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# D2.2 Research Report on the Micro-Credential Solutions to Boost the Green Skills Match for Industry

WP2 - Green Skills and Knowledge Needs in Industry and Policy Context for Responding to Them

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## Document Summary

The Research Report on the Micro-Credential Solutions to Boost the Green Skills Match for Industry (D2.2) outlines the key green skills, for each of the target sector, on which building a micro-credential process to address the current education and training needs caused by fast-changing knowledge-development labour market demands for the green transition. Through the direct engagement of labour market stakeholders across various levels of the value chain, the report identifies the content of the micro-credential courses, the modalities for their implementations, and the assurance mechanisms required. It defines how existing courses can be enriched with sector-specific, transversal, soft, and digital skills and competences, aligning with the principles of vocational excellence. Furthermore, the research report provides recommendations to address growing concerns about the quality criteria of micro-credentials. It suggests the application of specific standards to navigate the increasing variety of alternatives and emphasises the added value of short learning programs. The report also reinforces a shared and clear understanding of the definition of micro-credentials, helping to promote their credibility and effectiveness.

RESEARCH REPORT

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# 1. Micro-Credential Solutions to Boost the Green Skills Match for Industry

## 1.1 Introduction

Driving the **current double green and digital transition** paradigm, combined with European **demographic dynamics**, urges a **re-thinking of the vocational education and training (VET) system** to adjust current job and skill profiles to new frameworks (CEDEFOP,2023). Being short-term, small educational pieces, **micro-credentials** deliver targeted learning and flexibility while simultaneously assessing learning outcomes and knowledge certification at the end of the process (CEDEFOP,2022).

However, the process of implementing micro-credentials in the VET sector in Europe requires efforts to outline a common methodology for the identification, development, testing, and assessment of **innovative policy approaches** supporting the national, and sectorial initiatives' compliance with the priorities for a European approach to micro-credentials (EU Directive 2022). In addition, the demand for green skills is evolving rapidly, shaped not only by sectoral needs but also by emerging priorities driven by Europe's green and competitive development policies. Initiatives such as the Net Zero Industry Act (EU, 2023), which supports decarbonized industrial production, and the revision of the Waste Framework Directive (EU, 2024), which emphasizes enhanced extended producer responsibility, highlight this shift.

This report seeks to identify the green skills and knowledge required across the sectors involved in the project. It is an initial step in MASTERY's bottom-up approach, aiming to design micro-credentials that address these evolving needs and facilitate the green and competitive transition. Though the European Commission has already portrayed the demand for green skills, this has not led to a definitive taxonomy because of the dynamic economic context, **complexity,** and **multidimensionality of their definition.** There is still a strong **misalignment** between the demand for green skills and their availability on the labor market, considering the difficulty in tracking and developing cross-cutting green skills that apply to all industries.

Micro-credentials, designed as concise and focused learning pathways, provide several key advantages. They enable vocational education and training programs to address the urgent demand for upskilling and reskilling individuals in the labor market, particularly in sectors undergoing rapid transformation. By documenting and recognizing an individual's training and skills throughout their

life, micro-credentials enhance the traceability of lifelong learning experiences. They also validate skills and knowledge gained in both formal education systems and informal learning contexts, fostering greater inclusivity and relevance. Additionally, their modular nature allows for flexible training pathways, enabling individuals to tailor their education to specific career goals while meeting dynamic labor market needs. This adaptability aligns with European frameworks like the EQF (European Qualifications Framework) and supports lifelong learning initiatives.

Therefore, the MASTERY project aims to (1) boost green job opportunities, through the recognition of micro-credentials that enable upskilling and reskilling pathways; (2) provide faster responses to the skills needs identified by employers; and (3) enhance flexible qualification and retraining aligned with labour market needs.

- More specifically, the research, whose main findings are outlined in this report, aimed to investigate the following aspects Identifying and understanding the needs and the cross-cutting green skills in the selected sectors (Agri-food, Construction, Manufacturing, Wood and Furniture, and Sustainable Management and Transversal skills) and developing an appropriate taxonomy related to them (comparison for an integration proposal within the ESCO framework).
- Analysing which rigidities and barriers in the labour market and professional qualification system hamper the positive green employment effects.
- Fostering the knowledge of the economic and environmental policy instruments for structuring and managing the work transition to a green economy.
- Defining a shared benchmark for the identification of green skills needs and related micro-credentials development, including different stakeholders' perspectives on the Training, Labour, and Productive sectoral applications of the micro-credentials for emerging green skills.

To achieve these objectives, a structured methodology was adopted to analyze the demand for green skills across the sectors and countries involved in the project. This methodology incorporated three key research approaches:

- Desk research and survey: existing studies and sectoral case studies at European and national levels were reviewed to understand green skills needs comprehensively. These findings were further refined through a direct survey of companies in the participating countries, focusing on specific green skills requirements.

- Direct interviews and workshops engaging stakeholders: interviews were conducted to gain deeper insights into perspectives on developing micro-credentials tailored to green skills. These interviews built on the findings from the desk research and surveys, allowing for a more nuanced understanding of how to meet emerging green skills needs effectively.
- Marker set identification and micro-credentials design recommendation: based on data from desk research, surveys, and interviews, a set of markers was identified to ensure the replicability of green skills updates over time. These markers support adapting or redesigning micro-credential pathways to remain responsive to evolving demands.

Additionally, in alignment with the European approach to micro-credentials (EU, 2022) recommendations were developed to guide the working group in prioritizing key factors for designing the micro-credentialing system. These outcomes serve as a foundation for the next stages of the project, focused on developing and implementing the 12 targeted training pathways, including the processes for delivering and issuing micro-credentials.

More details on the MASTERY research methodology and activities are available in Annex 1.

## 1.2 Green Skills, Training, and Micro-Credentials: An Overview

The twin green and digital transition paradigm, combined with European demographic trends, has created the **necessity to reshape the Vocation and Education Training (VET) system** (CEDEFOP,2023). Accordingly, it is essential to understand the **evolution of market trends** and actualize the **sector-specific, transversal, soft, and digital skills** enabling an alignment between skills' demand and supply. In this context, the impact of the green transition on the various sectors depends on numerous factors. As a result, it is difficult to pinpoint a single, consistent trend or a universal green job across all sectors (Business Europe,2019); instead, adopting the concept of **green occupations** is more effective. Specifically, it is more practical to identify which current job positions are directly and indirectly affected by the green transition and how they can be adapted to the mechanisms mentioned above (European Commission,2021).The phenomena occurring in various sectors range from **job disruption** - typical of obsolete industries such as coal and mining - **job substitution or readaptation** - seen in industries that have experienced structural changes, such as the automotive sector - or **job creation** - typical of industries involved in waste recovery and those associated with the principles of circular economy, which have significant job creation potential.

For instance, in the **agri-food sector**, structural changes related to resource use, sustainable food production, precision agriculture, organic farming, agri-ecology, agri-forestry, and stricter animal welfare standards, as well as the implementation of new eco-schemes to reward environmental and climate performance, are contributing to declining employment in traditional farming. However, these changes may encourage job creation in alternative agricultural sectors, and new jobs in the former farmlands (i.e., organic farming or eco-tourism) may be promoted by these changes (Business Europe, 2021).

The **construction sector**, which accounts for roughly 40% of total energy consumption, is undergoing structural changes due to the rise of climate-proof buildings, smart homes, and the renovation of private and public buildings. Large-scale projects are increasingly focused on adapting to a fully integrated, integrated, and digitalised European energy sector and aligning with more efficient waste management requests. These trends foster potential job creation, particularly boosting SMEs and local employment. However, the demand for new skills is growing, especially those related to the use of environmentally friendly materials or techniques (Business Europe, 2021).

In the **manufacturing sector**, the introduction of new production technologies, the growing level of technological complexity, and the increasing automation and robotisation of industrial production through Industry 4.0 are driving a need for a workforce equipped with broader interdisciplinary knowledge. In addition, the digitalisation and shortening of value chains, as well as the incorporation of new materials, require adjustments in the workers' skills, competences, and knowledge to meet evolving industry needs (CEDEFOP, 2023a).

The **wood and furniture sector** has been significantly impacted by policies focused on forest protection. In 2013, the EC staff Working Document "A Blueprint for the Eu Forest-Based Industries" reported an overall negative trend in the number of forest-based industries, with over 9% of sectoral firms closing over eight years, highlighting the need for a more sustainable growth brought about through increased competitiveness (EC, 2013). Opportunities for forest-based industries are now emerging under strategies aligned with the European Green Deal, including the EU Bioeconomy and Circular Economy strategies.

In the domain of **sustainability management and transversal skills**, notable changes are related to energy, recycling and reuse, and waste management (Business Europe, 2021). In the **energy** sector, the shift towards reducing energy consumption, phasing out coal and gas decarbonisation, and enhancing renewable energy and smart infrastructure is leading to a disappearing of jobs in the traditional energy production sectors but also creating new jobs in renewable energy sectors and related services. In addition, changes are influencing the nature of jobs related to the change of technologies, maintenance and used materials.

**Recycling and reuse** are primarily related to developing and implementing reusable and recyclable packaging, stricter recycling requirements, and extending the recycling chain to reduce and reuse materials before recycling. This offer potentialities for new job creation, especially in extended recycling chains, which require new skills related to the knowledge of new materials and technologies.

Similarly, advanced quality requirements in **waste management** and the increased waste to be processed within the EU as the export of waste will be stopped pave the way for potential job creation and changes within existing jobs to embrace new waste management technologies.

According to Business Europe (2021), these phenomena will have a **neutral or generally positive quantitative impact** on the labour market, even if some sectors would be dramatically impacted, accompanied by **increased sector**

**mobility**. Despite this, it is tough to define a general employment impact since labour market policies and institutions vary widely across countries (Château et al., 2011) What stands out in this positive forecast is that, despite the overall optimism, there has been a **significant misalignment** between the demand for green skills from employers and the availability of skilled workers over the last 5 years.

Also, most of the demand for green skills arises from **not-traditional green jobs** (Global Green Skills Report, 2022). European institutions have acknowledged this issue, but it still requires **formalisation** due to its complexity and multidimensionality.

The journey toward this formalisation began in 2010, with the **Business Europe recommendations** (Business Europe, 2010), and has progressed through significant milestones, including the 17 **Sustainable Development Goals (SDGs)** established in 2015 (UN, 2015), the **European Green Deal** introduced in 2019 (EC, 2019), and the **Council Resolution on a strategic framework for European cooperation in education and training towards the European Education Area and beyond** in 2021 (Council of the European Union, 2021).

Additionally, the European Commission **Fit for 55** initiative (EC, 2021d) and the **Recommendation on a European approach to micro-credential for lifelong learning and employability** (Council of the European Union, 2022) further underscores this ongoing effort.

**Sector-specific initiatives**, such as the European-funded Erasmus+ Construction Blueprint project and the CEDEFOP policy brief on "Growing green" in the agri-food sector (CEDEFOP, 2023b), have highlighted the efforts of policy makers to renew the training and education system. The O*NET Resource Center has identified the **differences in employment trends across various sectors (**Strietska-Ilina et al., 2011), resulting in phenomena such as reskilling for obsolete position, upskilling in sectors affected by minimal changes, or training for new jobs or products, as in the case of the circular economy.

Generally, several **common trends** can be identified, including the presence of multiskilled teams, hybrid profiles, and a shift away from the traditional linear economy paradigm in favour of the circular economy (CEDEFOP, 2023). In this context, CEDEFOP has outlined **potential labour scenarios** aligned with the primary objectives of the European Green Deal to reach climate neutrality by 2050, decouple economic growth from the exploitation of natural resources, and ensure that no one is left behind in the transition (CEDEFOP, 2024).

These scenarios also bring important considerations for both employers and employees. First, **employment benefits are evident for both high-skilled and lower-labour profiles**. This is largely because the green transition has significantly impacted all activities and value chains within organizations, transforming sustainability from an elitist approach reserved for decision-makers into a comprehensive strategy embraced by all levels. Second, **the demand for green skills varies considerably from one sector to another**, and it is influenced by the extent of the impact of EU requirements and the degree of compliance with production standards, as well as the thresholds set by the regulatory bodies. In this sense, the importance of developing **transversal green skills** has been emphasised in several documents, such as the Inner Development Goals Framework (IDG, 2021) and the Green Comp: The European sustainability competence framework (Bianchi et al., 2022).

In this evolving context, the role of **micro-credentials** become increasingly significant. According to the European Union Council recommendation of June 2022 (CEU ,2022) Micro credential are defined as: " the record of the learning outcomes that a learner has acquired following a small volume of learning. These learning outcomes will have been assessed against transparent and clearly defined criteria. Learning experiences leading to micro-credentials are designed to provide the learner with specific knowledge, skills and competences that respond to societal, personal, cultural or labour market needs. Micro-credentials are owned by the learner, can be shared and are portable. They may be standalone or combined into larger credentials. They are underpinned by quality assurance following agreed standards in the relevant sector or area of activity."

Updating and adapting easily, micro-credentials present numerous advantages, including their ability to meet the labour market demand, impact on continuous learning, support for both formal and informal learning for students, as well as their flexible format, short-term outcomes, and modularity.

Nevertheless, several challenges persist, including the recognition and validation of achievements for disadvantaged students, issues related to the recognition of quality of the training provided, as well as the unregulated increase in certifications. In general, if properly adapted to different sectors and VET systems, micro-credentials can be a powerful instrument for advancing a green and equitable transition.

Finally, regarding skills' taxonomy, a short premise should be posed. The **soft skills** presented inside this report have been formulated according to the European Commission's Green Comp Report and the Inner Development Goal

Framework. Their role is complementary to the sector specific, digital and transversal skills mentioned throughout the analysis since they are not specifically related to green skills and abilities but have a supporting function. Their utility is related to fostering and promoting the assimilation and internalization of the other skills, facilitating their acceptance by the learners' side. For this reason they have not been included inside the final definition of the 12 skills since, despite their transversality and adaptability to different industries, they cannot be assimilated to the transversal skills mentioned in the ESCO framework

# 2. Economic and Environmental Policy Instruments for Structuring and Managing the Labour Transition to a Green Economy: An Overview of Countries and Sectors Involved

## 2.1 Introduction

Building on the framework established by the 2030 Agenda for Sustainable Development and the Fit for 55 package, numerous policies and recommendations have been introduced to support organizations in navigating the green transition The EC Transitions Performance Index (EC, 2022) demonstrated that **all EU countries, except Hungary, have improved their performance** - measured on the four dimensions of economic, social, environmental, and governance sustainability - since 2011.

However, **environmental transition** has a different dynamic than the three other transitions, showing that **most countries have not yet bent their curve towards green transition** (EC, 2022). **Differences among countries** exist, but they are not due to the different starting points, as some strong performing countries have continued to advance impressively and lesser performers have succeeded in catching up (EC, 2021a).

Developing **environment-related technologies** and **economic opportunities to policy responses** are key factors to make improvements related to the transitions (Cheba et al., 2022). **Investment in research and innovation** are critical to support the path to recovery towards prosperous sustainability, as some countries could develop and take further advantage of their innovation capacity to improve their transitions performance (EC, 2022). As a result, **education and training** are essential in equipping both current and future workers with the necessary skills to meet the evolving challenges of the job market.

This section aims to present the **economic, social, environmental, and governance policy instruments** for structuring and managing the labour transition to a green economy, based on **existing initiatives across various countries and sectors**. Each sector under analysis (**Agri-food**, **Construction**, **Manufacturing**, and **Wood and Furniture**) was associated with a specific partner country (**Finland**, **Bulgaria**, **Italy**, and **Spain**). In addition, a focus on **public administrations** was included to gain insights into **sustainability management and transversal skills** issues.

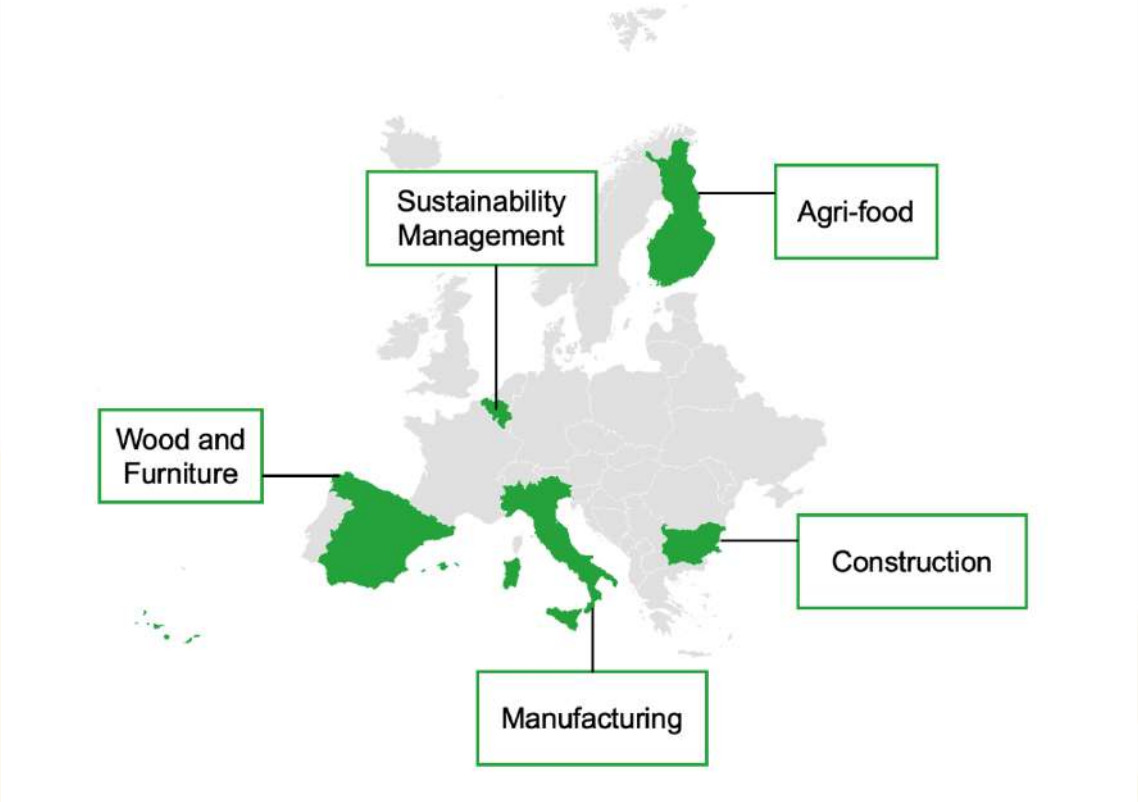


*Figure 1: Countries and sectors involved in the MASTERY project.*

To contextualise the green transition at country and sectorial level, the analysis covered **key initiatives, policies, and regulations implemented in the past five to ten years**. This section aims not to cover all the changes brought about by the green transition, but to highlight the key areas where new green skills can significantly contribute to business innovation and competitiveness. The results outlined a framework of priorities, which were then refined through an in-depth exploration of strategic green skills. These priorities were examined through both an online survey and in-person interviews and workshops, providing further clarity on the strategic role of green skills in driving forward the green transition. This approach involved collecting data in **three main areas**:

- **Sustainability framework at country level**: This area focuses on sustainability policies implemented at the country level over the past five to ten years. It aims to identify significant changes related to sustainability and their impact on the VET system at the country level.

- **Green skills for sustainability at country level**: This area focuses on polices and initiatives related to green skills developed at the country level. It highlights the bodies responsible for training and certification, as

well as the availability and diffusion of micro-credentials and/or similar knowledge certificates.

- Sectorial analysis: This area focuses on sustainability policies implemented at the sectorial level over the past five to ten years. It aims to identify significant changes related to sustainability and their impact on the VET system at the sectorial level, while cross-referencing differences across countries.

## 2.2 The Agri-Food Sector in Finland

### 2.2.1 Sustainability Framework at Country Level

The **United Nations Global Agenda for Sustainable Development** is Finland's most significant international document related to sustainable development. According to the international country comparison assessment (United Nations,2015), **Finland has achieved noteworthy results in social sustainability, yet still faces challenges in ecological sustainability**. Moreover, despite growing awareness and recent educational initiatives, such as the inclusion of sustainable development education in the National Board of Education's roadmap, **no formal national action plans for sustainability education have been established** (Prime Minister's Office,2020;Kuusela et al.,2023)

The Finnish **National Commission on Sustainable Development** (2022) has published an **Agenda 2030 roadmap for Finland**, grounded in its **2022–2030 Strategy "Sustaining the carrying capacity of nature, well-being and globally responsible Finland"**. Current planning efforts in Finland are also related to the **National Biodiversity Strategy** and the **national climate Strategy "Carbon Neutral Finland 2035"**. These strategies aim to integrate **research and development** with **communication and education**, fostering societal adaptation to the ecological transition. In this context, the **National Forest Strategy 2035** specifically aims to strengthen **knowledge-based management and expertise** within the forest sector. Additionally, the **report from the Prime Minister's Office to the UN** (Prime Minister's Office, 2020) supports **integrating sustainable development into primary and secondary education curricula**, encouraging the adoption of a holistic approach to education.

In addition, the ongoing **transition away from fossil energy sources**, along with the development of **low-emission building stock and related infrastructure**, has significantly influenced the **education and skill requirements** in the **wood and furniture sector**. For instance, the **national carbon neutrality goal 2035** involves extensive electrification efforts intended to upgrade numerous existing technical systems. The **primary objectives** of "Carbon Neutral Finland 2035" can be summarised as follows:

- **Promoting low- and zero-emission industrial products** (e.g., innovation in steel and cement production methods, industrial wood construction products, wood-based textile fibres, and plant-based protein processing).
- **Integrating recycling into economic practices**.

- Enhancing agricultural and forestry practices.
- Establishing new carbon sinks and land use strategies that bolster biodiversity through the management of both built and natural environment (e.g., restoration, rewilding, and development of ecological corridors).

Various other aspects of the green transition are also emerging in Finland as driving mechanisms, investments, and innovations within the wood and furniture sector; however, the changes they bring about can manifest in diverse ways.

