



Project: 101140058 — ERASMUS-EDU-2023-PI-ALL-INNO

SiT

Sustainability in TCLF

D2.2. Training Structure Report



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Delivery Slip

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Sustainability in TCLF

Project Number:	101140058 — SIT — ERASMUS-EDU-2023-PI-ALL-INNO
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Project Acronym:	SiT
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Project Title:	Sustainability in TCLF
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Deliverable Title:	Training Structure Report
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Deliverable number:	D2.2.
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Work package:	Work Package 2: Training structure Analysis
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Task:	Tasks 2.2.-2.6.
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Type:	R-Report
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Dissemination Level:	PU-Public
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Version:	1
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Due date:	M9
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Keywords: Collaborating organizations, organizations that sign the KTs

Abstract:

The report provides a comprehensive analysis of the training needs related to learning outcomes (LOs) for the green transformation of the TCLF sector. It summarizes and compares data from national reports on professional needs, collected during field research involving TCLF SMEs, HEs and VET in Task 2.3. The report is structured into three main sections:

1. The first section gives an overview of the professional needs for the green transition in the TCLF sector across partner countries, summarizing emerging trends, challenges, and the skills and competencies required to address them.

2. The second section synthesizes these findings into a taxonomy of competencies for two emerging occupational profiles identified in Task 2.1: the Bio-Textile Technician

and the Recycling Manager. It also identifies the specific skills needed for these competencies, using the ESCO model as a reference.

3. The third section presents the TCLF GreenComp reference framework, based on the GreenComp framework, to standardize the development of green skills, competencies, and knowledge in the TCLF sector.

The report is developed in English and will be translated into project languages to ensure accessibility for partners and stakeholders. It serves as a key input for developing two new professional curricula in WP3 and supports the



enhancement of existing training programs in the TCLF sector.

4. The final section presents Training Structure for two new emerging professions: the Bio-Textile Technician and the Recycling Manager.

Electronic/PDF

Language: English

Lead Beneficiary: EESTI KUNSTIAKADEEMIA (EKA), PIC 955368327
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Release Date: 29.11.2024



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SECTION 1

1.1. Introduction

The current report provides a comprehensive analysis of the skills gaps and training needs facing professionals in the TCLF sector (Textile, Clothing, Leather, and Footwear) at both national and European levels, based on the international field survey conducted in eight European countries (Germany, Italy, Spain, Estonia, Bulgaria, Greece, Croatia, and Slovakia) as part of the Erasmus+ project Sustainability in Textile (SiT; project number 101140058 — ERASMUS-EDU-2023-PI-ALL-INNO). This report is the main outcome of WP2 and provides the basis for the development of training materials in WP3, while also serving as a general guideline for the entire project.

The primary objective of the research was to identify the most effective framework for supporting the sector's transition to greener practices, ensuring that the workforce is equipped with the essential skills required to respond to emerging environmental challenges. The results emphasize the importance of aligning training programs with these needs to facilitate a successful green transformation within the industry. The findings from the research have been examined through the perspectives of mapping two emerging professions that are essential for the green transformation of the TCLF sector: the **Bio-Textile Technician** and the **Recycling Manager**.

The roles of a Bio-Textile Technician and a Recycling Manager are pivotal in the contemporary textile and fashion industry, as they drive the creation of sustainable solutions and foster responsible production practices.



The **Bio-Textile Technician** specializes in developing cutting-edge, eco-conscious materials. Their work focuses on designing biodegradable and naturally sourced fibers that significantly reduce environmental impact, requiring less water and fewer harmful chemicals compared to conventional synthetic fibers. The primary objective of the Bio-Textile Technician is to engineer textiles that are not only environmentally sustainable but also robust and of superior quality. By doing so, they help the fashion industry transition from resource-intensive, environmentally detrimental manufacturing practices to innovative approaches that align with growing consumer demand for sustainability.

Meanwhile, the **Recycling Manager** plays a critical role in promoting zero-waste production and optimizing the reuse of materials throughout the textile and fashion sectors. They evaluate manufacturing workflows to devise strategies for recycling, reusing, or upcycling textile waste, thereby prolonging the life cycle of materials and curbing the volume of textile waste directed to landfills. For instance, they may facilitate the conversion of discarded garments into new fibers or repurpose textile scraps into alternative products. The Recycling Manager's efforts are fundamental in mitigating the environmental footprint of the fashion industry and advancing the principles of the circular economy, where materials are continuously repurposed rather than discarded after a single use. Their contribution ensures that production processes become more sustainable and that the reuse of textiles becomes a standard practice, significantly reducing resource consumption.

The collaboration between Bio-Textile Technicians and Recycling Managers is essential for building a more responsible and sustainable future in the fashion industry. The innovative materials engineered by Bio-Textile Technicians, when combined with the Recycling Manager's expertise in waste reduction, create a holistic system that safeguards environmental health while facilitating the production of high-quality, durable products. This partnership enables the industry to progress towards eco-friendly solutions that are not only sustainable but also aesthetically refined and commercially viable.



These roles are important for pushing the industry towards more sustainable practices as they help promote eco-friendly methods and new ideas. By focusing on these positions, the sector can lead the way in supporting sustainability, which benefits both the environment and industry standards. Their work is crucial in advancing efforts that highlight the need for environmental responsibility, ultimately creating a more sustainable future for the industry.

The first part of the report presents how the in-depth field survey was conducted in eight SiT project partner countries, involving representatives from SMEs, higher education (HE), and vocational education and training (VET). It introduces the structure of the research and the methodologies used, which helped to highlight the sector's objectives and professional needs related to the green transition in these partner countries. Slovakia, as a special case, participated only in conducting the online survey.

The second section gives a general overview of the TCLF SME and HE/VET sectors before describing in detail the two crucial new job roles of the Bio-Textile Technician and the Recycling Manager, their critical importance for the green transition in the TCLF sector, and the needed key competencies.

The third section introduces the SiT TCLF GreenComp, which is a reformulation of the European Commission's GreenComp framework based on the survey results. The TCLF GreenComp framework describes four competence areas which emerged as fundamental for the profiles of the Bio-Textile Technician and the Recycling Manager, and forms the basis for the SiT training program which is to be developed in the project.

Finally, in the fourth section, the report lines out the structure of said training program, supporting the development of two new training curricula within Work Package 3 (WP3) in the project.



This structure is based on the insights gained from the field research, ensuring that the training programs are innovative and responsive to the sector's changing needs, steering the industry toward more environmentally friendly practices. The report outlines emerging trends and challenges, describing the specific skills and competencies required to effectively address these issues. To ensure that the SiT training programs align with current demands, the report maps the identified skills within existing frameworks such as the European Qualifications Framework (EQF), National Qualifications Framework (NQF), and ESCO model. This alignment not only enhances the relevance of the training programs but also helps textile companies understand what different EQF levels mean for their employees.

The Annex1 of this report presents country overviews in a free-form style, derived from semi-structured interviews with top-representatives from SMEs, HE and VET institutions in the SiT project partner countries, to clearly and concisely highlight the primary challenges and expectations faced by TCLF sector.

1.2. Methodology

The SiT project implemented a comprehensive variety of methodologies to effectively gather and analyze data related to skills and training needs in the TCLF sector. The research was conducted through various surveys during the period from May 21, 2024, to September 15, 2024.

Key methodologies included:

1. Surveys: Online surveys were designed and distributed to different target groups, including SME representatives and HE/VET education trainers. The surveys aimed to gather quantitative data on skills gaps and training needs.



2. Interviews: Semi-structured interviews were conducted with focus group representatives from each target group. These interviews aimed to gain qualitative insights into the specific challenges and training requirements faced by professionals in the TCLF sector.

Data Mapping: An accompanying activity in the research involved mapping specific skills against established frameworks to ensure alignment with existing standards and to facilitate their application within the sector, such as the European Qualifications Framework (EQF) and ESCO systems. This mapping was used to ensure the relevance of the identified skills to existing standards.

The online survey was designed to engage various stakeholders which facilitated direct engagement with industry professionals to acquire qualitative data regarding their experiences and perspectives on training needs. Two separate target groups were identified for the survey: representatives of small and medium enterprises (SMEs), who represented the employers, and representatives from higher education (HE) and vocational education and training (VET) institutions, who represented the education and training providers. The survey was conducted among these two target groups (SMEs and HE/VET) using online questionnaires. The questions were distributed via Google Forms and they were translated into the native languages. Separate questionnaires were developed for each representative group, comprising 117 questions for SME representatives and 79 questions for HE/VET representatives.

