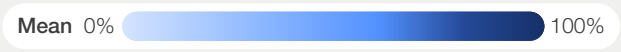
Overall, in any region digital skills are rarely rated as developed well by education systems compared to human-centric skills (Figure 2). Even where digital skills are strongest, teamwork and collaboration still score higher, highlighting global gaps and inconsistencies in skill development through education systems, a worrying sign that the development of digital skills is falling behind the expectations of most business leaders.

Education systems around the world struggle to embed digital skills effectively, with progress varying widely between regions and even between schools, reflecting unequal access to resources, infrastructure and teacher training. Reports from the Organisation for Economic Co-operation and Development (OECD) continue to highlight gaps in digital coverage, with large holes in the availability of qualified technical assistance staff and limited incentives for teaching staff to integrate digital devices into their teaching.[6]

Student access to technology is also far from uniform. According to research conducted by UNESCO, internet connectivity is highly unequal in terms of wealth and region.[7] The percentage of 3–17 year-olds with an internet connection at home in both the richest and poorest families varies considerably in some regions, but is universally low in others. In the Democratic Republic of Congo, for example, connectivity is in the low single-digit percentages across all wealth groups. In Japan, just over 60% of the poorest in this age category have access to the internet at home, compared to close to 90% of the wealthiest.

FIGURE 2 **Share of executives indicating that public education systems develop well the stated skill, by region**

	Working with others	Creativity and problem solving	Technology literacy	Curiosity and lifelong learning	Resilience, flexibility and agility	Networks and cybersecurity	AI and big data
Central Asia	42	44	45	37	33	19	29
Eastern Asia	68	46	37	39	36	14	17
Europe	49	39	41	37	31	16	15
Latin America and the Caribbean	64	35	28	37	34	6	4
Middle East and Northern Africa	50	43	50	43	38	17	27
Northern America	43	44	43	36	36	22	29
Oceania	39	46	34	40	42	27	26
South-Eastern Asia	58	52	54	42	44	26	23
Southern Asia	56	50	55	41	48	29	24
Sub-Saharan Africa	65	53	42	47	45	14	10
Global	56	44	42	40	37	16	16



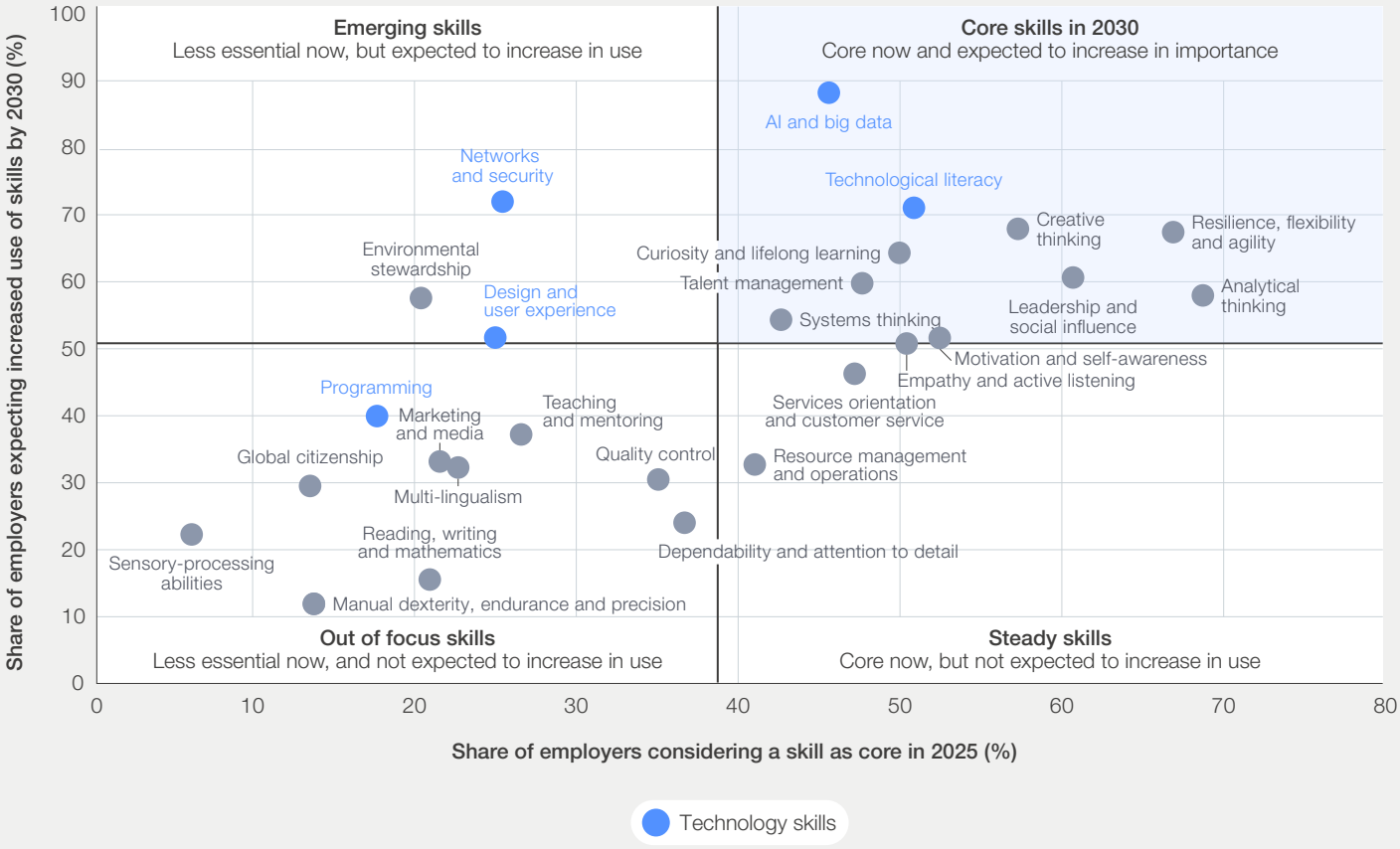
Source: World Economic Forum Executive Opinion Survey 2025.

In regions where students have better access, the issue is often not a lack of digital literacy in students, but in their teachers and other adults. According to the 2023 European Commission's Digital Economy and Society Index (DESI), almost 70% of young people (ages 16-24) in the EU possess at least basic digital skills, compared to 54% of the overall population.[8] One study examining several OECD countries suggests that many practicing teachers did not acquire sufficient digital skills prior to entering the classroom.[9] And, on average across OECD countries, 43% of teachers in the 2018 survey reported not having studied the use of ICT as part of their initial teacher education, an issue more pronounced among experienced teachers.[10]

Regardless, young people still face challenges applying these skills later in life, particularly in the form of more advanced skills such as data analysis, coding and the ethical considerations surrounding AI, which are less consistently developed. The OECD's Programme for International Student Assessment (PISA) has found that while students are adept at using technology for communication and information retrieval, fewer demonstrate proficiency in computational thinking or digital content creation.[11] This points to a need for curricula that move beyond foundational skills and engage learners in more complex and creative uses of technology.

Another significant gap in the talent pipeline is gender. Women's participation in tech and science, technology, engineering and mathematics (STEM) fields has grown only marginally in recent years (from 26% in 2016 to 28% in 2024), and women still represent less than one-third of the STEM workforce.[12] Recent Forum research shows that women are less likely to hold AI-engineering roles and are more likely to occupy jobs that are at higher risk of disruption from generative AI. LinkedIn data shows that between 2018 and 2025, in nearly 92% of the countries analysed, men outpaced women in listing AI-engineering skills.

FIGURE 3 | **Skill evolution, 2025–2030**



Note: Share of surveyed organizations that consider skills to be core skills for their workforce and their estimated increase in use in the next five years.
Source: World Economic Forum Executive Opinion Survey 2025.

Business leaders ramp up demand for digital skills in the wake of sweeping transformation efforts

Figure 1.3 shows a significant increase in employer-perceived demand for digital skills. Competencies such as technology literacy, AI and big data, networks and cybersecurity, design and user experience, and programming are currently viewed as essential now and even more so over the next five years. For example, technology literacy is considered a core skill by 51% of organizations surveyed in 2025, with 68% anticipating heightened relevance by 2030.

AI and big data skills are considered particularly important, driven by substantial enterprise investment in the field. Nearly 90% of business leaders expect these skills to become more important, with 45% regarding them as core today, underscoring the pivotal role of AI and data-driven approaches in shaping business strategies, operations and innovation.

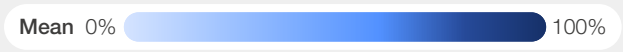
Overall, the analysis demonstrates that a large proportion of business leaders foresee an increase in value for all digital skills, reaffirming the escalating demand across the field. Yet, business sentiment raises flags that the workforce may not possess adequate skills for current and future needs. According to the World Economic Forum's Executive Opinion Survey 2025, slightly over 20% of leaders believe their employees are proficient in AI and big data skills – despite the anticipated growth in demand through 2030. Workforce proficiency in technology literacy is comparatively higher; however, only half of leaders express confidence in this skill.

Analysis of the data does indicate that trends in skill development proficiency are consistently reflected in labour-market outcomes. Generally, regions with robust education systems for skills such as technology literacy demonstrate higher levels of worker proficiency in that area. For instance, Northern America exhibits the highest perceived AI skill development and worker proficiency, whereas Latin America and the Caribbean reports some of the highest for resilience and collaboration (Figure 4).

It is significant to note that, in most cases, perceptions of workforce proficiency surpass those of skill development capabilities, suggesting

FIGURE 4 **Share of executives indicating most proficient skills among their workforce, by region**

	Working with others	Creativity and problem solving	Technology literacy	Curiosity and lifelong learning	Resilience, flexibility and agility	Networks and cybersecurity	AI and big data
Central Asia	48	51	43	32	48	21	26
Eastern Asia	69	47	40	30	54	15	17
Europe	50	50	47	30	44	22	17
Latin America and the Caribbean	60	50	21	34	57	13	8
Middle East and Northern Africa	51	49	52	30	48	28	31
Northern America	38	49	56	27	41	30	34
Oceania	35	52	37	30	49	33	25
South-Eastern Asia	54	45	54	28	56	32	30
Southern Asia	62	57	57	37	51	35	24
Sub-Saharan Africa	64	53	42	39	50	19	10
Global	56	51	43	33	49	22	18



Source: World Economic Forum Executive Opinion Survey 2025.

that educational foundations in essential skills may facilitate accelerated development during employment. Furthermore, workers continue to display stronger human-centric skills compared to digital skills, due perhaps to the greater difficulty in cultivating digital competencies or challenges for education systems in integrating them at earlier stages.

Learners run up the clock on AI skills development

As employers emphasize the need to increase digital proficiency, data from the online learning platform Coursera provides an encouraging outlook (Box 1). While AI is expected to be an area of significant demand and simultaneously an area where employee proficiency is relatively low, it now accounts for one of the largest proportions of learning hours on the Coursera platform. Notably, engagement with genAI has grown significantly, paralleling increased focus on core AI competencies.

In contrast, interest in other technologies has been more variable. For instance, technological literacy, a key foundational skill, has experienced a decline in its share of learning hours after a notable increase in 2021. Similar downward trends have been observed in networks and cybersecurity, as well as programming.

BOX 1

GenAI and the enduring nature of human-centric skills

Coursera's research for this report highlights the strong and evolving demand for AI, data, and digital skills (Figure 5). AI and big data now account for the largest share of learning hours on the platform, representing about 21% in the second quarter of 2025. Learning activity in this area has followed a sharp upward trajectory since mid-2022, peaking at nearly 6 million learning hours – 27% of total learning time – by mid-2024. This surge was driven largely by the rapid adoption of AI tools and by the breakthrough of generative AI following the release of ChatGPT in late 2022. Networks and cybersecurity, by contrast, shows a more fluctuating pattern of demand, rising after 2023 but trending downward again in mid-2025.

Technological literacy experienced a steep increase in 2020, likely reflecting the widespread shift to remote work, online education and greater reliance on digital platforms during the COVID-19 pandemic. Since then, demand declined sharply until mid-2021, then decreased more gradually suggesting that the initial urgency for basic digital literacy has eased as learners and workplaces adapted.