The VET system, along with professional and higher education providers, bears the responsibility of building the capacity for the green transition across all involved areas. This includes fostering the emergence of entirely new green jobs and addressing new knowledge requirements, particularly in engineering, natural science, process management, and control of activities (e.g., environmental licensing). Notably, energy production and transfer, as well as the development of smart grids, are operations with a high degree of certainty that demand increased research, development, and innovation (RDI) investments alongside advanced skills (Prime Minister's Office,2020)

The transition may also entail an expansion of responsibilities across the entire field of expertise, particularly with the integration of the circular economy into various product designs and building processes, as well as the development of green business models. Also, advanced skills will increasingly involve competences related to emotional intelligence, alongside other critical skills. Over a long-term horizon of more than ten years, knowledge of sustainability is expected to become a fundamental component of legislation and societal norms, significantly shaping citizens' personal development and work habits (Prime Minister's Office,2020; Kuusela et al.2023).

### 2.2.2 Green Skills for Sustainability at Country Level

In Finland, a collaborative process is underway in which higher education institutions define principles for integrating sustainability competences, including green skills, into their curricula. This initiative is part of the Council of Rectors of Finnish Universities (UNIF)'s "Theses on sustainable development and responsibility". As part of this effort, higher education institutions are developing ways to share existing field-independent sustainability expertise courses and forms of teaching (e.g., basics of sustainability and climate change).

The Ministry of Education and Culture and the Finnish National Board of Education ensure the integration of sustainability competences into vocational education institutions. Initiatives aimed at enhancing professional and higher education focus on areas such as energy and electrical engineering, circular economy, construction, and industrial wood construction. For instance, in the short term, within 1–5 years, the transition away from fossil energy sources and the planning and construction of low-emission building stock and infrastructure will be highlighted (Kuusela et al., 2023).

Efforts to enhance education related to agriculture, forestry and community planning programs are primarily aimed at establishing biodiversity and carbon sinks. However, experiences from the COVID-19 pandemic have kept self-sufficiency in food production - particularly concerning inputs - at the forefront of political discussions.

For instance, the 4H organisation in Finland provides online agri-food courses; but, the only course associated with micro-credentials focuses on general working life rather than agri-food topics. In addition, some Finnish Universities of Applied Sciences are engaged in ongoing EU co-funded projects to promote micro-credential acquisition (e.g., in the tourism, hospitality, and restaurant sectors).

Through the Open Badge Passport platform, Finland offers various courses based on micro-credentials across multiple sectors, including financial management, social and health care, pharmacy, cybersecurity, IT software, as well as transversal cultural and environmental themes and various other certifications.

### 2.2.3 Sectorial Analysis

In Finland, the transition is guided by the emission reduction targets set by the EU and Finland and the control measures chosen for their implementation, such as emissions trading. In addition, the energy crisis caused by Russia's war of aggression further accelerates the transition away from fossil energy towards renewable forms of energy production. In addition to the obligations set by the EU, Finland's goal is to achieve carbon neutrality by 2035 (Kuusela et al., 2023).

Currently, numerous new green initiatives are in development and piloting stages. Similarly, several policy initiatives are being actively discussed in public debates that could significantly enhance the development of training activities and the updating of employees' skills.

Despite this, **the availability of micro-credentials related to the agri-food sector is limited**, as demonstrated by a search on the Open Badge Passport platform using keywords such as "agri-food," "food production," "sustainable agriculture," "food processing," and "food engineering" revealed no relevant courses in Finland.

Only one course was identified in the platform, **"*Sustainable Development – Basics*"**, issued by **Häme University of Applied Sciences (HAMK)**. This course underlines the need for **understanding of various aspects and interconnections of sustainability**, the ability to **compare sustainability practices among different sectors**, and the capacity to **apply sustainability thinking in both personal and professional contexts**.

However, it does not specifically address sustainability or sector-specific green skills for the agri-food sector. Therefore, there is still a significant **need to innovate and develop new courses that offer micro-credentials aimed at updating and reskilling the employees in Finland's agri-food sector**.

To anticipate the skill and labour needs in the agri-food sector, it is essential to **monitor the processes** and **assess the impacts of the policies** aimed at enhancing Finland's land-use carbon sinks, as well as the key actions required by the EU Biodiversity Strategy. A shift in agricultural support policy would promote **multi-faceted regenerative farming practices** that align with the regional carrying capacity of nature.

Moreover, **local nutrient and energy cycles**, facilitated by precision farming technologies, will necessitate cost-effective learning to adopt **new working methods**. There is still a potential, however, for the **development of EU regulations in agriculture and forestry to prioritise restoration activities related to land use**. Also, the **EU Circular Economy Action Plan** should emphasise more issues such as the use of materials, recycling, and reusing in product design. This approach will gradually change the **business models** of many food processing industries, value networks, and markets, creating a demand for new knowledge and effective, concise updates to skills.

## 2.3 The Construction Sector in Bulgaria

### 2.3.1 Sustainability Framework at Country level

Over the past ten years, **Bulgaria has made significant progress in advancing its sustainability priorities and agenda**, driven by both **EU directives and domestic policy shifts**. Below is a list of the most important milestones identified throughout the process:

- **2014-2020** (programming period): Bulgaria adopted the **EU Europe 2020 Strategy** (EC, 2010), focusing on smart, sustainable, and inclusive growth.

- **2017**: The **National Development Programme: Bulgaria 2020** (Council of Ministers of Bulgaria, 2017) served as a key document guiding the country's sustainable development efforts, outlining goals aligned with the EU sustainability targets, including the reduction of greenhouse gas emissions, the increase of energy efficiency, and the promotion of renewable energy sources.

- **2019**: Bulgaria adopted the **Integrated Energy and Climate Plan 2021 – 2030** ( Republic of Bulgaria-Ministry of Energy,2024) Ministry of Energy and Ministry of the Environment and Water, 2019), a comprehensive strategy aligning with the EU's "Clean energy for All Europeans package".

- **2020**: The Council of Ministers adopted the **National Development Programme: Bulgaria 2030** (Council of Ministers of Bulgaria, 2020), a strategic framework document of the highest order within the hierarchy of national programming documents. This document articulates the **vision** for the sustainable development of the country over a ten-year horizon. It is structured around **three strategic goals**, the implementation of which is supported by **targeted policies and interventions** grouped into **5 interconnected and integrated development axes**, along with **13 national priorities**. Each priority refers to specific **UN SDGs** and includes an indicative **financial framework** for the implementation of the interventions. In addition, the Bulgarian government endorsed the **National Recovery and Resilience Plan (NRRP)**, guided by the **European Green Deal** and the **EU Recovery and Resilience Facility**. This plan emphasizes **green investments, digital transformation, and economic resilience**.

- 2021: Bulgaria approved the National Development Programme: Bulgaria 2030 (Council of Ministers of Bulgaria, 2020), which incorporates the UN SDGs into national policy.

- 2022: The Council of Ministers adopted the Strategy and Action Plan for the transition to a circular economy in Bulgaria for the period 2022-2027 (Council of Ministers of Bulgaria, 2022) with the aim to achieve resource efficiency by implementing the waste management hierarchy, preventing waste generation, promoting reuse and recovery through recycling, reducing landfilling, and limiting harmful impacts on the environment and human health.

Many important sectorial initiatives have been undertaken in Bulgaria to promote the green transition, primarily focusing on energy, circular economy, biodiversity, forestry, and agriculture, as well as green infrastructure.

The most relevant energy and climate initiatives are the Integrated Energy and Climate Plan (Republic of Bulgaria Ministry of Energy and Ministry of the Environment and Water, 2019) and the Integrated National Energy and Climate Plan (2024). The first one establishes specific targets for renewable energy (30.3% by 2030) and energy efficiency improvements. This includes measures to decrease reliance on coal and facilitate the transition to a low-carbon economy. The second one is intended to strengthen commitments to EU climate goals by focusing on reducing emissions by 40% compared to 1990 levels and achieving carbon neutrality by 2050. Renewable energy initiatives also include significant investments in solar and wind energy projects, as well as the Sofia Integrated Urban Transport project, aimed at enhancing sustainable urban mobility and reduced carbon emissions.

Circular economy and waste management initiatives mainly refer to the National Waste Management Plan 2014-2020 (Ministry of Environment and Water of Bulgaria, 2014), aimed at reducing landfill use and promoting recycling, and the new National Waste Management Plan 2021-2028 (Ministry of Environment and Water of Bulgaria, 2021a), aimed at improving recycling rates for packaging and electronic waste.

Biodiversity and nature conservation initiatives involve the Nature 2000 network, which encompasses 34% of Bulgaria's territory, as well as the implementation of the National Biodiversity Strategy and Action Plan (Ministry of Environment and Water of Bulgaria, 2021b), which aims to protect ecosystems and endangered species.

Sustainable agriculture and forestry initiatives focus on adopting sustainable agricultural practices in line with the Common Agricultural Policy (EC, 2023), as well as promoting organic farming and agri-environmental measures to boost biodiversity, such as agroforestry, limitation of phytosanitary treatments and conversion to organic farming.

Green infrastructure is strengthened by investments in projects that include sustainable water management and flood protection measures on local level through projects in the Bulgarian municipalities, alongside the promotion of green building standards and energy-efficient renovations within the construction sector.

These changes have impacted training activities and may lead to further developments:

- Curricula and training programs: The transition towards a green economy requires updates to the VET curricula to include green skills related to renewable energy, energy efficiency, sustainable practices, and more. According to the National VET Agency (NAVET), there is a strong demand for specialized training programs for emerging green sectors such as sustainable agriculture, green construction, and waste management.

- Skills development: The demand for skills in environmental management, circular economy, biodiversity conservation and more is increasing (CEDEFOP, 2023c). Additionally, ongoing professional development for educators and trainers is essential to be update on the latest sustainability trends and technologies.

- Infrastructure and resources: Investment in green infrastructure within VET institutions is necessary, including energy-efficient buildings and renewable energy installations that can serve as practical learning environments. Such measures are envisaged in the National Recovery and Resilience Plan as part of the establishment of industrial parks. There is a need for updated learning materials and resources related to sustainability topics (OECD, 2023).

- Policy and governance: As indicated by NAVET experts during the MASTERY webinar "Greening the Future: Micro-credentials Empowering Sustainable Skills", held in October 2024, Bulgaria is delayed in aligning VET policies with national and EU sustainability strategies to ensure coherence and support for the green transition. Providing incentives and

funding opportunities for VET institutions to develop and implement sustainability-focused programs will further enhance these efforts.

## 2.3.2 Green skills for Sustainability at Country Level

In Bulgaria, the training sector is shaped by a combination of **national initiatives** and **legislative frameworks** aimed at aligning VET with labour market demands and EU standards. The cornerstone of Bulgaria's VET system is the **Vocational Education and Training Act**, enacted in **1999** and later amended. This law defined the **structure, organization, and management of vocational education**, encompassing the accreditation of training institutions and the certification of competencies.

More recent initiatives include the **National Strategy for Lifelong Learning (2014-2020)** (Ministry of Education and Science of Bulgaria, 2014) and its subsequent strategies, which emphasise the importance of **continuous skills development and upskilling** to meet the demands of a dynamic labour market. In addition, the **National Qualifications Framework (NQF)**, aligned with the **European Qualifications Framework (EQF)**, provides a **standardised system for recognizing and validating skills and qualifications** across various education levels.

**The National Plan for the Development of the Active Labour Market (2021-2023)** (Cedefo, 2022)) aims to improve workforce employability through **targeted training programs**. The plan endorses initiatives such as digital skills training, entrepreneurship education, and specialised programs designed for vulnerable groups, including the long-term unemployed and individuals with disabilities.

Several key bodies oversee and regulate the **training and certification processes** in Bulgaria. The **National Agency for Vocational Education and Training (NAVET)** is the primary authority responsible for accrediting VET institutions, approving training programs, and ensuring quality standards. NAVET plays a crucial role in aligning VET offerings with labour market demands and EU standards. The **Ministry of Education and Science** oversees the broader educational framework, including both general and vocational education. It collaborates with NAVET and other stakeholders to develop and implement national education policies.

Also, the **Human Resources Development Operational Program** (Republic of Bulgaria-Ministry of Labour and social policy,2014) co-funded by the European Social Fund, provides financial support for various training and upskilling

initiatives. This program focuses on improving workforce competencies, promoting social inclusion, and enhancing the overall competitiveness of the Bulgarian economy.

**The promotion of micro-credentials** in Bulgaria is supported by several initiatives. The **Ministry of Education and Science**, in collaboration with **NAVET**, is exploring methods to integrate micro-credentials into the existing qualifications framework. Pilot projects and partnerships with industry stakeholders are underway to formally develop and recognize these short courses. Additionally, **European initiatives** such as the EU Digital Education Action Plan (EC, 2020b) influence the adoption of micro-credentials in Bulgaria. These initiatives promote the development of digital and innovative learning solutions, including the creation and recognition of micro-credentials across EU member states.

**The recognition and value of micro-credentials are gradually increasing among employers in Bulgaria**. Companies are increasingly recognising the advantages of these specialised qualifications for fulfilling specific job requirements and enhancing the skills of their workforce in a cost-effective and timely manner.

### 2.3.3 Sectorial Analysis

**Over the past decade, Bulgaria's construction sector has experienced significant growth and transformation**, driven by increased investment in infrastructure, urban development, and regulatory reforms. This sector has been a crucial contributor to Bulgaria's GDP, with **considerable activity in both residential and non-residential construction**.

**Between 2014 and 2020**, Bulgaria's construction sector benefited from **substantial funding from the European Union**, which facilitated investments in major infrastructure projects, including highways, railways, and urban development. The **EU Cohesion Policy** and the **European Structural and Investment Funds** were instrumental in financing these efforts.

The years **2017 and 2018** marked a **significant growth** phase for the construction sector, characterised by key initiatives such as the expansion of Sofia's metro system and modernization of the road networks. However, **from 2019 to 2021**, the sector faced **significant challenges** due to the COVID-19 pandemic, resulted in widespread project delays, supply chain disruptions, and a temporary downturn in construction activities.

Since 2021, the **National Recovery and Resilience Plan (NRRP)** has provided a renewed impetus for the sector, prioritising green and digital transitions. This aligns closely with the **European Green Deal** (EC, 2019), which promotes sustainable construction practices and the development of energy-efficient buildings.

Among the **changes** that have occurred in the Bulgarian construction sector, the following are the most significant:

- **Energy efficiency and green building standards**: There has been a growing emphasis on energy-efficient buildings. The implementation of the **Energy Performance of Buildings Directive** (Directive EU 2024/1275) has led to stricter regulations regarding energy performance. This includes mandatory energy efficiency certificates for both new and renovated buildings, as well as incentives for the construction of nearly zero-energy buildings.

- **Sustainable urban development**: Initiatives like the **Sofia Integrated Urban Transport** project have promoted sustainable urban mobility and reduced carbon emissions. The focus on developing **green spaces** and **sustainable public transportation systems** reflects broader sustainability goals, as determined in Vision for Sofia 2050 strategic initiative (Department "Architecture and Town Planning" of the Metropolitan Municipality of Sofia, 2017).

- **Waste management and recycling**: The construction sector has aimed to adopt improved waste management practices to minimise waste and enhance recycling rates. Regulations have been introduced to ensure that construction waste is properly managed and recycled, aligning with the principles of the circular economy (EC, 2021c).

The shift towards **sustainable construction practices** has significant implications for training activities within the sector. In Bulgaria, according to the latest forecast published by the Ministry of labour and Social Policy (Ministry of Labour and Social Policy of Bulgaria, 2019), **the number of employed in the construction sector is expected to reach 250,600 in 2032**. In the same report, statistics for the demand of skilled labour in construction indicated that, in 2022, **approximately 25,600 individuals in the sector had only basic or lower education**. The greatest demand is observed for **personnel with a secondary school education**, which is necessary for covering the entire construction life cycle. By 2030, the labour needs are expected to exceed the available workforce, particularly in areas related to digital and green skills.

There is a pressing **need to redesign the entire educational and vocational training process**, including new training courses and tools for **reskilling and up-skilling** to effectively respond to the emergence of **new jobs related to the twin transition**. The main areas where skills are currently **lacking** are related to **energy efficiency** - including **renewable energy systems** - **circular waste management**, **design and engineering**, **new building systems and materials**.

**VET institutions and training providers must update their curricula** to include sustainability-related topics. This should include courses on **energy efficiency**, **green building standards**, **waste management**, and the integration of **renewable energy**. Specialized training programs focusing on **sustainable construction practices** are essential to equip the workforce with the necessary skills.

There is a growing demand for skilled professionals knowledgeable about sustainable construction techniques. **Continuous professional development and certification programs** in areas such as energy auditing, sustainable architecture, and green building technologies are expected to become more prevalent. **Training institutions should collaborate closely with construction companies** to ensure that their training programs align with industry needs. Additionally, **apprenticeships and on-the-job training programs** can provide practical experience in sustainable construction practices, thereby enhancing the employability of graduates.

## 2.4 The Manufacturing Sector in Italy

### 2.4.1 Sustainability Framework at Country Level

The sustainability regulatory framework in Italy has undergone significant evolution over the past five to ten years, influenced by both EU directives and national policies. These regulations aim to enhance transparency, promote sustainable business practices, and integrate environmental, social, and governance (ESG) considerations into corporate strategies. As a result, companies operating in Italy are increasingly required to align with these sustainability standards, contributing to the country's overreaching goals of sustainable development and climate resilience. Key actions and strategies are outlined below.

- National Strategy for Sustainable Development ("Strategia Nazionale dello Sviluppo Sostenibile"): This strategy serves as Italy's primary reference for outlining a comprehensive framework of actions and targets aligned with the Paris Agreement, the UN SDGs, and European sustainability policies, such as the "Fit for 55" package. The National Strategy is a milestone for the development of regional plans and guides environmental and territorial planning, programming, and assessment processes related to sustainability.

- Corporate Sustainability Reporting Directive: Officially entered into force on 5 January 2023, this directive replaced the previous Non-Financial Reporting Directive, which was implemented in Italy by Legislative Decree No. 254 of 30 December 2016. This directive expands the scope of sustainability reporting requirements, encompassing more companies and introducing more detailed reporting standards.

- Sustainable Finance Initiatives: Borsa Italiana has introduced sustainability guidelines for listed companies, promoting transparency and encouraging sustainable business practices. Italy has actively promoted the issuance of green bonds to finance environmentally friendly projects, with participation from both the government and the private sector in the market.

- Corporate Governance Code: Updated in 2020, this code outlines principles and recommendations for sustainable corporate governance, emphasizing the role of the board of directors in overseeing sustainability issues and integrating them into the company's strategy.

- Sustainable Development and Climate Reporting: Companies are increasingly demanded to disclose climate-related risks and opportunities in accordance with the Task Force on Climate-related Financial Disclosures (TCFD).

In addition, among the incentives and support programs, the National Recovery and Resilience Plan (NRRP), which is part of the EU's NextGeneration recovery package, allocates significant resources to green and digital transitions, supporting businesses in the adoption of sustainable practices. Also, the European policy REPowerEU holds a significant relevance for Italy, as it supports SMEs in self-production of energy from renewable energy sources. It aims to provide financial support to small and medium-size enterprises for purchasing the equipment necessary for self-production, self-consumption, and the storage of energy generated from RES. With a budget of €320 million (2023), this measure seeks to stimulate investments totalling twice that amount.

The Italian government has introduced various tax incentives to promote energy efficiency, renewable energy adoption, and other sustainable business practices. These incentive instruments include tax deductions, the heat bill, and the white certificate system. Additionally, the National Energy Efficiency Fund supports energy efficiency measures implemented by companies and public administrations in buildings, plants, and production processes. The Ecobonus and Superbonus 110% programs provide further support for energy efficiency improvements in buildings, as outlined in the Relaunch Decree.

Italy has implemented regulations aimed at promoting the circular economy, focusing on waste reduction, recycling, and sustainable production practices. Among these initiatives is the "Economia Circolare", which encourages companies to transition towards a production model that preserves the value of products, materials, and resources for as long as possible while minimising waste. It is accessible to enterprises of all sizes, including those engaged in industrial, agro-industrial, craft, industrial services, and research centres, which submit projects individually or jointly.

A range of targeted measures have been introduced to promote sustainable agriculture practices, supporting initiatives such as organic farming and environmentally friendly cultivation methods.

The recent introduction of the NAP BIO (National Action Plan for Organic) in 2023 marks a crucial step toward fostering the growth of organic food production and consumption while advancing the ecological transition of Italian

agrifood systems. The NAP BIO 2024-2026 outlines key priorities, offering Italian farmers access to services of Information (consumer-oriented promotional campaigns to enhance awareness and understanding of organic labelling, dissemination of knowledge about control systems, establishment of a national "Made in Italy bio" organic label, improved systems for collecting and analyzing agricultural data), Training (specialized courses to support professional development in the organic sector), R&I initiatives aimed at improving the efficiency and sustainability of organic production systems, financial incentives for converting to and maintaining organic farming practices, targeting 25% of agricultural land under organic cultivation by 2027. Additional rural development measures are fixed to enhance producer collaboration and aggregation aimed to the market development, including the promotion of Green Public Procurement practices, the support for key sales channels to increase organic consumption (public canteens) and enhance the efficiency and effectiveness of certification and inspection systems.

Through PNRR funding and supported by EU programs such as Horizon Europe, Italy implements pilot projects that integrate renewable energy sources, such as solar-powered irrigation systems, with sustainable farming practices. In high-performing agrifood regions like Emilia-Romagna, the PSR (Piano di Sviluppo Regionale, or Regional Development Funding) under CAP's second pillar finances initiatives aimed at reducing greenhouse gas emissions while maintaining high productivity.

Regional funds under PSR also support compliance with Directive 91/676/EEC (Nitrates Directive), implemented in Italy via Decreto Legislativo 3 aprile 2006, n. 152 (Environmental Code). These measures include environmental contributions targeted at water-sensitive areas. For example, the Po Valley has received dedicated funding to address water pollution through eco-friendly cultivation practices. Farmers in this region are incentivized to reduce nitrate runoff by planting buffer strips and optimizing fertilizer application, contributing to both environmental preservation and sustainable agriculture.

