

INSIGHTS BEYOND THE SKILLS GAP

February 2025



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SUMMARY

This report takes a closer look at the current workforce challenges facing the manufacturing sector, focusing on how industry needs are evolving. It draws on the results of CECIMO's November 2024 survey, which gathered insights from a wide range of companies, 23% large, 29% medium, 46% small, and 3% micro. By comparing the industry's skill priorities from 2023 to 2024, the report highlights key areas that need urgent attention. One of the changes observed this year was mix of respondents to the survey. Responses from large companies dropped by around 20%, while engagement from mid-sized companies increased by around 30%. This shift provides a fresh perspective on workforce trends, particularly when it comes to mid-sized manufacturers.

The report builds on last year's CECIMO's publication, "[*From Survey to Strategy: Understanding the Skills Trends in Advanced Manufacturing*](#)," while also updating the existing [*Skills Dashboard*](#). This database remains a key resource for industry stakeholders, educational institutions, and policymakers. As the demand for skills continues to evolve, this database provides an essential snapshot of where gaps are emerging and where action is needed.

While automation and AI bring new opportunities to tackle labour shortages, they also create an urgent need for specialist skills. The report examines which technical skills and job roles are most in demand, highlighting the ongoing struggle to recruit and retain skilled workers in advanced manufacturing. It also explores the root causes of the recruitment and retention challenges.

The need for automation specialists, AI engineers, and robotics experts continues to grow. At the same time, sustainability regulations are starting to influence workforce priorities, albeit more gradually. The third chapter takes a closer look at emerging digital-green skills, how they have evolved since 2023, and what is at stake as digital technologies, such as AI and automation, become more widespread.

With education and training systems struggling to keep up with these rapid changes, the report also reflects on how the industry is responding. Key recommendations include increasing collaboration between businesses and education providers, improving labour mobility across Europe, modernising training frameworks, and implementing better workforce retention strategies in place.

1. INTRODUCTION

The European manufacturing sector is at a crossroads, facing growing skills and labour shortages that threaten its global competitiveness. A critical shortage of engineering professionals, alongside gaps in digital, technical, and green skills, places additional strain on recruitment and workforce development efforts. Therefore, the competitiveness of the European economy, is fundamentally based on the strength of its skilled workforce and its market-oriented know-how. However, the [Draghi Report](#)[1] highlights a convergence of demographic and structural challenges that threaten the sustainability of the labour force. Chief among these are the changing skill requirements driven by the twin transitions of digital and green, which are exacerbating an already widening skills gap. Key contributing factors include underperforming education systems, an ageing workforce, insufficient adult learning opportunities, limited labour mobility, housing shortages, and persistent geographic disparities.

The impact of emerging technologies on the labour market remains a subject of both optimism and uncertainty. While advances promise to alleviate labour shortages through automation and efficiency, they also increase the demand for specialised skills. Today's workforce must increasingly complement automated systems by performing tasks that require creativity, critical judgment, and adaptability-qualities that no machine can replicate. This shift is putting pressure on education and training systems to adapt to rapidly changing industry needs. On the positive side, these technologies can improve training methods and create new ways to bridge the gap between skills supply and demand.

Among the most pressing issues flagged in the Draghi Report is the acute shortage of engineering professionals, a cornerstone for achieving the digital twin goals of boosting Europe's competitiveness, and stimulating investment. This finding is in line with CECIMO's report "[From Survey to Strategy: Understanding Skills Trends in Advanced Manufacturing](#)" which reveals critical shortages in areas such as production line operations, electrical engineering, and mechanical/industrial engineering. These shortages not only lengthen hiring timelines for unfilled positions, but also force companies to hire underqualified workers, ultimately leading to production inefficiencies. Without a coherent, strategic approach to addressing these shortages, Europe risks long-term economic stagnation and declining global influence.

Crucially, skills requirements vary widely across Europe due to differences in economic structures and industrial priorities. This reality requires the development of targeted, adaptable strategies that can effectively respond to national and regional challenges and ensure sustainable growth and a resilient workforce.

[1] The future of European competitiveness (2024), accessible at: https://commission.europa.eu/document/download/97e481fd-2dc3-412d-be4c-f152a8232961_en?filename=The%20future%20of%20European%20competitiveness%20%20A%20competitiveness%20strategy%20for%20Europe.pdf.

2. THE CURRENT LANDSCAPE

The European manufacturing sector is under growing pressure due to skills and labour shortages, driven by rapid technological advancements, demographic shifts, and evolving industry demands. As companies struggle to find and retain qualified workers, these challenges threaten productivity, innovation, and long-term competitiveness.

This happens because labour market imbalances arise from both demand and supply-side factors. On the demand side, employment growth in high-skill occupations outpaces the availability of suitably trained professionals. On the supply side, workforce attrition, caused by retirements, career transitions, and other factors, further exacerbates shortages. Additionally, education and training systems often fail to keep pace with industry needs, resulting in a mismatch between the skills workers have and the skills employers need.

2.1 Skills and Labour Shortages: A Growing Concern

Previously, both labour shortages and skills shortages were considered major challenges. However, as shown in Figure 1, skills shortages are now seen as the slightly greater concern, with around 65% of respondents rating them as either "significant" or "very significant," compared to approximately 54% of labour shortages. While the difference is not dramatic, the data indicate that businesses are more worried about a lack of specific skills, even though labour shortages remain a notable issue, as reflected in the higher proportion of respondents who consider them "moderately significant."

It is important to acknowledge that differences in participant demographics, regional education systems, and economic structures may influence these results. Some regions may struggle more to find qualified workers, while others may struggle to attract enough candidates. Despite these nuances, the two issues are closely related and together complicate recruitment efforts in advanced manufacturing.

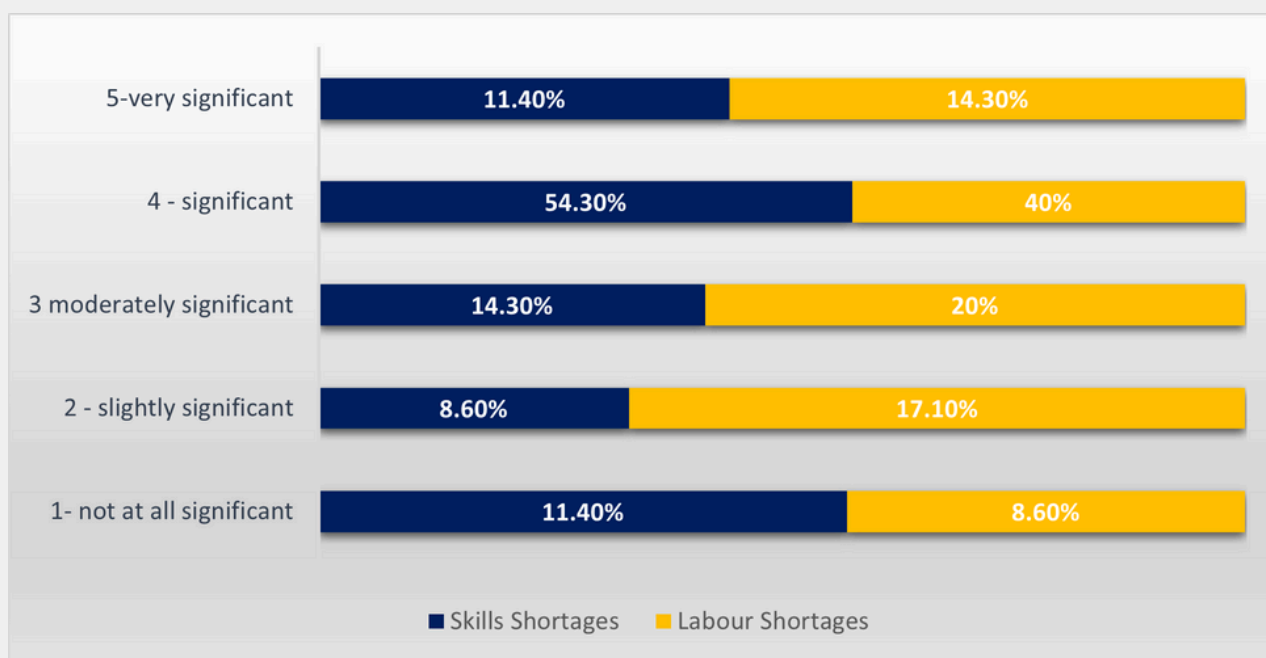


Figure 1: Skills and Labour Shortages

Figure 2 highlights significant skills shortages in key departments, with Mechanical and Industrial Engineering (63%), Electrical Engineering (54%), and Production (47%) facing the most pressing shortages when considering both 'significant' and 'very significant' responses. Notably, Mechanical and Industrial Engineering has seen a 20% increase in shortages compared to 2023, likely due to the growing adoption of advanced technologies such as automation and AI, which require specialised expertise.

In contrast, departments such as Finance and Administration Control (43.8%), Logistics (36.7%), and Sales/Marketing (33.3%) report comparatively lower shortages. It is worth noting, however, that shortage in Sales/Marketing has nearly doubled, reflecting a growing demand for professionals with expertise in digital marketing strategies and customer engagement. This shift underscores the broader impact of digital transformation across multiple business functions.