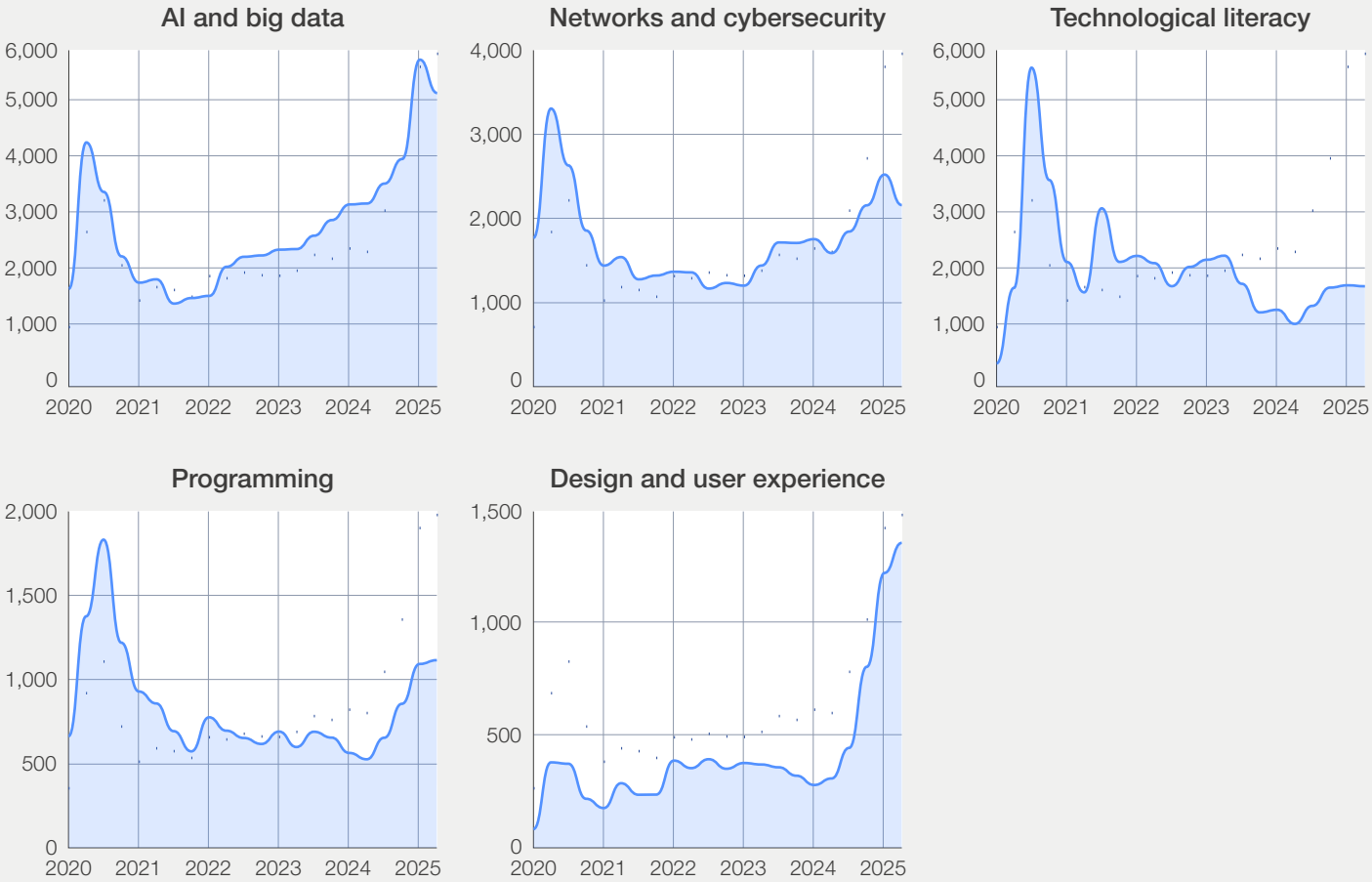
Programming has maintained steady demand since 2022, showing an upward trend beginning in 2024, underscoring its role as a foundational digital skill. Meanwhile, design and user experience (UX), though starting from a smaller base, has demonstrated accelerating growth since 2023, as human-centred design becomes increasingly central to digital product development.

A closer look at AI skills (Figure 6) shows how technological breakthroughs have reshaped learning demand. Beyond an initial surge during COVID-19, interest in AI skills accelerated significantly from early 2022. Importantly, the rise of genAI introduced a distinct growth pattern: while core AI skills continued to expand, demand for genAI surged after the release of ChatGPT, marking a clear inflection point in global upskilling trends.

FIGURE 5

Learning trends in AI, data and digital skills

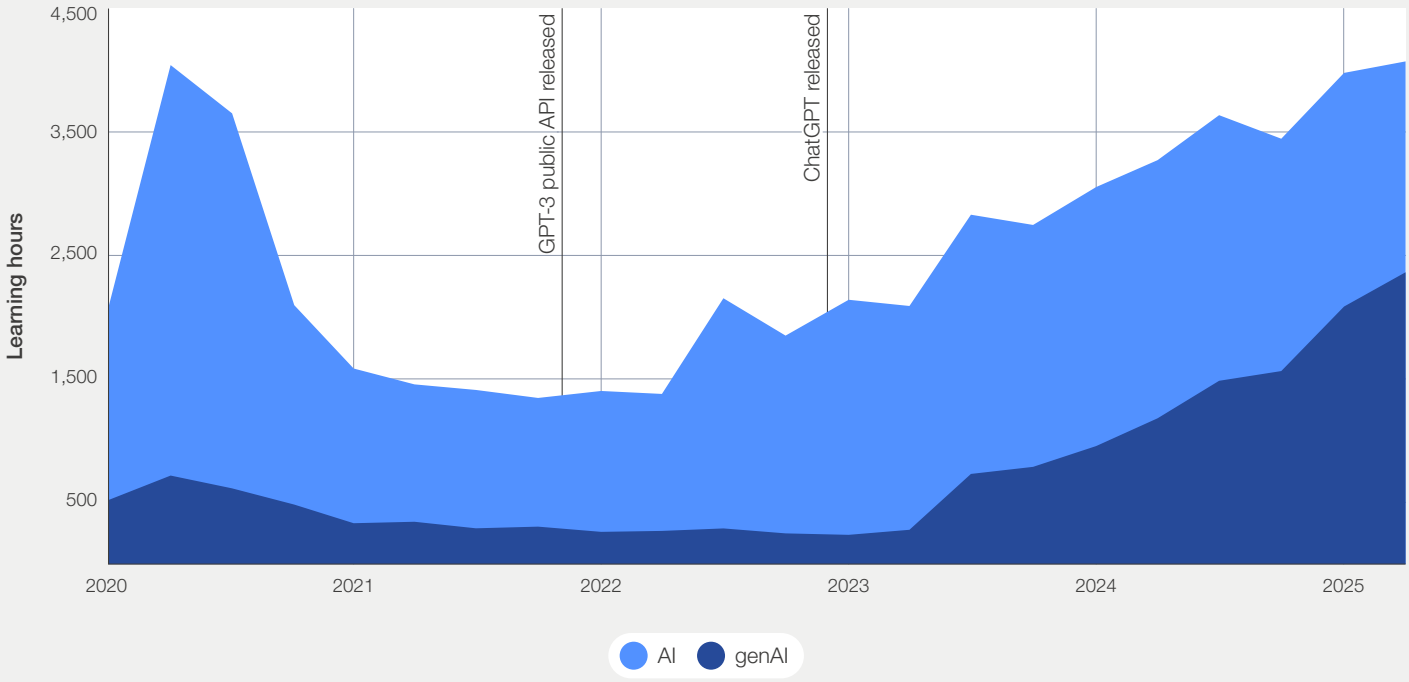
Learning hours ('000s) spent pursuing assessments and credentials, 2020–2025.



Source: Coursera; World Economic Forum, Global Skills Taxonomy.

FIGURE 6 | **Demand for AI and genAI skills**

Learning hours spent pursuing assessments and credentials in AI and genAI, 2020–2025.



Source: Coursera; World Economic Forum, Global Skills Taxonomy.

The perception of the value of digital skills is unmistakably accelerating, with digital proficiency especially in AI, set to become an increasingly prized asset. But is this perceived value translating into economic value? Wage data serves as a telling indicator of this shift, reflecting not only the heightened value attributed to digital and AI skills but also the widening gap between its demand and supply (Box 2). As businesses compete to attract and retain top digital talent, remuneration packages are being driven upwards, underscoring both the scarcity and the strategic importance of these roles.

BOX 2

Growing demand and wage premiums in digital skills

The digital workforce is undergoing rapid transformation, with generative AI accelerating demand for advanced skills like AI. While recent research suggests that programming skills are highly exposed to AI disruption,[13] this transformation also reinforces the continued importance of foundational digital competencies. Research conducted by ADP for this report provides new evidence on employment and wage trends for digital skills (Figure 7). To capture demand, ADP analysed US job postings from January 2019 to July 2025 with titles containing keywords (such as artificial intelligence, deep learning, cybersecurity, UX design, data analysis, etc.) linked to four categories: AI/ML, networks and cybersecurity, design and UX, and data and programming.

The figure shows that employment growth during this period in roles requiring AI/ML skills expanded by a factor of 13.8, surpassing all other digital skills. Although growth slowed in 2023 because of economic pressures such as rising US interest rates, inflation and changes in research and development (R&D) tax treatment, it rebounded significantly in 2024 and 2025, coinciding with genAI advancements following the release of ChatGPT.

Despite strong growth, AI/ML roles remain a relatively small share of the digital workforce, representing just 1.1% of digital employment in July 2025. By contrast, network and cybersecurity roles account for more than half (54.7%) of the total jobs covered in this analysis.

Employment growth in data and programming as well as networks and cybersecurity, decelerated consistently between 2021 and 2025. Roles requiring design and UX skills, however, followed a different trajectory. After a slowdown from 2021 to 2024, they saw renewed growth in early 2025, potentially driven by AI integration and enhanced investment in user-focused digital experiences.

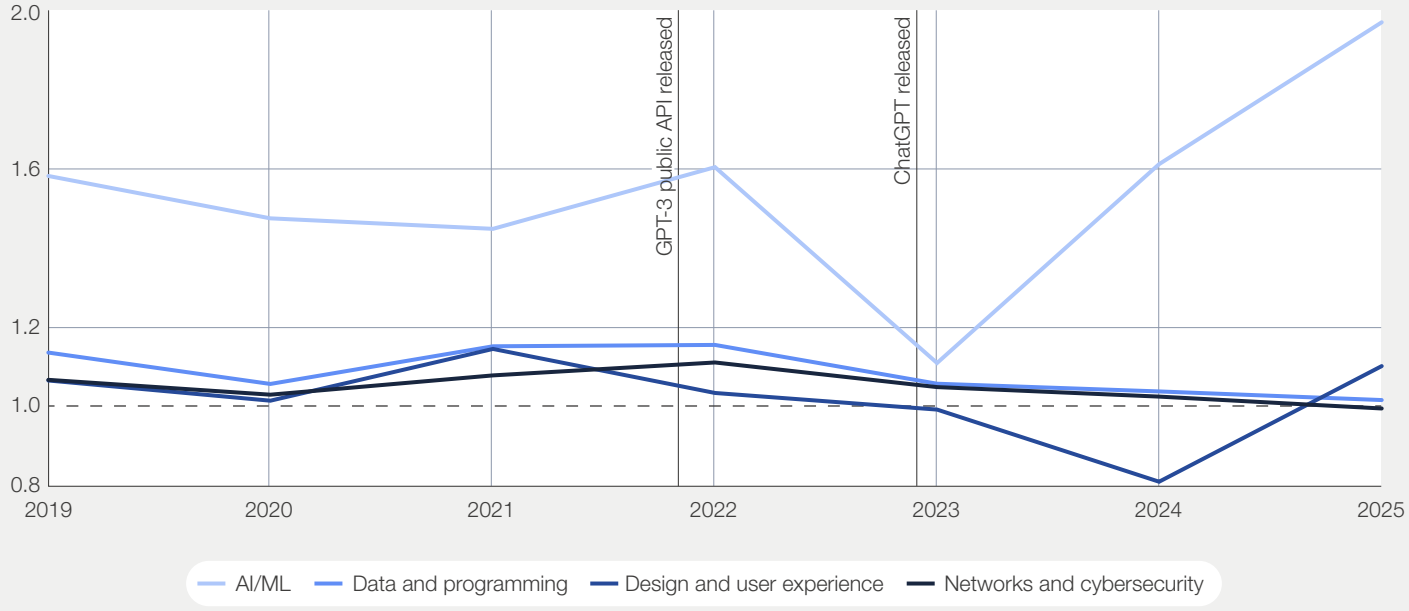
Wage dynamics mirror these shifts (Figure 8). Median salaries across digital occupations have trended upward since 2019, but AI/ML roles experienced a substantial wage increase beginning in 2023, reversing earlier stagnation. From 2019 to July 2025, median wages for AI/ML rose from $150,000 to $189,800, underscoring the considerable market value attributed to expertise in this area.

This analysis underscores the growing importance of digital skills, noting that while jobs and wages for people with AI/ML expertise are growing, foundational digital skills such as programming, networks and cybersecurity, and design and user experience continue to represent critical pillars of technology careers.