The government has implemented collaborative initiatives with private sector entities and non-governmental organizations to advance sustainability efforts. Initiatives such as the Italian Sustainable Investment Forum (ItaSIF) are designed to promote sustainable finance and responsible investment practices.

In addition, several voluntary measures enhance awareness of green production. One notable initiative is the "Made in Italy" scheme, which focuses on assessing and communicating of the environmental footprint of products.

Managed by the Ministry of the Environment and Energy Security, this scheme is based on the Product Environmental Footprint (PEF) method, as defined by the European Commission Recommendation 2013/179/EU (as amended), and it entered into force with Ministerial Decree No. 56/2018.

The **"Made Green in Italy"** scheme aims to **promote Italian products that demonstrate good or optimal environmental performance**, verified by a scientifically robust system. By using its logo, the scheme seeks to make products easily recognisable to consumers, encouraging more conscious purchasing decisions. **The quantification of a product's environmental performance** is based on a comprehensive Product Environmental Footprint (PEF) study, which is verified and validated by an independent third party. This assessment categorises products into three performance classes: **A** (above the benchmark), **B** (close to the benchmark), and **C** (below the benchmark). Only products in class A and those in class B are permitted to use the logo. This scheme not only anticipates, but also synergises with the Digital Product Passport regulation.

The **Corporate Sustainability Reporting Directive (CSRD)** introduces several significant changes regarding corporate sustainability reporting, including:

- **Broadening stakeholder scope**: The number of companies subject to sustainability reporting will expand significantly from approximately 11,600 to 49,000 across Europe, with nearly 7,000 based in Italy.

- **Increased reporting requirements**: Companies will need to provide more detailed information, including:
  - A description of the company's business model and strategy, including their resilience to sustainability-related risks.
  - Plans to ensure that the business model and strategy align with the green transition and the goal of limiting global warming to 1.5°C, in accordance with the Paris Agreement and the EU target of achieving climate neutrality by 2050.
  - A description of the role of the administration, management and control bodies concerning sustainability issues, as well as information on the existence of sustainability-related incentive schemes for them.
  - A description of the company's objectives and policies related to sustainability.

- **Due diligence procedures**: Companies will be required to implement due diligence procedures concerning sustainability issues.

- Mandatory disclosure in management reports: Sustainability reporting will need to be included in the management report, presented in a designated section, as prepared by the directors in accordance with Article 2428 of the Italian Civil Code.

- Dual materiality principle: Companies will have to identify and specify the main impacts of their activities and value chains on society and the environment (inside-out perspective), as well as the risks and opportunities posed by sustainability factors affecting company development and performance (outside-in perspective).

- Integration of ESG aspects along the value chain: Companies will have to include information on material impacts, risks, and opportunities related to both the upstream and downstream value chain, based on due diligence activities and materiality analysis.

- Introduction of European reporting standards. The European Commission has adopted the European Sustainability Reporting Standards (ESRS), developed by the European Financial Reporting Advisory Group (EFRAG). In addition, a simplified ESRS standard designed for listed SMEs (ESRS LSME) is currently in development. There are also a voluntary, non-legally binding standards for micro, small and medium-sized enterprises outside the scope of the CSRD. These standards support unlisted SMEs in starting their sustainability journey and serve as a reference for partners in the value chain and lenders.

- Single electronic reporting format: The CSRD directive mandates that financial statements and management reports be prepared in XHTML format and that sustainability information be tagged. This "digital tagging" system will be closely linked to the implementation of the 'Single European Access Point' (ESAP), facilitating easier access to sustainability information.

### 2.4.2 Green skills for Sustainability at Country Level

Based on the analysis of the regulatory environment - designed to support and incentivise businesses in implementing fiscal and financial measures for the green transition - several impacts on Italy's VET system become evident, especially regarding the skills and knowledge required across various stages of production.

Insights from the **Sistemi Formativi Confindustria (SFC) observatory** highlight **emerging skill needs** in the labour market, including:

- **Design and prototype development**:
  - **Sustainable design**, to address material recovery, reuse, and by-products exchange, as well as product functionality that aligns with the "right to repair" concept (i.e., ref. to ESCO skill in Communication, Collaboration and Creativity: ***advising on environmental issues***; ESCO knowledge in Engineering, construction manufacturing: ***sustainable manufacturing sustainable technologies***).
  - **Life Cycle Assessment (LCA)** of products and processes (i.e., ref. to ESCO skill in ***Assess the Life Cycle of resources***).

- **Production and business administration**:
  - **Supply chain compliance**: Ability to identify supply chains aligned with the CSRD priorities (i.e., ref. to ESCO skill in ***Assisting and Caring***, such as the use sustainable materials and components).
  - **Sustainability reporting**: Skills in documenting and communicating sustainability aspects across processes, products, and supply chains (i.e., ref. to ESCO skill in Communication Collaboration and Creativity: ***advise on corporate social responsibility***; ESCO skill in Information skills: ***lead the sustainability reporting process***).
  - **By-product selection for regeneration**: Competences in selecting appropriate by-products for regeneration processes (i.e., ref. to ESCO skill in Handling and Moving: ***collect industrial waste***).
  - **ESG and sustainability planning**: Knowledge and skills in developing Environmental, Social, and Governance (ESG) strategies and sustainable business plans (i.e., ref. to ESCO knowledge in ***Social Science, Journalism, Sustainable Development Goals***).

- **Logistic and packaging**:
  - **Green logistic**: Knowledge and skills in implementing environmentally friendly logistics practices (i.e., ref. to ESCO knowledge in ***Business, Administration and Law***).

To meet the demands of a sustainable economy, **Italy is gradually incorporating green skills into existing VET curricula across manufacturing disciplines**, such as business administration, product design and development, logistics,

construction, and more. This integration is part of a standardized process to update **both formal and informal training** provision at **all EQF levels**. However, **several external factors** are accelerating this shift toward green skills in established pathways. Among them, it is worth mentioning:

- **The National Recovery and Resilience Plan (NRRP)**, funded by the European Union's NextGenerationEU program: This plan allocates substantial investments toward green skills development. It includes actions to retrain workers in ecological transition skills that are increasingly demanded by the market. In addition, it strengthens specialised skills within local administrations to support energy efficiency initiatives and renewable energy production.

- **The National Energy and Climate Plan (NECP)**: This plan outlines Italy's strategy to meet the EU's 2030 climate and energy targets. It highlights the importance of education and training programs to develop green skills in key sectors, including renewable energy, energy efficiency, and sustainable mobility.

**Emerging green skills profiles at EQF level 5 in Italy** are being developed through both formal and informal VET education. Within the VET formal offerings, there are **17 Higher Technological Institutes** (equivalent to Applied Universities) specialising in the **Energy Efficiency technology**. Among the professional roles trained at these institutions are:

- **Higher technician for energy saving in sustainable construction**.
- **Higher technician for energy supply and plant construction**.
- **Higher technician for the management and verification of energy plants**.

These qualifications enable professionals to deal with both the procurement of energy, especially from renewable sources, and the various stages of constructing and operating energy production and distribution facilities.

**The certification procedures in Italy** are underpinned by **Legislative Decree No. 13 of 16 January 2013**, which requires certificates to be issued with the **legal authority of public deeds** and validated by **independent third parties**. A recent decree from the **Minister of Labour and Social Policies**, dated 9 July 2024, represents a significant step in the implementation of micro-credentials within the Italian certification systems. This decree defines the **roles and responsibilities of the Ministry within the national skills certification system** and promotes **collaboration between the regional vocational training system and**

economic and social partners. It emphasises the role of interprofessional and bilateral funds to support continuous training and income assistance.

The decree also promotes the recognition of skills gained in non-formal learning environments, such as apprenticeships, internships, entrepreneurial support programs, universal civil service, volunteering, and public utility projects. This represents a significant advancement in reforming the national skills certification system and promoting active labour policies through extensive collaboration between public authorities, economic partners, and social entities.

The National Directory of Education and Training Titles and Professional Qualifications constitutes the unitary reference framework for the identification, validation and certification of qualifications and competences, also in terms of training credits in a European perspective. It encompasses all repertoires of education and training qualifications, including VET and professional qualifications. A critical component of this directory is the National Reference Framework of Regional Qualifications (NQR), which serves as a reference for the alignment and standardisation of qualifications across Italy.

Micro-credentials are becoming increasingly popular in Italy as a flexible and targeted method for developing and recognising specific skills, including green skills. Despite a regulatory framework exists that could activate more substantial initiatives in micro-credential issuance, the primary trends observed so fare include:

- Digital Credentials: The rise of digital platforms has facilitated the dissemination of micro-credentials. Platforms such as Coursera, Open Edu, and EdTech, and various European Commission services, such as SELFIE within the DigComp framework, offer a range of courses that provide digital badges and certificates upon completion. These often platforms collaborate with businesses and industry associations to ensure the credentials remain relevant to the job market.

- European Qualifications Framework (EQF): Italy is working to align its micro-credentials within the VET system with the European Qualifications Framework (EQF) to ensure their recognition across Europe. This alignment could help Italian workers validate their green skills internationally and improve their mobility within the EU labour market.

- **Industry Collaboration**: Italian industries are increasingly collaborating with **educational institutions** to develop micro-credentials that are tailored to their specific needs. For instance, the renewable energy sector provides **micro-credentials in solar panel installation and wind turbine maintenance**, ensuring that workers possess the precise skills required.

- **Lifelong Learning and Upskilling**: Micro-credentials could be key component of Italy's lifelong learning strategy, as they enable workers to continuously update their skills in response to technological advancements and evolving environmental standards. This approach is particularly important in the context of the green transition, where new skills are constantly emerging.

### 2.4.3 Sectorial Analysis

**Italy's manufacturing sector plays a crucial role in the national economy**, contributing significantly to employment, exports, and industrial output. As the country adjusts to a global shift towards sustainability, this sector encounters various **challenges and opportunities**, particularly in light of the European Union's ambitious climate policies, such as the Fit for 55 framework.

To achieve a credible transition to a low-carbon economy, Italy must transform its **energy production, distribution, and consumption**, prioritising efficiency and environmental sustainability. The decarbonisation agenda, along with strategies for energy independence, is directly influencing various industrial sectors, pushing companies to **innovate in energy management and supply systems**, as well as to **invest in technologies** that adhere to the high **environmental, social, and governance (ESG) standards**, **new certifications**, and **sustainability practices**. Coherently with the Directive (EU) 2023/1791, to strengthen the role of energy audits in supporting the energy efficiency transition, large enterprises are asked to regularly conduct energy audits while the small and medium-sized enterprises are encouraged to adopt similar practices through incentives and accessible frameworks. These audits aim to identify opportunities to enhance energy performance, reduce consumption, and integrate more efficient technologies.

According to the National Smart Specialisation Strategy (NSSS) and data from Italian National Institute of Statistics (ISTAT, 2023), between 2020 and 2022, 29.1% of Italian enterprises with at least three employees invested in **research and innovation within one of the smart specialisation clusters**. Notably,

companies in the Agri-food sector (13.8%), Health sector (5.8%), and Energy and Environment sector (5.1%) collectively account for 48.9% of total value added and 60.7% of Italy's exports. Larger firms, particularly those in Aerospace (0.5%), Smart Community (0.5%), Green Chemistry (0.6%) sectors and or other sectors like Energy, Sustainable Mobility, and Intelligent Factories, lead in research investment. Conversely, smaller firms, especially those with fewer than ten employees, are more active in the Health (5.8%), Design and Creativity (4.4%), and Energy (4.1%) sectors.

In response to these changes, manufacturers are increasingly prioritising the development of green skills to promote sustainability throughout their operations, products, and supply chains (CEDEFOP, 2023; Unioncamere,2021; Linkedin,2024). These skills are essential not only for meeting regulatory requirements but also for ensuring long-term profitability and competitiveness in a global market that is increasingly influenced by environmentally conscious consumers and investors.

Green skills encompass the knowledge and capabilities required to foster environmental sustainability in the workplace. These competencies span areas such as energy management, carbon accounting, renewable energy technologies, and circular economy practices. In Italy, the demand for these skills is growing as manufacturers seek to align with both national and EU sustainability goals:

- Energy efficiency and transition management: Italian manufacturers are making investments in technologies that reduce energy consumption and greenhouse gas emissions. There is a high demand for professionals with expertise in energy efficiency, renewable energy integration, smart grid management, and carbon footprint reduction.

- Circular economy and waste management: Circular economy principles, which focus on reducing, reusing, and recycling materials, are becoming fundamental to Italian manufacturing practices. Skills related to product design that priorities longevity, recyclability, and resource efficiency are increasingly sought after.

- Sustainable supply chain management: It is essential for manufacturers to ensure environmental and social responsibility throughout their supply chains. Green skills in sustainable sourcing, ethical procurement, and supply chain transparency are crucial, especially in complex industries such as fashion, automotive, and food production.

- ESG reporting and compliance: The growing significance of ESG standards necessitates that manufacturers transparently demonstrate their sustainability initiatives through comprehensive reporting and compliance with regulations. This has led to increased demand for professionals skilled in ESG reporting, environmental auditing, and sustainability certification.

- Adopting cleaner technologies: Industries that rely heavily on fossil fuels or resource-intensive processes, such as steel, cement, and chemicals, are face considerable challenges due to their high carbon emissions. Failure to adopt cleaner technologies may result in higher operational costs and potential penalties. The automotive sector, in particular, is experiencing a substantial transformation with the shift to electric vehicles (EVs), which requires new skills, revamped supply chains, and significant investments in technology.

Industries that embrace green innovation are poised to become significant contributors to Italy's manufacturing landscape. Key sectors where green skills will drive strategic growth include:

- Renewable energy: Manufacturing companies that produce components for solar, wind, and other renewable energy systems will benefit from Italy's commitment to expanding its renewable energy capacity.

- Circular economy and waste management: Companies engaged in recycling and waste transformation are likely to prosper as demand for sustainable packaging and resource efficiency continues to grow.
- Construction: Companies that integrate energy-efficient materials and eco-friendly building techniques are well-positioned for expansion, supported by the Fit for 55 framework's emphasis on sustainable urban development.

- Agri-food: Innovations driven by sustainability in the agri-food sector, such as precision farming and organic products, align with national and European goals. Green skills related to sustainable farming, efficient processing, and waste reduction are crucial.

Italy's manufacturing sector finds itself in a pivotal moment, facing the dual pressures of stricter environmental regulations and the opportunities presented by the green economy. Developing green skills is crucial for

ensuring that Italian manufacturers can achieve the EU's climate targets while remaining competitive. Some industries may struggle to adapt; however, those involved in **renewable energy**, **sustainable construction**, and the **circular economy** are well-positioned for success in a sustainable future.

Between 2021 and 2022, 51.2% of companies aimed to **recruit human resources**, with even higher rates among small businesses (71.9%) and medium to large companies (around 90%). However, **significant challenges in finding employees** with the necessary skills became evident. **Larger companies**, in particular, reported more pronounced difficulties, with 56.3% struggling to find staff with the required technical and soft skills, such as teamwork and adaptability. These challenges were even more acute in **technology-driven companies** and in **Northern Italy**, where the skills gap is most severe. This shortage of specialised skills poses a significant **obstacle to fulfilling business needs**, hindering both growth potential and overall competitiveness (Unioncamere,2023)

## 2.5 The Wood and Furniture Sector in Spain

### 2.5.1 Sustainability Framework at Country Level

In the last decade, **Spain has made substantial progress in establishing a robust legislative framework to advance sustainability initiatives across multiple levels**. This has led to the promotion of policies for **decarbonisation**, **circular economy practices**, **biodiversity protection**, and **climate change adaptation**. These efforts are aligned with **international agreements and covenants**, and they have been shaped by **European policies**, particularly the European Green Deal, as well as by **temporary instruments** such as the Recovery and Resilience Facility (RRF). Below is a brief overview of the key **sustainability regulations introduced in Spain over the past years**:

- **2015**: All United Nations Member States adopted the **17 SDGs** as part of the 2030 Agenda for Sustainable Development. Spain has become the first country in the European Union to undergo its **third Voluntary National Review**, assessing the progress made towards the SDGs. This review will evaluate Spain's compliance with the SDGs and outlines priorities for future actions. In addition, the a mid-term review of the 2030 Sustainable Development Strategy, aimed at implementing the 2030 Agenda in Spain, has just began.

- **2017**: A draft of the **Spanish Circular Economy Strategy** (MITECO, 2017) was developed, integrating environmental, competitiveness, and social national policies related to circular economy. The strategy was complemented by an initial **Action Plan (2018-2020)**, which identified five priority sectors for addressing these challenges in Spain: construction, agri-food, manufacturing, consumer goods, and tourism.

- **2018**: The **Action Plan for the implementation of the 2030 Agenda** (Gobierno de España, 2018a) was introduced, aimed at promoting new policies, measures, governance and working methods for adopting the **Sustainable Development Strategy 2020-2030**. The same year, law 11/2018 (Gobierno de España, 2018b) came into force requiring large companies to **disclose non-financial information related to sustainability** - encompassing environmental, social and governance aspects - that is currently awaiting updates, although a draft bill has already been prepared.

- **2019**: The Spanish government unveiled the **Strategic Framework for Energy and Climate** (Ministry for Ecological transition and demographic challenges,2020), which included the **National Integrated Energy and Climate Plan (PNIEC) 2021-2030** (MITECO, 2020c). An updated draft of the PNIEC was presented in June 2023 and is currently undergoing evaluation by the European Commission. The PNIEC aims for a 23% reduction in greenhouse gas emissions, meaning that one out of every three tons of currently emitted greenhouse gases must be eliminated. Within it, the **Just Transition Strategy** (Instituto para la Transición Justa, O.A., 2020) details a support strategy to capitalize on opportunities for green transition across key sectors. In addition, the **Strategic Framework on SME Policy 2030** (SG de Industria y de la Pequeña y Mediana Empresa, 2019) outlines strategies to facilitate the transition of small and medium-sized enterprises (SMEs) to a sustainable and circular economy.

- **2020**: The Spanish government approved the **Long-Term Strategy for a Modern, Competitive and Climate Neutral Spanish Economy in 2050** (MITECO, 2020a). This document outlines the pathway to achieving climate neutrality by 2050 and identifies the economic and job creation opportunities offered by this transition. In addition, the **National Strategy for Green Infrastructure and Ecological Connectivity and Restoration** (Gobierno de España, 2020) was introduced to regulate the implementation and development of a coherent and strategically planned network of natural and semi-natural areas aimed at conserving and maintaining ecosystems and ecosystem services.

- **2021**: The **Recovery, Transformation and Resilience Plan** (Gobierno de España, 2021) was developed as Spain's response to the COVID-19 pandemic, primarily funded by the EU NextGenerationEU Recovery Fund. This plan features four cross-cutting areas: **green transition**, **digital transformation**, **social and territorial cohesion**, and **gender equality**. The green component of the plan includes investments in **renewable energy**, **energy efficiency**, **sustainable mobility**, and **biodiversity protection**. Additionally, the Spanish government enacted the Climate Change and Energy Transition Law (law 7/2021), which aims to achieve the decarbonisation of the Spanish economy by 2050. This law was accompanied by the **National Plan for Adaptation to Climate Change** (MITECO, 2020b) and its **Work Program 2021-2025**. Finally, the **I Circular Economy Action Plan 2021-2023** (MITECO, 2021a), the **Environmental Education Action Plan for Sustainability (2021-2025)** (MITECO, 2021b) and the **Guidelines for the Design and Development of Actions in**

Accordance with the Principle of not Causing Significant Damage to the Environment (MITECO, 2021c) were also published.

- 2022: The Spanish government enacted a law addressing waste and contaminated soils for a circular economy (Law 7/2022) and a law on packaging and packaging waste (Royal Decree 1055/2022).

The interconnection between various policies and strategies strongly influences the development of transformational changes toward a sustainable circularity. In this context, the Study of the Contribution of Technical Standards to the Circular Economy (UNE, 2022), lists the technical standards that support the circular economy.

In January 2020, the Spanish government issued the Agreement of the Council of Ministers Approving the Government's Declaration in the Event of a Climate and Environmental Emergency, (EC, 2020) which formalizes Spain's commitment to the adoption of 30 priority lines of action. These lines of action are aimed at combating the undeniable effects of climate change and promoting a green and inclusive transition to minimise the economic, social, and environmental impact of this shift toward a green, circular, equitable, and climate-neutral economy by 2050, ensuring no one is left behind.

A significant portion of the priority lines of action, public policies, and measures included in this accelerating policy framework stems from the aforementioned declaration. Moreover, it emphasises the integration of climate emergency considerations across various public policies and actions within the framework of the 2030 Sustainable Development Strategy. According to the European Climate Foundation's Planning for Net Zero Emissions Report (European Climate Foundation, 2019), Spain is the first EU country in terms of alignment with national plans to combat climate change.

The Green Transition Index (GTI) 2023, which provides a detailed analysis of the progress of 29 European countries - including EU member states, the United Kingdom and Norway - in sustainability and emissions reduction across seven key categories, places Spain 14$^{th}$ out of 29, with a score of 49.6 out of 100. This ranking puts behind neighbouring countries such as France and Italy. The country's position is largely attributed to a significant reduction in greenhouse gas emissions between 2015 and 2020, improved energy efficiency, and increased public spending on R&D focused on environmental sustainability. In addition, the energy sector has demonstrated a strong commitment to advancing the deployment of renewable energies and transition technologies, particularly green hydrogen.

In parallel, the **Sustainable Mobility Bill** is currently undergoing parliamentary processing through an expedite procedure, aiming for implementation in 2024. This legislation established an ambitious framework that recognizes sustainable mobility as a fundamental right, promoting the creation of an efficient, inclusive, and environmentally respectful transportation ecosystem.