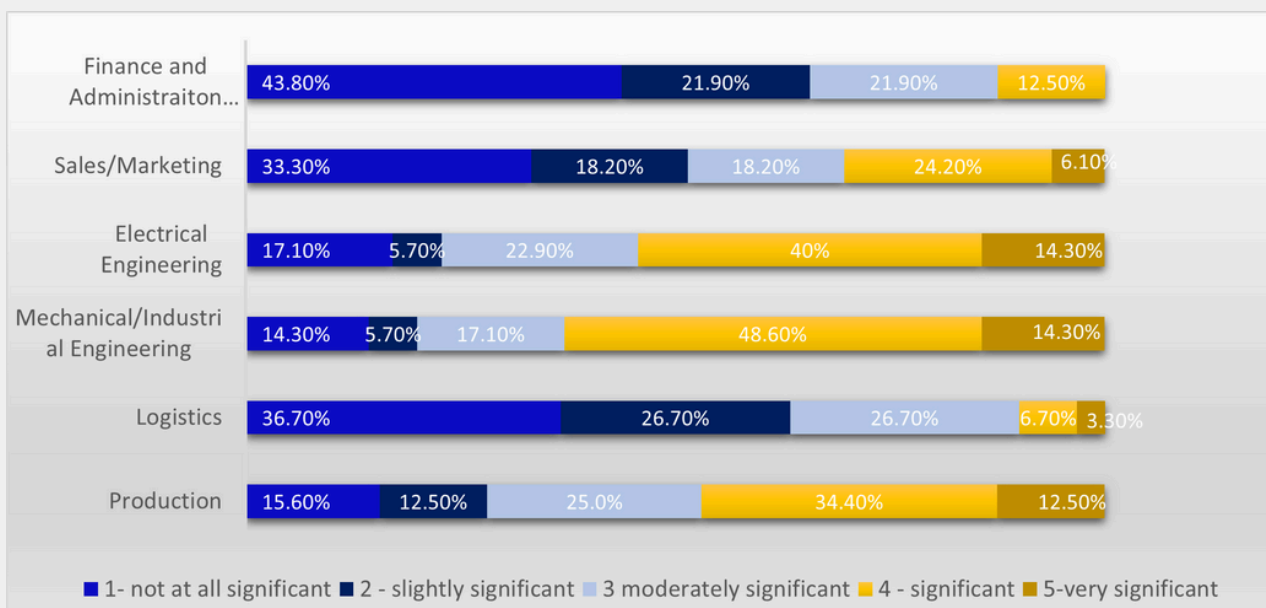


Figure 2: Skills Shortages Across Departments

The survey results also highlight the skill categories considered most critical to industrial growth (Figure 3). Nearly all respondents emphasise the importance of technical skills, particularly those related to machinery knowledge, as essential to maintaining operational efficiency and competitiveness.

In addition, 51% of companies emphasise the value of soft skills, including communication, problem-solving, and management, recognizing their role in fostering collaboration and effective leadership. Meanwhile, 46% of respondents emphasise digital skills, such as cybersecurity, AI, and data sharing, reflecting the increasing integration of technology into industrial processes.

In contrast, green skills, which include sustainability practices, energy efficiency, and a green mindset, are prioritised by only 14% of organisations, despite their long-term importance for environmental and regulatory compliance. While technical and digital skills remain the primary focus, awareness of the importance of soft skills is increasing. However, green skills, though relevant, have yet to become a top priority in workforce development strategies.

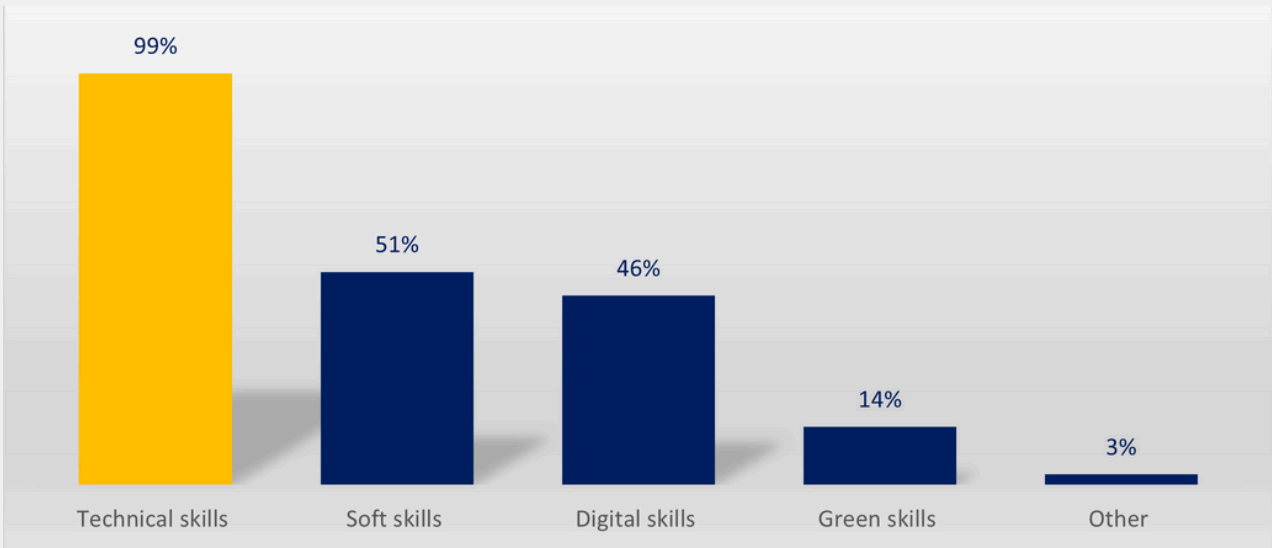


Figure 3: Importance of Skills Categories for Industry Growth

2.2 Recruitment and Retention Challenges

Recruitment challenges are both complex and multifaceted, influenced by demographic shifts that affect both the labour supply and the skills available in the workforce. According to CEDEFOP[2], the proportion of older workers is increasing in countries such as Spain and Italy, while it is decreasing in Poland. An ageing workforce poses considerable challenges for Member States' skills systems in the coming years, as it may hamper the adaptability of the labour supply to emerging skill needs. Older workers find it difficult to keep up with technological advances, increasing the need for robust systems to retrain, upskill, and retain them effectively in the labour market.

Figure 4 highlights the severity of recruitment difficulties, with 46% of respondents reporting challenges in finding skilled talent and a further 40% describing the process as very challenging. This suggests a critical shortage of candidates with the required skills, consistent with Figure 1, which underscores the broader issue of skills and labour shortages.

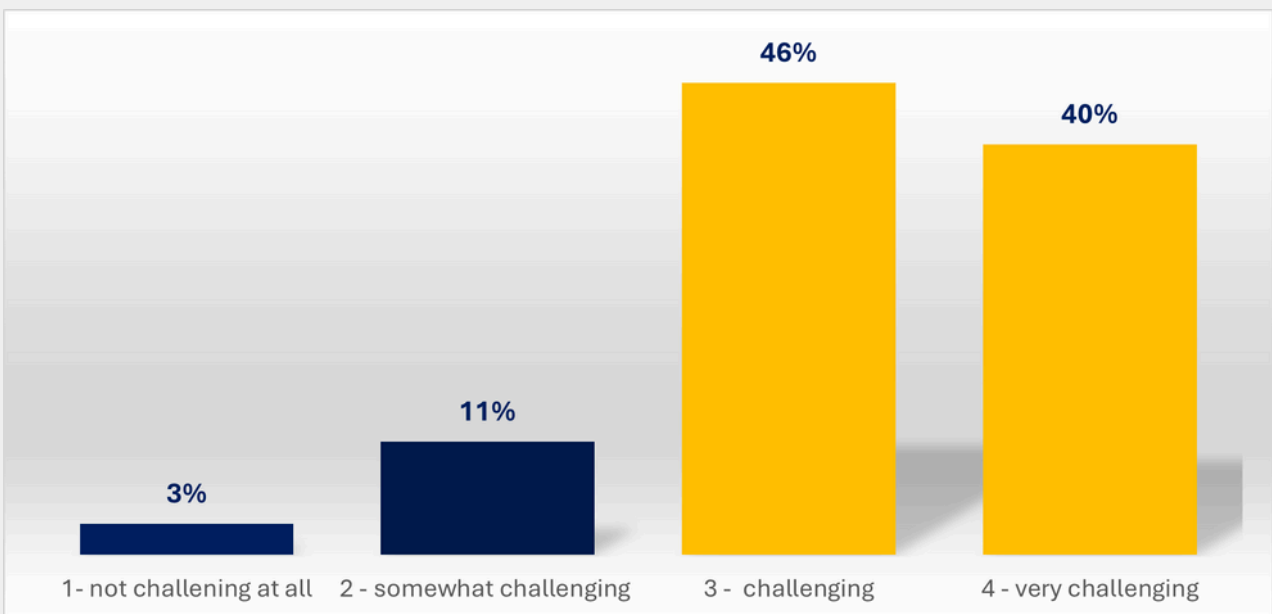


Figure 4: Talent Recruitment Challenges

The primary reasons for hiring challenges are shown in Figure 5. The most frequently cited obstacle is the lack of qualified candidates (77%). The rapid pace of technological change has outstripped the ability of education and training systems to equip candidates with the skills needed for emerging roles. This widening skills gap is exacerbated by a limited applicant pool (over 50%), as demographic trends and the declining attractiveness of the manufacturing sector contribute to a shrinking workforce. An ageing workforce presents an additional challenge, as retiring professionals take invaluable knowledge and skills with them, leaving critical knowledge gaps.

Beyond workforce availability, the manufacturing sector faces persistent perception issues. Many younger workers view the industry as outdated and labour-intensive, often overlooking the sector's advances in automation, robotics, and smart manufacturing. This perception deters potential candidates, who are instead drawn to industries perceived as more modern and dynamic. Travel requirements (37%) further complicate recruitment, as many roles require frequent travel for equipment installation, training, or repair, an increasingly unattractive prospect for workers who prioritise work-life balance.

Another significant challenge is the cost and time investment required for training (23%). Whether conducted in-house or externally, training programs require significant resources, disrupting daily operations and placing a financial burden on companies. Geographic constraints (20%) also play a role, as manufacturing facilities are often located in remote areas with limited public transportation, making them less accessible to potential employees.

