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Green Skills & the GreenComp Framework

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Chapter 5 - The Green Skills Gap and Training Needs

Chapter 5 examines the green skills gap, and training needs that SMEs face as the green and digital “twin transition” reshapes regulatory requirements, market expectations and everyday business practices. Building on the policy and competitiveness context of the previous chapter, it clarifies what “green skills” mean in an SME setting—not as a separate family of specialised “green jobs”, but as the greening of existing roles through a combination of technical and operational capabilities, strategic and managerial competences, and transversal skills for working with complexity and change. Drawing on international and European evidence, the chapter highlights persistent mismatches in SME participation in job-related learning, limited internal capacity for monitoring and compliance, and segmentation between front-runner firms and non-movers. It also argues that closing the green skills gap depends not only on training volume but on the quality and design of support, favouring flexible, contextualised and work-based learning approaches suited to SME constraints.

Finally, the chapter introduces GreenComp as a shared reference framework for sustainability competences and outlines how it can inform realistic training pathways that bridge strategic intent and operational practice in SMEs.

5.1 The Green Skills Gap: What It Is and How It Affects SMEs

The transition to a climate-neutral and resource-efficient economy is reshaping what people need to know and be able to do at work. “Green skills” are increasingly described as the knowledge, abilities, values and attitudes needed to live in, develop and support a sustainable and resource-efficient society (Arthur, 2022). They are not confined to a narrow group of “environmental experts”: they concern engineers and technicians, managers and planners, inspectors, administrative staff and entrepreneurs. For small and medium-sized enterprises (SMEs), this raises a simple but uncomfortable question: do they actually have the skills needed to make use of the new frameworks, technologies and business opportunities described in the previous chapter?

5.1.1 What exactly are “green skills” in an SME context?

Global and European policy work converges on a broad view of green skills. UNIDO identifies four groups of work tasks that are especially important in green occupations: engineering and technical skills (designing and operating cleaner technologies), science skills (understanding physical and biological processes), operations-management skills (organising work, supply chains and life-cycle impacts), and monitoring skills (checking compliance with technical and legal standards) (Arthur, 2022). To this it adds soft skills such as design thinking, adaptability, resilience and empathy, which are increasingly important for working in fast-changing environments.

European analysis goes a step further and emphasises bundles of competences.



The green and digital “twin transition” does not just require more environmental know-how; it calls for combinations of green, digital and transversal skills—critical thinking, problem-solving, communication, collaboration and entrepreneurial initiative (Pissareva et al., 2025). Many emerging green roles are strongly high-skill-biased: they depend on engineering, advanced technical and managerial capabilities. Lower-skilled jobs often remain in existing occupations, but with added requirements for environmental awareness and new procedures. In practice, this means that SMEs rarely need a separate “green job family”; instead, they must “green” existing roles—owners and managers, technicians, logistics staff, office workers—by adding environmental, digital and transversal elements to their existing tasks.

From the perspective of this toolkit, green skills in SMEs can therefore be understood as:

- Technical and operational skills to run processes, machines, buildings and logistics in more energy- and resource-efficient ways, comply with environmental rules and use greener technologies;

- Managerial and strategic skills to interpret regulatory and market signals, integrate sustainability into strategy and investment decisions, and engage value-chain partners; and
- Transversal skills that allow people to work with complexity, uncertainty and change.

The rest of this chapter unpacks these layers and explores how they can be developed through work-based learning.

5.1.2 What do we know about the green skills gap in SMEs?

Despite growing policy attention, evidence shows that SMEs face a persistent skills mismatch in relation to the green transition.

First, SMEs matter enormously for the transition itself. In the EU, SMEs are estimated to account for around 40% of total business-sector greenhouse-gas emissions, making them a central part of decarbonisation and circular-economy strategies (OECD, n.d.). At the same time, they are particularly exposed to resource

and energy shocks: during the 2022–2023 energy crisis, the share of energy costs in SME turnover in the EU rose from 4% in 2018 to 6.4% in the first half of 2022, sharply increasing pressure to improve energy and resource efficiency (OECD, n.d.). This would suggest a strong incentive to develop energy and green-management skills—but most SMEs start from a lower skills and training baseline than large firms.