Both questionnaires included structured, semi-structured and open formats. Most of the questions were structured on a Likert scale, with response options ranging from 1 - 5. The 1-5 Likert scale, in particular, represented a range of possible responses, structured as follows:

1. Strongly Disagree – indicates complete disagreement with the statement;



2. Disagree – signals some level of disagreement, though less intense than "Strongly Disagree";
3. Neutral – neither agreeing nor disagreeing; a middle-ground response;
4. Agree – shows general agreement with the statement;
5. Strongly Agree – expresses complete agreement with the statement.

In the survey, the competences were classified into three categories: functional, green, and transversal. Functional competencies are essential for job performance, green competences are directly related to environmental sustainability, and transversal competences cut across various job roles and support the green transformation of the TCLF sector. Competences were further divided into basic (applicable to all job profiles) and specialized (leading to deeper expertise within specific profiles).

The semi-structured interviews were conducted with one representative from each target group in each country, ensuring diverse perspectives were captured across all countries. A total of 27 questions were prepared for the interviewees, and all participants responded to the same set of questions. The interviews were conducted using semi-structured questionnaires.

The initial KPI set in the SiT project application indicating 30 SMEs, 10 HE/VET institutions and 3 interviewees per country was fully reached in countries where the TCLF sector is one of the main economy drivers like in Spain and Italy. Some countries like Germany struggled with the data protection issues and others just found that the TCLF sector is not so active yet as it was expected first. But, in terms of overall KPIs, the numbers of responses were much higher than indicated in the project application and gave a solid basis for the analysis. In total **625 SMEs and 90 HE/VET** institutions were targeted during the survey.

Figure 1.1 Sample of the study

Country	Targeted SMEs	Targeted HE/VET institutions	Targeted interviewees	Responses from SMEs	Responses from the HE/VET institutions	Responses from interviewees
Germany	400	15	3	12	19	3
Italy	57	10	3	57	10	3
Spain	38	12	3	38	12	3
Estonia	45	11	3	17	11	3
Bulgaria	27	13	3	27	13	3
Greece	26	10	3	25	10	3
Croatia	29	13	3	29	13	3
Slovakia	3	6	N/A	2	1	N/A
Total	625	90	21	207	89	21



To address critical training-related questions, the research was conducted to outline the most effective learning methods for the TCLF sector. In parallel, mapping the identified skills against the European Qualifications Framework (EQF) and ESCO systems to ensure alignment with existing standards and provide clarity on what these qualification levels mean for TCLF companies.

The methodologies lined out above provided a clear framework for conducting thorough research, ensuring that the project met its objectives of identifying training needs and skills gaps. This systematic approach allowed for a comprehensive analysis for this report and comparison of the responses provided, both by question and by country.

1.3. Objectives

This report addresses the first specific objective articulated in the SiT project proposal, i.e. identifying the emerging skills needed in the Textile, Clothing, Leather, and Footwear (TCLF) sector. The goal was to gather insights from stakeholders to pinpoint the skills in demand for the sector's green transition. The SiT project aimed to engage 30 TCLF entrepreneurs/MSME managers, 5 HE/Research Institutes (RI), 5 VET providers, and 3 TCLF representative organizations in each participating country, with the exception of Slovakia.

Through this inclusive approach, the SiT project seeks to ensure that the identified skills and training needs are well-aligned with labor market demands, contributing to the green transition of the TCLF sector. By involving a broad range of stakeholders, the project can develop a training structure that is relevant, effective, and impactful, and that supports the sector's shift towards sustainable practices.



The research focused on identifying and mapping the green skills and competences required for the two emerging occupations within the TCLF sector, namely the Bio-Textile Technician, a profession aimed at developing sustainable alternatives to conventional textile materials, and the Recycling Manager, who is responsible for ensuring the circularity of the textile supply chain. The objective was to define and map these occupations, detailing the knowledge, competences, and skills necessary to perform these roles effectively. The report maps these emerging roles against the European Skills, Competences, Qualifications, and existing occupations in participating countries to ensure that the identified skills and competences are recognized across borders, facilitating better mobility and recognition for professionals in the TCLF sector.

Key Aims of the Report:

1. Analysis of skills gaps and training needs: The report identifies the skills gaps and training needs for TCLF professionals at both national and European levels, with a focus on facilitating the sector's green transformation.
2. Mapping identified skills: The report maps the identified skills according to EQF, and ESCO systems within the TCLF sector, ensuring alignment with existing frameworks.
3. Describing and mapping emerging professions: The two emerging professions Bio-Textile Technician and Recycling Manager, which are essential for the green transformation of the TCLF sector, are described and mapped.
4. Definition of a new sector specific competence framework for Green Skills: The report defines a new reference framework for green skills in the TCLF sector, the SiT TCLF GreenComp, supporting its sustainable future.



5. Identification of the SiT training structure: The SiT project's training structure, which serves as the foundation for the development of two training curricula in WP3, is identified based on the insights from this research.



SECTION 2

2.1. Field survey analysis outcomes

The TCLF sector is facing unprecedented change as sustainability and circular economy practices become central to the industry's future. Environmental concerns, consumer demand for eco-friendly products, and regulatory pressures are driving the need for new skills and competencies, particularly in emerging green occupations. This chapter presents the findings of a comprehensive survey designed to define and map the green skills required for **two crucial professions**: the **Bio-Textile Technician** and the **Recycling Manager**. These roles are essential to the sector's transformation, playing a key part in reducing its environmental impact while fostering innovation in sustainable practices.

The **Bio-Textile Technician**'s role is emerging as a response to the increasing need for sustainable alternatives to conventional textile materials. These technicians **focus on developing and implementing bio- based, biodegradable materials that align with the principles of sustainability and reduced environmental impact**. As bio-based materials gain popularity, Bio-Textile Technicians are at the forefront of innovation, working to develop materials that can replace synthetic fibers, reduce resource consumption, and create more sustainable production processes.

Similarly, the **Recycling Manager** is becoming a pivotal figure in ensuring the circularity of the textile supply chain. This role **focuses on implementing systems that efficiently recycle textiles, reduce waste, and extend the life cycle of materials**. **Recycling Managers work across the supply chain, ensuring that textiles are collected, sorted, and processed in ways that minimize environmental impact while maximizing resource recovery**. The role also involves ensuring compliance with regulations and standards for waste management and recycling, making it critical for businesses aiming to align with circular economy principles.



The survey, conducted among two key respondent groups—small and medium-sized enterprises (SMEs) and vocational education and training (VET) and higher education (HE) institutions—sought to identify the technical and soft skills required for these roles. The aim was to gain insight into the current understanding of these emerging professions, the competencies considered most relevant, and the training or development needs perceived by industry stakeholders. The responses to the survey are presented in separate sections, highlighting the differences in perspective between SMEs and VET/HE institutions.

The survey addressed a wide range of topics, beginning with general awareness of the emerging occupations of Bio-Textile Technician and Recycling Manager. Respondents were asked if they had heard of these roles and to what extent they recognized their importance in the future of the TCLF sector. This question aimed to gauge the level of awareness and readiness within the industry to adopt these new professions.

To understand the skill requirements for these occupations, the survey explored both technical and soft skills that are deemed critical. Respondents were asked to rate the relevance of various technical competencies, such as material science, textile production processes, and environmental impact assessments, on a scale of 1 to 5, where 1 represented "not important" and 5 represented "extremely important." Similarly, they were asked to evaluate the significance of soft skills, including problem-solving, collaboration, innovation, and adaptability, which are becoming increasingly vital as the sector evolves towards sustainability.

A key aspect of the survey was the exploration of regulatory requirements and standards, specifically certifications for sustainable textiles. Respondents were asked to rate the importance of knowledge in this area, reflecting the growing need for professionals who can navigate complex regulatory landscapes to ensure that textile production meets environmental and quality standards. Understanding these regulations is vital for both Bio-Textile Technicians



and Recycling Managers, as it allows them to align their work with industry expectations, consumer demands, and legal obligations.

Additionally, the survey examined the importance of assessing the environmental impact of different textile materials and production processes. Respondents were asked to evaluate how critical it is for Bio-Textile Technicians and Recycling Managers to possess this knowledge, as environmental assessments are central to the development of sustainable products and recycling processes. These assessments help professionals identify areas for improvement, optimize resource use, and reduce the overall environmental footprint of textile production.

Training and professional development opportunities were also a major focus of the survey. Respondents were presented with various options for enhancing the skills and knowledge of professionals working with bio-based materials and recycling systems. The options included workshops, on-the-job training, certification programs, and collaboration with industry and academic partners. The goal was to identify which types of training would be most beneficial in ensuring that these professionals are equipped with the latest knowledge and skills to drive innovation and sustainability in the sector.