Compensation and benefits are another critical factor, with 17% of companies acknowledging that current compensation packages may not meet employee expectations. Competitive salaries and benefits are essential to attracting and retaining skilled talent, and failure to offer them can deter candidates from pursuing careers in manufacturing. Similarly, 11% of respondents cite a mismatch between available training programs and industry needs, making it difficult to develop a workforce with the necessary skills. Finally, only 6% of companies believe that workers themselves contribute to the problem by resisting additional training, suggesting that systemic barriers play a far greater role in the ongoing labour and skills shortages.



Figure 5: Reasons for Recruitment Challenges

[2] Cedefop (2024), Evolution of European Skills Systems Performance 2015 to 2022 available at: https://www.cedefop.europa.eu/files/9199_en.pdf

Retention remains a significant challenge for the manufacturing sector. As shown in Figure 6, 34% of firms report difficulty in retaining skilled workers, while 31% describe retention as moderately difficult. These numbers have remained consistent since 2023, underscoring the ongoing struggle to maintain workforce stability.

Several factors contribute to these retention challenges. Competition for skilled talent is intense, with employees often receiving more attractive offers elsewhere, including higher salaries, better benefits, or clearer career paths. In addition, a lack of investment in employee development and engagement can lead to dissatisfaction, causing employees to seek alternative opportunities. Shifting employee priorities also play a critical role. Employees increasingly value flexible working conditions, comprehensive benefits, work-life balance, and transparent growth opportunities. Organisations that fail to adapt to these evolving expectations risk losing valuable talent to competitors that are better aligned with workers' needs.

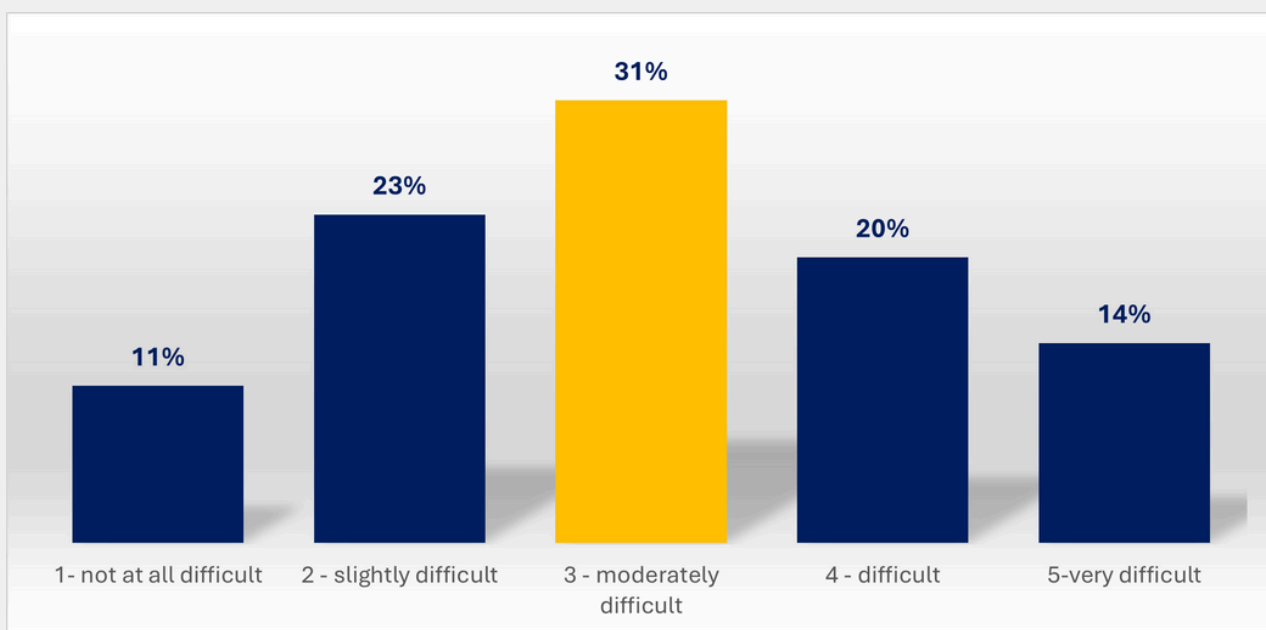


Figure 6: Difficulty in retaining skilled workers

Ultimately, addressing recruitment and retention challenges requires a holistic and innovative approach. The manufacturing sector must modernize its image, align training initiatives with technology and market demands, and foster a work environment that prioritizes professional growth and work-life balance. These strategies are essential to ensure a skilled workforce and the long-term competitiveness of the industry.

3. TWIN TRANSITION: ADAPTING TO DIGITAL AND GREEN CHALLENGES

As industries embrace automation, sustainability practices, and smart technologies, workers with expertise in automation, AI, cybersecurity, environmental awareness, green computing and resource efficiency will be in high demand. While technology may displace certain jobs, it also creates new opportunities, shifting the focus from routine tasks to more complex roles that require creativity, emotional intelligence, problem-solving and strategic thinking. Rather than widespread job loss, this transition signals an evolution in the nature of work, where machines perform routine and repetitive tasks, while people take on more complex responsibilities[3].

Furthermore, with the introduction of the Corporate Sustainability Reporting Directive and the Corporate Sustainability Due Diligence Directive, the need for professionals skilled in sustainability reporting and regulatory compliance will increase. As industries continue to adapt, investment in upskilling and training will be critical to ensuring a workforce that is equipped for the future[4].

3.1 Digital Skills

The demand for digital skills has grown rapidly alongside automation, requiring many manufacturing workers to undergo significant reskilling or upskilling to stay competitive. While concerns about job losses due to automation persist, industries report that technological advances are driving new skill requirements. Workers are now expected to manage and operate the digital components of advanced machinery on the shop floor. CEDEFOP[1] recognises that automation is often linked to job displacement, but the growing demand for AI-skilled workers suggests that the adoption of AI does not inherently reduce employment. Instead, it changes the nature of work and requires investment in more advanced skills. As the saying goes, “AI won’t replace humans, but humans with AI skills will replace humans without them.” This shift may lead to a more expensive but highly skilled workforce, potentially reducing overall labour demand while increasing productivity, improving job quality, and driving higher wages.

[3] International Monetary Fund (2024), “Gen-AI: Artificial Intelligence and the Future of Work,” available at: <https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2024/01/14/Gen-AI-Artificial-Intelligence-and-the-Future-of-Work-542379>

[4] CEDEFOP (2024), “Tracking the green transition in labour markets: Using big data to identify the skills that make jobs greener,” available at: https://www.cedefop.europa.eu/files/9197_en.pdf

[5] CEDEFOP (2024), “Digital skills ambitions in action: Cedefop’s skills forecast digitalisation scenario,” available at: <https://www.cedefop.europa.eu/en/publications/4218>.

Despite AI's central role transforming the workplace, its long-term impact on employment remains uncertain, as shown in Figure 7. More than 50% of companies recognise that more observation is needed to understand the full impact of AI on the workforce. Nevertheless, 49% see AI as a catalyst for innovation and productivity, creating new job opportunities that complement human labour, resulting in new job opportunities, mitigating any negative impacts (i.e. employment), boosting income levels and contributing to economic growth. However, the benefits of AI adoption many are often not evenly distributed, with college-educated workers generally better positioned to transition into AI-enhanced roles, while older workers may be more vulnerable to such changes. To realise AI's potential, ongoing training and upskilling initiatives will be essential to ensure that all workers can adapt to this rapidly evolving landscape.

Conversely, 14% of companies are concerned that AI will make low-skilled jobs obsolete, driving up demand for high-skilled workers while displacing traditional shop-floor roles. This dual reality highlights the need for balanced strategies to maximise AI's potential, while ensuring a fair transition for the workforce.

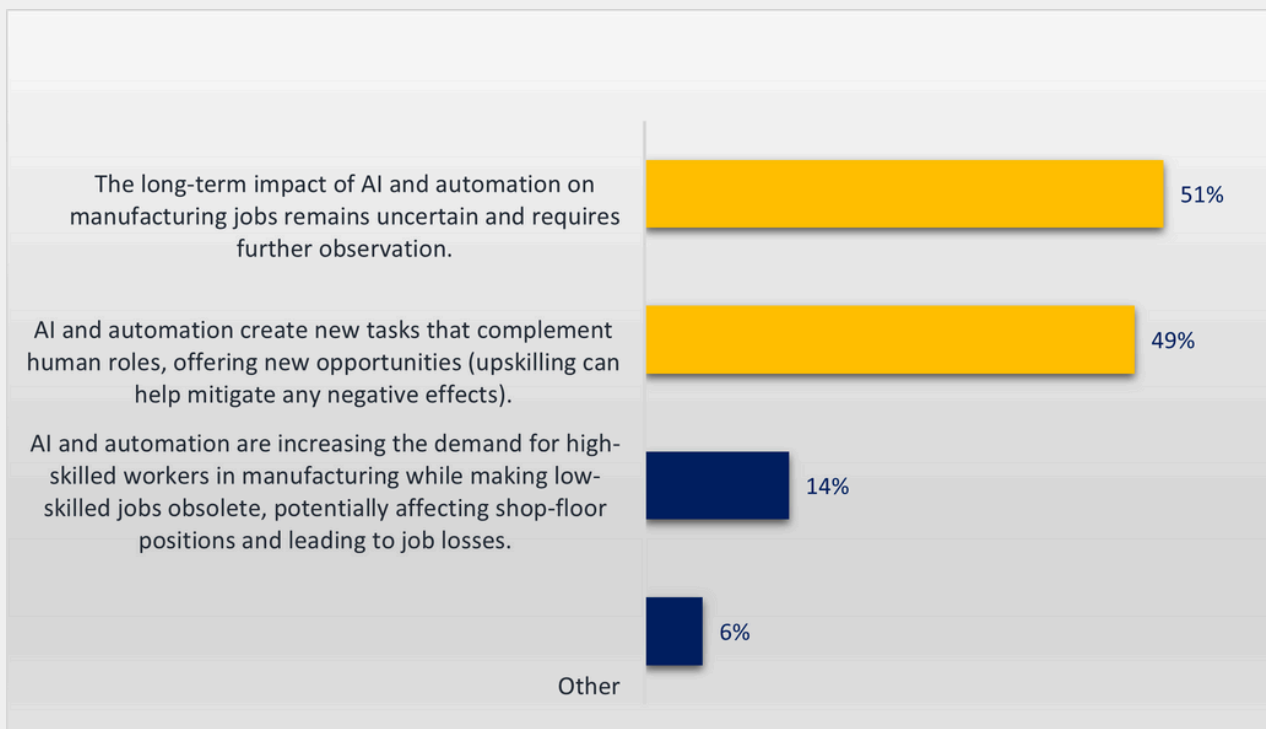


Figure 7: Industry Perspectives on the Impact of AI in Manufacturing

Figure 8 provides further clarity on the digital capabilities that are becoming essential in advanced manufacturing. Automation and robotics dominate the landscape, with 63,6% of companies citing automation control systems as critical to streamlining operations. Closed behind, 60,6% of companies emphasise the importance of Robotics Operations, which encompasses a wide range of skills, including programming, integration, maintenance, troubleshooting, and managing of collaborative robots (cobots). These two areas have seen notable increases, 10% and 16% respectively, since 2023, underscoring the growing reliance on robotics technology to optimise manufacturing workflows.

