Co-funded by the European Union

FLEXI-SKILLED INNOVATORS
Empowering the next generation VET professionals

Flexi-Skilled Innovators

Empowering the Next Generation VET Professionals

SKILL GAP IN EUROPE

European Labour Market Needs and Skill Gaps: Evidence Base for the Design of the FSI Learning Platform and Micro-Credentials

Project no. 2025-1-NL01-KA220-VET-000359292

This report represents a key deliverable produced within the framework of Work Package 2 (WP2 - Needs Analysis and Skills Gap Assessment) of the *Flexi-Skilled Innovators (FSI)* project (Project Number: 2025-1-NL01-KA220-VET-000359292), supported by the Erasmus+ KA220-VET Cooperation Partnerships in Vocational Education and Training action of the European Union

The drafting of this report was led by the University of Naples L'Orientale (Italy) and authored by Lorenzo Cicatiello, Giuseppe Lucio Gaeta, Benedetta Parenti and Mauro Pinto. The preparatory activities, data collection, and analytical groundwork underpinning this report were made possible through the substantial collaborative contribution of all partners involved in the Flexi-Skilled Innovators (FSI) consortium.

The project is coordinated by Nova College (Netherlands) and implemented in partnership with Università degli Studi di Napoli L'Orientale (Italy), Wux B.V. (Netherlands), EGEKO Danışmanlık Dış Ticaret Sanayi ve Ticaret Limited Şirketi (Türkiye), Skills Zone Malta Co. Limited (Malta), EMPOWER MKO (Greece), and Essenia UETP (Italy).

Executive Summary

Context and Objectives

European labour markets are undergoing profound structural changes driven by digitalization, transition to environmental sustainability, and demographic ageing. These transformations operate simultaneously on labour demand and labour supply, reshaping not only employment levels and occupational structures but also, more fundamentally, the task content of jobs and the skill profiles required across sectors.

Against this background, understanding emerging skill needs becomes crucial for anticipating labour market adjustments and supporting effective education and training responses.

This report examines skill gaps in Europe with a specific focus on skills and competencies associated with the so-called twin transition, i.e., digital and green, alongside entrepreneurial skills that support innovation, adaptability, and organizational transformation.

Key Findings

Labour Market Transformation

- EU-27 employment is projected to grow moderately from 217 million (2025) to 224 million (2035), representing a 3% increase.
- Growth is driven primarily by Business and Other Services, Distribution and Transport, and Non-market Services.
- Employment among Professionals is expected to increase by 15%, while Skilled Agricultural Workers will decline.
- Replacement demand, i.e., the need to fill positions vacated by retiring or exiting workers, will exceed 6 million workers annually, creating sustained recruitment needs even in sectors with limited employment growth.

Skill Mismatch Dynamics

- Labour market adjustment in Europe is driven primarily by changes in skill requirements within existing occupations rather than large-scale job destruction.
- Skill mismatches reflect not only insufficient skill supply, but also weak coordination between education systems, training providers and employers.

- The pace of technological and environmental transformation outstrips the responsiveness of education and training systems, resulting in persistent gaps between emerging skill demands and available human capital.

Digital Skills

- Demand is concentrated on advanced, specialized skills such as data analysis, software development and digital systems management.
- At EU level, 55.6% of individuals aged 16-74 possess at least basic digital skills and only 27.32% posses above basic digital skills, with significant cross-country variation.
- Professional IT skills show the strongest relative growth in employer demand, indicating increasing selectivity and task-specificity.

Green Skills

- Demand is expanding through both transformation of existing jobs and emergence of new green roles, particularly in energy, transport and environmental management.
- Employment in circular economy sectors reached 4.3 million workers in 2023, with an average growth rate of 1.2% over twenty year despite pandemic disruptions.
- The supply of green skills remains underdeveloped in many European labour markets, characterized by a paucity of dedicated training pathways and by insufficient mechanisms for anticipating emerging competency needs.

Entrepreneurial Skills

- Growing demand for transversal competences such as leadership, adaptability, strategic thinking and innovation management.
- These skills enable firms and workers to navigate uncertainty and continuous change across sectors.
- Supply is fragmented, with limited recognition and certification within structured training frameworks.

Methodological Approach

Starting from the well-established idea that jobs can be decomposed into bundles of tasks and corresponding skill requirements (Autor, Levy and Murnane, 2003; OECD, 2019), this report interprets labour market transformation through a skills-based lens. Drawing on international evidence from the OECD, CEDEFOP, the ILO, Eurostat and the World Economic Forum, it

uses the European Skills, Competences, Qualifications and Occupations (ESCO) classification to map digital, green and entrepreneurial skills across occupational groups and sectors, providing an operational framework to inform training design.

Main Recommendations

Priority skills for training interventions: based on ESCO analysis, the report identifies 2,091 distinct skills, of which:

- 1,197 are classified as digital
- 527 are classified as green
- 212 are classified as entrepreneurial

Cross-thematic skills (spanning multiple domains) represent strategic priorities, as they generate returns across digital, green and entrepreneurial transitions simultaneously.

Most Frequently Required Skills Across Sectors

- Project management and strategic planning
- Data analysis and statistical techniques
- Environmental compliance and sustainability awareness
- Business relationship building and conflict management
- Technical competences in CAD software, GIS and digital systems

Policy Implications

- Training systems must shift from static qualifications to dynamic skill provision through lifelong learning and modular pathways.
- Closer coordination between training providers and employers is essential to reduce mismatches.
- Mechanisms for the recognition of non-formal and informal learning should be strengthened, including the development and uptake of micro-credentials and skills-based hiring practices to enhance labour market signalling and validation processes.
- Special attention is needed to ensure equal access to training, particularly for workers with lower initial educational attainment.
- Dedicated country-level assessments are provided for Greece, Italy, Malta, the Netherlands and Turkey, highlighting context-specific skill gaps and institutional arrangements. Training programmes should take into account national differences.

Index

Introduction

Over the past decade, economies and labour markets worldwide have been undergoing dramatic structural change, driven by the combined effects of rapid technological transformation and the rising urgency of addressing climate change and ecological challenges.

This twin transition, combining digitalisation and the shift towards environmental sustainability, reshapes technologies, products, and market incentives, including consumer preferences. Firms respond by adapting production processes and organisational arrangements, and these responses, together with sectoral reallocation, ultimately translate into changes in the structure of labour demand (OECD, 2023). While this is happening in both advanced and emerging economies, the intensity, direction and distributional effects of such transformations vary significantly across regions, depending on pre-existing socio-economic trends, positions in the global value chain, and the ability of societies and economies to address these global challenges.

Industrial structure and demographic trends make European economies particularly exposed to the twin digital and green transition. First, Europe's industrial structure is characterized by a substantial presence of sectors - such as manufacturing, construction, transport and energy-intensive sectors - that, according to OECD projections, are directly affected by decarbonisation and technological change/automation (OECD, 2023). Second, demographic ageing and limited growth of the working-age population make European economies increasingly dependent on the ability of the existing workforce to adapt to the evolving labour demand.

Beyond these structural factors related to industrial composition and demographics, these European labour market transformations take place within an institutional setting characterised by an ambitious EU policy framework supporting digital and green transition, notably in climate policy. Instruments such as the European Climate Law (European Parliament and Council, 2021) and the Fit for 55 package (EU Commission, 2021) define binding long-term targets and provide a stable regulatory orientation that guides investment, innovation, and structural adjustment. In this context, changes in labour demand are not only expected but structurally embedded in the policy framework.

In this context, European countries' ability to adapt labour supply is crucial to preserve/improve competitiveness and mitigate the twin transition's distributional effects across regions, industrial sectors and social groups. If left to unregulated market forces, these effects risk widening existing inequalities or create new ones, undermining the already fragile EU social cohesion, one of the founding pillars of the Union.

For these reasons, in recent years, a growing number of academic scholars and policy analysts have sought to estimate the effects of the twin transition on labour markets. Emerging international evidence challenges the idea that digital transformation and efforts to address environmental sustainability will primarily result in job demand contraction or large-scale job destruction. Instead, a common understanding is that these transformations mainly affect the content of existing jobs, leading to the emergence of new tasks and a rising demand for skills to address them within existing occupations. From this perspective, analysing the effects of the twin transition requires analytical frameworks capable of capturing how work activities and related requirements evolve within occupations. This view is closely aligned with the task-based approach to labour market analysis, which emphasises that technological and structural change primarily alter the composition of tasks within jobs rather than simply replacing entire occupations (Autor, Levy and Murnane, 2003; OECD, 2019).

The literature commonly draws on two major systems for structuring information on occupations and work-related requirements: the Occupational Information Network (O*NET), a U.S.-developed occupational information system, and ESCO (European Skills, Competences, Qualifications and Occupations), a classification developed by the European Commission. These systems are based on different conceptual hierarchies and were designed to serve partly distinct analytical and policy purposes. O*NET adopts a bottom-up and task-centered architecture: occupations are decomposed into tasks and work activities, which constitute the primary units of analysis. Skills and knowledge are treated as worker attributes directly linked to the execution of these tasks - that is, as capacities and domain-specific information required to perform concrete work activities - and are positioned at the same analytical level. As a result, O*NET is particularly well suited to analysing how technological and environmental changes reshape the content of work and the associated requirements.

By contrast, ESCO follows a top-down and policy-oriented hierarchy explicitly designed to support education, training and skills recognition systems. While task changes are not described explicitly, they are reflected in the way occupations are linked to skills, knowledge and competences. In this framework, skills represent the central operational unit connecting labour market demand and training provision, knowledge provides the cognitive foundation for skills, and competences capture the integrated and contextualized use of skills and knowledge, often implying autonomy and responsibility.

Evidence from CEDEFOP(2023,2025) and the European Commission (2023) emphasizes that the twin transition implies changes in occupational structures and skill requirements and this highlights the central role of skills development policies (for example through lifelong learning) in managing the twin transition. Although these transformations affect both the

knowledge base and the skill sets required in the labour market, contemporary policy framework tend to place particular emphasis on skills. This orientation reflects both a more complex rethinking of the role of education and the idea that adapting knowledge often requires slower processes of change within formal education. By contrast, skill policies enable more flexible and timely responses, supporting the workforce in adapting to rapidly evolving task requirements.

This report adopts the ESCO framework and places skills at the centre of the analysis, with the aim of identifying the skill requirements that education and training systems should address to respond effectively to the evolving labour market demand. The idea behind this approach is that skills capture the application of knowledge to concrete tasks and therefore constitute the most policy-relevant unit for linking labour market demand to education and training provision, as they can be directly mapped to occupational profiles and learning pathways. Consistent with the ESCO architecture, the analysis treats skills and competences as an integrated analytical category. While European qualification frameworks conceptually distinguish between the two — with competences referring to the autonomous and contextualised use of knowledge and skills — ESCO operationalises them jointly, reflecting the difficulty of separating these dimensions in real-world job requirements. This integrated perspective is also broadly aligned with international analytical approaches, which increasingly emphasise the combined mobilisation of technical abilities, judgement and responsibility in the performance of work activities. It strengthens comparability and supports the robust identification of emerging skill gaps, while providing a sufficiently granular evidence base that can subsequently inform the design of learning pathways, micro-credentials and upskilling strategies, in line with the objectives of the Flexi-Skilled Innovators (FSI) project.

In this context, the purpose of this report is twofold. First, it aims to provide a structured and evidence-based analysis of skill gaps in European labour markets, understood as mismatches between the skills required by evolving occupational profiles and those supplied by the workforce and education and training systems. The analysis focuses on these gaps' nature and underlies their drivers in the context of the twin digital and green transition. Second, building on this analytical foundation, the report seeks to support the identification of priority skill areas on which future training interventions should concentrate. The analysis adopts a selective and policy-oriented perspective, seeking to reduce analytical complexity and translate aggregate evidence into actionable guidance for training design. More specifically, the report is conceived as an evidence base for the development of targeted learning pathways, with a particular focus on digital, green and entrepreneurial skills that are both transversal

across sectors and critical for workers' adaptability in a context characterised by rapid task reconfiguration and sustained replacement demand.

Report Structure

This report is structured as follows. Section 1 examines labour market transformations in Europe, focusing on employment projections and structural reallocation across sectors and occupations. Section 2 reviews existing evidence on skill gaps. Section 3 adopts a demand-supply perspective to investigate how skill requirements and skill provision interact over time. Finally, Section 4 introduces the ESCO framework and identifies priority skills and knowledge by sector, providing a concrete foundation for policy interventions and training design. Finally, Section 5 provides country-level assessments for Greece, Italy, Malta, the Netherlands and Turkey, examining how digital, green and entrepreneurial skill mismatches emerge in different national labour market structures.

1. Labour Market Transformation in Europe

The OECD (2023) provides detailed projections of how the green transition is expected to affect employment and skill demand across EU countries by comparing two scenarios: one based on the pre-EU Fit for 55 policy framework and another incorporating the implementation of the EU Fit for 55 measures[i]. While these projections do not constitute a general labour market forecast, they offer valuable insights into the expected direction and magnitude of employment and skill demand shifts associated with the policy-driven green transition in Europe. According to these projections, achieving the EU target of reducing greenhouse gas emissions by 55% by 2030 is compatible with a moderate increase in overall employment, approximately 1.3% between 2019 and 2030, while employment is expected to grow about 3% in the baseline policy scenario. However, these aggregate employment trends conceal substantial structural reallocation across sectors and occupations. First, employment is expected to decrease in Primary sector & utilities with the largest decrease in fossil- based energy sectors. Second, job destruction is expected to be larger for blue-collar and farm workers, declining by about 3%, while employment is expected to increase by 4-5% for managers, professionals and technicians,. In other words, these projections reflect a structural shift away from manual and routine-intensive occupations and from carbon-intensive sectors towards more skill-intensive roles in services and knowledge-based activities.

Such scenario-based projections can be complemented by the long-term (up to 2035) employment forecasts produced by CEDEFOP looking at the EU and disaggregated by country, sector and occupation. The CEDEFOP figures are based on harmonised modelling assumptions designed to ensure consistency between historical trends and long-term projections. As a result, although based on data from Eurostat and DG-ECFIN AMECO, they may not fully coincide with data observed by Eurostat, particularly when looking at the most recent years[ii].

According to CEDEFOP, total employment in the EU-27 is expected to increase from approximately 217 million in 2025 to around 224 million by 2035 (Figure 1), corresponding to a net gain of about 10 million jobs, i.e., a growth by 3% from 2025 to 2035 (about 7% from 2019, which is the reference period in the OECD projections presented above). Figure 2 shows the CEDEFOP employment projections by broad sector. It suggests that the aggregate growth is driven by Business and Other Services, Distribution and Transport, and Non-market Services. In contrast, employment is declining in the Primary Sector and in Utilities (specifically in Agriculture, forestry and fishing and Mining & quarrying) and is almost stagnant in Manufacturing and Construction. The trends observed at the broad sectoral level

reflect heterogeneous dynamics at a more granular level of analysis, which are not examined here for reasons of scope and readability.

CEDEFOP employment projections by occupation (Figure 3) reveal a significant increase of Professionals (about 15% from 2025 to 2035), followed by Technicians and Associate Professionals. Instead, the other groups of workers show stagnant or negative growth, which appears more sizeable for Skilled Agricultural. More detailed projections from CEDEFOP's Future Employment Growth indicator[iii],, based on the Skills Forecast database, reveal substantial heterogeneity across broad occupational categories. Clerical workers are generally projected to experience a sizeable decline in employment, with the notable exception of customer clerks, for whom employment is projected to grow by 12.8%. By contrast, hospitality and retail managers are expected to face a marked employment decrease of 14.7%, while employment for other managerial occupations is projected to increase on average by 6.9%.

Overall, these trends are consistent with the direction of change highlighted by the OECD analyses, reinforcing the view that, in aggregate, labour market transformations in Europe are characterized less by large-scale job destruction and more by a gradual structural reallocation across sectors and occupations.

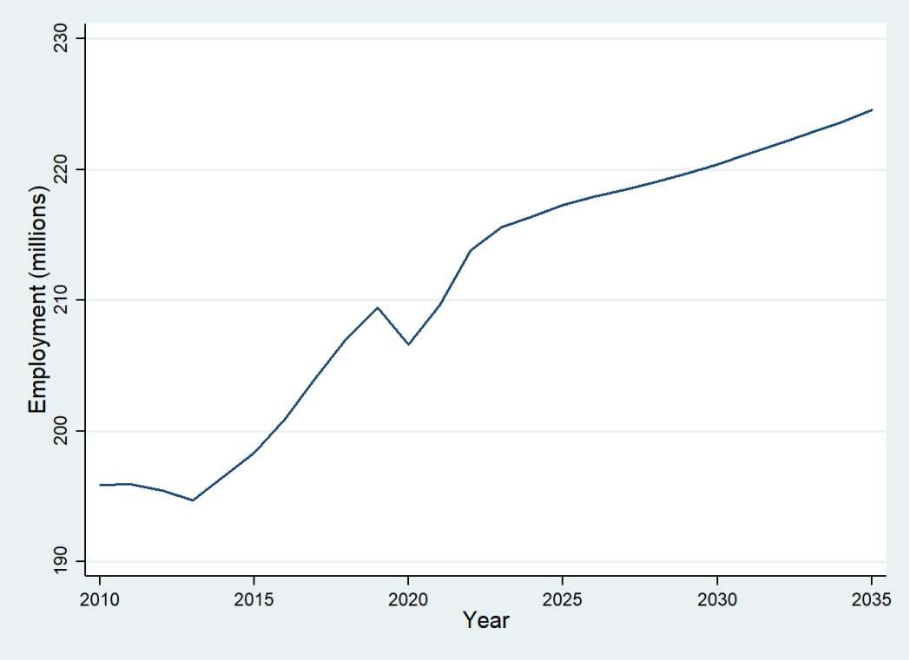
This picture might be completed by considering projections of labour force size. According to CEDEFOP, the total labour force in the EU-27 is expected to increase by about 7.5% from 2022 to 2035 (CEDEFOP data 2023, consulted in November 2025) [iv].

A further useful insight concerns replacement demand (i.e., the number of job openings not depending on expansion demand, but rather on people exiting the labour market or changing jobs), which plays a crucial role in shaping future labour market needs. Labour replacement demand forecasts are very important for the purpose of this report, since in a labour market characterised by deep and rapid transformations, these projections imply sustained and dynamic recruitment activity even in sectors and occupations with limited or declining employment growth. In addition, replacements increasingly require new skills since tasks in existing occupations tend to continuously change as a consequence of the twin transition. Looking at CEDEFOP forecasts, over the coming decades a remarkable share of job openings in the EU are expected to arise from the need to replace retiring or departing workers. Figures 4 and 5 show the replacement demand projections. At aggregate level (Figure 4), CEDEFOP estimates a moderately increasing trend, with an annual demand always above 6 million workers. This trend is mainly driven by "Professionals", "Technicians and Associate Professionals" (Isco, and "Service Workers and Shop and Market Sales Workers" (Figure 5).

Completing this picture on labour market transformations, it is useful to refer to World Economic Forum (WEF) insights on labour market churn (Future of Jobs Report, 2023). Labour-market churn refers to the structural reallocation of workers and job roles over time, capturing both the emergence of new roles and the decline of others as task content and skill requirements evolve[v]. Although WEF does not provide projections specifically for the European labour market, it offers global insights based on survey data covering more than 800 companies worldwide and complemented by external labour market data. Taking all this data into consideration, WEF estimates a labour market churn rate around 23% over the period 2023-2027, suggesting that nearly a quarter of jobs is already undergoing significant restructuring.

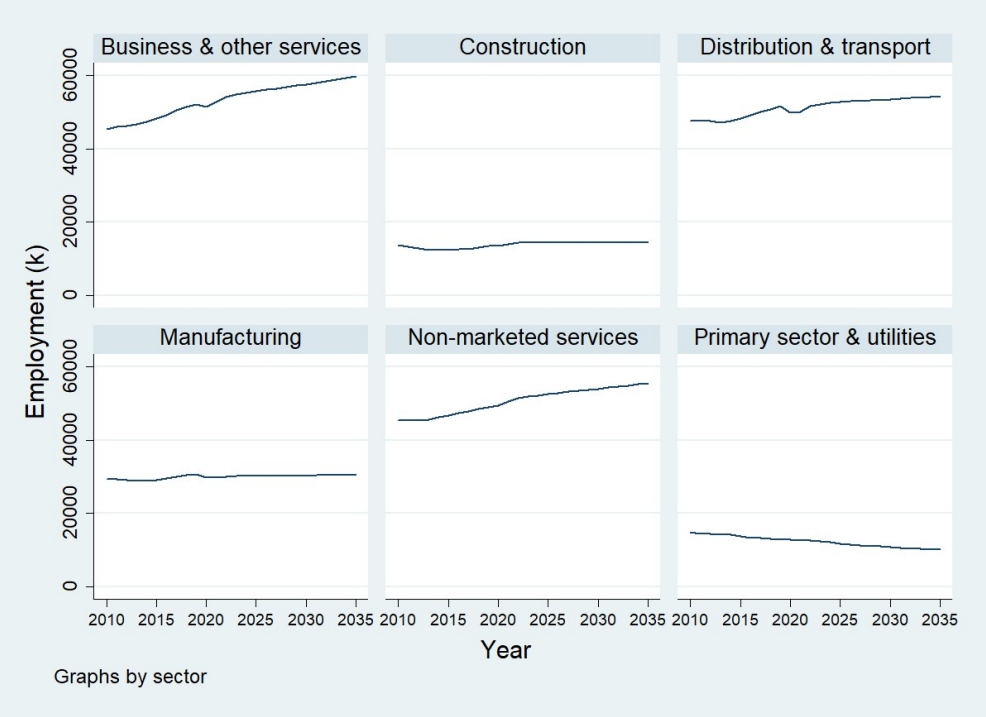
Taken together, the figures presented in this section suggest that the European labour market is characterised by relatively modest net employment growth, sustained internal replacement demand, and internal reallocation and transformation of job roles. Within this evolving context, international policy framework-including those developed by the OECD, ILO, WEF-increasingly frame labour market challenges in terms of the misalignment between changing job requirements and the skills available in the workforce. Understanding the nature of these mismatches and the extent to which education and training systems can address them, has therefore become a central policy priority, shaping the growing emphasis on skilling, upskilling and reskilling initiatives across sectors and occupations.

Figure 1 Total Employment in EU-27 (millions of workers). Trend and forecast from 2010 to 2035.



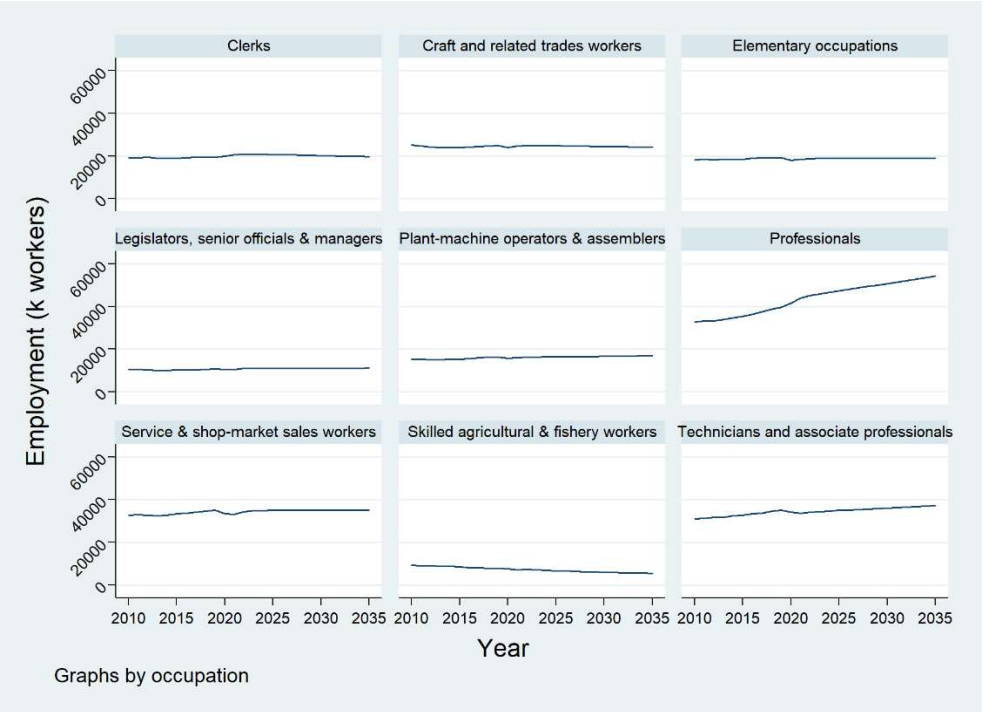
Source: Author's elaboration on CEDEFOP data (2023) downloaded in November 2025.

Figure 2 Total Employment (thousands of workers) in EU-27 by broad sector. Trend and forecast from 2010 to 2035.



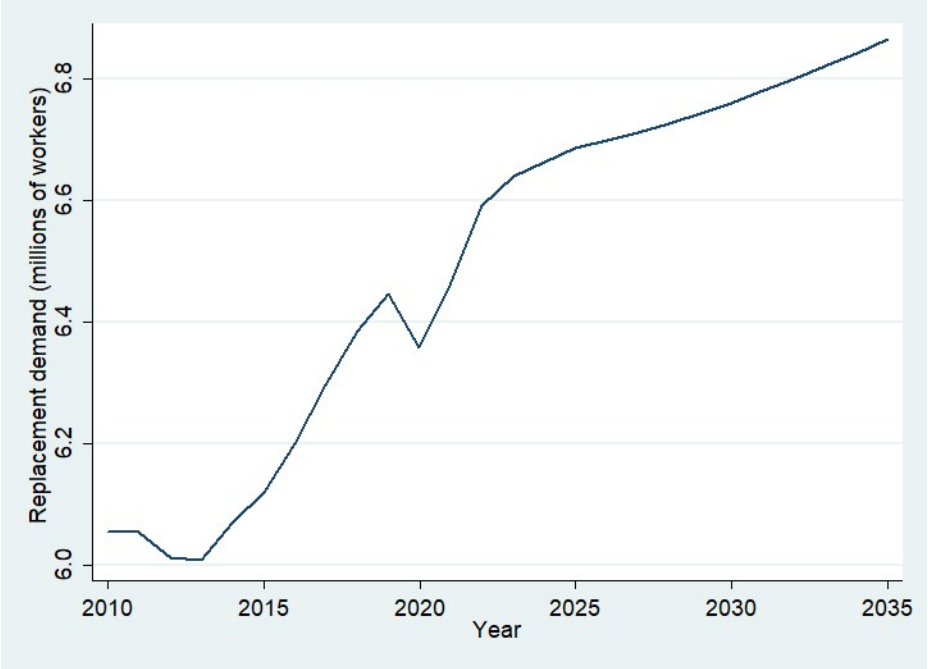
Source: Author's elaboration on CEDEFOP data (2023) downloaded in November 2025.

Figure 3 Total Employment (thousands of workers) in EU-27 by occupation (ISCO 1d). Trend and forecast from 2010 to 2035.



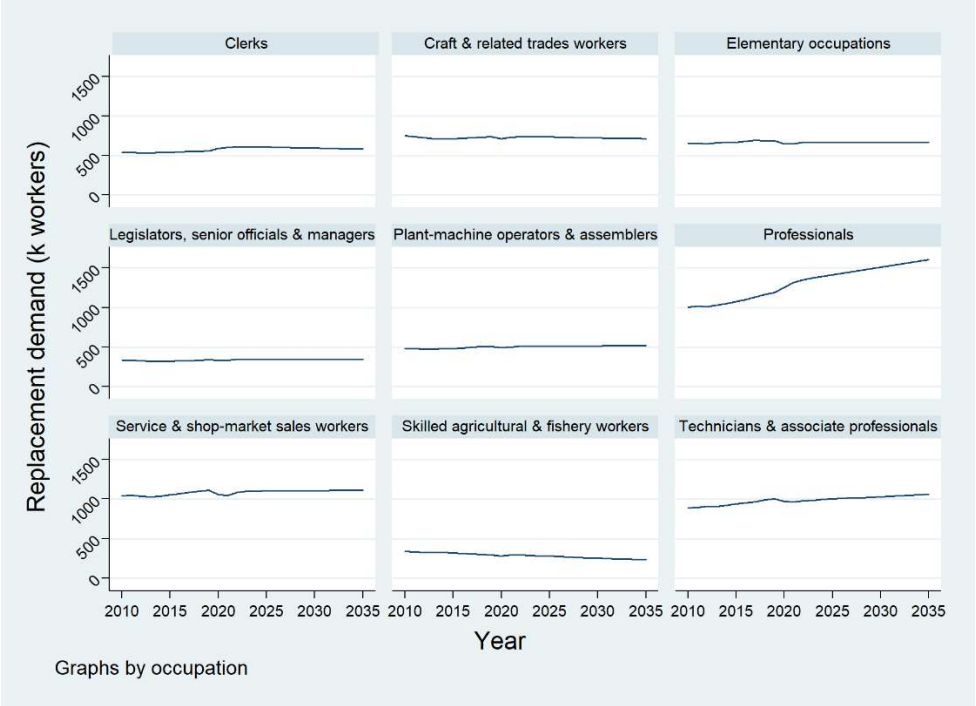
Source: Author's elaboration on CEDEFOP data (2023) downloaded in November 2025.

Figure 4 Replacement demand in EU-27 (millions of workers). Trend and forecast from 2010 to 2035



Source: Author's elaboration on CEDEFOP data (2023) downloaded in November 2025.

Figure 5 Replacement demand (k workers) in EU-27 by occupation (ISCO 1d). Trend and forecast from 2010 to 2035



Source: Author's elaboration on CEDEFOP data (2023) downloaded in November 2025.

2. Labour Mismatch, Education and Training

The structural changes in employment patterns presented in section 1 raise important questions about how the workforce adjusts to the evolving job requirements. This section examines the concept of skill mismatch, focusing on the extent to which existing education and training systems are able to align workers' skill profiles with the changing content of jobs.

The concept of mismatch has been extensively developed in the labour economics literature and is widely used by international organisations to describe situations in which workers' qualifications or skills do not correspond to those required by their jobs. According to the International Labour Organization (ILO) guidelines concerning measurement of qualification and skill mismatch (ILO, 2018), a person in employment can experience two main forms of mismatch: qualification mismatch and skill mismatch[vi].

Qualification mismatch refers to situations in which a person occupies a job whose qualification requirements do not correspond to the qualification level they possess. It can concern the level of education (vertical mismatch: persons can be under- or over-educated) or the field of study (horizontal mismatch). Instead, skill mismatch refers to situations in which a person in employment occupies a job whose skill requirements do not fully correspond to their actual skill endowments. Skill mismatch can refer to overall skills or types of skills. When considering the type of skill, mismatch is related to: a) job-specific/technical skills, i.e. skills directly related to the performance of specific tasks within a particular occupation, profession, or sector, such as ability to operate a machine; b) basic skills, i.e. foundational cognitive abilities such as literacy; c) transferable skills, i.e. skills that are applicable across different occupations, sectors, and work contexts, such as problem solving. For each category of skills, similarly to education mismatch, a person in employment can be under- or over-skilled.

Taken in its micro-perspective, the concept of mismatch captures the misalignment between a worker's education or skill endowment and the characteristics of the job they occupy. Beyond individual job matches, however, the notion of mismatch is also used in a broader labour market perspective, to characterise a situation where industries, occupations, locations or groups with different levels of education/skills diverge over time in the unemployment-to-vacancies ratio (CEDEFOP, 2010; European Commission, 2014). Indeed, persistent divergences in this ratio across industries, occupations, or regions signal frictions in the allocation of labour that cannot be explained by aggregate labour supply or demand alone

Skill mismatches can manifest either as skill gaps, when workers' competences do not fully meet job requirements, or as skill shortages, when employers face difficulties in recruiting workers with the required skill profiles. Both concepts are useful for the purpose of our

analysis. The concept of skill gaps follows a more micro-logic and usually refers to insufficient proficiency in required skills of employed workers at individual or firm-level. Skill shortages follow a macro perspective and, in a widely adopted approach, refer to skill-related labour market shortages, namely a situation in which labour markets experience an insufficient supply of workers with specific skills (CEDEFOP, 2015) Some scholars often use the concept of skill shortage to refer to aggregate mismatch between the available skills and jobs (Shah and Burke, 2003).

While detailed analysis of skill gaps at country, sectoral and firm level is the final purpose of this report, in this first part of the analysis, we mainly focus on the aggregate level, looking at the concept of skill shortages.

Literature observes that shortages may arise because of the differential dynamics between skill demand and skill supply and can be driven by different factors, such as demography, sectoral restructuring, technological change, business cycle movements, geographic barriers, information gaps, and institutional constraints (CEDEFOP, 2015).

Following this approach, skill shortages can be understood as a reflection of structural imbalances between the supply of skills produced by education and training systems and the evolving demand for skills generated by firms and sectors.

In the current context, this structural imbalance seems to be mainly driven by the speed of labour market changes, depending on the twin transition as well as on demographic trends and institutional settings. According to OECD (2023), "the speed and complexity of changes associated with green and digital transition require profound transformations in how education systems equip young people with the skills, as well as the knowledge and attitudes, to thrive in the future" (OECD, 2023, p. 23).

In practice, policy analysts argue that the speed of change requires workers to be continuously updated to new innovations. Since "the speed of climate change and recent technological innovation is not matched by the speed of change in education and skills policies" (OECD, 2023, p. 20) a rethinking of skill policies as well as of education and training systems (which should be more based on lifelong learning) is deemed to be essential. A dominant idea is that, rather than being the result of temporary job search frictions, persistent skill mismatches contribute to structural unemployment, limiting the efficient allocation of labour and slowing productivity growth even in contexts of overall employment expansion and technological innovation (OECD, 2023).

The OECD argues for rethinking the classification of skill endowments along a purely vertical axis. This vertical perspective - typically distinguishing workers as ‘low-skilled’ manual

workers or ‘high-skilled’ professionals - reflects a traditional view of skill acquisition that relies primarily on formal educational qualifications obtained through schooling. Such a classification is argued to weaken incentives for lifelong learning, as it implicitly frames skill development as a one-off process completed early in the life course, both for workers classified as low- and high-skilled. Instead, the OECD advocates a more horizontal approach to skills, emphasising the transferability, and continuous development of skills across occupations and over time.

Policy responses to mismatch traditionally distinguish between the role of education systems and that of training systems. Formal education plays a fundamental role in shaping long-term qualification structures and in addressing mismatches related to educational attainment and fields of study. However, it is observed that education systems tend to respond slowly to changing labour market needs and are less suited to addressing rapidly emerging skill requirements. By contrast, vocational education and training (VET), continuous vocational training and adult learning systems are more flexible and better positioned to respond to dynamic skill mismatches. Training interventions can target specific skill gaps, support reskilling besides upskilling, and facilitate workers' adaptation to changing task requirements within existing occupations.

This distinction appears particularly relevant in the current context of labour market transformation. As discussed in the previous section, employment change in Europe is increasingly driven not by the disappearance of occupations, but by changes in task content within occupations and by significant replacement demand. In such a context, mismatches arise not only because workers lack formal qualifications, but because their skill profiles do not evolve at the same pace as job requirements. This highlights the limits of purely education-based responses to labour market imbalances.

However, while increasing emphasis is placed on horizontal skill formation and on the need to promote a culture of lifelong learning, policy analysts observe that such a process should be accompanied by fostering equal access to education and training opportunities. Not only skills, but also attitudes have a crucial role in ensuring people have the predisposition and flexibility to continuously adapt their knowledge and skills over the adult life (OECD, 2023b)

In the European context, where demographic ageing, digitalisation and the green transition are reshaping labour demand, skill mismatch has therefore become a central policy concern. Following the dominant policy approach, addressing mismatch increasingly requires a shift from a "static" view of qualifications towards a "dynamic" understanding of skills, emphasising lifelong learning, modular training pathways and closer links between training provision and labour market needs. This perspective places skill mismatch - rather than educational

mismatch alone - at the core of current labour market challenges and sets the foundation for analysing how training systems can be designed to support workforce adaptability and resilience in the face of ongoing transformation.

Following this perspective, the growing emphasis on skills reflects not only the specific dynamics of mismatch observed in contemporary labour markets, but also a broader rethinking of the role of education, increasingly understood as a process aimed at developing individuals' capabilities rather than merely supplying job-specific qualifications (Leoni, 2025). In this sense, a focus on skills does not imply a marginalisation of education, but rather a redefinition of its function within a dynamic and lifelong learning framework. While this report follows a task-based approach and the logic presented above, it does not ignore the indisputable role of education. Beyond its strategic importance for individuals' socio-cultural formation, education also plays a crucial role from a market-oriented perspective, by fostering cognitive abilities, learning attitudes and behavioural predispositions that constitute necessary preconditions for workers to remain open and able to adapt to evolving skill needs over the working-life course.

3. Demand and Supply of Skills

Understanding skill mismatches require examining both sides of the labour market. This section adopts an explicit demand-supply perspective to analyse how skill requirements and skill provision interact over time.

As discussed in previous sections, technological change, the green transition and demographic trends are not only altering employment levels and occupational structures but are substantially reshaping the types of skills required by employers and calling for a rethinking of the ways in which these skills are produced, updated and maintained over time. To properly understand skill mismatches, the analysis therefore needs to move beyond a static description of labour market outcomes and adopt an explicit demand-supply perspective on skills.

The OECD analyses emphasise that skill mismatches emerge when the skill profiles demanded by firms diverge from those supplied by workers, which are largely shaped by education systems and training institutions. From this perspective, the labour market can be understood as a mechanism that matches bundles of skills, rather than qualifications alone, to evolving job requirements.

Skill demand is driven by firms' production technologies, organisational models and strategic choices, including the greening of developed economies, while skill supply reflects the combined output of formal education, vocational training, lifelong learning systems and individual career trajectories (OECD, 2017; OECD, 2023). Mismatches arise when these two sides fail to adjust at the same pace or in a coordinated manner.

On the demand side, OECD evidence highlights that skill requirements are becoming more complex, hybrid and task specific. Digitalisation is increasing demand for both advanced ICT skills and complementary competences such as problem-solving, adaptability and communication. At the same time, the green transition is generating demand for new technical skills related to energy efficiency, sustainable production and environmental management, while also transforming skill requirements within existing occupations as it happens in manufacturing incorporating the knowledge and the ability to use automation systems and AI (McKinsey&Company, 2018) Importantly, as already highlighted in section 1, these changes rarely translate into entirely new occupations; instead, they are reflected in changes in task content and rising skill intensity within existing jobs. As a result, skill demand is increasingly dynamic, evolving within occupations rather than only across them.

On the supply side, OECD points to persistent structural rigidities. Education systems play a central role in shaping foundational skills and qualifications, but their capacity to respond

rapidly to changing market needs is limited. Skill supply is heavily influenced by education choices made early in an individual's life course, which may no longer align with labour market demand years later. Moreover, participation in adult learning and training remains uneven across countries, sectors and population groups, contributing to unequal adjustment capacities across the workforce. These patterns are particularly relevant in Europe, where ageing populations increase the importance of continuously updating the skills of the existing workforce rather than relying solely on new labour market entrants.

A key insight from OECD's skills framework is that mismatches are not solely the result of insufficient skill supply, but also of weak coordination between demand and supply. Information failures, imperfect forecasting of skill needs and limited involvement of employers in training design can all exacerbate mismatches, even in contexts where training provision is relatively abundant. From this perspective, skill mismatches reflect governance and coordination challenges as much as quantitative and qualitative imbalances.

CEDEFOP (2015) reinforces and complement this interpretation, by highlighting that skill gaps are shaped not only by institutional factors but also by individual readiness to engage in learning. Foundational education plays a critical role in this process, as it is within initial education systems that learning attitudes, motivation and the capacity for continuous skills development are primarily formed. At the same time, motivation, attitudes towards training and the ability to participate in lifelong learning significantly influence the effective availability of skills, pointing to the need for policy frameworks that support both strong basic education and accessible adult learning opportunities.