Also, the new **Law on the Organization and Integration of Vocational Training in Spain** (GDS-Organic law 3/2022), approved in March 2022 and set to take effect in the 2024/2025 academic year, aims to foster a more dynamic, sustainable, inclusive, and competitive labour market through comprehensive policies and coordinated measures to tackle various structural challenges in the country. To achieve this objective, the plan included expanding the range of vocational training programs to encompass **diverse sectors and occupations**, particularly those linked to **technology, innovation, and sustainability**. In addition, a new mandatory module will be introduced for all students in middle and higher vocational training: **"Sustainability applied to the production system"**. This module will equip students with knowledge about the **environmental, social, and governance challenges** confronting Spanish society, providing them with the tools to design sustainability plans and ensure effective professional practices. The module comprises five teaching units, articulated into several subunits, with the following titles:

- Our Future at Risk
- Challenges of Sustainability: A Global Commitment
- Agenda 2030: A Guide for Change
- From Linear to Circular Economy
- Sustainability in Companies

There are also ongoing **efforts to train teachers**, enabling them to acquire and enhance their basic knowledge and skills in green economy, sustainability, and the environmental impacts of production processes relevant to various sectors. These initiatives mark a significant advancement for vocational training programs in Spain, as previous courses in the national vocational training catalogue did not include any sustainability or environmental protection training content.

## 2.5.2 Green Skills for Sustainability at Country Level

The current legislation, set to be implemented starting in the 2024-2025 academic year, is the aforementioned **Law on the Organization and Integration of Vocational Training in Spain** (GDS-Organic law 3/2022). In addition to this law,

various **royal decrees and educational orders** issued in recent years have been established to regulate the curriculum content of vocational training cycles and to modify of the National Catalogue of Professional Qualifications, including the creation of new professional qualifications within the wood, furniture, and cork sectors.

**Training initiatives for the wood and furniture industries** primarily refer to:

- **Vocational Education and Training (VET)**:
  - **Basic Level VET**: Basic Professional Certificate in Carpentry and Furniture.
  - **Intermediate Level VET**: Technician in Carpentry and Furniture; Technician in Furniture and Installation; Intermediate Level VET: Technician in Wood Processing and Transformation.
  - **Higher Level VET**: Higher Technician in Furniture Design and Manufacturing.

- **Professional certificates**:
  - **Level 1**: Carpentry and furniture works; Application of varnishes and lacquers on carpentry and furniture elements.
  - **Level 2**: Furniture installation; Finishing of carpentry and furniture; Wood sawing Assembly of furniture and carpentry elements; Obtaining veneers, plywood, and laminated veneers; Manufacture of particle boards and wood fibre boards; Installation of carpentry elements; Assembly and installation of wooden constructions; Upholstery of furniture.
  - **Level 3**: Carpentry and furniture projects; Organization and management of production in furniture and carpentry industries; Planning and management of manufacturing in wood and cork industries; Installation and furnishing projects.

In Spain, various **public and private organisations** are dedicated to professional training and certification across multiple sectors, including the wood industry. These organisations establish **quality standards** and ensure that training aligns with **labour market needs**. Some of the key organisations include:

- **Ministry of Education, Vocational Training and Sports**: It oversees a Vocational Education and Training program that offers regulated qualifications across numerous professional sectors, ensuring comprehensive and relevant educational offerings.

- State Public Employment Service: As an autonomous body under the Ministry of Labour and Social Economy, it is responsible for issuing professional certificates. These certificates are official titles recognised throughout Spain, certifying that individuals possess the necessary qualifications to perform specific job functions as outlined in the National Catalogue of Professional Qualifications.

- National Qualifications Institute: It is a technical body operating under the Ministry of Education and Vocational Training that is aimed at monitoring the evolution and transformation of professional profiles in strategic sectors critical for sustainable social, economic, and environmental development. It also plays a role in accrediting professional competencies and incorporating them into the National Vocational Training Program.

It's noteworthy that various technological institutes, research centres, professional and sectoral associations, chambers of commerce, and consulting firms also provide targeted, informal, and concise training related to the furniture sector, for instance, through training sessions, conferences, and workshops.

In June 2023, the Ministry of Universities presented the Microcreds Plan (Ministerio de Ciencia, Innovación y Universidades, 2023), aimed at engaging a sector of the population that is underrepresented in Spanish universities, thereby making higher education more accessible to citizens of all ages. This plan is part of a European lifelong learning strategy (Cedefop,2023) that seeks to create more flexible educational systems. The action plan lays out a coherent framework for developing micro-credentials within the Spanish university system, in accordance with the European Recommendations on Micro-credentials (Council of the European Union, 2022). It outlines an initial set of actions designed to promote a relevant and high-quality selection of university micro-credentials.

A key challenge the Microcreds Plan addresses is the need to align skills with emerging job opportunities, as technological development and the green transition are reshaping economic activities and job roles. In October 2023, the Action Plan Guide for the Development of University Micro-credentials in Spain (Ministerio de Ciencia, Innovación y Universidades, 2023) was published. This action plan aims to establish a coherent framework for developing micro-credentials within the Spanish university system, in line with the European Recommendation. It avoids unnecessary rigidity and encourages universities

and Autonomous Communities to adapt the initiative to their own strategies, priorities, and specific regional contexts.

The Action Plan proposes **forty-one measures** aimed at advancing university micro-credentials in Spain, structured around **five strategic pillars**:

- Pillar 1: Stimulate lifelong learning among adults and employers.
- Pillar 2: Transform universities into institutions for education at all ages.
- Pillar 3: Offer micro-credentials with significant labour and educational impact.
- Pillar 4: Guarantee the right to education for all adults.
- Pillar 5: Facilitate personalized educational pathways in adulthood.

In 2023, CEDEFOP released a report titled **Case Study Spain: Micro-credentials for Labour Market Education and Training** (González Gago, 2023), highlighting the significant relevance of **micro-credentials** in Spain, particularly due to the substantial number of **low-skilled adults and individuals with low employability**. Moreover, employers are increasingly seeking **greater flexibility in training offerings** and **better alignment of educational programs** with the evolving demands of the labour market. In response to this need, three parallel processes are being undertake in Spain to regulate micro-credentials, spearheaded by the authorities in **VET, higher education, and employment** sectors.

## 2.5.3 Sectorial Analysis

**Around a quarter of the world's furniture is manufactured within the European Union**, representing a market value of **84 billion euros**. This translates to an EU-28 consumption of approximately **10.5 million tons of furniture annually**, and supports **nearly one million European jobs**, primarily in **SMEs** (Centre for European Policy Studies, 2014; European Environmental Bureau, 2017).

**The shift towards greater sustainability in the furniture sector** over recent years has largely been driven by the need for a **step-by-step approach** to ensure a **gradual, sustainable, and realistic transition to circular economy principles**, especially for SMEs. This shift has been reinforced by the European Commission's adoption of the new **Circular Economy Action Plan (CEAP)** in March 2020 (EC, 2020c), which identifies **furniture as a priority product group within the value chain** due to its environmental impact and circularity potential.

In **2017**, the **European Environmental Bureau** published a report addressing the challenges and opportunities of transitioning to a circular furniture sector,

"Circular economy opportunities in the furniture sector" (European Environmental Bureau, 2017). The conclusions of the study were directed toward policymakers and key stakeholders in the furniture value chain.

In **2020**, the **European Furniture Industries Confederation (EFIC)** published a report, **"The furniture sector and Circular Economy 2.0: the European Furniture Industries Confederation shares its views"** (EFIC, 2020) that identified various challenges and opportunities associated with the transition to a circular economy. This report covered the different stages of furniture manufacturing, from material supply to the end-of-life phase, and included a policy paper on the challenges and opportunities recognised by European furniture industries in relation to the previously mentioned CEAP from the European Commission.

In **2021**, the **European Economic and Social Committee (EESC)** published a document, **"The European furniture industry – Its recovery towards an innovative, green and circular economy"** (EESC, 2021), stating that they believe the **EC Communication on the New European Bauhaus** (EC,2021) presents an excellent opportunity for the furniture industry to contribute to the creation of **sustainable and inclusive products** for a new way of living, where sustainability harmonizes with lifestyle.

**The Ecodesign for Sustainable Products Regulation (ESPR)** (Regulation EU 2024/1781), which entered into force on **18 July 2024**, has replaced the Ecodesign Directive (2009/125/EC) by introducing **additional Ecodesign criteria for a broader range of products**. Formulated within the framework of the **European Green Deal**, the ESPR establishes **eco-design requirements for specific product groups** to improve their circularity, energy efficiency, and other aspects of environmental sustainability, with the furniture sector identified as a **priority for the European Commission**.

Each year, businesses and consumers in the EU Member States dispose of **10 million tons of furniture**. According to statistics from the European Federation of Furniture Manufacturers, between 80% and 90% of the EU's furniture waste in municipal solid waste is incinerated or sent to landfills, resulting in a **recycling rate of only 10%** (European Environmental Bureau, 2017).

With the **goal of recycling up to 65% of the products consumed by 2035** and achieving the most circular economy possible, Spain enacted the **Waste and Contaminated Soils Law** in **2023**. This law stipulates that furniture and household items must be properly recycled and managed. Although the furniture sector still operates on a linear production and consumption model, it has significant potential for circularity.

Currently, **furniture reuse is less than 2%**, while the **estimated potential for furniture reuse is as high as 55%** (European Environmental Bureau, 2017). This new regulation presents a **business opportunity**, as managing waste and restoring or rehabilitating furniture and household items can become a profitable venture. By developing **scalable business models** that promote **"servitization" and furniture reuse**, particularly in second-hand business markets, businesses can drive the shift toward a more sustainable economy.

The most relevant **sustainability-related laws and regulations in the furniture sector** are the following:

- **EN 17902:2023**: Furniture - Circularity - Evaluation method for dis/reassembly capability.
- **UNE-EN ISO 14001:2015**: Environmental management systems. Requirements with guidance for use (ISO 14001:2015).
- **UNE-EN ISO 14002-1:2020**: Environmental management systems. Guidelines for using ISO 14001 to address environmental aspects and conditions within an environmental subject area. Part 1: General.
- **UNE-EN ISO 14006:2020**: Environmental management systems. Guidelines for incorporating eco-design.

**The furniture sector in Spain has undergone a significant transformation in recent years**, marked by a tumultuous trajectory influenced by the **global COVID-19 health crisis** and **fluctuations in both the national and international economies**.

Given the challenges ahead, the use of **sustainable and innovative materials** is of great importance. Spanish companies are increasingly turning to **products that are innovative, non-toxic, recyclable, certified, and safely disposable**. Also, in Spain, 70% of the wood used in furniture manufacturing comes from **sustainably managed forests**. In line with sustainability principles, there is also a clear emphasis on **extending the lifespan of furniture**, which requires higher-quality products (Lopez Corralo, 2024).

As a result, one substantial change has been the increased adoption of certifications such as:

- **EU Ecolabel**: It certifies the use of recycled fibres or virgin fibres from sustainably managed forests, limits harmful substances to health and the environment, promotes designs for greater product durability, facilitates ease of disassembly and recycling, encourages the use of recycled packaging, and more.

- EUTR: It is a mandatory regulatory framework aimed at combating illegal timber harvesting. It prohibits any involvement in the timber and timber-related product supply chain within EU member states if illegally harvested timber is detected.

- FSC and PEFC: They ensure that wood comes from sustainably managed forests.

- TSCA Title VI: It plays a crucial role in protecting public health and the environment by regulating formaldehyde emissions from laminated products and other composite wood materials in products imported to the United States.

- Digital Product Passport (DDP): Considered an enabler for the circular economy, it will become a necessary document accompanying products throughout their lifecycle, consolidating data from sourcing and material extraction to end-of-life recycling. This new tool will be particularly relevant in several key sectors, such as furniture. While the DPP is not yet mandatory, the EU is expected to adopt and enforce it between 2026 and 2030.

The use of more sustainable materials has also increased, with reclaimed wood, bamboo, and cork becoming popular choices in furniture design. These materials help reduce the environmental impact associated with traditional manufacturing practices. However, furniture designers and manufacturers still need to find substitutes for materials that cannot be easily reused, restored, or repaired. An example is the particle board, made from compressed wood particles, which is inexpensive to produce but not very durable.

Lastly, in the context of the circular economy, the furniture sector is striving to develop strategies within the following six key cycles:

- Maintain: Use preventive maintenance to maximise the product's lifespan.
- Repair: Perform corrective maintenance.
- Reuse: Redistribute products through a change of ownership.
- Refurbish or remanufacture: Restore products to extend their lifespan.
- Repurpose: Change the functionality of the product.
- Recycle: Recover the value of components and materials as raw materials.

There is a **significant mismatch between educational provision and the needs of the labour market regarding sustainability**. **Students** are demanding this type of knowledge, while **companies** report that workers are not sufficiently trained in these subjects when they enter the workforce. **VET teachers** also state that they lack the necessary training in sustainability and that the curricula are too rigid, outdated, and do not allow for deviations from the established guidelines. As a result, knowledge about sustainability often remains outside the classroom or is addressed only briefly.

**New VET legislation will come into force in the 2024-2025 academic year**, introducing a common, transversal, and mandatory educational module for all VET courses, called **"Sustainability applied to the production system"**. This module will serve as a starting point for meaningfully integrating sustainability into VET programs designed for the sector.

Nevertheless, **specific regulated training** within the national vocational training offerings for the sector is still needed to address its specificities, challenges, needs, difficulties, and opportunities. Considering the sector's requirements, market trends, and legislative changes, the main aspects that should be covered in training programs aimed at the wood and furniture sector include:

- Circular economy and industrial symbiosis
- Waste management
- Eco-design and design for disassembly, reassembly, and remanufacturing
- Sustainable business models

## 2.6 Focus on Public Administrations

### 2.6.1 Sustainability Framework at European level

Over the past five to ten years, the EU has significantly advanced its sustainability agenda, establishing a comprehensive framework to address environmental, social, and economic challenges. A key milestone occurred in 2019 when the European Commission published the European Green Deal to fulfil commitments under the Paris Agreement of 2015.

The European Green Deal comprises a collection of policy initiatives aimed at setting the EU on the path to a green transition, with the ultimate goal of becoming the first climate-neutral continent by 2050. It includes initiatives covering climate, the environment, energy, transport, industry, agriculture, and sustainable finance.

To translate those ambitions into law, the EC published a set of proposals known as the "Fit for 55" (Erbach, G., & Jensen,2022) to revise existing legislation and introduce new initiatives that align EU laws with climate goals. The European Climate law (EU-2018/1999), adopted in 2021, formalised Europe's commitment to becoming climate-neutral by 2050 and established a target of 55% fewer emissions by 2030 compared to 1990 levels. To achieve these targets, the EC presented a series of proposals.

Because the green transition should be just and fair, the EU has also ensured financial support for those who are more vulnerable and most affected by climate change through the implementation of financial mechanisms, such as the Just Transition Mechanism (EC,2020) and the Sustainable Europe Investment Plan (EC,2020). In addition, the EU Taxonomy Regulation (EC,2020) entered into force in 2020 to facilitate direct investment in sustainable projects and activities. This regulation establishes a classification system that defines criteria for economic activities to qualify them as environmentally sustainable.

One of the main building blocks of the EU Green Deal is the Circular Economy Action Plan (CEAP) (EC, 2020), adopted in 2020. The CEAP addresses product design, encourages sustainable consumption, and aims to prevent waste while keeping resources in the EU economy for as long as possible. It introduces measures to make sustainable products the norm, empower consumers and public buyers, reduce waste, make circularity work for people, regions, and cities, and lead global efforts on circular economy. It focuses on the following

sectors: electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water, and nutrients.

Public procurement is a powerful tool that can drive sustainability across the EU, leveraging its significant purchasing power. The **Public Procurement Directives** — specifically **Directive 2014/24/EU** (EU,2014) on public procurement and **Directive 2014/25/EU** (EU,2014) on procurement by entities operating in the water, energy, transport, and postal services sectors — provide this crucial framework.

These Directives allow public administrations to incorporate environmental, social, and innovation criteria in their tendering processes. This means that public contracts don't have to be awarded solely based on the lowest price; instead, the **Most Economically Advantageous Tender (MEAT) principle** can be used. MEAT allows the evaluation of tenders based on multiple criteria that reflect sustainability, quality, life-cycle costs, and other non-financial values.

The **Waste Framework Directive (2018/851)** (EU,2018) is a central piece of EU legislation aimed at reducing waste and promoting recycling across Member States. This Directive establishes waste management principles and sets binding targets that cascade down from national governments to local public authorities, which are critical players in implementation. It includes **recycling targets** for waste streams, separate collection obligations, Extended Producer Responsibility requirements, and more. The Directive is undergoing a **revision** to better align with EU's evolving sustainability objectives, with special focus on the textile and food waste sectors.

In recent years, the **climate agenda** has emerged as a paramount priority at the European level. The need to transform production and consumption patterns has become increasingly clear to maintain a high quality of life within the planet's ecological limits. The **COVID-19 pandemic** has further highlighted the necessity of transitioning to a more sustainable society, emphasizing the importance of efficient resource use and respect for natural cycles. Notably, **resource extraction and processing** account for 90% of biodiversity loss and water stress (IRP, 2019).

**Sustainability has been integrated into various sectors to different extents**. For instance, the high energy prices precipitated by the COVID-19 pandemic and the war in Ukraine, along with new policy measures, have significantly embedded **energy efficiency** within the construction sector. In terms of the **circular economy**, measures have been introduced to make sustainable products the norm. Consumers are empowered by gaining access to the right

information, enabling them to make **informed purchasing decisions**. Additionally, **innovation** is actively supported to enhance circular practices, leading to the emergence of new circular business models.

The implementation of the **European Green Deal** has affected all EU sectors and occupations, albeit with varying intensities and directions. According to CEDEFOP, **employment effects** are concentrated in sectors directly targeted, such as extraction, construction, and waste management, while increases in employment are forecast in service sectors such as engineering and administration.

The green and digital transitions necessitate **upskilling and reskilling**, and VET can play a crucial role by providing individuals with the skills the labour market needs and offering career development opportunities. To identify **priorities** for upskilling and reskilling, CEDEFOP emphasised the important of a **sectoral focus** (CEDEFOP, 2021). The European Green Deal has a strong social component and aims to ensure a just transition for workers.

In addition to targeted investments aimed at alleviating economic shocks and developing skills, a **comprehensive approach** to skills matching should be a priority (CEDEFOP, 2021). Curriculum development will also be influenced by the green transition through the integration of green skills and knowledge related to sustainable practices, encompassing both technical and soft skills.

**Training methodologies** will need to be adapted, and policies must align with the demands of the green economy. This alignment not only supports environmental goals but also fosters economic resilience and social inclusion across the EU.

### 2.6.2 Green Skills for Sustainability at European Level

The demand for **transversal skills** in the green transition is evident across sectors and are projected to be increasingly important in meeting the European Green Deal's goals. According to CEDEFOP (2023d) **up to 2.5 million additional jobs** could be created through green initiatives which will necessitate considerable **investment in reskilling and upskilling**, especially in roles requiring both technical and transversal skills.

At the European level, several **policies and initiatives** actively promote the development of **green skills** to support the shift towards a sustainable economy.

The European Skills Agenda for sustainable competitiveness, social fairness, and resilience (EC, 2020a) aims to improve the relevance of skills in the EU, ensuring that people acquire the competences needed for available jobs. The agenda comprises the following key elements:

- Working together under a Pact for Skills.
- Skilling for a job, starting from the mapping of individual's skills set and then define a targeted training to help the individual find a job on the labour market
- Developing tools that enable lifelong skills development and continuous learning.
- Set ambitious objectives for upskilling and reskilling to be achieved within the next five years.
- Increasing and mobilising investment.

As part of the European Skills Agenda the Pact for skills (EC, 2020a), is a collaborative framework for upskilling and reskilling. Members of the Pact gain access to information on skill needs, guidance on relevant funding instruments to enhance adult skills across regions, and partnership opportunities within the community.

Council Recommendation on VET for Sustainable Competitiveness, Social Fairness, and Resilience (Council of EU,2020): It outlines essential principles to ensure that VET is adaptable, responding quickly to labour market demands, and provides high-quality learning opportunities for both young people and adults.

The main bodies at the European level for training and certification are summarised as follows:

- European Centre for the development of Vocational and Educational Training (CEDEFOP): It provides information and analyses on VET systems, policies, research, and practice across Europe.

- European Qualifications Framework (EQF): It serves as a translation tool to make national qualifications more understandable across Europe, promoting lifelong learning and enhancing employability.

- European Quality Assurance in Vocational Education and Training (EQAVET): It is a community of practice dedicated to promoting the development and improvement of VET systems.

- European Credit System for Vocational Education and Training (ECVET): It facilitates the recognition of competences acquired in vocational training, allowing learners to accumulate, transfer, and apply their learning as units are completed.

- European Skills, Competences, Qualifications and Occupations (ESCO): It is the European classification system for skills, competences, qualifications, and occupations, providing a common language to bridge the gap between education and the labour market.

While qualifications and degrees from initial education and training play a key role in Europe, **alternative credentials** - such as digital badges, micro-credentials, nano-credentials, and minor awards - are increasingly viewed as **complementary or reformative additions to existing qualification systems** (Pouliou,2024). However, while micro-credentials have gained considerable attention in academic settings, **their role in ongoing labour market training is less clearly understood**.

Recognition of micro-credentials is growing in the EU, underscoring their importance in skills development and education. The **2020 EU Skills Agenda** (EC,2020a)) refers to micro-credentials as a tool to support lifelong learning pathways. The **Council Recommendation** (Council of EU,2022) adopted in June 2022 aims to foster the development, implementation, and recognition of micro-credentials across institutions, businesses, sectors, and borders. This recommendation offers foundational building blocks, including definitions and principles for designing and issuing micro-credentials.

Nevertheless, **adoption and integration of micro-credentials vary among member states**. While some have established frameworks and policies to support their development and recognition, others are still exploring their potential and implementation.

2.6.3 Sectorial Analysis

The adoption of the **European Green Deal** marks a transformative shift for the EU, redefining its approach to sustainability, economic growth, and societal wellbeing. By setting ambitious new targets and revising EU legislation, alongside introducing new proposals, the European Green Deal impacts policies and practices at local, regional, and national levels.

