# What role for AI skills in (re-)shaping the future European workforce?

SUMMARY

Driven by the rapid pace of technological change and the need for a human-centric approach to the development of artificial intelligence (AI), AI skills have a significant role in shaping the future European workforce. The growing skills gap in the EU, with almost half of the population lacking basic digital skills, including AI skills, poses a significant challenge for the future that needs to be addressed for the EU to maintain its competitiveness and manage regional disparities.

Several EU initiatives are under way, including the recently adopted union of skills communication and AI continent action plan. Fostering anticipatory governance, a culture of innovation, supporting diversity and inclusiveness in the AI workforce, and strengthening digital infrastructure are all critical to ensuring that the benefits of AI are shared by all, while minimising its negative impacts. Aligning with European values will be important to ensure fairness in this process. The EU's future prosperity depends on using AI's potential while basing it on a human-centric approach and ethical development, ensuring transparency and accountability, as well as prioritising people's wellbeing.

Targeted investment in EU-wide digital infrastructure and education that emphasises lifelong learning and skills development could ensure balanced economic growth and competitiveness in the global talent market. By examining the multifaceted interaction between AI, skills and jobs, a way forward may be identified that focuses on the needs of EU citizens and ensures that the future European workforce – and citizens in general – are equipped to succeed in an increasingly automated and AI-driven economy.
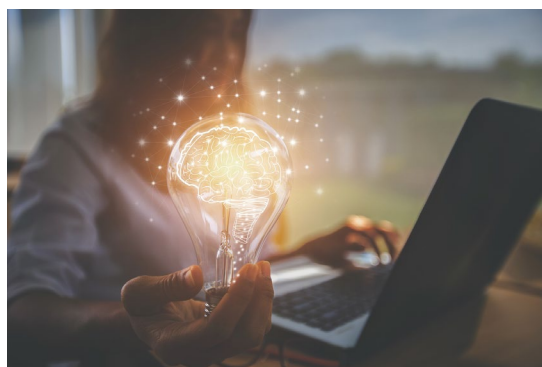
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Introduction

In the EU, the digital transformation and the use of artificial intelligence (AI) are as much about technological sovereignty, innovation and competitiveness as they are about social fairness, inclusiveness and other European values. While the EU has recognised that AI will have a substantial impact on labour, it is uncertain what exact role AI skills will play in shaping Europe's future workforce – and what concrete steps we can take now to prepare for and influence possible developments.

As AI applications move from traditional information and communications technology (ICT) sectors into finance, healthcare, education and policymaking, AI literacy is becoming important for a wide variety of jobs. However, according to the 2024 Digital Economy and Society Index (DESI), around 45 % of the EU population (between 16 and 74 years old) does not have basic digital skills, let alone AI skills. Taking into account that more than half of EU businesses consider the lack of skilled staff as a major obstacle to investments, the need to tackle the digital skills gap, including AI, is becoming urgent.

EU policy landscape and European Parliament position

While education and training policies remain within the remit of the Member States, the EU promotes cooperation between them and contributes with proposals for reforms and investment. The European Commission's 2024 political guidelines, together with the Mission Letter to Executive Vice-President Roxana Mînzatu, the Draghi Report on EU competitiveness and the communication on the union of skills adopted on 5 March 2025, describe the *union of skills* as a policy initiative whose goal is to strengthen human capital, create a resilient and inclusive labour market, promote constant upskilling and help with skill retention. The communication consists of four pillars: (i) Building skills for quality jobs and lives; (ii) Upskilling and reskilling; (iii) Circulating skills (i.e. skilled workers) within the EU; and (iv) Attracting and retaining talent. A follow-up discussion was held during the European Parliament's March 2025 plenary session. While showing support for the initiative, Members underlined the complexity and multifaceted nature of the skills challenge in the EU, and the need for a coordinated and comprehensive approach, including the issue of brain drain, the EU's role and investment in education and skills, and the need for a multi-stakeholder approach.

The European pillar of social rights promotes a 'skilled innovative workforce' that can lead the digital and green transition with an ambitious goal of having at least 80 % of the adult population (16 to 74 years old) with basic digital skills by 2030. A new strategic plan for STEM education (encompassing science, technology, engineering and mathematics) will focus on encouraging more women to enter these fields, and the introduction of a skills portability initiative in 2026 is expected to foster labour mobility across Member States.