Taken together, these elements suggest that addressing skill mismatches requires a comprehensive understanding of how skill demand and supply interact over time. Policies aimed at improving labour market outcomes must therefore consider not only the volume of skills produced, but also their relevance, adaptability and timing. At the same time, providing a detailed empirical assessment of skill gaps remains challenging. Key difficulties stem from the speed at which skill demands evolve compared to the capacity of institutions to collect and analyse data, as well as from strong heterogeneity across countries and economic sectors. Differences in productive structures make it difficult to develop highly granular analyses at an aggregate level, while country-specific analyses, although informative, capture only partial aspects of a highly integrated European labour market, where firm- and sector-level choices can have cross-border effects.

Taking these limitations into account, the following sub-sections present selected aggregate indicators on skill demand, skill supply and skill development, and discuss key findings from international reports.

3.1 Skill Demand

3.1.1 Eurostat data

The following analysis draws on multiple data sources to map skill demand patterns across European economies.

Eurostat's firm level Continuing Vocational Training (CVT) survey provides useful informative data on skill demand, collected across EU countries in four reference years: 2005,: 2010, 2015 and 2020. Despite offering detailed information at the country and firm levels, the data are still relatively aggregated in their categorisation of skills. Moreover, some of the databases build by micro-data collected through the CVT survey provide availabe data only from 2010 to 2020.

Table 1 reports the percentage of firms that identify each skill category (distinguishing between general IT skills, professional IT skills and management skills) as critical for their development. The figures therefore reflect the share of enterprises perceiving specific skill domains as strategically important for their future growth and competitiveness[vii]. Overall, the table highlights both a significant shift in the composition of employer-perceived skill needs over time and a marked cross-country heterogeneity.

At the aggregate EU level, the share of enterprises identifying general IT skills as a strategically important declined sharply from 43.6% in 2010 to 19.3% in 2015, before slightly increasing to 21.5% in 2020. This decline does not indicate a reduced importance of digital skills, but rather their progressive normalisation as basic requirements. As digital technologies became embedded in standard work processes, general IT skills increasingly shifted from being perceived as strategic bottlenecks to minimum entry conditions. In other words, this pattern reflects a process of diffusion and partial saturation of basic digital skills across firms.

A similar, though less pronounced, trend can be observed for management skills, whose reported importance steadily declined between 2010 and 2020. Again, such a trend possibly reflects organisational adjustments and the routinisation of management practices over time: while management skills were perceived as essential in a context where they were relatively scarce, their subsequent diffusion has led them to be regarded as a minimum requirement rather than a distinctive asset.

Professional IT skills show a marked decline between 2010 and 2015 across most countries, followed by a moderate recovery in 2020. However, even after this rebound, their reported importance generally remains below 2010 levels. This pattern suggests not a straightforward expansion of advanced digital skill demand, but rather a partial rebalancing after an earlier

contraction. Compared with general IT skills, which experience a sharper initial drop and only a limited recovery, professional IT skills appear to stabilise at a lower but more persistent level of perceived criticality. This may indicate a consolidation phase in which only a subset of firms continues to regard specialised IT capabilities as strategically essential, with implications for the increasing segmentation of digital skills needs across enterprises

Overall, such evidence supports the view that skill demand is becoming increasingly selective and firm-specific, with important implications for training systems.

Contexts also seem to matter since cross-country differences are substantial. Countries such as Denmark, Germany, Finland, Belgium and Lithuania report consistently high demand for general IT skills. In most countries, around one quarter of firms considered general IT skills as strategic for development in 2020. In several Central and Eastern European countries, general IT skills were particularly important in 2010, followed by a marked decline in subsequent years, pointing to a process of rapid catch-up in basic digital skills.

Between 2015 and 2020, most countries recorded an increase in the share of firms identifying general IT skills as strategic, while only a limited number followed a different trajectory, including Estonia, Ireland, France, Italy, Latvia, Malta and Sweden.

Looking at professional IT skills, only Italy shows a sizeable increase between 2015 and 2020 and is the only country where approximately one quarter of firms identified this type of skill as strategic in 2020. However, the general pattern of increasing importance of professional IT skills in the late 2010s is not observed in a small group of countries, including Denmark, Ireland, Greece, Latvia and Portugal. A relatively high share of enterprises in Ireland and Spain continued to identify management skills as critical for development in 2020, underlining the role of organisational and leadership capabilities in supporting innovation and growth.

Table 2 complements this picture by highlighting sectoral heterogeneity. In 2020, the sectors in which general IT skills were most frequently considered important include NACE L-N-R-S, i.e., real estate activities, professional, scientific and technical activities, administrative and support service activities, arts, entertainment and recreation, and other service activities. In this macro sector more than one quarter of firms (25.8%) consider general IT skills crucial for development. By contrast, professional IT skills were considered strategic by nearly one firm out of two (46%) in the information and communication and financial and insurance activities sectors (i.e., NACE J-K), confirming the strong concentration of advanced digital skill demand in ICT-intensive activities. Across sectors, demand for general IT skills declined sharply between 2010 and 2020, although a slight recovery relative to 2015 can be observed in industry

and in L-N-R-S services. Management skills remain particularly relevant in sectors J-K (29.3% in 2020), despite a consistent decline in their reported importance since 2010.

Table 3 provides further evidence by illustrating firms' responses to skill needs by NACE sector. The data in the Table distinguish among firms: i) investing in continuing vocational training, ii) relying on internal reorganisation, iii) recruiting new staff and iv) combining training and recruitment strategies. At the aggregate level, continuing vocational training was the most adopted strategy in 2010 (58.8%), closely followed by external recruitment (56.6%), while 30.7% of firms pursued both strategies simultaneously. In 2015 and 2020, the overall pattern changes only gradually, with recruitment becoming the most widespread strategy in 2020 (66%). Overall, over time continuing vocational training and internal reorganisation display moderate growth, while the most pronounced rise concerns recruitment combined with specific training, suggesting a growing need for tailored skill acquisition. Rather than indicating a substitution between internal development and external hiring, the data points to a cumulative intensification of firms' responses to evolving competence requirements. Sectoral differences are also marked: knowledge-intensive services (J–K) systematically report the highest engagement across all strategies, whereas more traditional service sectors (G–I) exhibit comparatively lower involvement, particularly in recruitment combined with training. Manufacturing and construction (B–E) show a more dynamic trajectory: although initially closer to or slightly below the aggregate average, the sector records one of the largest increases over time in continuing vocational training, exceeding the overall average by 2020. This suggests a gradual process of adjustment in sectors traditionally less associated with continuous skill upgrading.

Table 4 provides additional evidence on digital and green skills by reporting the share of all firms employing ICT specialists, based on Eurostat's ICT usage and e-commerce survey. For some sectors historical data is not continuously available due to breaks in the time series[viii]. Looking at the Table, with the exception of construction (NACE F) and accommodation and food service activities (NACE I), in all sectors at least 10% of firms employed ICT specialists already in 2014. NACE F and I are the only sectors for which the share of firms employing ICT specialists does not increase over the period 2014-2024. As expected, ICT specialists are most widespread in the information and communication sector (sector J, where specialists work in more than 70% of firms), followed by the energy/utilities (NACE D, approximately 47%) and professional /technical activities (NACE M, around 31%) sectors.

Tables 5 and 6 provide further insights into demand for digital skills. Table 5 shows the share of firms that recruited or attempted to recruit personnel having ICT specialist skills. Net of time-series interruptions, all sectors display a positive or stable trend between 2014 and 2024.

Sector J shows the highest diffusion of enterprises demanding digital skills, followed by sector D. Although sectors C, G, H and N report lower shares of enterprises recruiting ICT specialists, they exhibit sizeable growth over the period, suggesting a diffusion of specialistic digital skill demand beyond traditionally ICT-intensive activities.

Table 6 highlights recruitment difficulties for ICT specialist roles. On average, 5.4% of enterprises reported hard-to-fill vacancies in 2024, with substantial heterogeneity across sectors. Sectors with higher demand, such as J and D, also experience the greatest recruitment difficulties, while sector M records above average difficulty levels as well.

Figure 6 shows employment trends in circular economy sectors, defined by Eurostat as including recycling, repair and reuse, and rental and leasing activities. Employment in these sectors has increased steadily since 2007, with temporary interruptions in 2020 and 2022 due to the COVID-19 pandemic. In 2023, employment reached 4.3 million workers, only slightly below the levels observed in 2019 and 2021. Even accounting for the pandemic shock, the average growth rate over the period is around 1.2%, confirming the structural expansion of circular economy activities.

Table 1. Main skills needed for the development of the firm by country and type of skill (% of all firms). EU 27.

	General IT skills			Professional IT skills			Management skills		
	2010	**2015**	**2020**	**2010**	**2015**	**2020**	**2010**	**2015**	**2020**
EU - 27 (from 2020)	43.6	19.3	21.5	21.9	11.4	13.0	37.9	24.4	23.1
Belgium	50.0	27.3	32.5	11.5	6.0	6.5	28.4	16.2	14.8
Bulgaria	61.8	20.6	23.7	28.3	10.5	10.9	38.8	6.5	6.4
Czechia	27.7	19.8	24.5	13.1	4.8	5.4	32.2	12.5	11.9
Denmark	51.5	29.2	31.4	24.8	14.3	11.9	45.4	30.8	26.4
Germany	56.4	31.2	35.1	11.3	8.0	9.8	34.5	13.4	13.8
Estonia	57.4	19.9	18.8	30.5	11.6	13.8	45.1	23.1	16.5
Ireland	:	23.5	15.0	:	11.4	9.9	:	36.4	32.1
Greece	45.0	29.2	29.6	31.2	18.0	16.5	34.3	14.8	14.9
Spain	47.3	10.2	15.8	22.9	6.5	7.4	27.1	49.6	44.3
France	37.3	11.1	10.8	30.2	12.3	15.4	49.5	29.5	29.5
Croatia	60.6	40.9	43.2	12.8	7.7	8.2	49.2	17.5	21.7
Italy	48.5	16.4	15.5	27.9	19.6	24.1	38.6	28.1	22.8
Cyprus	53.5	21.4	26.4	35.6	10.7	13.5	60.3	15.8	18.7
Latvia	24.0	16.7	15.5	17.1	9.2	8.8	23.9	9.6	10.5
Lithuania	54.4	34.7	38.0	27.5	10.8	14.1	48.9	30.7	27.1
Luxembourg	52.2	22.4	23.2	16.3	9.6	10.5	33.	15.6	20.1
Hungary	25.5	19.7	27.3	19.7	18.5	19.5	13.4	8.2	10.5
Malta	51.8	18.4	17.0	20.1	7.5	10.2	47.8	34.2	28.1
Netherlands	33.1	13.6	16.4	12.2	9.4	10.6	39.	23.2	22.7
Austria	54.1	18.8	23.1	31.3	7.9	10.1	55.5	15.9	16.1
Poland	15.7	11.6	12.2	11.4	8.3	9.0	23.2	17.3	17.4
Portugal	43.6	28.9	30.0	31.3	19.5	19.3	44.	23.7	21.
Romania	20.4	13.4	13.9	16.5	13.0	9.2	39.2	31.6	30.1
Slovenia	70.1	19.7	20.4	19.8	8.8	13.6	62.9	25.8	24.4
Slovakia	60.2	23.6	28.9	35.1	14.5	16.4	64.7	24.2	22.9
Finland	55.2	16.7	23.3	26.0	10.9	14.5	63.4	41.5	50.3
Sweden	40.7	:	14.9	28.7	:	11.6	44.4	:	34.2

Source: Eurostat (2025- CVT Survey).

Table 2. Main skills needed for the development of the enterprises by type of skill and NACE rev.2 (% of all firms). EU-27.

NACE rev.2	B-E	F	G-I	J-K	L-N-R-S
YEAR	GENERAL IT SKILLS				
2010	42.1	34.4	43.0	57.7	50.2
2015	17.5	14.7	19.6	24.7	22.2
2020	19.9	14.2	22.4	22.2	25.8
	PROFESSIONAL IT SKILLS				
2010	20.7	17.2	18.4	54.7	25.7
2015	10.8	6.7	7.9	47.5	11.9
2020	12.8	7.3	9.9	46.7	13.0
	MANAGEMENT SKILLS				
2010	39.3	33.7	35.7	51.8	40.0
2015	26.3	20.7	24.3	31.6	22.6
2020	24.3	20.5	22.7	29.3	22.5

Note: B-E: Industry (except construction); F: Construction; G-I : Wholesale and retail trade, transport, accommodation and food service activities; J-K: Information and communication; financial and insurance activities; L-N-R-S: Real estate activities; professional, scientific and technical activities; administrative and support service activities; arts, entertainment and recreation; other service activities

Source: Eurostat (2025- CVT Survey).

Table 3. Reactions to future skill needs by NACE Rev 2 (% of all firms). EU-27.

	NACE rev 2	**TOT**	**B-E**	**F**	**G-I**	**J-K**	**L-N-R-S**
YEAR	REACTION						
2010	Continuing vocational training of current staff	58.8	54.9	62.8	55.5	71.6	64.6
	Internal reorganisation to better use existing skills and competences	51.2	52.3	48.0	49.8	58.2	53.1
	Recruitment of new staff with suitable qualifications, skills and competences	56.6	55.1	57.7	54.7	63.8	60.0
	Recruitment of new staff combined with specific training	30.7	30.6	28.0	28.7	39.3	34.6
2015	Continuing vocational training of current staff	62.3	61.1	63.4	59.5	74.3	65.0
	Internal reorganisation to better use existing skills and competences	53.5	55.2	48.5	52.3	62.0	54.1
	Recruitment of new staff with suitable qualifications, skills and competences	62.3	61.6	57.7	60.9	70.4	66.5
	Recruitment of new staff combined with specific training	36.0	36.3	28.2	35.0	43.9	40.0
2020	Continuing vocational training of current staff	64.3	66.2	64.3	59.7	76.0	68.0
	Internal reorganisation to better use existing skills and competences	54.7	58.2	48.3	53.8	61.6	55.3
	Recruitment of new staff with suitable qualifications, skills and competences	66.0	65.8	63.1	64.6	74.2	68.1
	Recruitment of new staff combined with specific training	43.2	47.6	39.9	40.8	51.9	43.2

Note: B-E: Industry (except construction); F: Construction; G-I : Wholesale and retail trade, transport, accommodation and food service activities; J-K: Information and communication; financial and insurance activities; L-N-R-S: Real estate activities; professional, scientific and technical activities; administrative and support service activities; arts, entertainment and recreation; other service activities. Source: Eurostat (2025-CVT Survey).

Table 4. Firms employing IT specialists by NACE Rev. 2 sector (% of all firms), EU-27.

NACE rev 2		2014	2015	2016	2017	2018	2019	2020	2022	2024
C	Manufacturing	20.17	20.73	20.6	19.7	19.6	20.8	20.6	21.5	20.62
D	Electricity, gas, steam and air conditioning supply	:	:	:	:	:	:	:	48.5	47.87
E	Water supply; sewerage, waste management and remediation activities	:	:	:	:	:	:	:	24.5	22.53
F	Construction	8.13	8.03	8.12	8	7.5	8.22	8.41	8.75	7.97
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	18.5	18.94	19.7	18.2	18.3	18.9	18.6	20.4	19.12
H	Transportation and storage	13.68	14.42	12.9	13.7	12.5	12.6	13.6	16	14.96
I	Accommodation and food service activities	8.16	7.72	7.82	6.88	7.86	7.42	6.18	8.14	7.66
J	Information and communication	72.76	74.79	75.3	73.8	73.5	73.1	72.4	76.8	76.24
L	Real estate activities	:	:	:	:	:	:	:	24.3	21.94
M	Professional, scientific and technical activities	:	:	:	:	:	:	:	31.6	30.89
N	Administrative and support service activities	15.31	17.4	16.1	16.3	17.4	16.7	17.7	18.8	18.3

Note: populations include enterprise with 10 or more employees; data for Nace A and B are not available; ":" indicates not available data. Source: Eurostat (2025) (European ICT usage survey).

Table 5. Firms that recruited or attempted to recruit personnel for jobs requiring ICT specialist skills by NACE Rev. 2 sector (% of all firms), EU-27.

Nace rev 2		2014	2015	2016	2017	2018	2019	2020	2022	2024
C	Manufacturing	5.41	6.1	6.2	6.6	7.01	7.5	6.9	7.54	7.86
D	Electricity, gas, steam and air conditioning supply	:	:	:	:	:	:	:	23.9	26.3
E	Water supply; sewerage, waste management and remediation activities	:	:	:	:	:	:	:	7.55	8.44
F	Construction	2.58	2.69	2.2	2.7	2.77	2.98	2.9	3.22	2.58
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	6.24	6.32	7	6.5	7.35	7.66	6.9	7.98	8.34
H	Transportation and storage	4.46	4.36	4.8	5.4	4.78	4.75	5.1	5.43	6.03
I	Accommodation and food service activities	3	2.87	3.3	2.5	2.49	2.97	2.6	3.12	2.97
J	Information and communication	47.6 4	50.4	53	55	54.9	56.3	53	58.3	56
L	Real estate activities	:	:	:	:	:	:	:	9.14	8.09
M	Professional, scientific and technical activities	:	:	:	:	:	:	:	15.3	15.7
N	Administrative and support service activities	6.28	6.58	6.1	8.1	8.26	8.43	8.1	8.31	cc

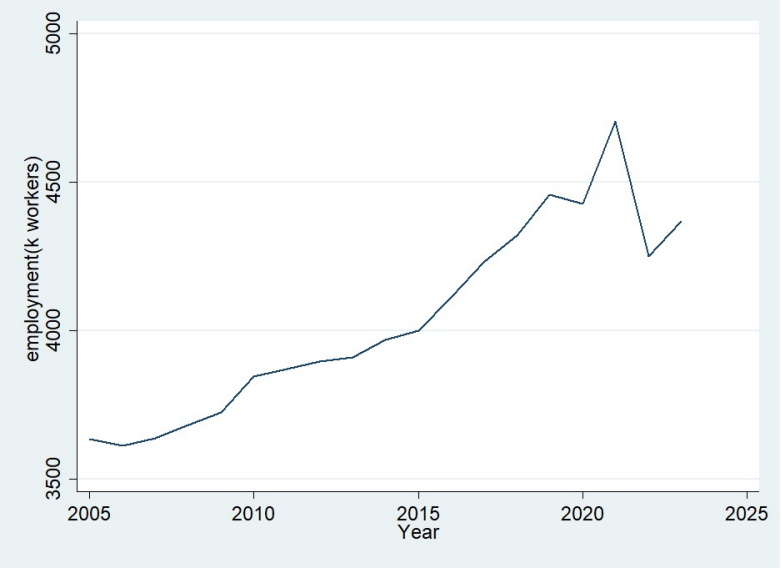
Note: population includes enterprise with 10 or more employees; data for Nace A an B are not available; ":" indicates not available data. Source: Eurostat (2025) (European ICT usage survey).

Table 6. Enterprises had no hard-to-fill vacancies for jobs requiring ICT specialist skills- EU 27 (% of all firms)

Nace rev 2		2014	2015	2016	2017	2018	2019	2020	2022	2024
C	Manufacturing	3.76	4.13	3.87	3.83	3.49	3.49	3.39	3.19	3.44
D	Electricity, gas, steam and air conditioning supply	:	:	:	:	:	:	:	7.81	9.04
E	Water supply; sewerage, waste management and remediation activities	:	:	:	:	:	:	:	3.52	4.09
F	Construction	1.82	2.2	1.64	1.8	1.92	2.05	2.09	1.85	1.48
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	4.19	4.41	4.57	3.88	3.94	3.67	3.43	3.17	3.94
H	Transportation and storage	3.27	2.94	3.47	3.32	2.58	2.53	2.7	2.61	2.56
I	Accommodation and food service activities	2.49	2.27	2.74	1.89	1.76	1.96	2.1	2.06	1.8
J	Information and communication	21.3	21.8	19.7	17.9	15.1	13.8	14.7	13.1	19.1
L	Real estate activities	:	:	:	:	:	:	:	5.06	4.3
M	Professional, scientific and technical activities	:	:	:	:	:	:	:	5.21	6.39
N	Administrative and support service activities	3.71	4.25	3.59	4.61	3.77	3.56	3.62	3.54	3.61

Note: population includes enterprise with 10 or more employees; data for Nace A an B are not available; ":" indicates not available data. Source: Eurostat (2025) (European ICT usage survey).

Figure 6. Workers employed in circular economy sectors (thousands of workers)



Note: employed in the recycling sector, repair and reuse sector and rental and leasing sector.

Source: Eurostat (2025).

3.1.2 Evidence from other international reports

Other international reports further complement Eurostat evidences.

A particularly detailed analysis of skill demand emerges from the OECD Skills Outlook 2023[ix]. By framing its analysis around the "Resilient Green and Digital Transition", the OECD emphasises that the twin transition to digitalisation and environmental sustainability requires a broad set of skill and competencies beyond traditional technical abilities, including information-processing, socio-emotional, and adaptive capacities that enable individuals to navigate and apply complex knowledge in environmental and technological contexts. These capacities are identified as critical enablers of both green and digital transitions, as they underpin individuals' ability to access, interpret and act on information associated with environmental challenges and digital change. More broadly, international reports tend to maintain a conceptual distinction between skills and competences while often treating them jointly for analytical purposes, reflecting the integrated nature of work requirements in contemporary labour markets and aligning with task-based approaches that focus on how these requirements combine within occupations.

OECD projections combine online vacancy data (extracted from the Lightcast commercial platform) with sectoral employment projections. Natural language processing and text-mining techniques are applied to job postings to quantify the frequency with which specific skills are required by employers. These frequency measures are then interpreted in the context of sectoral employment levels and projected labour force trends. This methodology enables meaningful comparisons across skills and the identification of relative trends. In such analysis, the use of term “skill” is even more extensive than other works. As explained by Borfonovi et al. (2023), skill is used as an overarching term to refer to skills, knowledge and abilities as normally classified in ESCO and O*NET.

Figure 7 reproduces Table 3.1 of the OECD Skills Outlook 2023 (pp. 84-85), showing projected changes in skill demand between 2019 and 2030 under the Fit for 55 scenario. Skills (in this broad definition) are grouped into six categories—Skills, Knowledge, Abilities, Technology Skills and Tools, Work Activities and Work Styles—following the O*NET classification, and ranked by quartiles of projected change.

Among the skills with fastest-growing demand, several are related to digital technologies and dynamic task profiles, including computers and electronics, programming, web platform development, analytical or scientific software, interacting with computers and analysing data or information. At the same time, several transversal skills are projected to grow strongly, such

as creative thinking, communication with external stakeholders, and organising, planning and prioritising work.

The report further shows that within the Technology Skills and Tools category only a small subset of skills (around 7%) belongs to the group with the highest projected growth, while a much larger share is expected to grow more slowly. This highlights that digital skill demand is increasingly selective and specialised rather than uniformly expanding across all technological domains. Conversely, declining demand is concentrated in skills related to routine manual and machine-operation tasks.

Overall, OECD evidence points to a polarisation of skill demand towards higher-order cognitive, digital and communication skills, reflecting the increasing complexity and hybridisation of tasks across occupations. Complementary OECD analysis on AI-related skills further suggests that, although AI-specific skills still represent a small share of total job postings, their demand is rising rapidly and is associated with a premium on leadership, innovation and problem-solving capabilities.

While the OECD report does not provide a detailed taxonomy of green-labelled technical skills, a growing body of research and international reporting indicates that the demand for green skills is expanding faster than supply in many labour markets. For example, LinkedIn's Global Green Skills research (2023) shows that job adverts requiring one or more green competencies, such as *sustainable procurement* or *climate action planning*, grew by more than 15% over a recent 12-month period, and workers with green skills were hired at a higher rate than those without during the same period. These trends are consistent across a large set of countries and suggest that green skill demand is becoming both more diffuse.

Nevertheless, according to the World Economic Forum (2025)–, digitalisation remains the single most important driver shaping skill demand over the coming years. This report stresses that growing demand does not concern only highly specialised ICT profiles, but increasingly affects a broad range of occupations through changes in task composition. Digital skills are described as becoming foundational across the labour market, rather than confined to technology-intensive sectors. Employers consistently report rising demand for skills related to AI and big data, technological literacy, programming and software development, cybersecurity, and digital systems design and maintenance. At the same time, the report highlights that purely technical digital competences are rarely sufficient on their own. The fastest-growing digital skill profiles are those combined with higher-order cognitive abilities such as analytical thinking, complex problem-solving, systems thinking, and creative thinking, reflecting the need to interpret, adapt and apply digital technologies within evolving organisational and production contexts.

Moving beyond evidence produced by international organisations and academic research, additional insights are offered by private-sector analytical agencies. In this regard, the consulting firm SIA Partners provides a relevant contribution in its report “Navigating the Landscape of Green Jobs” (SIA Partners, 2023). Drawing on cross-country web scraping of online job advertisements, the study analyses a dataset of 46,420 job postings from 433 companies and identifies 3,712 positions classified as green jobs. A job advertisement is defined as “green” if its textual description contains at least one skill labelled as green according to the ESCO taxonomy. Based on the analysis of these 3,712 green job postings, the report provides evidence on the sectoral distribution of green employment demand and on the skill composition associated with green job profiles. The results show a strong concentration of demand around a limited set of skills groups: renewable energy engineering, sustainability management, energy management, and environmental compliance represent 75% of the skills required. Together with waste management and recycling, electric vehicles and sustainable transportation, sustainable agriculture, environmental science, water and wastewater management, and forestry management, they account for nearly the entirety of observed demand (97.8%), indicating a high degree of specialisation within the green labour market.

Looking more in detail, these findings suggest that the highest levels of demand are associated with skills related to energy production and energy management. The growing relevance of renewable energy engineering reflects increased investment in clean energy infrastructure, including solar and wind farms, biogas plants and the upgrading of existing carbon-intensive infrastructure. Energy management skills, by contrast, focus on the efficient use of different forms of energy (electric, gas and thermal) and on reducing energy consumption and losses across production processes.

Beyond technical energy-related skills, significant demand is also observed for skills linked to organisational and regulatory adaptation. Sustainability management emerges as one of the most sought-after green skill categories, covering activities such as the development of corporate sustainability strategies, environmental education initiatives and the improvement of firms' environmental, social and governance performance. Closely related, environmental compliance skills, auditing and reporting to public authorities, reflect the tightening of regulatory frameworks and the growing importance of compliance in firms' operational strategies.

Overall, this evidence confirms that green skill demand is shaped both by sector-specific requirements and by broader organisational and regulatory pressures. From the perspective highlighted in this report, the green transition is driven less by the creation of entirely new occupations than by the transformation of existing jobs, through the integration of new

professional practices. This reinforces the need for targeted upskilling strategies capable of supporting both the introduction of new green skills and the adaptation of existing roles to evolving environmental standards.

In line with this evidence, the World Economic Forum's Future of Jobs Report 2025 emphasises that the green transition is expected to reshape existing jobs, embedding new environmental competences into traditional roles across industry and services. The green skills projected to grow most strongly include environmental stewardship, energy efficiency management, renewable energy technologies, sustainable resource management, and climate risk assessment. This report follows the World Economic Forum Global Skill Taxonomy[x], which treats skills, abilities and knowledge as an integrated category, emphasises that these skills are often hybrid in nature, combining technical knowledge with regulatory awareness, monitoring and reporting capabilities, and an understanding of environmental standards. As a result, green skills are increasingly required not only in energy and environment-related sectors, but also in manufacturing, construction, transport, logistics and business services, reinforcing the idea that sustainability-related competences are becoming transversal rather than sector-specific.

In one of the most comprehensive global analyses of how the transition to environmentally sustainable, low-carbon and resource-efficient economies affects labour markets, the ILO provides further useful evidence on green skill demand. The report "Skills for a Greener Future: A Global View", examines changes in occupations, skill gaps and skill shortages in 32 countries integrating both qualitative insights and quantitative analyses based on scenarios to 2030. The report underscores that the green transition generates two overlapping dynamics of skill demand: i) transformation of existing jobs, where incumbent occupations adapt to incorporate new environmental and sustainability-related tasks; ii) emergence of green job profiles, where new or significantly evolving roles arise in response to expanding segments of the green economy (e.g., renewable energy, circular economy).

Rather than adopting a rigid hierarchical taxonomy, the ILO groups green skills into broad functional categories to identify emerging skills demand. On the one hand this demand focuses on core and transferable skills associated with the transformation of existing jobs and required across all labour force. These skills include: i) Environmental awareness and respect; willingness to learn about sustainable development; ii) adaptability and transferability skills, to enable workers to learn and apply new technologies and processes required to green their jobs; iii) teamwork skills, reflecting the need for organisations to work collectively on tackling their environmental footprint; iv) resilience, to see through the changes required; v) communication and negotiation skills, to promote required change to colleagues and

customers; vi) entrepreneurial skills, to seize the opportunities of low-carbon technologies and environmental mitigation and adaptation.

In addition, more specialised skills required in medium-higher skilled occupations include: i) analytical thinking (including risk and systems analysis) to interpret and understand the need for change and the measures required; ii) coordination, management and business skills that can encompass holistic and interdisciplinary approaches incorporating economic, social and ecological objectives; iii) innovation skills, to identify opportunities and create new strategies to respond to green challenges; iv) marketing skills, to promote greener products and services; v) consulting skills, to advise consumers about green solutions and to spread the use of green technologies; vi) networking, IT and language skills, to perform in global markets; vii) strategic and leadership skills, to enable policy-makers and business executives to set the right incentives and create conditions conducive to cleaner production and cleaner transportation[xi]

The report emphasises that these categories cut across skill levels and occupational types: while low- and medium-skilled occupations typically require increased environmental awareness and simple task adaptations, higher-skilled occupations increasingly demand analytical, interdisciplinary and managerial competences to drive strategic transitions within firms and sectors. This demand intersects skills, knowledge and attitudes and spreads from specific green domains to entrepreneurship.

Taken together, the ILO evidence suggests that the demand for green skills is both broad and deep—spanning core transferable capabilities needed to transform existing jobs, and specialised competencies tied to the growth of green economic segments. This dual nature of skill demand implies a need for coordinated policies that support both upskilling of incumbent workers and development of new green specialisations across training systems and labour market institutions.

Alongside digital and green competences, the Future of Jobs Report 2025 highlights a strong and growing demand for entrepreneurial and managerial skills, reflecting firms' need to navigate uncertainty, rapid technological change and organisational transformation. These skills are not limited to entrepreneurs or top managers, but are increasingly expected across a wide range of professional and technical roles. Skills identified as growing most rapidly include entrepreneurial thinking, leadership and social influence, strategic thinking, innovation management, and resilience, flexibility and agility. The report underlines that such competences are crucial for translating technological and environmental change into productivity gains, enabling firms to reorganise work processes, adopt new business models and integrate new technologies effectively. In this sense, entrepreneurial skills act as a

connective layer between digital and green transitions, supporting the capacity of organisations and workers to adapt continuously rather than through episodic adjustments.

To conclude the analysis of skill demand, we rely on two synthetic figures from the World Economic Forum's Future of Jobs Report 2025 which identify a suite of core skills that are important today and are expected to be increasingly important by 2030, including leadership, resilience, flexibility, agility and social influence, alongside cognitive and technical abilities.

These skills are strongly associated with the capacity for organisational innovation, strategic decision-making and cross-functional problem solving—competencies that are widely recognised in the literature as central to entrepreneurial performance and enterprise adaptability in the face of rapid economic change. Figures 8 and 9 report figures 3.4 and 3.5 of the WEF report, ranking the core skills today and in 5 years.

Taken together, these sources suggest that future skill demand is not unidimensional: in addition to digital specialisations, structural labour market changes increase the salience of both green-oriented technical competencies and entrepreneurial/enterprise skills that cut across occupational and sectoral boundaries. These trends imply that both policy responses and training systems will need to integrate technical, cognitive and adaptive skill development to support individuals and firms in the transition to sustainable and innovative economic models.

Figure 7. Projected change in the demand for skills between 2019 and 2030 under the Fit for 55scenarios

Group 1: Top quartile of absolute increase	Group 2: Second quartile of absolute increase	Group 3: Third quartile of absolute increase	Group 4: Bottom quartile of absolute increase	Group 5: Skills declining in demand
Oral expression	Originality	Mathematical reasoning	Memorisation	Physics
Sales and marketing	Fluency of ideas	Fine arts	Written comprehension	Mechanical
Computers and electronics	Law and government	Transportation	Information ordering	Repairing
Language	Chemistry	Philosophy and theology	Therapy and counselling	Equipment maintenance
Economics and accounting	Biology	History and archaeology	Design	Offset printing presses
Customer and personal service	Public safety and security	Telecommunications	Systems evaluation	Injection moulding machines
Administration and management	Engineering and technology	Sociology and anthropology	Service orientation	Computer-aided manufacturing (CAM) software
Medicine and dentistry	Administrative	Judgement and decision making	Active listening	Lasers
Production and processing	Mathematics	Management of material resources	Critical thinking	Milling machines
Communications and media	Building and construction	Management of personnel resources	Resource management skills (general)	Handling and moving objects
Personnel and human resources	Psychology	Monitoring	Programme testing software	Repairing and maintaining mechanical equipment
Food production	Education and training	Systems analysis	Music or sound editing software	Repairing and maintaining mechanical equipment
Programming	Geography	Graphics or photo imaging software	Metadata management software	Controlling machines and processes
Time management	Management of financial resources	Database user interface and query software	Automatic teller machines (ATMs)	
Web platform development software	Complex problem solving	Enterprise application integration software	Information retrieval or search software	
Operating system software	Quality control analysis	Web page creation and editing software	Cloud-based data access and sharing software	
Analytical or scientific software	Database management system software	Spreadsheet software	Business intelligence and data analysis software	
Interacting with computers	Object or component-oriented development software	Internet browser software	Geographic information system	
Thinking creatively	Office suite software	Desktop publishing software	Access servers	
Analysing data or information	Configuration management software	Computer-based training software	Word processing software	
Assisting and caring for others	Development environment software	Inspecting equipment, structures, or material	Computer-aided design (CAD) software	
Communicating with persons outside an organisation	Enterprise resource planning (ERP) software	Operating vehicles, mechanised devices, or equipment	Optical character reader (OCR) or scanning software	
Performing general physical activities	Customer relationship management (CRM) software	Scheduling work and activities	Network monitoring software	

7 (Continuing)-

Group 1: Top quartile of absolute increase	Group 2: Second quartile of absolute increase	Group 3: Third quartile of absolute increase	Group 4: Bottom quartile of absolute increase	Group 5: Skills declining in demand
Provide consultation and advice to others	Application server software	Identifying objects, actions, and events	Transaction security and virus protection software	
Guiding, directing, and motivating subordinates	Presentation software	Training and teaching others	Video creation and editing software	
Performing administrative activities	Documenting/recording information	Coaching and developing others	Object-oriented database management software	
Establishing and maintaining interpersonal relationships	Communicating with supervisors, peers, or subordinates	Getting information	Safety harnesses or belts	
Organising, planning, and prioritising work	Performing for or working directly with the public	Evaluating information to determine compliance with standards	Blow moulding machines	
Selling or influencing others	Judging the qualities of things, services, or people	Developing and building teams	Compliance software	
Monitoring and controlling resources	Staffing organisational units	Updating and using relevant knowledge	Interpreting the meaning of information for others	
Developing objectives and strategies	Monitor processes, materials, or surroundings	Stress tolerance	Processing information	
Making decisions and solving problems	Resolving conflicts and negotiating with others	Concern for others	Repairing and maintaining electronic equipment	
Dependability	Self-control	Attention to detail	Estimating the quantifiable characteristics of products, events, or information	
Initiative	Analytical thinking	Co-operation	Co-ordinating the work and activities of others	
Achievement/effort	Adaptability/flexibility	Innovation	Integrity	
Leadership			Persistence	

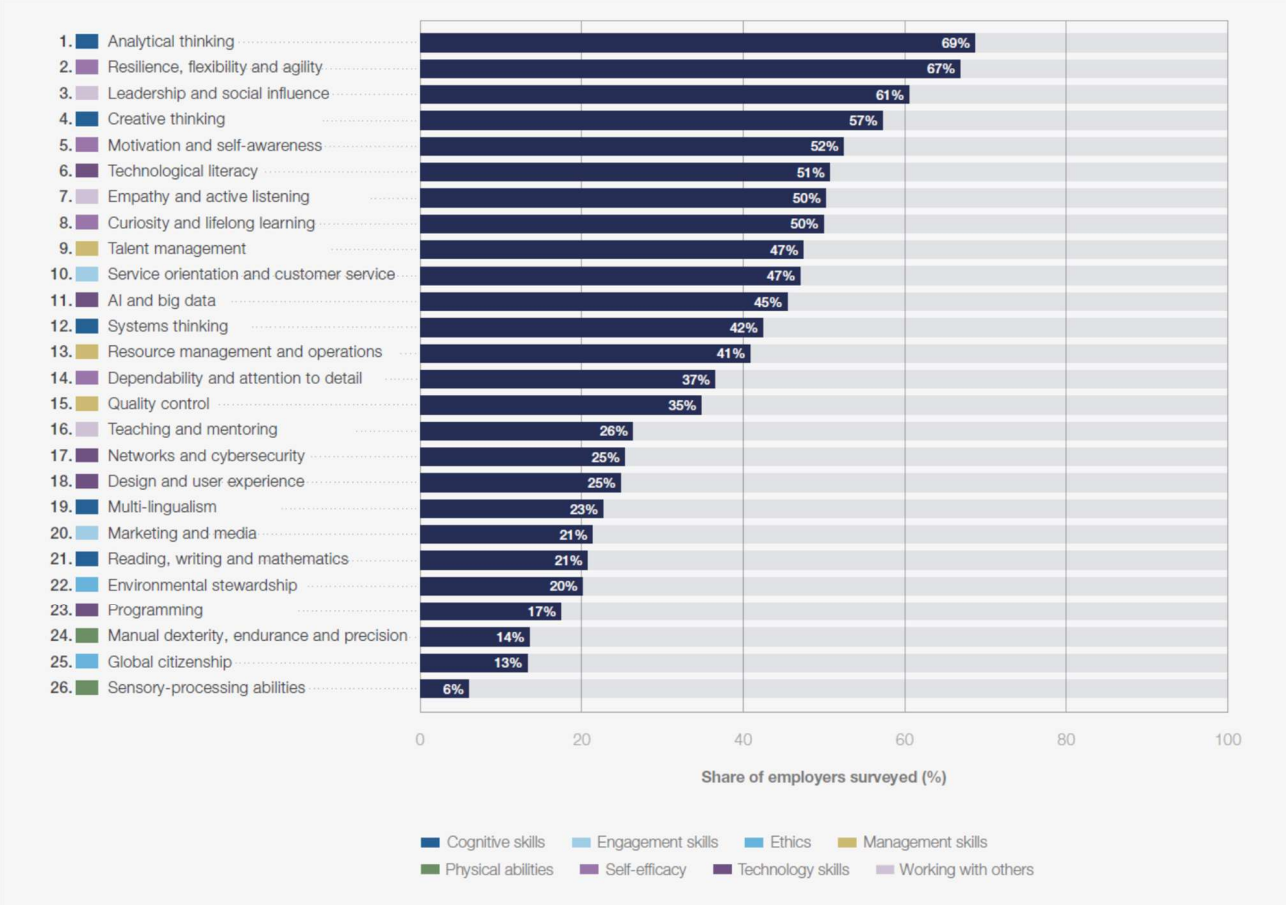
Note: Individual skills are grouped into five groups depending on the size of projected changes in demand between 2019 and 2030 under the Fit for 55 scenario. Each skill is assigned a colour depending on the skill category to which the skill belongs. Estimates of changes in skills demands were computed by multiplying the calculated importance of a specific skill with overall employment numbers in 2019 and in 2030 under the Fit for 55 Scenario.