**Local and regional authorities** play a pivotal role in this transition:

- Support for SMEs and Micro-SMEs: They can provide essential support to small businesses, which often lack the resources to invest in innovative training or long-term initiatives. Instead, these businesses may priorities immediate needs, such as responding to shifts in value chain dynamics.

- Regulatory Competence in Health, Safety, and Environment (HSE) and VET Standards: Regions hold regulatory authority over HSE standards and, in many cases, over VET quality standards, which are critical in fostering a sustainable workforce.

- Management of Funding for Upskilling and Reskilling: Regional governments, and in some cases city authorities, oversee significant funding allocations aimed at upskilling and reskilling initiatives, ensuring that local workforces are prepared for green and sustainable transitions.

Changes related to sustainability in public administration span multiple key areas and policies. Some of the main changes include:

- Environmental policies and regulations: Public administrations are enforcing stricter environmental policies to address climate change, conserve natural resources, and reduce pollution. Examples include enhanced regulations on greenhouse gas emissions, improved air and water quality standards, and protection for vulnerable ecosystems.

- Waste management and circular economy: Governments are prioritising waste minimisation and resource maximisation through initiatives that emphasise recycling, reuse, and the principles of the circular economy.

- Education and awareness: Governments are integrating environmental education and sustainability awareness into school curricula and educational programs, including public campaigns and educational projects to foster sustainable behaviours across society.

- Sustainable public procurement: Public administrations are leading sustainable public procurement practices, focusing on products and services with lower environmental and social impacts.

- Renewable energy and energy efficiency: Governments are actively promoting renewable energy sources such as solar, wind, and hydroelectric power through tax incentives, subsidies, and financing

programs. They are also adopting regulations to enhance energy efficiency in public and private buildings.

- Sustainable food systems: Public authorities are supporting organic and local agriculture, aiming to reduce food waste and promote climate resilience in agricultural practices.

Capacity building for public authorities is essential to equip them with the knowledge, skills, and capabilities necessary for effectively driving the green transition. This empowers them to tackle complex environmental challenges, implement green policies, engage diverse stakeholders, stimulate demand for sustainable solutions, foster innovation, and lead sustainable development initiatives across all levels of governance.

# 3. Needs and cross-cutting green skills in the selected sectors: Green Skills, Training, and Micro-Credentials

## 3.1 Introduction

After analysing economic and sectoral contexts, key actions taken at both national and sectoral levels, and identifying emerging green skills, the MASTERY methodology incorporates a targeted approach for directly identifying skills development priorities within companies. This approach was implemented through multiple survey stages, forming the core of MASTERY's needs analysis methodology, which emphasizes a process of listening, synthesizing, and reworking insights gathered from direct dialogues with companies and regional stakeholders. To ensure a bottom-up approach in prioritizing the development of green skills that impact the labour system's ability to integrate green transition objectives, MASTERY used the following tools:

- An online survey directed at business contacts, HR professionals, and experts in enterprise work organization systems.
- Semi-structured interviews with key stakeholders from project sectors and influential European industries.
- Workshops involving experts in sector-level skills needs surveys, as well as national and European policymakers focused on VET system development.

For further details on the specific tools employed during each research phase, please refer to Annex 1.

## 3.2 Green Skills Focus

A primary objective of the research is to identify, drawing on all the methodologies presented, the specific **green skills needed across sectors**. **The results** of this section are mainly drawn from survey data, enriched with insights from interviews and workshops. It is worth noting that **response rates to the survey online varied across industries and countries**, but the data nonetheless offers valuable observations, revealing **common trends and needs**.

Starting with sector-specific green skills in the **agri-food sector** (Figure 2), priorities include adopting a **sustainable, resource-efficient approach through the entire value chain and food processing processes**, selecting **adequate packaging and labelling**, and implementing **climate-smart agriculture practices**.

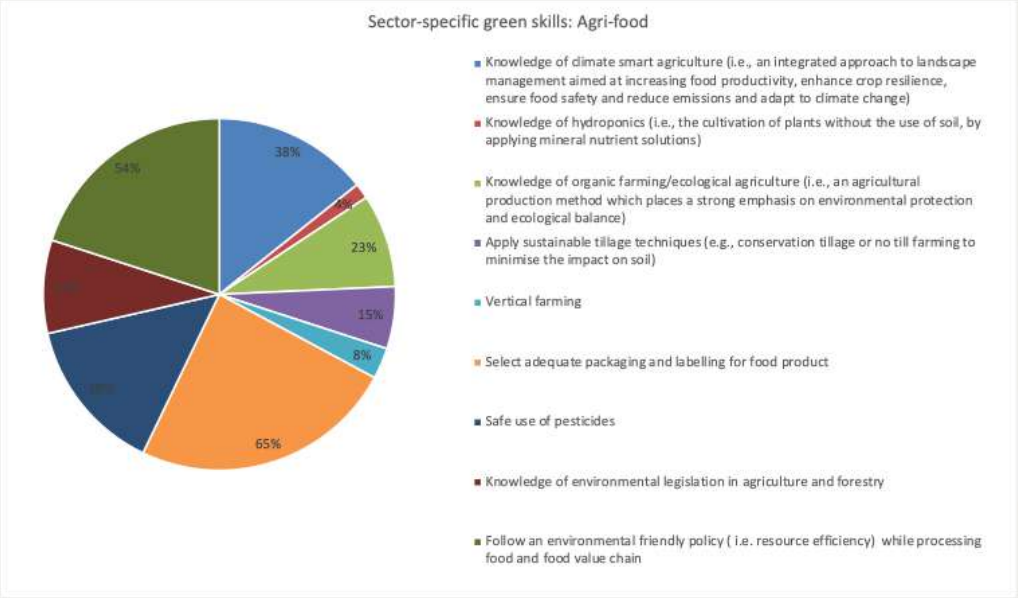


*Figure 2: Sector-specific green skills: Agri-food*

As highlighted in the survey, it is important to clarify that every action undertaken by industry actors aimed at **increasing the natural resilience of the environment**, as well as **reducing emissions and harmful anthropogenic impacts**, is considered crucial. In addition, efforts related to **pest reduction**, the application of **adequate knowledge of forestry and agricultural laws**, and adherence to **ecological and organic production** standards are also of significant value. Other skills identified by survey respondents in the agri-food sector include a focus on **animal welfare** regulations and the potential to develop a **supply chain platform** aimed at connecting all involved actors.

In the **construction sector** (Figure 3), the most important skills are related to materials: **materials advisory services for clients** and the **selection of environmentally friendly materials**. The third most significant skill is adopting **energy-efficient solutions**. Additionally, **sustainable procurement**, **environmental site evaluations**, and **selective demolition** are critical.

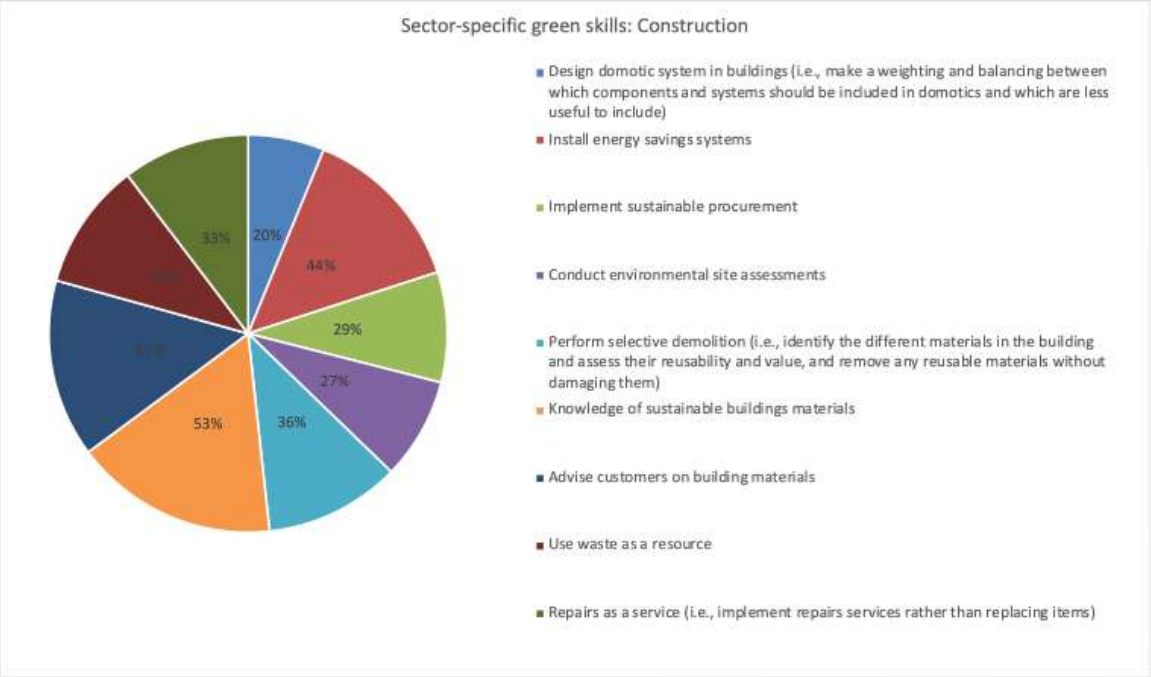


*Figure 3: Sector-specific green skills: Construction*

For the **manufacturing sector** (Figure 4), the most important skills highlighted, especially through the survey, include the **development and innovation of plants and machineries** that optimize resource and energy efficiency throughout the production process, including during logistics. Skills in **pollution monitoring**, **waste management** (from cradle to grave), and the general **adoption of a circular approach** are also highly prioritised. Just behind these are **smart production** techniques focused on waste reduction and productivity maximisation, as well as the **application of the ESG principles** across the value and supply chains.

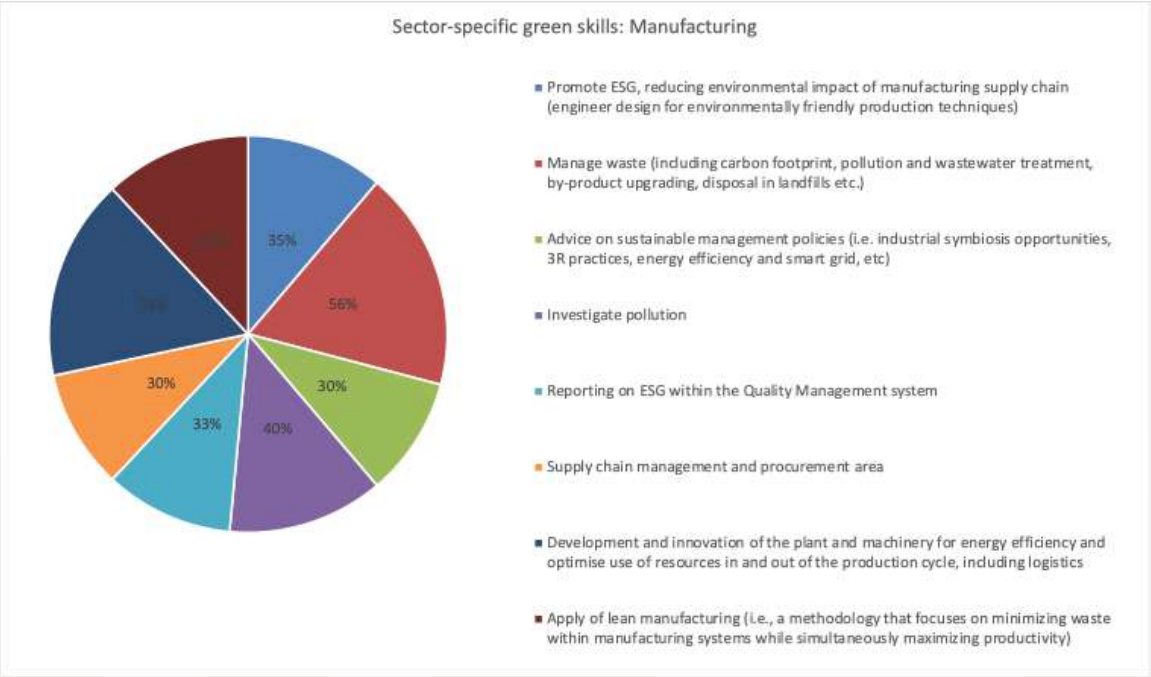


*Figure 4: Sector-specific green skills: Manufacturing*

In the **wood and furniture sector** (Figure 5), **eco-design skills** are seen as the most important, followed by skills in **waste management of harmful components**. Other significant skills include **sustainable sourcing and supply chain management**, as well as the **design and production of durable products and interchangeable components**.

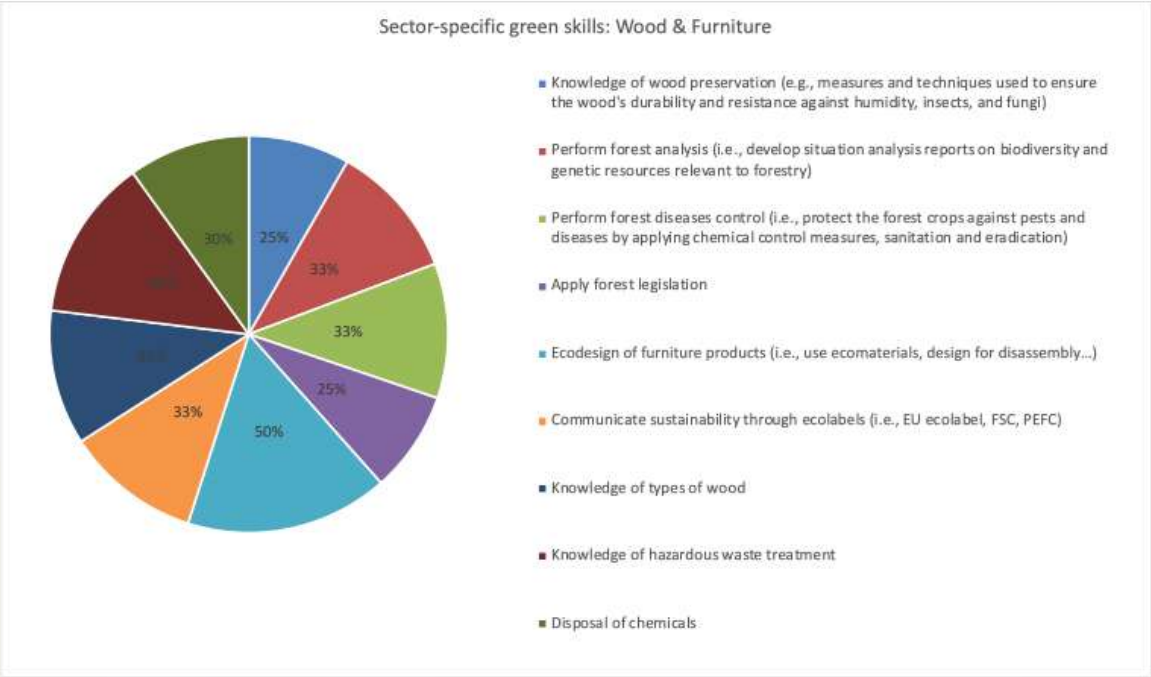


*Figure 5: Sector-specific green skills: Wood and Furniture*

To ensure a comprehensive understanding of the European market, the survey and interviews were also extended to companies beyond the industries mentioned, providing deeper insights into **transversal, soft, and digital skills** required. While soft skills do not have a direct "green" connotation, they play a crucial role in supporting or even accelerating the green transition across the European market.

**Transversal green skills** (Figure 6) are generally adaptable across sectors, but their importance varies significantly depending on the specific field and the country in which the respondents are based. These skills are also influenced by the participation of public administrations representative in the survey interviews.

The most frequently mentioned transversal green skill is the **application of principles, policies, and regulations aimed at environmental sustainability**. For Italian participants, a notable emphasis is placed on skills related to **evaluating the impact of personal behaviours** and **engaging others** towards the same goal.

On the other hand, **water, air, and general pollution control** are considered more important in countries like Bulgaria and Spain, while in Finland, where the majority of respondents are in the agri-food sector, **animal welfare** emerges as a particularly significant topic. Despite this, one informant highlighted the

importance of **providing these transversal green skills to everyone**, regardless of their sector or background:

*"The goal is making this common language accessible for people coming from different sector and with different academic level."*

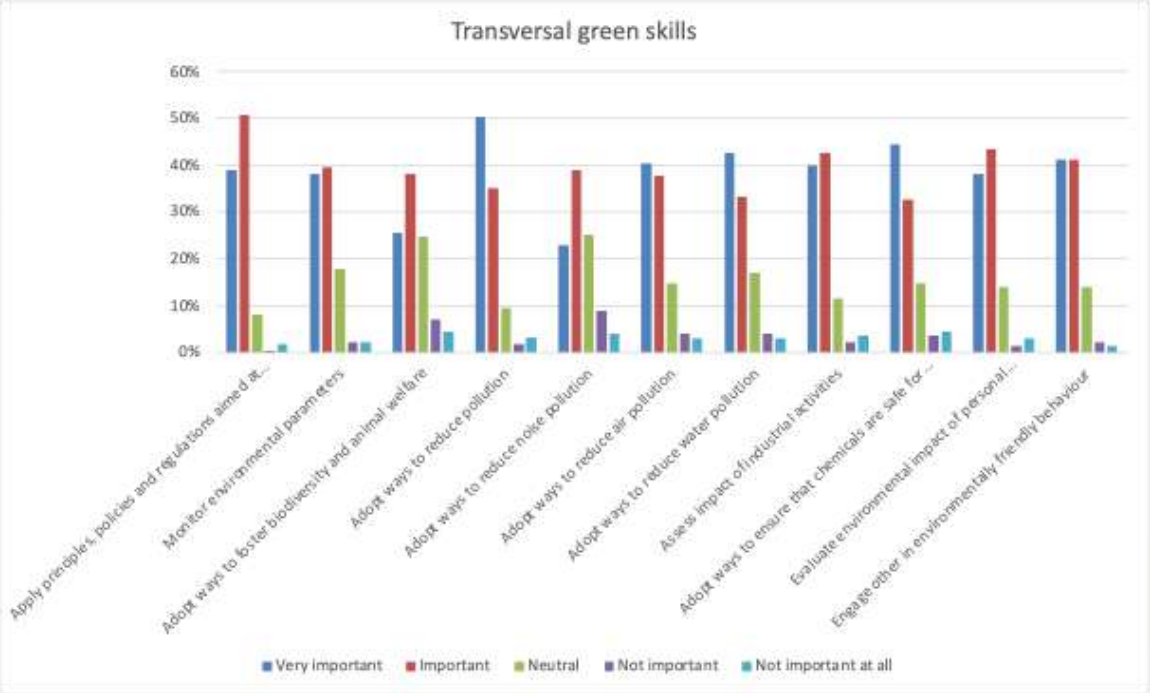


*Figure 6: Transversal green skills*

In terms of **soft skills** (Figure 7), **problem-solving**, **decision-making**, and **communication skills** are the most frequently highlighted. An important role is also attributed to the cultivation of an **inner compass** and the ability to maintain and foster an **open mindset**.

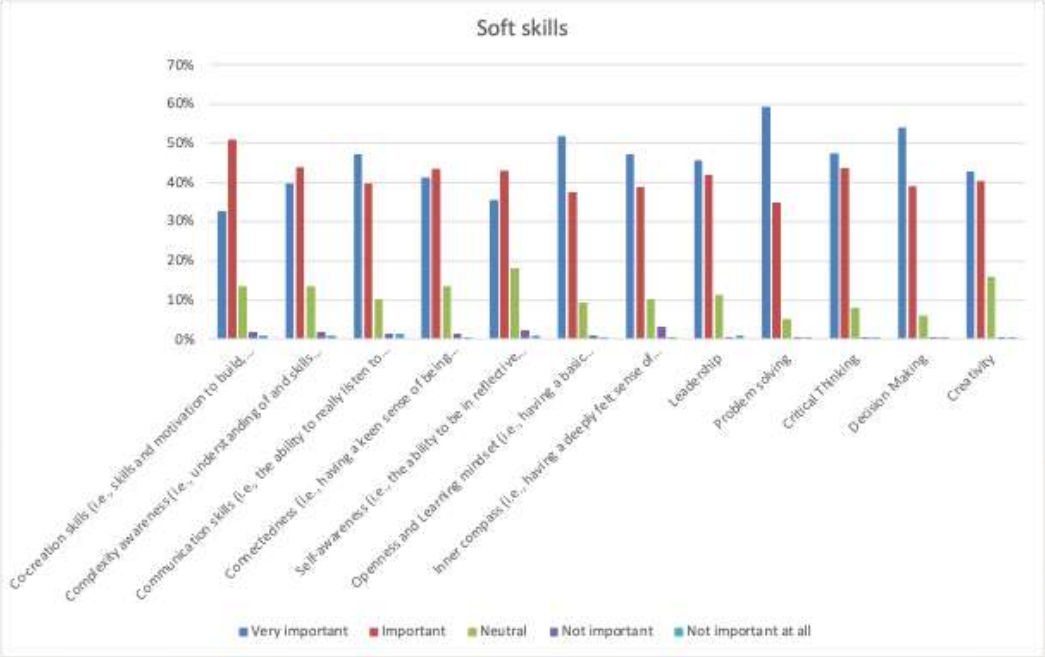


*Figure 7: Soft skills*

Despite limited training activities (see Figure 9), soft skills are **highly valued** by industries for their strategic importance. As one informant noted:

*"At the strategic level, they would need to be involved with values, creating systems".*

Finally, **digital green skills** (Figure 8) primarily refer to the use of **resource-efficient and energy-saving technologies**, which were widely and consistently rated as very important by participants. One informant emphasised the necessity of investing in digital skills to advance sustainability objectives:

*"Understanding what we generate allows us to reduce it effectively: quantifying what ends up in the trash, identifying processes for improvement. Tools and training, both digital and educational, are crucial for this purpose."*

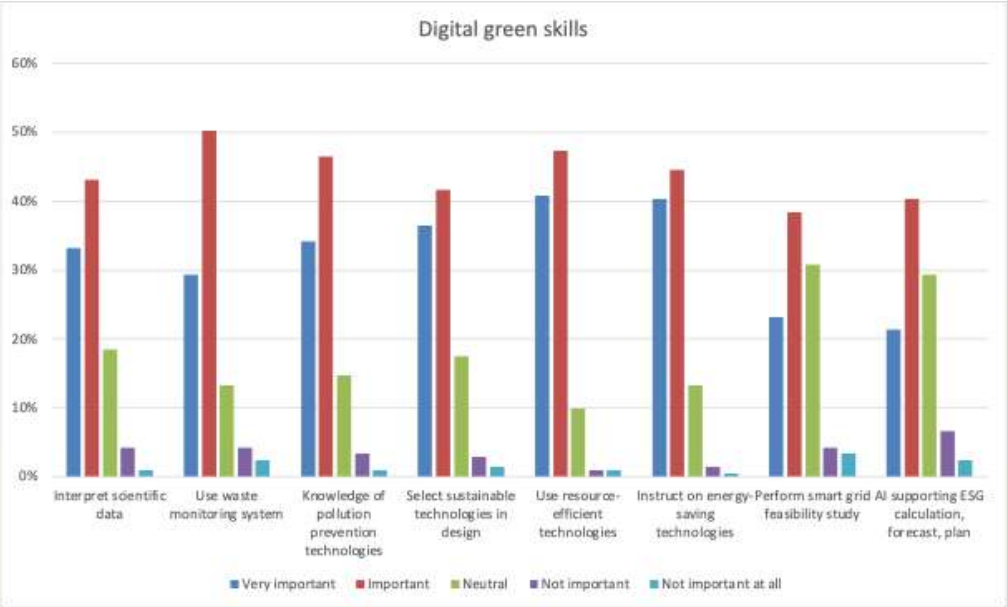


*Figure 8: Digital green skills*

## 3.3 Green Training Activities

After assessing the most critical skills based on current market demands, the research further investigates whether these needs are adequately met by **green training activities** provided at the European level across all previously mentioned categories. It also explores green training **formats**, as well as **development and implementation approaches**.