The responses were divided into two main categories: those from SMEs and those from VET/HE institutions. This division reflects the different perspectives and needs of these two groups. SMEs, often focused on the practical aspects of production and business operations, tend to prioritize immediate skill needs and the direct applicability of training to their day-to-day work. In contrast, VET/HE institutions place greater emphasis on the theoretical foundations and long-term development of skills, preparing students for the evolving demands of the industry. It is important to note that the section on textile recycling, which focused on the emerging role of the Recycling Manager, was addressed exclusively by higher education institutions. This reflects the academic sector's role in shaping the future of the recycling field through research, curriculum development, and collaboration with industry partners. However,

the overall conclusions of the report encompass input from both SMEs and VET/HE institutions, providing a comprehensive view of the challenges and opportunities facing the sector in adopting green skills and sustainable practices.

2.1.1. General Overview of the SME sector

The survey gathered insights from the SMEs to understand their specific areas of operation. The following breakdown presents the distribution of respondents across different sectors within the TCLF industry, highlighting the relative representation of each area.

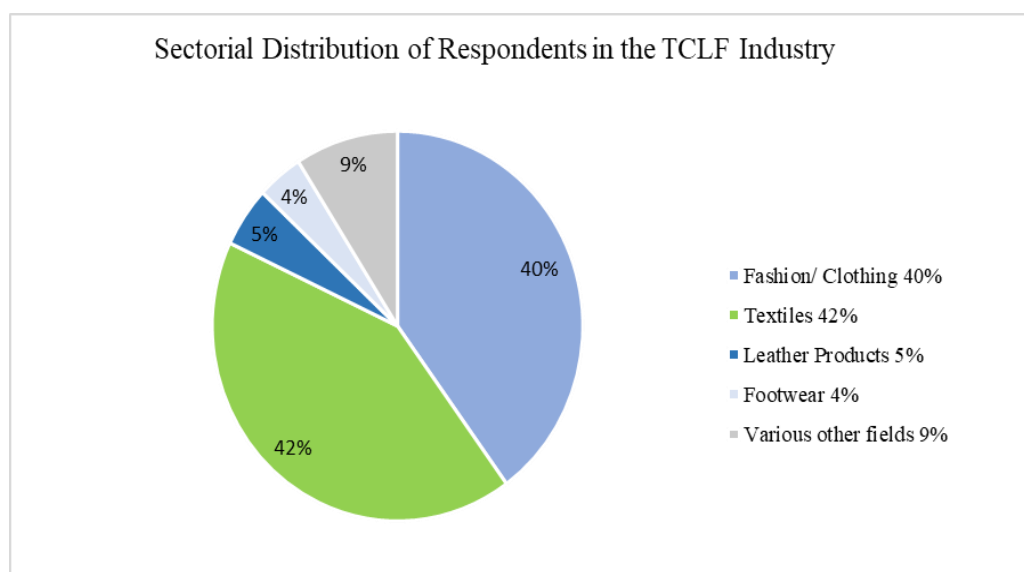


Figure 2.1. Sectorial Distribution of Respondents in the TCLF Industry

The survey responses show that a diverse group of businesses participated, with the majority representing **Fashion/Clothing** (40%) and **Textiles** (42%). A smaller portion of respondents indicated involvement in **Leather Products** (5%) and **Footwear** (4%). Additionally, 9% of the



respondents identified their operations in various other fields, including niche areas such as synthetic fiber processing, packaging, and services like business consultations and training in sustainable fashion. Other sectors include areas such as entertainment, synthetic fiber processing, and packaging, along with services like consultations, business support, and innovation support.

A key question asked about the number of employees in their companies to gauge the size of the SMEs represented. Here are the breakdowns and analysis of the results:

0-5	employees:	103	responses	(53%)
6-10	employees:	31	responses	(16%)
20-40	employees:	39	responses	(20%)
60-80	employees:	2	responses	(1%)
80-100	employees:	5	responses	(3%)
More than 100 employees: 8 responses (4%)				

A significant majority of the respondents (53%) represent **micro-enterprises** with 0-5 employees. Another 16% of respondents indicated working in companies with 6-10 employees, while 20% represent companies with 20-40 employees. The remaining 10% are distributed across larger companies, with 60-80, 80-100, and more than 100 employees, though these are far less common.

The respondents' roles within their respective SMEs were also examined to better understand perspectives from different levels of the company hierarchy, which is essential for interpreting the impact of decisions on sustainability and business operations. The results revealed the following distribution of roles:



Owner/Co-owner: 97 responses (50%)

Employee/Staff: 41 responses (21%)

Head/Manager/Managing Director: 27 responses (14%)

Member of the Board/Management Board: 18 responses (9%)

Department Head: 10 responses (5%)

Other Roles: 2 responses (1%) (includes titles such as **Legal Representative, Area Coordinator, Sustainability Manager, and President**).

The survey responses primarily reflect input from company owners and senior management, with **50%** identifying as owners or co-owners and **14%** as heads or managers. Employees and staff members make up **21%** of respondents, providing a mix of perspectives from both leadership and operational roles. The diverse range of roles indicates that the survey engaged participants with various levels of responsibility, from ownership and governance to day-to-day operations, offering a broad view of insights from across company hierarchies.

The survey included a mapping of **the respondents' years of experience** in the TCLF sector, recognizing that their time spent in the industry would significantly shape their perspectives and insights. Understanding the level of experience helps contextualize their views on challenges and opportunities within the sector.

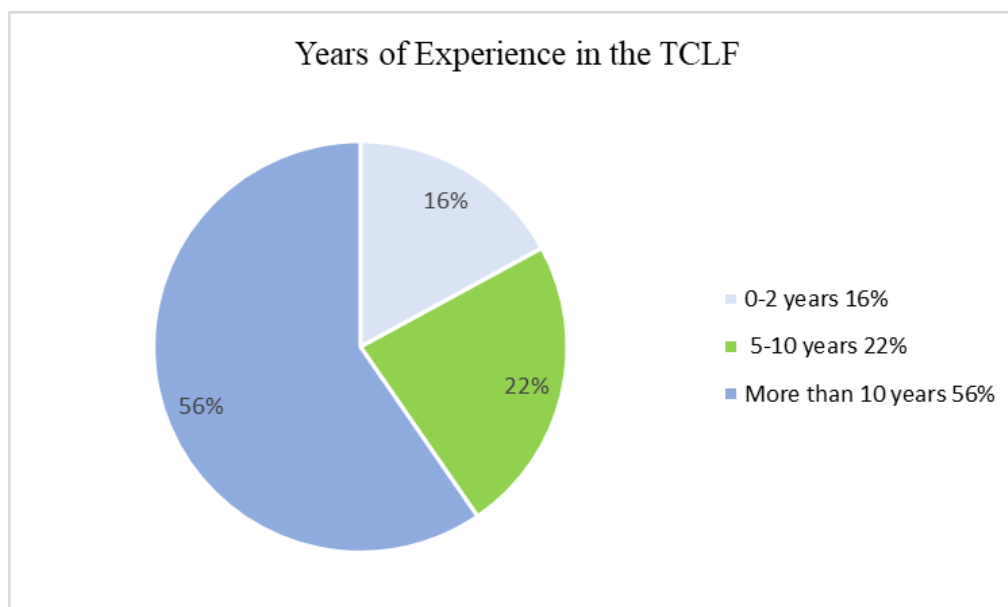


Figure 2.2. Years of respondents' experience in the TCLF sector

A significant majority of respondents (56%) have **more than 10 years of experience**, indicating that the survey approached highly experienced individuals with a deep level of industry knowledge. **22% of respondents** have **5-10 years of experience**, representing mid-level professionals who have substantial exposure to the industry but are likely still in a phase of professional growth. A smaller portion, **16% of respondents**, have **0-2 years of experience** in the sector, reflecting the perspectives of newer entrants.

2.1.2 General Overview - HE/VET

The survey included respondents from a variety of educational institutions, representing both higher education and vocational education sectors. Their distribution is as follows: **40%** came from public VET centers, **35%** from public universities, **18%** from private VET centers, and **7%** from Private Universities. The next chart provides a visual representation of this division.