FIGURE 7

Employment growth in AI, data and digital skills, 2019–2025

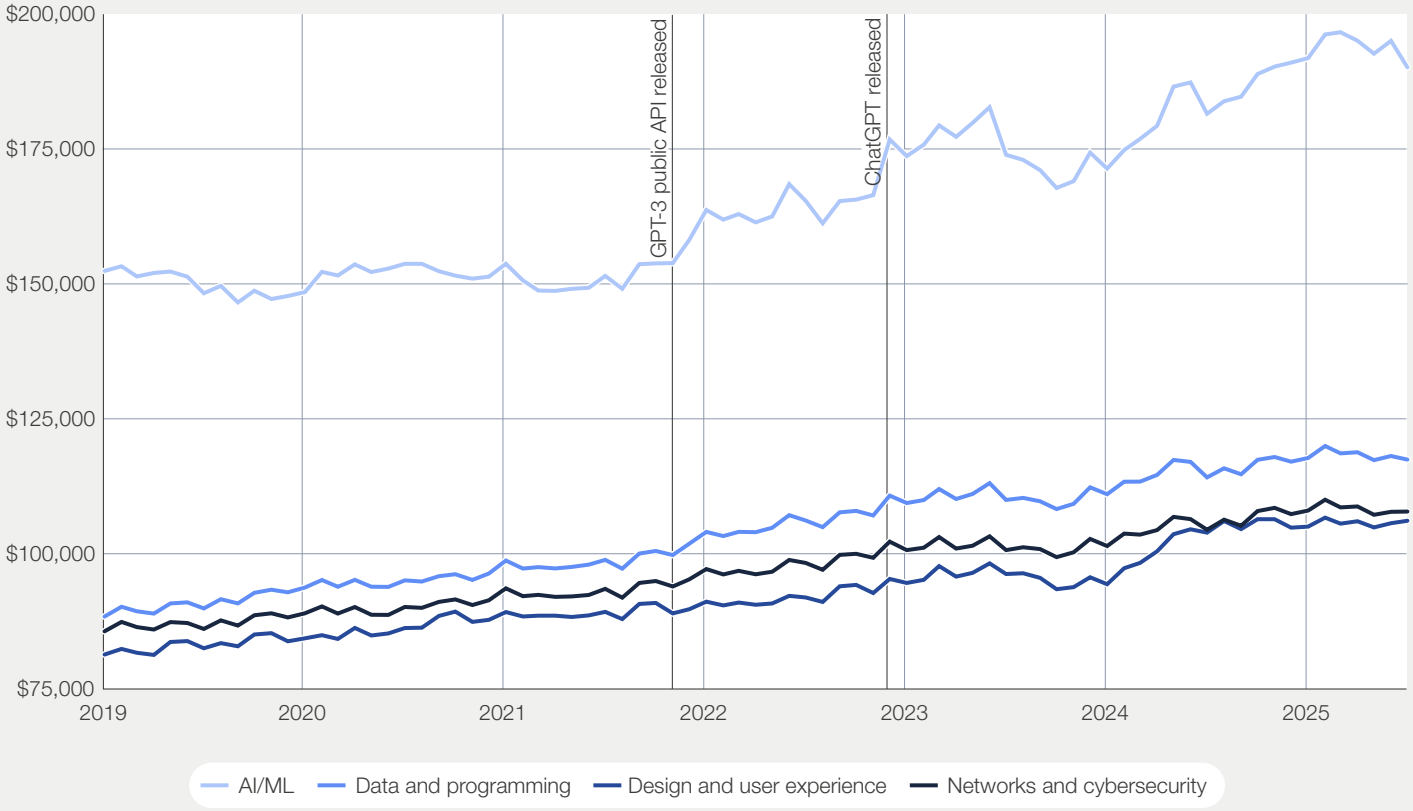
Compound annual growth factor of employment. Values above 1 indicate employment growth, while values below 1 reflect employment decline.



Note: 2025 values reflect data from January to July.
Source: ADP research.

FIGURE 8 | **Median wages for AI, data and digital skills, 2019–2025**

Seven-month centred moving average.



Note: 2025 values reflect data from January to July.
Source: ADP research.

The forces behind this surge in demand and escalating wages for digital expertise are multifaceted. As the pace of technological innovation quickens, organizations are adopting advanced AI tools and digital solutions at an unprecedented rate. This has sparked a need for specialists who can not only build and maintain these systems but also drive innovation. At the same time, the explosion of cyber threats has placed network and cybersecurity professionals in high demand, as companies prioritize protecting sensitive data and maintaining operational resilience.

With supply or highly skilled digital professionals lagging behind the ever-growing demand, particularly in AI and ML, employers are offering increasingly competitive packages to secure talent. Additionally, the growing importance of user experience has prompted more investment in design and UX roles, as businesses recognize the critical link between intuitive digital products and customer satisfaction. These factors illustrate how digital skills have become central to organizational strategy, innovation and competitiveness.

The urgent need to scale digital talent

For businesses to effectively align sought-after talent and skills with their strategic objectives, and for governments to unlock both latent and future opportunities for prosperity, a coordinated effort toward expanding digital skill development is essential. Yet, according to Coursera data on the time required to reach proficiency in digital competencies, significantly increasing the talent pipeline remains a complex and gradual process (Box 3).

The journey to mastering digital skills varies greatly depending on the area of focus. While the fundamentals can often be grasped relatively quickly, progressing to higher levels of expertise calls for far greater time commitment. Equally significant are the intricate relationships that exist among various skills. Digital competencies are often interdependent, with these connections enhancing the development of each skill and amplifying their overall impact.

The data underscores a central point: digital skills are most powerful when combined with human-centric and business capabilities that allow technology to be applied effectively to real-world challenges.

BOX 3 **Digital skills learning curves**

Research from Coursera reveals clear contrasts in the time needed to build digital skills. A basic level can often be achieved within a few days of study, but advancing to higher proficiency demands a far greater commitment, stretching to 108–155 hours, or several weeks of part-time learning (Figure 9).

Programming is the most demanding digital skill at the beginner and intermediate stages, requiring comparatively higher investment from the outset. Networks and cybersecurity escalates most sharply, becoming the most time-intensive at advanced levels (around 155 hours), reflecting the growing complexity of securing systems and managing evolving cyber threats. Technological literacy shows a similar steep progression, nearly matching programming in effort throughout.

By contrast, AI and big data, along with design and user experience, provide more accessible entry points. Beginners can often start AI with as little as 30 hours of study, as many beginner courses focus on AI literacy fundamentals. Advancing to higher levels, however, demands a significant leap into complex areas such as ML models and data science, with the average time to reach an advanced level estimated at 137 hours. Design and UX maintains the smoothest and least time-intensive learning curve across all stages, reflecting its emphasis on design thinking and user-centred practice rather than deep technical specialization.

However, learners seldom acquire skills in isolation. As new skills are taught, they often intersect with complementary abilities. Figure 10 illustrates the interconnectedness of digital skills, showing that they are built on a foundation of human-centric and business skills.

Technological literacy emerges as a core competency commonly taught alongside other digital skills, underscoring its role as a base for more specialized expertise. Programming is also frequently co-taught with AI and big data (26% of programming courses also include AI and big data) and with networks and cybersecurity (17%). Likewise, the strong links between UX and AI (26% of UX courses also teach AI) or programming (15%) highlight the growing emphasis on designing technology solutions around user needs.

Among human-centric skills, analytical and systems thinking are key complements to digital skills. Mathematical and statistical thinking, leadership and social influence, creative thinking, and dependability also appear frequently alongside digital skills learning. Business-related areas such as resource management, operations, marketing, media, and quality control further highlight the use of digital skills for applied real-world challenges.

FIGURE 9 | **Time to skill in AI, data and digital skills**

Average learning hours required to achieve a credential at beginner, intermediate or advanced proficiency in AI, data and digital skills..

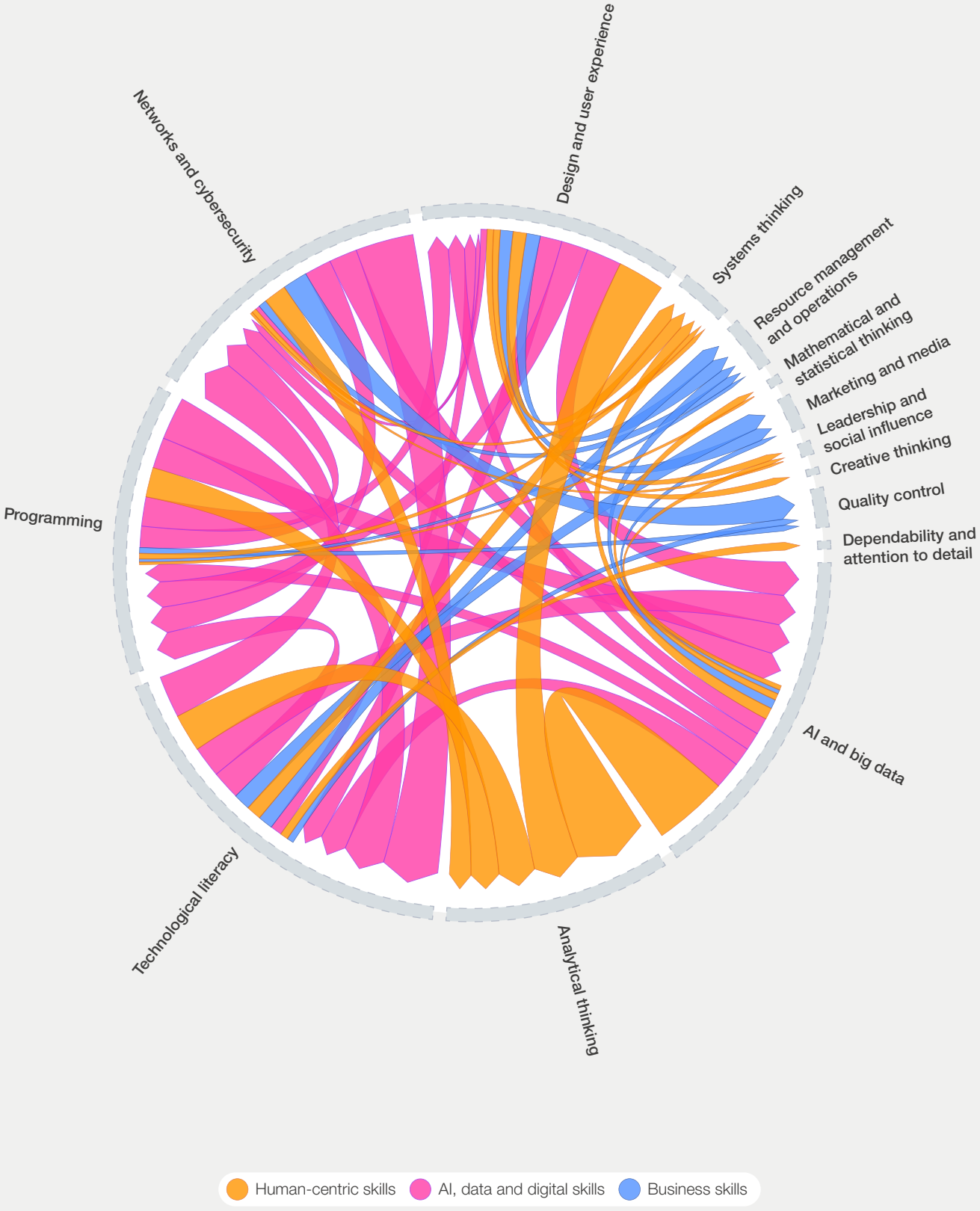
	Beginner	Intermediate	Advanced
AI and big data	30.4	83.8	136.8
Design and user experience	32.0	72.4	107.9
Networks and cybersecurity	57.3	107.8	155.3
Programming	67.3	116.3	144.0
Technological literacy	61.2	116.2	143.5

Mean 0% 150%

Source: Coursera; World Economic Forum, Global Skills Taxonomy.

FIGURE 10 | **Simultaneous skill acquisition: links between AI, data and digital skills and other skill categories**

Probability that courses covering each focus AI, data and digital skill also teach other skills. Each arrow shows the pair of skills that are often co-taught with another skill in Coursera courses. Thicker flows mean skills are more often taught together, with colours highlighting the category of the related skill.



Note: This graph was constructed by first selecting AI, data and digital skills as the focus, to provide a clearer view of how they connect with related skills.
Source: Coursera; World Economic Forum, Global Skills Taxonomy.

AI as both a driver of skills demand, and a solution to skill supply

While demand for digital skills is likely to remain strong, AI may eventually reduce demand by automating tasks. Cognizant research suggests up to 90% of jobs could be affected by AI by 2032, with some roles, like computer developers, facing significant disruption.[14]

However, predictions about the future are mixed. For example, Google's 2024 DORA report found only slight improvements in code quality and review speed from AI tools, but also noted decreased delivery stability and throughput.[15] One study even showed that experienced open-source developers became 19% slower when using AI tools, challenging assumptions about efficiency gains.[16]

At the same time, AI offers new opportunities that could speed up skill development (Box 4). For instance, AI-powered personalized learning platforms can adapt content and pace to individual learners, allowing beginners to quickly grasp core concepts in areas like AI literacy, programming or data science. Interactive virtual tutors and coding assistants, such as AI-driven code editors or chatbots, provide instant feedback and guidance, helping learners solve problems more efficiently. Additionally, AI can curate recommended learning pathways, highlight relevant resources and even generate tailored practice exercises, streamlining the acquisition of both technical and human-centric skills.

BOX 4 **How genAI is transforming digital skills**

The rapid advancement of genAI has prompted debate about its impact on work, reshaping not only how tasks are performed but also the future relevance of skills, particularly digital skills. Analysis by Indeed highlights both the growing capability of AI tools to transform digital skills and the rising importance of human proficiency with digital tools and technologies in an AI-driven economy.