The analysis examined the extent to which **green training activities** are implemented within various organisations (Figure 8). A notable **gap** in green training activities emerges, especially considering **insufficient regulatory requirements** and the **urgent need for new policies**, as outlined in previous sections. In Bulgaria, for example, a large portion of surveyed participants reported not being involved in any green training initiatives.

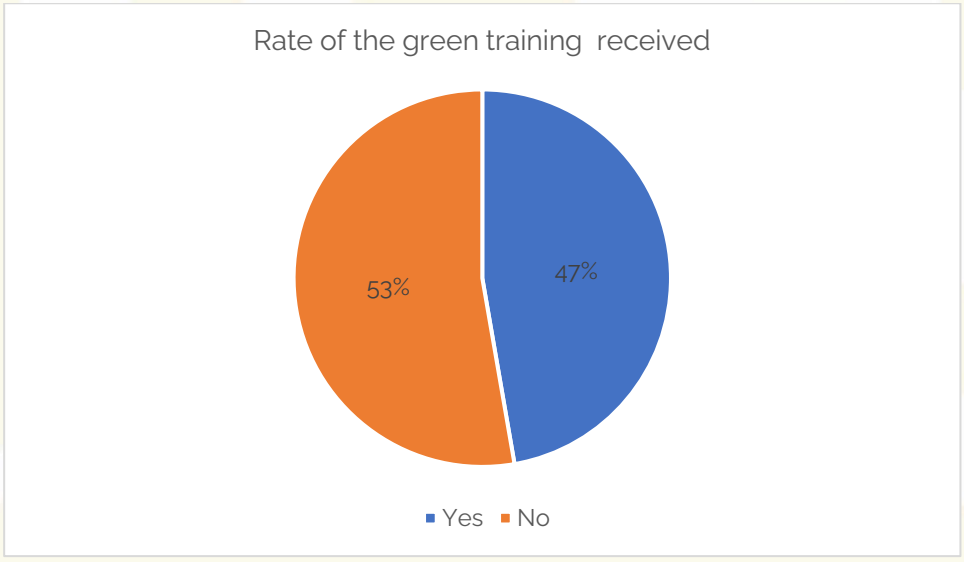


*Figure 9: Green training activities*

Across the countries and sectors examined, even where green training programs are available, they often **fall short of fully meeting the market's expressed needs**. Overall, **nearly half of all respondents indicated they had not received any form of green training**.

Some organisations do provide **on-the-job training**, although only a few respondents mentioned this approach:

*"We also train them on the job, assigning a mentor who oversees their gradual integration into our principles and way of working, so that after a certain period,*

*they can independently work and adhere to our principles and policies in this area, as well as perform their duties".*

Most organisations offering green training also incorporate **digital green skills** (Figure 10). **Soft skills** are less common (Figure 11), though strong interest in them was expressed during the interviews. An exception is Finland, where soft skills are highly valued in training activities. Finally, **transversal green skills** are not yet widely included in training activities (Figure 12), with a primary focus on applying principles, policies, and regulations aimed at environmental sustainability.

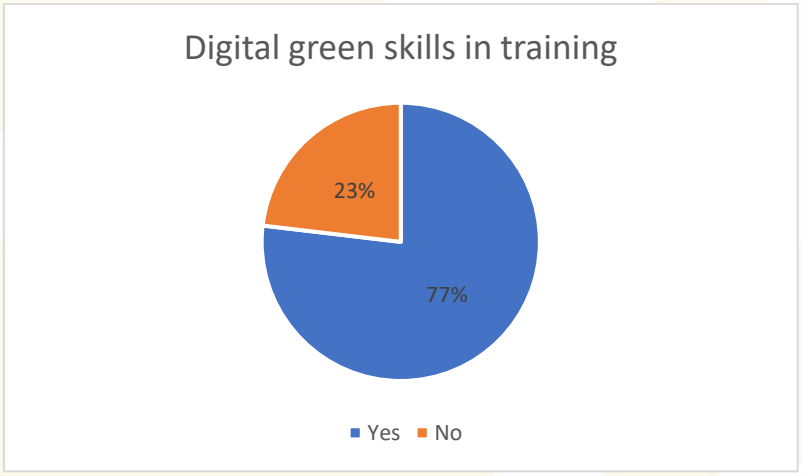


*Figure 10: Digital green skills in training*

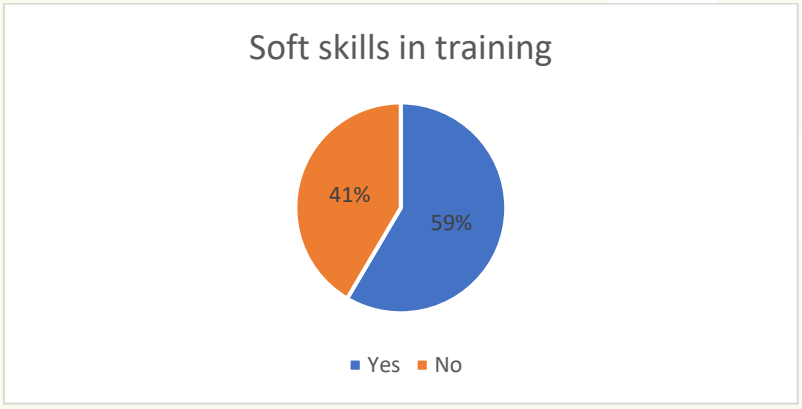


*Figure 11: Soft skills in training*

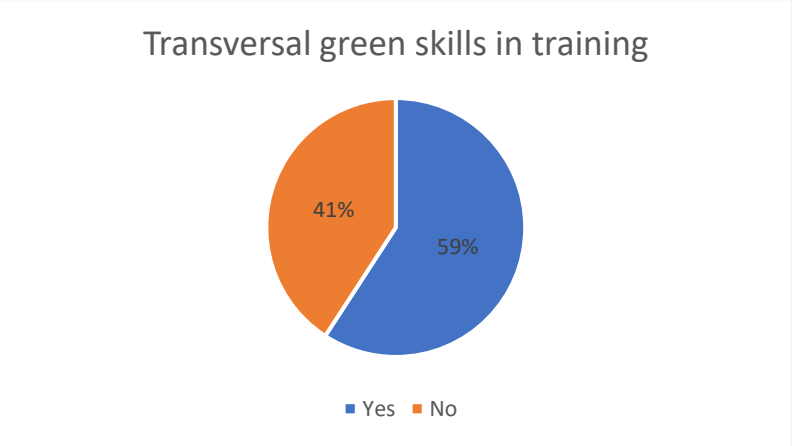


*Figure 12: Transversal green skills in training*

Considering soft skills, an **open mindset** and **communication competences** are seen as **essential prerequisites for initiating an effective green transition**, especially as people often exhibit **strong resistance to change and to new work approaches**. Digital green skills, including those related to **waste monitoring systems**, **energy-saving technologies**, and **data analysis**, are even more critical for accelerating the transition to a sustainable future.

Furthermore, a **comparison of the sector-specific green skills in training with those identified in the "green skills" section** has revealed several interesting insights. For instance, in certain sectors there are **mismatches** between the skills that received the highest ratings and those actually taught in the training activities.

In the **agri-food** industry, training focuses on the skills that scored highest in the previous section: adopting a **sustainable, resource-efficient approach through the entire value chain and food processing processes**, selecting **adequate packaging and labelling**, and implementing **climate-smart agriculture practices**.

This is not the case for the **construction** industry, where a skill that had not received much attention in terms of its importance for promoting the green transition has been given the most focus: providing **repair services** as an alternative to component replacement. Other training in the construction sector focuses on **energy-saving systems** and providing **materials advisory services for clients**.

In the **manufacturing** sector training primarily focuses on **waste management** and **ESG promotion and reporting**. However, the **development and innovation**

of plants and machineries that optimize resource and energy efficiency throughout the production process received the lowest score.

Finally, in the wood and furniture sector, training activities mainly cover eco-design, eco-labelling, and the management of hazardous waste.

The most common areas covered in training activities related to transversal green skills include applying principles, policies and regulations aimed at environmental sustainability, monitoring environmental parameters, adopting ways to reduce pollution, as well as evaluating environmental impact of personal behaviour and engaging others in environmentally friendly behaviour. Particularly in the construction sector, a strong emphasis is placed on reducing air pollution, likely due to the significant environmental impact of construction activities.

Training in soft skills varies significantly across sectors, with most activities focusing on leadership, communication, self-awareness, critical thinking, and problem-solving capacities.

The variability in digital green skills training is even more pronounced, with significant differences across the sectors. In general, training in digital green skills focuses on waste monitoring systems and energy- and resource-efficient technologies, and the ability to interpret scientific data. In the agri-food sector, energy savings technologies, including smart grids, are the mostly frequently taught. However, in the wood and furniture sector, training is centred on sustainable technologies for the design phase, and, in the construction sector, knowledge on pollution prevention technologies is emphasised, while Life Cycle Assessment (LCA) methods were commonly mentioned by representatives of the manufacturing sector.

Green training formats often prefer hybrid modalities, combining online lessons with frontal lectures (Figure 13). Despite the flexibility offered by this approach, direct interviews suggest that in-person meetings are perceived more effective. In line with these insights, other suggested formats include activity days, workshops, and information-sharing sessions through dedicated meetings.

As an informant noted regarding their training approach:

*"We often form larger groups and conduct in-person training at the company, although increasingly everything is done online. But we still do group training at the company."*

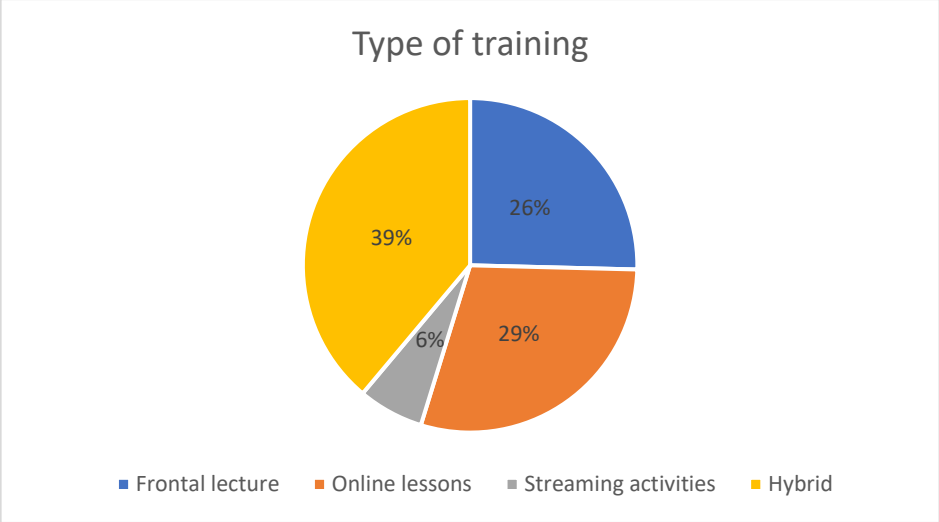


*Figure 13: Type of training*

**Training programs are typically developed by internal resources** (Figure 14). When external support is needed, home country consultants are involved, or assistance is sought from universities or other high-level institutions. Similarly, **green training is primarily implemented by internal resources**, with external home country consultant and university or other high institutions playing a supporting role (Figure 15).

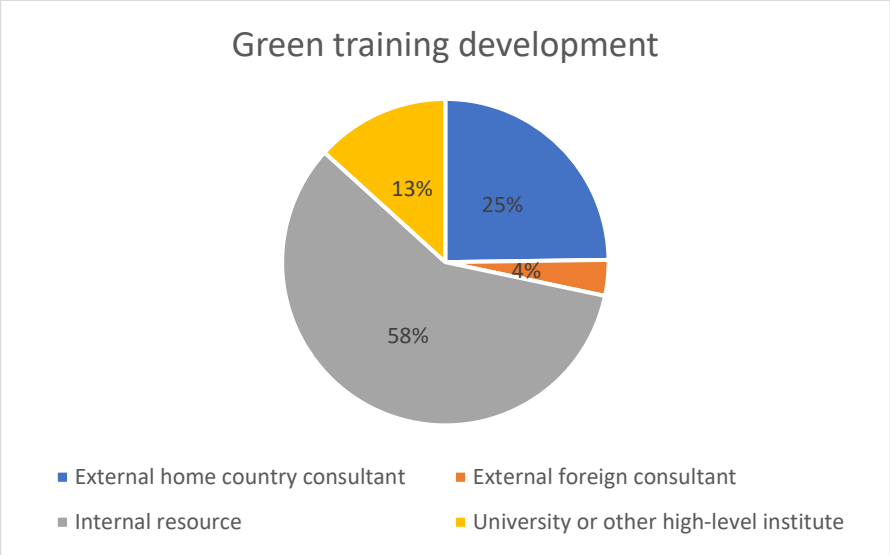


*Figure 14: Green training development*

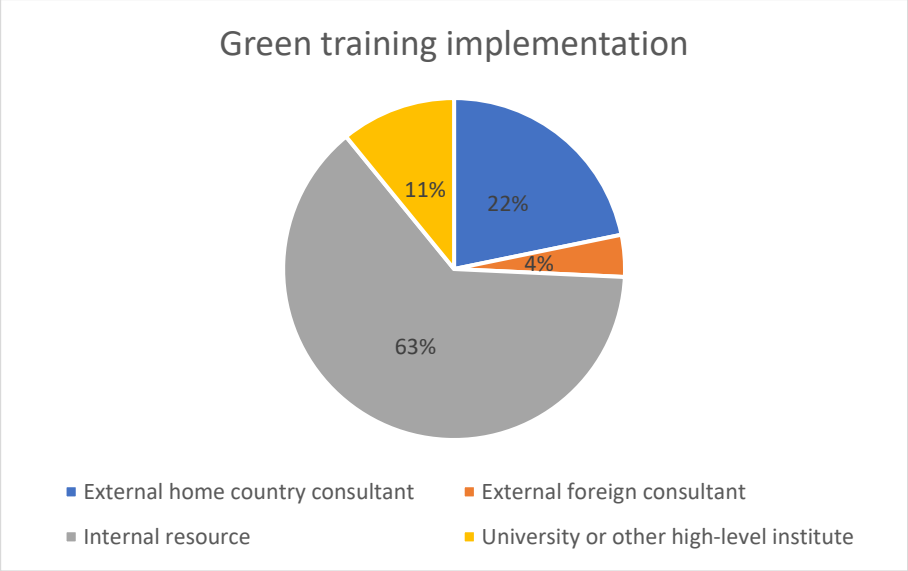


*Figure 15: Green training implementation*

Interviews with Italian organization, particularly in the manufacturing sector, have revealed the adoption of a **"learning pills" system**, which shares many similarities with the concept of micro-credential, especially in terms of flexibility and adaptability. This system **could facilitate the acceptance of micro-credentials in the workplace**.

A valuable opportunity could lie in using **micro-credentials as the final certification for a short course** focused on acquiring **ESG-related competences**, in compliance with legal dispositions. This would enhance existing sustainability modules, transforming them into targeted 20-40 hours courses available to the employers in the sector. These courses could be delivered in **a hybrid format**, combining online lessons with in-person workshops, ensuring compatibility with work schedules and while maintaining the value of face-to-face interactions. Such training would be particularly beneficial for **workers in their 40s and 50s**, who may lack full awareness of environmental sustainability issues and would greatly benefit from upskilling in this area. Additionally, this approach could support **reskilling workers in obsolete sector**, using interprofessional founds to provide tailored classes.

In the Italian metalworking industry, an **online portal**, "MetApprendo", has been developed to bring together **metalworking companies and their workers**, promoting **learning and training activities**. This portal integrates a **"digital formative dossier"** for each worker, which includes **micro-learning and training activities**. Using **blockchain technology**, the dossier tracks a secure and verifiable record of their skills and training.

**The MetApprendo portal** serves as a learning management tool for affiliated companies, helping them **plan training formats and desired outcomes**. **Every learning activity is recorded in the online dossier**, whether linked to MetApprendo's micro-learning modules or external programs. The dossier is **portable** and can be used to **certify workers' training achievements and career progression**. The model could easily be adapted to micro-a credential system and applied in several sectors, offering a standardized approach to recognising and tracking professional development.

## 3.4 Micro-Credential knowledge

**Micro-credential knowledge remains limited** (Figure 16), with more than half of the survey respondents (52%) reporting they are **very unaware** or **unaware** of micro-credentials. Furthermore, it is important to note that a significant number of respondents expressed **neutrality** towards micro-credentials (20%). While they may have heard of them, they are either unable to describe them or understand their potential use. As a result, the number of people unfamiliar with the concept of micro-credentials is even higher.

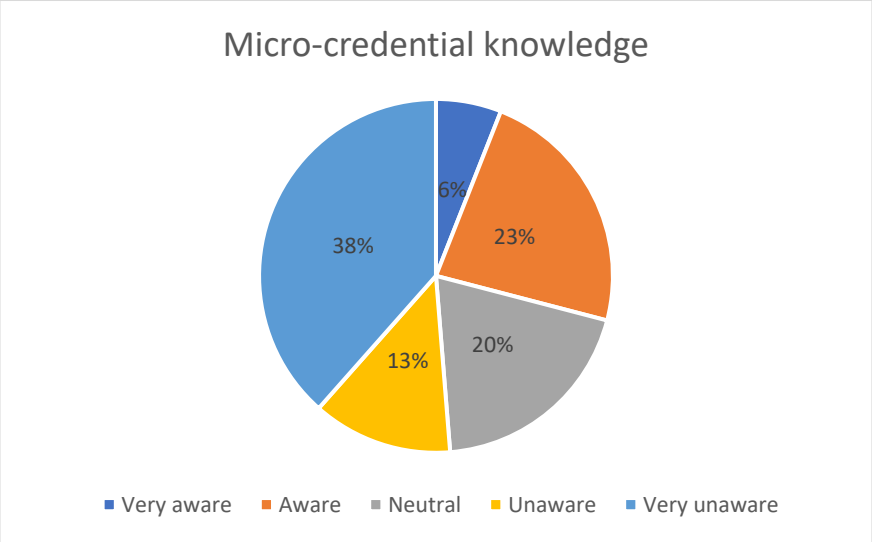


*Figure 16: Micro-credential knowledge*

These findings are further supported by interviewees, as one of them highlighted:

*"We don't know how it works, we don't have information regarding micro-credentials, but we are very interested in knowing more information and, probably, to include them in our training".*

Even when similarities in training activities exist, the **impossibility to compare and formalise sectorial initiatives** makes the widespread adoption of short-term certifications and their international recognition even more difficult.

Despite these challenges, after explaining the role of micro-credentials in the training and education system, **more than half of the respondents (57%) acknowledged their usefulness** (Figure 17).

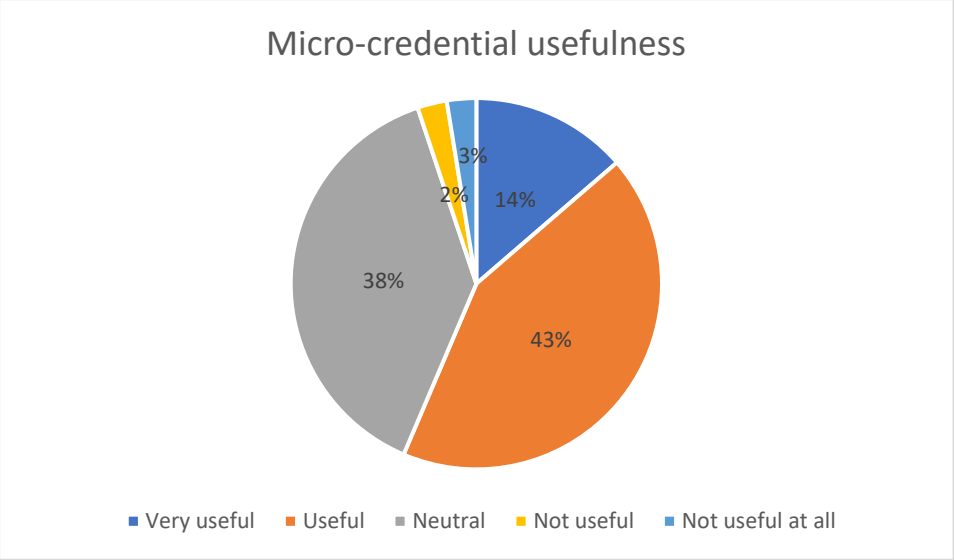


*Figure 17: Micro-credential usefulness*

## 3.5 Labour Market and Professional Qualification System Rigidities and Barriers

**Potential rigidities and barriers** that can alter the use and diffusion of a micro-credential system are primarily related to a **lack of integration** between micro-credentials and existing qualification frameworks, **insufficient awareness and collaboration** between educational institutions and the private sector, and the **absence of a harmonized, international framework**. These challenges are further exacerbated by the difficulty in **identifying specific skills** for training activities, the **interdisciplinary nature** of the green transition, and the **resistance to change** within certain segments of the workforce. Additionally, **limited support for SMEs**, along with the **absence of effective legislative frameworks and clear policy guidelines**, might further impedes the widespread adoption of micro-credentials.