The 2020 European skills agenda, the pact for skills and the digital education action plan highlighted the labour shortage, particularly in relation to digital technologies (e.g. software developers), and the importance of improving and gaining new skills through lifelong learning, and ensuring high quality, inclusive and accessible digital education and cutting-edge skills. Ensuring inclusive and quality education and lifelong learning for all is also a part of goal 4 of the United Nations Sustainable Development Goals.

Many EU programmes and initiatives are supporting wider skills development. The European Social Fund Plus and EU Cohesion Fund, together with the Recovery and Resilience Facility, the Digital Europe , Erasmus+ and Horizon Europe programmes, among other things, are investing in up- and reskilling. These initiatives reflect the growing understanding that AI and digital literacy will soon no longer be optional but rather basic requirements for future employability.

Article 4 of the AI Act, in force since February 2025, requires providers and those who use AI systems to have staff with an adequate level of AI literacy. The Commission has recently published a repository of 28 use cases (fully and partly implemented or planned) to encourage exchange on best practice and facilitate the implementation of this article. However, the question remains as to how

and by whom this will be monitored, with the AI Office (established in 2024 within the European Commission to support the implementation of the AI Act across the EU) pointing to the national market surveillance authorities. No fines are proposed in cases of lack of compliance.

AI (giga)factories have been established[1] to foster innovation and collaboration, bringing together computer power, data and talent to create cutting-edge generative AI (GenAI) models. According to the President of the European Commission, Ursula von der Leyen, they might deliver a further surge in the EU's AI capabilities and high-skilled jobs. The newly adopted AI continent action plan mentions AI skills and the possibility to keep and attract talent through easier international recruitment of highly skilled non-EU citizens. The plan also proposes launching new educational and training programmes in GenAI to train AI specialists and others that might need these skills in their everyday work.

Through the new calls under the Digital Europe programme, launched in April 2025, the EU is investing €27 million to boost digital skills and €55 million to support the uptake of AI, together with boosting European Digital Innovation Hubs, accelerating the deployment of digital technologies and the fight against disinformation, including the establishment of the European Network of Fact-Checkers.

These initiatives, coupled with the €50 billion InvestAI initiative, seek to incentivise AI development through public-private partnerships, help bridge the AI skills gap, and maintain global competitiveness. However, the plans' long-term viability, as well as the EU's ability to attract and keep the necessary talent, remain uncertain.

During Parliament's October II part-session, and following a statement from the Commission and the publication of the Draghi Report, Members debated possibilities to close the EU skills gap and boost the EU's competitiveness. These were declared as a top EU priority, together with reskilling and upskilling of the European labour force as a key factor for success.

In its resolution of 23 October 2024 on guidelines for the employment policies of the Member States, Parliament welcomed the updated Commission proposal for employment guidelines, which focuses on education and training, including AI and algorithmic management and skills shortages. It urged for a package on quality employment, including, among other things, work conditions relating to telework, the right to disconnect or the use of AI in the workplace.

During the February 2025 plenary session, Members held a debate on United States (US) AI chip export restrictions: A challenge to European AI development and economic resilience, which also highlighted the importance of developing AI skills and investment in AI education and training in Europe.

As mentioned above, following the Commission's adoption of the union of skills initiative, a discussion was held during Parliament's March 2025 plenary session in the presence of Commission Vice-President Mînzatu. In addition to AI skills, the debate stressed the communication's importance in addressing skills gap and labour market challenges, and the need for a comprehensive and inclusive approach. Many MEPs emphasised the need to invest in education to keep the EU competitive and prevent brain drain. They called for better coordination between Member States and greater consideration of workers' and businesses' needs. The debate showed broad support for the initiative but also concerns about its implementation and the important role of civil society and social partners in this regard. MEPs agreed that investing in people is crucial for the EU's future prosperity and competitiveness. Parliament's Intergroup on the future of education and skills for a competitive Europe also welcomed the communication, while calling for more audacious policies, increased investment, and stronger commitment to lifelong learning to empower Europeans and maintain Europe's global leadership.

On 3 April 2025, Parliament decided to enter into interinstitutional negotiations based on the of the Civil Liberties committee's report on establishing an EU talent pool. The aim is, among other things,

to overcome labour shortages and advance on the green and digital transition, while taking account of future competences, including AI, robotics and automation.