- Abilities
- Knowledge
- Skills
- Technology Skills and Tools
- Work Activities
- Work Styles

Source: Calculations based on OECD ENV-Linkages model, Lightcast (2023[14]), Lightcast™, https://lightcast.io/, (accessed April 2023), European Union (2019[15]), European Labour Force Survey, ad hoc data extraction (for the year 2019), https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey, in Borgonovi et al. (2023[2]), "The effects of the EU Fit for 55 package on labour markets and the demand for skills", https://doi.org/10.1787/6c16baac-en.

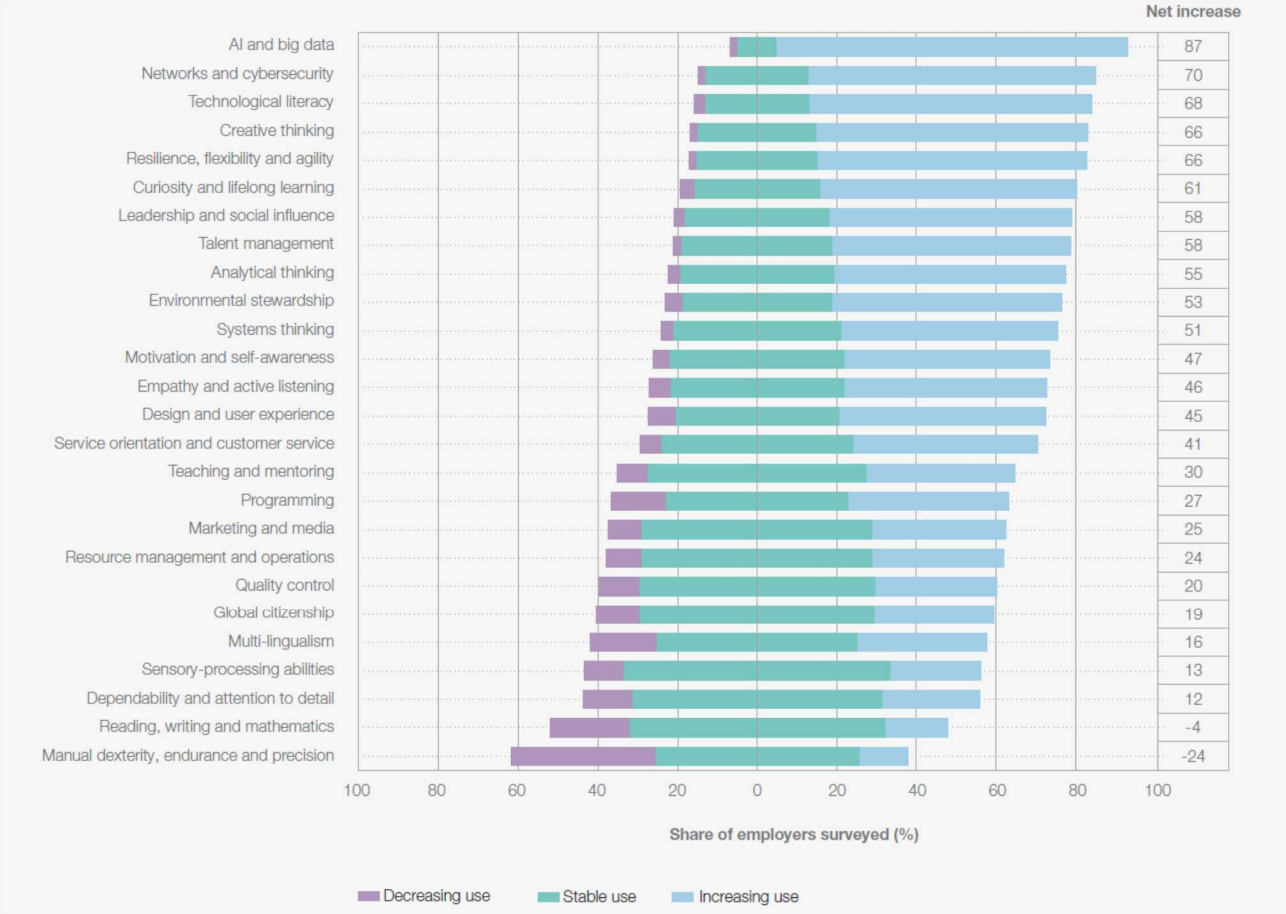
Source: OECD (2023), OECD Skills Outlook 2023, pp. 84-85.

Figure 8. Share of employers who consider the stated skills to be core skills for their workforce.



Source: World Economic Forum (2025) Future of jobs report 2025, p.35.

Figure 9. Share of employers who consider skills to be increasing, decreasing o remaining stabile in importance in 5 years (2025-2030).



Source: World Economic Forum (2025) Future of jobs report 2025, p.35.

3.2 Skill Supply

OECD evidence (2023, 2025) consistently points to the presence of persistent structural constraints on the supply of skills. While educational attainment has increased across most OECD countries, this quantitative expansion has not translated into a commensurate alignment with rapidly evolving skill demands.

Foundational skills, such as literacy, numeracy and problem solving, remain strong predictors of employment outcomes, with higher proficiency levels associated with higher employment rates and more stable career trajectories. At the same time, participation in adult learning and continuous training - which is crucial for updating skills over the life course - remains uneven across countries, sectors and socio-demographic groups. A substantial share of the adult population does not engage regularly in formal or informal training, limiting the capacity of the existing workforce to adapt to technological, green and organisational change. This uneven access to lifelong learning represents a structural bottleneck in the adjustment of skill supply, particularly in ageing societies where labour market adaptation depends significantly on upskilling incumbent workers rather than on new entrants.

OECD analyses stress that skill mismatches reflect coordination failures between education systems, training providers and employers. Limited employer involvement in curriculum design, weak labour market information systems and imperfect signaling mechanisms[xii] can all contribute to persistent mismatches, even in contexts where training opportunities formally exist. Countries with stronger governance frameworks and closer links between training institutions and employers tend to display lower measured mismatches and smoother labour market adjustment, highlighting the importance of institutional coordination alongside quantitative skill provision.

3.2.1 Eurostat data

Eurostat provides a set of complementary indicators that allow to observe long-term trends in educational attainment, participation in training and the diffusion of digital skills among the European population.

Figure 10, based on data from the Eurostat Labour Force Survey, offers an overall picture of educational attainment in the working-age population in the EU-27. It shows the temporal evolution (2014-2024) of the educational attainment distribution among the population aged 15–64, classified according to the International Standard Classification of Education (ISCED) framework maintained by UNESCO. Three attainment groups are considered: levels 0-2

correspond to less than primary, primary and lower secondary education; levels 3-4 correspond to upper secondary and post-secondary non-tertiary education; finally, levels 5-8 correspond to tertiary education.

According to the data, over time, the share of the EU working-age population with tertiary education increased from about 25% to around 32%. At the same time, the proportion of individuals with low educational attainment (ISCED 0-2) declined from 28.4% to 24.1%. This represents a substantial structural shift in the educational composition of the European labour force, indicating a gradual strengthening of the formal qualification base.

ISCED levels 3–4 (upper secondary and post-secondary non-tertiary education) remain the most prevalent educational attainment category, encompassing 47.1% of the population in 2014 and increasing to 44.2% in 2024. More detailed information for this segment, available from 2021 onwards, shows that, in terms of the total population around 32% of individuals followed vocational education pathways (ISCED 35 and 45), while only 12% completed general education programmes (ISCED 34 and 44). This distribution remains broadly stable between 2021 and 2024. These figures underline the central role of vocational education and training in shaping the effective supply of skills in Europe, particularly for medium-skilled occupations.

Going beyond formal educational attainment, Tables 7 and 8 provide more direct evidence on digital skill supply in EU countries, drawing on data from the Digital Skills Indicator 2.0 (DSI).

DSI is a composite index based on individuals' reported engagement in activities related to internet and software use across five domains: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving[xiii]. Information and data literacy skills are measured by relying on self-reported activities such as finding information about goods or services, seeking health-related information, reading online news sites, newspapers or magazines, and engaging in fact-checking of online information and its sources. These activities reflect the ability to access, evaluate and use information in digital environments. Communication and collaboration skills are based on activities including sending and receiving emails, making telephone or video calls over the internet, using instant messaging services, participating in social networks, expressing opinions on civic or political issues through websites or social media, and taking part in online consultations or voting processes. This domain therefore captures both interpersonal communication and forms of digital civic participation. Digital content creation skills encompass a broader and more technically demanding set of activities. These include using word processing and spreadsheet software, editing photos, videos or audio files, copying or moving files across folders, devices or cloud environments, creating composite digital content combining text, images, tables, charts or multimedia elements, using advanced spreadsheet features (such as functions,

formulas or macros) to organise and analyse data, and writing code in a programming language. Safety skills are inferred from activities related to the management and protection of personal data online. These include checking whether websites are secure before providing personal data, reading privacy statements, restricting or refusing access to geographical location, limiting access to personal profiles or shared online storage, refusing the use of personal data for advertising purposes, and changing browser settings to prevent or limit cookies. Finally, problem-solving skills are measured through activities such as downloading or installing software or applications, changing software, app or device settings, making online purchases or selling goods online, using online learning resources, accessing internet banking services, and searching for jobs or submitting job applications online.

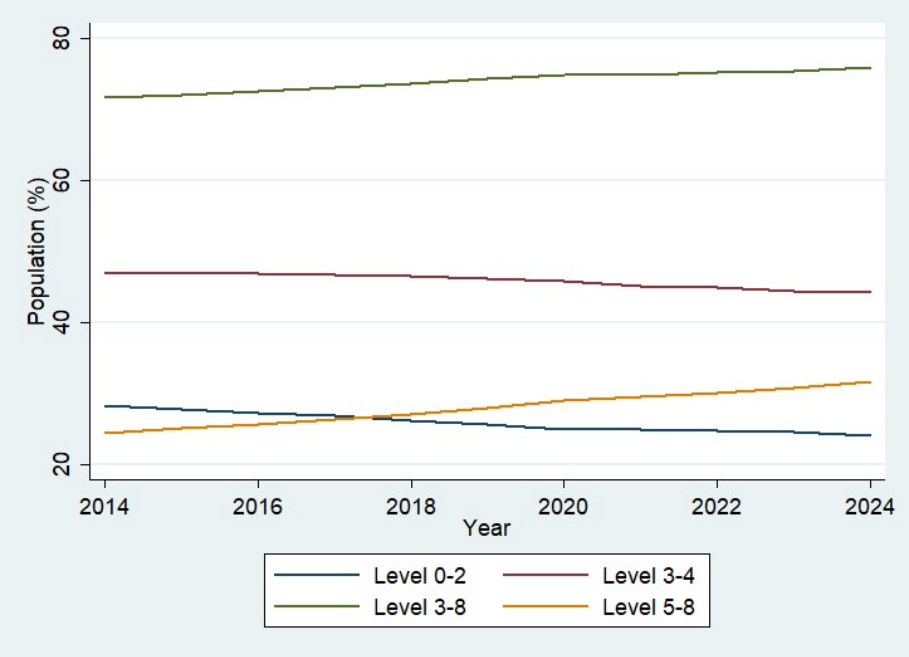
On the basis of their self-reported engagement in domain-specific activities, individuals are classified into “basic” or “above basic” skill levels for each domain, where “above basic” denotes sustained and diversified use of digital practices rather than occasional or passive interaction with digital technologies; these domain classifications are then aggregated to derive an overall digital skills indicator.

Table 7 reports the share of individuals aged 16-74 with at least basic digital skills in 2021 and 2023. Overall, more than half of the EU population possesses at least basic digital skills, and this share increases over time. However, substantial cross-country differences exist. In several member States - most notably Romania and Bulgaria - less than one third of individuals have basic digital skills. Other countries such as Poland, Cyprus, Latvia, Italy and Slovenia also remain below the EU average. This heterogeneity highlights markedly different starting conditions across member States and poses challenges for the functioning of an integrated European labour market. While most countries record improvements between 2021 and 2023, a limited group - including France, Croatia, Latvia, Luxembourg, Slovenia and Slovakia - shows stagnation or slight declines. These divergent trajectories suggest that convergence in digital skill endowments cannot be taken for granted and may require more targeted national policies.

Table 8 allows a more granular reading of the digital skill supply by skill domain[xiv]. Looking at this table, only 13.8% of individuals display basic information and data literacy skills, while basic communication and collaboration skills are observed for just 8.2% of the population. Slightly higher shares are recorded for digital content creation (22.1%), safety (24.4%) and problem-solving in digital environments(26.0%)[xv]. Although these shares have increased marginally over time, they remain relatively low. This suggests that the majority of individuals classified as having "at least basic" digital skills rely on a limited subset of activities, rather than on a broad and balanced digital skill profile.

It should also be noted that a non-negligible share of individuals had not used the internet in the three months preceding the survey, which prevents the assessment of their digital skills and further limits effective digital inclusion. From a labour market perspective, this reinforces the idea that basic digital skills remain a binding constraint for a significant share of the population.

Figure 10. EU-27 Population by educational attainment (% of total population from 15 to 64 years)



Source: Eurostat 2025 (Labour force survey)

Table 7. Share of individuals (16-74 years) having at least basic digital skills

Year	2021	2023
EU - 27	53.92	55.56
Belgium	54.23	59.39
Bulgaria	31.18	35.52
Czechia	59.69	69.11
Denmark	68.65	69.62
Germany	48.92	52.22
Estonia	56.37	62.61
Ireland	70.49	72.91
Greece	52.48	52.40
Spain	64.16	66.18
France	61.96	59.67
Croatia	63.37	58.95
Italy	45.60	45.75
Cyprus	50.21	49.46
Latvia	50.80	45.34
Lithuania	48.84	52.91
Luxembourg	63.79	60.14
Hungary	49.09	58.89
Malta	61.23	63.02
Netherlands	78.94	82.70
Austria	63.33	64.68
Poland	42.93	44.30
Portugal	55.31	55.97
Romania	27.82	27.73
Slovenia	49.67	46.70
Slovakia	55.18	51.31
Finland	79.18	81.99
Sweden	66.60	66.44

Note: The basic digital skill indicator is a composite measure constructed from individuals' reported performance of selected internet-related activities within five conceptual domains: information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. The indicator classifies digital skill proficiency into six ordered levels, with the two highest levels corresponding to "basic" and "above basic" digital skill attainment, respectively, reflecting broader and more complex engagement with digital practices rather than infrequent or passive use of digital technologies. This measure is derived from microdata collected through the EU Survey on the Use of Information and Communication Technologies (ICT) in households and by individuals administered by Eurostat.

Table 8. Individuals' level of digital skills (% of individuals 16-74 years)

Year	2021	2023
Individuals with basic or above basic information and data literacy skills	80.47	81.70
Individuals with above basic information and data literacy skills	68.35	68.52
Individuals with basic information and data literacy skills	12.12	13.18
Individuals with basic or above basic communication and collaboration skills	86.28	89.33
Individuals with above basic communication and collaboration skills	77.48	81.09
Individuals with basic communication and collaboration skills	8.80	8.24
Individuals with basic or above basic digital content creation skills	66.16	68.28
Individuals with above basic digital content creation skills	45.23	46.18
Individuals with basic digital content creation skills	20.93	22.10
Individuals with basic or above basic safety skills	68.00	69.55
Individuals with above basic safety skills	43.64	45.15
Individuals with basic safety skills	24.36	24.39
Individuals with basic or above basic problem solving skills	79.27	82.53
Individuals with above basic problem solving skills	52.73	56.57
Individuals with basic problem solving skills	26.54	25.96
Individuals with basic or above basic overall digital skills	53.92	55.56
Individuals with above basic overall digital skills	26.46	27.32
Individuals with basic overall digital skills	27.46	28.24
Individuals with low overall digital skills	17.14	17.71
Individuals with narrow overall digital skills	9.47	9.70
Individuals with limited overall digital skills	5.42	5.46
Individuals with no overall digital skills	3.04	3.01
Digital skills could not be assessed: individual has not used internet in the last 3 months	11.00	8.57

Note :

The Digital Skills Indicator 2.0 (DSI) is a composite indicator which is based on selected activities related to internet or software use that individuals aged 16-74 perform in five specific areas (Information and data literacy, Communication and collaboration, Digital content creation, Safety, and Problem solving). It is assumed that individuals having performed certain activities have the corresponding skills. Therefore, the indicators can be considered as proxy of individuals' digital skills.

According to the variety of activities performed, two levels of skills are computed for each of the five areas ("basic" and "above basic"). Finally, based on the component indicators for each area, an overall digital skills indicator is calculated as a proxy of the digital skills of individuals ("no skills", "limited", "narrow", "low", "basic", "above basic" or "at least basic skills").

Individuals with basic or above basic overall digital skills= all five component indicators are at basic or above basic level,
Individuals with above basic overall digital skills=all five component indicators are at above basic level,
Individuals with basic overall digital skills= all five component indicators are at basic or above basic level, without being all above basic;
Individuals with low overall digital skills=four out of five component indicators are at basic or above basic level.
Individuals with narrow overall digital skills=three out of five component indicators are at basic or above basic level;
Individuals with limited overall digital skills=two out of five component indicators are at basic or above basic level
Source: Eurostat 2025 (ICT Survey)

3.2.2 Evidence from other international reports

Several international reports can be used to complement Eurostat evidence by providing additional insights into systemic challenges in skills provision.

The OECD Skills Outlook 2023 emphasises that education and training systems struggle to keep pace with the speed and hybrid nature of emerging skill requirements, particularly in relation to digitalisation and the green transition. Initial education systems remain slow to adjust, while adult learning participation is uneven, constraining the responsiveness of skill supply. OECD(2025) further argues that qualifications-based systems may under-recognise competences acquired through non-formal and informal learning. From this perspective, improving skill supply requires not only expanding training provision, but also strengthening transparency, recognition and signaling mechanisms. Modular training pathways, micro-credentials and skills-based hiring practices are identified as tools to enhance adaptability, especially for digital and transversal skills.

ILO provides complementary insights on green skill supply. In *Skills for a Greener Future* (ILO, 2019), it shows that training systems have only partially integrated environmental and sustainability-related competences, and that dedicated green training programmes remain limited in scope. In many instances, green skills remain informally embedded within existing occupations instead of being developed through structured learning pathways, a pattern that reflects weak systems for anticipating emerging green skill requirements. This reinforces the idea that supply-side constraints risk slowing down the green transition, even where demand for green skills is rapidly expanding.

The World Economic Forum's *Future of Jobs Report 2025* approaches skill supply primarily through employers' strategies. Firms increasingly expect to rely on internal training, on-the-job learning and partnerships with external providers to address skill gaps. This points to a growing role of firms as direct suppliers of skills, particularly for digital, organisational and entrepreneurial competences, complementing but not substituting formal education systems.

3.2.3 Adult Learning, Digital Education and Policy Responses

Recent OECD evidence highlights the transformative role of digital technologies in reshaping skill supply. The expansion of online learning - accelerated by the COVID-19 pandemic - has significantly increased participation, with around 60% of adults in OECD countries engaging in some form of online education, compared to 36% before the pandemic. Digital platforms have improved accessibility and flexibility, supporting personalised learning pathways and enhancing engagement through multimedia and interactive content.

As alternative learning pathways expand, new mechanisms are emerging to formalise and recognise acquired skills. OECD analyses underline the growing relevance of alternative credentials and micro-credentials, while European initiatives such as the European Digital Credentials framework aim to enhance portability and credibility of non-formal learning outcomes (European Commission, 2020). These developments signal a gradual shift towards more flexible, modular and employability-oriented models of skill provision.

Tables 9 and 10 report data from the Continuing Vocational Training Survey (CVTS) carried out by Eurostat. Continuing vocational training (CVT) refers to training measures or activities whose primary objective is the acquisition of new competences or the development and improvement of existing ones. These training activities are financed at least partly by enterprises and targeted at persons employed by them, including both workers with a formal employment contract and individuals who benefit directly from their work for the enterprise, such as unpaid family workers or casual workers.[xvi]

CVT measures and activities encompass both structured CVT courses and other forms of continuing training [xvii].

CVT courses are formalised training pathways designed for specific groups of learners and based on a predefined curriculum or training framework. They are characterised by a high degree of organisation in terms of time, content, and learning environment, and are typically delivered by a trainer or a specialised training institution. Two main types of CVT courses can be distinguished: internal CVT courses, which are organised directly by the enterprise for its employees, and external CVT courses, which are provided by specialised external training providers.

Other forms of CVT are closely connected to the active workplace and day-to-day work processes[xviii], i.e. they involve informal, practice-based learning processes. They include learning through participation in conferences, workshops, trade fairs or other work-related activities with an explicit learning component. These forms of training are often characterised by a higher degree of self-organisation by individual learners or groups of workers, and the content is typically tailored to specific, context-dependent needs arising in the workplace.

In surveys, those who took part in one or more CVT courses during the reference year are considered as aa CVT training participants. This implies that participation rates capture the training engagement rather than the intensity or duration of training received.

Using data from 2005 onwards, Table 9 reveals a steadily increasing interest of EU enterprises in continuing vocational training. The share of firms providing CVT rose from 55.6% in 2005 to 67.4% in the most recent available year. At the same time, Table 10 reveals that the number

of participants in CVT courses relative to total employment has increased continuously over the period. However, participation rates still fall short of covering even half of the total employed population, indicating that access to employer-sponsored training remains limited and unevenly distributed. Women participate slightly less than men, highlighting persistent gender disparities in access to continuing training opportunities. This pattern suggests that, despite overall progress, CVT systems may continue to reproduce existing labour market inequalities rather than fully offsetting them.

Additional evidence is presented in Table 11, which draws on data collected by Eurostat annualy through the 2014-2024 EU Labour Force Survey (EU-LFS). For each considered year, these figures measure participation in education and training among individuals aged 25–64 during the four weeks preceding the survey and are computed as annual averages of quarterly observations. Participation rates are calculated using the total population in this age group as the denominator, excluding individuals who did not respond to the participation question. The inspection of these data suggests two main evidences. First. adults with higher levels of education - particularly those with tertiary education -display significantly higher participation in learning activities. Second, over the time period under investigation, participation rates increased across all ISCED levels, with faster growth observed among individuals with higher educational attainment. Both these evidences suggest that lifelong learning systems tend to benefit those who are already better equipped in terms of initial education, raising concerns about cumulative advantage and the risk that low-skilled workers may fall further behind in rapidly changing labour markets.

Table 9. Enterprises providing training by type of training - EU 27 (% of all enterprises)

Year	**2005**	**2010**	**2015**	**2020**
CVT courses and/or other forms of CVT	55.6	63.6	70.5	67.4
CVT courses	46.5	55	60.2	54.9
CVT courses - internal	23.9	29.5	34.3	35

Source: Eurostat 2025 (Continuing Vocational Training Survey -CVTS)

Table 10 Participants in CVT courses by sex- EU 27 (% of persons employed in all enterprises)

Year	2005	2010	2015	2020
Total	32.9	38.9	42.9	42.4

Men	34	40.4	44	43.1
Women	31	36.2	41.2	41.4

Source: Eurostat 2025 (Continuing Vocational Training Survey -CVTS)

Table 11. Participation rate in education and training (over previous last 4 weeks) by educational attainment level

Year	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Levels 0-2	4.1	4	4	4.1	4.1	4.3	3.4	4.3	4.6	5.1	5.5
Levels 3-8	12	12	12.2	12.3	12.5	12.6	10.7	12.6	13.7	14.7	15.5
Levels 3 and 4	8.5	8.3	8.5	8.5	8.4	8.5	7	8.2	9.1	9.8	10.3
Levels 5-8	18.2	18	18.2	18.3	18.7	18.7	15.9	18.5	19.9	21	21.9
All ISCED 2011 levels	10.1	10.1	10.3	10.4	10.7	10.8	9.1	10.9	11.9	12.8	13.5

Source: Eurostat 2025

3.3 Conclusion

Taken together, the evidence on skill demand and supply points to a growing misalignment driven not by differences in speed, composition and coordination across the two sides of the labour market. While firms' skill requirements are evolving rapidly in response to digitalisation, the green transition and organisational change, the mechanisms shaping skill supply remain comparatively rigid and uneven across countries, sectors and population groups.

Along the digital axis, demand is increasingly concentrated on advanced, specialised and task-specific competences - such as data analysis, software development and digital systems management—combined with higher-order cognitive skills. On the supply side, basic digital skills are becoming more widespread, while more complex digital competences remain scarce and highly unevenly distributed across Member States. This suggests that current education and training systems are effective in diffusing baseline digital literacy, but less capable of scaling up advanced and differentiated digital skill provision in line with firms' needs.

Along the green axis, the evidence consistently shows that demand is expanding both through the transformation of existing jobs and the emergence of new green roles, particularly in energy, transport and environmental management. By contrast, the supply of green skills remains underdeveloped and often embedded informally within existing occupations, with limited dedicated training pathways and weak anticipation mechanisms. As a result, green skill gaps tend to reflect shortages of specialised technical competences and, moving beyond the scope of this report, also of insufficient integration of environmental knowledge, regulatory awareness and sustainability-oriented practices across a broad range of occupations.

Finally, along the entrepreneurial and organisational axis, demand is rising for transversal skills such as leadership, adaptability, strategic thinking and innovation management, which enable firms and workers to navigate uncertainty and continuous change. Supply-side evidence suggests that these competences are only partially addressed by formal education systems and are increasingly developed through workplace learning and employer-driven training. This creates a fragmented landscape in which entrepreneurial skills are valued across sectors, but unevenly recognised, certified and supported within structured training frameworks.

Overall, the analysis highlights that skill gaps are not uniform across domains, but differ in nature: advanced digital skills face depth and specialisation gaps; green skills face structural and institutional gaps; entrepreneurial skills face recognition and coordination gaps. These

patterns underline the need for analytical frameworks capable of linking emerging skill demands to concrete and comparable skill definitions.

Against this background, the next section focuses on the European classification of skills (ESCO), using it as a common reference framework to map digital, green and entrepreneurial skills across occupational groups. This approach allows for a more granular and policy-relevant identification of skill needs, supporting the transition from aggregate evidence to operational tools for training and policy design.

4. ESCO-Based Mapping of In-Demand Digital, Green and Entrepreneurial Skills

ESCO is the European multilingual classification of skills, competences, qualifications and occupations, developed by the European Commission's Directorate-General for Employment, Social Affairs and Inclusion (DG EMPL). It is one of the most widely used taxonomies and ontologies of work-related information. It functions as a common reference framework that identifies, describes and classifies occupations and their associated skills using a standardised terminology that is interoperable across information systems and languages.

Conceptually, ESCO is organised around three main pillars:

- Occupations, which provide a hierarchical classification of professional profiles relevant to the EU labour market, aligned with the ISCO (International Standard Classification of Occupations);
- Skills, competences and knowledge, consisting of a comprehensive list of transversal and occupation-specific skills and knowledge elements that can be linked to occupations. According to ESCO Handbook(EU Commission, 2019, pag.19):
- Skill: The ability to apply knowledge and use know-how to complete tasks and solve problems. Skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments).
- Competence: The proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations, and in professional and personal development.
- Knowledge: The body of facts, principles, theories and practices that is related to a field of work or study. Knowledge is described as theoretical and/or factual, and is the outcome of the assimilation of information through learning.

- Qualifications, defined as formal outcomes of assessment processes aligned with national and European qualification frameworks and linked to relevant skills and occupations.

In its most recent versions, ESCO includes descriptions of 3,039 occupations and 13,960 skills, competences and knowledge items, defined into all the official EU languages.

ESCO is published as Linked Open Data, meaning that its concepts and relationships are openly available in machine-readable formats and accessible through web APIs or for local

download. This design strongly facilitates interoperability and integration with digital platforms, labour market information systems and statistical infrastructures. A key feature of ESCO is the presence of common identifiers that allow the systematic linking of data across the three pillars, enabling structured analyses of the relationships between skills, occupations and qualifications.

ESCO is widely used by employers, public employment services, education and training providers, HR and job-matching platforms, and policymakers. Its applications span several domains: job-matching and recruitment systems use ESCO to align job vacancies with jobseeker skills across countries and languages; career guidance and labour mobility tools, such as Europass and EURES, rely on ESCO to ensure consistent terminology; learning and training platforms use ESCO to identify skill gaps and suggest targeted upskilling or reskilling pathways; and researchers and policy analysts employ ESCO's structured data to analyse skill demand, supply and mismatch dynamics.

OECD (2023, 2025) and CEDEFOP(2023, 2025) analyses highlight the analytical potential of ESCO in supporting skills-first approaches. In particular, CEDEFOP emphasises that comparing the skills profile of a source occupation (currently held by a worker) with that of a target occupation provides an indication of skill similarity and transferability, which is crucial for facilitating labour market transitions, especially in the context of the green transition (CEDEFOP(2025). Validation and recognition mechanisms for shared skills can reduce training needs and accelerate occupational mobility.

At the same time, several limitations are acknowledged in the literature.

First, the list of skills/competences associated with each occupation cannot be considered fully comprehensive in all contexts, as national, regional and firm-specific circumstances may differ substantially. Moreover, ESCO captures the presence of skills/competences linked to occupations but does not provide qualitative information on skill intensity, frequency of use or proficiency levels. Compared to O*NET, ESCO also lacks a large-scale survey of jobholders that would allow empirical measurement of skill use and task content (Eurofound, 2025).

Second, ESCO data are produced through a combination of expert input and data-driven methods. Sectoral expert groups coordinated by the European Commission contribute to content development, while advanced natural language processing techniques are used to classify and update occupational profiles. In particular, the Commission applies the BERT algorithm alongside manual labelling and validation procedures to classify ESCO occupations (CEPS, 2023).

Third, and more importantly, although European qualification frameworks conceptually distinguish between skills and competences, ESCO adopts a pragmatic approach by operationalising them as a single category. The European Commission itself clarifies that "While sometimes used as synonyms, the scope of the terms skill and competence can be distinguished. Skills refer to the use of methods or instruments in a particular setting and in relation to defined tasks. Competence is broader and refers to the ability of a person, facing new situations and unforeseen challenges, to use and apply knowledge and skills in an independent and self-directed way. However, there is no distinction between skills and competences recorded in the ESCO skills pillar" (European Commission, 2021, p. 20).

This choice reflects the difficulty of separating these dimensions in real-world occupational requirements, where the effective performance of work tasks typically mobilises technical abilities, judgement and responsibility at the same time. The ESCO structure is therefore more closely aligned with labour market and task-based approaches, which prioritise observable job requirements over pedagogical distinctions. While knowledge is maintained as a separate pillar — reflecting its stronger institutional link with formal education pathways — skills and competences are integrated into a unified operational classification to enhance statistical reliability and support applications such as job matching and skills intelligence.

Although one of the hierarchical files available on the ESCO website provides a further disaggregation between skills and competences, for the purposes of this report — namely identifying skill gaps in Europe — we follow this integrated approach. This choice is consistent with ESCO's operational logic and with other international frameworks, including O*NET, OECD and CEDEFOP, which tend to analyse work-related requirements along a continuum rather than enforcing rigid conceptual boundaries.

Maintaining an integrated perspective offers important analytical advantages at this stage of the research. First, it preserves comparability with widely used international datasets and forecasting exercises. Second, it reduces the risk of arbitrary classification, as the distinction between skills and competences is often context-dependent and difficult to operationalise empirically. Third, analysing them jointly prevents excessive analytical fragmentation, allowing clearer identification of sectoral patterns and emerging shortages. Finally, this level of abstraction is coherent with the task-based approach to labour market analysis, which emphasises workers' ability to perform evolving job tasks regardless of whether these capacities are labelled as skills or competences.

However, while an integrated approach is analytically appropriate for diagnosing skill gaps — the primary objective of this report — a further step is required when translating this evidence into the design of learning provision, the ultimate goal of the project to which this report

contributes. From a training perspective, work-related requirements differ significantly in their degree of trainability and in the learning formats they typically require. Some can be effectively addressed through modular and short-cycle training, while others demand longer-term, practice-based or organisational learning processes.

For this reason, future developments of the Flexi-Skilled Innovators platform should complement the present analysis with an ex-post interpretation of the identified skills, grouping them according to their trainability and pedagogical implications. Attempting such a differentiation at the diagnostic stage would have introduced unnecessary conceptual rigidity and potentially weakened the robustness of the empirical analysis. By contrast, sequencing the analysis — first identifying gaps, then assessing training modalities — ensures both analytical clarity and policy relevance.

4.1 Data Preparation and Integration

The data preparation process followed a structured sequence of merging, cleaning and aggregation steps, resulting in a consolidated occupation-skill dataset suitable for analytical purposes and survey design.

First, ESCO occupation and skill files were imported (in November 2024). Occupations and skills were linked using the official ESCO occupation-skill relations file, producing a long-format dataset in which each observation represents a single occupation-skill association. This dataset constitutes the core analytical file used throughout the analysis. By construction, only skills explicitly linked to at least one occupation in ESCO are retained. As a consequence, transversal skills defined in the taxonomy but not directly associated with specific occupations are excluded. The resulting dataset therefore reflects skills that are empirically connected to occupational profiles rather than the full universe of ESCO-defined skills.

Second, skills were enriched with thematic classifications. Dedicated ESCO files identifying digital skills and green skills were merged into the dataset, and corresponding binary indicators were constructed to flag skills belonging to these two domains.

Third, an additional binary indicator for entrepreneurial skills was created using a text-based approach applied to skill labels. Skills whose descriptions contain keywords related to entrepreneurship, business activity, initiative, management or planning were identified through regular-expression matching. This approach allows entrepreneurial skills to be captured independently of the ESCO hierarchical structure.

Fourth, occupational information was enriched with ISCO classification codes at different levels of detail, enabling aggregation at multiple occupational groupings. Sectoral information was subsequently incorporated using NACE codes associated with occupations. Since occupations may be linked to multiple NACE sectors, duplicates were removed at the ISCO-NACE level, and sectoral information was aggregated consistently with the selected occupational hierarchy, with the aim of preserving the occupation-skill-sector linkage.

The final dataset, reported in the appendix, provides a comprehensive list of digital, green and entrepreneurial skills and knowledge by NACE sector. This work serves a twofold purpose. First, it offers a structured reference framework for the design of training and upskilling pathways tailored to sector-specific skill needs. Second, it provides the empirical basis for subsequent data-collection activities within the FSI Project. Starting from this detailed dataset, a process of conceptual abstraction and wording—supported by ChatGPT—was used to develop a survey questionnaire and the core structure for focus groups. This will allow a comparison between the top-down ESCO classification and locally identified skill needs emerging from stakeholder consultations that will offer a first precise guidance for identifying the skills to be proposed in the FSI training platform.

Although ESCO provides a hierarchical taxonomy of skills, this structure was not directly used in the construction of the analytical dataset. The analysis focuses on individual skills in order to maximise granularity. At a later stage, skills were grouped into broader thematic areas—again with the support of ChatGPT—to design a concise and cognitively manageable questionnaire. An explicit correspondence between these thematic groupings and the official ESCO hierarchy was constructed, ensuring that results can be mapped back to ESCO skill levels in subsequent analytical phases.

4.2 Findings

The final dataset includes **2,091 distinct skills**, of which 1,197 are classified as digital, 527 as green and 212 as entrepreneurial. Overlaps across categories are present: 20 skills are classified as both digital and green, 63 as both digital and entrepreneurial, 31 as both green and entrepreneurial, and 2 skills belong to all three categories.

Table 12 reports the distribution of skills and knowledge across NACE (Nomenclature of Economic Activities) sectors. The NACE classification is the European statistical classification of economic activities, established to ensure comparability of economic statistics across EU Member States. The current version in use is NACE Rev.2, defined by Regulation (EC) No 1893/2006.

NACE Rev.2 is structured hierarchically and, at the highest level, distinguishes 21 sections, identified by letters from A to U: A - Agriculture, forestry and fishing; B - Mining and quarrying; C - Manufacturing; D - Electricity, gas, steam and air conditioning supply; E - Water supply; sewerage, waste management and remediation activities; F - Construction; G - Wholesale and retail trade; repair of motor vehicles and motorcycles; H - Transportation and storage; I - Accommodation and food service activities; J - Information and communication; K - Financial and insurance activities; L - Real estate activities; M - Professional, scientific and technical activities; N - Administrative and support service activities; O - Public administration and defence; compulsory social security; P - Education; Q - Human health and social work activities; R - Arts, entertainment and recreation; S - Other service activities; T - Activities of households as employers; U - Activities of extraterritorial organisations and bodies.[xix]

These sections are further subdivided into divisions (2-digit), groups (3-digit) and classes (4-digit), allowing for increasing levels of sectoral detail.

In Table 12, since the same skill can be associated with multiple sectors, counts should be interpreted as indicators of the relative intensity of skill requirements by sector rather than as totals of distinct skills. The table shows that sectors B and M are associated with the largest number of skills, followed by J, A and C, while sectors I, T and U display much lower counts.

Table 13 provides a more detailed cross-NACE breakdown by distinguishing skills according to their thematic classification (digital, green or entrepreneurial). In this table, only skills associated with a single thematic dimension are reported, making the categories mutually exclusive. While it is possible to compute sectoral totals from this table (net of overlapping skills), totals by thematic dimension cannot be derived, as the same skill may appear in multiple sectors.

NACE sections A, B, C, J and M display the highest number of digital skills and knowledge requirements. This reflects both the technological intensity of sectors such as Information and Communication (J) and Professional, Scientific and Technical Activities (M), and the increasing digitalisation of traditionally non-ICT sectors such as Agriculture (A), Mining and Quarrying (B) and Manufacturing (C). In these sectors, digital competences appear to function as enabling skills, supporting productivity, process optimisation and data-driven decision-making rather than being confined to purely ICT occupations.

With respect to green skills and knowledge, sectors M, O, A and B show the highest overall counts. This pattern highlights the dual role of green competences: on the one hand, in technically and scientifically intensive activities (M and B), and on the other, in public services

and regulation-oriented sectors (O) and primary activities (A), where environmental standards, sustainability practices and resource management are increasingly embedded in core tasks. Sectors C, D, E and F also require a relatively high number of green skills, although these are associated with a comparatively lower number of green knowledge items. This suggests that, in these sectors, the green transition is currently driven more by operational and procedural skill adaptation than by the acquisition of highly specialised environmental knowledge.

From a quantitative perspective, entrepreneurial skills and knowledge play a smaller role compared to digital and green competences. However, this lower numerical weight should not be interpreted as lower strategic relevance. Entrepreneurial skills tend to be transversal and less occupation-specific, and therefore appear less frequently in occupation-skill linkages. Notably, sectors B, M and N stand out as those requiring the highest number of entrepreneurial-related skills and knowledge, consistent with their strong orientation towards innovation, project-based work and organisational flexibility.

Table 14 highlights the distribution of cross-thematic skills and knowledge, i.e. those classified in more than one thematic category. Sectors B and M, followed by C and A, are those in which the highest number of cross-thematic items is required. In particular, the intersection between digital and entrepreneurial competences emerges as the most significant, suggesting that digitalisation processes are closely intertwined with organisational, managerial and initiative-oriented capabilities. This reinforces the idea that digital transformation is not merely a technological phenomenon, but also an entrepreneurial and organisational one.

By jointly considering Tables 13 and 14, it is possible to examine the skill-knowledge ratio by sector. With the exception of sectors L and P, skills consistently outnumber knowledge items, indicating that most sectors place greater emphasis on applied, operational capabilities rather than on formal or theoretical knowledge alone. However, important heterogeneity emerges across thematic domains. In the digital domain, sectors A, B, J, P and S require more domain-specific knowledge than skills, suggesting that understanding digital systems, information structures and data-related concepts is particularly relevant in these contexts. In the green domain, this pattern is observed in sectors K (where no green skills are associated), L and P, pointing to a more regulatory or conceptual orientation of environmental competences. For entrepreneurial skills, a higher knowledge-to-skill ratio is found in sectors P and L, although the absolute numbers remain small.

Cross-thematic skills are of particular analytical interest, as investing in these competences appears to generate returns across multiple domains simultaneously. For this reason, Tables 15 presents the full list of cross-thematic skills independently of the NACE sector, highlighting

those competences that are strategically positioned at the intersection of digital, green and entrepreneurial transitions.