The rise of the Internet of Things (IoT) and sensor integration is also evident, with 45,5% of companies recognising its importance, a significant increase from the last year. Similarly, 42,4% of respondents emphasise Machine Learning (ML) and AI management skills, as well as expertise in Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) software, which are critical to smart design and manufacturing. These tools are integral to facilitating intelligent design and production processes, which are becoming essential to remaining competitive in an increasingly digital industry.

In contrast, Data Analytics and Visualisation skills have declined in importance, with only 36,4% of companies prioritising them, down more than 10% from 2023. Other specialised skills, such as 3D Modelling and Simulation and CNC Programming, remain essential for 27,3% of industries, highlighting the need for precision and efficiency in manufacturing. Meanwhile, cybersecurity awareness, digital twin modelling, and incident response and recovery skills are recognised by around 21% of companies as critical to securing operations and enabling predictive planning.

On the other hand, skills in Augmented Reality (AR), Virtual Reality (VR), SCADA Systems Operation, and Data Integration (ETL) remain lower priorities for most companies, in line with trends observed in 2023. While these technologies have potential, they are not yet considered as core components of the manufacturing skill set. Overall, the findings highlight an advanced manufacturing sector increasingly shaped by automation, robotics, and smart technologies, with a continued need for highly specialised technical expertise.

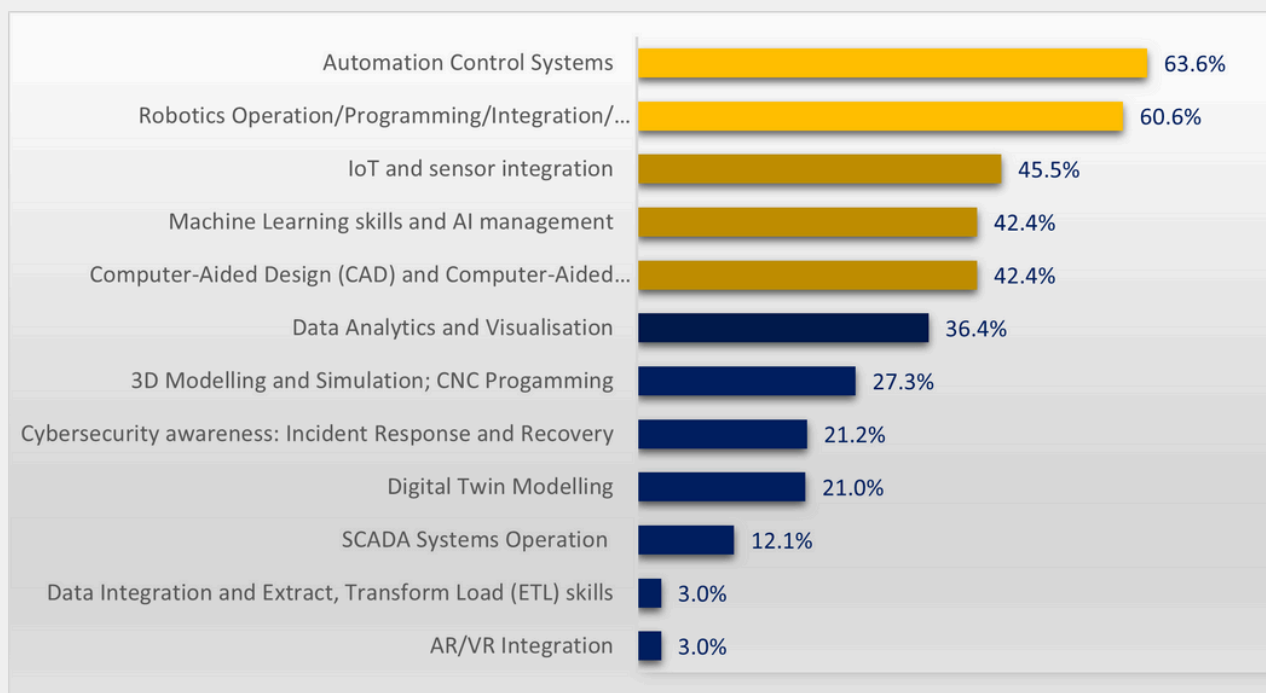


Figure 8: Digital Skills

3.2 Digital Occupations

The accelerating adoption of automation and digitalisation has led to a surge in demand for specialised technical roles, as shown in Figure 9. Automation and Mechatronic Systems Technicians are now considered critical by 85.74% of industries, an increase of more than 25% since 2023. This highlights their essential role in maintaining and optimising automated systems. Similarly, the importance of CAD and CAM Engineers and Designers has grown significantly, with 51.42% of companies prioritising these roles, reflecting an increase of nearly 30% since last year. This trend highlights the reliance on skilled professionals to improve the efficiency of design and manufacturing processes.

Roles such as AI and Machine Learning Specialists (37.14%) and Robotics Specialists and Human-Robot Interaction Operators (34.28%) are also in high demand, indicating the industry's increasing focus on collaborative robotics and AI-driven machine tools. Other roles, including Operational Technology Performers (22.85%), Data Engineers and Scientists and Digital Twin Data Analysts (20%), remain moderately prioritised, reflecting the varying levels of digital transformation across the industry. Surprisingly, only 14.28% of respondents identified cybersecurity professionals as a critical priority, despite the importance of protecting systems from digital threats. Similarly, niche roles such as Smart Factory Managers, Web Security Managers, and Additive Manufacturing Specialists are only valued by just 5.71% of companies, suggesting that these areas may still be in their infancy within advanced manufacturing.

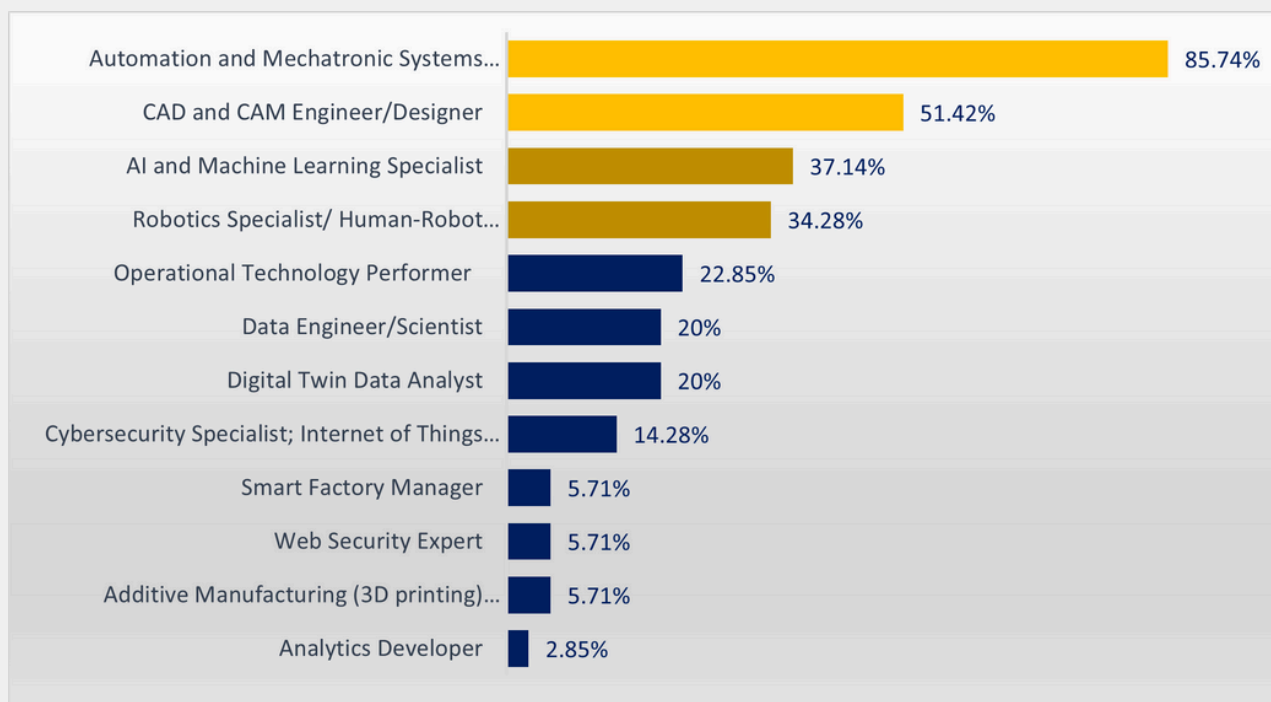


Figure 9: Digital Occupations

3.3 Green Skills

Figure 10 illustrates the diverse industry perspectives on the significance of green skills in manufacturing. A majority (53,1%) of companies highlight the importance of environmental and energy regulatory awareness, alongside fostering a green mindset, indicating the growing need for sustainable practices at all levels of production. This is particularly relevant in light of ongoing regulatory changes that are expected to increase the demand for sustainability reporting. As compliance obligations grow, companies will need specialists to guide them through these requirements and reduce the associated administrative burden.