Figure 11 presents the potential for genAI to transform work skills, drawing on Indeed Hiring Lab's GenAI Skill Transformation Index. The index scores skills across cognitive abilities and physical requirements, and measures how AI could change the way skills are used or work is done. Using the World Economic Forum's Global Skills Taxonomy, the analysis classifies nearly 2,900 granular work skills into four categories of transformation potential under genAI: minimal transformation, assisted transformation, hybrid transformation and full transformation.[17]

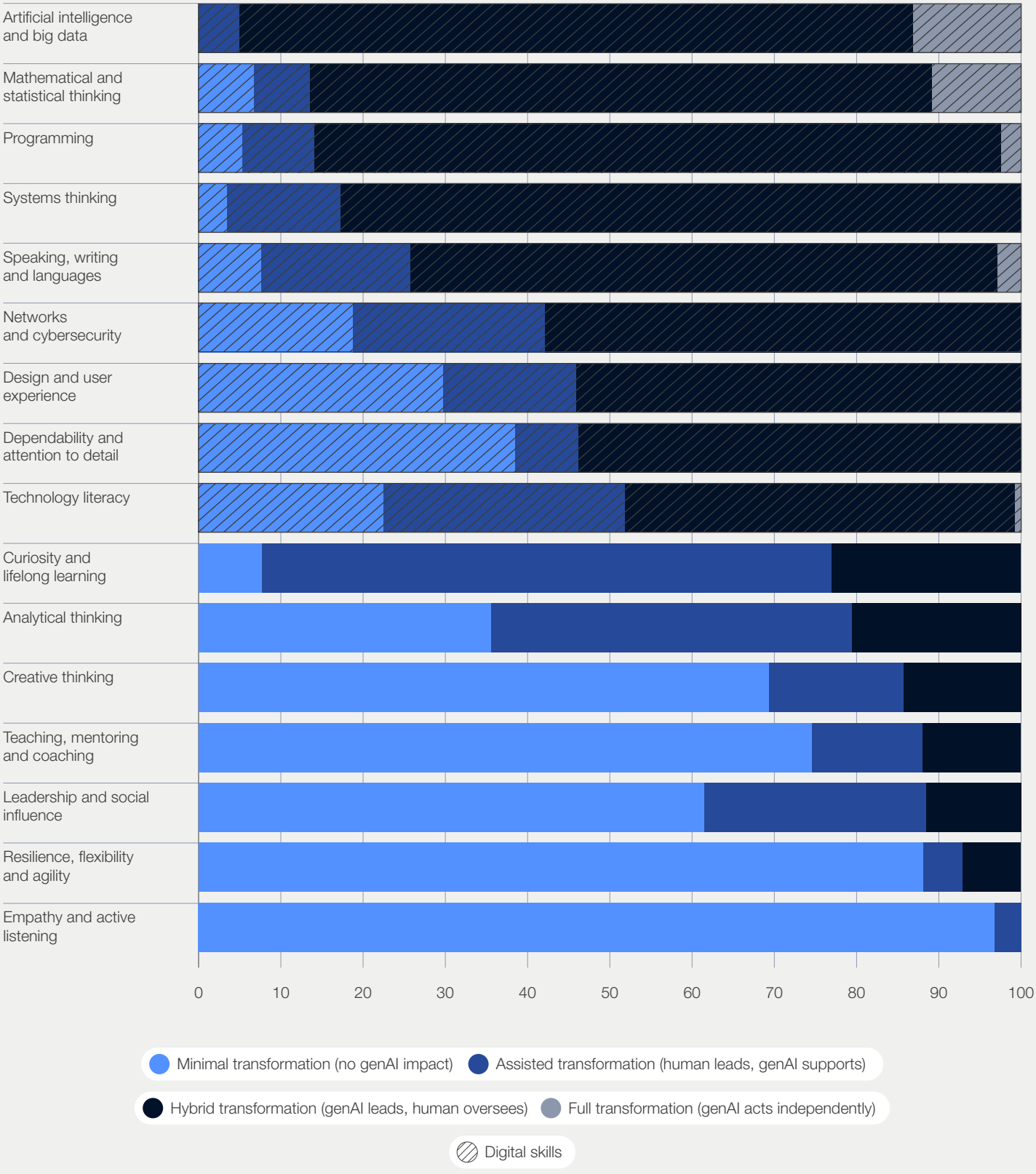
AI, data and digital skills are the most exposed to transformation, while human-centric skills are expected to see relatively minimal impact. Taken as an average, 68% of digital skills will see either hybrid or full transformation, compared to 35% across for all other, more human-centric, skills.

At the greatest extremes this gulf is vast: AI and big data skills, for example are over 30 times more likely to see full or hybrid transformation compared to empathy and active listening. AI and programming skills show greater capacity for transformation, as genAI can already handle many routine tasks and even perform independently in areas such as text or image classification, sentiment analysis, data preprocessing and prompt engineering. Still, this does not mean human workers will be displaced. The pace and extent of change will depend on model capabilities, organizational adoption, regulatory frameworks and the specific context in which tasks are performed.

By comparison, technology literacy – the ability to apply digital tools to context-specific business or social challenges – is far less affected. Many of these tasks rely on human judgement, creativity and adaptation. This divergence underscores the need for a dual investment in skills: advanced AI and data capabilities to manage and oversee digital systems, and a broad-based digital fluency that enable all workers to adapt, apply and reshape technology to address real-world challenges.

FIGURE 11 | **Current skill transformation capacity of genAI, by skill group**

Capacity of genAI to transform a given skill as a share of all granular skill within each skill group.
Analysis based on consolidated GPT-4.1 and Claude Sonnet 4 ratings, with close to 2,900 granular skills from the Indeed database, as of July 2025.



Note: In this report, the following are classified as AI, data and digital skills: artificial intelligence and big data, programming, networks and cybersecurity, design and user experience, and technological literacy.
Source: Indeed analysis; World Economic Forum, Global Skills Taxonomy.

While AI's impact on skills demand and supply is somewhat uncertain, there is clear demand for technical specialists to build and maintain the platforms set to automate or augment the skills noted in Box 4. For example, while statistical analysis possesses significant automation potential, its successful integration depends on the development and oversight of sophisticated AI solutions, either as foundational platforms or customized enterprise tools.

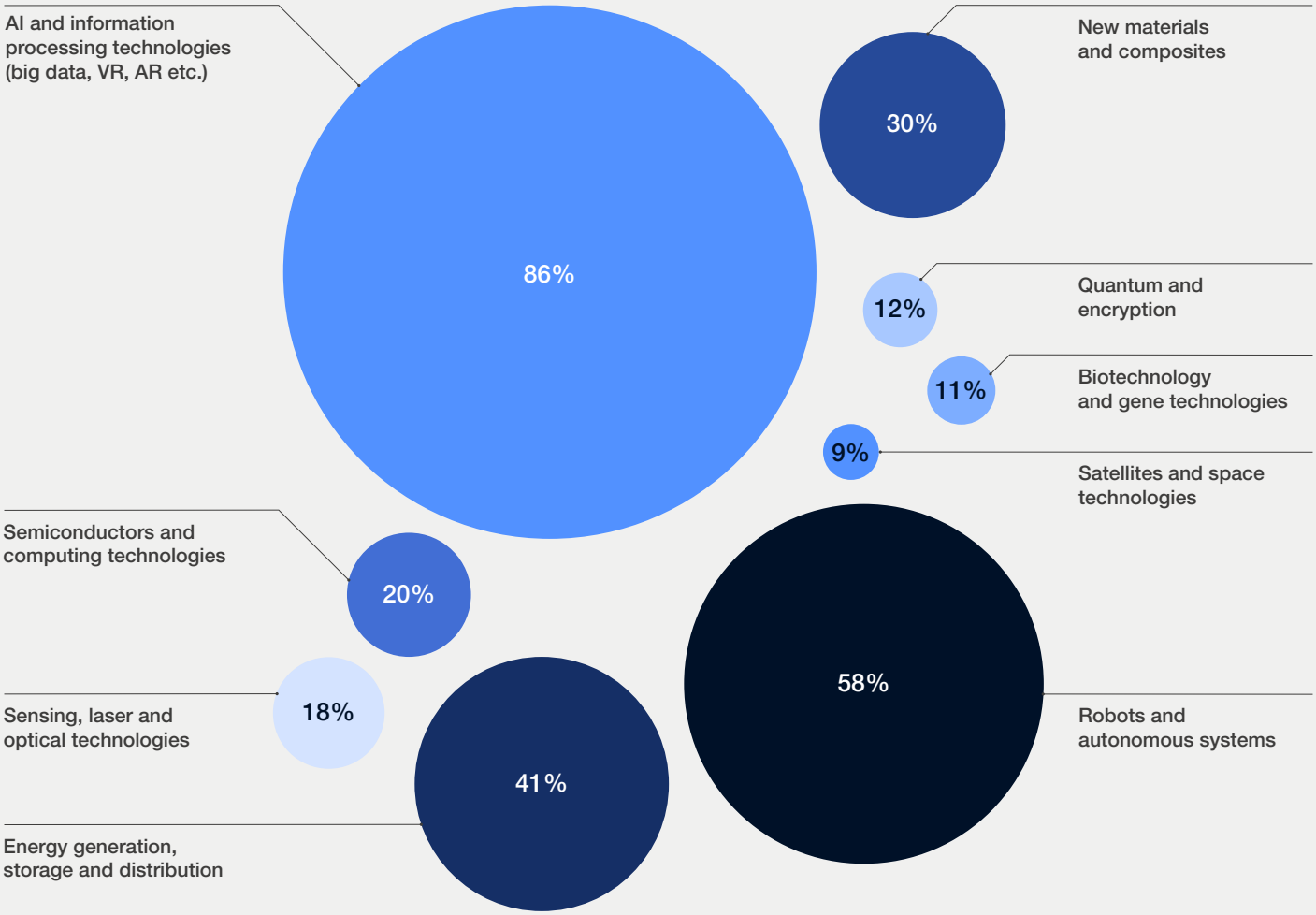
Further, demand for technology more broadly will continue to accelerate demand for related skills, even if AI can take on some of the burden of the limited supply. Recent research from the World Economic Forum predicts substantial investment in technologies that require skilled professionals for implementation and maintenance. According to Figure 12, business leaders have plans to implement a broad range of technologies. For example, 86% of surveyed employers expect AI and information processing technologies to transform their business.

Despite considerable technology investment, analysis of Indeed US job postings indicates that recruitment for digital skills remains highly specialized and focused. For instance, although AI is a high-demand competency and underpins substantial technology investments, it is mentioned as a required skill in only 2% of job advertisements.

And while technology investment is prevalent across all industries, its degree and strategic emphasis vary considerably. Physical robotics, for example, lag more widely adopted technologies such as AI, except in sectors like manufacturing, where investments tend to be more intense.

FIGURE 12 **Enterprise investment strategy**

Share of employers expecting this technology to transform their organization



Source: World Economic Forum Future of Jobs Report 2025.

BOX 4 | **How genAI is transforming digital skills**

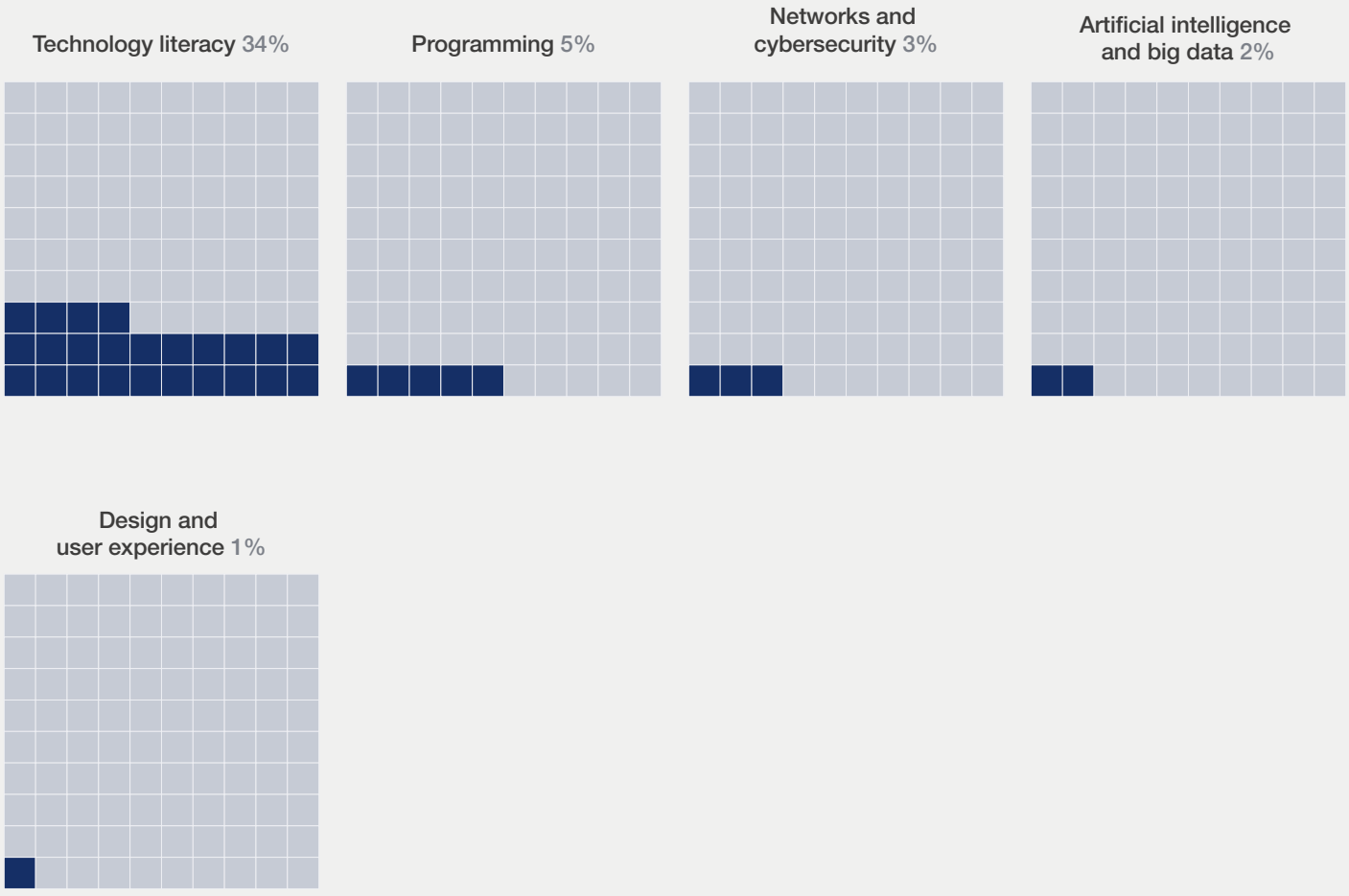
Employers increasingly expect workers at all levels to apply digital skills in everyday tasks, from managing productivity tools to leveraging AI for decision-making. Research conducted by Indeed for this report, underscores the importance of technological literacy for employers (Figure 13). It appears in 34% of US job postings overall, though with wide variation across sectors: just 16% in accommodation, food and leisure, compared with 84% in information technology and digital communications.