Finally, Tables 16 identifies the skills most frequently required across sectors. These items can be interpreted as systemic skills, as they recur in multiple economic activities and therefore represent priority areas for training and policy intervention. While digital skills dominate numerically, the items with the highest cross-sectoral frequency are predominantly entrepreneurial skills, underscoring their role as connective competences that support adaptation, innovation and coordination across diverse sectoral contexts.

While country-level desk analyses and qualitative data collection are necessary to provide more granular evidence on training priorities, the skills listed in Tables 15 and 16 already offer a first strategic and detailed guidance for the development of flexi-skilled innovators in Europe.

Table 12. Knowledege and skills by Nace sector

Nace	Knowledge	Skill/Competence	Tot
A	265	381	646
B	612	672	1,284
C	342	452	794
D	83	151	234
E	60	149	209
F	109	207	316
G	70	115	185
H	97	222	319
I	7	19	26
J	473	456	929
K	40	43	83
L	44	33	77
M	548	744	1,292
N	149	260	409
O	155	224	379
P	208	95	303
Q	57	104	161
R	127	223	350
S	169	181	350
T	2	6	8
U	3	4	7

Source: Authors elaboration on ESCO and NACE data (2025)

Table 13. Skills and knowledge assigned to a single thematic dimension (digital, green or entrepreneurship), by NACE sector

Nace	Digital		Green		Entrepreneurial		Total	
	Knowl.	Skill/Com	Knowl.	Skill/Com	Knowl.	Skill/Com	Knowl.	Skill/Com
A	146	140	90	201	12	28	248	369
B	399	375	124	198	48	71	571	644
C	206	250	96	153	20	31	322	434
D	26	38	52	102	2	3	80	143
E	15	18	38	113	3	8	56	139
F	33	69	65	124	5	8	103	201
G	32	48	21	30	12	29	65	107
H	45	103	30	69	19	34	94	206
I	1	5	2	9	1	4	4	18
J	408	395	11	19	18	29	437	443
K	12	13	6	0	20	30	38	43
L	8	4	21	16	13	12	42	32
M	306	374	148	248	58	83	512	705
N	70	130	40	76	22	45	132	251
O	41	47	74	126	26	36	141	209
P	139	63	36	13	22	16	197	92
Q	31	56	11	15	15	30	57	101
R	73	122	31	64	15	27	119	213
S	106	89	40	65	14	21	160	175
T	0	0	1	5	0	1	1	6
U	1	0	0	0	2	4	3	4

Source: Authors elaboration on ESCO and Nace data (2025)

Table 14. Skills and knowledge associated with multiple thematic dimensions (digital, green and/or entrepreneurship), by Nace sectors

Nace	Digital&Green		Digital&Entrepreneurial		Green&Entrepreneurial		Transversal	Total	
	Knowl.	Skill/Com	Knowl.	Skill/Com	Knowl.	Skill/Com	Skill/Com	Knowl.	Skill/Com
A	2	3	10	1	5	8	0	17	12
B	6	5	26	14	9	7	2	41	28
C	5	4	12	5	3	7	2	20	18
D	2	3	1	1	0	4	0	3	8
E	0	1	0	0	4	8	1	4	10
F	1	3	2	1	3	2	0	6	6
G	1	0	3	5	1	3	0	5	8
H	0	1	2	9	1	5	1	3	16
I	1	0	1	0	1	1	0	3	1
J	3	2	30	10	3	0	1	36	13
K	0	0	1	0	1	0	0	2	0
L	0	0	2	1	0	0	0	2	1
M	8	10	19	13	9	14	2	36	39
N	4	2	8	5	5	2	0	17	9
O	3	1	3	2	8	11	1	14	15
P	1	1	9	1	1	1	0	11	3
Q	0	0	0	2	0	1	0	0	3
R	0	2	4	2	4	5	1	8	10
S	3	1	3	0	3	5	0	9	6
T	1	0	0	0	0	0	0	1	0
U	0	0	0	0	0	0	0	0	0

Source: Authors elaboration on ESCO and Nace data (2025)

Table 15. Skill/competences with multiple thematic dimensions

Digital & green	**Digital & entrepreneurship**	**Green & entrepreneurship**	**Transversal**
analyse ecological data	conduct impact evaluation of ICT processes on business	advise on environmental risk management systems	identify software for warehouse management
apply precision farming	conduct radiotherapy computer planning	advise on sustainable management policies	manage environmental management system
design a domotic system in buildings	develop online sales business plan	advise on waste management procedures	
design ventilation network	establish an Information Security Management System	analyse transport business networks	
employ habitat survey techniques	implement ICT risk management	apply transportation management concepts	
explain blockchain implications	implement route planning in smart mobility services	carry out energy management of facilities	
maintain irrigation controllers	maintain ICT identity management	coordinate waste management procedures	
perform energy simulations	maintain up-to-date aeronautical information management services	design a building management system	
protect the environment from the impact of the digital technologies	manage aeronautical information management services	develop hazardous waste management strategies	
use sound measuring instruments	manage standard enterprise resource planning system	develop management plans	
	operate dealership management system	develop non-hazardous waste management strategies	
	operate relational database management system	develop waste management processes	
	outline blockchain-based identity management	engage local communities in the management of natural protected areas	
	propose ICT solutions to business problems	make decisions regarding forestry management	
	test improved aeronautical information management systems	monitor the farm environmental management plan	
	use a warehouse management system	perform a feasibility study for building management systems	
	use business simulation tools	provide training in sustainable tourism development and management	
	use computerised maintenance management systems	train staff on waste management	
	use content management system software		
	use customer relationship management software		
	use electronic health records management system		
	use fleet management system		
	use mine planning software		
	use production planning software		
	use rental management software		
	use thermal management		

Source: Authors elaboration on ESCO and Nace data (2025)

Table 16. Frequency of skills/competences by Nace sector

skill	Domain	f
perform project management	entrepreneurial	17
build business relationships	entrepreneurial	16
have computer literacy	digital	15
ensure compliance with environmental legislation	green	14
use CAD software	digital	14
apply conflict management	entrepreneurial	13
perform data analysis	digital	13
apply statistical analysis techniques	digital	13
promote environmental awareness	green	12
assess environmental impact	green	12
implement strategic planning	entrepreneurial	12
follow health and safety procedures in construction	green	12
inspect data	digital	11
perform resource planning	entrepreneurial	11
analyse environmental data	green	11
process data	digital	11
use technical drawing software	digital	11
apply blended learning	digital	11
operate open source software	digital	10
manage research data	digital	10
dispose of hazardous waste	green	10
report on environmental issues	green	10
manage open publications	digital	10
use spreadsheets software	digital	10
manage findable accessible interoperable and reusable data	digital	10
advise on soil and water protection	green	10
analyse big data	digital	10
perform ICT troubleshooting	digital	10
advise on environmental remediation	green	10
analyse business plans	entrepreneurial	10

Note: threshold at f=10

Source: Authors elaboration on ESCO and Nace data (2025)

5. Country-level Analysis

Building on the European-level analysis, the following country reports provide a more granular examination of labour market dynamics and emerging skill gaps within the partner countries. While the European analysis offers a comparative perspective on the structural drivers of change associated with the twin transition, national contexts add an essential layer of understanding, helping to explain how these transformations materialise in specific settings that may differ significantly from economic, social and institutional perspectives.

The country analyses draw on a combination of harmonised European datasets — primarily Eurostat and CEDEFOP — alongside international reports and national studies, in order to ensure both cross-country comparability and sensitivity to country-specific institutional and economic conditions.

It should be noted that data availability is not fully uniform across countries. In particular, Turkey presents a more constrained statistical landscape, as several indicators commonly used within the European statistical system are either not available or not directly comparable. Despite these limitations, the report maintains a consistent analytical framework to support meaningful comparison across partner countries.

5.1 Greece

While Greece shares many of the structural drivers shaping skill demand across Europe—digitalisation, the transition to environmental sustainability, and demographic ageing—the interaction between demand and supply of skills is strongly mediated by country-specific features of its productive structure, firm size distribution and training systems.

Greece's labour market exhibits distinctive features shaped by two major shocks: the 2008 financial crisis (more severe than in most EU countries) and the COVID-19 pandemic. Unemployment peaked at 27.5% in 2013 (Eurostat LFS), declining to 9.6% by October 2024 (Eurostat, 2025), though recovery remains incomplete. The crisis triggered substantial emigration disproportionately affecting skilled workers and creating persistent talent shortages.

Employment in Greece is heavily concentrated in the service sector, which accounted for 73.3% of total employment in 2023, according to the ELSTAT Labour Force Survey. The post-crisis employment recovery has been driven primarily by low-skill, labour-intensive service activities, rather than by high-productivity sectors. In particular, wholesale and retail trade employed 24.5% of the workforce, while accommodation and food service activities accounted for 21.1%, making them the two largest employing sectors in the economy (ELSTAT, 2023).

These sectors also absorb a disproportionate share of young workers. Based on survey evidence analysed by Filinis (2021) and reported in Katsikas (2021, p. 5), 16.2% of employed youth are concentrated in wholesale and retail trade, while 14.7% work in accommodation and food services. This pattern highlights the strong linkage between youth employment and relatively low-skill service occupations, raising concerns about long-term skill accumulation and career progression.

Outside the service sector, manufacturing accounted for 11.3% of total employment, construction for 5.1%, and agriculture for 11.2% in 2023 (ELSTAT, 2025). The relatively high share of employment in agriculture distinguishes Greece from most EU Member States, where agricultural employment has declined to significantly lower levels.

From a structural perspective, the Greek economy is characterised by a high prevalence of micro and small enterprises, especially in services such as tourism, retail, construction and personal services, alongside a relatively limited base of large, technology-intensive firms. This fragmentation constrains firms' capacity to internalise advanced skills, invest systematically in training and engage in long-term workforce development strategies (European

Commission, 2023; Eurofound, 2025). As a result, skill demand is often expressed in an implicit or informal way, while skill supply struggles to adapt rapidly to emerging needs.

5.1.1 Employment Projections and Sectoral Transformation

According to CEDEFOP projections, total employment is expected to grow modestly through 2035, following a recovery trajectory after the prolonged economic crisis. However, this aggregate stability masks substantial internal reallocation across sectors and occupations, consistent with broader European trends but with some Greek-specific characteristics.

As shown in Figure 11, Distribution and Transport is the sector with the highest number of employed workers, but the growth trend is projected to decelerate. Modest increasing paths are expected also for Non-market Services and Business and Other Services, which also absorb important shares of employment. Figure 12 shows a non-linear trend of employment in sectors included in the circular economy domain, such as recycling, repair and reuse, and rental and leasing. From 2015 to 2020 a growing path is observed, although it shows remarkable annual fluctuation. Since the COVID-19 pandemic, the negative trend has not been reversed, making medium-run projections difficult.

Occupational projections reveal substantial reallocation across skill levels and job categories (Figure 13). Professionals are expected to account for the largest absolute number of job openings (625,100 over 2022-35), driven by strong employment growth (+95,400 new jobs) combined with substantial replacement demand (529,700). Service and sales workers show the highest total job openings (913,400), though growth is concentrated in replacement needs rather than net job creation. Conversely, farm and related workers face the steepest decline (-236,100), reflecting continued structural shift away from agricultural employment. Significant contractions are also forecast for trades workers (-61,700), managers (-41,600), and associate professionals (-15,100), indicating automation and reorganisation effects in intermediate-skill occupations.

The occupational structure emerging from these projections highlights Greece's transition toward a more service-intensive, professionally-oriented labour market, while simultaneously experiencing contraction in traditional manual occupations and some middle-management roles. The large replacement demand across most occupational categories—even those experiencing net job losses—underscores the critical importance of ensuring adequate skills supply and effective matching mechanisms as the workforce undergoes generational renewal.

Nevertheless, according to Thanos and Kapoutsis (2024), conducted by Athens University of Economics and Business researchers with support from the Special Secretariat of Foresight, Greek businesses anticipate substantial transformation driven primarily by technological adoption and policy-driven sustainability requirements. This study, based on a survey involving 256 senior executives across various industries and company sizes in Greece, identifies five main transformations underway:

1. Technological transformation: 92% of businesses expect increased adoption of new and cutting-edge technologies.

2. Digital access expansion: Particularly important for Greece given geographic fragmentation (islands, mountainous regions).

3. Green transition investment: Focused on renewable energy expansion (solar, wind), sustainable tourism development, and adaptation to climate impacts on agriculture and water management.

4. Government regulations on data and technology: Reflecting anticipation of EU-level regulatory frameworks (AI Act, Data Governance Act) and their implementation in Greece.

5.1.2 Digital Skills

Consistent with European-wide evidence, digitalisation represents one of the most important drivers of skill demand in Greece. However, the Greek case illustrates a marked gap between the diffusion of digital technologies and the availability of corresponding skills within the workforce.

The Eurostat Continuing Vocational Training Survey (Table 1) reveals that general IT skills remain the most important skills needed for enterprise development, although the percentage of enterprises requiring such skills declined from 45% in 2010 to 29.6% in 2020. A similar path is observed regarding management skills, while the reduction from 34.3% to 14.9% in 2020 is significantly lower than that observed in the EU average. Consistently with observed EU trends, professional IT skills are required by a smaller share of enterprises.

As shown in Table 17, general IT skills are mainly needed in the Information and Communication sector, which is the only sector where the need increased over the 2010-2020 decade. It is followed by sectors L-N-R-S (Real estate activities; professional, scientific and technical activities; administrative and support service activities; arts, entertainment and recreation; other service activities), but demand is decreasing over time, suggesting a diffusion of general skills. Sectors J-K show the main need also for professional IT skills, but in this case

the only increasing path over time is observed in Construction, which, as suggested by international report evidence, is one of the sectors where the greening of the economy is changing tasks, requiring more technical competences linked to ecological goals. Nevertheless, these are trends that appear to be specific to the Greek case when compared with paths observed at EU level. On management skills, no surprises are observed compared to EU trends. However, Greek firms exhibit a lower need compared to the EU in all sectors. This can be explained either by a greater diffusion of skill endowment or, seen from the demand perspective, by slower organisational transformations in the Greek economy. Its fragmented firm structure can be one of the reasons explaining this pattern.

Going into the depth of digital skills demand (Table 18), sectors employing the highest number of ICT specialists are Information and Communication (J), Professional, Scientific and Technical Activities (M) and Transportation and Storage (H), with 40% of firms employing ICT specialists compared to the 15% EU average. Surprisingly, Greece doubles the average values observed at EU level in Construction and Accommodation and Food Service Activities.

Looking at Table 19, over the last decade, the percentage of firms finding difficulties in filling vacancies for jobs requiring ICT specialist skills has increased more than the EU average and appears to have increased dramatically in Information and Communication sectors (from 10.55% in 2016 to 29.77% in 2024). However, only in sectors H, N, and M do the observed difficulties appear sizeable compared to Europe.

This complex picture is enriched by data from Thanos and Kapoutsis (2024), according to which Greek businesses anticipate widespread technology adoption across all firm sizes and sectors. Over 80% expect to adopt digital platforms and applications, training and workforce development technologies, artificial intelligence, cloud computing, and big data analytics. Such technology adoption creates demand for advanced digital competences in areas including artificial intelligence, data science, cloud computing, cybersecurity and software development, alongside more widespread basic digital literacy across the workforce.

Recent survey evidence from Cedefop's 2024 European AI skills survey (Cedefop, 2024; as reported in Pouliakas, 2025) reveals that AI adoption in Greek workplaces remains below the European average, with only 21% of workers reporting use of AI tools compared to 28% across eleven EU countries surveyed. However, among Greek workers already using AI, 78% report increased task completion speed, indicating significant productivity potential. A critical challenge is that 51% of Greek workers acknowledge having an AI skill gap—the highest rate among surveyed countries—while only 14% participated in AI-related training in the past year. Moreover, 24% of Greek workers express concern about potential job loss due to AI

technologies, the highest proportion among EU11 countries, highlighting the need for comprehensive reskilling strategies alongside technology adoption.

5.1.3 Green Skills

The green transition represents a second major axis reshaping skill demand in Greece. Unlike countries with a strong industrial base in green technologies, green skill demand in Greece is largely driven by public investment, regulatory change and EU-level policy frameworks, particularly through the Recovery and Resilience Plan and climate-related funding instruments (European Commission, 2023).

Evidence from CEDEFOP (2020) highlights that green skills in Greece are predominantly associated with the transformation of existing jobs rather than the large-scale creation of entirely new green occupations. Sectors such as construction, energy, transport, waste management and tourism increasingly require environmental awareness, energy efficiency competences, regulatory compliance skills and the ability to integrate sustainability practices into routine activities. These findings align closely with ILO evidence on green transitions, which emphasises the embedding of environmental tasks within incumbent occupations rather than occupational replacement (ILO, 2019).

According to Thanos and Kapoutsis (2024), 73% of businesses plan investments to facilitate the green transition. The study identifies several key sectoral transformation areas including energy sector transformation (renewable energy expansion, lignite phase-out, smart grids), sustainable tourism development, climate adaptation in agriculture and food production, transport and logistics transformation (electric vehicles, sustainable shipping), and building sector transformation (energy efficiency retrofits, sustainable materials). These sectoral shifts require both technical competences in specific green technologies and transversal capabilities in environmental management, sustainability strategy and regulatory compliance.

5.1.4 Entrepreneurial Skills

A distinctive feature of the Greek labour market is the high incidence of self-employment and small-scale entrepreneurial activity. While this suggests a relatively strong entrepreneurial orientation, the report highlights a structural gap between entrepreneurial behaviour and the availability of structured entrepreneurial skills. Business planning, innovation management, strategic thinking and scaling competences are unevenly distributed and rarely supported by formal training pathways (OECD, 2023).

This paradox is reflected in the ESCO-based analysis, where entrepreneurial skills represent a smaller share of total skills compared to digital and green competences, but feature prominently among cross-thematic skills combining digital and entrepreneurial dimensions. In Greece, entrepreneurial skills are often developed through experience rather than formal education, which limits their transferability and recognition across sectors and regions.

The limited formalisation of entrepreneurial skills also constrains firms' ability to translate digital and green investments into productivity gains. As highlighted by the World Economic Forum, entrepreneurial and managerial competences play a critical role in enabling organisational adaptation and innovation, especially in contexts characterised by uncertainty and rapid change (WEF, 2025).

Looking at the business strategies reported by senior executives in Thanos and Kapoutsis (2024), occupational demand patterns appear consistent with broader European trends: strong demand growth for professionals in digital technologies, data analytics and environmental management; sustained demand for managers and technicians capable of leading organisational change; transformation rather than displacement of routine manual and administrative roles; and growing importance of hybrid roles combining technical, digital and interpersonal competences.

The emphasis on reskilling (73% of companies) rather than workforce reduction (20%) indicates that Greek firms expect labour market adjustment to occur primarily through skills upgrading within existing workforces rather than through large-scale job destruction.

Beyond technical and sector-specific competences, Thanos and Kapoutsis (2024) identify ten critical skills for 2030: (1) resilience, flexibility and agility, (2) empathy and active listening, (3) communication, (4) people management, (5) analytical thinking, (6) creativity, (7) AI and big data, (8) curiosity and lifelong learning mindset, (9) technological literacy, and (10) service orientation and customer management. Notably, eight of these ten critical skills are human-centred competences rather than technical abilities, highlighting the continued importance of socio-emotional and cognitive capabilities alongside technological expertise.

5.1.5 Skills supply and mismatch

The Greek labour market exhibits significant skill mismatch across multiple dimensions. Greece registers one of the highest rates of tertiary education attainment in the EU (approximately 43% of 25-34 year-olds hold tertiary degrees), yet experiences persistent over-qualification in several sectors. This reflects both structural features of the labour market

(limited availability of high-skill jobs in some regions) and misalignment between educational supply and specific skill demands.

Figure 14 offers a more complete picture of Greek population educational attainment. It confirms evidence on the exceptional percentage of the population having tertiary education and shows a clear positive trend over recent years. The decreasing percentage of people with ISCED levels 0-2 also appears to be more marked than the EU average.

Survey data from Thanos and Kapoutsis (2024) reveal critical gaps regarding skill mismatch: 38% of companies report difficulty finding personnel with required skills; only 50% of secondary education graduates possess necessary competences; 62% of employees require additional training by 2030; and only 52% of current core skills are expected to remain relevant.

Concerning AI-specific competences, 67% of Greek workers believe they will need to acquire additional AI-related skills to handle AI's impact on their jobs, considerably higher than the 61% EU average (Cedefop, 2024). However, 42% of Greek workers believe their employer will not provide necessary AI training, underscoring the gap between recognised skill needs and actual training provision.

This mismatch is particularly acute in digital and green skills, where demand is growing rapidly but training provision remains fragmented and insufficient.

Moreover, skill gaps vary significantly across Greek regions. The Athens-Piraeus area and Thessaloniki concentrate most high-skill job opportunities, while peripheral regions (particularly islands and rural areas) face both limited job availability and skills shortages in specific sectors (e.g., sustainable tourism, renewable energy).

According to Katsikas (2021), over 30% of all Greek workers experience horizontal mismatch. The fields most affected are Agriculture/Veterinary, Humanities/Languages/Arts, Science/Mathematics/Computing, and Engineering/Manufacturing/Construction.

Eurostat and OECD evidence shows that the share of individuals with basic digital skills remains below the EU average, with particularly low levels among older cohorts, low-qualified workers and those employed in small firms (OECD, 2023). Evidence from the Eurostat ICT Survey is summarised in Table 20.

Over recent years, individuals with basic or above basic information and data literacy skills have significantly increased, eventually surpassing the EU average. Nevertheless, individuals with basic skills represent only 8.59% of the population, compared to 13.18% observed at EU level. It is worth noting that Greece exhibits a higher percentage of individuals with basic safety

skills and basic problem-solving skills compared to the EU level, while the percentage is lower for individuals with above basic skills. Such statistics reveal a fragmented picture of skill endowment among different segments of the population, geographical areas and different fields of digital skills.

Recent evidence from Cedefop's 2024 AI skills survey indicates that between 40% and 62% of Greek workers report insufficient understanding of essential AI-related issues such as how algorithms function, the role humans play in developing AI, and how to identify potential biases or ethical risks (Cedefop, 2024; Pouliakas, 2025), highlighting gaps beyond basic digital literacy.

The Greek education system has made efforts to integrate digital skills into curricula, but several challenges remain: limited resources for technology infrastructure in schools, particularly in peripheral regions; insufficient teacher training in digital pedagogy; slow curriculum updates in vocational education and training programmes to reflect emerging technology demands; and fragmented continuous education and lifelong learning opportunities in digital skills (Thanos & Kapoutsis, 2024).

On the supply side, the integration of green skills into formal education and vocational training remains partial and fragmented. Training provision often depends on project-based funding and short-term initiatives, limiting continuity and scalability. As a result, green skills are frequently acquired informally or on the job, with limited certification and recognition. This reinforces the relevance of transversal and cross-thematic skills—identified through the ESCO framework—as strategic levers for supporting green transitions across sectors.

Several limitations characterise the supply side of green skills: few dedicated vocational programmes focused specifically on green skills; university programmes in environmental sciences that are not always well-aligned with practical industry needs; fragmented and often unstandardised continuing education in green skills; concentration of green skills training in major urban areas; and limited access to specialised green training in peripheral regions, despite strong local demand (e.g., renewable energy in islands, sustainable tourism in coastal areas).

Entrepreneurial and transversal skills have traditionally received limited attention in Greek education and training systems. In general education, traditional emphasis on theoretical knowledge and memorisation rather than problem-solving and critical thinking has limited development of soft skills and transversal competences. In vocational training, technical skills are often prioritised over transversal competences, with limited emphasis on soft skills

development and few structured pathways for developing leadership and management capabilities among technical specialists.

The Greek training system faces several structural challenges in responding to rapid skill demand changes. Training provision is distributed across multiple actors (public vocational training institutes, private training centres, universities, employer organisations), creating coordination difficulties. There is limited capacity for anticipating skill needs in curriculum design and training investment. Quality assurance mechanisms for training provision are fragmented in their application. Workers in small and medium enterprises (which dominate the Greek business landscape) have more limited access to structured training opportunities compared to employees of large firms.

Across all three skill domains, adult learning and continuing vocational training emerge as critical bottlenecks in Greece. Participation rates in lifelong learning remain below the EU average, particularly among low- and medium-skilled workers and employees in small firms (Eurostat CVTS; OECD, 2023). While enterprises increasingly recognise skill gaps, their capacity to respond through training is constrained by financial, organisational and informational barriers.

This pattern reinforces the structural nature of skill mismatches in Greece: gaps are not only quantitative, but reflect limited coordination between education systems, training providers and employers. As OECD evidence suggests, weak signalling mechanisms and insufficient recognition of non-formal learning further exacerbate mismatches, even where skills are acquired through work experience.

Table 21 shows that only 17.8% of firms provide training courses, compared to 67.4% observed at EU level. The trend has also decreased significantly since 2010. The number of participants in CVT courses (Table 22) also positions Greece significantly lower than the EU average (11.8% vs 42.4% in 2020). Participation rates in education and training (Table 23) are approximately one third of the EU average for all ISCED levels.

The survey findings indicate growing awareness among employers of these gaps, with 73% planning to invest in reskilling programmes. However, the capacity of existing training infrastructure to absorb this demand at scale and with appropriate quality remains uncertain.

5.1.6 Priority Digital, Green and Entrepreneurial Skills

The Greek skills challenge is shaped by structural constraints in the education and training system. According to Katsikas (2021), the vocational education and training system exhibits

persistent weaknesses in connecting educational supply with labour market demand. Curriculum design in VET programmes shows limited input from employers, particularly pronounced in technical and professional training pathways. This disconnect results in graduates possessing formal qualifications that do not align well with actual workplace requirements.

Further constraints emerge from the limited provision of continuing vocational training. As documented in Tables 21-23, only 17.8% of Greek firms provide training courses compared to 67.4% at EU level, while participation rates in education and training stand at approximately one-third of EU averages across all ISCED levels. These low participation rates, combined with weak coordination between training providers and enterprises, create systematic barriers to skills upgrading even where gaps are recognised (Katsikas, 2021; OECD, 2023).

The tertiary education system, despite producing high rates of graduates, shows similar misalignment. According to Thanos and Kapoutsis (2024), tertiary education does not provide adequate emphasis on developing the soft skills and transversal competences increasingly demanded by employers. This results in substantial gaps between future skill needs and the capabilities of university graduates, with only 50% of secondary education graduates possessing competences required by businesses.

Fragmentated and aggregated data do not allow to obtain a detailed and complete picture of skill priorities.

The Skill Intelligence dashboard elaborated by CEDEFOP allows the derivation of a list of priorities, based on the elaboration of top skills (at ESCO level 2) requested in online job advertisements in 2024. Figure 15 shows that "accessing and analysing digital data" has the highest value at 23.5%, while "programming computer systems has the lowest value", equal to 3.2%. "Using digital tools for collaboration, content creation and problem solving" is the second most requested skill, with 21%. Among the other top skills, none appear to be directly linked to green jobs or to entrepreneurship, with the exception of "developing objectives and strategies" and "organising, planning and scheduling work and activities".

Acknowledging the limitations of existing evidence, further suggestions can be derived from reports and country-specific studies.

According to Thanos and Kapoutsis (2024), training programmes should prioritise development of analytical thinking, creativity, and proficiency in AI and big data usage. These priorities directly correspond to the technologies businesses anticipate adopting, with over 80% expecting to implement AI, cloud computing, and big data analytics. The emphasis on analytical thinking and creativity as foundational competences reflects recognition that

effective technology adoption requires not merely technical operation but strategic application and innovative problem-solving.

The acute AI skills gap documented by CEDFOP Skill Intelligence (2024) and Pouliakas (2025) adds urgency to these priorities. With 51% of Greek workers acknowledging AI skill gaps—the highest rate among surveyed EU countries—and only 14% having received relevant training, systematic AI literacy programmes constitute a critical immediate priority. This includes not only technical AI competences for specialists but also broader AI literacy enabling all workers to understand algorithmic systems, identify potential biases, and apply AI tools appropriately in their roles. The fact that 40-62% of workers report insufficient understanding of how algorithms function, the role of humans in AI development, and ethical implications indicates that foundational AI literacy must precede more advanced technical training.

For green skills, available evidence indicates priorities centred on sectoral transformation patterns. According to Thanos and Kapoutsis (2024), 73% of businesses plan investments facilitating green transition, concentrated in energy sector transformation, sustainable tourism, climate adaptation in agriculture, transport electrification, and building sector sustainability. These sectoral priorities imply demand for competences in renewable energy technologies, energy efficiency implementation, sustainable construction practices, and climate adaptation strategies.

However, to the best of our knowledge, systematic skills taxonomy for the green domain remains limited in available evidence for Greece. While sectoral transformation areas are identified, detailed classification of specific technical competences, their required proficiency levels, and optimal training pathways requires further development. This represents a gap in skills anticipation infrastructure that constrains both training provision and occupational guidance.

The most clearly articulated priorities emerge in the entrepreneurial and transversal domain. Thanos and Kapoutsis (2024) identify ten critical skills required for effective performance in 2030 workplace contexts: resilience, flexibility and agility (ranked most critical); empathy and active listening (ranked second); communication; people management; analytical thinking; creativity; AI and big data; curiosity and lifelong learning mindset; technological literacy; and service orientation.

The composition of this list is revealing: eight of ten critical skills are human-centred socio-emotional and cognitive competences, with only two (AI/big data, technological literacy) being primarily technical. This distribution highlights that even in contexts of rapid technological

transformation, human capabilities—particularly those enabling adaptation, collaboration, and continuous learning—constitute the most critical priorities.

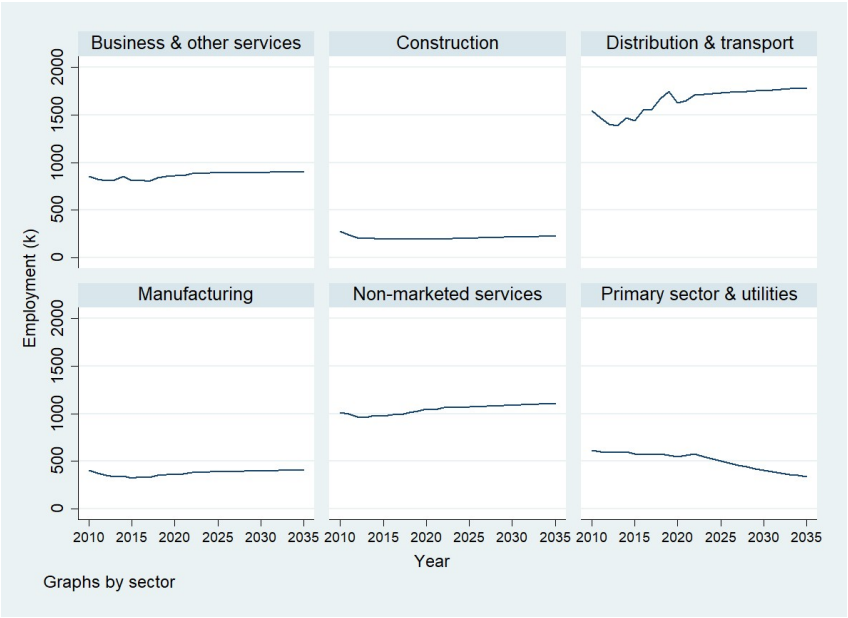
The prominence of resilience, flexibility and agility as the top-ranked skill likely reflects the Greek experience of prolonged economic crisis and ongoing uncertainty, contexts in which adaptive capacity becomes paramount. Similarly, the emphasis on empathy, active listening, and communication reflects recognition that effective organisational functioning in transformation contexts depends critically on interpersonal and collaborative capabilities.

It is worth noting that these competences are strongly linked to attitudes and socio-relational dispositions that, beyond the skill training focus of this report, underscore the foundational importance of basic education in cultivating interpersonal capabilities and adaptive mindsets.

A critical finding from Thanos and Kapoutsis (2024) is that despite clear identification of these skill priorities, their development does not constitute a priority in current training and education programmes. This misalignment between identified needs and actual provision represents perhaps the most important policy challenge. While 62% of employees are projected to require additional training by 2030, and only 52% of current core skills are expected to remain relevant, the training system shows limited capacity to respond at necessary scale and quality.

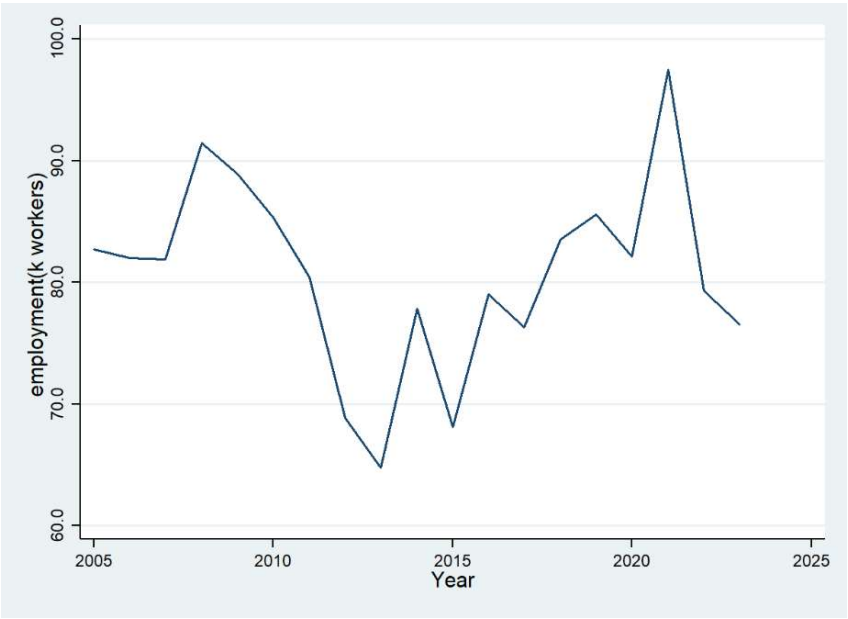
Addressing this gap requires coordinated intervention across multiple dimensions: curriculum reform in both tertiary and vocational education to integrate soft skills and transversal competences; substantial expansion of continuing vocational training provision, particularly targeting workers in SMEs; development of more effective skills anticipation mechanisms enabling training provision to respond to emerging demands; and strengthening of coordination between education providers, training institutions, and employers to ensure alignment between supply and evolving needs.

Figure 11 Total Employment (k workers) in Greece by broad sector. Trend and forecast from 2010 to 2035



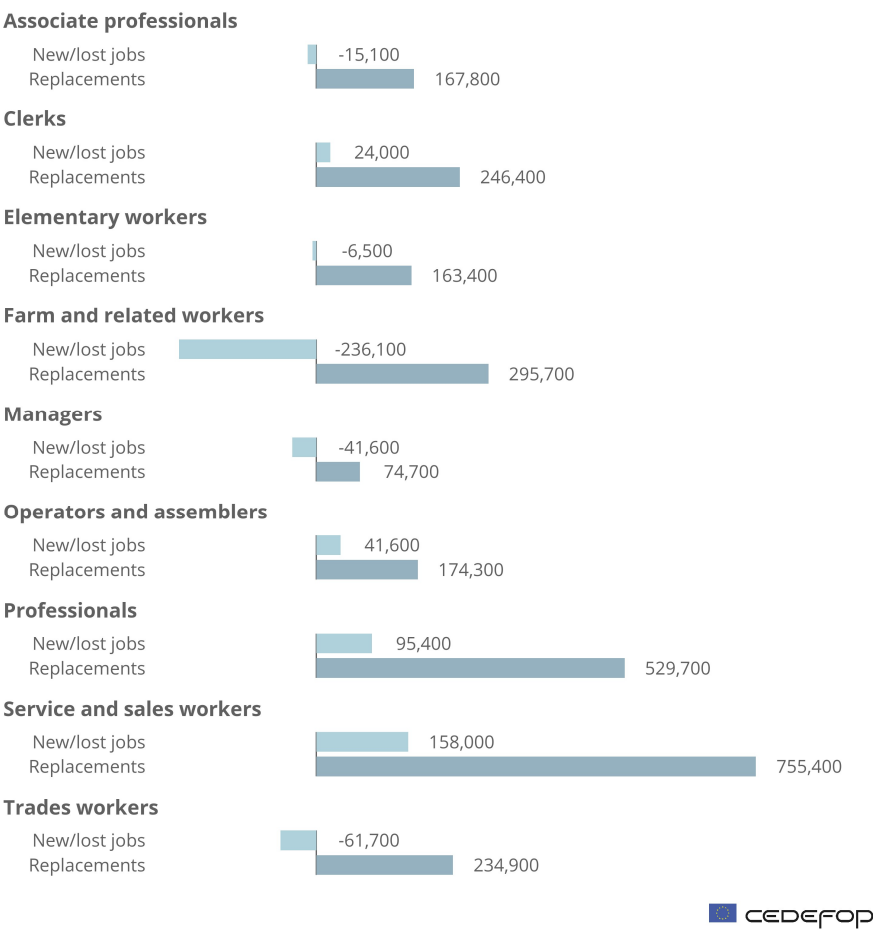
Source: Author's elaboration on CEDEFOP data (2023) downloaded in November 2025.

Figure 12 Persons Employed in Circular economy sectors (K workers). Greece (2005-2025)



Note: employed in the recycling sector, repair and reuse sector and rental and leasing sector
Source: Eurostat (2025)

Figure 13. Future needs (total job openings) by occupation in Greece 2022-2035.