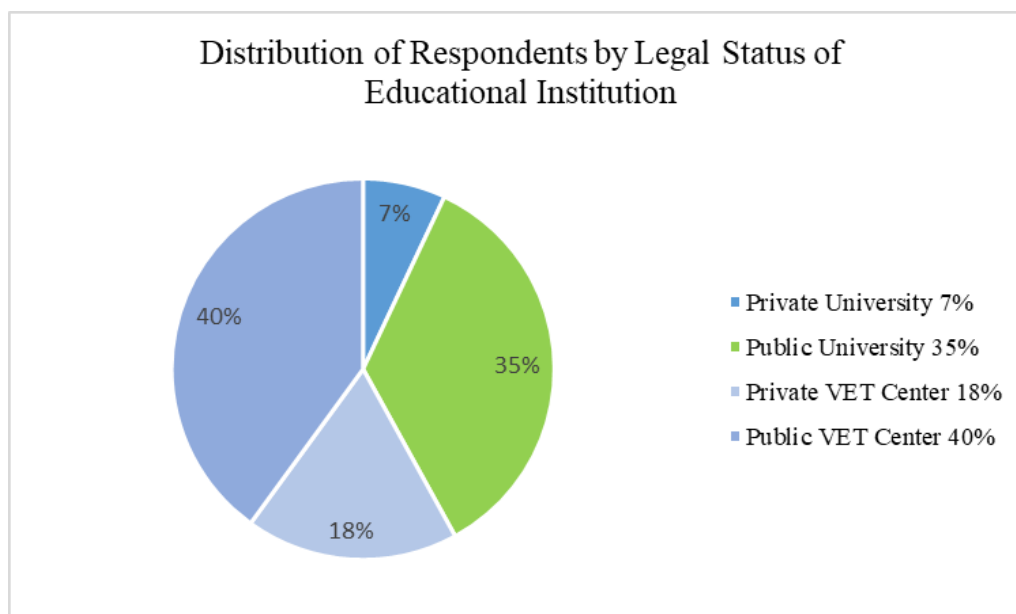


Figure 2.3. Distribution of respondents by legal status of educational institutions

Educational institutions across multiple countries highlight their expertise and the qualification levels they provide according to the European Qualifications Framework (EQF). The institutions cover a wide range of vocational and higher education disciplines, focusing on textiles, design, leather goods, and related fields.

When it comes to the level of training in the TCLF sector, the EQF levels vary significantly in the participating countries: In Germany, institutions demonstrate expertise in textiles, fashion management, and sustainability, with educational offerings spanning EQF levels 4 to 7. Italy focuses on design and footwear technology, providing qualifications at EQF levels 4 and 7. In Spain, institutions offer programs in textiles, leather goods, and design, with qualifications from EQF levels 4 to 7. In Estonia, institutions offer qualifications from EQF levels 5 to 7, specializing in textiles, material recycling, and leather goods. Greece provides both vocational and higher education, particularly in textiles and creative industries, with offerings from EQF



levels 4 to 7. Bulgaria focuses on fashion and textiles in vocational education at EQF level 4, with advanced programs reaching EQF level 7. In Croatia, institutions specialize in textiles, leather goods, and footwear, offering education from EQF levels 4 to 7. Slovakia provides training in science and textiles, with qualifications ranging from EQF levels 4 to 7. These institutions play a crucial role in preparing students for both technical and creative careers, offering a comprehensive mix of vocational training and higher education across EQF levels 4 to 7.¹

- EQF 4: 32%
- EQF 5: 21%
- EQF 6: 20%
- EQF 7: 27%

¹ <https://europass.europa.eu/en/description-eight-eqf-levels>



2.2. Describing and Mapping the emerging professions of the Bio-Textile Technician and the Recycling Manager

Both the **Bio-Textile Technician** and the **Recycling Manager** will be equally important in driving sustainability and innovation within the industry. The project sought to gather respondents' knowledge, perspectives, and experiences regarding these new professions to ensure that future professionals are adequately prepared for these key roles.

The survey analysis was structured to focus on both professions individually: Each profession was examined through the perspectives of the **SMEs** and the **HE/VET institutions**. This division is crucial because SMEs provide a direct perspective on the operational needs and challenges of integrating new expertise into their businesses, particularly in relation to sustainability goals and innovation. Their insights help to define what specific competencies and skills are most necessary from a practical standpoint. On the other hand, responses from **HE/VET institutions** play a pivotal role in shaping the curricula for these emerging professions. These institutions are responsible for ensuring that the training programs align with industry needs, particularly in preparing professionals who will be equipped to handle the demands of a rapidly evolving sector. This division allowed the project to comprehensively understand both the practical application and the educational foundation required for these professions, ensuring that the training programs developed through the project will be effective in fostering the next generation of Bio-Textile Technicians and Recycling Managers.

2.2.1. SMEs' describing the Bio-Textile Technician

It was essential to first understand how many SME representatives were even aware of a profession such as the Bio-Textile Technician because this knowledge provides insight into how familiar the industry is with emerging roles that are critical to advancing sustainable

practices. By gauging awareness, we could assess whether the concept of a Bio-Textile Technician is already integrated into the industry's mindset or if there is a need to increase visibility and education around this profession.

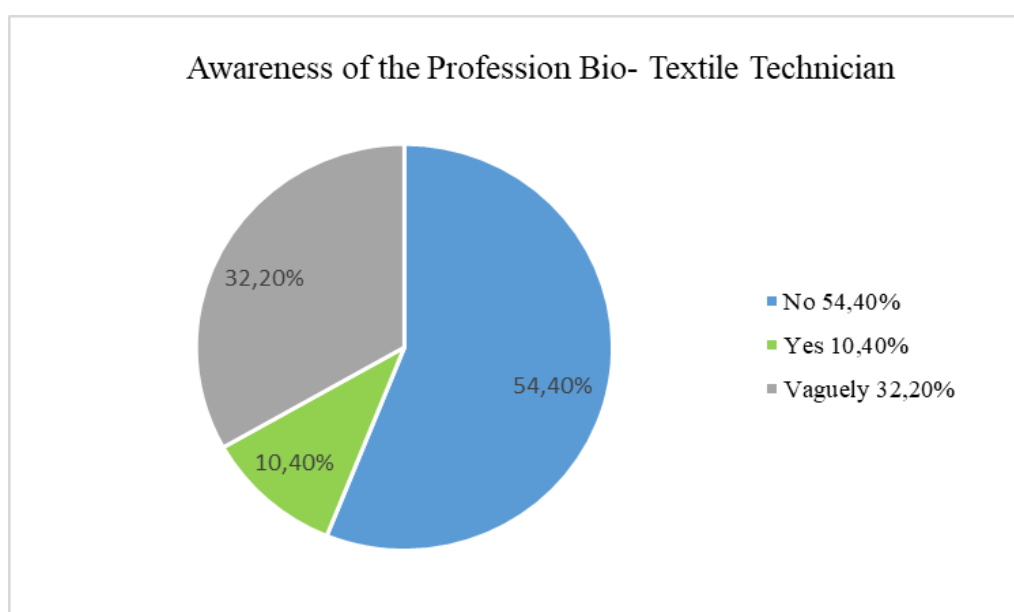


Figure 2.4. Awareness of the Profession: Bio-Textile Technician

Awareness of the Bio-Textile Technician position presents a similar challenge, although there is a slightly higher level of recognition compared to the Recycling Manager's role. **55%** of respondents indicated that **they had not heard of this position**, which shows that the profile is relatively unknown within the industry. Despite growing interest in bio-based materials and sustainable textiles, the specific profession of a Bio-Textile Technician is not yet widely understood or recognized. Interestingly, **35%** of respondents reported **vague awareness of the role**, indicating some level of exposure to the concept of bio-based textiles, but not enough clarity about the responsibilities and importance of this position. This group may be aware of the trend toward sustainable materials but lacks specific knowledge about the expertise required to develop and manage bio-based textile innovations. Only **10%** of respondents indicated that they were **familiar with the Bio-Textile Technician** role. This could reflect the



growing visibility of sustainability initiatives in the textile and fashion industries, where bio-based materials are becoming more prominent and where specialized knowledge is increasingly sought after.