OECD work on the twin transition finds that workers in SMEs participate about 15 percentage points less in job-related learning than workers in large enterprises, across countries (Pissareva et al., 2025). Many SMEs operate with narrowly specialised staff and underdeveloped “horizontal” functions such as IT, innovation management or energy management. This limits their ability to absorb new technologies, processes and regulatory requirements, and it makes it harder to re-skill or redeploy people as green and digital transitions accelerate. Micro-level evidence from European SMEs reinforces this picture. Using survey data from over 13,000 SMEs in 28 EU Member States, Bassi and Guidolin (2021) show that 57.4% of SMEs report no workers in green jobs at all and around 10% undertake no resource-efficiency action.

Only about one-fifth of SMEs identify lack of environmental expertise as a barrier to resource efficiency, even though statistical analysis shows that skills and dedicated green roles matter greatly for what happens next. Firms with no green workers are systematically less likely to implement or plan circular-economy and resource-efficiency measures, ranging from energy and water saving to recycling, reuse and eco-design. Where SMEs report that they lack environmental skills, this is actually associated with a higher probability of planning such actions—suggesting that the real problem is not only the skills gap itself, but also the fact that many firms do not yet recognise that they have one (Bassi & Guidolin, 2021).

The same study reveals strong segmentation: a minority of SMEs are “front-runners” implementing and planning multiple circular practices; a large share are “non-movers” with no action and no intention to act in the near term. Country and sector differences are pronounced, but across contexts the presence of green jobs and environmental skills, combined with size and turnover, are key discriminators between the two groups (Bassi & Guidolin, 2021).

In other words, the green transition is not experienced evenly: some SMEs are developing capabilities and experimenting, while many others remain stuck.

At a broader policy level, there is also evidence of a planning gap. When analysing national climate commitments (NDCs) under the Paris Agreement, the OECD finds that fewer than 40% of countries include explicit plans for skills development to support their environmental and climate targets, and more than 20% have no human-capital measures at all, despite ambitious sectoral goals (Pissareva et al., 2025). Policy mapping across 38 countries shows that skills programmes are heavily skewed towards digital competences: around 60% of initiatives focus on digital skills, roughly a quarter on transversal/entrepreneurial skills, and only 13–14% explicitly on green skills, with relatively few initiatives bundling them together (Pissareva et al., 2025). Only about one-third of mapped policies target SMEs specifically. Taken together, these patterns suggest that while the green skills issue is recognised in principle, policy instruments often remain misaligned with the scale and structure of SME needs.

European agencies have been warning about this misalignment for more than a decade. CEDEFOP’s “Skills and jobs for the green transition” work links the European Green Deal to changing occupation and skills profiles in sectors such as waste management, agri-food and circular economy, and stresses that impacts are uneven across regions and sectors, requiring anticipatory skills intelligence and adaptation of vocational education and training (Cedefop, n.d.). Yet the persistence of basic training and capability gaps at SME level indicates that this intelligence has not yet translated into sufficiently accessible, targeted learning opportunities on the ground.

5.1.3 The quality of support: how learning is designed matters

The green skills gap is not only about what SME workers know, but also about how support and training are designed. A conceptual review of enterprise support for pro-environmental SMEs highlights that many programmes are built around easily counted outputs—such as the number of audits delivered or tonnes of CO₂ saved—rather than around the learning needs of SME owners and managers (Paterson et al., 2022).

Support often focuses on “low-hanging fruit” such as basic energy-efficiency measures, while under-emphasising deeper eco-innovation, new business models or supply-chain collaboration.

By contrast, when pro-environmental SMEs are asked what kind of support they find useful, a different picture emerges. Owners and managers consistently value eco-preneurial learning: short, flexible and contextualised learning experiences linked to real business problems, combining hard topics (finance, product development, supply-chain management) with sustainability leadership and environmental understanding; opportunities to work with specialist intermediaries at key moments; and peer-to-peer learning with like-minded firms (Paterson et al., 2022). This suggests that closing the skills gap requires not only more training hours, but also different pedagogical approaches that fit SME time constraints, sectoral contexts and decision-making realities.