Additionally, 34,4% of respondents recognise the value of Life Cycle Assessment (LCA) and environmental impact analysis, reflecting growing regulatory and sustainability efforts to minimise carbon emissions and promote green product design. Demand for expertise in sustainable design and green material selection (28,1%) is also on the rise, as companies prioritise environmentally responsible choices in product development.

Conversely, fewer companies place emphasis on other green competencies. Only 21,9% value knowledge of renewable energy technologies, while around 19% consider regenerative manufacturing practices essential. Circular economy skills are identified by only 15,6% of firms, a 20% decrease from 2023. Similarly, only 12,5% stress the importance of energy auditing and green product certification. These disparities suggest that while green skills are increasingly acknowledged, their adoption remains uneven. There appears to be more focus on regulatory compliance and green design rather than on energy and resource optimisation.

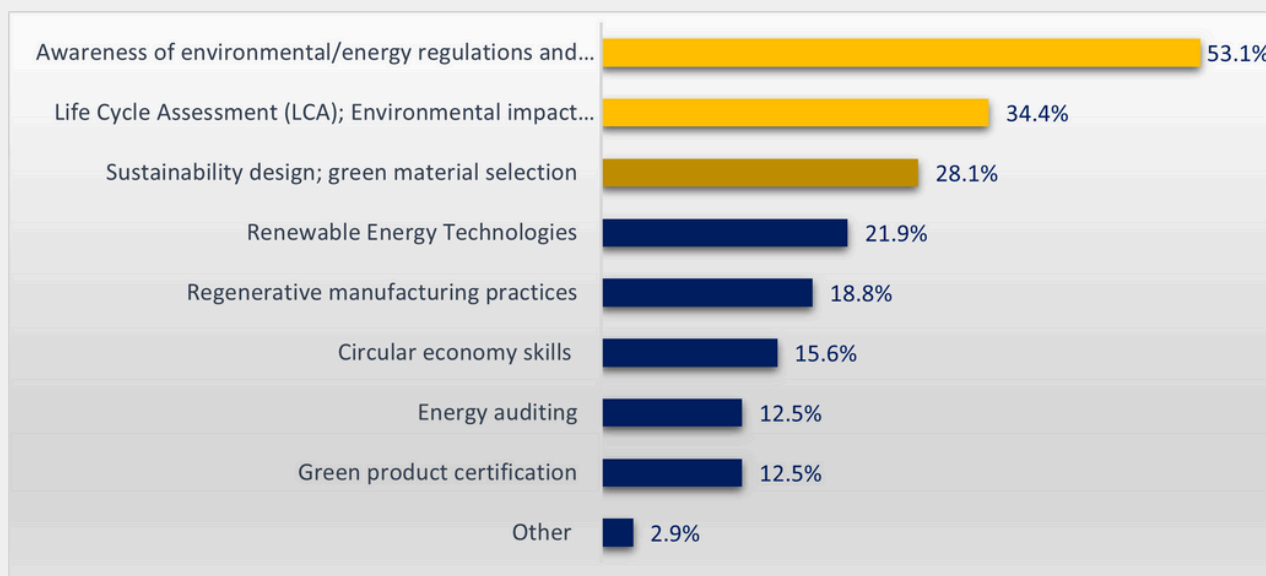


Figure 10: Green Skills

3.4 Green Occupations

As shown in Figure 11, not all participating companies have clearly defined the green professional profiles they consider most critical. This uncertainty likely stems from the evolving nature of the advanced manufacturing sector and the difficulty in predicting which roles will prove indispensable in the future. Nevertheless, among the identified roles, energy efficiency analysts and consultants are deemed crucial by 48,4% of industries, reflecting their vital role in optimising energy use and supporting sustainability initiatives. Nearly 40% of companies also recognise the importance of sustainability and environmental consultants, who provide expertise on regulatory compliance and sustainable strategies.

By contrast, fewer organisations regard eco-design engineers and waste reduction engineers (22,6%) as essential, while only 12,9% prioritise circular economy specialists, a relatively low emphasis on closed-loop manufacturing systems. Additionally, 9,7% of respondents highlighted the need for emerging roles, such as green technology integration specialists, underscoring the dynamic and evolving landscape of green occupations.

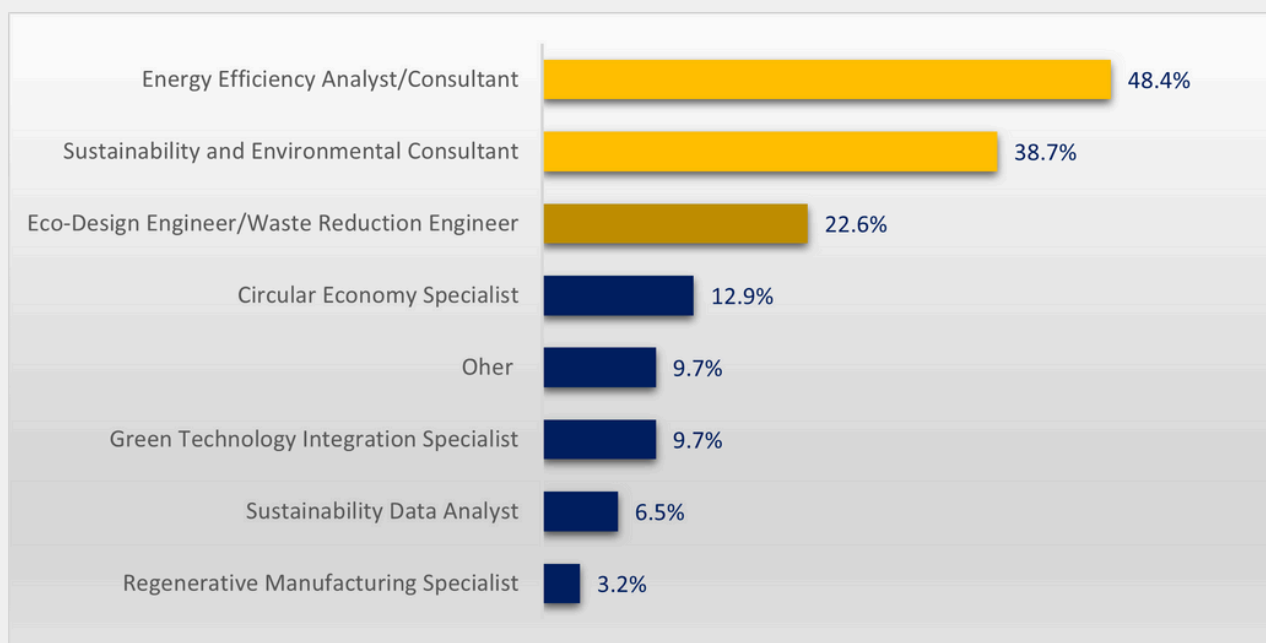


Figure 11: Green Occupations

3.5 Comparing Skills Priorities: 2023 and 2024

A comparative analysis of the 2023 and 2024 survey results reveals significant shifts in industry priorities across various skill domains. Expertise in automation control systems has seen a 10% increase in importance compared to 2023, while demand for skills in robotics operation, programming, integration, maintenance, and troubleshooting has surged by over 15%. This trend reflects the accelerating shift towards digital transformation, as businesses increasingly require advanced technological capabilities to navigate the complexities of modern "smart factories."

Similarly, competencies in IoT and sensor integration have experienced a respectable 13% rise in importance. In contrast, the perceived importance of machine learning has remained largely unchanged, alongside a stable demand for CAD, CAM, digital twin modelling, and SCADA systems. However, a departure from last year's trends is evident in the diminished emphasis on data analysis and visualisation, a potential shift towards more automated and AI-driven solutions. Additionally, cybersecurity awareness and incident response skills have seen a slight decline in priority (under 10%).