In summary, the awareness of the Bio-Textile Technician role is still limited but appears to be slightly more established than the Recycling Manager role. As bio-based materials gain market traction, the need for professionals in this area is expected to grow, leading to greater demand and faster integration into the labor market. The **technical competencies** were examined to identify the specific skills required for Bio-Textile Technicians, given their crucial role in advancing sustainable practices in the textile industry. The survey asked SMEs to rate a series of technical competencies that they considered particularly relevant for a Bio-Textile Technician. Respondents were asked to rate each competence on a scale from 1 (not important) to 5 (extremely important). The competencies included:

- Knowledge of bio-based material properties and processing techniques
- Expertise in biotechnology and bioengineering
- Understanding of sustainable sourcing and supply chain management for bio-based materials
- Proficiency in organic and inorganic chemistry, focusing on their application in textile processing and dyeing
- Proficiency in Quality Control and testing methods for bio-based products
- Technical skills in textile production, including weaving, knitting, and non-woven technologies
- Capability in Life Cycle Assessment (LCA)

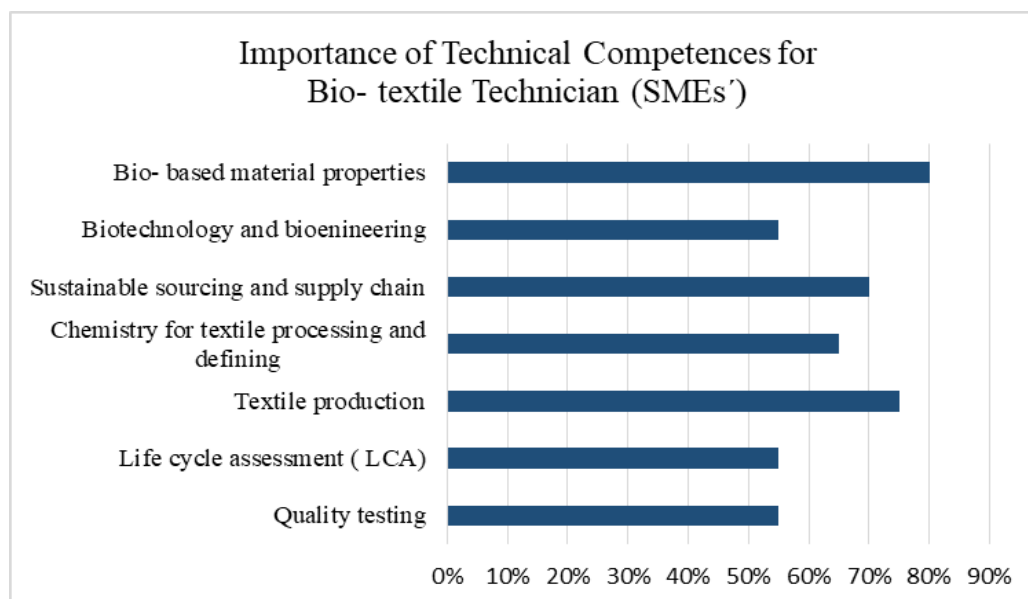


Figure 2.5. Importance of Technical Competencies for Bio-Textile Technicians (rated by SME's)

SMEs were asked which technical skills they consider most important for someone to master when working in the bio-textile field. **Bio-based material properties and processing** emerged as the top priority, with over 80% of respondents highlighting its importance. **Sustainable sourcing and supply chain management** was also identified as a key competence, with approximately 70% of SMEs rating it as vital. This reflects the industry's growing focus on ensuring that materials are sourced responsibly, and processes are efficient and ethical throughout the supply chain. **Textile production skills**, encompassing weaving, knitting, and non-woven technologies, received a rating of around 75%, underlining the need for technicians to have hands-on capabilities across various production methods. Additionally, **chemistry for textile processing and dyeing** was rated by 65% of respondents as essential. About 60% of SMEs considered **quality testing** and **Life Cycle Assessment (LCA)** competencies to be important. **Biotechnology and bioengineering** were rated by 55% of participants, suggesting a moderate need for skills in developing bio-based solutions.



As additional feedback, the following skills were also highlighted: **digital literacy, ethical material sourcing, and reducing waste through design**. Some respondents noted a need for a more comprehensive understanding of the field, suggesting that continual learning and adaptability are key.

SMEs were also asked to evaluate the relevance of various **soft skills** for Bio-Textile Technicians. Respondents rated these skills on a scale from 1 (not important) to 5 (extremely important). These skills included:

- Communication: ability to convey ideas clearly and collaborate effectively with teams
- Problem-solving: capability to address challenges and develop practical solutions
- Critical Thinking: the skill to analyze complex information and make informed decisions
- Time Management: managing deadlines efficiently in fast-paced, innovation-driven projects
- Adaptability: flexibility in adjusting to new materials, technologies, and evolving industry demands
- Creativity/Innovation: developing new and sustainable solutions through creative approaches

The following table illustrates the percentage of respondents who rated the importance of various soft skills with the highest Bio-Textile Technician, highlighting the key competencies that are valued within the sector.

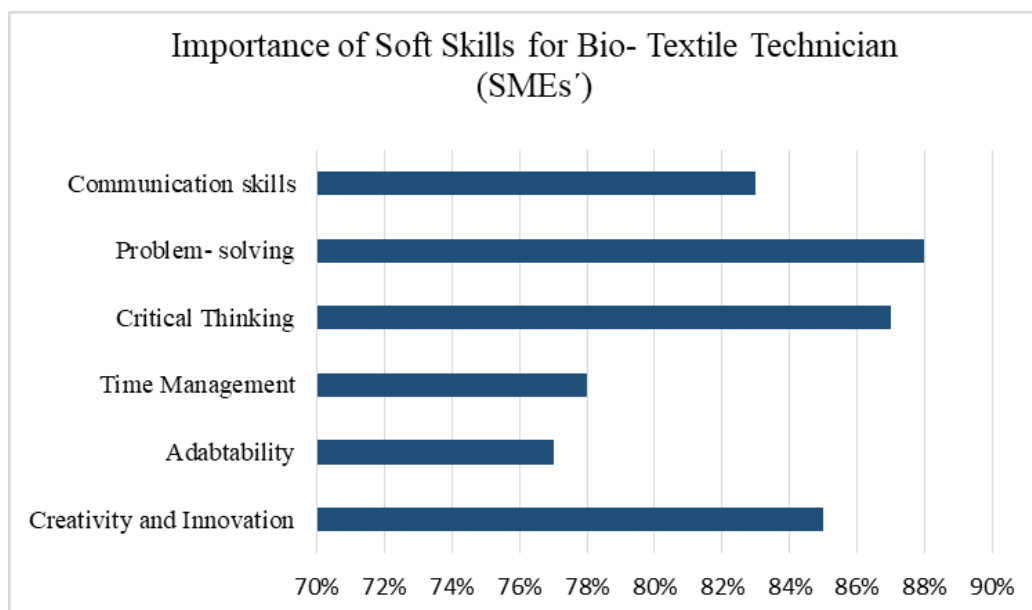


Figure 2.6. Importance of Soft Skills for Bio-Textile Technician (rated by SME's)

The survey results show that **problem-solving is highly valued by respondents**, with around 88% rating it as either a 4 or 5. This suggests that Bio-Textile Technicians must frequently address complex challenges in the production process, such as ensuring sustainability while maintaining technical feasibility. **Critical thinking**, which was rated highly by **87% of respondents**, closely complements problem-solving. This skill is crucial for managers to assess complex situations and make informed, strategic decisions that support both the development of bio-based textiles and the overall business goals. **Creativity and innovation** stood out as the most important skills, with approximately **85% of respondents** rating them highly. **Communication skills** were rated highly by **83% of respondents**. This underscores the importance of clear and effective communication in fostering collaboration among teams and ensuring that all stakeholders are aligned. **Time management** was rated as important by around **78% of respondents**. This reflects the industry's focus on efficiency, as managers are often required to meet tight deadlines in innovation-driven projects. **Adaptability** was also considered important, with about **77% of respondents** giving it a high rating. This highlights



the need for managers to be flexible and responsive to changes in regulations, market demands, and technological advancements. However, adaptability was rated lower than creativity and innovation, indicating that while flexibility is necessary, fostering innovation takes priority.

SMEs preferred training methods for Bio-Textile Technicians

In response to the question about which types of training or professional development opportunities would be most beneficial for individuals working with bio-based materials, the feedback from the SMEs highlighted a strong preference for **hands-on training and practical experience**. This was identified as one of the most important methods by the majority of respondents. They emphasized that practical training offers the opportunity to apply knowledge in real-world situations, which is essential for mastering bio-based materials. Equally valued was **collaboration with research institutions or industry partners**, as this approach also offers practical experience but with the added benefit of exposing individuals to real-life challenges and problem-solving scenarios that are crucial in this field. Additionally, **online courses and certifications** were recognized as an important training method. Many respondents noted that online learning is particularly beneficial for those already working in the field, who may not have the flexibility to attend in-person workshops or hands-on training sessions. The theoretical knowledge gained through online courses can still be valuable, especially in a field where working professionals often experience gaps in foundational knowledge. Therefore, while practical experience remains crucial, online courses offer an accessible and effective way to enhance skills for those balancing their professional responsibilities with continued learning.

2.2.2. HE/ VET describing the Bio-Textile Technician

The question, “Have you heard of the emerging occupation of Bio-Textile Technician?” was posed to higher education (HE) and vocational education and training (VET) institutions, aiming to assess their awareness of this new profession. The chart presents the following distribution of responses.