**Experiences from the Netherlands** (Wesselink,2023) **and Germany** (Haseloff,2023) - both demonstrating strong performance in the most critical phase of the CEDEFOP's European Skill Index (ESI), skill activation - have revealed critical points, barriers, and potential benefits of short training activities. Despite strong interest in micro-credentials, their uptake has been generally slow, as evidenced by the low level of awareness of this concept. As a result, the Netherlands had to rely on Edu badges analysis as a proxy for micro-credentials, since they are best known and are the results of a formal learning outcome like micro-credentials. Moreover, open badges, issued after an informal learning activity, have been included in the analysis.

The **adoption of short learning courses from private sector is even more complex** and primarily linked to the use of open badges, not linked to formal training, as only students registered with educational institutions are eligible to receive Edu badges, but not professionals. Despite this, the fact that private sector is already adopting a training activity related to informal learning, open badges, gives the opportunity to harmonise them with Edu badges or micro-credential related to formal learning activity, giving financial incentives for VET providers and bridging the gap between the recognition and value of badges for both employees and Higher Education (HE) students. As one informant pointed out:

*"It's complicated because each party progresses towards green goals at different rates".*

Main barriers to widespread adoption of micro-credentials include the lack of integration between Edu badges and qualification systems, the inability to accumulation Edu badges toward full qualification, and the absence of a shared understanding of the core characteristics of micro-credentials. Additionally, there is no common international framework in place.

These challenges could potentially be addressed by the MASTERY project, as it contributes to the development of an instrument applicable across different sectors and countries. Micro-credentials and Edu badges are seen as valuable opportunities to maintain high levels of engagement in learning activities, for both students and employees. Their small, flexible format allows for a modular approach and is action-oriented, market-driven, and portable, making them an attractive option for both personal and professional development.

The interviews revealed consistent findings, with additional insights on the importance of defining specific levels for micro-credential learning programs based on the existing background knowledge of the participants. Interviewees also emphasized the need for a "joint transversal role" to ensure the proper application of policies and laws supporting environmental sustainability.

A key issue highlighted was the fragmentation that could affect the quality and effectiveness of micro-credentials. This fragmentation underscores the need to involve not only organizations focused on high-level training but also policy-level bodies and higher education institutions.

Another critical point raised is the lack of harmonization in the micro-credential system. There is a need to develop a framework that is not limited to specific industries or countries but can be applied across sectors and internationally. In terms of responsibility. International organizations or EU-level bodies must define which organisations should be directly involved in the application of micro-credentials within education and training programs, first at EU level and then at national level. This process can be simplified by integrating micro-credentials with existing initiatives at the country level.

The difficulty of establishing stable collaboration between the public and private sectors remains a complex barrier. A key aspect identified by the experts is the need for a legislative framework addressing, among others, greenwashing sanctions and supporting green procurement. Such a framework would help both organizations and consumers actively engage in the transition.

Public support is especially critical when considering the **challenges SMEs face,** which often lack the resources to adopt sustainability principles. Two interviewees, for example, highlighted these criticalities, noting that limited resources and a lack of sustainability knowledge are significant barriers for many small businesses.

*"The smaller companies couldn't do that. They didn't have the knowledge, they didn't have the time, they didn't have the money".*

*"Many of my colleagues lack knowledge of and about sustainability. In addition, we do not think solution-oriented and come up with short-term solutions".*

Another key challenge is the **lack of a common European framework** supporting the integration of micro-credentials into national education systems. Such a framework would help **define the scope** of micro-credentials' impact, regulate the emergence of **joint multidisciplinary roles** to support compliance with laws and sustainability requirements, and ensure **alignment across countries**. Additionally, the framework should include a **monitoring system** connected to country-specific performance indicators to assess micro-credentials effectiveness in promoting positive learning outcomes. The dissemination of **best practices and successful experiences**. could further support it.

The framework should also clearly define the **resources dedicated to supporting micro-credentials**, along with the **roles and responsibilities** of the actors involved, particularly at policy level. For micro-credentials to become mainstream, **support from companies, sectorial organisations, and employers' organisations** is essential, as these are groups directly involved in the green transition.

Another barrier is the **difficulty in identifying specific skills to focus on in training activities**. Some interviews, particularly with public organizations operating in the waste management sector, revealed that even sustainability experts struggled to define the relevant skills for the sector's green transition. This issue highlights one of the key features of the green transition: its interdisciplinarity and holistic nature. Given the complexity of the process, which touches on a wide range of aspects, interviews emphasized the importance of transversal skills, such as those related to circular economy, circular procurement, and knowledge of tools like green SWOT analysis for assessing environmental impacts.

Finally, interviews highlighted the **lack of an effective training culture** and **significant resistance to change**, especially among a segment of the active workforce that missed formal sustainability education. While not yet at retirement age, this group often shows limited interest in upskilling or reskilling, further complicating efforts to advance sustainability-focused competencies.

*Table 1 - Green skills emerging from the MASTERY survey*

| Sector | Sector-specific green skills | Sustainability Management and Transversal skills |
|---|---|---|
| Agri-food | • Developing and applying resource-efficient approaches through the entire value chain and food processing processes<br>• selecting adequate packaging and labelling<br>• Implementing climate-smart agriculture practices | • Green procurement<br>• Waste management<br>• Application of ESG principles<br>• Application of principles, policies, and regulations aimed at environmental sustainability<br>• Monitoring of water, air, and general pollution |
| Construction | • Advisory services on materials for clients<br>• Selecting environmentally friendly materials<br>• Environmental site evaluation<br>• Selective demolition | |
| Manufacturing | • Developing and innovating plants and machineries<br>• Monitoring pollution<br>• Smart production | |
| Wood and Furniture | • Eco-design<br>• Knowledge of hazardous waste treatment<br>• Design and production of durable products and interchangeable components | |
| **Rigidities and barriers** | • Insufficient awareness and collaboration between educational institutions and the private sector<br>• Difficulties in establishing stable collaboration between the public and private sector<br>• Absence of effective legislative frameworks and clear policy guidelines<br>• Absence of a harmonized, international framework<br>• Limited support for SMEs<br>• Difficulties in identifying specific skills for training activities<br>• Interdisciplinary nature of the green transition<br>• Resistance to change<br>• Lack of integration between existing badges and qualification systems<br>• Impossibility to accumulation existing badges toward full qualification<br>  • Lack of integration between micro-credentials and existing qualification frameworks<br>  • Absence of a shared understanding of the core characteristics of micro-credentials | |

# 4. Developing the Marker Set and Selecting Priorities to Design the Micro-Credential System

The MASTERY methodology for identifying emerging green skills, intended for development and certification through micro-credentials, is enhanced by referencing these skills within the **European ESCO framework**. This process aligns the identified priority skills from the MASTERY survey with the ESCO framework, structuring the design and certification of related micro-credentials. MASTERY ensures that the developed micro-credentials are relevant, standardized, and aligned with broader labour market trends, by mapping emerging skills to a recognized European framework, This provides clarity and consistency in reacknowledging and validating green skills across Europe.

The objective to develop **12 macro-categories of green skills** - against **EQF 5, 6, and 7 competencies** - declined in the **ESCO framework**, ensuring high scalability of the MASTERY methodology and outputs. The ESCO framework descriptors, serve as a **reference model** for designing future training pathways, supporting modularity and customisation of learning experiences.

In addition, **criteria for selecting priorities** to identify relevant green skills and design the micro-credential system are presented to provide insights on tackling the increasing concerns about micro-credential quality. This includes **criteria to select key green skills** for which applying a micro-credentials process will allow addressing the current education and training needs caused by fast-changing knowledge development and labour market demands for the green transition. In addition, it suggests **criteria to apply to face the growing number of diverse alternative credentials**, reinforcing a sharable understanding of micro-credential.

## 4.1 Micro-Credential Marker Set

In line with the EU Council's 2022 recommendations on a European approach to micro-credentials (EU, 2022), it is crucial to assess the effectiveness of micro-credentials both before and after their implementation. To this end, the MASTERY project seeks to establish a shared benchmark for selecting and describing green skills and their corresponding micro-credential system (see Table 2).

This benchmark will support further developing micro-credential systems for green skills, ensuring consistent and meaningful integration across various sectors and countries.

In December 2021, the EC published **"A European Approach to Micro-Credentials"** (EC, 2021b) identifying ten **EU standard elements** micro-credentials should include. The standard elements are reported in the following Table 2.

The activity performed throughout this phase of the project explicitly and directly integrates these principles while defining the content of the micro-credentials and the principles and rules that partners should be follow while implementing them, aiming to create a European Joint methodology validated at local, national, international and European level.

*Table 2 – Principles for a European approach to micro-credentials*

| Principle | Characteristic |
|---|---|
| Quality | Micro-credentials are subject to both internal and external quality assurance by key stakeholders. |
| Transparency | Micro-credentials are measurable, comparable, and understandable with clear information on learning outcomes, workload, content, level, and the learning offer. |
| Relevance | Micro-credentials are distinct, targeted learning achievements, and learning opportunities designed to meet identified learning needs. |
| Valid assessment | Micro-credential learning outcomes are assessed against transparent standards. |
| Learning pathways | Micro-credentials support flexible learning pathways, including the possibility to stack, validate, and recognise micro-credentials from across different systems. |
| Recognition | Micro-credentials are recognised based on standard recognition procedures for academics or employment and are comparable across EU. |
| Portability | Micro-credentials are owned by the credential-holder (i.e., the learner), who can store and share them easily, including through secure digital wallets (e.g., Europass). |
| Learned-centered | Micro-credentials are designed to meet the needs of the target group of learners. |
| Authentic | Micro-credentials contain sufficient information to check the identity of the credential-holder (i.e., the learner), the legal identity of the issuer, and the date and location of issuance |
| Information and guidance | Information and advice on micro-credentials should be incorporated into lifelong learning guidance services. They should reach the broadest possible learner groups, inclusively, supporting education, training, and career choices. |

The criteria for selecting priorities in designing the MASTERY micro-credential system for green skills encompass both ex-ante (before implementation) and ex-post (after implementation) considerations. These criteria include all standard elements required for a transnational European application of micro-credentials, as outlined in the EU Recommendation (2022) and summarised in Table 1. By aligning with these criteria, the project aims to promote a robust and harmonized approach to micro-credentials, fostering their broader recognition and application across Europe and different sectors.

The ex-ante criteria aim to identify green skills gaps that micro-credential could effectively address, ensuring alignment with sectoral and market requirements. They also aim to determine the most impactful formats and approaches for upskilling and reskilling both employed and unemployed individuals. In addition, these criteria help ensure that micro-credentials are adaptable to international standards, making them applicable across different countries and industries.

In the design phase, the ex-ante criteria should include:

1. Ex ante criteria

*Marker 1.1. Company involvement*

MASTERY's bottom-up approach emphasizes active enterprise participation in analysing green skills needs. This is achieved through direct engagement methods, such as interviews, and indirect actions facilitated by key stakeholders, including sectoral representatives at the European and national levels, and experts in educational innovation systems. These efforts help sustain corporate involvement, even among companies less aware of the evolving competitive dynamics driven by green transition strategies. Among the potential indicators of this marker, there are:

- Representation in surveys: check whether companies from relevant sectors have actively participated in surveys or consultations.
- Direct dialogue: confirm using semi-structured interviews, workshops, or focus groups involving company representatives (HR professionals, sustainability officers, etc.).
- Industry diversity: ensure the involvement of companies of various sizes (SMEs, large enterprises) to capture a broad perspective.

*Marker 1.2. Feedback loop between Education and the Labor market*

The MASTERY partnership, structured around the collaboration of business system representatives and VET providers, underscores the critical role of information exchange between Education and the Labor Market. This circular flow of information is essential to maximizing micro-credentials' impact on shaping relevant curriculum content. To support this objective, the following actions are proposed as examples for consideration:

- Stakeholder engagement: assess whether VET providers, policymakers, and employers have been engaged in a collaborative process.
- Curriculum relevance: ensure that the latest labor market trends and employers need information educational programs.
- Skills matching: check alignment between the skills defined in the analysis and actual job descriptions or required competencies from employers.

*Marker 1.3. Mapping of Green policy frameworks*

The evolving nature of the green transition as a key driver of competitiveness within the European economic system necessitates the continuous reassessment and realignment of policies, priorities, development opportunities, and business investments. These adjustments ensure that green skills are effectively tailored to emerging needs. At this stage, the actions to be undertaken include:

- Policy inventory: confirm that key EU and national policies impacting green skills (e.g., Net Zero Industry Act, etc.) have been identified.
- Sector-specific analysis: ensure that sectoral policies (e.g., waste management, renewable energy) influencing skill needs are included in the mapping.
- Timeline analysis: check whether the mapping considers upcoming or revised legislation that could affect skill requirements.
- Alignment with ESCO, UNESCO Green skills framework, : ensure that the emerging skills are categorized using frameworks like ESCO for coherence with European standards, or justify the innovative scope of the emerging skill.

*Marker 1.4. Validation of findings*

The green skills survey must undergo validation to ensure both the accuracy of the identified emerging skills and the proper interpretation of survey findings. Key actions to address this requirement include:

- Expert review: confirm sectoral experts' involvement in validating the skills analysis findings.
- Benchmarking: comparing identified skills with similar initiatives or reports at the international level to ensure relevance and consistency.
- Stakeholder workshops: facilitate sessions with employers, educators, and policymakers to interpret findings collaboratively and refine conclusions.

Ex-post criteria focus on evaluating the long-term effectiveness of the micro-credential system. These criteria encompass a structured verification process addressed to attendees and, when possible, gathering insights from employers. Additionally, they include an analysis of improvements in working climate, organisational reputation, and overall performance linked to implementing a micro-credential system for green skills.

The following ex-post criteria and markers are proposed to ensure the sustainability and impact of a micro-credential system for green skills:

2. Ex post evaluation

*Marker 2.1 Participant outcomes:*

The MASTERY approach places the individual at the core of micro-credential utilization, emphasizing the importance of feedback on their usability from the individual's perspective. Consequently, ex-post evaluation prioritizes understanding how micro-credentials support personal and professional growth. Actions to support this evaluation could include:

- Skill application: assess the extent to which attendees apply the acquired green skills in their job roles.
- Career progression: track improvements in participants' career trajectories (e.g., promotions, job transitions, or increased responsibilities in green-related roles).

*Marker 2.2 Employer feedback:*

From the perspective of the impact of micro-credentials for green skills on business competitiveness, the proposed actions include:

Integration into business strategy: ensure that green skills micro-credentials align with organizational sustainability goals and strategic plans.

Skill relevance and adaptability: regularly update micro-credentials' content to reflect emerging green technologies and practices.

*Marker 2.3 System evolution:*

Analysing improvements in working climate, organisational reputation, and overall performance might reveal interesting insights on how green training activities influence organisations' internal operations and external perceptions. Possible actions are aimed at to test:

- Adaptability: examine how well the micro-credential system evolves to address emerging green skills and integrate advancements in policy or technology.
- Scalability: evaluate the system's ability to expand micro-credential across sectors, regions, or professional levels.

Table 3 summarises the criteria for selecting priorities to identify green skills and quality standards in the design of a micro-credential system.

*Table 3: Quality criteria for designing a micro-credential system*

| Phase | Markers | Actions |
|---|---|---|
| Ex-ante | *Company involvement* | Ensure alignment with current education and training needs by engaging directly with key stakeholders (e.g., companies, public administration, VET providers, NGOs, etc.) |
| | *Feedback loop between Education and the Labor market* | Establish a circular and collaborative process. ensuring that the latest labor market trends and employer needs inform the latest labor educational programs |
| | *Mapping of Green policy frameworks* | Assessing the alignment between the labour market and policy framework at the European and national level |
| | *Validation of findings* | Results assessment through experts validation, benchmark alignment and stakeholder workshops |
| Ex-post | *Participant outcomes:* | Assess through different indicators the career improvement of the learner |
| | *Employer feedback:* | Assess the integration of green skills inside the firm business strategy and everyday activity |
| | *System evolution:* | Assess the adaptability of micro-credential to new emerging trends |

## 4.2 Priorities to Design the Micro-Credential System

The selection of priorities to design the MASTERY micro-credential system first involves establishing a referencing of green skills with the competency descriptors tracked in ESCO **Framework**. This referencing aims to create a structured approach to green skills development, ensuring consistency and alignment with existing European classifications. In addition, insights are provided on the **development and implementation of micro-credentials**.

Here we identified some key points that can be applied for defying the micro-credential system for green skills, also referring to EU recommendations (EU, 2021).

### 4.2.1 Green Skills for Micro-Credentials

Research findings identified the **skills deemed most relevant for driving the green transition**, as recognised by stakeholders across the industries NS confirmed by MASTERY partners. To enhance the reliability of these findings, green skills were carefully selected and analised referencing to the **ESCO framework** and official **European guidelines**, including **CEDEFOP recommendations**. Following **expert evaluations and consultations**, the implementation of the MASTERY micro-credential system has been recommended for the following **12 macro-categories of green skills (GS)**:

- GS1: Select sustainable resource efficient approaches through the entire agri-food value chain (sector-specific skill: Agri-food)
- GS2: Select environmentally friendly materials and components for buildings (sector-specific skill: Construction)
- GS3: Design innovative, energy- and resource-efficient machines and systems for manufacturing processes (sector-specific skill: Manufacturing)
- GS4: Cradle-to-cradle design (sector-specific skill: Wood and Furniture)
- GS5: Reduce waste and material outputs (transversal skill)
- GS6: Advise on sustainability certifications and standards (transversal skill)
- GS7: Measure and report sustainability performance (transversal skill)
- GS8: Ensure compliance with environmental legislation (transversal skill)
- GS9: Educate on environmental sustainability concepts (transversal skill)
- GS10: Implement circular, green, and socially responsible procurement (transversal skill)

- GS11: Develop and implement joint sustainability initiatives (transversal skill)
- GS12: Evaluate sustainable investment opportunities (transversal skill)

Table 4 summarised the key features of the 12 selected macro-categories of green skills comparing the result obtained with the research activity with the ESCO dataset definitions. *Label* indicates the skill's identification according to the selection made with informants and workshops. *Macro-categories* indicate the groups to which the green skills is part, built on literature analysis. *Status* means the presence/absence in the ESCO framework. Finally, *broader concept* refers to the ESCO framework. Further adaptations with respect to national and sectoral needs along with any deviation and innovation with respect to the ESCO data will be carry out in the subsequent work packages relating to the definition and implementation of the micro credential courses.