The evolving skills landscape

Increasing use of AI and automation in the workplace requires workers to develop skills that can help them use AI-based tools. This includes a shift towards remote work that surged during the COVID-19 pandemic but is driven mostly by technological advancements. According to many estimates, 90 % of future jobs will require digital skills. The growing gap between the skills workers possess and those required by employers is seen particularly in emerging fields relating to the use of AI.

This is why **upskilling and reskilling** is deemed important, as is constant investment in the development of these skills and support for the digital transition. Upskilling initiatives are crucial for aligning with the evolving demands including of the new AI professional roles. This involves both technical skills such as machine learning and data security and 'soft' skills such as problem-solving and communication.

It is estimated that the EU attracts a comparatively small share of AI talent and loses many to the US. For example, according to a recent analysis looking at GenAI start-ups founded in 2020 in Europe and the US, around two thirds are from the US (173 companies). In the subsequent two-year period, employee growth rate was 40 % higher among US start-ups. Developing and promoting an **innovation and start-up culture** in different EU regions[2] might therefore be an opportunity to retain talent and support the workforce outside of major innovation hubs, as well as to attract creative individuals from the outside of the EU.

A recent World Economic Forum report on the Future of Jobs provides an estimate of how **tasks completed predominantly by humans**, which today account for more than half of the tasks (53 %), **will decrease considerably** in the next five years, to one third (34 %). Tasks predominantly done by machines (17 % currently and 27 % in 2030) or a combination of both (30 % currently and 39 % in 2030) are projected to increase substantially.

As is commonly agreed, the rapid pace of technological change necessitates a shift from traditional education models to **lifelong learning, as well as new and diversified approaches** to learning. This involves developing knowledge and skills that are adaptable to changing future job requirements and technological shifts. According to a recent UNICEF Generation Unlimited survey that involved young people from 181 countries, almost half of them consider having AI skills, such as prompt engineering, AI for productivity, AI for content creation or using AI responsibly for future jobs, as critical. Conversely, only 15 % claim to have an extensive knowledge in using AI. Figure 1 shows a significant divergence in computer science availability at primary and secondary schools worldwide and across Europe.

Demand for AI workers is rapidly rising, with high employment and growth in weekly working hours, and wages growing in line with the overall workforce. AI professionals are predominantly male (over 60 %), with a tertiary degree (between 60 and 80 % depending on the job), and with higher income on average.

The **combination of human and AI** capabilities is becoming increasingly sought after. In addition to technical skills, scientists agree that various 'soft' skills – such as creativity, empathy, sense-making, complex problem-solving, together with communication, collaboration, and emotional intelligence – will continue to be needed.

Figure 1 – Computer science in education
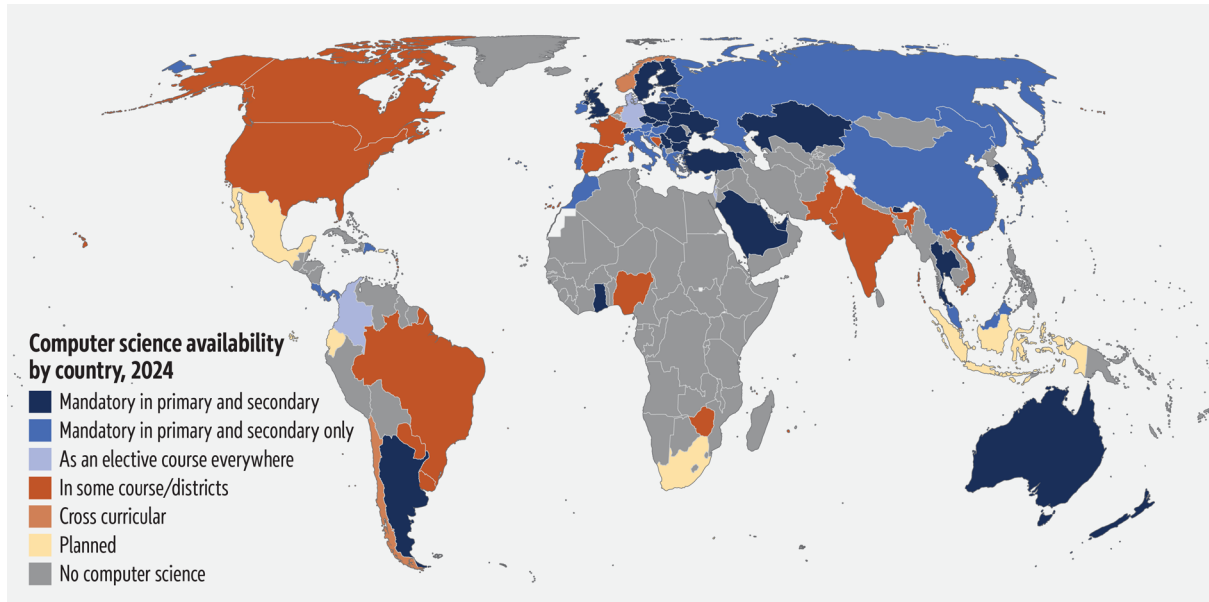
Data source: Stanford University, 2025 AI Index Report.