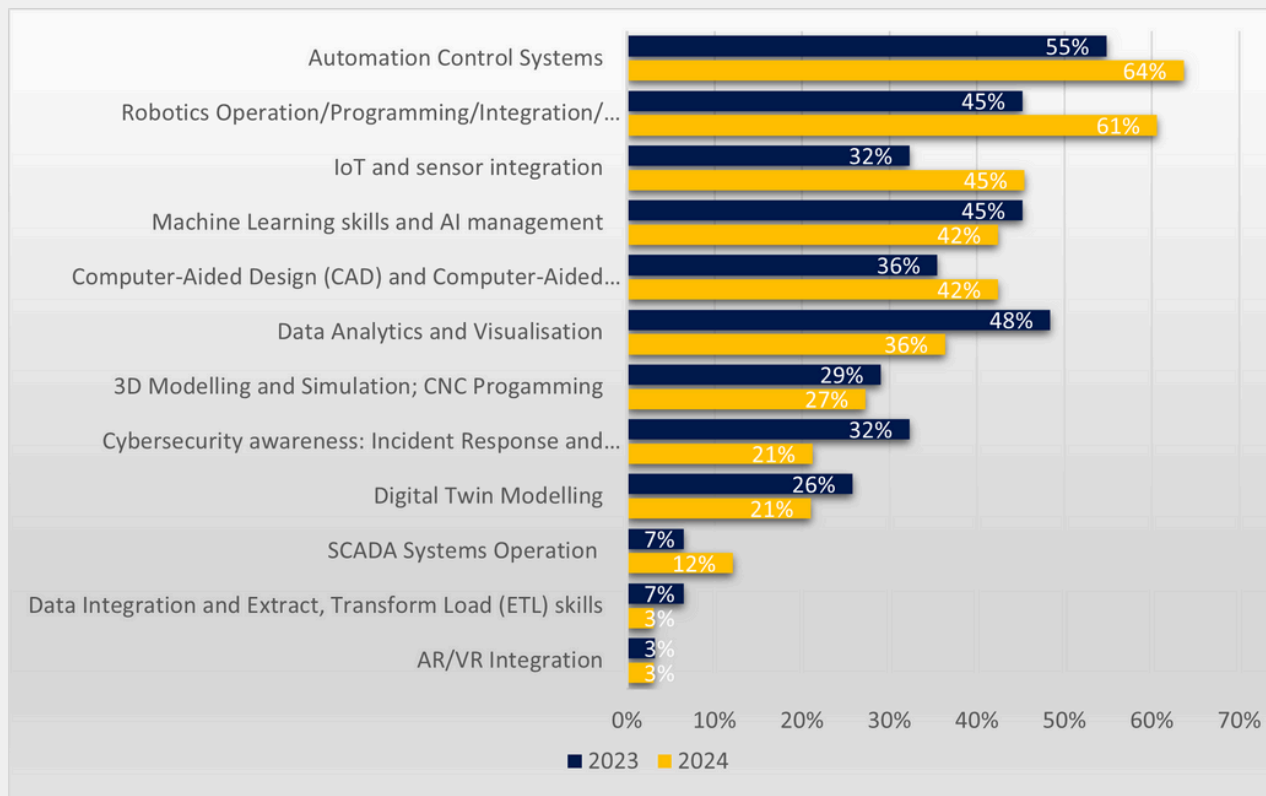


Figure 12: Comparison of Digital Skills 2023-2024

Examining the evolution of green skills from 2023 to 2024, several key trends emerge. Awareness of environmental and energy regulations, along with fostering a green mindset, will continue to be evident in sustainable industry practices. However, the importance of life cycle assessment skills has declined, with a 14% decrease in awareness.

In addition, circular economy and energy auditing competencies have experienced a downturn, with nearly 20% fewer organisations identifying them as critical in 2024. Meanwhile, other green skills, including sustainable design, green materials, renewable energy technologies, regenerative manufacturing practices, and green product certification, have seen only marginal declines, suggesting that while they remain important, their prioritisation has slightly waned.

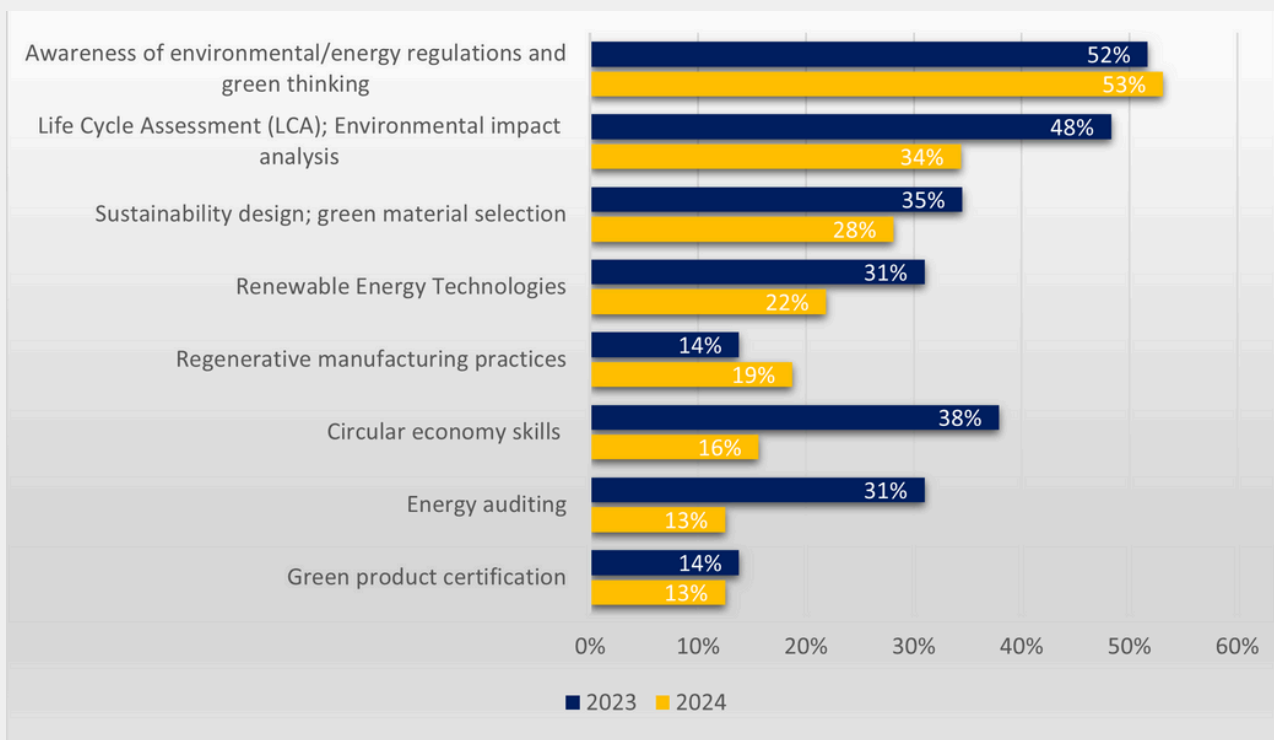


Figure 13: Comparison of Green Skills 2023-2024

With rapid technological advancement, companies were asked to predict which skills, whether technical, digital, green, or soft, might become less relevant over the next decade. Some companies were unable to give a definitive answer, citing uncertainty. However, many noted that traditional technical skills are becoming less important due to the increasing prevalence of automation and digitisation. While technical expertise remains essential today, an ageing workforce and a shortage of younger skilled workers are accelerating the shift away from manual skills. Increasingly, automation and advanced systems capable of self-diagnosis and repair are expected to replace many repetitive and routine technical tasks, shifting the focus to using human brainpower for more complex problem-solving and innovation.

Digital skills were highlighted as dominating the employment landscape, overshadowing green skills. The rise of AI and smart technologies may reduce the importance of basic skills such as operating word processors or performing manual data entry, as these tasks become increasingly automated. Similarly, traditional mechanical skills may become less relevant, unless they are integrated with advanced digital systems such as CNC programming, as modern machines become more sophisticated. This underscores a broader shift toward hybrid skills that blend technical and digital fluency, particularly in areas such as data analytics and automation technology integration.

Interestingly, while green skills remain vital to the twin transitions of sustainability and digitalisation, some responses suggest a potential deprioritisation in favour of digital and marketing skills. Nevertheless, the human factor will continue to hold a central position in sectors requiring non-standardised processes, such as bespoke machine assembly. Companies foresee a world in which adaptability and the ability to effectively manage change, alongside digital skills, will shape the core attributes of the workforce. Ultimately, this analysis highlights the need for education and training systems to realign with emerging industry priorities to ensure a resilient and future-ready workforce.

4. EDUCATION AND TRAINING

The pursuit of competitiveness and the dual transition to digitisation and sustainability demand that vocational education and training (VET) systems continue to evolve. In advanced manufacturing, in-house training remains critical to equip workers with the skills to efficiently maintain, troubleshoot, and repair equipment. A well-trained workforce helps to minimise production disruptions, improve operational efficiency, and ensure the seamless integration of new technologies.

The rise of micro-credentials and short-term training courses has significantly changed the educational landscape. According to CEDEFOP[6], these learning opportunities have expanded rapidly across Europe and beyond, outpacing traditional national education systems. Their flexibility allows individuals to acquire and apply skills through formal education, on-the-job training, and self-directed learning. While VET has long provided short and adaptable learning experiences, their importance has grown as industries prioritise agile, learner-centred training models to meet evolving skill needs.

4.1 Training Approaches

Figure 14 shows the range of training strategies that companies have implemented over the past year to address skills shortages. A significant 89% of businesses have adopted in-house training, recognising its cost-effectiveness and practicality in the long run. Delivered directly on the manufacturing shop floor, this approach eliminates the need for external trainers, reduces outsourcing costs, and allows programmes to be tailored to meet specific operational needs. Additionally, 54% of companies have utilised online training to provide targeted, flexible, and cost-effective training opportunities. About half of the companies surveyed have also invested in external training programmes, sending employees to specialised providers. While in-house training is generally more cost-effective, external programmes are often essential for acquiring advanced skills, particularly in areas such as digital technologies and sustainable manufacturing.

Apprenticeships and internships have been embraced by 37% of companies as a means of training new talent while assessing potential long-term employees. These programmes offer individuals valuable hands-on experience while enabling businesses to shape their future workforce. However, cross-training initiatives, which aim to equip employees with skills across multiple roles, were implemented by only 20% of companies. Despite being less common, cross-training increases workforce flexibility and resilience, enabling employees to adapt to evolving production demands.

[6] CEDEFOP (2024), "Exploring the emergence of microcredentials in vocational education and training (VET)," available at: <https://www.cedefop.europa.eu/en/publications/6221>.