Other skills such as programming, networks and cybersecurity, AI and big data, and design and UX are mentioned far less frequently and are largely concentrated in the IT sector. This suggests that advanced technical competencies are still required mainly for specialized roles rather than being distributed broadly across the workforce.

A closer look at sectoral patterns shows that demand for AI, data, and digital skills is most pronounced in technology-intensive industries such as information technology and digital communications, as well as automotive and aerospace. By contrast, sectors traditionally less reliant on technology, such as accommodation, food and leisure, report minimal demand for these skills (Figure 14).

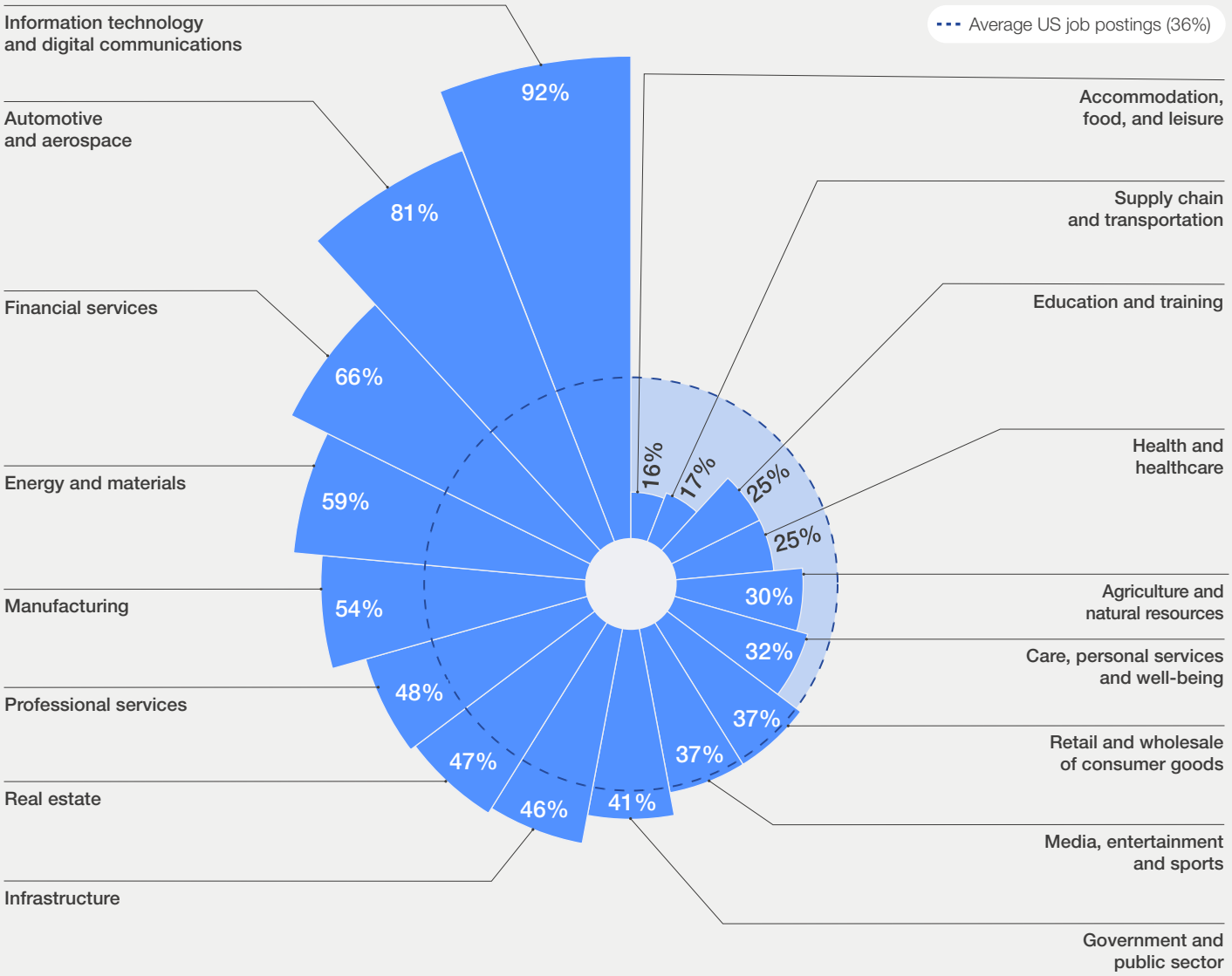
Further, there are significant disparities in how digital transformation is unfolding across sectors. Advanced digital expertise is highly demanded primarily in technology-intensive industries, with limited demand elsewhere, which risks widening digital divides and limiting innovation across industries.

FIGURE 13 | **Share of job postings mentioning AI, data and digital skills, 2024–2025**



Note: Share of 2,900 U.S. job postings mentioning AI, data and digital skills from May 2024 to April 2025.
Source: Indeed analysis; World Economic Forum, Global Skills Taxonomy.

FIGURE 14 **Share of job postings mentioning AI, data and digital skills, by sector, 2024–2025**



Note: Share of U.S. job postings mentioning AI, data and digital skills from May 2024 to April 2025, by sector.
Source: Indeed analysis; World Economic Forum, Global Skills Taxonomy.

Industry and regional transformation trends

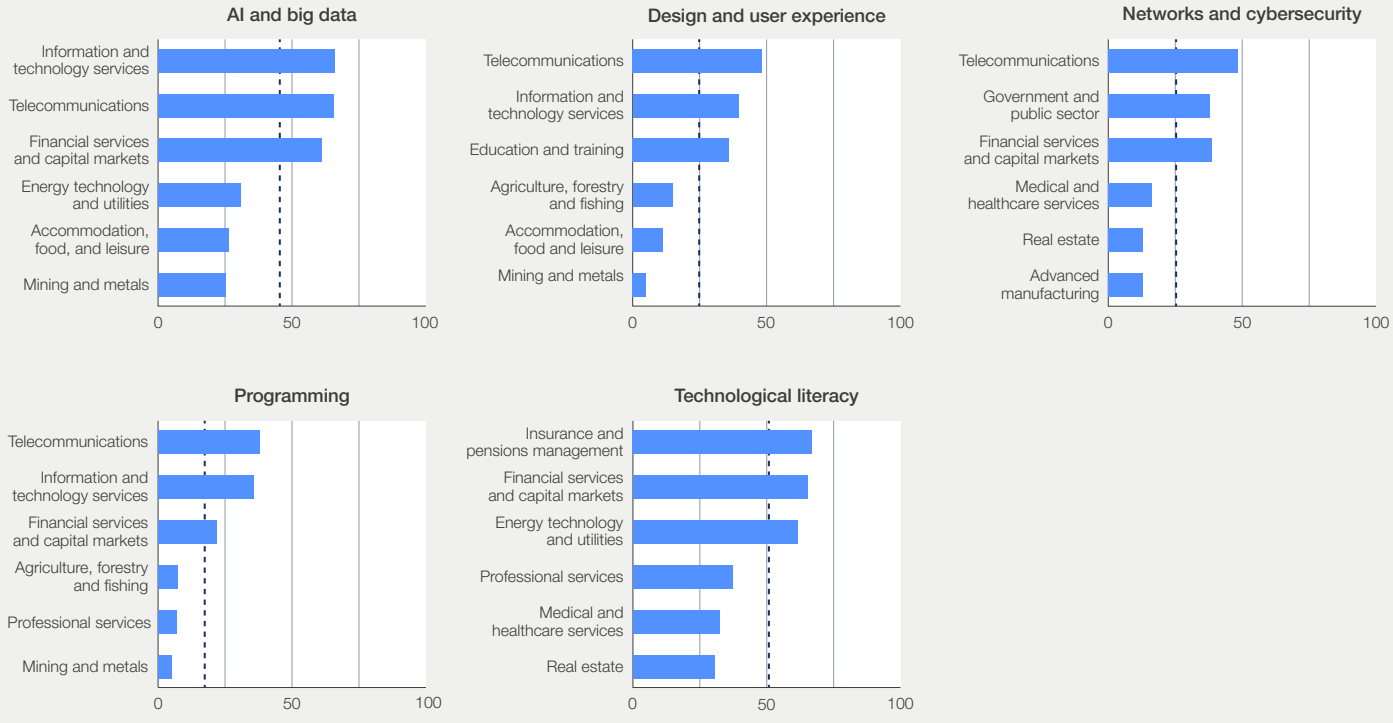
Figure 15 presents the share of employers surveyed who consider skills to be core for their workers across different industries. Understandably, tech-heavy sectors such as information and technology services, and telecommunications tend to see digital skills as core to the greatest extent, particularly in AI and programming. These industries rely heavily on digital technologies to deliver their core products and services, drive innovation and maintain competitive advantage. Rapid development and deployment of new technologies in these sectors require employees with high levels of digital literacy to develop, implement and manage complex systems. As these sectors are often at the forefront of digital transformation, the ability to adapt to and leverage emerging technologies is crucial for operational success and continued growth.

Insurance, financial services, and energy and utilities place a similarly high value on digital skills, particularly foundational technological literacy, because their operations increasingly depend on digital technologies for efficiency, innovation and security. In financial services and capital markets, for instance, digital skills are essential for automating processes, developing secure transaction systems and managing extensive data sets. Insurance firms rely on digital tools to analyse risk, streamline claims processing and personalize customer offerings. Energy, technology and utilities companies use technological literacy to manage smart grids, implement predictive maintenance and integrate renewable energy solutions. In all these sectors, the need to handle large volumes of data, comply with regulatory requirements and respond swiftly to market changes, means that digital skills are critical for maintaining competitiveness and driving ongoing transformation. While foundational technological literacy is vital, these industries also see specialist skills such as programming and data analytics as core.

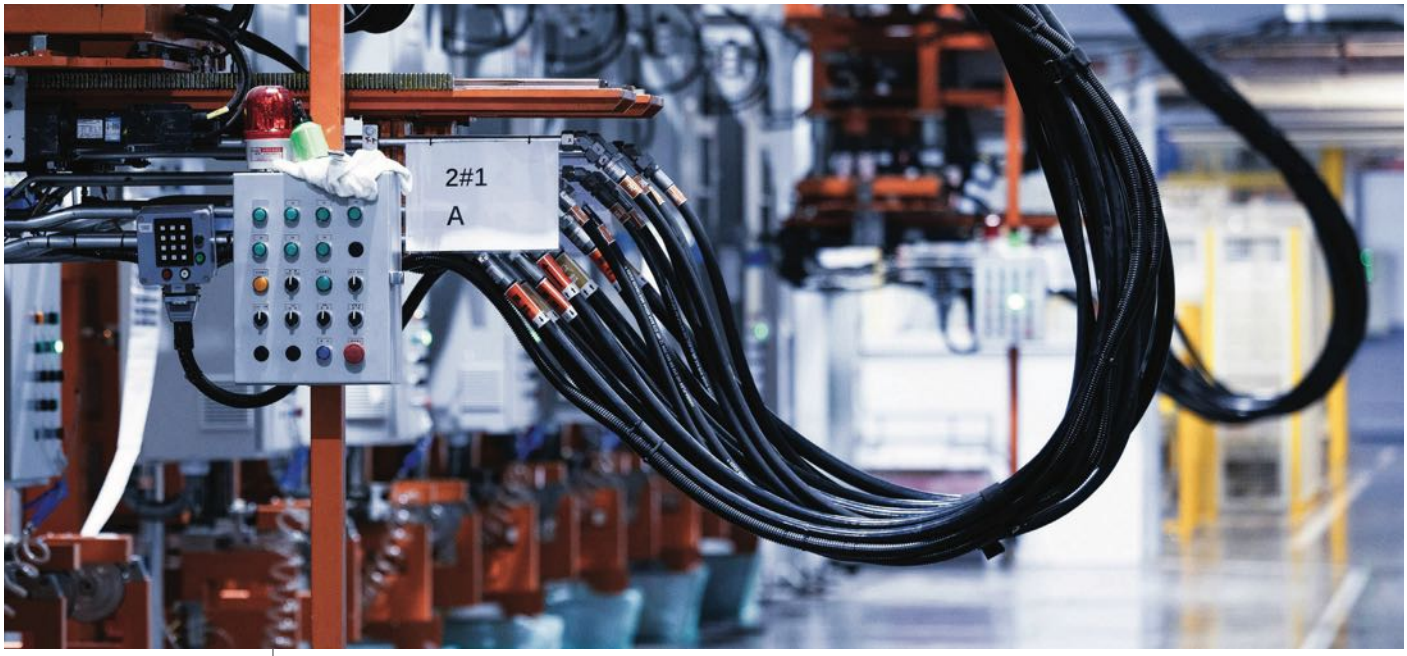
Compared to other sectors, industries such as mining and metals; agriculture, forestry, and fishing; and accommodation, food, and leisure are the least likely to view digital skills as essential. Currently, about one-quarter of Mining and Metals companies see AI and big data expertise as central to their operations, while only 5% regard programming as fundamental. Daily activities in these sectors generally depend more on physical processes, heavy machinery and manual labour, rather than on advanced digital technologies. As a result, digital tools often play a supporting role instead of being core to their work, which accounts for the relatively low emphasis on digital competencies like AI and programming.