GenAI is increasingly used in workplaces. This can boost productivity and assist with tasks outside of one's original skillset. However, the higher the exposure and confidence in its use, the more likely one is to lose the ability to recognise the model's boundaries. The question also arises as to what extent human knowledge increases using AI. For example, a recent study has compared GenAI to an exoskeleton. It points out that, although the tool can empower users while they use it, once GenAI is removed from their work environment, the specific knowledge acquired is lost.

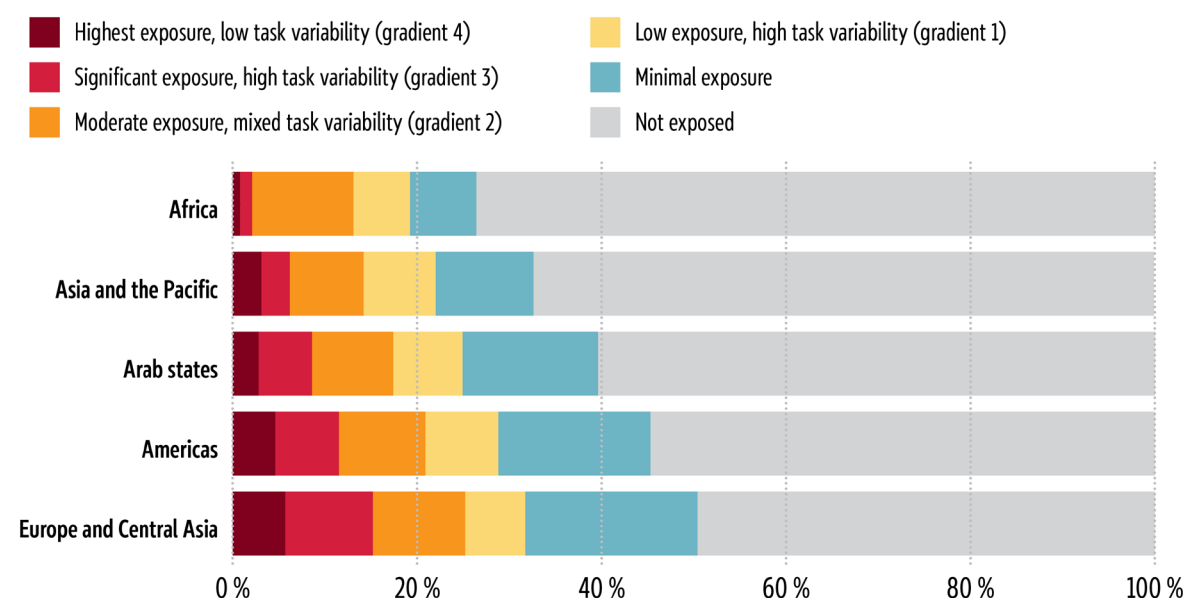# Challenges and opportunities in bridging the skills gap

Impact of AI on jobs

There is an ongoing policy debate about the **potential impact** of AI on employment, with some arguing AI will create new job opportunities, and others believing it will lead to significant job losses and displacements. Because of the growing inclusion of AI in work processes, millions of jobs requiring physical strength and repetitiveness, as well as similar tasks that can be easily automated, are deemed to be at very high risk of eradication. Figure 2 below shows a potential impact of AI on existing jobs across the world, with the biggest impact expected in Europe and Central Asia. Globally, around one quarter of jobs are to some extent exposed to the impact of GenAI.