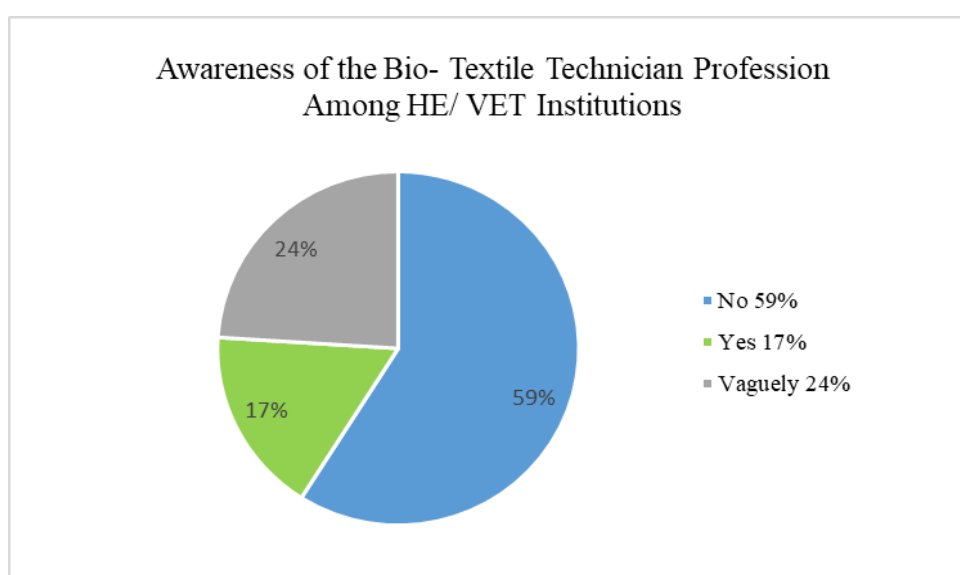


Figure 2.7. Awareness of the Bio-Textile Technician Profession among HE/VET

Quantitatively, the results show that **59% of respondents** have not heard of the Bio-Textile Technician profession, which indicates a significant lack of awareness in the sector. **24% of respondents** indicated that they had heard of the profession but only **to a small extent**, suggesting that although some familiarity exists, it is not widespread or deeply understood. Finally, only **17% of respondents** stated that they were aware of this emerging role. These findings reveal a significant gap in awareness about the Bio-Textile Technician profession, which may hinder its growth and adoption. As these technicians are crucial to developing

sustainable practices and bio-based materials in the textile industry, a lack of awareness in educational institutions could slow the creation of training programs and the supply of skilled professionals.

The survey also looked into whether institutions offer **a dedicated learning pathway for the Bio-Textile Technician profession**. The findings show that there is a **significant lack of formal education** specifically tailored to this role, with **65 %** of respondents indicating that no such pathway exists at their organization. This points to a clear gap in educational programs that directly address the needs of this growing profession. **About 15%** of respondents stated that, while there is no dedicated pathway, there are related courses available. Around **15%** of respondents mentioned that recycling management is taught as part of a broader program. Only a small proportion, **less than 5%**, reported having a fully dedicated pathway for this role. This underlines the scarcity of focused educational tracks for recycling managers, signaling an opportunity for institutions to develop more targeted programs that align with the industry's growing needs.

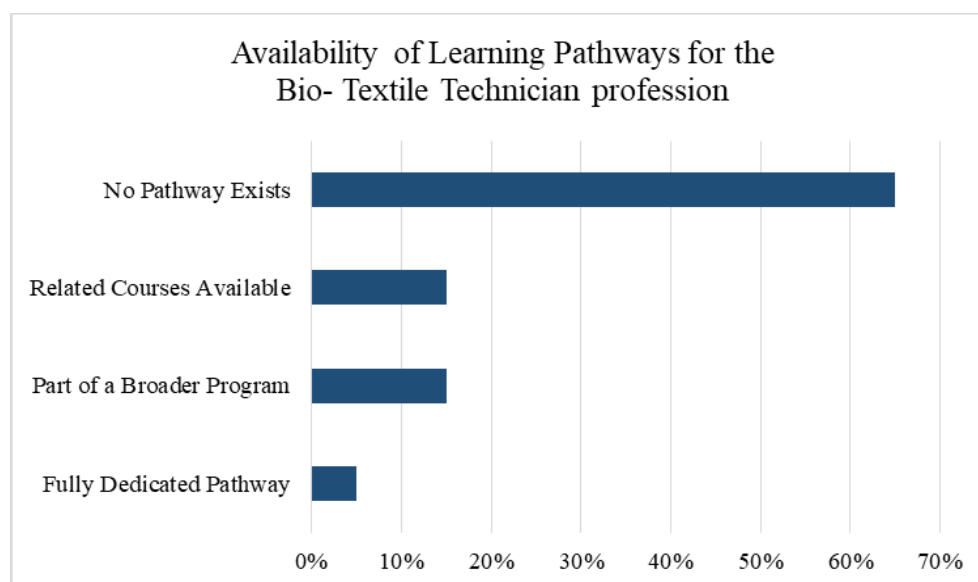


Figure 2.8. Availability of Learning Pathways for the Bio-Textile Technician Profession



Similarly to the SMEs, the HE/VET institutions were also asked to assess the relevance of **technical skills** for the emerging role of a Bio-Textile Technician. Respondents were asked to rate each competence on a scale from 1 (not important) to 5 (extremely important). The chart below shows the percentage of respondents who rated each skill as a 4 or 5 on the importance scale. **Understanding sustainable sourcing and supply chain management** emerged as the most critical competence, with **87% of respondents** rating it as highly relevant. This reflects the growing emphasis on sustainability within the textile industry, especially as bio- textiles increasingly rely on ethically sourced and environmentally friendly materials.

Following closely, **80% of respondents** rated **proficiency in quality control and testing methods** as key skills. This skill ensures that bio-textile products adhere to high standards of quality and safety, which is crucial not just for maintaining product integrity but also for meeting the demand for durable, reliable materials. Similarly, **79% of respondents** highlighted the importance of **proficiency in organic and inorganic chemistry**. A solid understanding of chemistry allows technicians to better control processes like textile dyeing and material optimization, ensuring that production aligns with environmental objectives. On the more practical side, **77% of respondents** pointed to the importance of **technical skills in textile production, including weaving, knitting, and non-woven technologies**. The ability to integrate eco-friendly techniques into traditional textile methods highlights the ongoing need for foundational production skills in this evolving field.

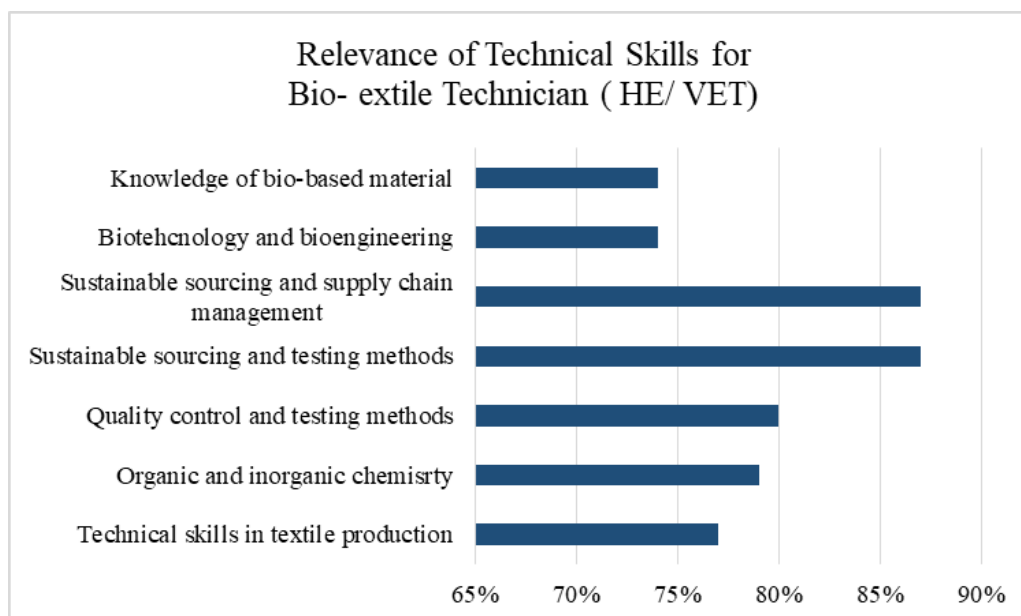


Figure 2.9. Relevance of Technical Skills for Bio-Textile Technician (HE/ VET)

Knowledge of bio-based material properties and processing techniques, as well as **expertise in bio-technology and bioengineering**, were both rated as essential by **74% of respondents**. These competences reflect the growing need for specialized knowledge in developing and processing bio -based materials, which is fundamental for Bio-Textile Technicians as they work to innovate and improve the sustainability of textile production.