International organisations have started to frame green skills more explicitly in this way. UNIDO emphasises that green competence involves values and attitudes as well as knowledge and abilities, and that soft skills—creativity, adaptability, resilience, empathy—are integral to working in complex, uncertain green transitions (Arthur, 2022). European initiatives such as the Climate Pact and the Pact for Skills stress the need to promote green employment, up- and reskilling, and anticipation of workplace changes, backed by instruments like the European Social Fund Plus (ESF+), which aims to support training for millions of people in green jobs and the green recovery (European Commission, n.d.). At the same time, OECD’s work on SME greening underlines that SMEs will not be able to respond to green finance, reporting and innovation opportunities unless the wider ecosystem—banks, accountants, training providers, public agencies—also develops the skills and coordination needed to offer coherent, proportionate support (OECD, n.d.).



5.1.4 Why the green skills gap is a strategic issue for SMEs

For SMEs, the green skills gap is not an abstract labour-market statistic; it is a strategic constraint. The combination of factors described above—large environmental footprint, exposure to energy and resource volatility, lower participation in training, limited access to high-skill green and digital talent, patchy policy support and often shallow learning design—translates into several risks:

- Compliance and market access risk: without staff who can interpret and respond to emerging requirements around emissions, resource use, product design or value-chain transparency, SMEs risk becoming weak links in CSRD-driven and Taxonomy-driven supply chains.
- Cost and efficiency risk: lacking skills in energy and resource management, SMEs may pay more for inputs than necessary and be less able to buffer shocks such as the recent energy crisis.
- Innovation and competitiveness risk: without capabilities for eco-innovation, life-cycle thinking and collaboration, SMEs may miss opportunities in new green markets and in circular supply chains.

- People and organisation risk: if managers and employees are not supported in developing the transversal skills needed to work with change—systems thinking, collaboration, problem-solving—the firm may struggle to adapt even when technologies or funding are available.

At the same time, the evidence is clear that where SMEs do invest in green jobs and environmental skills, they are more likely to adopt circular practices and to plan further improvements (Bassi & Guidolin, 2021). And where policy initiatives deliberately target SMEs with tailored, work-based and ecosystem-based learning, the potential exists to turn the skills gap from a constraint into a driver of innovation and resilience (Pissareva et al., 2025; Paterson et al., 2022).

The remaining sections of this chapter build on this diagnosis. They introduce the GreenComp framework as a reference for sustainability competences, distinguish between strategic/managerial and technical/operational green skills in SMEs, and explore how work-based learning and local ecosystems can be used to develop these skills in ways that are realistic, relevant and impactful for small and medium-sized enterprises.

5.2 The GreenComp Framework: A Common Language for Sustainability Competences

The previous subsection showed that SMEs face a layered green skills gap: they often lack not only technical expertise but also the strategic and transversal competences needed to navigate complex sustainability demands. The question, then, is how to describe these competences in a way that is coherent and usable for training and management. GreenComp, the European sustainability competence framework, provides one such common language.

5.2.1 What GreenComp is – and how it defines sustainability competences

GreenComp is an EU reference framework that describes what it means to be competent for sustainability. It identifies 12 competences grouped into four areas (embodying sustainability values, embracing complexity, envisioning futures, acting for sustainability), but it is not a curriculum, qualification or standard. Instead, it offers a shared vocabulary that schools, VET providers, adult-learning organisations and workplaces can use to design their own learning pathways, assessment tools and training offers (Bianchi et al., 2022).