The rapid adoption of AI and automation might **fill in gaps** caused by labour shortage, relating for instance to some repetitive tasks for which there is low interest and where AI and automation could lead to productivity gains, in areas such as healthcare, finance, and logistics. However, it is uncertain how swiftly EU employers, particularly in sectors such as manufacturing and logistics, can adjust to this shift. Investing in digital infrastructure would further support online learning and skills development and allow everyone to participate in it.

> Imagine ... that the increasing reliance on AI and automation led to a significant decline in employment in the EU. How could policymakers respond to the resulting social and economic challenges?

Figure 2 – Potential impact of GenAI on jobs in different regions of the world

Legend:
- Highest exposure, low task variability (gradient 4)
- Significant exposure, high task variability (gradient 3)
- Moderate exposure, mixed task variability (gradient 2)
- Low exposure, high task variability (gradient 1)
- Minimal exposure
- Not exposed

Regions (top to bottom): Africa, Asia and the Pacific, Arab states, Americas, Europe and Central Asia

X-axis: 0 %, 20 %, 40 %, 60 %, 80 %, 100 %

Data source: International Labour Organization (ILO) Working Paper 140, 2025.[3]

Regional disparities between countries with stronger and weaker innovation systems could aggravate further. Countries that are already good at innovating may be able to create more jobs that use AI, which could help their economies grow. Other countries might face challenges. Furthermore, digital skills and education are not equally offered across the EU. Automation and AI might also **exacerbate existing skills gaps**, particularly in areas such as data science, AI engineering and cybersecurity. This could threaten EU competitiveness and the quality of life in the longer term. Managing these disparities across Europe is considered key for balanced economic growth.

New AI-based and fusion jobs

AI is set to create **new job categories**. It might generate 'fusion roles', in which **humans and AI systems work closely together**. Such jobs could be AI trainers, AI translators, digital twin experts, explainability specialists, chief AI officers or AI ethics consultants (see examples in Figure 3 below).

Moreover, understanding and interpreting large datasets will become crucial in many fields. Data scientists, analysts and machine learning experts, as well as those who could develop, implement and manage AI systems, will be in high demand. As companies rely more on AI, the risk of cyberattacks is likely to increase. Professionals skilled in cybersecurity will be essential to protect sensitive data and AI systems from such threats. For these reasons, skills development will need to keep pace with the rapid technological advancements.

Figure 3 – Illustration of possible future professions

An **AI ethics consultant** reviews an organisation's AI systems and ensures it is fair and unbiased. The consultant works with ethicists, data scientists and engineers to identify potential biases and develop guidelines for responsible AI development. They monitor AI systems to prevent biases and create a framework for transparent and fair AI decision-making.

A **digital twin engineer** working in a hospital designs, develops and maintains personalised virtual models of patients, organs and medical devices. They simulate treatment outcomes, predict disease progression, and optimise therapy plans. Engineers collaborate with clinicians to develop tailored treatment strategies, reducing costs and improving the results or effects of care and treatment for patients. They make healthcare more precise, effective, and patient-centric. Data-driven insights will inform clinical decisions.
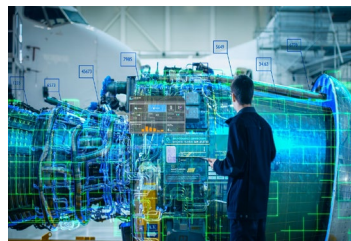
An **AI-driven sustainability specialist** analyses and optimises the supply chain of an agri-food company, reducing waste and environmental impact. The specialist uses GenAI to analyse data from sensors, drones and other sources, identifying areas for improvement and developing strategies for sustainable practices. Based on this data, swarms of generative agents are used to identify novel optimisation strategies and the discovery of new patterns and trends in the data.

An **AI-powered mental health coach** develops personalised coping strategies and motivational messages for patients, while engaging in simulated conversations. The coach uses emotional intelligence analysis and creative therapy tools to increase user engagement and effectiveness. They work with human therapists to ensure comprehensive care, using GenAI to provide insights that inform treatment plans tailored to an individual's specific needs and preferences.

Source: Job categories are a revised version of the professions created by GPT@JRC, based on the author's prompts; photo credits (top to bottom): © Anon, Gorodenkoff, Gorodenkoff and Satori Studio / Adobe Stock.

AI for getting and retaining jobs

GenAI skills are increasingly valued for **finding a new job** or **staying in the current one**. A trend shows a growing number of LinkedIn members adding AI skills to their profiles. Between 2023 and 2024, this number increased 142fold, mostly consisting of skills relating to ChatGPT and Copilot use. This is linked with the growing demand for AI experts in both the private and public sectors.