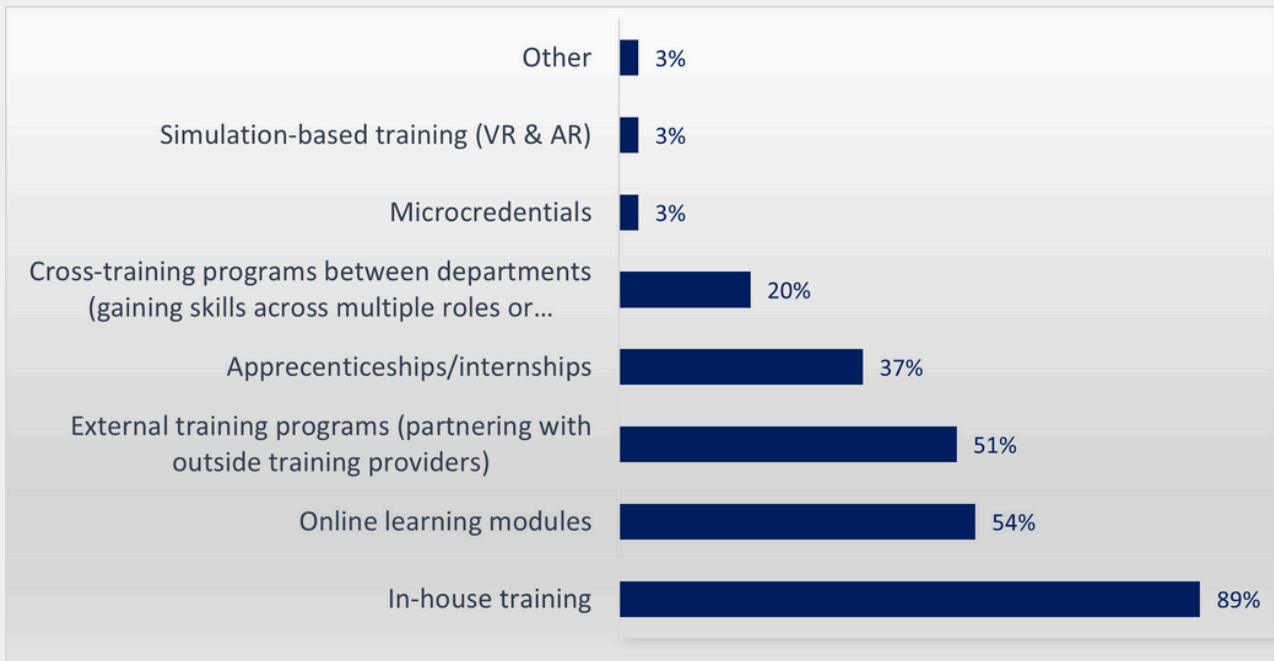


Figure 14: Implemented Types of Training

4.2 Education Priorities

Figure 15 illustrates companies' educational preferences when hiring for manufacturing roles. University degrees remain the top priority, with 74% of companies favouring tertiary qualifications in disciplines such as mechanical and electrical engineering, as well as fields that support digital transformation, including AI, automation, and robotics.

At the same time, vocational training, apprenticeships, and hands-on experience are also highly valued, with 46% and 43% of industries recognising their importance, respectively. Higher education provides the theoretical foundation essential for technical and engineering roles, while vocational training and apprenticeships provide the hands-on experience essential for tasks such as machine operation, maintenance, and production. Internships and apprenticeships play a critical role in bridging the gap between education and industry demands, offering students the opportunity to apply their knowledge in a real-world setting by applying theoretical knowledge on the job, develop practical skills, and gaining valuable insight into the workplace.

Interestingly, some companies prioritise practical experience over formal qualifications, particularly for roles requiring manual or blue-collar skills. In contrast, careers in digital technologies, such as IT and data analytics, tend to value the theoretical expertise provided by higher education.

In addition, 20% of companies acknowledge the growing significance of micro-credentials, seeing them as a valuable asset for candidates looking to enhance their employability and differentiate themselves in the job market.

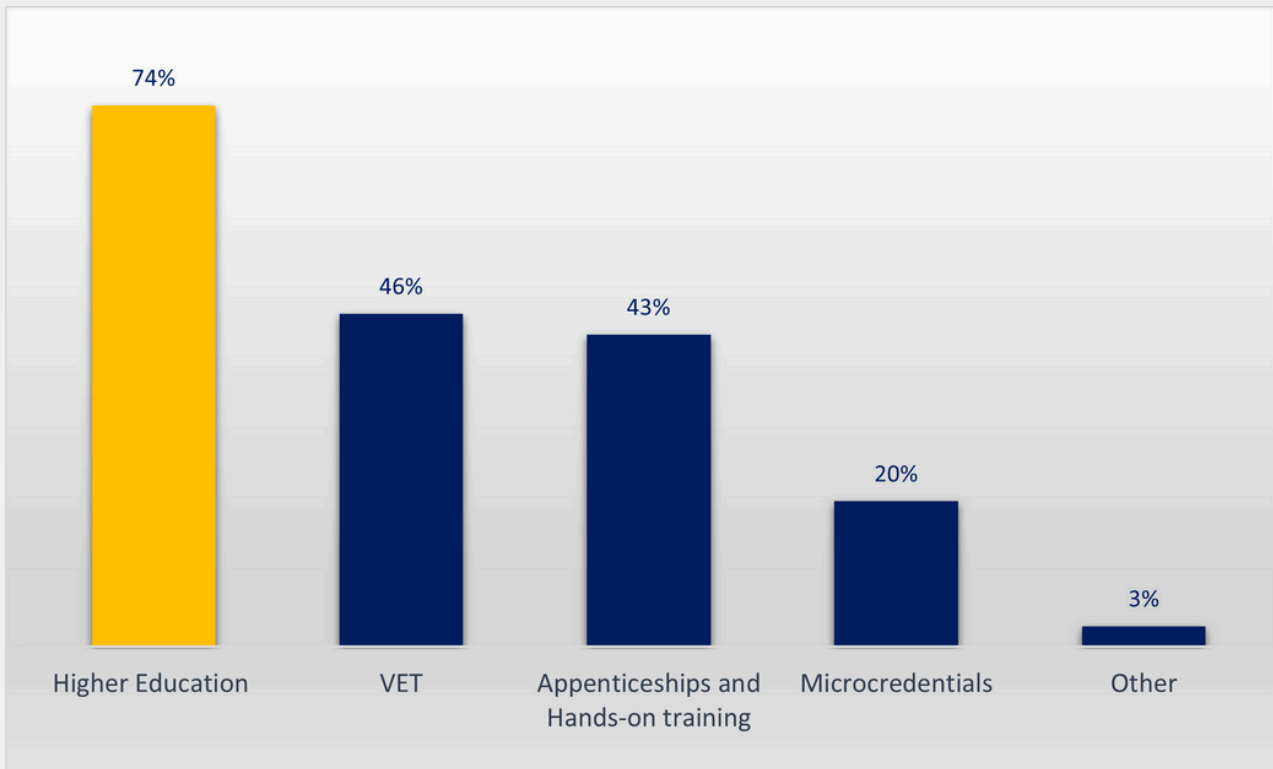


Figure 15: Types of Education for Manufacturing Roles

4.3 The Role of Micro-credentials

Micro-credentials are emerging as a valuable way for people to gain specific skills, knowledge, and competencies that align with the changing needs of the job market. According to CEDEFOP[7], they offer a practical advantage by delivering meaningful learning outcomes in a short timeframe. By recognising prior learning and validating skills gained outside formal education, whether at work, home, or through life experience, micro-credentials can make education more flexible, accessible, and inclusive for a wider range of learners.

That said, company perspectives on microcredentials remain mixed. As shown in Figure 16, 38% of businesses consider them valuable, while a further 38% consider them as somewhat valuable. This split suggests that microcredentials are still finding their place in workforce development, appeal largely depending on how well companies understand and integrate them. However, as industries continue to look for more flexible and targeted approaches to skills development, the importance of microcredentials is expected to grow in the coming years.

[7] CEDEFOP (2024), "Exploring the Emergence of Microcredentials In Vocational Education And Training (VET)", available at: <https://www.cedefop.europa.eu/en/publications/6221>.

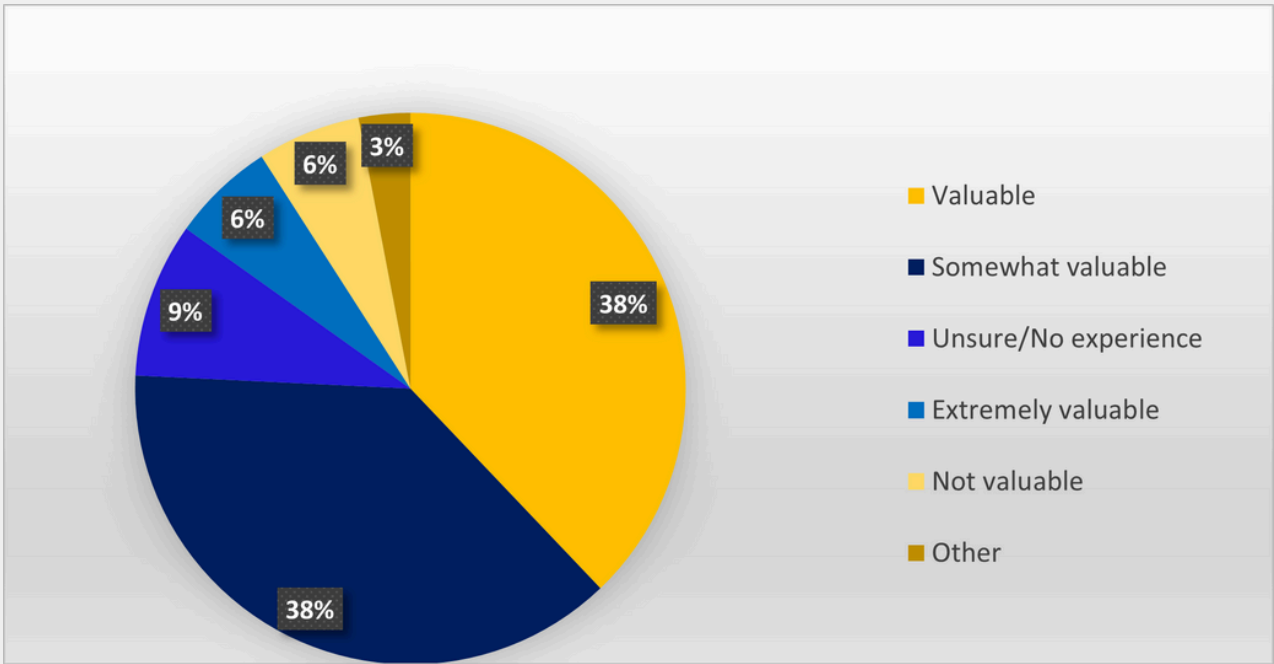


Figure 16: Importance of Micro-credentials

5. REFLECTIONS ON INDUSTRY AND POLICY

The challenges facing the manufacturing sector are a result of a complex interplay of systemic, generational, geographic, educational, financial and administrative factors. Overcoming these barriers requires a multifaceted approach, that includes changing industry perceptions, improving access to training programs, offering competitive compensation, fostering a work environment that attracts and retains talent, enabling labour mobility, and reducing administrative burdens on businesses.