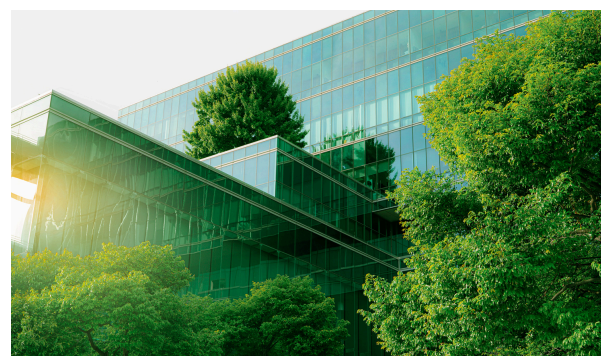
The framework adopts a clear definition of sustainability rooted in planetary boundaries: human activity must remain within ecological limits while prioritising the needs of all life forms and of the planet (Bianchi et al., 2022). Sustainability is treated as inherently multidimensional—environmental, social, cultural and economic aspects are interlinked—but ecological limits are non-negotiable.

A “sustainability competence” in this framework is more than technical know-how. It is the ability to embody sustainability values, embrace complex systems, and take or request action that restores ecosystem health and enhances justice, while generating visions for sustainable futures (Bianchi et al., 2022). This definition explicitly integrates four dimensions:

- Values – what people care about (e.g. fairness, care for nature).
- Systems thinking – understanding interdependencies and unintended consequences.
- Futures orientation – seeing the future as open and shapeable.
- Agency – the capacity to act or to demand action from those with power.

GreenComp also frames learning for environmental sustainability as lifelong and transformative. Learning is expected to occur in formal, non-formal and informal settings, and to engage head, hands and heart—knowledge, practical skills and attitudes—so that people move from knowing about sustainability to feeling responsible and able to act (Bianchi et al., 2022; Liverano, 2024).

For SMEs, this matters because it shifts the conversation from “Do we have a sustainability specialist?” to “Does our organisation have the mix of values, systems thinking, imagination and agency needed to steer change?”



5.2.2 The four competence areas – translated for SME reality

GreenComp’s competences are presented as a honeycomb: interdependent, non-linear and mutually reinforcing. They can be grouped, however, into four areas that translate well into SME contexts (Bianchi et al., 2022; Liverano, 2024).

Embodying sustainability values

This area includes valuing sustainability, supporting fairness and promoting nature. It asks whether people recognise sustainability as a core value, see the links between environmental quality and justice for current and future generations, and feel connected to nature rather than separate from it.

In an SME, this is reflected in questions such as:

- Do leaders talk about environmental and social issues as strategic concerns rather than optional extras?
- Are decisions about suppliers, products and investments discussed in terms of fairness, long-term impacts and responsibility, not just short-term cost?

Without some shared values and ethical framing, technical improvements tend to remain superficial or reversible.

Embracing complexity in sustainability

This area covers systems thinking, critical thinking and problem framing. It recognises that many sustainability issues are wicked problems—they cannot be “solved” once and for all, but can be managed through prevention, mitigation and adaptation.

Competent individuals can see how actions in one part of a system (e.g. procurement, logistics, energy use) affect others, question assumptions, and detect oversimplifications or greenwashing (Bianchi et al., 2022).

For managers and technicians in SMEs, this translates into abilities such as:

- Understanding how regulatory changes, customer expectations and resource constraints interact.
- Assessing trade-offs (e.g. lower emissions vs higher upfront costs) without falling into paralysis.
- Recognising when external claims or internal proposals are too good to be true.

Envisioning sustainable futures

Here the focus is on futures literacy, adaptability and exploratory thinking. People are encouraged to distinguish between expected, alternative and preferred futures, and to see the future as something they can influence. They learn to cope emotionally and practically with uncertainty and to experiment with new solutions, including circular-economy approaches and cross-disciplinary ideas (Bianchi et al., 2022).

In an SME setting, this competence area supports:

- Scenario thinking about markets, regulations and technologies (e.g. “What happens to our business model in a low-carbon, high-energy-price world?”).
- Openness to new value propositions (repair, sharing, as-a-service models).
- Willingness to test small changes and learn from them rather than waiting for perfect information.