Source: Cedefop skill forecast (2026)

Table 17- Main skills needed for the development of the enterprises by type of skill and NACE Rev. 2 activity (% of all enterprises) in Greece

NACE REV.2	B-E	F	G-I	J-K	L-N-R-S
YEAR	GENERAL IT SKILLS				
2010	44.7	49.0	43.7	38.2	50.5
2015	32.5	22.5	27.3	32.3	34.0
2020	32.3	26.1	24.9	46.3	42.3
	PROFESSIONAL IT SKILLS				
2010	31.2	29.9	26.8	63.6	39.9
2015	20.5	28.4	12.7	43.6	24.0
2020	23.3	30.2	12.4	45.1	13.9
	MANAGEMENT SKILLS				
2010	32.4	38.4	32.1	39.1	41.5
2015	16.7	15.1	12.6	21.4	18.7
2020	17.7	6.8	13.2	23.7	19.4

Note: B-E: Industry (except construction); F: Construction; G-I : Wholesale and retail trade, transport, accommodation and food service activities; J-K: Information and communication; financial and insurance

activities; L-N-R-S: Real estate activities; professional, scientific and technical activities; administrative and support service activities; arts, entertainment and recreation; other service activities
Source: Eurostat (2025- CVT Survey)

Table 18 Enterprises that employ ICT specialists by NACE Rev.2 in EU-27 (% of enterprises). Greece (2014-2024)

Nace rev 2		2014	2015	2016	2017	2018	2019	2020	2022	2024
C	Manufacturing	:	:	:	:	:	:	:	17.08	19.06
D	Electricity, gas, steam and air conditioning supply	:	:	:	:	:	:	:	46.07	37.41
E	Water supply; sewerage, waste management and remediation activities	:	:	:	:	:	:	:	22.40	25.93
F	Construction	19.98	18.10	16.29	13.31	15.90	19.02	:	12.72	15.27
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	:	28.02	32.22	24.16	26.47	29.11	:	24.06	19.47
H	Transportation and storage	38.36	32.12	38.51	29.32	29.87	33.11	:	27.38	40.10
I	Accommodation and food service activities	14.32	12.69	18.85	8.81	11.91	8.42	:	14.11	14.40
J	Information and communication	:	:	:	:	:	:	56.01	70.58	72.50
L	Real estate activities	:	:	:	:	:	:	:	35.41	24.58
M	Professional, scientific and technical activities	:	:	:	:	:	:	:	34.24	41.83
N	Administrative and support service activities	31.34	24.97	33.79	29.95	25.78	28.17	:	22.69	28.15

Note: population include enterprise with 10 or more employed;
data for Nace A an B are not available;
: not available
Source: Eurostat (2025) (European ICT usage survey)

Table 19. Enterprise had hard-to-fill vacancies for jobs requiring ICT specialist skills. Greece (2015-2024)

Nace rev 2		2015	2016	2017	2018	2019	2020	2022	2024
C	Manufacturing	0.79	1.74	1.47	2.37	2.99	:	4.32	3.40
D	Electricity, gas, steam and air conditioning supply	:	:	:	:	:	:	17.43	9.35
E	Water supply; sewerage, waste management and remediation activities	:	:	:	:	:	:	12.32	2.05
F	Construction	0.09	0	1.11	0.13	2.29	4.56	5.25	1.18
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	0.98	1.50	3.04	3.92	3.88	:	7.32	4.22
H	Transportation and storage	3.65	1.02	2.86	5.35	3.36	1.93	4.18	8.52
I	Accommodation and food service activities	1.66	2.27	1.32	1.08	0.90	:	3.75	3.06
J	Information and communication	:	10.55	:	:	:	:	34.9	29.77
L	Real estate activities	:	:	:	:	:	:	4.61	4.03
M	Professional, scientific and technical activities	:	:	:	:	:	:	11.58	11.72
N	Administrative and support service activities	1.03	3.61	5.39	6.82	3.65	:	5.73	13.30

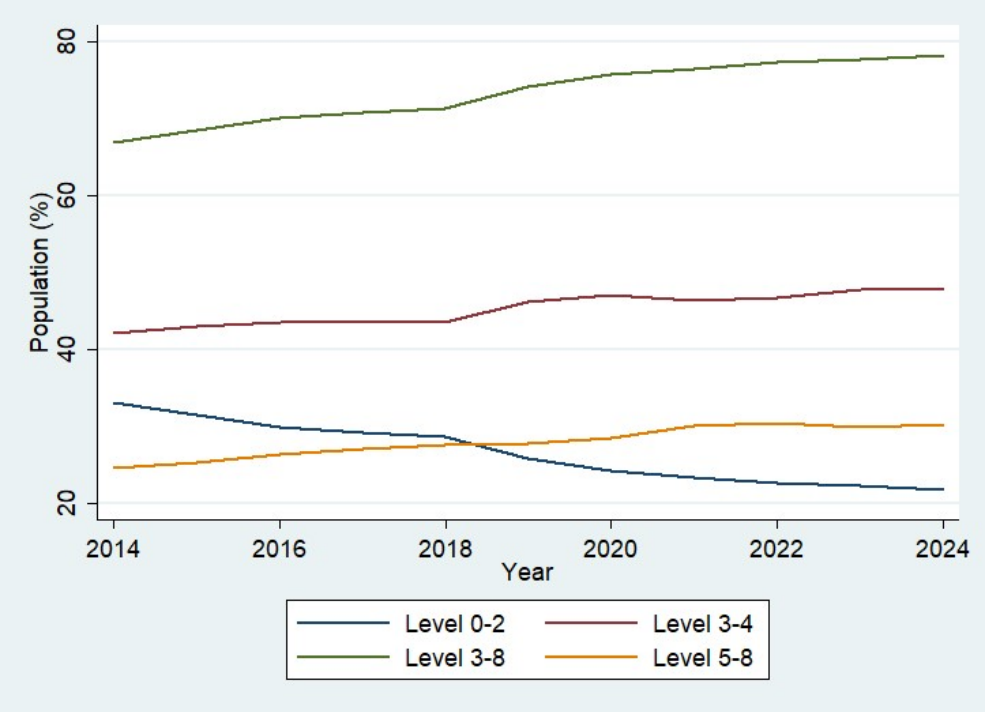
Note: population include enterprise with 10 or more employed;

data for Nace A an B are not available;

: not available

Source: Eurostat (2025) (European ICT usage survey)

Figure 14. Greece: Population by educational attainment (% of total population from 15 to 64 years)



Source: Eurostat 2025 (Labour force survey)

Table 20. Greece: Individuals' level of digital skills (% of individuals 16-74 years)

Year	**2021**	**2023**
Individuals with basic or above basic information and data literacy skills	76.49	82.30
Individuals with above basic information and data literacy skills	70.22	73.71
Individuals with basic information and data literacy skills	6.27	8.59
Individuals with basic or above basic communication and collaboration skills	75.62	80.25
Individuals with above basic communication and collaboration skills	70.15	73.32
Individuals with basic communication and collaboration skills	5.47	6.93
Individuals with basic or above basic digital content creation skills	62.29	63.46
Individuals with above basic digital content creation skills	40.55	45.11
Individuals with basic digital content creation skills	21.74	18.35
Individuals with basic or above basic safety skills	60.41	66.03
Individuals with above basic safety skills	35.75	33.16
Individuals with basic safety skills	24.65	32.87
Individuals with basic or above basic problem solving skills	66.7	70.86
Individuals with above basic problem solving skills	39.96	39.77
Individuals with basic problem solving skills	26.74	31.09
Individuals with basic or above basic overall digital skills	52.48	52.4
Individuals with above basic overall digital skills	21.7	20.02
Individuals with basic overall digital skills	30.78	32.38
Individuals with low overall digital skills	10.64	14.98
Individuals with narrow overall digital skills	7.86	8.51
Individuals with limited overall digital skills	5.45	6.31
Individuals with no overall digital skills	2.07	2.81
Digital skills could not be assessed: individual has not used internet in the last 3 months	21.51	14.99

Note :
The Digital Skills Indicator 2.0 (DSI) is a composite indicator which is based on selected activities related to internet or software use that individuals aged 16-74 perform in five specific areas (Information and data literacy, Communication and collaboration, Digital content creation, Safety, and Problem solving). It is assumed that individuals having performed certain activities have the corresponding skills. Therefore, the indicators can be considered as proxy of individuals' digital skills.
According to the variety of activities performed, two levels of skills are computed for each of the five areas ("basic" and "above basic"). Finally, based on the component indicators for each area, an overall digital skills indicator is calculated as a proxy of the digital skills of individuals ("no skills", "limited", "narrow", "low", "basic", "above basic" or "at least basic skills").
Individuals with basic or above basic overall digital skills= all five component indicators are at basic or above basic level,
Individuals with above basic overall digital skills=all five component indicators are at above basic level,
Individuals with basic overall digital skills= all five component indicators are at basic or above basic level, without being all above basic;
Individuals with low overall digital skills=four out of five component indicators are at basic or above basic level.
Individuals with narrow overall digital skills=three out of five component indicators are at basic or above basic level;
Individuals with limited overall digital skills=two out of five component indicators are at basic or above basic level. Source: Eurostat 2025 (ICT Survey)

Table 21. Enterprises providing training by type of training - Greece (% of all enterprises)

Year	2005	2010	2015	2020
CVT courses and/or other forms of CVT	21	27.8	21.7	17.8
CVT courses	18.8	20.8	12.7	13
CVT courses - internal	7.2	10.5	7.9	4.9

Source: Eurostat 2025 (Continuing Vocational Training Survey -CVTS)

Table 22. Participants in CVT courses by sex- Greece (% of persons employed in all enterprises)

Year	2005	2010	2015	2020
Total	13.6	16.3	18.5	11.8
Males	12.9	16.1	19.8	10.7
Females	14.8	16.6	16.8	13.7

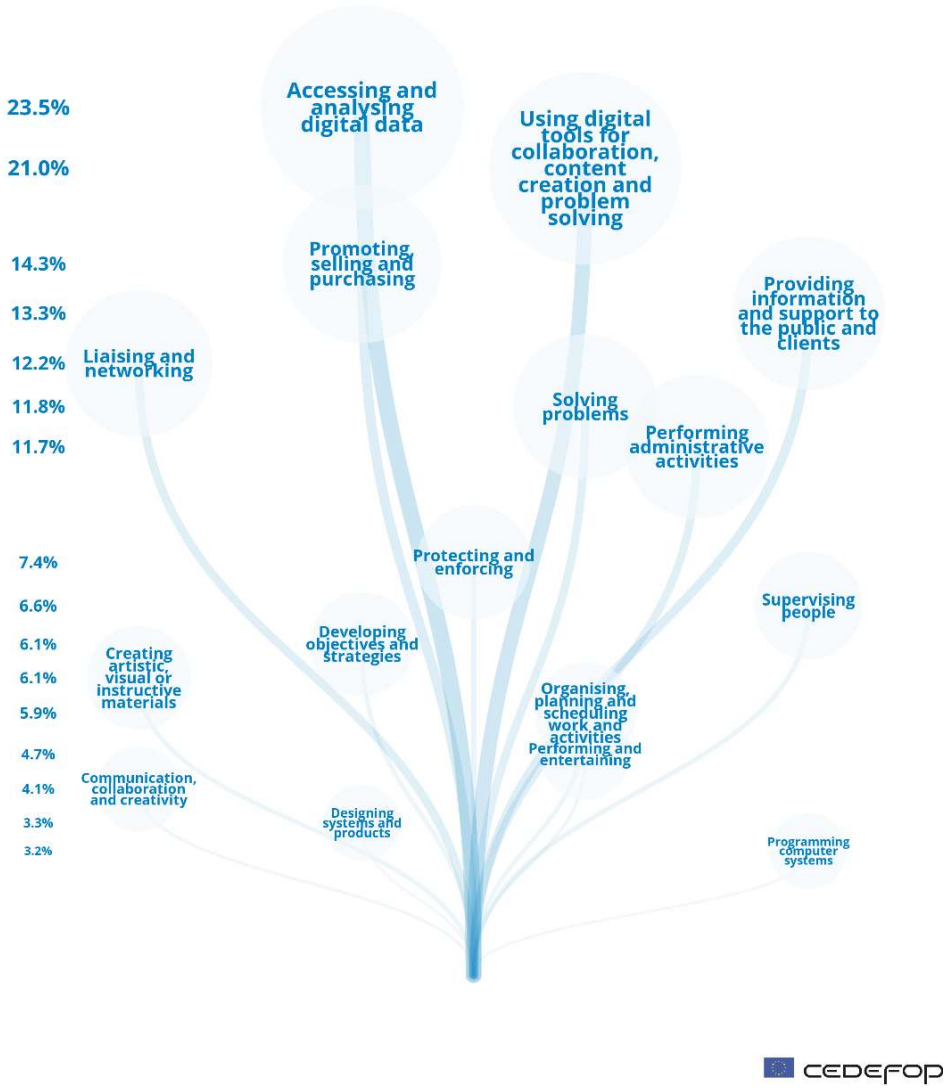
Source: Eurostat 2025 (Continuing Vocational Training Survey -CVTS)

Table 23. Participation rate in education and training (over previous last 4 weeks) by educational attainment level (% population aged 25-64 years)- Greece

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Levels 0-2	0.4	0.4	0.7	0.7	0.8	0.8	0.8	0.4	0.4	0.3	0.4
Levels 3-8	4.5	4.5	5.3	5.9	5.9	4.9	5	4.3	4.2	4.1	5.3
Levels 3 and 4	3.7	3.6	4.1	4.6	4.6	3.8	4.2	3.2	3.4	3.2	3.8
Levels 5-8	5.8	5.7	7	7.7	7.5	6.4	6.2	5.6	5.4	5.3	7.2
All ISCED 2011 levels	3.2	3.3	4	4.5	4.5	3.9	4.1	3.5	3.5	3.4	4.4

Source: Eurostat 2025 (EU Labour Force Survey)

Figure 15. Most requested skills in online job ads in Greece in Skills in 2024 (ESCO level 2)



Source: CEDEFOP Skill Intelligence (2025)

5.2 Italy

While Italy shares the broader European structural drivers shaping skill demand—digitalisation, the green transition, and demographic shifts—the Italian labour market exhibits distinctive features rooted in its productive structure and recent economic trajectory. The Italian economy is characterised by a prevalence of micro and small enterprises, a strong manufacturing tradition particularly concentrated in specific industrial districts, and persistent territorial disparities between Northern and Southern regions.

According to OECD (2024,25), Italy lags behind other European Union Member States with respect to overall entrepreneurship rates. The business entry rate in 2021 stood at 8%, approximately 3 percentage points below the EU average of 11%. Between 2019 and 2023, the Total Early-stage Entrepreneurial Activity (TEA) rate averaged 4%, compared to an EU average of 7%. Notably, the self-employment rate in 2023 reached 19%, markedly above the EU average of 13%, though declining by 0.2 percentage points between 2022 and 2023, continuing a decade-long downward trend (OECD, 2024,25).

The Italian employment structure reveals a dominant service sector. According to ISTAT (2025), in the first quarter of 2025, total employment reached 24.186 million, with an employment rate of 62.7% and unemployment at 6.1%. Employment in services (sectors G-S, excluding public administration) accounted for the majority of positions, while industry (sectors B-F) represented a substantial but secondary share. Within services, key sectors include wholesale and retail trade, professional and technical activities, and accommodation and food services, the latter showing a significant concentration of part-time work (ISTAT, 2025).

5.2.1 Employment Projections and Sectoral Transformation

According to CEDEFOP projections (2023), Italy's employment is expected to evolve through 2035 by 4.6%, slightly below the EU average (5%). This aggregate path follows sectoral reallocation patterns. As shown in Figure 16, the sectoral distribution reflects ongoing transformation, with Business and other services maintaining a substantial share alongside Distribution and transport. These leading sectors are followed by Non-marketed services, showing a positive trajectory, and Manufacturing, which appears largely stagnant.

Figure 17 illustrates employment trends in circular economy sectors, including recycling, repair and reuse, and rental and leasing activities. Since 2015, Italy has experienced a clear

upward trend until the COVID-19 pandemic, and the negative shock has not yet been fully absorbed.

Occupational projections reveal significant reallocation across skill levels and job categories. According to CEDEFOP Skill Intelligence (2026), future job openings by occupation between 2022 and 2035 demonstrate substantial demand for professionals, technicians and associate professionals, and service and sales workers (Figure 18). Job openings depend mainly on replacement demand. Only for professionals is a more sizable number of new jobs observed. This occupational structure highlights Italy's limited growth and the gradual transition toward higher-skilled employment patterns, though constraints remain in specific technical domains.

According to ISTAT (2025), in the first quarter of 2025, employee positions grew by 0.6% quarter-on-quarter (seasonally adjusted), with full-time positions increasing by 0.6% and part-time positions by 0.5%. Year-on-year growth stood at 1.9% for total positions, with equal intensity for full-time positions and slightly lower growth (1.6%) for part-time positions. The share of part-time positions remained stable at 28.8%, showing a slight decline (-0.1 percentage points) compared to the same quarter of the previous year.

Sectoral analysis reveals differentiated dynamics. Construction registered robust growth (+1.0% quarter-on-quarter, +3.0% year-on-year), while services expanded moderately (+0.7% quarter-on-quarter, +2.3% year-on-year). Within services, market services (G-N) grew by 0.7% and 2.2% respectively, with notable increases in professional, scientific and technical activities (+1.2% and +4.8%) and real estate activities (+1.7% and +9.0%). Manufacturing showed modest growth (+0.1% and +0.2%), reflecting ongoing structural challenges in industrial competitiveness (ISTAT, 2025).

5.2.2 Digital Skills

Consistent with European-wide evidence, digitalisation represents a major driver of skill demand transformation in Italy. However, the Italian context exhibits specific characteristics related to the productive structure and digital skill supply constraints.

According to Eurostat (2025) Continuing Vocational Training Survey, Table 24 shows that general IT skills are needed across all sectors, with particularly high incidences in Information and Communication (J-K) and Professional, Scientific and Technical Activities (L-N-R-S). Overall, the need for professional IT skills is significantly higher across all sectors. In the J-K sectors, 50% of firms consider these skills important for development. The incidence is double compared to other NACE sectors. J-K is also the sector where the need for management skills

is highest, though decreasing over time, suggesting a process of diffusion and organisational change.

The data reveal that Italian firms prioritise technical and professional skills alongside general IT competences, reflecting the need to upgrade workforce capabilities in response to ongoing digital transformation.

Examining ICT specialist employment (Table 25), sectors with the highest percentages of firms employing ICT specialists include Information and Communication, Financial and Insurance Activities, and Professional, Scientific and Technical Activities. The time series from 2014 to 2024 shows gradual increases in ICT specialist employment across most sectors, though levels remain below some EU comparators, indicating persistent digital skills gaps (Eurostat, 2025).

Table 26 presents data on enterprises facing hard-to-fill vacancies for jobs requiring ICT specialist skills between 2014 and 2024. The evidence indicates growing recruitment difficulties in specific sectors, again notably Information and Communication, and Professional, Scientific and Technical Activities. Taken together, these figures suggest that demand is mainly concentrated in some sectors, where both the number of specialists employed and the difficulties in filling vacancies are higher.

According to the SISTAN CPI Report (2024), in 2023, Digital Jobs accounted for 10.1% of total contract activations (1,341,250 contracts). The sectors with the highest digital job incidences were Energy supply (53.0% with 5,662 contracts), Financial and Insurance Activities (47.6% with 20,672 contracts), and Professional, Scientific and Technical Activities (46.5% with 160,666 contracts). Information and Communication Services also showed significant relevance, with a 25.4% incidence and over 267,000 contracts activated (Rapporto SISTAN CPI, 2024).

However, the report highlights a critical aspect: while numerical growth is evident, most digital jobs concentrate in mid-level technical roles or operational positions using digital tools instrumentally (such as distance sellers and call center operators) rather than in core innovation professions like advanced software developers, artificial intelligence specialists, cybersecurity experts, or data scientists. This pattern suggests that the Italian labour market is absorbing intermediate technical figures rather than driving frontier digital innovation (SISTAN CPI Report, 2024).

5.2.3 Green Skills

The green transition represents a second major axis reshaping skill demand in Italy. According to the SISTAN CPI Report (2024), Green Jobs represented 16.5% of total contract activations in 2023 (2,174,558 contracts).

The sectoral distribution reveals that Agriculture, Forestry and Fishing registered the highest incidence (95.1%, corresponding to 1,357,724 contracts), followed by Water Supply, Sewerage, Waste Management and Remediation (57.8% with 30,405 contracts), and Energy Supply (19.5% with 2,089 contracts). Other sectors with significant green job shares include Business Support Services (16.9% with 143,560 contracts) and Manufacturing (15.9% with 148,198 contracts).

However, the skill complexity analysis reveals a critical characteristic of Italian green jobs: the overwhelming majority (65.2% in 2023) are classified as medium-low vocational level, with a further 21.4% at low vocational level. Only 10.6% fall into the high vocational category, and 2.9% into the medium-high vocational level. This concentration in lower skill categories primarily reflects the predominance of agricultural workers, who constitute the vast majority of green job activations across all territorial areas (Rapporto SISTAN CPI, 2024).

This evidence indicates that current green job demand in Italy is heavily concentrated in traditional agricultural activities rather than in emerging sustainability professions requiring advanced technical competences.

According to the “Piano Nazionale Integrato per l'Energia e il Clima” (PNIEC, 2024), Italy has updated its decarbonisation objectives with increased investments in renewable energy sources, creating additional employment opportunities in the sector. The PNRR (Piano Nazionale di Ripresa e Resilienza) Mission 2, focused on the green revolution and ecological transition, has strengthened investments in renewable energies and green infrastructure, promoting energy efficiency in buildings and supporting the growth of new occupational sectors in clean technologies.

5.2.4 Entrepreneurial Skills

Entrepreneurial dynamics in Italy present distinctive features. According to OECD (2024-25), between 2019 and 2023, women's TEA rate (3%) was approximately half that of men (6%), with a higher share of women entrepreneurs driven by necessity (28% vs. 15%). Youth (18-30 years) engagement in starting or managing new businesses was below the EU average (6% vs. 9%), while seniors (50-64 years) stood at about half the EU average (2% vs. 4%).

The share of early-stage entrepreneurs expecting to create more than 19 jobs within five years stood at 6% between 2019 and 2023, well below the EU average of 14%, indicating limited growth ambitions among Italian entrepreneurs. This reflects structural constraints in access to finance, innovation capacity, and internationalisation capabilities characteristic of the Italian SME ecosystem (OECD, 2024,25).

The classification of entrepreneurial skills within the ESCO framework and other taxonomies remains limited. As the SISTAN CPI Report (2024) notes, entrepreneurial and transversal skills have traditionally received limited attention in Italian education and training systems, creating gaps in competences such as strategic thinking, innovation management, digital leadership, and change management capabilities.

5.2.5 Skills Supply and Mismatch

The Italian labour market exhibits significant skill mismatch across multiple dimensions. Educational attainment data reveal important structural characteristics. Figure 19 shows population by educational attainment (percentage of total population aged 15 to 64 years), indicating the distribution across tertiary, upper secondary, and lower secondary education levels (Eurostat, 2025). Italy's performance is significantly below the EU average, with 20% having tertiary education, 44.6% upper secondary non-tertiary education, and 35% primary or below-primary education.

Focusing on digital skills supply, Table 27 presents individuals' level of digital skills (percentage of individuals aged 16–74 years). The data show very stable values over time. Individuals with basic or above-basic overall digital skills represent 45.75%; those with above-basic skills account for 22.21%, and those with basic digital skills for 23.54%. The area where the percentage of individuals with basic or above-basic skills is relatively lower is the safety domain (59%), while the highest is registered in communication and collaboration skills (83.9%).

According to the ISTAT Focus on Professional Skills (2024), Italian workers report varied levels of skill utilisation. The survey examined time dedicated to using digital tools, technical documentation, complex calculations, physical-motor activities, precision in digit use, relational-communicative activities, and aspects characterising work conduct modalities such as degree of autonomy, task repetitiveness, and rigor in labour procedures.

The data reveal that 37.1% of workers reported high use of digital tools, 13.8% high use of technical documentation reading, and 10.0% high use of complex calculations. For physical-motor skills (forza), 37.4% reported high utilisation. Regarding relational skills, 36.1%

reported high levels of internal communication (com. interna), and 28.6% high levels of external communication (com. esterna). Concerning autonomy, 44.7% reported high autonomy in task sequencing (aut. ordine) and 38.8% high autonomy in content definition (aut. contenuti). Task repetitiveness (ripetitività) was reported as high by 44.2%, while procedural rigor (procedure) was high for 42.5% of workers (ISTAT, 2024).

The Italian training system faces structural challenges in responding to rapid skill demand changes. Table 28 shows that enterprise provision of Continuing Vocational Training (CVT) courses and other forms of CVT has increased over time, with 68.9% of firms providing courses in 2020. The participation rate among the employed has also increased over time, from 28.5% in 2005 to 44.6% in 2020 (Table 29).

Finally, Table 30 reports participation rates in education and training (over the previous four weeks) by educational attainment level for the population aged 25–64 years, highlighting sizable differences in lifelong learning engagement across qualification levels. The highest rate of participation is registered among those with tertiary education (22.3%), while it is very low among those with ISCED levels 0–2 (2.9%). Data suggest that lifelong learning tends to be concentrated among the employed with higher education levels, posing issues for the reskilling and upskilling of individuals with lower education levels.

According to the SISTAN CPI Report (2024), green and digital skill mismatches exhibit distinct territorial and vocational patterns. For green skills, high-vocational positions are concentrated in Northern metropolitan areas, while Southern regions show a predominance of low-skilled agricultural positions. For digital skills, while greater diversification emerges compared to green jobs, most positions remain at technical-operational rather than innovation levels. Northern metropolitan areas show greater variety, but still anchored to mid-level technical functions rather than cutting-edge digital innovation roles.

5.2.6 Priority Digital, Green and Entrepreneurial Skills

The Italian skills challenge is shaped by structural constraints in the education and training system, characteristics of the productive structure, and territorial disparities.

According to the Strategia Nazionale per le Competenze Digitali (2023), Italy aims to ensure that 70% of Italians possess basic digital skills by 2026, aligning with European objectives. The most recent data make achieving such objectives difficult.

The National Plan Industry 4.0 has incentivised the digital transformation of small and medium enterprises through tax credits and fiscal incentives. Since 2023, the extension of

these measures has included the tax credit for 4.0 training, aiming to develop digital competences among workers (SISTAN CPI Report, 2024).

Figure 20 presents the most requested skills in online job advertisements in Italy in 2024 (ESCO level 2), derived from CEDEFOP Skill Intelligence data (2026). This provides evidence-based indicators of immediate market priorities, though with limitations inherent to job advertisement analysis as a proxy for comprehensive skill demand. The most requested skill is “accessing and analysing digital data”, immediately followed by “using digital tools for collaboration, content creation and problem solving”. The fourth most requested is also a digital skill: “analysing and evaluating information and data”. Among the other most requested skills, some can be linked to the entrepreneurial category, although this classification is based on qualitative evaluation and should be treated with caution (“supervising people”, “organising, planning and scheduling work and activities”, “developing objectives and strategies”, “allocating and controlling resources”).

Given the fragmented nature of available evidence, comprehensive priority rankings remain difficult to derive from existing documents. However, certain patterns emerge from the data:

For digital skills, priorities appear concentrated in foundational digital literacy and general ICT competences for widespread workforce upgrading; intermediate technical skills in specific domains (professional and technical activities, information and communication); and addressing recruitment difficulties for ICT specialists, particularly in sectors experiencing rapid digital transformation.

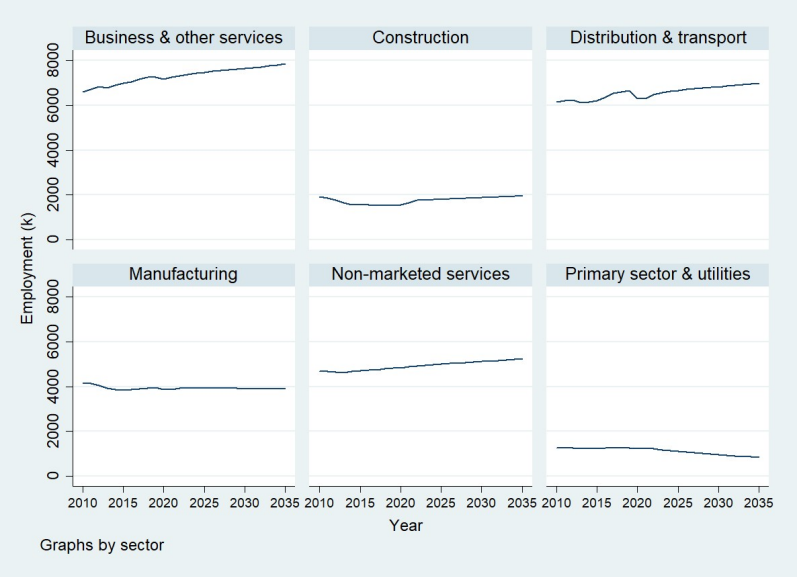
For green skills, given the current concentration in low-skilled agricultural positions, a main priority can be identified in creating pathways from agricultural employment to higher-skilled green occupations.

For entrepreneurial skills, the above-cited list of skills identified in CEDEFOP projections based on job advertisements can be considered.

The Fondo Nuove Competenze has represented a crucial instrument for supporting enterprises in continuous employee training, particularly in the context of green and digital transitions. The fund's expansion in 2023 has allowed training to be oriented toward creating competences that respond to new market requirements (Rapporto SISTAN CPI, 2024).

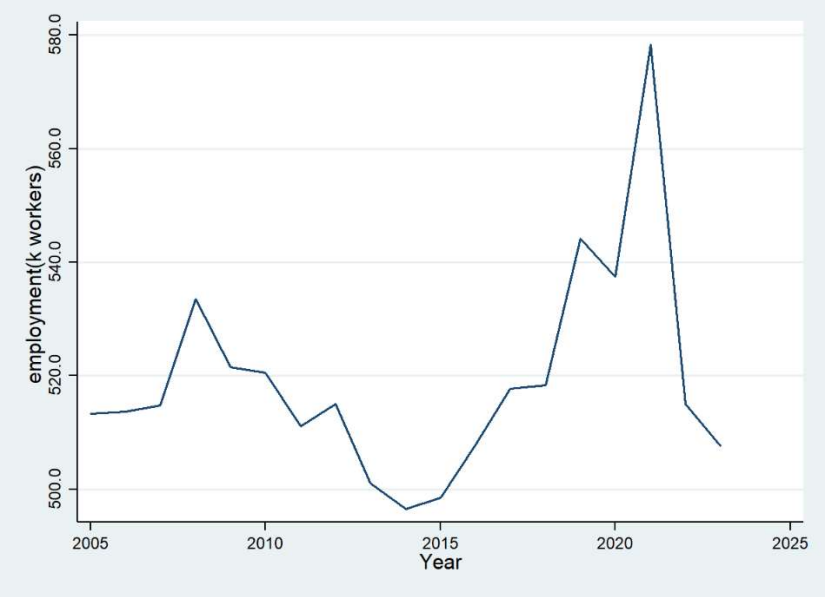
However, it is important to note that the available documentation does not permit the derivation of complete, granular priority lists with specific skill rankings or detailed taxonomic breakdowns. Further evidence would be required for comprehensive skills prioritisation across all three domains and territorial contexts.

Figure 16 Total Employment (k workers) in Italy by broad sector. Trend and forecast from 2010 to 2035



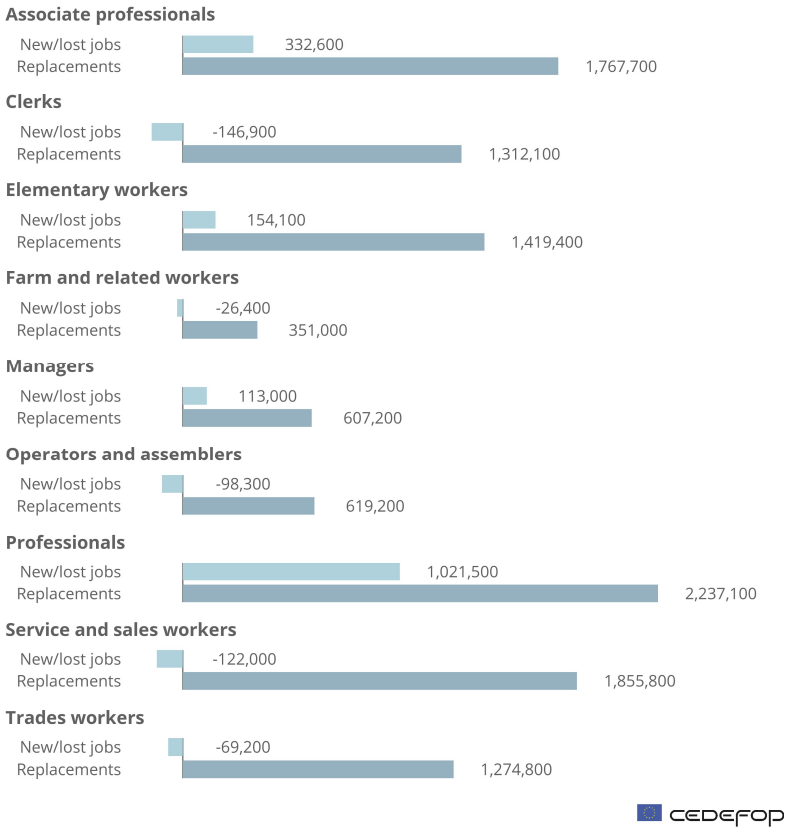
Source: Author's elaboration on CEDEFOP data (2023) downloaded in November 2025.

Figure 17 Persons Employed in Circular economy sectors (K workers). Italy (2005-2025)



Note: employed in the recycling sector, repair and reuse sector and rental and leasing sector. Source: Eurostat (2025)

Figure 18 Future needs (total job openings) by occupation in Italy in 2022-2035



Source: Cedefop skill forecast (2026)

Table 24. Main skills needed for the development of the enterprises by type of skill and NACE Rev. 2 activity (% of all enterprises) in Italy

NACE REV.2	B-E	F	G-I	J-K	L-N-R-S
YEAR	GENERAL IT SKILLS				
2010	47.5	45.0	50.4	58.0	47.0
2015	14.1	16.6	18.7	15.3	16.6
2020	13.4	15.2	17.2	13.4	16.9
	PROFESSIONAL IT SKILLS				
2010	28.3	26.4	25.0	51.8	28.1
2015	19.6	15.7	15.1	54.2	23.1
2020	23.3	19.8	22.3	50.8	25.5
	MANAGEMENT SKILLS				
2010	42.3	36.6	37.2	43.6	31.6
2015	31.5	24.9	25.0	35.9	26.4
2020	24.1	19.3	22.0	34.8	20.3

Note: B-E: Industry (except construction); F: Construction; G-I : Wholesale and retail trade, transport, accommodation and food service activities; J-K: Information and communication; financial and insurance activities; L-N-R-S: Real estate activities; professional, scientific and technical activities; administrative and support service activities; arts, entertainment and recreation; other service activities. Source: Eurostat (2025-CVT Survey)

Table 25 Enterprises that employ ICT specialists by NACE Rev.2 in EU-27 (% of enterprises). Italy (2014-2024)

Nace rev 2	2014	2015	2016	2017	2018	2019	2020	2022	2024

C	Manufacturing	16.87	17.64	18.40	16.30	:	17.84	12.96	14.02	13.64
D	Electricity, gas, steam and air conditioning supply	:	:	:	:	:	:	:	:	:
E	Water supply; sewerage, waste management and remediation activities	:	:	:	:	:	:	:	:	:
F	Construction	8.28	9.93	9.29	9.26	9.22	8.94	6.11	6.64	5.30
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	13.54	15.60	15.79	15.78	14.90	13.83	12.70	12.62	11.87
H	Transportation and storage	11.39	11.04	12.87	13.45	11.41	9.40	:	10.91	9.89
I	Accommodation and food service activities	3.43	3.88	2.06	3.21	5.50	4.39	1.84	3.23	1.58
J	Information and communication	66.84	66.38	68.28	73.15	71.11	69.50	66.23	59.89	62.03
L	Real estate activities	:	:	:	:	:	:	:	18.24	11.07
M	Professional, scientific and technical activities	:	:	:	:	:	:	:	22.06	20.93
N	Administrative and support service activities	10.92	19.01	14.24	12.91	17.79	12.85	10.39	11.32	14.47

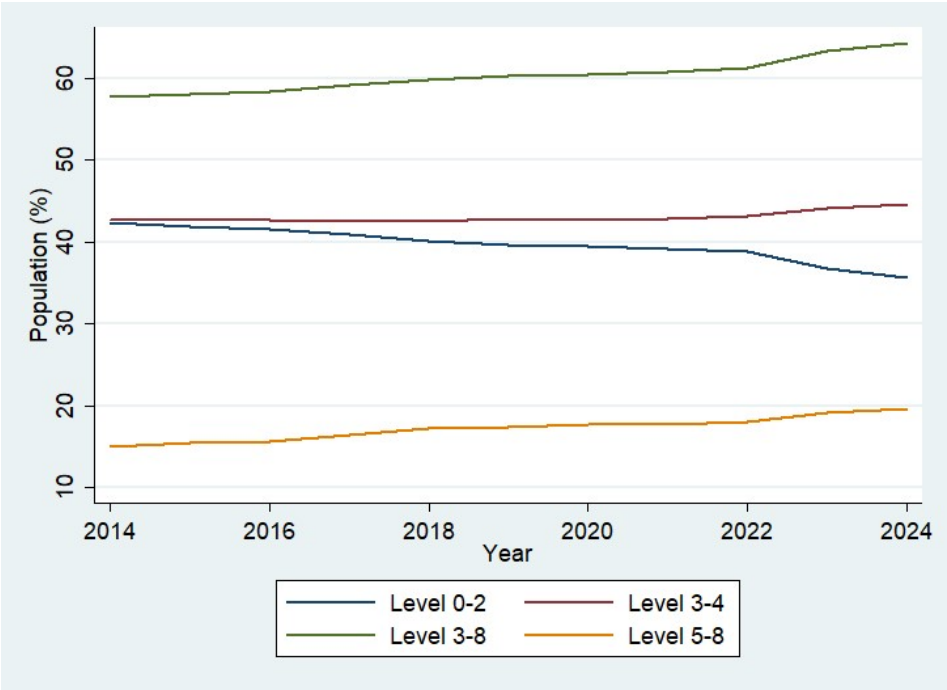
Note: population include enterprise with 10 or more employed;
data for Nace A an B are not available;
: not available
Source: Eurostat (2025) (European ICT usage survey)

Table 26 Enterprise had hard-to-fill vacancies for jobs requiring ICT specialist skills. Italy (2014-2024)

Nace rev 2		2014	2015	2016	2017	2018	2019	2020	2022	2024
C	Manufacturing	0.76	0.82	1.37	1.31	2.31	3.08	1.66	2.16	2.65
D	Electricity, gas, steam and air conditioning supply	:	:	:	:	:	:	:	:	:
E	Water supply; sewerage, waste management and remediation activities	:	:	:	:	:	:	:	:	:
F	Construction	0.44	0.57	0.34	1.17	1.55	1.07	0.67	1.24	1.32
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	1.20	1.48	1.15	1.68	2.13	2.34	1.93	2.53	2.42
H	Transportation and storage	0.65	0.84	0.33	1.76	0.73	0.95	0.56	1.01	2.01
I	Accommodation and food service activities	0.32	0.47	0.36	0.50	0.31	0.21	0.17	0.09	0.66
J	Information and communication	14.59	18.0	19.5	25	29	33.6	29.09	28.22	21.05
L	Real estate activities	:	:	:	:	:	:	:	3.04	2.12
M	Professional, scientific and technical activities	:	:	:	:	:	:	:	6.26	6.25
N	Administrative and support service activities	1.05	1.07	1.84	1.05	4.78	3.93	1.51	3.31	2.47

Note: population include enterprise with 10 or more employed;
data for Nace A an B are not available;
: not available
Source: Eurostat (2025) (European ICT usage survey)

Figure 19. Italy: Population by educational attainment (% of total population from 15 to 64 years)



Source: Eurostat 2025 (Labour force survey)

Table 27. Italy: Individuals' level of digital skills (% of individuals 16-74 years)

Year	2021	2023
Individuals with basic or above basic information and data literacy skills	71.39	75.35
Individuals with above basic information and data literacy skills	58.4	60.64
Individuals with basic information and data literacy skills	12.99	14.71
Individuals with basic or above basic communication and collaboration skills	80.24	83.98
Individuals with above basic communication and collaboration skills	75.7	79.77
Individuals with basic communication and collaboration skills	4.53	4.2
Individuals with online information and communication skills	3.36	3.97
Individuals with basic or above basic digital content creation skills	57.74	60.14
Individuals with above basic digital content creation skills	40.88	42.47
Individuals with basic digital content creation skills	16.86	17.67
Individuals with basic or above basic safety skills	59.80	59.
Individuals with above basic safety skills	35.95	34.75
Individuals with basic safety skills	23.85	24.25
Individuals with basic or above basic problem solving skills	69.23	73.58
Individuals with above basic problem solving skills	46.88	49.88
Individuals with basic problem solving skills	22.35	23.71
Individuals with basic or above basic overall digital skills	45.6	45.75
Individuals with above basic overall digital skills	22.52	22.21
Individuals with basic overall digital skills	23.08	23.54
Individuals with low overall digital skills	16.34	18.23
Individuals with narrow overall digital skills	9.84	10.70
Individuals with limited overall digital skills	6.12	7.15
Individuals with no overall digital skills	3.69	5.09
Digital skills could not be assessed: individual has not used internet in the last 3 months	18.41	13.08

Note :
The Digital Skills Indicator 2.0 (DSI) is a composite indicator which is based on selected activities related to internet or software use that individuals aged 16-74 perform in five specific areas (Information and data literacy, Communication and collaboration, Digital content creation, Safety, and Problem solving). It is assumed that individuals having performed certain activities have the corresponding skills. Therefore, the indicators can be considered as proxy of individuals' digital skills.
According to the variety of activities performed, two levels of skills are computed for each of the five areas ("basic" and "above basic"). Finally, based on the component indicators for each area, an overall digital skills indicator is calculated as a proxy of the digital skills of individuals ("no skills", "limited", "narrow", "low", "basic", "above basic" or "at least basic skills").
Individuals with basic or above basic overall digital skills= all five component indicators are at basic or above basic level,
Individuals with above basic overall digital skills=all five component indicators are at above basic level,
Individuals with basic overall digital skills= all five component indicators are at basic or above basic level, without being all above basic;
Individuals with low overall digital skills=four out of five component indicators are at basic or above basic level.
Individuals with narrow overall digital skills=three out of five component indicators are at basic or above basic level;

Individuals with limited overall digital skills=two out of five component indicators are at basic or above basic level
Source: Eurostat 2025 (ICT Survey)

Table 28. Enterprises providing training by type of training - Italy (% of all enterprises)

Year	2005	2010	2015	2020
CVT courses and/or other forms of CVT	32.2	55.6	60.2	68.9
CVT courses	26.8	46.8	52.3	59.5
CVT courses - internal	12.8	26.2	26.4	36.3

Source: Eurostat 2025 (Continuing Vocational Training Survey -CVTS)

Table 29. Participants in CVT courses by sex- Italy (% of persons employed in all enterprises)

Year	2005	2010	2015	2020
Total	28.8	36	45.9	44.6
Males	29.5	37.1	47.8	44.8
Females	27.5	33.9	42.5	44.4

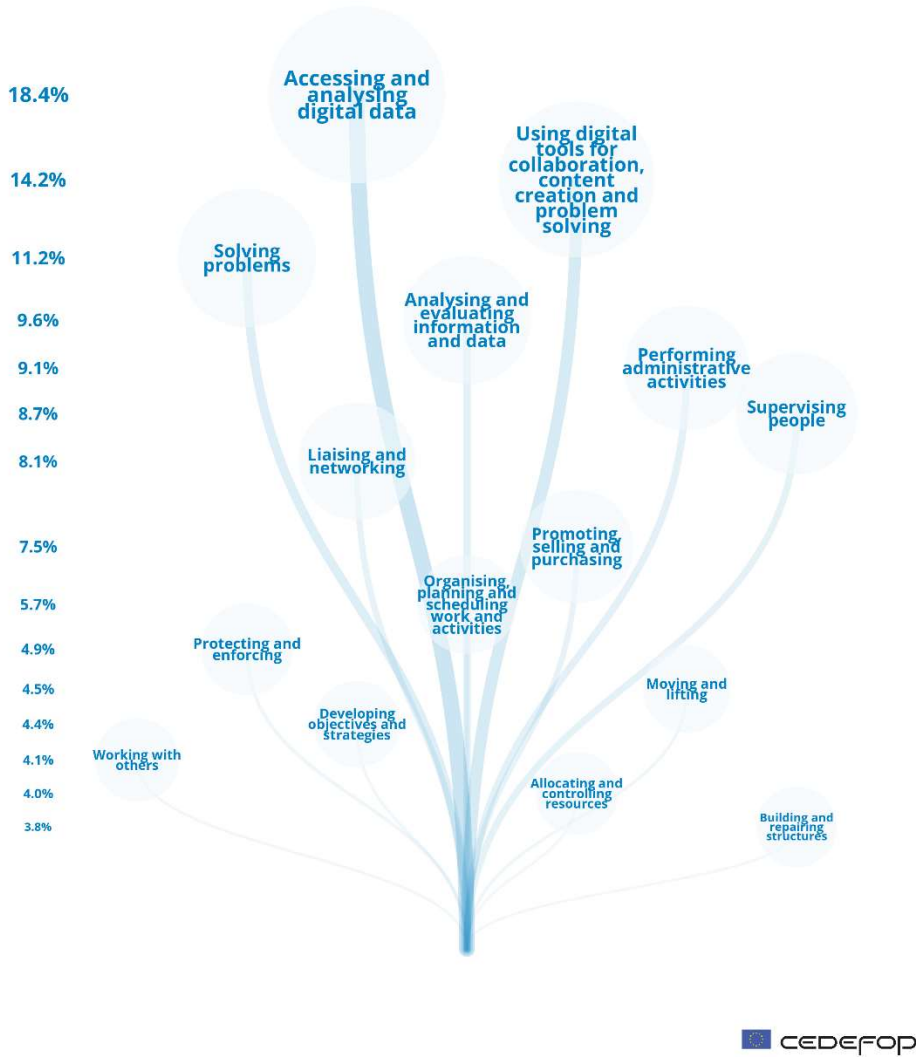
Source: Eurostat 2025 (Continuing Vocational Training Survey -CVTS)

Table 30. Participation rate in education and training (over previous last 4 weeks) by educational attainment level (% population aged 25-64 years) - Italy

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Levels 0-2	2.2	2	2.3	2	2	2.1	1.4	2.4	2.5	3.2	2.9
Levels 3-8	12.1	10.9	12.2	11.7	11.9	11.8	10.6	14.4	13.9	16	14.1
Levels 3 and 4	9.5	8.4	9.3	8.9	8.8	8.8	7.6	10.1	9.9	11.5	10
Levels 5-8	18.7	17	19.1	18.3	18.7	18.3	16.9	23.4	22.2	25.2	22.3
All ISCED 2011 levels	8.1	7.3	8.3	7.9	8.1	8.1	7.1	9.9	9.6	11.6	10.4

Source: Eurostat 2025 (EU Labour Force Survey)

Figure 20 Most requested skills in online job ads in Italy in Skills in 2024 (ESCO level 2)



Source: CEDEFOP Skill Intelligence (2026)

5.3 Malta

While Malta shares many of the structural drivers shaping skill demand across Europe—digitalisation, the transition to environmental sustainability, and demographic ageing—the interaction between demand and supply of skills is strongly mediated by country-specific features of its productive structure, exceptionally small labour market size and geographic island constraints.