FIGURE 15 **Digital skill importance, 2025**

Share (%) of employers who consider skills to be core for their workers, by industry.
Chart shows the top three and bottom three industries by average share.



Source: World Economic Forum, Future of Jobs Survey 2024.



Similarly, agriculture, forestry, and fishing remains heavily dependent on manual and human-centred work, despite the introduction of new technologies. Leisure industries also place greater emphasis on interpersonal and practical skills, such as communication and customer service. In both sectors, the slower pace of digital transformation and the ongoing importance of traditional practices mean that digital skills, while valuable, are not yet seen as critical to core activities.

Looking more closely, Figure 16 illustrates the difference in employers who believe certain skills will become important or less important for their workforce between 2025 and 2030. Once again, there are significant contrasts between industries. For example, AI and big data skills are expected by 100% of those surveyed to see widespread growth in usage across both telecommunications and automotive and aerospace sectors, while 69% of organizations in accommodation, food, and leisure anticipate an increase in these skills.

Drivers for this anticipated demand vary. In the automotive sector, the shift towards connected and autonomous vehicles, along with smart manufacturing, is driving advanced analytics to process sensor data, enhance safety, optimize supply chains and support innovation in electric and self-driving technologies. Professional services firms deal with complex and data-rich environments like finance and consulting, and increasingly depend on AI and big data to automate tasks, glean insights and offer tailored recommendations. Meanwhile, telecommunications companies face growing demands due to expanding networks, the advent of 5G, and the rise of Internet of Things (IoT) and need AI-driven analytics to manage vast data volumes, improve operations and deliver personalized customer experiences.

On the other hand, sectors like agriculture, forestry, and fishing, and accommodation, food, and leisure appear be more cautious. About 70% of leaders in each field expect AI usage to rise, but 4% in agriculture, forestry, and fishing and 8% in accommodation, food, and leisure predict a decline. The importance of human-focused abilities, such as communication skills in leisure and manual labour in agriculture, likely explains the less enthusiastic outlook in these industries.

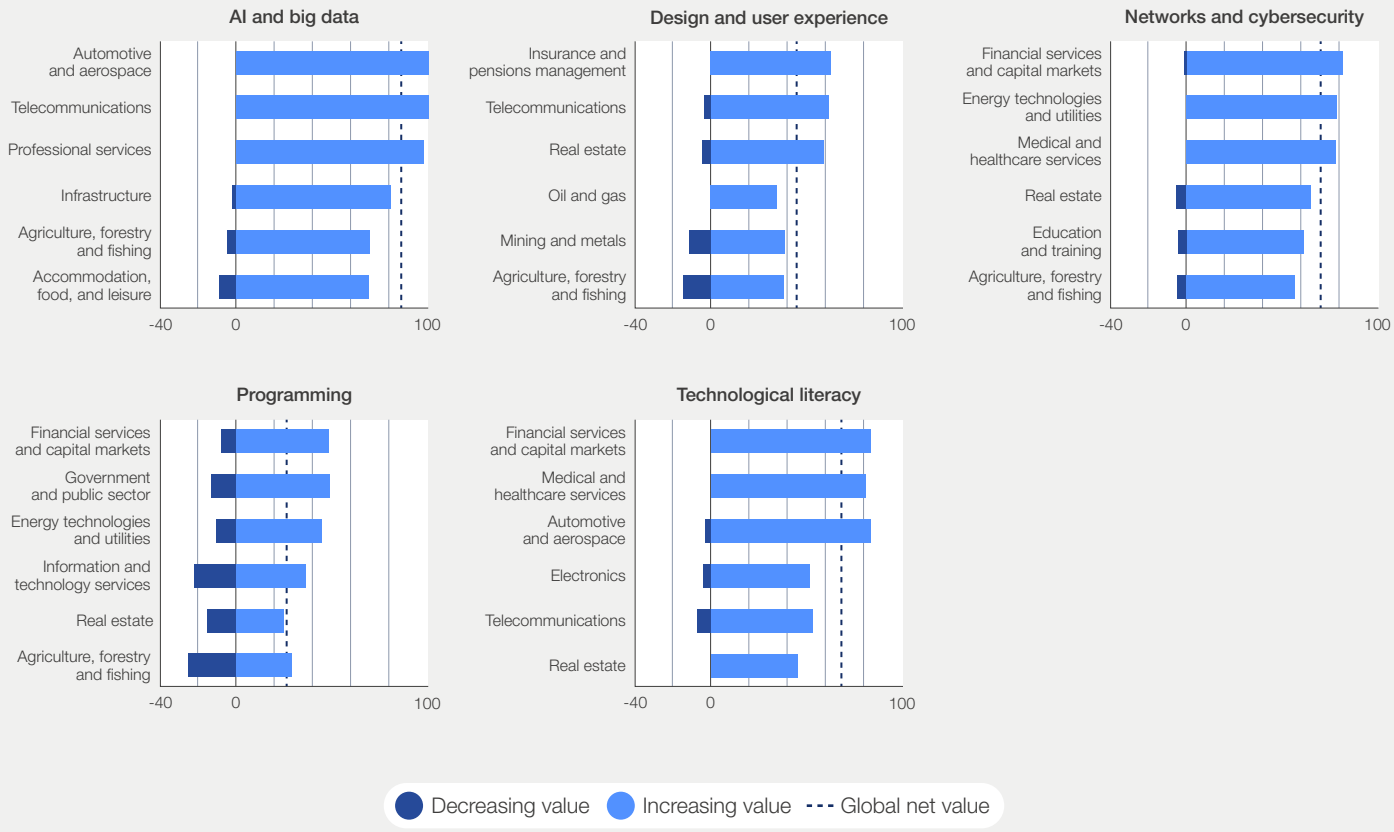
Programming skills present a similar picture, framed within expectations of high demand, albeit not as aggressive as AI. Nearly half of financial services and capital markets firms, government and public sector bodies, and energy technology and utilities companies expect an increase in demand for programming skills, with around one in 10 businesses anticipating a decline in use.

Rising demand for programming skills in financial services and capital markets, government and public sector, and the energy technology and utilities sectors is fuelled by ongoing digital transformation and the need for advanced software solutions, albeit with some businesses anticipating a decline due to increasing reliance on AI for automating development and testing tasks.

About one-quarter of agriculture, forestry, and fishing businesses expect programming use to decrease, while nearly 30% anticipate an increase. In real estate, 25% foresee increased demand for programming skills, compared to 15% expecting a decline. Once again, these differing views reflect each sector's approach to technology and the involvement of human workers: agriculture remains reliant on manual work despite new innovations, while real estate's gradual digital shift still depends heavily on personal connections. Both sectors balance adopting new technology with traditional practices, leading to mixed expectations for programming talent.

FIGURE 16 **Digital skill importance, 2025–2030**

Net difference (%) between the share of employers who consider skills to be increasing and decreasing in importance to their workers from 2025 to 2030. The share of employers predicting skill stability is not used in the calculation. Chart shows the top three and bottom three industries by net values.



Source: World Economic Forum, Future of Jobs Survey 2024.

1.3 Regional trends

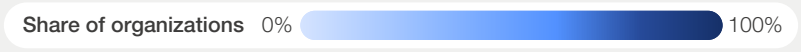
Significant regional differences also exist. Business leaders' perspectives on whether specific skills within a region will grow or decline in importance over the next five years may be shaped by a variety of factors. These include external influences such as current labour supply, governmental and regulatory frameworks, and available infrastructure, as well as internal considerations like investment strategies and customer requirements.

Nevertheless, several significant differences stand out. Figure 17 illustrates the proportion of organizations in various regions that view certain skills as essential for their employees. Overall, AI and technological literacy are regarded as more fundamentally important than areas like programming, which sees less enthusiasm. Northern America leads in prioritizing AI and big data, with 60% of executives considering these skills vital for their workforce. Similar levels of importance are noted in South-Eastern Asia, Southern Asia, and Sub-Saharan Africa, highlighting the widespread relevance of this technology. Meanwhile, Eastern Asia places greater emphasis than average on design and UX.

FIGURE 17 **Skill importance in 2025, by region**

Share (%) of organizations that consider skills to be core skills for their workers.

	AI and big data	Design and user experience	Networks and cybersecurity	Programming	Technological literacy
Central Asia	32	14	20	17	52
Eastern Asia	45	39	27	16	30
Europe	44	23	24	16	54
Latin America and the Caribbean	40	29	21	16	51
Middle East and Northern Africa	46	21	20	19	35
Northern America	62	28	40	26	64
South-Eastern Asia	58	33	42	12	67
Southern Asia	55	19	13	13	52
Sub-Saharan Africa	54	30	39	24	64



Source: World Economic Forum Executive Opinion Survey 2025.

Executives worldwide also differ in how they see the importance of skills changing over the next five years. Figure 18 shows the net difference between organizations expecting skills to increase or decrease from 2025 to 2030. AI skills continue to lead globally; every region reports high expectations for the growing value of these skills and highlights the urgent need to develop them in line with business needs. South-Eastern Asia is especially strong when it comes to networking and cybersecurity skills, with Sub-Saharan Africa and the Middle East and North Africa following close behind. Additionally, Sub-Saharan Africa expects to see the largest increase in importance for programming skills.

Except for Eastern Asia, where a minor decline in programming's significance is anticipated, all regions anticipate an increase in the importance placed on digital skills. Worldwide, organizations are advancing comprehensive digital transformation strategies,

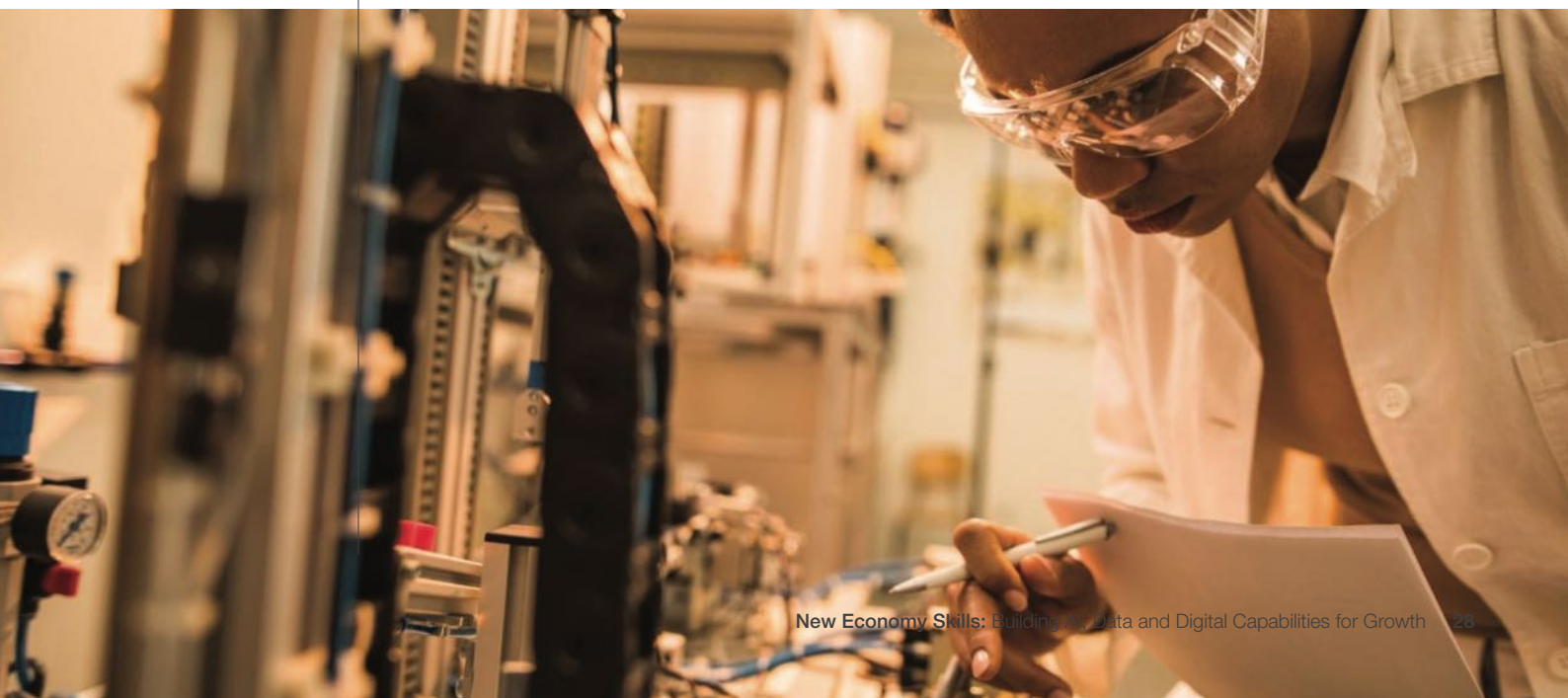
FIGURE 18 | **Skill importance evolution, 2025–2030, by region**

Share (%) of organizations that consider skills to be core skills for their workers.