AI's role is also rising in the **hiring process**. Many companies, particularly in the IT sector, now use AI-based systems for the first assessment of candidates and their biographies, as well as to conduct automated interviews, assess body language and analyse candidates' emotions with emotion recognition technologies. Both the public and private sectors' employers have used AI-based proctoring[4] of online tests as a part of the selection process, capable of tracking candidates' eye movements and/or facial recognition (similar to using the tool in education). Some believe that this could decrease employers' traditional bias in hiring and candidates' potential cheating. For example,

one study found that AI-assisted recruitment processes could improve the quality and efficiency of traditional recruitment, and decrease related administrative work. However, the same study, as well as some others, point to the risk of potential discrimination based on bias relating to limited datasets (e.g. on gender, race, age), assessment inaccuracy, transparency, fairness and privacy. This would also make the recruitment less accessible to some people. In the EU, the AI Act (Article 5) prohibits the use of emotion recognition in the recruitment process.

Importance of developing other skills

It remains to be seen how AI will impact other skills that are necessary in the work place, such as communication, leadership, emotional intelligence and empathy. GenAI offers the **possibility for interactions** that mimic those human have with other humans, and users often communicate with GenAI as they would with a fellow human. For example, prompts are often complemented with words such as 'please' or 'thank you'. This allows for an easier adoption of the technology and less technical skills needed. In this **interplay between humans and machines** – with GenAI being able to perform human colleagues' roles and even team working, according to a recent study – the question also arises of how such use will further impact the development of other skills.

Fostering critical thinking is key to making sense of the world around us, making better choices, questioning certain decisions and facts, and ultimately preserving our democracies and European values. To be able to recognise the potentials and limitations of digital technologies and a digital society, as well as potential manipulations, competences such as media, digital, AI and data literacy are needed. Futures literacy is important as well, to equip young people with a sound understanding of future uncertainties, complexities and turbulences, and develop more structured anticipatory and systems thinking.

Reforming education

A reform of education systems towards those highlighting **skills development and lifelong learning** might help overcome this. The use of AI in traditional learning processes holds both promises and challenges for the future. For example, in the classroom, AI-powered tools could offer a blended learning experience, combining traditional teaching with AI-powered resources to improve learning capacities. This could help teachers to provide individualised feedback to each student, and enable immersive learning experiences. The European Training Foundation (ETF) notes the emergence of innovative learning programmes and environments, and the **increase of virtual programmes and tutors**. However, ensuring that the use of AI-power tools does not impact students' cognitive capacities and the quality of education will be crucial for future generations.

Apart from leading to potentially more productivity and competitiveness, gaining new skills can also promote **social inclusion and equality**, bridging disadvantaged groups' skills gap. Upskilling of an aging population would ensure that older workers – who, owing to the megatrend of ageing populations will be a majority, and who are not digital natives and thus could have more difficulties accepting the use of technology – can continue to contribute to the European workforce.

Reskilling can enable individuals to **pursue new career paths, enhance their job satisfaction, and improve their overall wellbeing**. It can allow workers to do jobs in emerging sectors (e.g. renewable energy, precision agriculture) and develop skills that support the transition to a more sustainable and green economy.

> Imagine … that the EU introduced a mandatory AI literacy programme for all citizens, closing the skills gap and boosting the job market in the long term, without a possibility to opt-out. How would policymakers ensure a buy-in from all citizens?

The engagement in lifelong learning can empower citizens to learn new skills, to **contribute to social cohesion and community development**, and thus to participate more actively in their communities. However, under European Labour Law, the **training is still not fully considered as working time**; this, although the Court of Justice of the EU's ruling stated that time spent for a vocational training

course should be considered as working time, and despite Articles 14 and 31 of the EU Charter of Fundamental Rights. A right to training during work hours has been proposed by some authors.

Securing (AI) talent

The EU will continue **competing with other regions** and countries for skilled workers. **Securing talent might become of strategic importance** for the future, particularly in an ageing society such as Europe's. **Higher shares of female labour market participation** would also increase the availability of talent and workforce in general. There is uncertainty as to whether the **EU's talent attraction policies**, such as the revised Blue Card Directive or the Choose Europe funding and support scheme, will be enough to retain competitiveness in the global talent market. This could leave critical gaps in EU industries that are dependent on cutting-edge skills, making employers more reliant on migration flows. By integrating migrant workers into the EU labour market, they will also gain opportunities for skills development. However, it is not known whether the employers will invest enough in reskilling programmes for both domestic and migrant workers.