Acting for sustainability

The final area includes individual initiative, collective action and political agency. It recognises that sustainability requires both personal responsibility and the ability to mobilise others—inside the organisation and in the wider system. People need skills to design and implement change projects, collaborate across functions, and, where relevant, demand effective policies and frameworks (Bianchi et al., 2022).

For SMEs, this might look like:

- Employees initiating small improvement projects on energy, waste or product design.
- Cross-functional teams working with suppliers and customers to reduce impacts.
- Managers engaging with local authorities or sector associations to shape more enabling conditions.

Liverano (2024) summarises this logic as a sequence of understanding – awareness – action. Deep comprehension of sustainability and complex systems, and a reflective awareness of values and impacts, are seen as prerequisites for meaningful, intentional action. Training that jumps directly to “what to do” without building understanding and awareness risks producing compliance rather than commitment.

5.2.3 From framework to training: how GreenComp is being used

GreenComp was designed as a flexible reference rather than a fixed programme, and practice across Europe shows a wide variety of applications. Case studies from different countries and sectors document how organisations use the framework to update qualifications, design courses, build assessment tools and structure teacher and trainer development (European Commission, 2024).

One cluster of initiatives uses GreenComp as a “library of competences”. Practitioners select the competences most relevant to their context and turn them into learning outcomes, key messages or micro-lessons.

The DEED project in vocational education, for example, translated each of the 12 competences into about 15 key messages and created around 200 micro-lessons that teachers can plug into existing programmes, allowing sustainability to be integrated in small, targeted units rather than only through new full courses (European Commission, 2024).

Another example with clear SME relevance is EntreComp4Transition, which targets SMEs navigating the green and digital twin transition. Chambers of commerce first ran skills-needs assessments with SMEs, then mapped those needs against three EU frameworks: GreenComp (sustainability), DigComp (digital) and EntreComp (entrepreneurship). This mapping informed four modular learning paths—on sustainability, digitalisation, entrepreneurship, and an integrated “green transition facilitator” profile—delivered as blended learning over a few months and certified through open badges (European Commission, 2024). GreenComp provided the sustainability backbone, but content and language were adapted to the realities of small businesses.

These cases illustrate two points that are important for SME managers and trainers:

- GreenComp can be scaled and sliced: it lends itself to micro-learning, modular courses and blended formats that fit the time constraints of SMEs.
- Effective use requires translation: competences must be rephrased in sector and business language, and combined with other frameworks where relevant (digital, entrepreneurial).

5.2.4 What GreenComp offers to SMEs and trainers

For SMEs, GreenComp does not provide a ready-made training programme, but it does offer a robust, open and non-proprietary reference for thinking about green competences in a structured way. It can help managers and trainers:

- Map competence needs by role: for example, focusing on systems thinking, futures literacy and collective action for owners and senior managers, and on problem framing, adaptability and individual initiative for line managers and technical staff.
- Design learning pathways that respect the understanding–awareness–action sequence: starting with shared values and systems understanding, then moving towards concrete projects and behaviour changes.

- Choose learning formats that fit SME realities: micro-lessons embedded in work, small group projects that tackle real operational issues, and peer-based learning within clusters or supply chains.
- Align internal language with external expectations: using GreenComp as a shared vocabulary with training providers, sector organisations, or public programmes that already reference the framework.

At the same time, evidence from early adopters shows that GreenComp is not plug-and-play. It requires time and expertise to prioritise competences, translate them into concrete tasks and behaviours, and embed them in curricula or workplace learning. Many initiatives therefore rely on partnerships—between education providers, chambers, companies and public agencies—and on communities of practice where practitioners share examples and tools (European Commission, 2024; Liverano, 2024).



Used in this way, GreenComp becomes less an academic document and more a design scaffold: it helps SMEs and their partners ensure that green skills development does not focus only on narrow technical tasks, but also builds the values, systems thinking, futures orientation and agency needed to make sustainability part of everyday management and work. The next subsection builds on this by distinguishing more explicitly between strategic/managerial and technical/operational green competences within SMEs, and by exploring how they can be combined in practice.