	AI and big data	Design and user experience	Networks and cybersecurity	Programming	Technological literacy
Central Asia	79	24	68	48	53
Eastern Asia	87	46	64	-4	43
Europe	90	43	74	24	71
Latin America and the Caribbean	91	63	67	32	76
Middle East and Northern Africa	68	43	70	36	64
Northern America	90	24	61	10	80
South-Eastern Asia	96	68	92	29	78
Southern Asia	89	60	54	15	63
Sub-Saharan Africa	86	54	71	57	84

Source: World Economic Forum Executive Opinion Survey 2025.

spurred by recent advancements in AI. These efforts serve as both opportunities to enhance economic prosperity through systematic digitilization and labour-market improvement, as well as responses to competitive pressures to deliver goods and services efficiently. In short, digital skills underpin the modern economy, and organizational reliance on them continues to grow, yet current talent supply does not meet existing demand. Without decisive action to broaden talent pools and improve skill assessment, development and credentialing globally, this will hamper the potential for significant economic and societal advancement.



2

Call to action: developing, assessing and credentialing digital skills

Strategic investment in digital skills must be embedded in workforce strategies, with clear frameworks for development, assessment and credentialing.

Strategic investment in digital skills development has the potential to unlock new sources of growth, boost economies and create resilient, future-ready societies. Countries and organizations that prioritize digital upskilling will be better positioned to harness technological advances, adapt to rapid change and lead in the global economy. Conversely, inertia will only deepen disparities and slow progress.It is imperative for leaders across all organizations to go beyond rhetoric and commit to tangible investments in digital learning, robust assessment mechanisms and meaningful credentialing frameworks. This means embedding digital skills into the heart of workforce strategies, partnering with educators and policy-makers, and ensuring employees have access to lifelong learning opportunities that keep pace with technological evolution.

Towards global guiding principles

Developing, assessing and credentialling digital skills is complex and cannot rely on one-off exposure or static tests. Unlike traditional technical knowledge, digital skills are dynamic, context-dependent and rapidly evolving. Effective strategies demand authentic learning experiences, diverse perspectives and recognition systems that make these skills visible and portable. Yet, UNESCO research indicates that current systems are predominantly developed by commercial organizations, which tend to provide training resources and certifications aligned with proprietary vendor technology ecosystems, rather than adopting a comprehensive framework applicable across industries.

To address these gaps, this chapter presents a global framework for digital skills that promotes coherence, integrity and alignment across education, industry and policy. Framework principles are designed to help business leaders shape workforce strategies, governments to understand and nurture digital talent, and educators create effective pathways for developing digital skills.

Assessing digital skills

Digital skills are complex and highly dependent on specific contexts. Proficiency in skills such as AI, data analytics or cybersecurity may vary across sectors due to differing industry requirements, organizational cultures and technological infrastructures. Although a broad spectrum of standardised assessment methods with recognized benchmarks for comparison and validation exist, the thorough evaluation of these competencies calls for a more nuanced and personalized approach. The following set of principles can help leaders set new standards for assessing digital skills.

See the whole human: Assessment systems must capture the full picture of every individual, recognizing their demonstrated achievements and their ongoing growth. By combining industry benchmarks for consistency, performance-based assessments for real-world demonstration and reflective tools that document continuous growth, leaders can evaluate what learners know, how they think and how they evolve. Purpose-driven assessments measure outcomes, as well as the critical thinking, ethical reasoning, creativity and problem-solving displayed along the way, enabling personalized development and meaningful recognition of progress.

FIGURE 19 | **Global principles to develop, assess and credential digital skills**

Assessment

1. **See the whole human**: Use diverse tools to get a 360° view of skills and potential.
2. **Make it real**: Evaluate skills through authentic, performance-based tasks.
3. **Track thinking, not just results**: Monitor both progress and thought processes over time to track holistic growth.

Development

4. **Prioritize new economy skills**: Put new economy skills at the heart of learning.
5. **Create safe spaces**: Encourage growth through feedback, practice and reflection.
6. **Fuel purposeful learning**: Cultivate self-awareness and encourage hands-on collaborative experiences.

Credential

7. **Set shared standards**: Align on clear, consistent ways to recognize skills globally.
8. **Prove it in practice**: Use portfolios and real-world evidence to show skills application.
9. **Badge what matters**: Award modular, skill-specific and context-rich credentials, connected to clear career and learning pathways.

Technology is increasingly transforming how such assessment is done. AI-powered adaptive testing can personalize challenges to each learner's strengths and areas for growth, providing timely, tailored feedback. Immersive technologies such as virtual and augmented reality (VR/AR) can simulate complex, high-stakes, lifelike scenarios, like cybersecurity incident response or collaborative product design. Digital platforms can aggregate peer feedback and performance metrics at scale, promoting collaborative evaluation and continuous improvement. Offline or edge AI solutions can remove barriers to access, making sophisticated assessment tools available even in low-connectivity or remote settings.

Make it real: Standardized certifications, such as broad-based assessments like CompTIA or vendor-specific credentials like Azure or Google Cloud, facilitate comparability and provide recognized benchmarks across industries. Yet they tend to focus on theoretical knowledge and procedure rather than the agility and problem-solving required of digital skills in real-world contexts.

Effective evaluation of digital skills is best achieved through authentic, performance-based assessments such as coding challenges, hackathons and project portfolios, which test not only technical ability but also creativity, teamwork and adaptability. Self-assessment and peer review, including contributions to platforms like GitHub and Kaggle, complement these methods by highlighting collaborative skills and promoting continuous learning.

Each method has strengths and drawbacks: hackathons are resource-intensive and only measure skills at a single point in time, while self-assessment can lack fairness and rigour. However, combining standardized certifications with practical tasks and peer evaluation offers a more balanced and reliable assessment system to meet the needs of today's changing technology landscape.

Track thinking, not just results: One-off assessments rarely capture the adaptability and growth essential to digital skill development. Digital portfolios, online platforms and continuous learning records allow individuals to showcase projects, contributions and feedback over time, demonstrating their capabilities and the evolution of their skills. However, challenges around privacy, comparability and access persist and must be addressed to ensure fairness and inclusion. In addition to showcasing tangible results, these tools can also help document how people solve problems, respond to feedback and improve through iteration, offering deeper insights into how a learner adapts to new challenges and integrates feedback into future work. This is invaluable for educators seeking to personalize instruction and for employers aiming to

identify candidates with technical expertise as well as a growth mindset and resilience.

Technology has the potential to significantly enhance the effectiveness of digital skills assessment systems. AI can monitor individual learning pathways chosen and provide tailored recommendations to optimize their progress and address specific gaps. In doing so, AI can highlight particularly innovative or effective problem-solving approaches, ensuring that creative achievements and unique solutions that might go unnoticed in traditional assessment frameworks are recognized and recorded. AI-driven insights can identify targeted training opportunities for those who need additional development and document and celebrate exceptional contributions of high achievers.

To translate these principles into practice:

- **Educators**: can partner with industry to develop real-world, performance-based assessment experiences, including hackathons, simulated projects and internships, that mirror workplace demands.
- **Employers**: can collaborate with other employers within and across industries to align on recognized assessments for AI, data and digital skills, and use AI and analytics tools to map workforce digital capabilities.
- **Governments**: can develop and promote national frameworks to assess digital, data and AI skills; invest in accessible, AI-enabled assessment infrastructure, particularly for underserved or low-connectivity regions; incentivize collaboration between education, industry and certification providers to align assessment practices; and support research and pilots that test innovative assessment models.

Developing digital skills

Digital skills require consistent practice, targeted feedback and supportive environments. Learners need hands-on tasks, mentorship and safe spaces to make mistakes and learn from them. Collaboration, access to resources and ongoing support are vital for building, retaining and applying digital skills in the real world.

Prioritize new economy skills: Digital skills are no longer optional, but central to innovation, growth and resilience. They must therefore be woven intentionally into curricula and professional development, supported by robust investment, clear strategic commitment and ongoing practical application. Structured, hands-on opportunities to build and apply digital skills beyond basic literacy must be embedded across education systems and workplaces alike. This requires intentional integration, sustained investment and practical application rather than one-off initiatives.

Yet, supply challenges still mire global economies. Bridging this gap requires a mindset shift: digital skills must be treated as essential infrastructure rather than a niche domain. Aligning digital skill development with industry-recognized standards and learning environments for authentic practice and reflection are critical. Equally important, leaders must commit resources over the long term, ensuring that learners have access to tools, support and structured learning opportunities across their careers.

Create safe spaces: Developing digital skills requires environments where people can fail safely and learn by doing. Replicated safe environments of real systems provide realistic practices spaces without the risk of causing damage. Technology can help. AI can simulate sophisticated cybersecurity opponents, enabling learners to test their defences against realistic and adaptive threats in a secure environment. Meanwhile, virtual reality (VR) allows participants to bridge the gap between theory and practice through hands-on, interactive experience.

A culture of psychological safety is also important. Mistakes become valuable learning opportunities, allowing learners to build resilience and confidence as they try out new digital tools, approaches and solutions.

Fuel purposeful learning: Immersive, practical experiences tied to a clear purpose are essential for developing genuine digital skills. Activities like interactive simulations, building coding portfolios, and role-playing digital scenarios allow learners to experiment, apply their knowledge in realistic situations and learn from direct feedback. Moreover, when aligned with a realistic objective, such as a cybersecurity simulation where learners are defending a digital representation of their organization, the purpose of the training exercise is even clearer.

To translate these principles into practice:

- **Educators**: can establish “digital sandboxes”, virtual labs where students can test code, run simulations and solve real-world challenges safely; promote cultures that celebrate experimentation and reflection; and use AI and VR tools to simulate complex digital scenarios for hands-on learning.
- **Employers**: can build “digital sandboxes” and internal simulation environments for safe innovation; map digital skill gaps and embed skill-building into workforce development strategies; and connect training programmes to tangible business goals.
- **Governments**: can create national digital skills strategies aligned with economic priorities and industry needs; fund public-private partnerships that expand access to advanced digital training; and develop ethical and safety standards for digital learning environments.

Credentialling digital skills

Credentialling digital skills is challenging, as recognition needs to be robust, transferable and trusted across regions and sectors. While some qualifications are well-established, newer forms like micro-credentials still struggle with limited transferability and inconsistent recognition.

Set shared standards: Traditional qualifications like degrees and certificates are trusted indicators of digital competence but often measure theory rather than practice. In contrast, micro-credentials, digital badges and endorsements are rapidly growing in popularity for certifying skills like data analysis, programming, cybersecurity and networking. Flexible and stackable, they offer more direct pathways for educational and career advancement but still need universal standards and widespread employer acceptance. Yet, the rise of vendor-specific and internal organizational credentials has led to credential inflation, a crowded landscape of overlapping, opaque qualifications. It is therefore crucial to create global and national validation frameworks that ensure consistency and interoperability.

Prove it in practice: Digital competence is best shown through what people can do. Practical evidence, such as curated GitHub repositories, documented projects, peer feedback or digital journals, provide powerful evidence of applied skills but often lack formal recognition. To improve validation, hybrid models now combine traditional qualifications with modular, skill-based credentials that emphasize targeted digital abilities and lifelong learning. For instance, a developer might pair a university degree with an open-source portfolio endorsed by peers.

Emerging technologies can further enhance credibility. Digital platforms, blockchain verification and smart badges now allow employers and institutions to confirm authentic achievements.

Badge what matters: For digital credentials to be meaningful and portable, they must clearly communicate context, process and outcomes. Further, digital skills required by employers are frequently changing, technology vendors widely develop their own credentials, and traditional qualifications often fail to capture the breadth and depth of practical abilities. Metadata-rich badges and portfolios show how skills were developed, tested and applied, helping employers and educators interpret qualifications accurately and ensure skills are aligned with industry needs and standards.

Emerging technologies can help. Blockchain-based ledgers and secure digital portfolios make digital credentials portable, transparent and verifiable across borders. QR-coded badges and embedded metadata link credentials to verified evidence of learning and assessment. Offline and hybrid solutions ensure that digital skill credentialling remains equitable and accessible for all.