The HE/VET institutions were asked to evaluate the relevance of **soft skills for a Bio-Textile Technician**. Respondents rated each skill on a scale from 1 (not important) to 5 (extremely important). The chart below illustrates the percentage of respondents who rated these soft skills as either a 4 or 5, reflecting their high importance across the board.

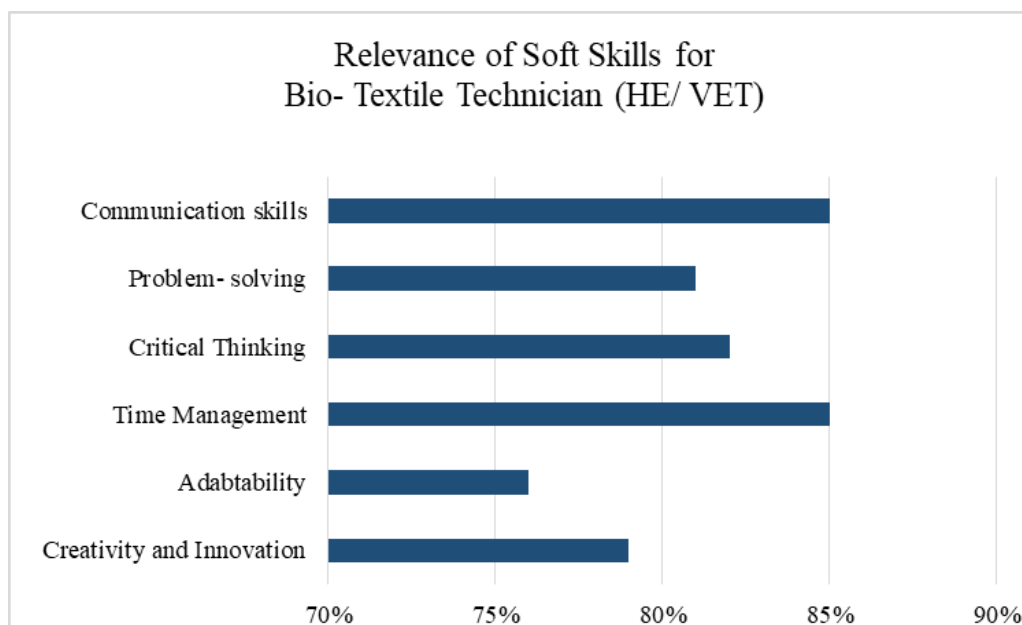


Figure 2.10. Relevance of Soft Skills for a Bio-Textile Technician (HE/VET)

Communication skills were rated as the most critical, with **85%** of respondents assigning them a 4 or 5. This highlights the importance of conveying technical information clearly, collaborating effectively with colleagues, and interacting with clients or stakeholders in the bio- textile field. **Time management** is also highly valued, with **85%** of respondents rating it as important. This suggests that the ability to prioritize tasks, allocate resources efficiently, and meet project deadlines is essential for Bio-Textile Technicians, who often juggle multiple responsibilities. **Critical thinking** followed closely, receiving high ratings from **82%** of respondents. This competence is essential for technicians as they must evaluate complex information, analyze data, and make informed decisions. **Problem-solving** was deemed highly relevant by **81%** of respondents. **Creativity and innovation** were also rated highly, with **79%** of respondents recognizing their importance. Finally, **adaptability** was rated as relevant by **76%** of respondents. The bio-textile field is dynamic and ever-evolving, so being open to change, embracing new trends, and adapting to new technologies are all crucial for success in this role.

Another question which was asked was to evaluate which areas of **knowledge regarding regulatory requirements and standards a Bio-Textile Technician should possess**. The focus was on understanding how well technicians should be informed about crucial topics such as certifications for sustainable textiles, environmental regulations, chemical safety standards, supply chain transparency, and social compliance. Institutions rated these knowledge areas on a scale from 1 (not important) to 5 (extremely important). Given the increasing importance of sustainability and ethical production in the textile industry, assessing the required level of understanding of these regulations is key to ensuring that future technicians are adequately prepared to meet industry demands.

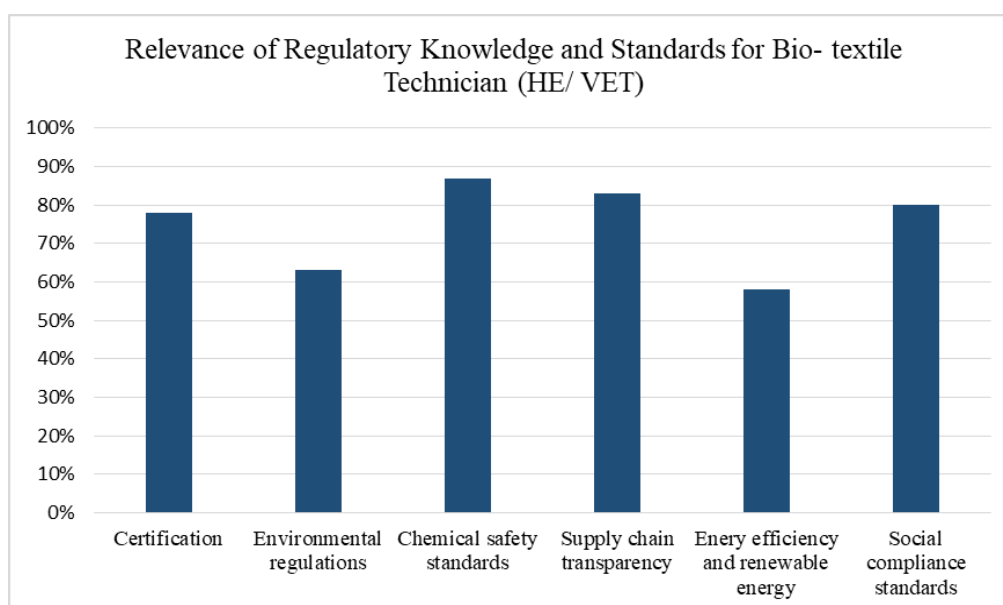


Figure 2.11. Relevance of regulatory knowledge and standards for Bio-Textile Technicians (HE/VET)

Chemical safety standards stood out as the most highly rated area of knowledge, with **87%** of respondents identifying it as crucial. This underscores the importance of ensuring that Bio-Textile Technicians are well-versed in chemical safety regulations, particularly given the industry's growing reliance on bio- based and eco-friendly materials. Similarly, **supply chain transparency**, rated highly by **83%** of respondents, is another key area of necessary expertise.



As bio- textiles become more integrated into mainstream markets, Bio-Textile Technicians must understand how to trace materials and ensure due diligence throughout the supply chain. With increased pressure from consumers and regulatory bodies for transparency, technicians need to possess knowledge that guarantees ethical sourcing and compliance across the supply chain. Mastery of these standards helps build trust in sustainable practices within the bio- textile industry. **Certifications for sustainable textiles and social compliance standards**, were also rated as highly relevant. Knowledge of **Environmental Regulations**, including waste management and chemical use standards, was considered important by **63%** of respondents. Although **Energy Efficiency and Renewable Energy** knowledge was rated slightly lower, with **58%** of respondents deeming it important, it remains essential for long-term sustainability in bio- textile production.

Preferred training methods for Bio-Textile Technicians by HE/VET institutions

Similarly to the results from the SME survey, the responses from HE/VET institutions reveal a clear preference for **practical training**, with **74%** of respondents selecting this option. This indicates that hands-on experience is seen as the most effective way for professionals in this field to enhance their skills and knowledge. **Technical workshops and seminars**, as well as **cooperation with research institutions or industrial partners**, were each selected by **37%** of respondents. This shows that structured learning environments and collaborative projects are also valued, though not to the same extent as direct practical experience. **Online courses**, on the other hand, were chosen by only **14%** of respondents, suggesting that while digital learning has its place, it is not considered as beneficial as in-person or hands-on approaches when it comes to working with bio- based materials. This highlights a strong preference for experiential and interactive learning methods in this particular field.