Malta's labour market exhibits distinctive features shaped by sustained strong economic growth. The employment rate among the working-age population (20-64) increased from 75.6% in 2019 to 83.0% in 2024, compared with a rise from 72.7% to 75.8% in the EU-27 (JobsPlus Annual Report 2024). Throughout this period, Malta consistently recorded employment levels significantly higher than the EU average, with the gap widening from around 3 percentage points in 2019 to over 7 percentage points in 2024. By 2024, Malta was only 1.6 percentage points away from achieving its EU 2030 national employment target of 84.6% (JobsPlus Annual Report 2024).

In 2024, Malta recorded the third-lowest unemployment rate among EU member states, behind only Czechia and Poland. By March 2025, the unemployment rate stood at 2.8%, with youth unemployment at 7.7% and core working-age unemployment (25-74 years) at 2.3% (NSO, March 2025).

Employment in Malta is heavily concentrated in the service sector. In 2023, over 0.3 million people were active in the labour market (EURES, 2023). Sectoral analysis reveals that employment growth has been concentrated in professional, scientific, technical, administrative and support service activities, followed by wholesale and retail trade, transportation and storage, and information and communication (JobsPlus Annual Report 2024). Wholesale and retail trade employed 18% of the workforce, administrative and support services 11.4%, manufacturing 10.3%, and accommodation and food services 10.2% (EURES, 2023).

From a structural perspective, the Maltese economy is characterised by a high prevalence of micro and small enterprises. Micro companies with up to 9 employees employed 32.4% of the workforce, while large companies employed 25.6% (EURES, 2023). This fragmentation constrains firms' capacity to invest systematically in training and engage in long-term workforce development strategies.

Foreign workers account for a substantial share of the workforce: 11.2% from other EU member states and 28.7% from third countries (EURES, 2023). EU nationals employed in

Malta increased from 33,836 in December 2021 to 38,387 in May 2024, while third-country nationals nearly doubled from 42,559 to 80,543 over the same period (EURES, 2023). This substantial immigration reflects acute domestic labour shortages across all sectors and skill levels.

5.3.1Employment Projections and Sectoral Transformation

According to European Commission projections, Malta's economy is maintaining strong growth momentum. Real GDP grew by 6.0% in 2024 and is projected to expand by 4.1% in 2025 and 4.0% in 2026. Employment growth reached 5.1% in 2024 and is expected to remain strong at 3.1% in 2025 and 2.8% in 2026 (European Commission, 2025a).

Comparing CEDEFOP data on future employment growth over the period 2022-2035, Malta exhibits an exceptional employment growth (28.9%) while EU27 follows with 5% (CEDEFOP Skill Intelligence, 2026), but it should be considered that such a growth rate is dependent on the relatively small size of the Maltese economy.

As shown in Figure 21, Distribution and Transport is the sector with the highest number of employed workers in Malta. Construction shows a strong growth trend through 2035. Business and Other Services and Non-market Services also show increasing employment paths. Manufacturing appears relatively stable over the projection period.

Trying to detect some data on green demand, figure 22 shows employment trends in circular economy sectors (recycling, repair and reuse, and rental and leasing). From 2015 to 2020 an increasing path is observed, although with notable annual fluctuation. Since 2020, employment in these sectors has shown continued growth.

Occupational projections reveal substantial transformation across occupations (Figure 23). Service and sales workers show the highest total job openings over 2022-35, reflecting both new job creation and replacement demand. Also Associate professionals and Professional show significant job openings. Elementary occupations show substantial replacement demand. Conversely, farm and related workers show the more moderated projected need, consistent with broader European trends of structural shift away from agricultural employment and routine intensive jobs.

An interesting issue for Maltese labour market is the Female employment, that has been a major contributor to labour market growth. The female employment rate rose steadily from 63.9% in 2019 to 75.6% in 2024, compared with an increase from 67.1% to 70.8% in the EU-27. Malta surpassed the EU average by 2021 and continued to extend this lead, reaching 73.6%

in 2023 (JobsPlus Annual Report 2024; EURES, 2023). This achievement reflects targeted policy interventions, particularly the Free Childcare Scheme introduced in 2014 (EURES, 2023) but also this indicator needs to be framed in the reduced dimension of the national economy.

5.3.2 Digital Skills

Consistent with European-wide evidence, digitalisation represents one of the most important drivers of skill demand in Malta. However, the Maltese case illustrates a marked gap between the diffusion of digital technologies and the availability of corresponding skills within the workforce.

Despite Malta's strong economic performance, labour shortages are particularly acute in the ICT sector. In Q1 2025, 68.5% of services sector employers reported labour shortages limiting production, compared to 24.1% in the EU (European Commission, 2025c). Labour shortages are particularly pronounced in ICT, construction, arts, entertainment, recreation, parts of professional services, health and long-term care sectors, as well as in teaching (European Commission, 2025c).

The Eurostat Continuing Vocational Training Survey (Table 31) reveals trends in skill needs for enterprise development. General IT skills show a declining percentage of enterprises requiring such skills: from 45.4% in Industry (B-E) in 2010 to 15.0% in 2020; from 50.9% in Wholesale/retail/transport/accommodation (G-I) in 2010 to 20.0% in 2020. The Information and Communication sector (J-K) shows the highest demand for general IT skills at 64.7% in 2010, declining to 19.4% in 2020, suggesting increasing diffusion of basic digital competences. Professional IT skills show similar patterns, with Information and Communication (J-K) maintaining highest demand at 67.6% in 2010 and 38.9% in 2020. Management skills demand has also declined across most sectors between 2010 and 2020.

Going into the depth of digital skills demand (Table 32), sectors employing the highest percentage of ICT specialists are Information and Communication (J), with 87.43% of enterprises in 2024, followed by Professional, Scientific and Technical Activities (M) at 44.70% and Wholesale and retail trade; repair of motor vehicles and motorcycles (G) and Real estate (L) at 28.59% and 28.23%. Manufacturing (C) shows an increasing trend from 18.48% in 2014 to 29.29% in 2024. Transportation and Storage (H) increased from 21.11% in 2014 to 33.95% in 2024. Notably, Accommodation and food service activities (I) showed 23.53% in 2024, up from 20.62% in 2014.

Looking at Table 33, the percentage of firms finding difficulties in filling vacancies for jobs requiring ICT specialist skills has increased substantially over the last decade. Information and Communication (J) shows the most dramatic difficulties, rising from 51.35% in 2014 to 63.11% in 2024. Professional, Scientific and Technical Activities (M) shows difficulties increasing from 14.40% in 2022 to 18.48% in 2024. Transportation and Storage (H) increased from 1.12% in 2014 to 10.66% in 2024. Manufacturing (C) shows difficulties rising from 2.98% in 2014 to 9.34% in 2024.

Labour market data confirm growing unmet demand, with over 1,700 vacancies registered in professional, scientific and technical occupations at the end of 2023, and ICT vacancy rates reaching approximately 5% (European Commission, 2025).

Gender segregation in STEM education is pronounced. Female students remain underrepresented in ICT (17.4%) and engineering (27.1%). In vocational education and training (VET), only 13.6% of STEM learners are women, well below EU targets (European Commission, 2025).

Adult participation in learning remains below the 2030 target of 57.6% (European Commission, 2025). Administrative and regulatory burdens pose challenges for businesses, with Malta ranking lowest in the EU for barriers related to trade, investment and licensing (European Commission, 2025).

5.3.3 Green Skills

The green transition represents a second major axis reshaping skill demand in Malta. Green skill demand is largely driven by public investment, regulatory change and EU-level policy frameworks, particularly through the Recovery and Resilience Plan (69% dedicated to green transition) and climate-related funding instruments.

According to EURES, employment in environmental goods and services represents approximately 1.5% of total employment, mostly in waste management, protection of biodiversity and landscapes, and water and wastewater management (EURES, 2023). Figure 22 shows that employment in circular economy sector has shown continued growth, but more detailed data on green skills demand and sectoral transformation patterns for Malta are limited in available documentation.

According to Malta's National Energy and Climate Plan 2021-2030 submitted to the European Commission, Malta's renewable energy share reached 13.4% in 2022, up from 3.76% in 2013, with a national target of 24.5% by 2030 (Energy and Water Agency, Malta's National Energy

and Climate Plan). However, Malta's renewable energy potential is severely constrained by spatial limitations, with land availability and cost being the main barriers to large-scale deployment (Malta's National Energy and Climate Plan, 2024).

The National Policy for the Deployment of Offshore Renewable Energy, developed by the Ministry for the Environment, Energy and Enterprise, creates demand for skill profiles combining marine engineering, renewable energy technology and operations management. Studies conducted by the Energy and Water Agency have identified six potential sites for offshore renewable energy investments focusing on floating wind and solar technologies (Malta Ministry for Environment, Energy and Enterprise, 2023).

Key sectoral transformation areas include: - Energy sector transformation: photovoltaic systems deployment, offshore wind and solar technologies, second electricity interconnector with Sicily (expected 2026), gas pipeline linking to European Gas Network Grid (2025-2028) - Building and construction: energy efficiency retrofits, nearly zero-energy building (NZEB) standards, sustainable building design - Sustainable tourism: balance between growth and environmental preservation - Transport: electric vehicle infrastructure expansion, shore-to-ship power projects - Waste management: organic processing, waste-to-energy facilities, material recovery capacity enhancement.

5.3.4 Entrepreneurial Skills

The Maltese economy is dominated by micro and small enterprises, which face significant constraints in innovation capacity and R&D investment. Self-employed women and youth in Malta are more likely than the EU average to have employees, indicating capacity to scale businesses (OECD/EU 2019, The Missing Entrepreneurs).

The Smart Specialisation Strategy 2022-2027 identifies digital technologies as priority areas for investment in innovation, prioritising AI, IoT, high-performance computing, distributed ledger technologies, cybersecurity, chatbots and digital games. The strategy couples skills investments with targeted support for innovative start-ups.

Consistent with broader European trends identified by the World Economic Forum, demand is rising for transversal skills enabling firms and workers to navigate uncertainty and continuous change. These competences are particularly critical for Malta’s SMEs managing technological transformation and twin transitions. However, specific data on entrepreneurial skills demand patterns in Malta are not available in the documentation reviewed.

5.3.4 Skills Supply and Mismatch

Despite relatively high public investment in education, Malta faces significant skill mismatch across multiple dimensions. According to the Education and Training Monitor (European Commission, 2025), learning outcomes remain among the weakest in the EU, with around one third of 15-year-olds underachieving in basic skills, posing risks to long-term competitiveness. Persistent shortages of qualified teachers, particularly in STEM subjects, further limit the system's performance.

Labour shortages are particularly pronounced among business and administration associate professionals, legal, social and cultural professionals, and personal service workers. In contrast, surpluses are observed in science and engineering associate professionals, building trades (excluding electricians), and customer service clerks (EURES, 2023).

Figure 24 shows Malta's population by educational attainment. The percentage of population with tertiary education (ISCED 5-8) has increased steadily, reaching approximately 37% by 2023. The share of population with upper secondary and post-secondary non-tertiary education (ISCED 3-4) has remained relatively stable around 35-40%. The percentage with less than primary, primary and lower secondary education (ISCED 0-2) has declined over time, reaching approximately 30% by 2024. This educational structure shows Malta's progress in increasing educational attainment, though substantial shares of the population still have lower levels of formal education.

Eurostat ICT Survey evidence on digital skills is summarised in Table 34. Individuals with basic or above basic overall digital skills reached 63.02% in 2023, up from 61.23% in 2021, above the EU average of 55.6%. However, individuals with basic overall digital skills (as distinct from above basic) represent 26.04% in 2023. Individuals with above basic overall digital skills represent 36.98% in 2023.

Examining specific digital skill components, Malta shows relatively strong performance: 87.50% have basic or above basic information and data literacy skills (2023); 90.81% have basic or above basic communication and collaboration skills (2023); 78.96% have basic or above basic safety skills (2023); 86.29% have basic or above basic problem solving skills (2023). Digital content creation skills show somewhat lower levels at 68.91% with basic or above basic skills (2023).

Notably, 7.93% of individuals in 2023 had digital skills that could not be assessed because they had not used internet in the last 3 months, down from 12.53% in 2021, indicating increasing internet usage.

The Maltese training system faces structural challenges in responding to rapid skill demand changes. Workers in micro and small enterprises, which employ 32.4% of the workforce (EURES, 2023), have more limited access to structured training opportunities.

Table 35 shows that 45.1% of enterprises provided CVT courses and/or other forms of CVT in 2020, down from 61.6% in 2015 and 53.9% in 2010. The percentage providing CVT courses specifically was 29.2% in 2020, down from 43.3% in 2015 and 37.5% in 2010. Internal CVT courses were provided by 20.8% of enterprises in 2020, down from 29.9% in 2015.

The number of participants in CVT courses (Table 36) shows 27.8% of persons employed participated in 2020, down from 35.8% in both 2010 and 2015. Female participation (29.9% in 2020) remains slightly higher than male participation (26.5% in 2020), though both have declined from 2015 levels.

Participation rates in education and training over the previous 4 weeks (Table 37) show significant increases from 2014 to 2024, but remain below EU averages. For all ISCED levels combined, participation increased from 7.7% in 2014 to 18.6% in 2024. However, substantial gaps persist across educational levels: those with Levels 0-2 (lower education) show 7.4% participation in 2024, up from 3% in 2014. Those with Levels 5-8 (tertiary) show 28% participation in 2024, up from 19.7% in 2014. The gap between high and low educational attainment groups in accessing continuing education has widened over time.

Vocational education and training deliver strong employment outcomes, with 89.1% of recent VET graduates employed in 2024, well above the EU average. However, only about half of VET learners participated in work-based learning, indicating scope to strengthen links with employers and practical skills acquisition (European Commission, 2025).

5.3.5 Priority Digital, Green and Entrepreneurial Skills

Systematic skills taxonomy and priority identification for Malta is constrained by limited country-specific evidence in available documentation. The most concrete evidence comes from CEDEFOP Skill Intelligence dashboard analysis of online job advertisements.

Figure 25 shows the most requested skills in online job ads in Malta in 2024 (ESCO level 2). “Selling products and services” has the highest value, followed by “Managing physical resources and activities” and “Developing objectives and strategies”. “Accessing and analysing digital data” appears prominently. “Communicating and collaborating effectively” and “Planning and organising effectively” also feature among top requested skills. “Using digital

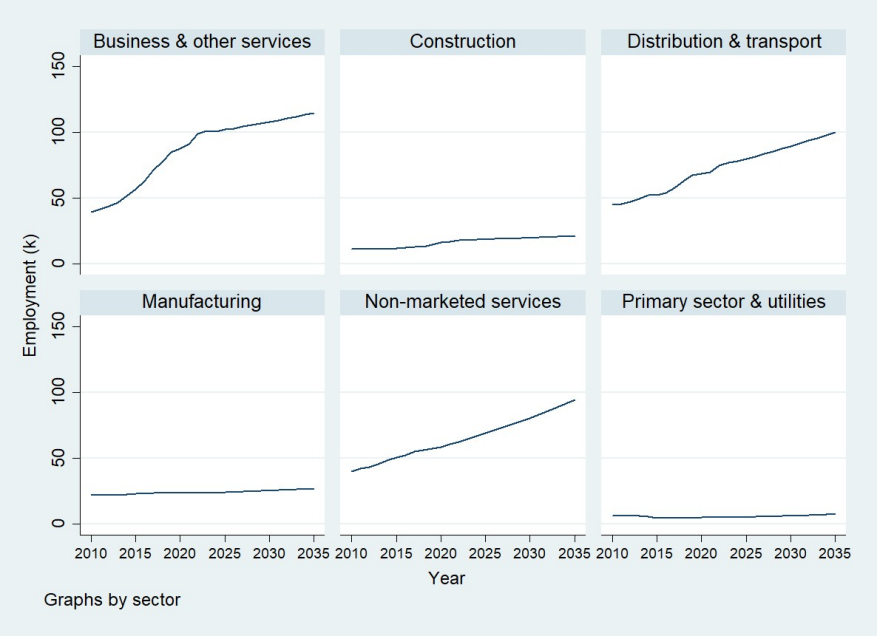
tools for collaboration, content creation and problem solving" appears in the ranking. "Identifying, understanding and meeting customer needs" is also highly requested.

This evidence suggests strong demand for skills related to commercial activities, management, strategic planning, digital data competences and customer service, consistent with Malta's service-oriented economy and high concentration of employment in wholesale/retail, administrative services and tourism sectors.

However, detailed taxonomies of specific technical competences, required proficiency levels and optimal training pathways are not available in the documentation reviewed for Malta. The National eSkills Strategy 2022-2025, coordinated by the eSkills Malta Foundation, provides a framework for digital skills development across Education, Society, Workforce and ICT Professionals pillars, but specific skill priorities within each domain are not detailed in available sources.

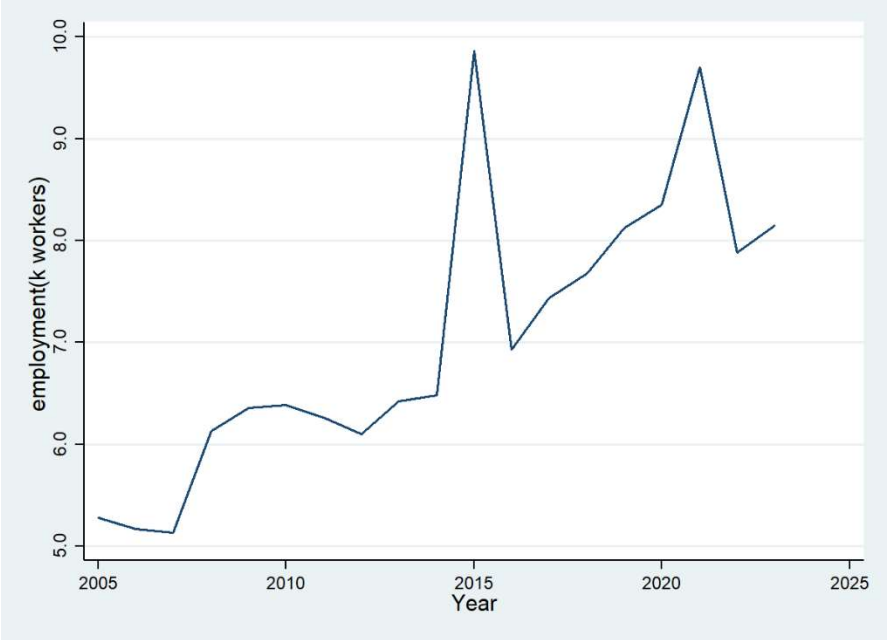
To address skills shortages and mismatches, Malta has introduced governance measures including establishment of a National Skills Council and increased stipends and scholarships for priority STEM and green skills, as well as reforms outlined in the National Education Strategy 2024-2030 (European Commission, 2025). However, the impact of these initiatives remains to be assessed, and sustained implementation will be critical to addressing Malta skills shortages.

Figure 21 Total Employment (k workers) in Malta by broad sector. Trend and forecast from 2010 to 2035



Source: Author's elaboration on CEDEFOP data (2023) downloaded in November 2025.

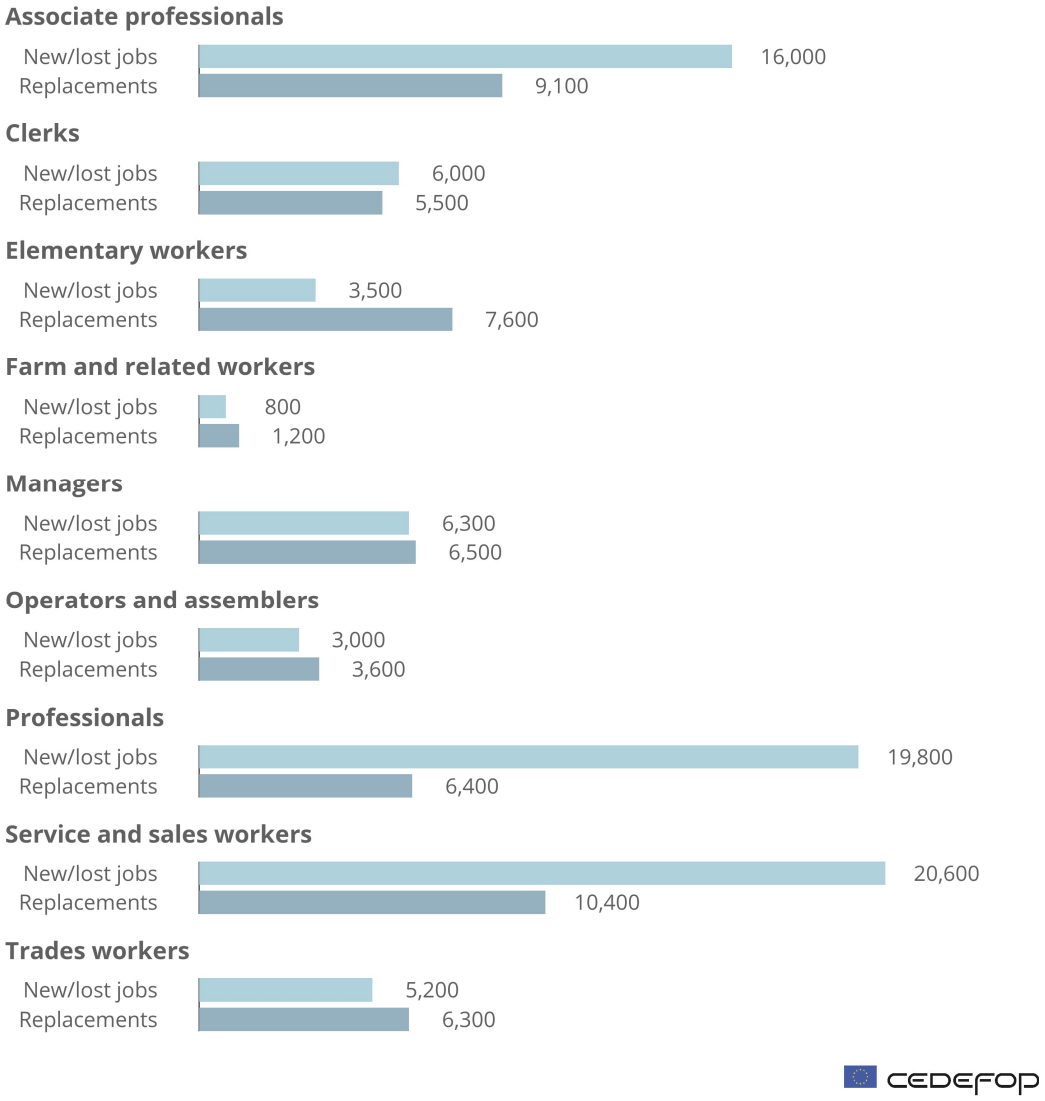
Figure 22 Persons Employed in Circular economy sectors (K workers). Malta (2005-2025)



Note: employed in the recycling sector, repair and reuse sector and rental and leasing sector

Source: Eurostat (2025)

Figure 23. Future needs (total job openings) by occupation in Malta in 2022-2035



Source: Cedefop skill forecast (2026)

Table 31. Main skills needed for the development of the enterprises by type of skill and NACE Rev. 2 activity (% of all enterprises) in Malta

Nace rev 2.	B-E	F	G-I	J-K	L-N-R-S
YEAR	GENERAL IT SKILLS				
2010	45.4	27.8	50.9	64.7	63.0
2015	11.4	7.4	20.0	24.3	20.4
2020	15.0	11.7	20.0	19.4	13.9
	PROFESSIONAL IT SKILLS				
2010	11.3	7.7	12.9	67.6	29.4
2015	2.1	3.5	3.6	40.9	5.6
2020	1.6	:	3.6	38.9	13.4
	MANAGEMENT SKILLS				
2010	39.1	42.1	45.0	71.7	54.0
2015	29.8	14.8	33.2	40.9	41.8
2020	29.2	19.4	28.7	42.6	22.9

Note: B-E: Industry (except construction); F: Construction; G-I : Wholesale and retail trade, transport, accommodation and food service activities; J-K: Information and communication; financial and insurance activities; L-N-R-S: Real estate activities; professional, scientific and technical activities; administrative and support service activities; arts, entertainment and recreation; other service activities

Source: Eurostat (2025- CVT Survey)

Table 32 Enterprises that employ ICT specialists by NACE Rev.2 in EU-27 (% of enterprises). Malta (2014-2024)

Nace rev 2		2014	2015	2016	2017	2018	2019	2020	2022	2024
C	Manufacturing	18.48	20.26	20.33	17.07	17.38	22.94	24.54	28.48	29.29
D	Electricity, gas, steam and air conditioning supply	:	:	:	:	:	:	:	:	:
E	Water supply; sewerage, waste management and remediation activities	:	:	:	:	:	:	:	35.42	:
F	Construction	15.60	14.41	13.44	10.52	9.09	10.05	9.59	18.47	16.14
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	21.62	22.32	20.28	16.27	16.59	22.53	25.25	29.11	28.59
H	Transportation and storage	21.11	20.02	28.77	21.60	24.35	22.85	23.58	31.57	33.95
I	Accommodation and food service activities	20.62	23.03	19.41	13.48	11.86	15.84	15.46	17.78	23.53
J	Information and communication	78.37	80.78	83.73	83.08	83.94	83.11	76.90	82.46	87.43
L	Real estate activities	:	:	:	:	:	:	:	37.60	28.23
M	Professional, scientific and technical activities	:	:	:	:	:	:	:	43.98	44.70
N	Administrative and support service activities	27.93	28.14	27.49	30.48	27.65	27.98	29.69	34.72	32.06

Note: population include enterprise with 10 or more employed;

data for Nace A an B are not available;

: not available

Source: Eurostat (2025) (European ICT usage survey)

Table 33. Enterprise had hard-to-fill vacancies for jobs requiring ICT specialist skills. Malta (2014-2024)

Nace rev 2	2014	2015	2016	2017	2018	2019	2020	2022	2024
C Manufacturing	2.98	4.15	5.53	2.27	4.56	4.95	5.20	7.78	9.34
D Electricity, gas, steam and air conditioning supply	:	:	:	:	:	:	:	:	:
E Water supply; sewerage, waste management and remediation activities	:	:	:	:	:	:	:	6.94	:
F Construction	3.15	2.27	0	3.52	1.66	0	3.18	4.41	2.64
G Wholesale and retail trade; repair of motor vehicles and motorcycles	2.34	4.38	3.71	4.80	5.17	4.76	5.22	7.23	7.54
H Transportation and storage	1.12	3.09	2.94	2.38	7.28	5.36	6.37	10.45	10.7
I Accommodation and food service activities	0.63	2.31	1.12	2.28	0.78	3.13	1.15	2.75	3.60
J Information and communication	51.35	45.5	50.3	55.41	53.5	52.0	47.6	57.35	63.11
L Real estate activities	:	:	:	:	:	:	:	17.77	12.62
M Professional, scientific and technical activities	:	:	:	:	:	:	:	14.4	18.4
N Administrative and support service activities	6.45	6.86	7.80	6.20	4.77	6.32	4.99	12.0	9.42

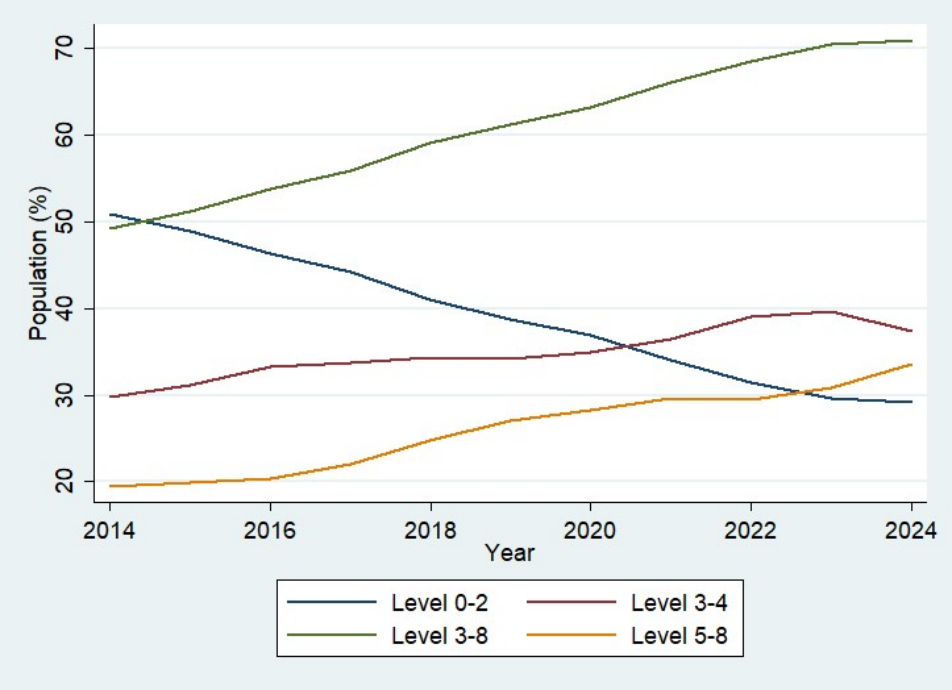
Note: population include enterprise with 10 or more employed;

data for Nace A an B are not available;

: not available

Source: Eurostat (2025) (European ICT usage survey)

Figure 24 Malta: Population by educational attainment (% of total population from 15 to 64 years)



Source: Eurostat 2025 (Labour force survey)

Table 34. Malta: Individuals' level of digital skills (% of individuals 16-74 years)

Year	2021	2023
Individuals with basic or above basic information and data literacy skills	83.91	87.50
Individuals with above basic information and data literacy skills	79.03	80.72
Individuals with basic information and data literacy skills	4.88	6.79
Individuals with basic or above basic communication and collaboration skills	85.7	90.81
Individuals with above basic communication and collaboration skills	82.99	88.41
Individuals with basic communication and collaboration skills	2.71	2.4
Individuals with online information and communication skills	1.58	1.82
Individuals with basic or above basic digital content creation skills	71.46	68.91
Individuals with above basic digital content creation skills	48.63	50.12
Individuals with basic digital content creation skills	22.83	18.78
Individuals with basic or above basic safety skills	72.97	78.96
Individuals with above basic safety skills	52.2	54.73
Individuals with basic safety skills	20.77	24.24
Individuals with basic or above basic problem solving skills	79.76	86.29
Individuals with above basic problem solving skills	61.02	63.57
Individuals with basic problem solving skills	18.74	22.72
Individuals with basic or above basic overall digital skills	61.23	63.02
Individuals with above basic overall digital skills	35.49	36.98
Individuals with basic overall digital skills	25.74	26.04
Individuals with low overall digital skills	15.45	16.68
Individuals with narrow overall digital skills	6.09	7.52
Individuals with limited overall digital skills	3.25	3.52
Individuals with no overall digital skills	1.46	1.34
Digital skills could not be assessed: individual has not used internet in the last 3 months	12.53	7.93

Note :
The Digital Skills Indicator 2.0 (DSI) is a composite indicator which is based on selected activities related to internet or software use that individuals aged 16-74 perform in five specific areas (Information and data literacy, Communication and collaboration, Digital content creation, Safety, and Problem solving). It is assumed that individuals having performed certain activities have the corresponding skills. Therefore, the indicators can be considered as proxy of individuals' digital skills.
According to the variety of activities performed, two levels of skills are computed for each of the five areas ("basic" and "above basic"). Finally, based on the component indicators for each area, an overall digital skills indicator is calculated as a proxy of the digital skills of individuals ("no skills", "limited", "narrow", "low", "basic", "above basic" or "at least basic skills").
Individuals with basic or above basic overall digital skills= all five component indicators are at basic or above basic level,
Individuals with above basic overall digital skills=all five component indicators are at above basic level,
Individuals with basic overall digital skills= all five component indicators are at basic or above basic level, without being all above basic;
Individuals with low overall digital skills=four out of five component indicators are at basic or above basic level.
Individuals with narrow overall digital skills=three out of five component indicators are at basic or above basic level;

Individuals with limited overall digital skills=two out of five component indicators are at basic or above basic level
Source: Eurostat 2025 (ICT Survey)

Table 35. Enterprises providing training by type of training -Malta (% of all enterprises)

Year	2005	2010	2015	2020
CVT courses and/or other forms of CVT	45.6	53.9	61.6	45.1
CVT courses	30.6	37.5	43.3	29.2
CVT courses - internal	19.3	26.5	29.9	20.8

Source: Eurostat 2025 (Continuing Vocational Training Survey -CVTS)

Table 36. Participants in CVT courses by sex- Malta (% of persons employed in all enterprises)

Year	2005	2010	2015	2020
Total	31.8	35.8	35.8	27.8
Males	30.1	32.3	32.9	26.5
Females	35.7	42.6	38.2	29.9

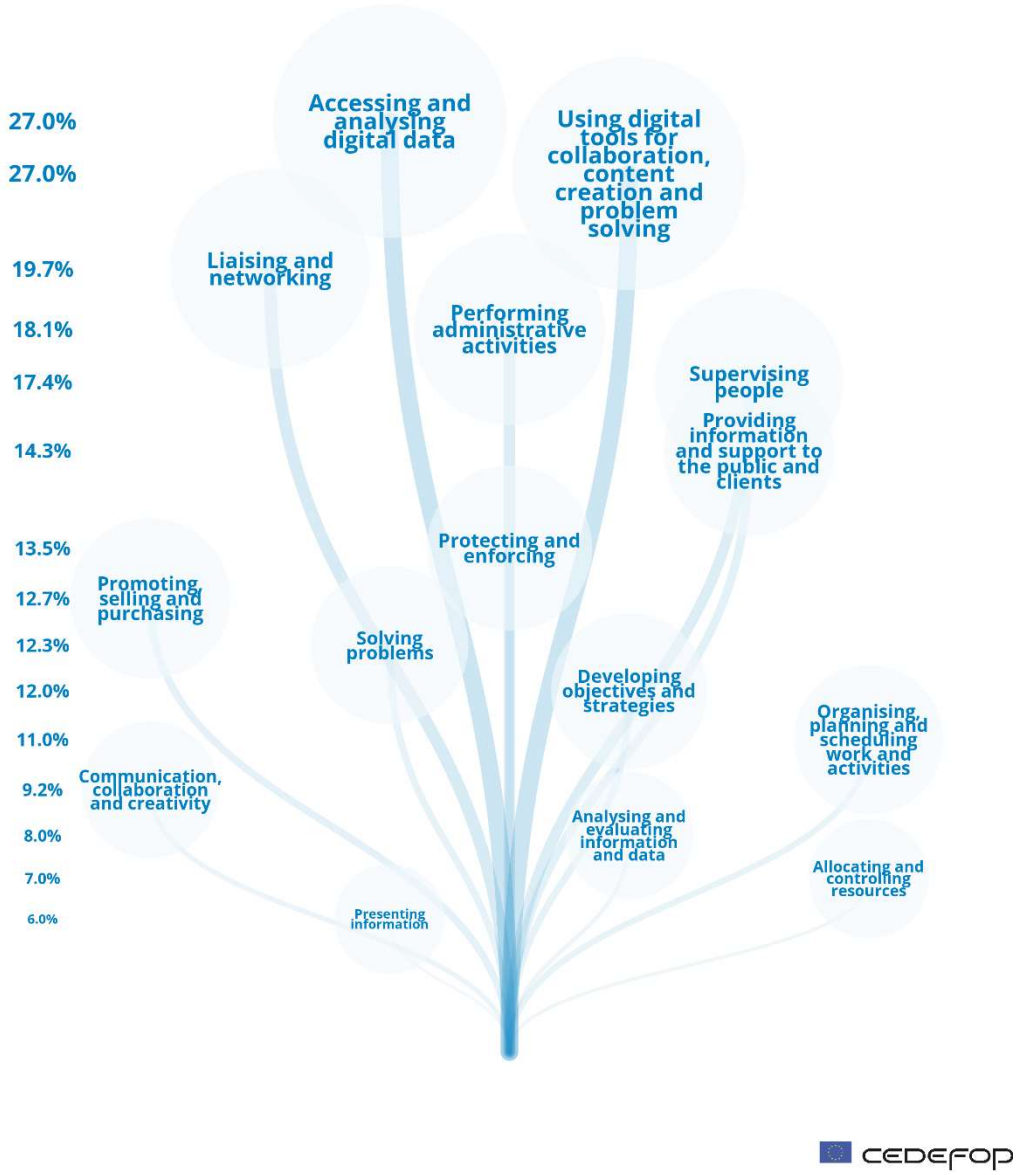
Source: Eurostat 2025 (Continuing Vocational Training Survey -CVTS)

Table 37. Participation rate in education and training (over previous last 4 weeks) by educational attainment level (% population aged 25-64 years) - Malta

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Levels 0-2	3	2.5	2.8	3.8	4.1	4.1	3.2	3.9	3.8	6.3	7.4
Levels 3-8	13.6	12.9	13	16.9	16.5	17.4	16.1	19.7	17.9	21.1	23.4
Levels 3 and 4	8.2	8.4	9.2	13.5	10.6	10.8	12	13.5	13.7	15.1	18.5
Levels 5-8	19.7	18.1	17.7	20.9	22.6	23.6	19.9	25.7	22.3	27.5	28
All ISCED 2011 levels	7.7	7.4	7.8	10.6	10.9	11.8	10.8	13.8	13	16.4	18.6

Source: Eurostat 2025 (EU Labour Force Survey)

Figure 25 Most requested skills in online job ads in Malta in Skills in 2024 (ESCO level 2)



Source: CEDEFOP Skill Intelligence (2025)

5.4 Netherlands

While the Netherlands shares the broader European structural drivers shaping skill demand—digitalisation, the transition to environmental sustainability, and demographic ageing—the interaction between demand and supply of skills is strongly mediated by distinctive national features. According to CEDEFOP (2025a, 2025b), these include an advanced service-based economy, high digital infrastructure penetration, a robust vocational education and training system, yet persistent challenges in governance coordination, teacher shortages, and emerging skill mismatches particularly affecting medium-qualified workers.