To translate these principles into practice:

- **Educators**: can highlight specific digital competencies in transcripts and course descriptions; encourage learners to showcase their projects; and align with industry leaders on standards.
- **Employers**: can recognize digital portfolios and skills transcripts in recruitment, promotion and internal mobility, and collaborate within and across industries to set shared standards for digital skills.
- **Governments**: can develop national guidelines and standards for digital credentials and incentivize tools that make recognition transparent, traceable and accessible.

Enabling conditions for a digital skills ecosystem

These approaches will only succeed if supported by conditions that guarantee equity and trust. First, it is crucial to ensure that all learners, regardless of background, have access to digital skill development, assessment and recognition. Equally important is to align learning outcomes, hiring practices and recognition across systems. This shared understanding is reinforced by designing assessments, development pathways and credentials to recognize diverse cultural and gender perspectives, while actively minimizing bias. Inclusivity strengthens trust in digital skill recognition and ensures relevance across sectors and borders. Finally, technology should function as an enabler, extending access, supporting scalability and promoting reflection.

By embedding these principles in development, assessment and credentialling systems, and by anchoring them in conditions of equity, shared language, context awareness and responsible technology use, societies can ensure that digital skills are visible, valued and nurtured for the future of work and lifelong learning.

3 From principles to practice: assessing, developing and credentialing AI, data and digital skills

Four real-world examples illustrate the impact of putting into place structured, framework-aligned, organization-wide digital skill-building strategies.

The following case studies bring these principles to life. Each has been selected based on their alignment with a specific principle and was developed through a combination of expert consultations and in-depth research. Together, they highlight practical pathways for building and recognizing digital capabilities across education, work and lifelong learning systems. Moving forward, the World Economic Forum will continue to collect and share innovative examples of organizations, governments and systems that value and recognize AI, data and digital skills.

CASE STUDY 1

Check Point: tracking thinking, not just results in Cyber Ranges

Context: Check Point is rethinking how cybersecurity experts learn by letting them practice in realistic, high-pressure environments. Through its education arm, the company uses cyber ranges, virtual spaces that simulate real attacks, to help analysts sharpen their decision-making under pressure. In 2025, Check Point hosted its first Global Cyber Range Challenge, a virtual event that brought together participants from 11 countries and 12 universities. Using the company's Cyber Park simulation platform, teams investigated full-scale cyber incidents from start to finish. This demonstrates how hands-on, immersive training helps build stronger, more confident cyber experts by tracking how analysts think under pressure, not just the outcomes they produce.

Beyond events, Check Point publishes training programmes and a consolidated course catalogue to systematize advanced critical skill development for teams and enterprises. Over the past four years, the programme has trained an average of 8,500 learners annually, reaching more than 34,000 professionals globally.

Approach: The Cyber Range is designed to show how people think through a problem, not just whether they find the right answer. Participants start by exploring a network, then move step by step through analysis using standard cybersecurity tools. They finish by writing a report that explains their decisions and trade-offs. Throughout the exercise, the system records what they do, what information they check, and how they test their ideas. This allows coaches to assess reasoning, teamwork and communication to supplement technical results.

To keep evaluation consistent, teams use a shared framework to map what they observe to agreed-upon skills and threat types. This creates a common language for feedback and helps compare performance fairly across groups.

Results: Learners build a repeatable problem-solving habit: plan, investigate, explain and improve. Instructors can see how decisions are made, not just whether the right answer was found, and can focus coaching where it matters most, such as forming good hypotheses, handling evidence, working with others and communicating clearly. This approach helps analysts become confident faster and promotes consistent practice across teams.

For organizations, the model creates an automatic way to measure readiness. Data from exercises including range results, scoring rubrics and observation notes form a skills portfolio leaders can be used to guide staffing, mentoring and investment decisions. Linking assessment directly to training shortens the time between identifying a skills gap and building capability. The result is a steady, future-ready pipeline of cyber and digital talent which is ready for the front line.

The impact of the Cyber Range programme extends from individual learning to organizational readiness. Over four years, participants have shown:

- Up to 40% faster incident response times after repeated simulations
- Higher accuracy in root-cause analysis and containment
- Improved team coordination and communication clarity

Learners describe the range as "the closest thing to a real cyber crisis." More than 75% of participants continue with additional modules or team challenges, promoting a culture of continuous professional growth.

For organizations, Check Point provides a skills readiness dashboard that integrates behavioural data, technical outcomes and learning analytics. This gives Chief Information Security Officers (CISOs) and security leaders a real-time view of their team's preparedness, allowing them to:

- Identify and close capability gaps faster
- Align training programmes with real-world threats
- Optimize investment in human capital and cyber resilience

CASE STUDY 2

Censia: a 360 view of workforce skills

Context: A U.S.-based Fortune 50 telecom set out to build a living, skills-first view of its workforce to uncover hidden capabilities and accelerate mobility. Faced with static, self-reported employee profiles (less than 10% complete) the company couldn't see adjacent strengths, especially in AI, data and digital skills. Leaders launched an initiative to replace incomplete snapshots with real-time, evidence-based insights drawn from multiple data sources. Guided by the principle of "See the whole human," the approach balanced technical competencies with human capabilities, giving employees agency to validate their skills and creating a richer, more dynamic picture of workforce potential.

Approach: Censia, an AI-powered talent intelligence company, enabled the Fortune 50 telecom to unlock the full potential of its workforce by implementing Censia Employee Intelligence, a solution that enhances employee profiles with AI-inferred and validated, context-aware skills derived from employee data, work histories and global labour-market insights. Furthermore, the product assesses skills from employees' experiences including job history, projects and achievements, and then validates them against internal and market benchmarks. Employees review and confirm every inferred skill for accuracy and relevance. The initiative began with a six-week pilot involving 4,700 employees, where participants reviewed and confirmed every AI-enriched skill for accuracy and relevance. This validation created trust and ensured fairness across demographics, job families, and levels.

Profiles became dynamic records which evolved as employees took on new roles, projects or training, minimizing the problem of non-current skills data. Integration with the company's existing HR system enabled employees to explore, through the HR platform's talent management features, how their skills connected to potential career pathways within the organization. AI-driven enrichment ensured speed, accuracy and scale that manual processes could never achieve: a more accurate, fair and empowering way to highlight what people are truly capable of.

Results: With richer, more accurate profiles, there was an increase of 26% in internal mobility, driven by better job matching and a surge in employee applications for open roles.

Employees reported that the AI-inferred skills were more than 85% accurate, and that the experience left them feeling inspired, seen and capable.

Delivering a living, 360-degree view of skills rooted in real performance, benchmark validation and employee review strengthened workforce agility, improved fairness in career decisions, and positioned the organization to respond to future talent needs with confidence and significantly reduce voluntary turnover. The pilot eventually expanded to cover all the company's US-based 75,000 employees. In a year, the initiative generated significant operational efficiencies: 65,000 hours saved, equivalent to $29 million in overhead costs, by automating skills enrichment instead of relying on manual data entry from employees. This created the foundation for a large-scale resilient internal talent marketplace where AI, data and digital capabilities and human strengths are both visible and valued, enabling confident employee redeployment as needs evolve.

CASE STUDY 3

SkillsFuture Singapore: prioritizing new-economy skills with a data-driven, skills-first system

Context: SkillsFuture Singapore (SSG) is building a skills-first economy by placing labour-market intelligence and a common skills language at the centre of workforce development. Public data sets, shared taxonomies and employer signals are used to continually refresh which skills matter most, so investments by learners, providers and firms stay aligned with fast-moving demand in the digital economy.

Approach: SSG's Jobs-Skills Portal turns labour-market intelligence into actionable guidance on the latest business trends including AI, data and digital, spotlighting high-demand, transferable skills so learners and providers know what to build next. It also highlights role-level expectations by showing the technologies employers currently ask for (including an AI-related subset), and highlights areas where these requirements show up most – IT (29%), Engineering (12%), Research (7% – which enables individuals to compare their own skills/tool proficiency and amend upskilling plans accordingly. From 2019–2023, demand rose fastest for AI-enabling/cloud tools such as Microsoft Azure, AWS Cloud9, ServiceNow and Microsoft CRM, giving organizations and educational institutions clear targets for course refreshes and talent development programmes.

The Jobs-Skills Portal democratizes data and insights and makes these available to everyone, from individuals and firms to educational institutions and training providers. Beyond insights into the latest skills and technologies required in different job roles in the economy, a dashboard on job mobility and career pathways combines skills similarity, wage demand and transition history to surface practical career moves into job roles with good growth and potential for career mobility, including technology-intensive ones. More importantly, it highlights the skills required for transition and corresponding training courses if reskilling is required and expands individuals' understanding of learning choices and real pathways.

Anchoring the data-driven jobs-skills intelligence capability is the Skills Framework 2.0 that SSG developed and is adopted across different sectors of the economy, allowing individuals, employers and training providers to better identify suitable skills interventions both within and across sectors.

To support employers and firms, SSG appoints industry leaders as SkillsFuture Queen Bees (37 appointed thus far), to serve as sector anchors that rally small and medium-sized enterprises (SMEs), provide skills advisory and curate training and proof-of-concept projects, spreading priority digital capabilities across their networks. Seeing the chance to embed change across the employer ecosystem, Singapore appointed these industry leaders to drive adoption in the SMEs from the inside out, turning market signals into practical, sector-specific action.

At the industry level, the data-driven labour-market intelligence is used by SSG-appointed Skills Development Partners (SDPS) who work with specific industries to identify emerging skills, co-develop training solutions, and promote skills recognition through structured skills-based career pathways. For instance, one SDP, the Singapore Computer Society, has identified cybersecurity and cloud as two key trends and launched the respective Skills Pathways to meet the industry needs. Another SDP, SGTech, has partnered a local university to launch an AI Impact Series to boost AI business application skills for Singaporean enterprises.

Results: Learners find the right courses faster, waste less time and credit, and earn recognized, stackable credentials that add up to roles with real mobility across sectors. In 2024, 550,000 people trained with SSG support; participation in AI/cybersecurity/digital-marketing courses increased significantly from 34,000 (2023) to 96,000 (2024).

Employers shift from reactive hiring to skill-based planning, job-skill matching improves, internal movement rises and dependence on external recruitment falls. Education providers refresh portfolios more often because they can see what skills are in demand, which lifts relevance and employer trust. In 2024, the Queen Bee network engaged more than 5,200 companies (80% SMEs) who eventually undertook SSG-supported training curated and delivered by the Queen Bees.

These trainings take reference from the Portal's labour-market intelligence, translating insights into hands-on adoption (e.g. digital masterclasses, AI mentoring and technology proofs-of-concept) that accelerate capability-building in the field. In 2024, more employers (24,000 enterprises, compared to 23,000 in 2023) supported more employees (241,000 employees, compared to 228,000 in 2023) to participate in SSG-supported training. The quality and relevance of the training has increased satisfaction of learners, with over 84% (compared to 78% in 2023) of learners surveyed confirming that the learning and insights gained were transferable to their work.

For the wider ecosystem, regular and public skills insights align the ecosystem around shared priorities and steer investment where it has the greatest impact. Funding flows to priorities, gaps close earlier, and partnerships scale, creating a self-reinforcing loop (intelligence → tools → choices → outcomes → updated intelligence) that keeps the country focused on the new-economy skills that drive growth and value.

CASE STUDY 4

Putting skills and AI learning strategy into practice

Context: EY is building an AI-ready firm from the inside out by equipping people to use AI confidently and responsibly, strengthening core delivery and opening new client services. The goal is simple: practice, build and recognize AI skills in real time, not just track completion results. The strategy makes skills visible and portable across geographies and service lines by combining role-based learning, evidence-backed credentials and clear standards for responsible use.

Approach: A Skills Profile enables the connection of credentials to proof of work, requiring a clear demonstration of the application of skills and encouraging a "learning-by-doing" approach. Learners progress through role-based pathways that blend foundations, applied modules and even supervised projects. Outputs, which include code, analysis, prompts, agents, write-ups and client-safe simulations, are mapped to a skills framework and checked for meaningful application before EY's AI Badges are issued. Badges are portable across the whole EY organization and can even stack into EY-funded degree-level pathways (e.g. EY Tech MBA, EY Masters in Business, AI and Data [MBAID]).

Results: EY's AI learning ecosystem is operating at scale and delivering measurable results. In FY25, employees completed 25 million learning hours (average of 61 hours per person) backed by a $442 million in learning investment. The AI Now 2.0 programme, designed for individuals to receive hands-on learning with genAI as their "thought partner", impacted over 200,000 people, establishing a baseline for safe, effective use. AI depth is global, solid and growing, with more than 100,000 AI Badges awarded, 90,000 in progress, and a broader pool of more than 650,000 EY Badges allocated across the full range of future skills. This proactive and robust learning strategy is expanding AI capabilities and providing leaders verifiable credentials to staff AI projects faster and target coaching where it matters. When benchmarked against industry skills data (from Coursera) for AI/ML, data shows EY is building skills at nearly twice the rate of other enterprises and to a larger extent. For FY25, EY also reported a 30% increase year-on-year in AI-related revenues as these skills were applied into day-to-day work.

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