Figure 17 highlights the most effective strategies for retaining skilled workers, with a strong emphasis on workplace culture and professional development. A significant 64% of companies prioritise cultivating a positive workplace culture and providing flexible work arrangements. These efforts are critical to ensuring employee satisfaction and well-being, both of which are key to retention. In addition, 55% of companies emphasise the importance of employee recognition programs and internal talent mobility. Recognising employees' contributions fosters loyalty and engagement, while internal mobility allows employees to explore roles that better match their skills and interests, increasing job satisfaction.

Nearly half (48%) of companies also stress the importance of establishing apprenticeship and internship programs, which not only provide valuable training but also signal an employer's commitment to professional growth. Furthermore, 36% of companies recognise the benefits of partnering with educational institutions and workforce organisations to align workforce development with industry needs. Finally, 33% highlight increased investment in external training as a key retention strategy, acknowledging that continuous learning enhances employees' career prospects and encourages long-term commitment to the organisation. Taken together, these approaches demonstrate a well-rounded strategy that integrates job satisfaction, career development, and strategic partnerships to secure and develop a skilled workforce.



Figure 17: Actions for Retaining Staff with the Required Skills

Figure 18 illustrates companies' views on the European initiatives deemed most effective in tackling skills shortages and improving employment prospects in advanced manufacturing. A majority (58%) of businesses underscore the importance of continuous learning, particularly through funding for skills development and training programs facilitated by public-private partnerships. Similarly, 55% emphasise the necessity of regularly updating educational curricula and training programs to keep pace with advancements in the sector, ensuring alignment with evolving industry demands.

However, fewer companies, around 27%, consider initiatives such as collecting skills intelligence at the Member State level, attracting highly skilled workers from outside the EU, and reducing talent misallocation through financial incentives like scholarships and paid internships to be highly impactful. Other measures, including increased investment in early childhood education, boosting the appeal of VET and manufacturing careers (24%), and harmonising skills certification for cross-border recognition (15%), received even lower priority. These findings suggest that while long-term and foundational strategies are acknowledged, companies place greater immediate importance on measures directly linked to workforce training and industry-aligned education.

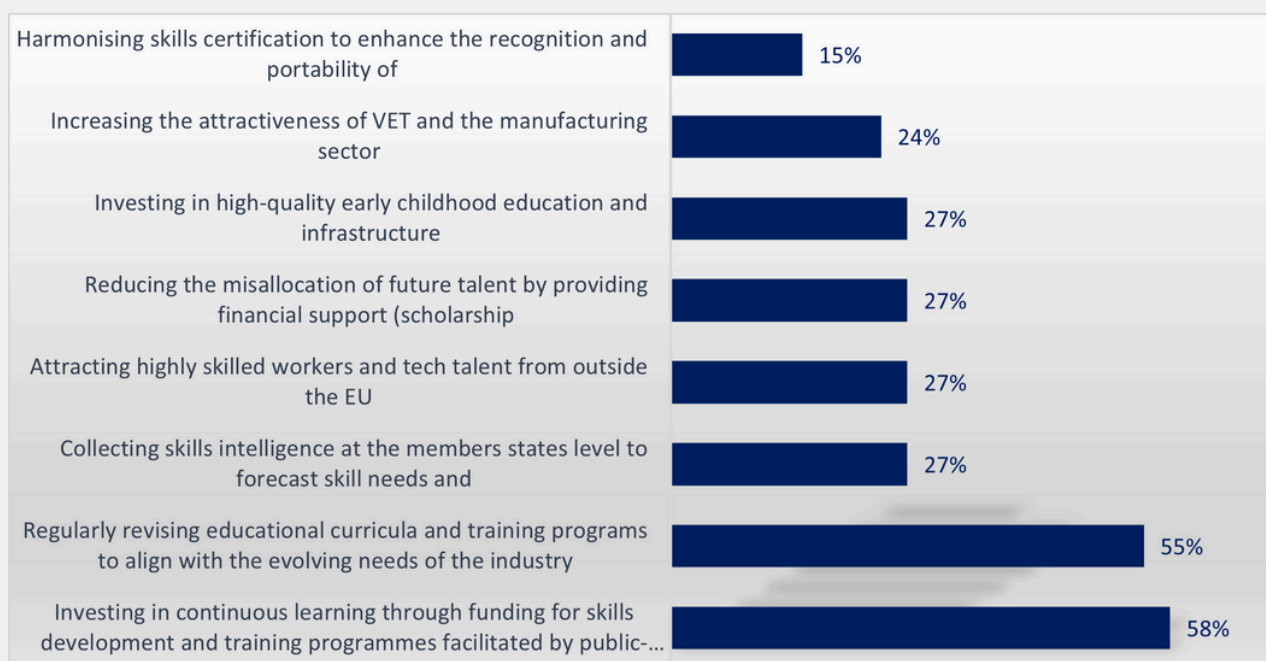


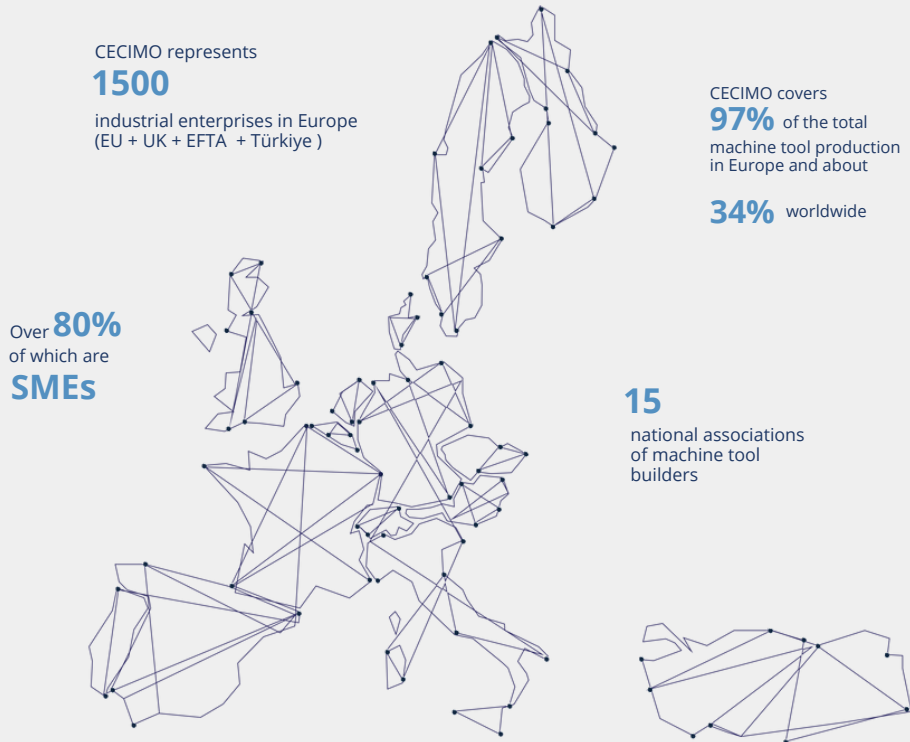
Figure 18: Impactful Initiatives for Bridging Skills Gaps in Manufacturing

Nevertheless, labour mobility within the EU remains limited. Easing restrictions and facilitating the movement of worker would help address existing shortages by ensuring that talent is better distributed where it is needed. However, significant challenges remain, including language barriers, cultural differences, and varying regulatory frameworks that vary from country to country. Uncertainty about social security, healthcare, and other employee benefits also adds to the complexity.

Furthermore, there must be fair recognition of country-specific qualifications and professional licences to ensure that workers can move seamlessly across borders. Reducing red tape would also be a step in the right direction, in particular by accelerating the development of a single digital declaration platform for posting workers, which would simplify compliance for businesses and reduce administrative burdens, making cross-border employment more efficient.

ABOUT CECIMO

CECIMO is the European Association of Manufacturing Technologies. With a primary focus on machine tools and additive manufacturing technologies, we bring together 15 national associations, which represent approximately 1500 industrial enterprises in Europe (EU + UK+ EFTA + Türkiye), over 80% of which are SMEs. CECIMO covers 97% of the total machine tool production in Europe and about 1/3 worldwide. It accounts for approximately 150,000 employees and a turnover of around 25.8 billion euros in 2024.



Austria: Metaltechnology Austria
Die Metalltechnische Industrie



Germany: VDW
Verein Deutscher Werkzeugmaschinenfabriken e.V.



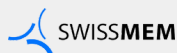
Sweden: MTAS
Machine and Tool Association of Sweden



Belgium: AGORIA
The Federation of Technology Industry



Italy: UCIMU
Associazione dei costruttori Italiani di macchine utensili robot e automazione



Switzerland: SWISSMEM
Die Schweizer Maschinen-, Elektro- und Metall-Industrie



Czech Republic: SST
Svazu Strojírenské Technologie



Netherlands: FPT-VIMAG
Federatie Productie Technologie / Sectie VIMAG



Türkiye: MIB
Makina Imalatçıları Birliği



Denmark: The Manufacturing Industry
a part of the Confederation of Danish Industry



Portugal: AIMMAP
Associação dos Industriais Metalúrgicos, Metalomecânicos e Afins de Portugal



United Kingdom: MTA
The Manufacturing Technologies Association



Finland: Technology Industries of Finland



Spain: AFM Cluster
Asociación española de fabricantes de máquinas-herramienta, accesorios, componentes y herramientas



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