Closing the skills gap

Closing the skills gap and ensuring equal access to development opportunities would be particularly important in **disadvantaged communities**. Skills development should **anticipate labour market needs** to support economic growth. This could be done by **streamlining skills development policies across EU Member States** to ensure effective governance structures. Upskilling, including **skills to use AI responsibly and safely**, could equip the workforce to go smoothly through the digital transition.

> Imagine ... that the EU failed to develop and implement a comprehensive strategy for addressing skills gaps in emerging technologies. What would the EU need to do to remain competitive in the global economy?

Policy considerations

AI skills will be pivotal in the EU's future, driving economic innovation, dealing with regional inequalities and ensuring ethical AI development. By focusing on up- and reskilling and aligning AI with European values, the EU aims to harness AI's potential while maintaining a human-centric approach and ensuring an ethical AI development. This would ensure the design of AI for the common good, including transparency, accountability and wellbeing.

The increasing use of AI and automation in the workplace raises both challenges and opportunities. EU policymaking in this area will need to be future-ready to support citizens most effectively and equip the European workforce with skills to thrive in the future AI-driven economy. Having AI-skilled citizens would allow for a fair transition, and could further lead to economic growth and competitiveness. This would also mean offering AI-related education programmes and training, as well as AI tools, to all.

Investing in education, lifelong learning and skills development would mean redesigning education and training programmes to focus on the development of digital skills and emerging technologies such as AI, data science and cybersecurity. At the same time, it is important also to develop skills such as responsible use of AI, critical thinking, analytical skills and creativity, to be able to deal with future challenges, including while using AI. This would help draft education programmes that are better aligned with future societal needs and labour market requirements.

Supporting upskilling and reskilling would also mean incentivising employers. Investing in reskilling programs, including for migrant workers, would ensure that the workforce is prepared to adapt to the changing job market. Streamlining skills development across EU Member States could avoid potential duplications. Attracting and retaining talent with new and existing policies could help the EU remain competitive in the global talent market and tackle critical skills gaps in key industries, including the digital sector.

Policies oriented towards supporting diversity and inclusiveness in the AI workforce could increase the participation of under-represented groups, such as women and disadvantaged communities, in the AI workforce. This could help overcome the current gap and ensure equal access to opportunities.

Fostering further a culture of innovation and entrepreneurship could provide resources for start-ups and small businesses to innovate and scale-up faster, which could contribute to the EU's competitiveness in research and innovation. The development of new professions and roles that combine human and AI capabilities could follow.

Strengthening digital infrastructure with investing in high-speed internet, interoperability and easily accessible online learning platforms could allow for the development of digital skills, and facilitate the adoption of AI and automation while ensuring that everyone has access, including in remote or rural areas.

Experts agree that **effective and anticipatory governance** is needed to ensure that the complex interaction between AI, skills and jobs is addressed from different perspectives. Policymakers would need to consider the implications of potential AI impacts on the workforce carefully, through engagement with stakeholders and citizens, and through further foresight analyses. This could support the anticipation of potential job losses and displacement, and the debate on most suitable proactive measures for re- and upskilling in the affected sectors. Reflecting on what this could mean for democracy and social cohesion, as well as acting on it, might prevent potential discontent and disparity in cases where AI replaces certain professions. In this context, it is deemed essential to develop and implement agile, adaptive governance and policies that would be able to support EU citizens in adapting to changing jobs and advancing in education. This could further increase the EU's societal resilience. Fairness could drive this change.

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ENDNOTES

1   While the first AI factories have been established, AI gigafactories are still under development, and a public consultation is ongoing.

2   See also an example of how supporting start-up culture in regional and local settings could boost economy and workforce shortage in Japan.

3   The regions presented in the graphic relate to how the ILO/UN uses them. Gradient levels indicate exposure to GenAI, ranging from 'Not exposed' (no impact) to 'gradient 4' (high exposure and automation potential), with varying levels of task variability within a specific job, and automation potential in between.

4   Automated remote proctoring refers to machine-assisted proctoring, i.e. the process of invigilating or monitoring candidates during a test to prevent cheating and ensure the integrity of an exam.

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