The Dutch labour market exhibits characteristics shaped by its highly developed economy and strong integration into global value chains.

Employment is heavily concentrated in the service sector. Key sectors include Professional, Scientific and Technical Activities (sector M), Information and Communication (sector J), Distribution and Transport, and Non-market Services including health and education. Manufacturing accounts for approximately 11.3% of total employment, construction for 5.1%, and agriculture for 11.2% in 2023—with the agricultural share being relatively high compared to most EU Member States (CEDEFOP, 2025a).

The Dutch economy is characterized by a high prevalence of large, internationally competitive firms alongside a substantial SME base, with the country's position as a major European logistics hub (Rotterdam port, Schiphol airport) and its strength in high-tech agriculture, ICT services, and creative industries creating specific patterns of skill demand (CEDEFOP, 2025b). However, the KPMG[1] Tech Report 2023 identifies persistent governance and coordination challenges: 56% of Dutch respondents cited "lack of governance and coordination within technology functions" as the top bottleneck to digital transformation initiatives—significantly higher than technical constraints such as legacy systems (39%) or cybersecurity concerns (30%) (KPMG, 2024).

5.4.1Employment Projections and Sectoral Transformation

According to CEDEFOP (2025a), employment in the Netherlands is forecast to grow slightly slower than the EU-27 average over the 2030-35 period, following strong post-pandemic recovery. Projections from 2022 to 2035 shows a 4.5% employment growth compared to 5% EU avarage.

[1]

The primary sector and utilities is forecast to see the strongest growth (around 1% per annum), followed by construction (0.7% per annum) and non-marketed services (0.4-0.6% per annum). CEDEFOP (2025a) notes that all broad sectors except manufacturing and distribution & transport are forecast to see positive employment growth over 2015-35.

Figure 26 shows the high and increasing importance of Business & other services in the national economy, followed by non-marketed services that are expected to experience a relevant growth and overcoming the quote of employment absorbed by distribution and transport. Moderate in the quote they absorber and steady trends are showed by manufacturing, primary sector, while construction is expected to have a very moderate positive path.

Figure 27 (Eurostat data) focuses employment in circular economy sector, eg. recycling sector, repair and reuse sector and rental and leasing sector. Although these sectors have experienced sharp decreases before and after Covid-10 pandemic, the relative importance of these sectors appear significantly higher compared to the beginning of ’10 decade.

According to CEDEFOP (2025a), important sub-sectoral variations emerge within these broad trends. In distribution & transport, accommodation and catering services are forecast to grow quite strongly despite accounting for 4.5% of employment in 2020, while wholesale and retail trade—currently employing 16% of the workforce—is forecast to shrink very slightly.

Within manufacturing, projects that sectors such as electrical equipment, other transport equipment, motor vehicles, and wood/paper/publishing are forecast to see relatively strong employment growth, while food, drink and tobacco (1.5% of total employment) is forecast to see strong decline. Within business & other services, computer programming and information services, market research and other professional services, telecommunications, and research & development show strong forecast growth, while administration and support services (12% of total employment) face substantial projected decline.

These sectoral reallocation happen in a context of expected increase of the labour force (by 16% over 2020-35) and population ageing (those with 15-29 and 45-59 years are forecast to decline during 2020-35, while the population aged 65 and over, in particular, is forecast to grow strongly). Both demographic dynamics have important impacts on labour market transformations.

Job openings in the professionals group are expected to account for 44% of the economy's total job openings over 2022-35, since these occupational figures are expected to experience a strong employment growth which contribute about one-third of the group's job openings, along with replacement demand, which contributes 68% of the total job openings.

Figure 28 shows the future employment needs by occupation, based on both the new jobs opening and replacement demand. Forecast estimate many job openings also for technicians and associate professionals, driven largely by replacement demand, as the total number of jobs is expected to increase only slightly. Service workers and shop and market sales workers are expected to see substantial job openings due entirely to replacement demand. Even among clerks and elementary occupations, substantial shares of all job openings in the Netherlands are expected, largely from replacement needs.

The increasing shares of business and administration professionals and science and engineering professionals reflects increasing specialization/automatization and job organisation in many economic sectors (CEDEFOP, 2025). In particular, ICT-related occupations benefit from strongly positive occupation effects as they gain importance in many sectors. Information and communications technology professionals and information and communications technicians strongly benefit from this. CEDEFOP (2025a) reports that these two occupation groups also benefit from sector specific effects as they are often employed in sectors that are expected to grow.

5.4.2 Digital Skills

According to the CEDEFOP (2025b), the Netherlands demonstrates advanced digital infrastructure and high levels of basic digital skill diffusion, yet faces specific gaps in specialized competences and coordination challenges in digital transformation. In line with EU average, management skills are those more needed for development of enterprises (see table 1), although from 2010 percentage of enterprising expressing this need decrease as for the other types of skills, suggesting a diffusion in skill supply. Need of both general and professional IT skills is below the EU average.

Table 38 shows the distribution of skill needed by Nace sector. main skills needed for the development of enterprises by type of skill and Nace sector. Differently from EU average, general IT skills are most needed in sector Information and Communication sectors, but always below the EU average. Regarding professional IT skills, almost half of enterprises in such sectors express skill need for development, going above the values expressed at EU average. In all other sectors, need appears to be very low. Finally, also management skills are most needed in these sectors, with almost 23% of enterprises expressing this need.

As a matter of fact, Information and communication are also those sectors where higher is the diffusion of ICT in enterprises: 82.11% of enterprises employ ICT specialist (table39). Distance of this sector of others is sizable. Only in Electricity, gas, steam and air conditioning supply

(60.42%) more then half of enterprises employ ICT specialists. However, in only one sector I (Accomodation and food service activities), enterprises employing ICT specialists on total enterprises are lower the EU average

At the same time, in Information and communication, 41.94% had hard to fill vacancies for jobs requiring ICT specialist skills, more then 5% more the EU average. Such more difficulties is experienced also in all other nace sector (table 40), specifically in Electricity, gas, steam and air conditioning supply (27.6%) and Water supply; sewerage, waste management and remediation (15.42%).

Following KPMG (2024), regarding employer-reported skill needs, 38% of companies report difficulty finding personnel with required skills, with only 50% of secondary education graduates possessing necessary competences. Furthermore, according to KPMG (2024), 62% of employees are reported to require additional training by 2030, and only 52% of current core skills are expected to remain relevant.

In the KPMG survey(2024), when asked about skills needed by tech professionals in leadership positions, Dutch respondents identified empathetic skills (ethical understanding ranked first, followed by creativity and innovation, and collaboration) and commercial skills (strategic thinking ranked first, followed by technical or digital literacy, and cost control) as critical priorities.

5.4.3 Green Skills

According to the CEDEFOP (2025b), the green transition in the Netherlands is shaped by ambitious national climate targets and EU-level policy frameworks, including the National Programme for Circular Economy 2023-30 (targeting full circularity by 2050) and the Implementation Agenda for Climate and Energy. The Action Plan for Green and Digital Jobs, launched in 2023, targets labour shortages in sectors critical to green and digital transitions: technology, construction, energy, and ICT (CEDEFOP 2025b).

The Implementation Agenda focuses on four priorities: promoting sustainability in education including new qualification development; addressing engineering and ICT skill shortages through lifelong learning and STEM outreach; facilitating transition to sustainable educational infrastructure; and enhancing women's participation in engineering. According to CEDEFOP (2025b), this policy framework indicates that green skill demand is strongly linked to both engineering/technical competences and ICT capabilities.

5.4.4. Entrepreneurial Skills

According to KPMG (2024), entrepreneurial and managerial competences constitute the most critical bottleneck to effective digital transformation in the Netherlands. When asked which challenges most likely slow transformation, Dutch respondents identified organizational factors far exceeding technical constraints: governance and coordination gaps (56%), risk-averse culture (44%), legacy technology (39%), immature data management (39%), cybersecurity concerns (30%), and spiraling costs (30%). The fact that governance gaps (56%) and risk-averse culture (44%) substantially outweigh technical constraints indicates entrepreneurial and change management competences are more critical gaps than technical capabilities (KPMG, 2024).

According to KPMG (2024), communication barriers compound these organizational challenges. When asked about improving collaboration, 57% emphasize the need to improve technology functions' ability to communicate new technologies' potential to boards—this communication deficit is more pronounced at regional (62%) and global (69%) levels. Furthermore, 79% agree their tech function would benefit from higher diversity concentration to support collaboration with wider business, suggesting recognition that diverse perspectives are essential for effective transformation (KPMG, 2024).

Following KPMG (2024), when asked about skills needed by tech professionals in leadership positions, respondents identified empathetic skills (ethical understanding ranked first, followed by creativity and innovation, then collaboration) and commercial skills (strategic thinking ranked first, followed by technical or digital literacy, then cost control). The emphasis on "ethical understanding" reflects growing importance of responsible innovation and stakeholder management. "Strategic thinking" as top commercial skill underscores need for leaders navigating complex, rapidly changing environments.

5.4.5 Skills Supply and Mismatch

The Netherlands faces a distinctive "missing middle" qualification challenge. While 72% of total job openings expected between 2022-2035 will require higher qualifications—12 percentage points more than the EU-27 average of 60%—the supply of medium-qualified workers is projected to fall significantly below demand. Less than one-third (28%) of job openings will require medium-level qualifications (CEDEFOP, 2025a).

On the supply side, following CEDEFOP (2025b), the share of high-qualified labour force is expected to increase from 42% to 55% by 2035, while medium-qualified drops from 40% to 36%, and low-qualified declines from 18% to 9%.

Figure 29 shows the distribution of 15-64 year population by educational attainment: individual with tertiary education show a remarkable positive path in the last years, anticipating in time and exceeding in size the trend observed at EU level (38.7% vs 31.7%). Over recent years, the percentage of individual with tertiary education overcome those with upper secondary non tertiary education (37.2), that follows the EU negative path.

The Labour Shortage Index reveals highest shortage values among plant and machine operators and assemblers, professionals, and elementary occupations. Among skilled manual occupations, assemblers show highest shortages. Among skilled non-manual occupations, numerical and material recording clerks face acute shortages. Among high-skilled workers, legal, social, and cultural professionals and associate professionals show greatest shortages (CEDEFOP, 2025a).

According to KPMG (2024), employer-reported skill gaps reinforce these structural mismatches: 38% of companies report difficulty finding personnel with required skills, only 50% of secondary education graduates possess necessary competences, 62% of employees require additional training by 2030, and only 52% of current core skills are expected to remain relevant. This mismatch is particularly acute in digital and green skills, where demand grows rapidly but training provision remains fragmented (KPMG, 2024).

Specifically considering digital skill supply, CEDEFOP (2025b) offer some useful insights: individuals aged 16-74 with at least basic digital skills stood at 82.7% in 2023, significantly above the EU-27 average of 55.6% and already exceeding the 2030 EU target of 80%. This reflects both strong digital infrastructure and effective integration of digital skills in education systems.

Overall, the digital skill supply is ranked at a good level compared to the EU average (Table 41). Individuals with basic or above basic information and data literacy skills are 97.55% of 16-74 year population (EU=81.7%) and individuals at basic level are only 5%, half of the EU average. Regarding communication and collaboration, 98.86% have basic or above basic skills (EU average=89.3%) and only 1.1% of individuals have basic skill level. Positive performance are shown also for other digital skill domain (creation, safety and problem solving). As a consequence, individuals with basic or above basic overall digital skills represent 82.7% of dutch population, almost 30% more the EU average. Also the more specialized segment is larger then EU, with 54.53% of population having above basic overall digital skills in front of 27.32%, while those with lower level are smaller the EU average

Regarding green skills, according to the CEDEFOP (2025b), supply faces significant structural challenges that constrain the system's ability to meet demand. Few dedicated vocational

programmes focus specifically on green skills. University programmes in environmental sciences exist but are not always well-aligned with practical industry needs. Continuing education in green skills is fragmented and often lacks standardisation. Most green skills training is concentrated in major urban areas, creating limited access to specialised green training in peripheral regions despite strong local demand in areas such as renewable energy in islands and sustainable tourism in coastal areas (CEDEFOP, 2025b).

Following the CEDEFOP (2025b), practorates—teams focused on innovation and practice-oriented research in VET, consisting of practors and teacher-researchers with a strong practical foundation in a specific sector or area of educational innovation—offer VET students the opportunity to get involved in research projects and learn about new technologies and agricultural sector innovations, supporting the green transition through VET research. However, these remain relatively limited in scale and scope, and do not address the broader supply-side fragmentation (CEDEFOP,2025b).

The pattern that emerges is one of strong policy ambition and business recognition of the importance of green skills, particularly as mediated through digital technologies, but with supply-side provision remaining fragmented, geographically concentrated, and insufficiently aligned with practical industry needs.

The evidence on entrepreneurial skills supply is largely implicit in the demand-side gaps identified. According to KPMG (2024), the fact that 56% identify governance and coordination gaps, 44% identify risk-averse culture, and 57% identify communication deficits between technology functions and business leadership suggests that the education and training system has not adequately equipped managers and leaders with the entrepreneurial competences required for digital transformation contexts. The prioritization of "ethical understanding" and "strategic thinking" over technical competences in leadership roles indicates these are competences not currently well-supplied through formal education pathways.

Following KPMG (2024), the lag in external-facing transformation outcomes (new business development at 49%, customer engagement at 44%) compared to internal outcomes (employee satisfaction at 59%, efficiency at 53%) further suggests that entrepreneurial competences related to market sensing, business model innovation, and customer value creation are insufficiently developed in the current workforce. The fact that only 50% of secondary education graduates are perceived to possess necessary competences, and 62% of existing employees require additional training by 2030, indicates systematic under-supply of the transversal and entrepreneurial competences needed for transformation contexts (KPMG, 2024).

5.5.5 Priority Digital Green and Entrepreneurial Skills

In Netherlands has an extended culture and practice of informed vocational training exists.

According to the CEDEFOP (2025b), the core of the Dutch VET system is upper secondary vocational education (MBO), serving both initial and continuing vocational education through two pathways: school-based (BOL, 20-60% workplace learning) and work-based dual (BBL, 60-80% workplace learning), both leading to equivalent diplomas. The

However, following the CEDEFOP (2025b), critical constraints limit system responsiveness: acute teacher shortages; declining basic skills performance; increasing early school leaving and fragmented lifelong learning provision with limited employer-provided training despite business recognition of skill gaps. These constraints directly limit VET system capacity to respond to emerging skill demands.

Table 42 shows that in 2020 76.8% of enterprises provide CVT courses and other forms of CVT. In 2005 it was the 74.7%. In line with EU trend, both categories have been reduced if compared to 2015, probably because emergency measure depending from the COVID-19 pandemic. Also participants in CVT courses (Table 43) have decreased from 2015 to 2020, representing 39.2% of total employed (42.4% in Europe average).

However, participation rate in education and training is significantly higher the EU average. Table 44 shows that 26.5% of 25-64 years population is involved in training and education, and that the higher rate is observed among individuals with tertiary education (33.6%).

Following KPMG (2024) and CEDEFOP (2025a), the Dutch skills challenge centers less on aggregate supply quantity than on: coordination effectiveness between education and labour market actors, granular matching between specialized demands and field-specific competences, maintenance of institutional quality (particularly teacher workforce and basic skills foundations), equitable access to training with increasing individualization raising equity concerns, and bridging organizational and cultural barriers preventing effective technology adoption, with governance and change management representing more critical bottlenecks than technical capabilities.

Considering this institutional framework and the sector and domain specific skill shortage, some final priorities seems to emerge.

According to the CEDEFOP (2025b), foundational competences remain a priority. The Masterplan Basic Skills, introduced in 2022 and allocating €30 million annually for teacher professional development, specifically targets Dutch, mathematics, citizenship, and digital

literacy as critical foundation skills, responding to PISA 2022 evidence of declining performance particularly among VMBO students.

The Skill Intelligence dashboard elaborated by CEDEFOP allows the derivation of a list of priorities (Figure 30), based on the elaboration of top skills (at ESCO level 2) requested in online job advertisements in 2024. "Accessing and analysing digital data" has the highest value at 2.1%, while "using digital tools for collaboration, content creation and problem solving" is the second most requested skill, at 1.4%. The remaining skills do not seem to be associated with green jobs. "Liaising and networking" (1.4%), "allocating and controlling resources" (1.3%), "organising, planning and scheduling work and activities" (0.8%) and "supervising people" can be included in the entrepreneurship skill list, bearing in mind that this category is not defined in the ESCO dataset, but is based on our conceptual elaboration.

Following KPMG (2024), at more advanced levels, technologies prioritized for short-term business ambitions indicate demand for skills in AI and machine learning implementation, data analytics, cybersecurity, and software development and system integration. However, the emphasis on organizational barriers—with 56% identifying governance and coordination gaps and 57% identifying need to improve technology functions' communication capabilities—highlights that technical digital skills alone are insufficient. Priority skills must include abilities to translate technical possibilities into business strategy, communicate technology value to non-technical stakeholders, and coordinate digital initiatives across organizational units.

According to the CEDEFOP (2025b), the Implementation Agenda for Climate and Energy prioritizes engineering and ICT skills as critical for the green transition, particularly through lifelong learning and STEM outreach initiatives. The emphasis on addressing these skill shortages suggests that technical engineering competences—particularly those enabling renewable energy deployment, sustainable construction, and energy efficiency implementation—constitute high priority areas where supply must be strengthened.

Following KPMG (2024), green skills are predominantly demanded in hybrid form, combining environmental objectives with digital capabilities. The high percentages of respondents recognizing technology's role in carbon emissions measurement and reporting (81%), developing sustainable products (81%), and reducing emissions through efficiency improvements (79%) indicate that priority green skills in the Netherlands include: ESG reporting and compliance capabilities, carbon measurement and monitoring competences, and abilities to leverage digital technologies (data analytics, IoT, AI) for environmental performance optimization. The emphasis on ESG transparency (47% identify it as leading

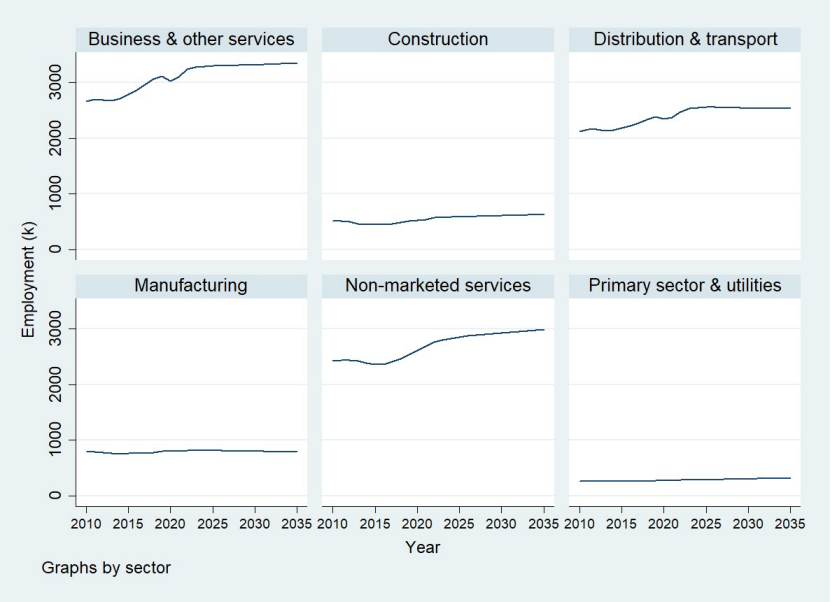
customer expectation) further highlights the importance of communication and reporting competences alongside technical green knowledge.

Finally, the most critical entrepreneurial skills are those addressing identified organizational bottlenecks. Governance and coordination capabilities emerge as highest priority, given that 56% identify lack of governance and coordination in technology functions as the primary obstacle to transformation. This encompasses abilities to establish clear decision-making structures, coordinate across organizational units, and translate technical initiatives into coherent strategic direction.

Following KPMG (2024), change management and cultural transformation competences constitute a second priority area, as 44% identify risk-averse culture as a major obstacle slowing transformation. This includes capabilities to overcome organizational resistance, foster innovation-friendly cultures, and manage transformation processes effectively. Strategic thinking ranks as the top commercial skill needed by tech professionals in leadership positions, essential for navigating complex environments and aligning operations with evolving market conditions.

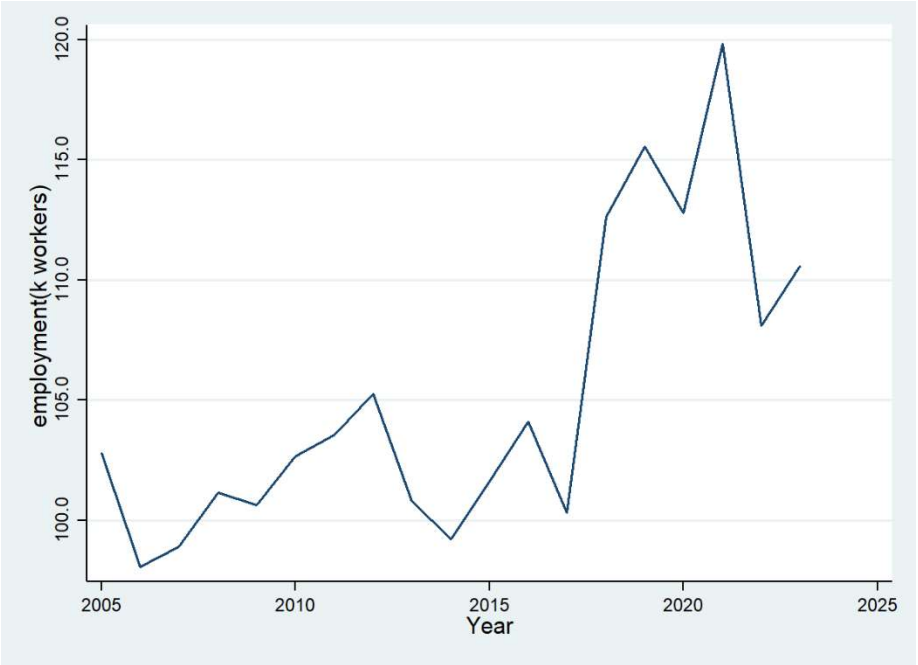
According to, communication and stakeholder engagement capabilities represent a third priority area, with 57% emphasizing need to improve technology functions' ability to communicate new technologies' potential to boards. This encompasses not only technical communication but also business case development, stakeholder alignment, and translation of technical possibilities into strategic opportunities. Ethical understanding—ranked as the top empathetic skill—reflects growing importance of responsible innovation and stakeholder management in transformation contexts. Finally, collaboration capabilities and comfort with diversity (79% recognize higher diversity would benefit collaboration) indicate that inclusive leadership and cross-functional coordination represent important entrepreneurial competences for effectively navigating digital and green transitions in the Dutch context. (KPMG, 2024)

Figure 26 Total Employment (k workers) in Netherlands by broad sector. Trend and forecast from 2010 to 2035



Source: Author's elaboration on CEDEFOP data (2023) downloaded in November 2025.

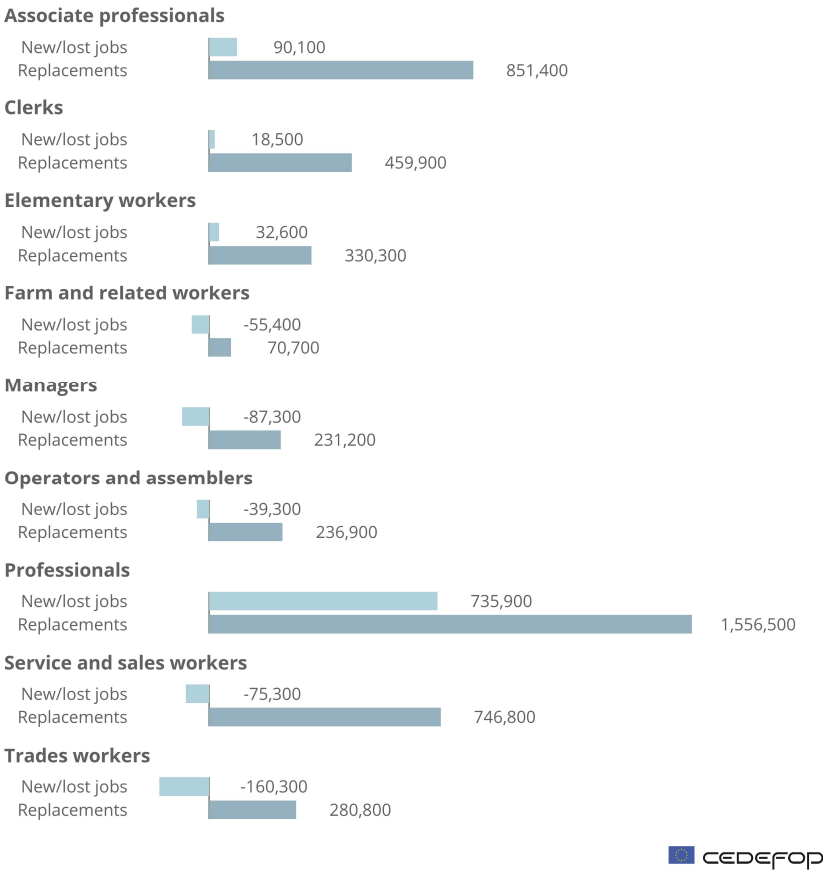
Figure 27 Persons Employed in Circular economy sectors (K workers). Netherlands (2005-2025)



Note: employed in the recycling sector, repair and reuse sector and rental and leasing sector

Source: Eurostat (2025)

Figure 28. Future needs (total job openings) by occupation in Netherland 2022-2035.



Source: Cedefop skill forecast (2026)

Table 38. Main skills needed for the development of the enterprises by type of skill and NACE Rev. 2 activity (% of all enterprises) in Netherlands

Nace rev.2	B-E	F	G-I	J-K	L-N-R-S
YEAR	GENERAL IT SKILLS				
2010	34.7	23.5	25.2	43.2	45.8
2015	15.5	10.3	12.0	19.1	14.5
2020	16.1	9.8	15.7	20.1	18.8
	PROFESSIONAL IT SKILLS				
2010	10.1	11.6	6.8	43.4	14.1
2015	7.9	5.2	5.8	43.5	7.9
2020	5.5	1.2	7.0	48.8	10.4
	MANAGEMENT SKILLS				
2010	34.0	30.1	35.8	52.7	47.9
2015	24.5	19.2	21.5	31.9	24.0
2020	20.2	19.9	24.7	22.8	21.9

Note: B-E: Industry (except construction); F: Construction; G-I : Wholesale and retail trade, transport, accommodation and food service activities; J-K: Information and communication; financial and insurance activities; L-N-R-S: Real estate activities; professional, scientific and technical activities; administrative and support service activities; arts, entertainment and recreation; other service activities
Source: Eurostat (2025- CVT Survey)

Table 39 Enterprises that employ ICT specialists by NACE Rev.2 in EU-27 (% of enterprises). Netherlands (2014-2024)

Nace rev 2		2014	2015	2016	2017	2018	2019	2020	2022	2024
C	Manufacturing	32.20	34.29	30.30	28.47	27.57	24.68	25.52	31.64	30.69
D	Electricity, gas, steam and air conditioning supply	:	:	:	:	:	:	:	71.19	60.42
E	Water supply; sewerage, waste management and remediation activities	:	:	:	:	:	:	:	30.24	33.67
F	Construction	13.87	15.84	17.72	15.23	14.03	10.25	11.95	14.88	14.90
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	23.05	25.57	24.65	27.67	27.91	26.50	23.54	31.42	31.27
H	Transportation and storage	22.79	20.71	17.97	23.74	19.94	20.19	19.93	24.93	24.06
I	Accommodation and food service activities	5.32	4.56	5.38	4.99	6.08	4.19	3.63	10.32	6.98
J	Information and communication	78.20	76.65	75.64	73.72	81.61	76.65	74.24	80.61	82.11
L	Real estate activities	:	:	:	:	:	:	:	33.67	32.98
M	Professional, scientific and technical activities	:	:	:	:	:	:	:	40.46	37.35
N	Administrative and support service activities	16.47	17.43	15.30	15.56	16.26	17.68	17.11	21.95	21.30

Note: population include enterprise with 10 or more employed;
data for Nace A an B are not available;
: not available

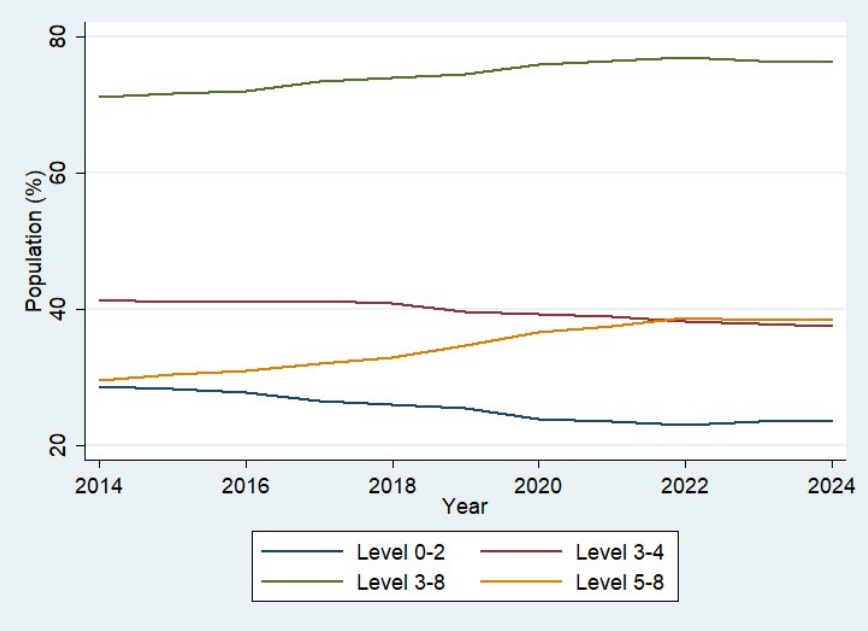
Source: Eurostat (2025) (European ICT usage survey)

Table 40 Enterprise had hard-to-fill vacancies for jobs requiring ICT specialist skills. Netherlands (2014-2024)

Nace rev 2		2014	2015	2016	2017	2018	2019	2020	2022	2024
C	Manufacturing	2.11	2.26	2.18	5.98	7.08	5.11	5.02	7.64	7.63
D	Electricity, gas, steam and air conditioning supply	:	:	:	:	:	:	:	35.89	27.60
E	Water supply; sewerage, waste management and remediation	:	:	:	:	:	:	:	10.94	15.42
F	Construction	1.12	1.07	0.73	2.91	2.60	2.08	2.23	2.70	4.60
G	Wholesale and retail trade; repair of motor vehicles &sec motorcycles	2.06	2.40	4.18	6.64	8.03	7.45	6.97	10.31	8.53
H	Transportation and storage	1.64	2.99	2.23	4.75	5.86	4.50	4.49	6.97	5.98
I	Accommodation and food service activities	0.22	0.21	0.07	0.66	0.52	0.24	0.37	1.00	1.16
J	Information and communication	31.54	32.9	38.42	42.54	49.00	43.	44.51	48.97	41.94
L	Real estate activities	:	:	:	:	:	:	:	7.48	10.05
M	Professional, scientific and technical activities	:	:	:	:	:	:	:	14.09	12.29
N	Administrative and support service activities	3.08	3.36	3.69	5.01	4.91	6.05	4.49	7.30	6.15

Note: population include enterprise with 10 or more employed;
data for Nace A an B are not available;
: not available
Source: Eurostat (2025) (European ICT usage survey)

Figure 29. Netherlands: Population by educational attainment (% of total population from 15 to 64 years)



Source: Eurostat 2025 (Labour force survey)

Table 41. Netherlands: Individuals' level of digital skills (% of individuals 16-74 years)

Year	2021	2023
Individuals with basic or above basic information and data literacy skills	93.37	97.55
Individuals with above basic information and data literacy skills	89.38	92.57
Individuals with basic information and data literacy skills	3.99	4.98
Individuals with basic or above basic communication and collaboration skills	94.36	98.86
Individuals with above basic communication and collaboration skills	92.78	97.75
Individuals with basic communication and collaboration skills	1.58	1.11
Individuals with basic or above basic digital content creation skills	83.34	86.46
Individuals with above basic digital content creation skills	64.88	66.74
Individuals with basic digital content creation skills	18.46	19.72
Individuals with basic or above basic safety skills	87.04	92.7
Individuals with above basic safety skills	71.51	77.39
Individuals with basic safety skills	15.53	15.31
Individuals with basic or above basic problem solving skills	93.58	98.15
Individuals with above basic problem solving skills	83.3	87.4
Individuals with basic problem solving skills	10.29	10.76
Individuals with basic or above basic overall digital skills	78.94	82.7
Individuals with above basic overall digital skills	51.77	54.53
Individuals with basic overall digital skills	27.18	28.16
Individuals with low overall digital skills	11.4	12.12
Individuals with narrow overall digital skills	3.39	3.43
Individuals with limited overall digital skills	0.46	0.65
Individuals with no overall digital skills	0.32	0.25
Digital skills could not be assessed: individual has not used internet in the last 3 months	5.48	0.85

Note :
The Digital Skills Indicator 2.0 (DSI) is a composite indicator which is based on selected activities related to internet or software use that individuals aged 16-74 perform in five specific areas (Information and data literacy, Communication and collaboration, Digital content creation, Safety, and Problem solving). It is assumed that individuals having performed certain activities have the corresponding skills. Therefore, the indicators can be considered as proxy of individuals' digital skills.
According to the variety of activities performed, two levels of skills are computed for each of the five areas ("basic" and "above basic"). Finally, based on the component indicators for each area, an overall digital skills indicator is calculated as a proxy of the digital skills of individuals ("no skills", "limited", "narrow", "low", "basic", "above basic" or "at least basic skills").
Individuals with basic or above basic overall digital skills= all five component indicators are at basic or above basic level,
Individuals with above basic overall digital skills=all five component indicators are at above basic level,
Individuals with basic overall digital skills= all five component indicators are at basic or above basic level, without being all above basic;
Individuals with low overall digital skills=four out of five component indicators are at basic or above basic level.
Individuals with narrow overall digital skills=three out of five component indicators are at basic or above basic level;
Individuals with limited overall digital skills=two out of five component indicators are at basic or above basic level
Source: Eurostat 2025 (ICT Survey)

Table 42. Participants in CVT courses by sex- Netherlands (% of persons employed in all enterprises)

Year	2005	2010	2015	2020
Total	34.1	38.6	41.4	39.2
Males	35.9	39.6	44.9	40.1
Females	30.8	36.5	36.6	37.6

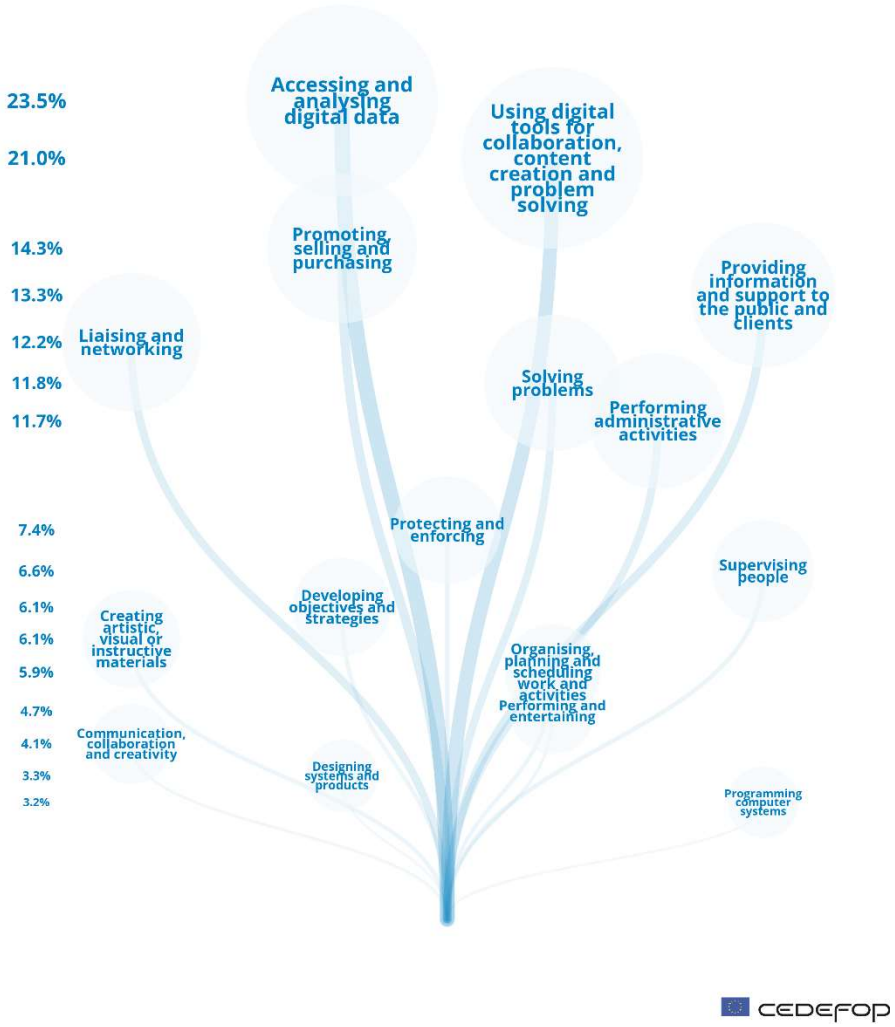
Source: Eurostat 2025 (Continuing Vocational Training Survey -CVTS)

Table 43. Participation rate in education and training (over previous last 4 weeks) by educational attainment level (% population aged 25-64 years)- Netherlands

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Levels 0-2	9	9.3	9.1	9.5	9.9	10.2	9.9	13.8	13.9	14.5	14.6
Levels 3-8	21.4	22.1	22	22.1	21.9	22.1	21.3	29.9	29.4	29.4	29.4
Levels 3 and 4	18.1	18.6	18.3	18.4	18.5	19	18	24.4	24.2	24.6	24.3
Levels 5-8	25.5	26.2	26.2	26.2	25.5	25.1	24.2	34.8	33.7	33.4	33.6
All ISCED 2011 levels	18.3	18.9	18.8	19.1	19.1	19.5	18.8	26.6	26.4	26.4	26.5

Source: Eurostat 2025 (EU Labour Force Survey)

Figure 30 Most requested skills in online job ads in Netherlands in Skills in 2024 (ESCO level 2)



Source: CEDEFOP Skill Intelligence (2025)

5.5. Turkey

Turkey occupies a specific position in this report, as it is not an EU Member State and is therefore excluded from EU-27 aggregates in Eurostat datasets. Moreover, while Turkish statistics generally follow comparable methodological standards and are collected through aligned survey instruments, they remain institutionally separate and exhibit certain coverage limitations.