*Table 4: Selection of 12 macro-categories of green skills*

| No. of the Green Skills | Skill Label | Macro category | Status | Reuse level | Green skill preliminary description | Referencing to Professional Area reported in the ESCO framework |
|---|---|---|---|---|---|---|
| GS1 | Select adequate packaging for food products | Production | Partially released | Sector-specific | Choose the appropriate packages for food products balancing out various aspects such as cost, attractivity and compliance with regulations and environment protection. | • Making decisions<br>• Estimating resource needs |
| GS2 | Select environmentally friendly materials and components for buildings | Advisory | Partially released | Sector-specific | Identify and select environmentally friendly materials and components for buildings, considering circular economy principles. | • Advising on design or use of technologies<br>• Designing buildings<br>• Complying with environmental protection laws and standards |
| GS3 | Design energy- and resource-efficient machines and systems for manufacturing processes | Production | Not released | Sector-specific | Develop design specifications to create or renovate manufacturing machines and systems that ensure efficient use of raw materials and energy. | • Designing industrial materials, systems, or products |

| | | | | | | |
|---|---|---|---|---|---|---|
| GS4 | Implement Eco- design solutions | Production | Not released | Sector-specific | Integrate circular economy,industrial symbiosis, cradle to cradle approach principles, waste management strategies to reduce the carbon and environmental footprint of products. | • Circular Economy<br>• Industrial Symbiosis<br>• Waste management or harmful components<br>• Eco-design and design for disassembly |
| GS5 | Reduce waste and material outputs | Production | Released | Cross-sector | Coordinate the operations of a facility or organisation to prevent waste generation and promote reuse. | • Leading others<br>• Managing waste<br>• Directing operational activities |
| GS6 | Advise on sustainability certifications and standards | Advisory | Not released | Cross-sector | Provide guidance on obtaining sustainability certifications and ensuring compliance with relevant standards | • Advising on environmental issues<br>• Ensuring compliance with environmental legislation |
| GS7 | Measure and report sustainability performance | Reporting | Partially released | Cross-sector | Monitor and document key sustainability indicators to evaluate organisational performance in alignment with the Sustainable Development Goals (SDGs) and international sustainability reporting standards (e.g., GRI and ISO 26000), including analysing data, preparing detailed reports, and providing actionable insights to support strategic decision- | • Complying with environmental protection laws and standards<br>• Monitoring operational activities<br>• Monitoring environmental conditions<br>• Reporting facts |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | making and regulatory compliance. | |
| GS8 | Ensure compliance with environmental legislation | Compliance | Released | Cross-sector | Ensure that the processes are compliant with environment regulations and best practices. Monitor activities and perform tasks ensuring compliance with standards involving environmental protection and sustainability, amening activities in the case of changes in environmental legislation. | • Ensuring compliance with legal requirements<br>• Complying with environmental protection laws and standards<br>• Advising others |
| GS9 | Educate on environmental sustainability concepts | Education and Communication | Not released | Cross-sector | Deliver education and training to organisations and individuals on key sustainability concepts, promoting a shared understanding of environmental principles, while fostering engagement in sustainable practices, both within organizations and in wider communities, to encourage environmentally responsible behaviours and actions. | • Communicating about sustainability<br>• Engaging others in environment friendly behaviours<br>• Instruct others |
| GS10 | Implement circular, green and socially responsible procurement | Compliance | Not released | Cross-sector | Use procurement as a strategic tool to achieve sustainability goals. | • Ensuring compliance with legal requirements<br>• Complying with environmental protection laws and standards<br>• Sustainable procurement |

| | | | | | | |
|---|---|---|---|---|---|---|
| GS11 | Develop and implement joint sustainability initiatives | Education and Communication | Not released | Cross-sector | Envision, plan, and develop collaborative strategies for companies and organisations aimed at achieving different shared sustainability goals, including creating new markets, enhancing resource efficiency, and upgrading equipment and infrastructure to align with sustainability objectives. | • Collaborating<br>• Implementing joint initiatives |
| GS12 | Evaluate sustainable investment opportunities | Advisory | Not released | Cross-sector | Integrate environmental, social and governance (ESG) considerations when making business or investment decisions, leading to increased longer-term investments into sustainable economic activities and projects. | • Developing financial, business or marketing plans<br>• Managing budgets or finances<br>• Promoting sustainability |

### 4.2.2 Identification of the Learner

Since micro-credentials encompass both formal and informal learning, it is crucial to define **potential working profiles** associated whit these courses. On a general level, two main categories of learners can be identified:

- **Current workforce**: This group includes individuals already employed in key industries, who require reskilling or upskilling to meet evolving market demands. Often aged 40-50, these workers are positioned between formal education and retirement, seeking training to maintain relevant skills.
- **Future workforce**: This group includes individuals entering the labour market for the first time and needing to align their skills with employer expectations for green and sustainable competencies.
- **Public Administration target groups** included in current and future workforce

In the case of the MASTERY project, the design of micro-credential courses in VETs, universities, and industries targets **EQF 5-6-7 training pathways**. The European Qualification Framework (EQF) encompasses **eight level of learning outcomes**, covering all types and all levels of qualifications, and connecting with **national qualifications frameworks**. The level increases according to the level of proficiency, level 1 is the lowest and 8 the highest level. EQF 5 specifically refers to **post-upper secondary education**, such as higher national diplomas. It focuses on disseminating comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that **knowledge**. This expertise is associated with a comprehensive range of cognitive and practical **skills** required to develop creative solutions to abstract problems. It also encompasses **responsibility and autonomy** in exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others.

### 4.2.3 Identification of the Context

**Countries and sectors** involved help support the development of micro-credentials in the **agri-food**, **construction**, **manufacturing**, and **wood and furniture** sectors, while offering learning opportunities in the field of **sustainability management and transversal skills** in the following countries:

- Spain

- Bulgaria
- Belgium
- Italy
- Finland

## 4.2.4 Development and Implementation of Micro-Credentials

While **general considerations** can be made, the development, implementation, and delivery of micro-credentials must adhere to the **specific regulations and rules adopted by each participating country**.

### 4.2.4.1 Key General Priorities

The **involvement of companies in the definition of training courses** is an innovative approach adopted by Higher Technological Institutes in Italy. However, a broad range of **key stakeholders** is engaged in the process of development, delivery, and certification of micro-credentials. This involves not only industry, universities, and VET providers but employer and employee representations, public authorities, NGOs, and more.

In general, for each course, **a brief description of the major learning outcomes** should be provided, outlining the competences associated with the implementation of the newly acquired skills for each identified profile. This will ensure that learners and employers can clearly understand the practical applications of the skills developed through the micro-credential, supporting effective integration into the workforce.

Given the role attributed to micro-credentials and the need for flexibility and adaptability (Pouliou A., 2024), as highlighted by the interviewees and the data analysed, **the course duration should range between 4 days and one week**.

This time frame would encompass **both frontal lectures and hands-on workshop activities**, ensuring that participants gain both theoretical knowledge and practical skills in an efficient, targeted manner.

The date of **issuance of the certificate** should coincide with the **final evaluation**. This alignment is fundamental for linking the micro-credential with the **Recognition of Prior Learning (RPL)** and ensuring that the micro-credential is consistent with **existing national policies**. By synchronizing the certificate issuance with the final assessment, the micro-credential becomes **a credible**

and recognised qualification that aligns with formal educational frameworks and labour market requirements across different countries.

The final evaluation is crucial for assessing the effectiveness of micro-credential outcomes as well. Alongside a theoretical discussion, learners could present a simulation or case study reflecting real-life work scenarios. This approach will allow learners to demonstrate how they would apply newly acquired skills in their professional environment, providing a more comprehensive evaluation of their readiness and practical understanding.

Findings also revealed that hybrid learning aligns well with the flexibility required by the working force and accommodates their limited time availability. However, experts involved in the research expressed a clear preference for in-person formats to enhance learning outcomes. To meet this preference, each course should include at least 25% direct lecture sessions, complemented by at least one hands-on workshop to foster practical understanding and engagement.

Finally, the analysis highlighted certain priorities for the effective implementation of micro-credentials. These are:

- Portability
- Blockchain technology
- Transversality
- Inclusion of ESG criteria
- Integration with Europass

#### 4.2.4.2 Country-Specific Priorities

From the Cedefop (2023a) document it has also been possible to detail the general characteristics identified making a connection with the specific characteristics of VET systems at country level:

In Spain, the VET system is modular, allowing learners to complete specific modules, regardless of their overall grade. This is very close to the concept of micro-credential. In higher education, short programmes such as units or modules are also common. For instance, in Catalonia, micro-credentials recognised by the university system can be integrated into a larger degree program. The VET law in Spain introduced a completely new framework for formal vocational training. This consists of grades (A, B, C, D and E) spanning a continuum from micro-training (grade A) to degrees and specialization courses (grades D and E), based on learning progression and obtaining an accreditation,

certification, or degree. These instances of micro-training will be an integral part of grade B credentials. Similarly, grade B training can be considered part of grade C (professional certificates).

In Bulgaria, a partial qualification in a profession can be awarded under the Vocational Education and Training Act (VETA). This partial qualification encompasses a set of professional competencies along with general knowledge and skills. While the term "micro-credential" is not explicitly mentioned in Bulgarian legislation, partial qualifications in a profession align with the definition of micro-credentials, as they are defined as "a separate work activity within a profession for which vocational training can be organised", and they include "a set of professional competences and general knowledge and skills".

In Belgium, like Spain, micro-credentials can be used to obtain exemptions from certain parts of educational programmes through the validation of competences. Additionally, micro-credentials can be applied to receive exemptions from part of a professional qualification.

In Italy, the VET sector widely uses micro-qualifications consisting of single units of one or more competences. These can be referenced to the NQF/EQF and are regulated by legislative Decree No 13 of 16 January 2013, which established the National System for the Certification of Competences (NSCC). Micro-qualifications represent short-term pathways, and individual units or competences can be separately certified and included in regional repositories as well as the national repository.

In Finland, both VET providers and Universities of Applied Sciences (UASs) allow for the validation and recognition of prior learning, as well as the personalisation of studies. These are the only subjects who can award official certificates or qualifications through the validation process. Non-formal providers may issue their own certificates, some of which can qualify as micro-credentials, aligned with the competences defined in formal national qualifications. These certificates can be validated by formal providers and are recognised in both educational and employment.

# 5. Conclusions

MASTERY aims to identify the green skills essential for driving the green transition and integrate them into a tailor-made micro-credentials system aligned with the current needs of the labour market.

To achieve this ambitious objective, a **co-creation** pathway has been established, engaging numerous actors and stakeholders across various levels of the value chain. This collaborative process has involved MASTERY consortium partners as **experts** of the main sectors involved (Agri-food, Construction, Wood & Furniture, Manufacturing, and Public Administrations) alongside **VET providers** and **public authorities**. Additionally, the **workforce** directly experiencing the green transition plays a dual role as both contributors to the project and primary learners for the courses that form the foundation of its outcomes.

The **12 macro-categories of green skills**, which are at the core of this activity, were selected after a thorough study of the ESCO framework and official European Community documents, particularly those from CEDEFOP, which served as a constant reference throughout the project's activity. The applicability of these skills was directly tested through various activities, including surveys, workshops, and direct interviews with project stakeholders. Through this process, the MASTERY consortium successfully identified the **green skills that will form the basis of the micro-credentials courses**. Moreover, MASTERY has established a common methodology for the design, delivery, and certification of a transparent micro-credential system. This methodology involved **collaboration with companies, VET providers, and stakeholders in the education system** at local, national, European, and international levels with the goal to stimulate debate and foster a structured reflection on current practices to ensure a strong and determined orientation on the quality of micro-credentials in VET, supporting the green transition.

The results obtained are summarised and synthetized in this section.

The MASTERY consortium has identified **12 macro-categories of green skills**, which are outlined below:

- **Select sustainable resource efficient approaches through the entire agri-food value chain** (sector-specific skill: Agri-food)
- **Select environmentally friendly materials and components for buildings** (sector-specific skill: Construction)

- Design innovative, energy- and resource-efficient machines and systems for manufacturing processes (sector-specific skill: Manufacturing)
- Cradle-to-cradle design (sector-specific skill: Wood and Furniture)
- Reduce waste and material outputs (transversal skill)
- Advise on sustainability certifications and standards (transversal skill)
- Measure and report sustainability performance (transversal skill)
- Ensure compliance with environmental legislation (transversal skill)
- Educate on environmental sustainability concepts (transversal skill)
- Implement circular, green, and socially responsible procurement (transversal skill)
- Develop and implement joint sustainability initiatives (transversal skill)
- Evaluate sustainable investment opportunities (transversal skill)

These skills will be at the core of the implementation of the MASTERY micro-credentials courses, aiming to address the current education and training needs driven by fast-changing knowledge development and labour market demand for the green transition, in alignment with the double transition paradigm. The selected skills will be integrated into existing courses in the partner countries, enriching transitional skills and competences in line with the principles of vocational excellence.

To ensure maximum replicability of the results and to address the challenges posed by the globalisation and digitalisation, the skills have been categorised as follows:

- Sector-specific skills, tailored to the specific needs of the industries involved in the project.

- Transversal and soft skills, adaptable across different value chains.

- Digital skills, characterized by a strong technological focus.

The research report also identified common characteristics that micro-credentials should adhere to, including the identification of learners, alignment with European Laws and national policies, ex-ante and ex-post assessment methodologies, course duration, and delivery modalities. These guidelines aim to address growing concerns about the quality criteria of micro-credentials, establishing a foundation for a common benchmark.

The holistic approach adopted enabled the consideration of all interests involved - from providers and recipients - and facilitated the definition of the most effective modalities for implementing the courses, while ensuring alignment with institutional consensus.

In conclusion, this task aims to promote the concept of micro-credentials, making them more attractive to VET providers and encouraging the direct participation of firms. It highlights their value as significant and complementary pillars of the European Union's education systems.

This approach was validated by the activities performed: although initial awareness of micro-credentials was low, once their potential role in national education systems was explained, a significant portion of participants recognized their usefulness. Participants particularly agreed on the value of micro-credentials for the upskilling and reskilling of workers within a short timeframe — especially for those not seeking full, advanced courses but needing retraining to align with the demands of the green transition. This is particularly relevant for workers who are not yet near retirement age but require targeted training to stay competitive, supporting lifelong learning opportunities.

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# Annex 1

## Data Collection Methodology and Project Activities

To achieve the objectives, the MASTERY Consortium conducted comprehensive research through four main activities: (a) desk research; (b) an online survey; (c) face-to-face interviews; and (d) workshops.

The **desk research,** which served as the basis for the subsequent activities, focused on both the concept of **micro-credential** and the growing **demand for green skills** in the labour market, considering various **industrial sectors** (Agri-food, Construction, Manufacturing, Wood and Furniture, and Sustainability Management) across **different countries** (majorly Finland, Bulgaria, Italy, Spain), with a particular emphasis on **small and medium enterprises** (SMEs).

Both **scientific and grey literature** were explored, and all the partners contributed to the recognition of the state of the art in the Vocational Education and Training (VET) system, as well as in the green skills and micro-credentials adoption across the different countries. Thus, the desk research supported the identification of the **strengths and weaknesses** of micro-credential systems and of the most prevalent green skills highlighted in the literature. Additionally, the desk research provided the foundation for designing both the questionnaire for the **online survey** and the protocol for the **face-to-face interviews**.

The **online survey** was aimed at investigating the **sector-specific, transversal, soft, and digital green skills** needed and delivered in the selected sectors (Agri-Food, Construction, Manufacturing, Wood and Furniture, and Sustainability Management), as well as among public administrations. In addition, the online survey investigated the **level of knowledge on and interest in micro-credentials**. All the partners contributed to the data collection by leveraging their own networks, and **189 out of 261 questionnaires** were completed.

Based on the **European Skills, Competences, Qualifications and Occupations (ESCO) Framework**, the online survey investigated the **skills and competences** needed by private companies and public administrations to align with the current market trend and address the green transition. **Green training activities** already implemented were also investigated, focusing on the **skills and competences** delivered, the **type of training** implemented (i.e., frontal lectures, online lessons, streaming activities, hybrid, or other), and the **entities responsible** for the development and implementation of green training activities (i.e., external home country consultant, external foreign consultant, internal resource, universities or other higher education institutes, or other).

The face-to-face interviews allowed for deepening the analysis and gathering qualitative data on green skills and training activities related to them, as well as on micro-credential knowledge. Due to the strong relationship between private and public bodies in providing education and training, the face-to-face interviews involved both private and public representatives of the selected sectors (Agri-Food, Construction, Manufacturing, Wood and Furniture, and Sustainability Management), as well as companies' academies. In total, 20 interviews were conducted, and reports were compiled to identify the most recurrent trends, attitudes, and barriers related to green skills and the training system.

Together, the online survey and the face-to-face interviews supported the identification of the labour market needs related to green skills, enabled the comparison of the information collected from the desk research, and contributed insights toward the development of the workshops. Finally, these two activities provided the basis for the definition of an appropriate taxonomy related to green skills to be integrated within the ESCO Framework.

In total, 3 workshops among consortium partners were organised to better define a marker set (i.e., a benchmark for further development of micro-credential systems supporting green skills) and the priorities to design the micro-credential system.

Two of these workshops were conducted in-person during the second Consortium Transnational Project Meeting (TPM) in Sofia (Bulgaria) and they provided valuable perspectives through expert support in the field of vocational education and training (VET). The guided interactions among the partners facilitated the gathering of meaningful insights for selecting priorities to design the MASTERY micro-credential system for green skills.

Following an initial introduction aimed at stimulating discussion among the partners, small group brainstorming sessions generated ideas for identifying and prioritizing key stakeholders and networks, determining the values of the micro-credential system, establishing mechanisms for evaluating performance and impacts, and identifying the resources necessary for implementing the micro-credential system for green skills. In addition, European principles and mandatory elements were presented to inspire the partner groups in identifying the green skills and the elements to be included into the micro-credentials system.

The third workshop was conducted online among the partners, and it focused on defining the marker set for the further development of micro-credential

systems supporting green skills. Following a recap of the previous activities and results, a selection of **green skills** based on the research findings was presented to facilitate the discussion on which 12 green skills should be included in the MASTERY micro-credential system. **Criteria** to support the further development of micro-credential systems supporting green skills were identified, and contributions from all the partners provided insights on **training methodologies** and **micro-credentials delivering**. Finally, the discussion centred on the **evaluation procedures** to be implemented to assess the effectiveness of the micro-credential system.

Altogether, **the desk research, the online survey, the face-to-face interviews, and the workshops** suggested a pool of findings and conclusions, reported in this document, that will serve as a basis for the **co-design of micro-credentials policy methodology (WP3)**.

This final report identifies **12 macro-categories of green skills** that will serve as the foundation for the micro-credential process designed to update the VET system in response to the demands of the twin transition. It establishes **priorities** for training and broadens the **literature on micro-credentials**, thereby enhancing their quality and effectiveness as powerful tools to be integrated into the domestic education system. Finally, it provides a **benchmark** and **criteria** for the ongoing update and development of micro-credential systems for green skills.

To examine in depth the potential needs of the European labour market in light of the green transition and the demographic trends, the MASTERY Consortium developed a methodology to collect both qualitative and quantitative data, ensuring a comprehensive view of the current landscape. This exploration began with **general research**, as presented in paragraph two, covering key actions taken at country and sectorial levels, including their impacts on the social system. Following this, a **survey** was conducted, involving participants from major sectors of the project and other key European industries.

The survey was structured into **six sections**:

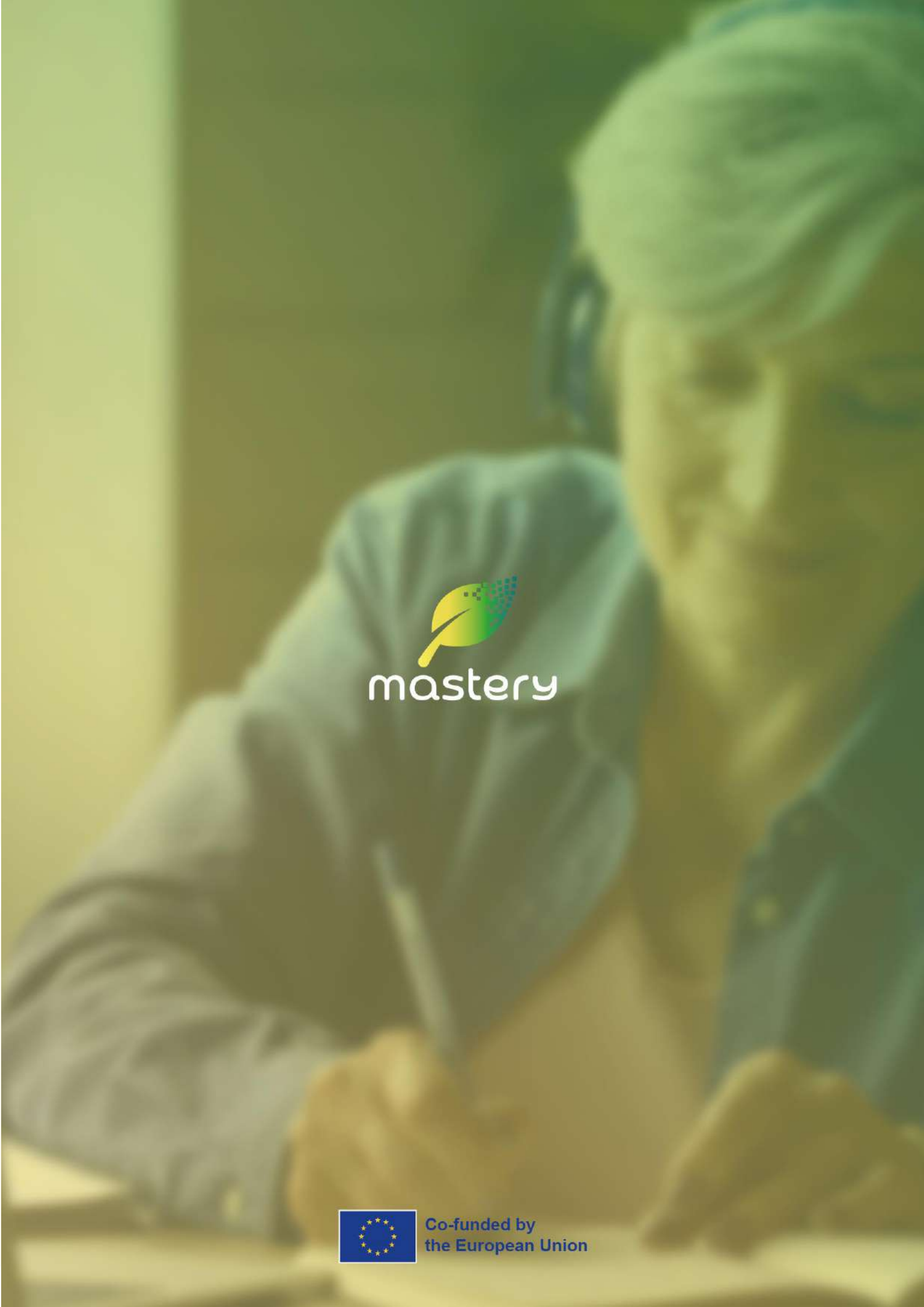
- Introduction
- Green skills
- Green training
- Green working climate, environmental performance, and reputation
- Micro-credential knowledge
- Personal information

To identify items, particularly for the "green skills" section, an **in-depth content analysis** was conducted based on data provided by the **partners**, **official documents**, and the **ESCO dataset**. The survey was translated into **five languages** - Italian, Bulgarian, Finnish, English and Spanish - to maximise respondent reach and engagement. To gather as many responses as possible, the survey, launched at the end of April, had its closing deadline extended to mid-August. **A total of 261 responses were collected, of which 189 were fully completed**.

To complement this data, which primarily focused on detecting specific green skills requirements and optimal methods for fostering their diffusion and development through training, **face-to-face interviews** were conducted in parallel with the survey. These interviews involved **key representatives** from the sectors involved and public administration, selected by the partners of the project. These interactions expanded the debate and highlighted significant strengths and barriers of micro-credentials as tools for promoting the green transition.

Finally, insights were further explored through **workshops**. **Expert contributions** helped gain meaningful insights on the labour market needs and gaps, as well as help establish the criteria for identifying priorities and developing the MASTERY micro-credential system.

The following sections provide an in-depth presentation of the results derived from this multi-method approach, organised according to the project's objectives.

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