Available evidence indicates that Turkey's skills landscape is shaped by the same macro-drivers affecting European economies—digitalisation, the environmental sustainability transition, and demographic change—yet these forces operate through distinctive national characteristics related to productive organisation, labour market structure, and institutional arrangements. With a working-age population of 53.6 million (WEF, 2025), Turkey differs markedly from most European economies due to its younger demographic profile and continued population growth.

The OECD Skills Strategy Diagnostic Report for Turkey (2017a) identifies a central paradox: educational attainment has improved steadily and vocational training infrastructure has benefited from substantial public investment, yet skills mismatches persist as a binding constraint on both productivity and employment quality. As emphasised by the 1, these mismatches reflect not only quantitative shortages in specific technical competences but also deeper structural weaknesses in skill anticipation mechanisms, quality assurance processes, and coordination between education providers and employers.

McKinsey's (2020) analysis of automation and digitalisation in Turkey examines the technical potential and realistic adoption scenarios. The study projects that approximately 7.6 million workers will require significant upskilling or reskilling involving role changes or occupational transitions by 2030. This represents a substantial share of Turkey's workforce and underscores the scale of the reskilling challenge ahead.

Turkey's productive landscape reflects a fundamental duality. One segment comprises modern, globally integrated sectors—such as automotive, machinery, and electronics—operating at technological frontiers with structured and clearly articulated skill demands. The other encompasses more traditional activities characterised by lower productivity, higher informality, and atomised firm structures. This dualism, as noted by the OECD (2017a), generates divergent skill demand patterns and compounds training provision challenges: small and medium-sized enterprises, which account for the bulk of employment, face systematically greater obstacles in both accessing and delivering structured training compared to large firms.

5.5.1Employment Projections and Sectoral Transformation

According to CEDEFOP (2023), employment in Turkey is forecast to grow substantially faster than the EU-27 average over the 2022–2035 period. Compared to the expected EU employment growth of 5%, Turkey's projected performance is markedly stronger. From 2022 to 2035, total employment is estimated to increase by 14%, rising from approximately 31 million to nearly 35 million workers (Figure 31). This trend reflects Turkey's younger demographic profile as well as its ongoing structural transformation from agriculture towards services and industry.

Figure 32 shows total employment by broad sector. Distribution and Transport exhibits the highest employment level and is projected to continue growing steadily, absorbing an increasing share of the workforce. Non-marketed services and Manufacturing also show sustained growth, reflecting demographic pressures and the expansion of public service provision. Business and other services maintain a relatively smaller employment share, following a moderately negative trajectory. The primary sector and utilities display a clear declining trend, consistent with structural transformation patterns observed across developing economies. While accounting for a limited share of total employment, Construction also shows a positive trend, positioning it by 2035 at approximately the same level as Business and other services.

According to the WEF Future of Jobs Report (2025), Turkish employers identify several key transformation drivers expected to reshape the labour market through 2030:

1. Broadening digital access, particularly relevant given geographic diversity and infrastructure gaps between major urban centres (Istanbul, Ankara, Izmir) and peripheral regions;
2. Technology adoption, with 97% of Turkish employers expecting AI and information-processing technologies to transform operations, notably through robotics and energy technologies;
3. Skills disruption, with 44% of on-the-job skills expected to be disrupted by 2030, exceeding the global average of 39%.

WEF (2025) identifies the fastest-growing job roles in Turkey as Robotics Engineers, Renewable Energy Engineers, Autonomous and Electric Vehicle Specialists, Big Data Specialists, and AI and Machine Learning Specialists. Conversely, declining roles include Accountants and Auditors, reflecting the automation of routine administrative and data-processing tasks.

5.5.2 Digital Skills

Consistent with European-wide evidence, digitalisation represents one of the most important drivers of skill demand in Turkey. According to the WEF Future of Jobs Report (2025), AI and big data constitute the fastest-growing skill category, with 92% of Turkish employers reporting an expected increase in importance by 2030. This is followed by technological literacy (76%) and networks and cybersecurity (74%), all exceeding global averages and indicating particularly rapid technology diffusion in the Turkish context.

However, the Turkish case illustrates a pronounced gap between the diffusion of digital technologies and the availability of corresponding skills within the workforce. McKinsey (2020) emphasises that technological skills will experience substantial growth in demand by 2030, far exceeding changes in other skill categories. The analysis identifies critical demand areas spanning the full spectrum from basic digital literacy to advanced technical competences, including IT skills and programming, data analysis and mathematical skills, and technology design, engineering, and maintenance.

Table 45 shows the percentage of enterprises employing ICT specialists by NACE Rev.2 sector in Turkey from 2018 to 2024. The Information and Communication sector (J) exhibits the highest diffusion, with 66.64% of enterprises employing ICT specialists in 2024, although this represents a decline from a peak of 76.22% in 2022. Electricity, gas, steam, and air conditioning supply (D) also shows substantial ICT specialist employment (46.95% in 2024), reflecting the technical complexity of energy-sector operations. Professional, scientific, and technical activities (M) and Administrative and support service activities (N) report relatively high rates as well, at 16.41% and 18.37%, respectively.

By contrast, more traditional sectors exhibit low levels of ICT specialist employment: Construction (F) at 5.07% in 2024, Accommodation and food service activities (I) at 8.64%, and Transportation and storage (H) at 9.80%. Manufacturing (C) stands at 14.40%. These figures highlight substantial variation in digital intensity across sectors, with many traditional industries lagging significantly behind service-oriented activities.

Table 46 examines hard-to-fill vacancies for ICT specialist positions. The Information and Communication sector (J) experiences the highest recruitment difficulties, with 16.29% of enterprises in 2024 reporting hard-to-fill vacancies, although this share has declined from 28.94% in 2019. Electricity, gas, steam, and air conditioning supply (D) shows the second-highest difficulty level (8.91% in 2024), indicating persistent skill shortages.

Other sectors report lower but non-negligible difficulties, including Administrative and support services (N) at 3.96%, Wholesale and retail trade (G) at 2.84%, Professional, scientific,

and technical activities (M) at 2.73%, Manufacturing (C) at 2.51%, and Transportation and storage (H) at 2.41%. Manufacturing and Transportation and storage are also the only sectors where recruitment difficulties increased over the 2018–2025 period. Overall, these patterns suggest that while ICT skill shortages are most acute in technology-intensive sectors, recruitment difficulties extend across the economy, consistent with the broad digitalisation of production and services.

Green Skills

The green transition in Turkey involves substantial transformations across multiple sectors. According to the WEF Future of Jobs Report (2025), Turkish employers rank environmental stewardship and renewable energy competences among priority skill areas, although below digital skills in perceived urgency. Within the international sources consulted for this report, sectoral and occupational disaggregation on green skills demand in Turkey remains limited, constraining the scope for more granular empirical analysis. While the report does not provide detailed sectoral breakdowns, it identifies energy technologies and sustainable development as key transformation drivers.

The OECD (2017a) notes growing demand for technical competences in sectors directly linked to renewable energy expansion, including solar and wind installation, energy storage, and smart-grid management. Consistent with broader European patterns identified in the EU-level report, green skills in Turkey are predominantly associated with the transformation of existing jobs rather than the creation of entirely new green occupations. The OECD emphasises that environmental awareness, regulatory compliance, and sustainability integration competences are increasingly embedded across multiple sectors, particularly in energy-intensive industries facing EU and domestic emissions regulations.

5.5.3 Entrepreneurial Skills

Turkey exhibits relatively high rates of self-employment and entrepreneurial activity, reflecting both economic opportunity and labour market informality. However, as emphasised by the OECD (2017a), entrepreneurial behaviour does not automatically translate into structured entrepreneurial competences. Skills related to business planning, strategic thinking, innovation management, and firm scaling remain unevenly distributed and weakly supported by formal training systems.

According to the WEF Future of Jobs Report (2025), Turkish employers identify the following core skills for 2025: analytical thinking (74%), resilience, flexibility, and agility (69%), leadership and social influence (65%), motivation and self-awareness (64%), and creative

thinking (60%). Skills expected to increase in importance by 2030 include creative thinking (68%) and resilience, flexibility, and agility (71%), while analytical thinking remains critical, albeit with a lower growth rate than technological skills (WEF, 2025).

McKinsey (2020) projects substantial growth in social and emotional skills by 2030, reflecting increased demand for competences related to adaptability, leadership, communication, interpersonal interaction, and entrepreneurship. These projections align with the dual nature of labour market transformation identified at the EU level: as routine cognitive and physical tasks become increasingly automated, human-centred competences involving judgement, creativity, social interaction, and adaptation to uncertainty gain importance.

5.5.4 Skills Supply and Mismatch

Figure 33 illustrates population by educational attainment from 2013 to 2024, showing substantial educational expansion, particularly at the tertiary level. This upward trend in formal qualifications provides a foundation for advanced skill development. However, the OECD (2017a) emphasises that educational expansion alone does not guarantee labour market alignment. Turkey's PISA scores remain below OECD averages in mathematics, science, and reading, indicating persistent weaknesses in foundational competences that constrain the effectiveness of subsequent skills acquisition. Moreover, the OECD notes that while educational attainment has risen, skills mismatches persist, reflecting insufficient responsiveness of education content to evolving labour market requirements.

Table 47 presents individuals' level of digital skills in Turkey for 2021 and 2023. Data from Eurostat (2025) reveal significant improvements but persistent gaps:
• Communication and collaboration: 85.54% of individuals aged 16–74 possess basic or above-basic skills in 2023 (up from 79.7% in 2021), representing the strongest area of digital competence in Turkey.
• Information and data literacy: 73.97% possess basic or above-basic skills in 2023 (up from 68.53% in 2021).
• Problem solving: 69.3% possess basic or above-basic skills in 2023 (up from 61.99% in 2021).
• Safety skills: 52.46% possess basic or above-basic skills in 2023 (up from 48.89% in 2021).
• Digital content creation: only 42.11% possess basic or above-basic skills in 2023 (up marginally from 39.81% in 2021), indicating the weakest area.

Critically, only 33.11% of individuals possess basic or above-basic overall digital skills in 2023 (up from 30.12% in 2021), with just 10.61% possessing above-basic overall digital skills. This indicates that while progress is occurring, the majority of Turkey's population still lacks

comprehensive digital competence across all five component areas (information and data literacy, communication and collaboration, digital content creation, safety, and problem solving).

Concerning green skills, the OECD (2017a) identifies critical gaps related to limited integration of environmental competences in vocational training, fragmented and project-based provision, weak certification mechanisms, and regional disparities in access to green skills training. Regarding entrepreneurial skills, the OECD (2017a) observes limited emphasis on entrepreneurial competences in general education, weak integration within vocational training, fragmented adult learning provision, and the absence of formal recognition for experience-based entrepreneurial learning.

While fragmented, these figures support international evidence indicating that Turkey experiences significant skills mismatches across multiple dimensions, reflecting both supply-side inadequacies and demand-side coordination failures. The OECD (2017a) highlights that skills mismatch in Turkey reflects not only insufficient skills supply but also weak anticipation mechanisms, fragmented employer–education coordination, inadequate recognition of informal learning, and pronounced regional imbalances, with skill supply concentrated in major urban centres and shortages persisting in peripheral regions. Moreover, it identifies skills mismatch as a critical constraint on productivity growth and a source of persistent labour market inefficiency.

According to WEF (2025), 66% of Turkish employers identify skills gaps as a key barrier to business transformation, exceeding the global average of 63%. Additional barriers include difficulties in attracting talent to industry (42% vs. 37% globally), shortages of investment capital (40% vs. 26%), difficulties in attracting talent to specific firms (38% vs. 27%), and limited data and technical infrastructure (36% vs. 32%).

Turkey has invested substantially in public training infrastructure, notably through İŞKUR, vocational training centres, technology development zones, and Model Factories supporting Industry 4.0 training (OECD, 2017a). However, effectiveness is constrained by fragmentation, uneven quality assurance, limited curriculum responsiveness, and weak certification mechanisms for competences acquired through non-formal learning pathways. Although WEF (2025) data suggest growing employer awareness—82% expect talent development to improve and 91% plan workforce upskilling—the OECD cautions that implementation capacity and resource constraints, particularly among SMEs, may limit effective delivery.

Table 48, reporting participation rates in education and training by educational attainment level from 2014 to 2024, offers some insights into the results of efforts devoted to

strengthening skill training. Eurostat data (2025) indicate a gradual increase in overall participation from 5.7% to 8%, still well below EU-27 averages. Participation remains highest among tertiary-educated individuals (16.7% in 2024), while low-educated workers show persistently minimal participation (3.5%). The persistently low participation of low-educated workers in adult learning appears particularly critical, given their higher exposure to automation and task transformation.

5.5.5 Priority Digital, Green and Entrepreneurial Skills

The analysis of available sources on Turkey reveals recurring skill priorities, though these emerge through different analytical frameworks rather than a unified prioritisation exercise.

Digital competences emerge consistently as the most critical area. The WEF Future of Jobs Report (2025) identifies AI and big data as the fastest-growing skill category, with 92% of Turkish employers reporting an expected increase in importance by 2030. This is followed by technological literacy (76%) and networks and cybersecurity (74%). These projections align with sectoral evidence: Table 45 shows substantial variation in ICT specialist employment across sectors, while Table 46 confirms persistent recruitment difficulties for ICT specialists, particularly acute in the Information and Communication sector. McKinsey (2020) emphasises that demand spans the full spectrum from basic digital literacy—necessary for universal workforce participation—to advanced technical competences in programming, data analysis, and technology design.

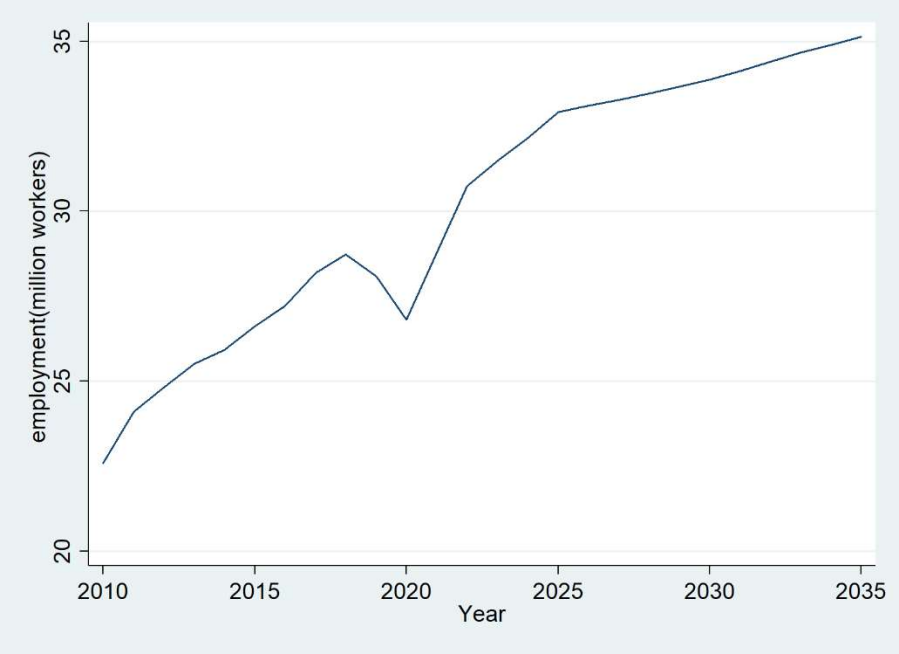
Green and environmental competences appear as an emerging priority, though with less granular empirical detail than digital skills. The WEF (2025) reports that Turkish employers identify environmental stewardship and renewable energy competences as priority areas. The OECD (2017a) notes growing demand for technical competences in solar and wind installation, energy storage, and smart-grid management, alongside broader requirements for environmental awareness and regulatory compliance across energy-intensive industries.

No direct insights on entrepreneurial skills can be derived from this analysis. However, considering that the boundaries of this skill category are quite flexible, some useful suggestions can be derived by focusing attention on transversal and socio-emotional competences. According to WEF (2025), analytical thinking, resilience and flexibility, and creative thinking rank among the core skills identified by Turkish employers for 2025. McKinsey (2020) projects substantial growth in social and emotional skills, including adaptability, leadership, communication, and entrepreneurship.

Foundational competences and training system effectiveness emerge as structural constraints that condition the effectiveness of all skill development efforts. The OECD (2017a) emphasises that despite steady improvements in educational attainment, Turkey's PISA scores remain below OECD averages in mathematics, science, and reading, indicating weaknesses in foundational competences that constrain advanced skill acquisition. The OECD identifies critical systemic gaps, including weak skill anticipation mechanisms, fragmented employer-education coordination, inadequate recognition of informal learning, and pronounced regional imbalances in training access.

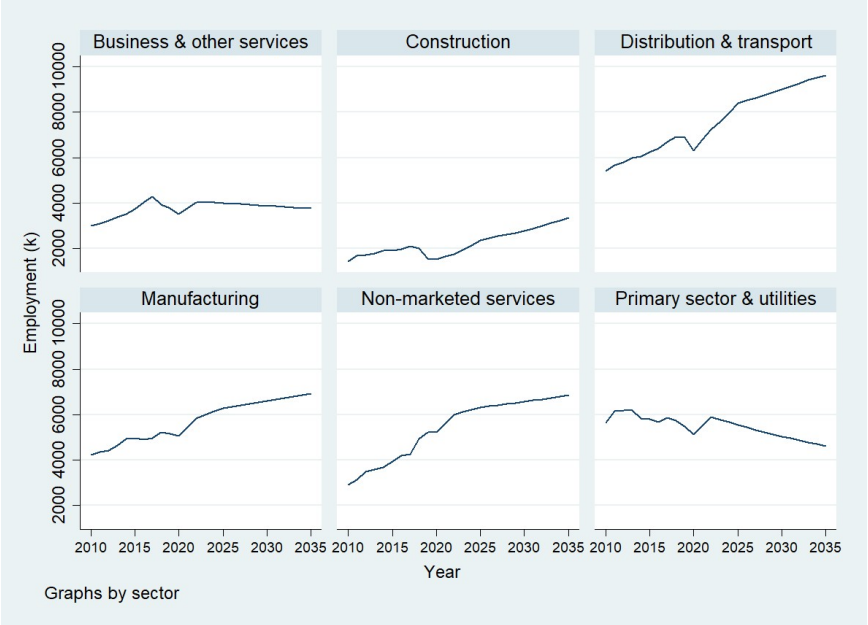
These recurring priorities do not constitute a formal policy hierarchy but rather reflect convergent emphases across different analytical perspectives. Addressing Turkey's skills challenge requires interventions spanning technical skill provision (digital and green), transversal competence development, and, even if out of the scope of this report, structural reforms to training systems' responsiveness, quality assurance, and coordination mechanisms.

Figure 31 Total Employment (million of workers) in Turkey by broad sector. Trend and forecast from 2010 to 2035



Source: Author's elaboration on CEDEFOP data (2023) downloaded in November 2025.

Figure 32 Total Employment (k workers) in Turkey by broad sector. Trend and forecast from 2010 to 2035



Source: Author's elaboration on CEDEFOP data (2023) downloaded in November 2025.

Table 44. Enterprises that employ ICT specialists by NACE Rev.2 in EU-27 (% of enterprises). Turkey (2018-2024)

Nace rev 2		2018	2019	2020	2022	2024
C	Manufacturing	10.72	14.49	12.62	17.36	14.40
D	Electricity, gas, steam and air conditioning supply	:	:	:	51.78	46.95
E	Water supply; sewerage, waste management and remediation activities	:	:	:	20.23	15.69
F	Construction	5.75	6.43	5.76	9.66	5.07
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	13.97	15.37	11.92	18.96	13.36
H	Transportation and storage	9.79	9.71	10.31	14.66	9.80
I	Accommodation and food service activities	10.55	10.23	7.25	13.96	8.64
J	Information and communication	67.57	73.41	65.59	76.22	66.64
L	Real estate activities	:	:	:	30.15	21.00
M	Professional, scientific and technical activities	:	:	:	19.54	16.41
N	Administrative and support service activities	10.24	12.83	11.80	24.81	18.37

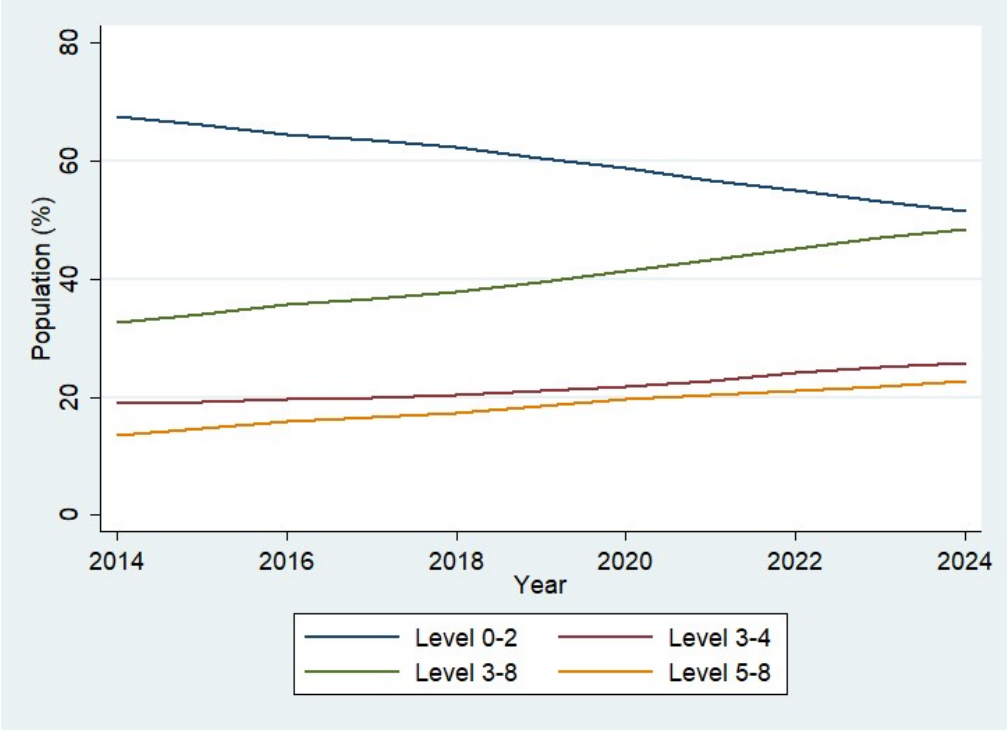
Note: population include enterprise with 10 or more employed;
data for Nace A an B are not available;
: not available
Source: Eurostat (2025) (European ICT usage survey)

Table 45. Enterprise had hard-to-fill vacancies for jobs requiring ICT specialist skills. Turkey (2018-2024)

Nace rev 2		2018	2019	2020	2022	2024
C	Manufacturing	1.63	2.18	1.89	2.25	2.51
D	Electricity, gas, steam and air conditioning supply	:	:	:	7.61	8.91
E	Water supply; sewerage, waste management and remediation activities	:	:	:	2.63	2.11
F	Construction	1.00	1.40	0.73	0.83	0.59
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	2.33	2.60	2.00	2.76	2.84
H	Transportation and storage	1.03	2.75	2.72	2.12	2.41
I	Accommodation and food service activities	1.78	0.87	1.00	1.68	1.50
J	Information and communication	19.49	28.94	15.48	19.83	16.29
L	Real estate activities	:	:	:	5.59	3.41
M	Professional, scientific and technical activities	:	:	:	2.14	2.73
N	Administrative and support service activities	2.38	3.01	2.40	2.78	3.96

Note: population include enterprise with 10 or more employed;
data for Nace A an B are not available;
: not available
Source: Eurostat (2025) (European ICT usage survey)

Figure 33. Turkey: Population by educational attainment (% of total population from 15 to 64 years)



Source: Eurostat 2025 (Labour force survey)

Table 46. Turkey: Individuals' level of digital skills (% of individuals 16-74 years)

Year	2021	2023
Individuals with basic or above basic information and data literacy skills	68.53	73.97
Individuals with above basic information and data literacy skills	57.12	62.86
Individuals with basic information and data literacy skills	11.41	11.11
Individuals with basic or above basic communication and collaboration skills	79.7	85.54
Individuals with above basic communication and collaboration skills	74.69	82.35
Individuals with basic communication and collaboration skills	5.01	3.19
Individuals with online information and communication skills	6.45	5.34
Individuals with basic or above basic digital content creation skills	39.81	42.11
Individuals with above basic digital content creation skills	17.16	19.63
Individuals with basic digital content creation skills	22.65	22.49
Individuals with basic or above basic safety skills	48.89	52.46
Individuals with above basic safety skills	27.75	29.05
Individuals with basic safety skills	21.15	23.41
Individuals with basic or above basic problem solving skills	61.99	69.3
Individuals with above basic problem solving skills	33.35	35.3
Individuals with basic problem solving skills	28.64	34.
Individuals with basic or above basic overall digital skills	30.12	33.11
Individuals with above basic overall digital skills	9.87	10.61
Individuals with basic overall digital skills	20.25	22.51
Individuals with low overall digital skills	19.64	20.91
Individuals with narrow overall digital skills	14.34	16.60
Individuals with limited overall digital skills	10.	9.05
Individuals with no overall digital skills	7.32	6.29
Digital skills could not be assessed: individual has not used internet in the last 3 months	18.59	14.04

Note :
The Digital Skills Indicator 2.0 (DSI) is a composite indicator which is based on selected activities related to internet or software use that individuals aged 16-74 perform in five specific areas (Information and data literacy, Communication and collaboration, Digital content creation, Safety, and Problem solving). It is assumed that individuals having performed certain activities have the corresponding skills. Therefore, the indicators can be considered as proxy of individuals' digital skills.
According to the variety of activities performed, two levels of skills are computed for each of the five areas ("basic" and "above basic"). Finally, based on the component indicators for each area, an overall digital skills indicator is calculated as a proxy of the digital skills of individuals ("no skills", "limited", "narrow", "low", "basic", "above basic" or "at least basic skills").
Individuals with basic or above basic overall digital skills= all five component indicators are at basic or above basic level,
Individuals with above basic overall digital skills=all five component indicators are at above basic level,
Individuals with basic overall digital skills= all five component indicators are at basic or above basic level, without being all above basic;
Individuals with low overall digital skills=four out of five component indicators are at basic or above basic level.
Individuals with narrow overall digital skills=three out of five component indicators are at basic or above basic level;
Individuals with limited overall digital skills=two out of five component indicators are at basic or above basic level. Source: Eurostat 2025 (ICT Survey)

Table 47. Participation rate in education and training (over previous last 4 weeks) by educational attainment level (% population aged 25-64 years) - Turkey

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Levels 0-2	2.9	2.7	2.8	2.8	3	2.8	2.7	3	2.9	3.4	3.5
Levels 3-8	11.3	10.7	11.1	11.1	11.5	10.1	10.2	11.3	11.6	12.1	12.9
Levels 3 and 4	9.1	8.6	8.6	8.4	8.6	7.6	7.6	7.8	7.8	8	8.5
Levels 5-8	13.9	12.9	13.6	13.8	14.1	12.4	12.5	14.2	14.8	15.6	16.7
All ISCED 2011 levels	5.7	5.5	5.8	5.8	6.2	5.7	5.8	6.5	6.7	7.4	8

Source: Eurostat 2025 (EU Labour Force Survey)

References

Autor, D. H. (2013). The "task approach" to labor markets: An overview. Journal for Labour Market Research, 46(3), 185-199.

Borgonovi, F. et al. (2023). The effects of the EU Fit for 55 package on labour markets and the demand for skills. OECD Social, Employment and Migration Working Papers, No. 297, OECD Publishing, Paris.

CEDEFOP (2010). The skill matching challenge: Analysing skill mismatch and policy implications. Luxembourg: Publications Office of the European Union.

CEDEFOP (2015). Skill shortages and gaps in European enterprises. Luxembourg: Publications Office of the European Union.

CEDEFOP (2023). Skills forecast: Trends and challenges to 2035. Luxembourg: Publications Office of the European Union.

CEDEFOP (2025). Meeting skill needs for the green transition. Luxembourg: Publications Office of the European Union.

CEDEFOP (2025a) Skills forecast Netherlands. Luxembourg: Publications Office of the European Union.

CEDEFOP. (2025b). *Vocational education and training policy briefs 2024 – Netherlands.* National VET policy developments 2023-24. Luxembourg: Publications Office of the European Union.

CEDEFOP Skill Intelligence (2024, 2025, 2026), https://www.cedefop.europa.eu/en/tools/skills-intelligence

CEPS (2023). BERT algorithm applications in ESCO classification. Brussels: Centre for European Policy Studies.

ELSTAT (2023, 2025) Hellenic Statistical Authority, Athens. https://www.statistics.gr/en/overview

EURES (2023). Labour market information - Malta. European Employment Services.

Eurofound (2025). ESCO vs O*NET: Comparative analysis of occupational classification systems. Dublin: European Foundation for the Improvement of Living and Working Conditions.

European Commission (2014). European vacancy and recruitment report 2014. Luxembourg: Publications Office.

European Commission (2019). ESCO Handbook. Luxembourg: Publications Office.

European Commission (2020). Towards a European approach to micro-credentials: A study of practices and commonalities in offering micro-credentials in European higher education. Brussels: European Commission.

European Commission (2022). BERT algorithm applications in ESCO classification. Brussels: European Commission.

European Commission (2023). Employment and Social Developments in Europe: Addressing labour shortages and skills gaps in the EU (2023). Directorate-General for Employment, Social Affairs and Inclusion. Brussels: European Commission.

European Commission (2025). Education and Training Monitor 2025: Malta. Luxembourg: Publications Office of the European Union.

Eurostat (2008). NACE Rev.2 - Statistical classification of economic activities in the European Community, established by Regulation (EC) No 1893/2006. Luxembourg: Publications Office.

Filinis, K. (2021). Young people in the Greek labour market. Future of work, republic.gr https://republic.gr/futureofwork/ai-skill-gaps-in-the-greek-and-eu-labour-market-a-competitiveness-roadblock/

JobsPlus (2024). Annual Report 2024. Malta: JobsPlus. Retrieved from https://jobsplus.gov.mt/media/nawivn00/jobsplus-ar-2024-final.pdf

Katsikas, D. (2021). Skills mismatch in the Greek labour market: Insights from a youth survey. Policy Paper #79/2021. Athens: ELIAMEP (Hellenic Foundation for European & Foreign Policy).

KPMG (2024) —*KPMG Tech Report 2023: A deep dive on the Dutch research results from the Global Tech Report. KPMG Netherlands,*

ILO (2018). Guidelines concerning measurement of qualifications and skills mismatches of persons in employment. 20th International Conference of Labour Statisticians, Geneva, 10-19 October 2018. Geneva: ILO Department of Statistics.

ILO (2019). Skills for a greener future: A global view. Geneva: International Labour Office.

ISTAT (2024) LE COMPETENZE PROFESSIONALI NEL MERCATO DEL LAVORO ITALIANO 2022

ISTAT (2025), IL MERCATO DEL LAVORO- I Trimestre 2025, http://www.istat.it

Leoni, S. (2025). A historical review of the role of education: From human capital to human capabilities. Review of Political Economy, 37(1), 227-244.

LinkedIn Economic Graph (2023). LinkedIn Global Green Skills Trends.

McKinsey & Company (2018). Skills shift: Automation and the future of the workforce. McKinsey Global Institute.

McKinsey & Company (2020). Future of Work: Turkey's Talent Transformation in the Digital Era. McKinsey & Company.

NSO Malta (2025), *Unemployment Rate: March 2025*, National Statistics Office Malta

OECD (2017). Getting Skills Right: Skills for Jobs Indicators. Paris: OECD Publishing.

OECD (2017a). Employment and Skills Strategies in Turkey. OECD Reviews on Local Job Creation. Paris: OECD Publishing. https://doi.org/10.1787/9789264279506-en

OECD (2022). Education at a Glance 2022: OECD Indicators. Paris: OECD Publishing. https://doi.org/10.1787/3197152b-en

OECD (2023a). OECD Skills Outlook 2023: Skills for a Resilient Green and Digital Transition. Paris: OECD Publishing.

OECD (2023b). Flexible adult learning provision: What it is, why it matters, and how to make it work. Paris: OECD Publishing. Retrieved from https://www.oecd.org/els/emp/skills-and-work/adultlearning/booklet-flexibility-2023.pdf

OECD (2023c). "Who does what" for active labour market policies: A zoom on the role of subnational governments. OECD Local Economic and Employment Development Papers, No. 2023/09. Paris: OECD Publishing. https://doi.org/10.1787/d8d6868d-en

OECD (2025). Empowering the Workforce in the Context of a Skills-First Approach. OECD Skills Studies. Paris: OECD Publishing. https://doi.org/10.1787/345b6528-en

Pouliakas, K. (2025). AI skill gaps in the Greek and EU labour market: a competitiveness roadblock? The Future of Work, May 16, 2025. Retrieved from

https://republic.gr/futureofwork/ai-skill-gaps-in-the-greek-and-eu-labour-market-a-competitiveness-roadblock/

Shah, C., & Burke, G. (2003). Skill shortages: Concepts, measurement and implications. Working Paper No. 52. Melbourne: Centre for the Economics of Education and Training (CEET), Monash University. Retrieved from http://monash.edu/education/non-cms/centres/ceet/docs/workingpapers/wp52nov03shah.pdf

SISTAN CPI (2024), La domanda di lavoro per bacino dei Centri per l'impiego-La Vocazione Green e Digitale, Servizio Statistico Nazionale di Sviluppo Lavoro Italia

SIA Partners (2023). Navigating the Landscape of Green Jobs. Paris: SIA Partners.

Thanos, I., & Kapoutsis, I. (2024). Μελέτη για το Μέλλον της Εργασίας & των Δεξιοτήτων στην Ελλάδα 2024-2030.Athens: October 2024.

World Economic Forum (2023). Future of Jobs Report 2023. Geneva: World Economic Forum.

World Economic Forum (2025). Future of Jobs Report 2025. Geneva: World Economic Forum.

PNIEC (2024). Piano Nazionale Integrato Energia e Clima. Rome: Ministero dell'Ambiente e della Sicurezza Energetica.

Dataset

Eurostat (2025). Continuing Vocational Training Survey (CVTS)

Eurostat (2025). Digital Skills Indicator 2.0 (DSI)

Eurostat (2025c). ICT Usage and E-commerce Survey

Eurostat (2025). Labour Force Survey

List of figures

List of tables

[i] Reduction of CO_2 emissions by 55% in 2030 compared to 1990 levels.

[ii] Original data come from LFS, National Accounts, annual data collections on population, and EUROPOP.

[iii]https://www.cedefop.europa.eu/en/tools/skills-intelligence/future-employment-growth?country=EU27&year=2022-2035#2

[iv] Most recent observed data from Eurostat stabilise employment in EU-27 at 196,974,000 people aged 20-64 years (Eurostat data consulted 8 January 2026).

[v] Labour market churn does not consider natural churn of workers moving between jobs for personal reasons or exiting jobs and is calculated relative to the size of the current workforce.

[vi] Guidelines concerning measurement of qualifications and skills mismatches of persons in employment, Department of Statistics, ILO, 20th International Conference of Labour Statisticians (10-19 October 2018).

[vii] For detailed information on the survey questions: https://ec.europa.eu/eurostat/cache/metadata/Annexes/trng_cvt_sims_ee_an_1.pdf

[viii]Although NACE sections D, E, L and M are formally included in the scope of the ICT usage and e-commerce in enterprises survey, sector-level data for the indicator "enterprises employing ICT specialists" are not available on a continuous basis over time due to methodological changes and revisions to the survey questionnaire, which resulted in the temporary suspension of detailed sectoral breakdowns for several activities (https://ec.europa.eu/eurostat/cache/metadata/en/isoc_e_esms.htm).

[ix] This report is based on a wide list o data source (OECD, 2023, p. 35): Programme for International Student Assessment (PISA) and the Survey of Adult Skills (a product of the Programme for the International Assessment of Adult Competencies [PIAAC]); data from social surveys such as the Lloyd's Risk Poll, the Wellcome Global Monitor, the World Values Survey, the European Social Survey, the OECD's Environmental Policy and Individual Behaviour Change (EPIC) Survey, the European Health LiteracyPopulation Survey, Ipsos Cycling Across the World Survey, the Adult Education Survey; key data on teaching languages at school in Europe; the European Labour Force Survey; the International Disasters Database; as well as data from vacancies posted on line by prospective employers

[x] https://www1.reskillingrevolution2030.org/skills-taxonomy/index.html

[xi] See table 5.7 (p. 119), Skills for a Greener Future: A Global View, ILO (2019).

[xii] Skills signaling refers to the ways through which individuals demonstrate their skills to employers when applying for jobs. Skills signaling is predominantly concerned with how skills are communicated and recognised. See: OECD (2025), *Empowering the Workforce in the Context of a Skills-First Approach*, OECD Skills Studies, OECD Publishing, Paris, p. 20. https://doi.org/10.1787/345b6528-en

[xiii] To calculate the levels of endowment of skills: Basic = one activity; Above basic = more than one activity; At least basic = basic or above basic skills.

[xiv] For more detailed information, see https://ec.europa.eu/eurostat/cache/metadata/en/isoc_sk_dskl_i21_esmsip2.htm

[xv] In more detail, “problem solving skills” include “to identify needs and problems, and to resolve conceptual problems and problem situations in digital environments. To use digital tools to innovate processes and products. To keep up-to-date with the digital evolution”

[xvi] Persons employed holding an apprenticeship or training contract are not taken into consideration for CVT.

[xvii] But exclude random learning and initial vocational training (IVT).

[xviii] Types of other forms of CVT: planned training through guided on-the-job training; planned training through job rotation, exchanges, secondments or study visits; planned training through participation (instruction received) in conferences, workshops, trade fairs and lectures; planned training through participation in learning or quality circles; planned training through self-directed learning/e-learning.

[xix] Eurostat (2008), *NACE Rev.2 – Statistical classification of economic activities in the European Community*, established by Regulation (EC) No 1893/2006 of the European Parliament and of the Council.

Project Partners:

Funded by the European Union. Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.
2025-1-NL01-KA220-VET-000359292