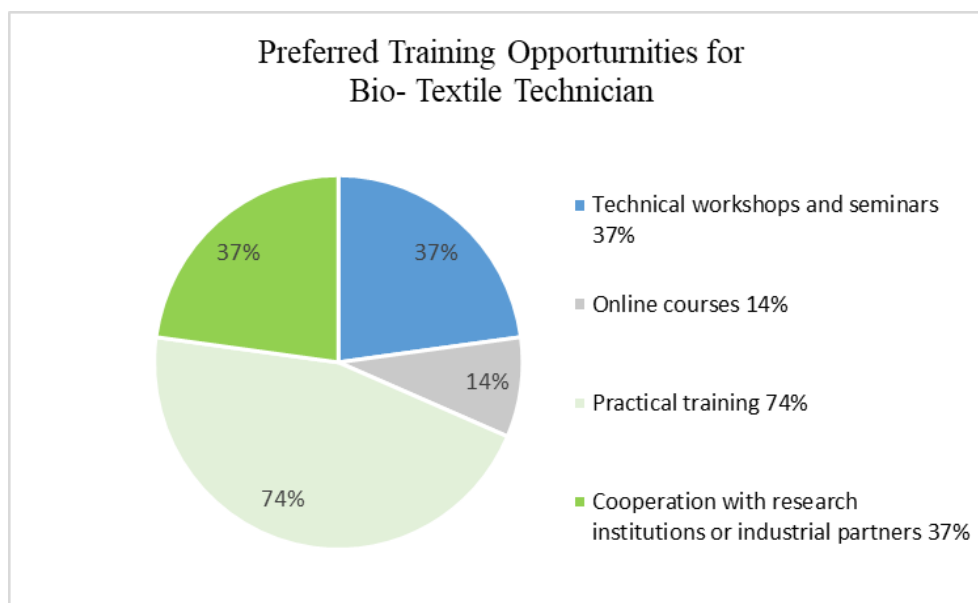


Figure 2.12. Preferred Training Opportunities for Bio-Textile Technician

2.2.3. Summary of the Bio-Textile Technician role and competence needs

The survey revealed that awareness of the Bio-Textile Technician profession is currently relatively low among SMEs and HE/VET institutions. Only a small portion of respondents are familiar with this emerging role, reflecting that, although sustainability is gaining traction, specialized knowledge in this area has yet to be widely adopted.

2.2.4. Key Competencies for a Bio-Textile Technician

The responsibilities of a Bio-Textile Technician revolve around the creation of innovative textiles from bio-based raw materials, managing processes such as fabric production and yarn development, with a strong emphasis on environmental sustainability. The survey identified several competencies that are essential for Bio-Textile Technicians to succeed in their role.



These competencies can be divided into technical skills, soft skills, and knowledge of regulatory standards.

Technical Competencies:

- **Knowledge of bio-based materials and processing techniques:** Bio-Textile Technicians must deeply understand how to work with materials derived from renewable resources. This knowledge is crucial for ensuring that production processes align with sustainability goals.
- **Expertise in bio-technology and bioengineering:** Since Bio-Textile Technicians often work with bio fibers and microorganisms, a background in bio- technology is essential for developing new materials and optimizing their properties for textile use.
- **Proficiency in textile production techniques:** Skills in weaving, knitting, and non-woven textile production remain important, even as the industry shifts towards more sustainable materials. Bio-Textile Technicians must be able to integrate traditional textile methods with modern eco-friendly practices.
- **Quality Control and testing methods:** Ensuring that bio-based textiles meet industry standards for durability and safety is a key responsibility. This requires knowledge of testing procedures and quality assurance protocols.
- **Life Cycle Assessment (LCA):** A critical tool in evaluating the environmental impact of textiles throughout their entire life cycle, LCA helps Bio-Textile Technicians make informed decisions that reduce waste and resource use.
- **Chemistry (organic and inorganic):** A strong understanding of chemistry is needed to work with various materials, particularly in dyeing processes and textile optimization.



Soft Skills:

- **Problem-solving and critical thinking:** These are among the highest-rated soft skills, essential for navigating the challenges that arise in sustainable textile production. Bio-Textile Technicians must be able to address unexpected issues while maintaining a balance between technical feasibility and sustainability.
- **Creativity and innovation:** Bio-Textile Technicians are expected to drive innovation within their industry, developing new materials and sustainable solutions. Creativity allows them to think outside the box and experiment with unconventional techniques.
- **Communication and collaboration:** As the field of bio- textiles is multidisciplinary, clear communication and effective collaboration with teams, stakeholders, and clients are essential for the successful implementation of innovative solutions.
- **Time management:** With multiple projects and deadlines, Bio-Textile Technicians must efficiently manage their time to ensure that production schedules are met while maintaining high standards.
- **Adaptability:** Given the dynamic nature of the bio-textile field, adaptability is a necessary trait. Technicians must be willing to embrace change, whether that involves adopting new technologies, responding to market trends, or complying with shifting regulations.

Regulatory Knowledge:

- **Chemical safety standards:** As Bio-Textile Technicians work with various chemicals, it is essential for them to be well-versed in safety protocols to protect both workers and the environment.



- **Supply chain transparency:** With a focus on sustainability, Bio-Textile Technicians must ensure that all materials are ethically sourced and that transparency is maintained throughout the supply chain. This becomes increasingly important as consumers demand more ethical production processes.
- **Certifications for sustainable textiles:** Knowledge of industry certifications is critical for ensuring that bio- textile products meet recognized sustainability standards, helping companies build trust with their customers.
- **Social compliance standards:** Bio-Textile Technicians must also consider the social impact of textile production, ensuring that labor practices are ethical and in line with international standards.

2.2.5. Training and Professional Development

The survey also highlighted **a clear preference for hands-on, practical training as the most beneficial form of professional development for individuals working with bio-based materials**. Respondents emphasized the importance of gaining experience through a real-work environment which allows professionals to refine their skills in actual production environments. Collaboration with research institutions and industry partners was another favored approach, as it provides opportunities for innovation and problem-solving in real-life scenarios. While practical training was prioritized, online courses and certifications were also recognized as valuable for professionals seeking to deepen their theoretical knowledge, particularly for those who may not have the flexibility to attend in-person training sessions. This suggests a need for diverse training opportunities that can accommodate various learning preferences and professional schedules. This mapping takes into account the insights and priorities highlighted in both the interviews and survey documents, reflecting the growing importance of sustainable practices in the textile industry and the need for specialized skills to meet these challenges.

2.2.6. Competency Mapping Table for Bio-Textile Technician

This mapping takes into account the insights and priorities highlighted in **both the interviews and survey documents**.

Competence Category	Competence/Skills	Description
Functional Competencies	Knowledge of bio- based materials and processing techniques	Expertise in identifying, processing, and utilizing bio- based, biodegradable, and renewable materials.
	Textile production techniques (weaving, knitting, non-woven)	Proficiency in using traditional and modern textile production methods, integrating eco-friendly materials into traditional processes.
	Bio- technology and bioengineering expertise	Applying scientific principles to develop bio-fibers and optimize their properties for textile production.
	Quality control and testing methods	Ensuring that bio- textiles meet safety, durability, and environmental standards through rigorous quality control processes.
	Life Cycle Assessment (LCA)	Assessing the environmental impact of textiles throughout their lifecycle, from production to disposal.
	Proficiency in chemistry (organic and inorganic)	Knowledge of chemical processes used in sustainable textile production, including dyeing

		and material treatment.
	Machinery operation and maintenance	Ability to operate and maintain both traditional and modern textile machinery for bio- based material production.
	Process optimization and efficiency	Implementing efficient processes to minimize waste, reduce energy consumption, and optimize resource usage in textile production.
	Environmental regulations and standards	Understanding and complying with environmental regulations and standards, including chemical safety and waste management.
Green Competences	Sustainable sourcing and supply chain transparency	Managing and ensuring transparency in the sourcing of bio- materials, promoting ethical and eco-friendly supply chains.
	Energy efficiency and renewable energy	Utilizing renewable energy sources and improving energy efficiency in production processes to reduce environmental impact.
	Sustainable innovation and research	Continuously researching and implementing sustainable innovations in textile production, focusing on bio- material development.
	Problem-solving and decision-making	Tackling sustainability and technical challenges in production processes, making informed decisions to drive innovation.
	Critical thinking and	Analyzing complex data and situations to

Transversal Competences	analytical skills	develop innovative, sustainable solutions for textile production.
	Creativity and innovation	Developing creative approaches to overcome challenges, fostering innovation in bio- textile materials and processes.
	Communication and collaboration	Effective communication and collaboration with teams, stakeholders, and clients to achieve sustainability goals.
	Leadership and team management	Leading teams in implementing sustainable textile production processes, ensuring alignment with environmental objectives.
	Time management and organizational skills	Managing deadlines and resources effectively to meet project goals without compromising sustainability standards.
	Adaptability and continuous learning	Adapting to industry changes and continuously learning new techniques and technologies in the evolving field of bio-textiles.
	Digital literacy and technological proficiency	Using digital tools and technologies to enhance textile production efficiency, quality control, and innovation.

Figure 2.13. Competency Mapping Table for Bio-Textile Technician

2.2.7. SMEs describing the Recycling Manager

SMEs were asked whether they were aware of professions such as Recycling Manager. The data indicates that the role of a Recycling Manager is not widely recognized among respondents, as seen from the next chart.

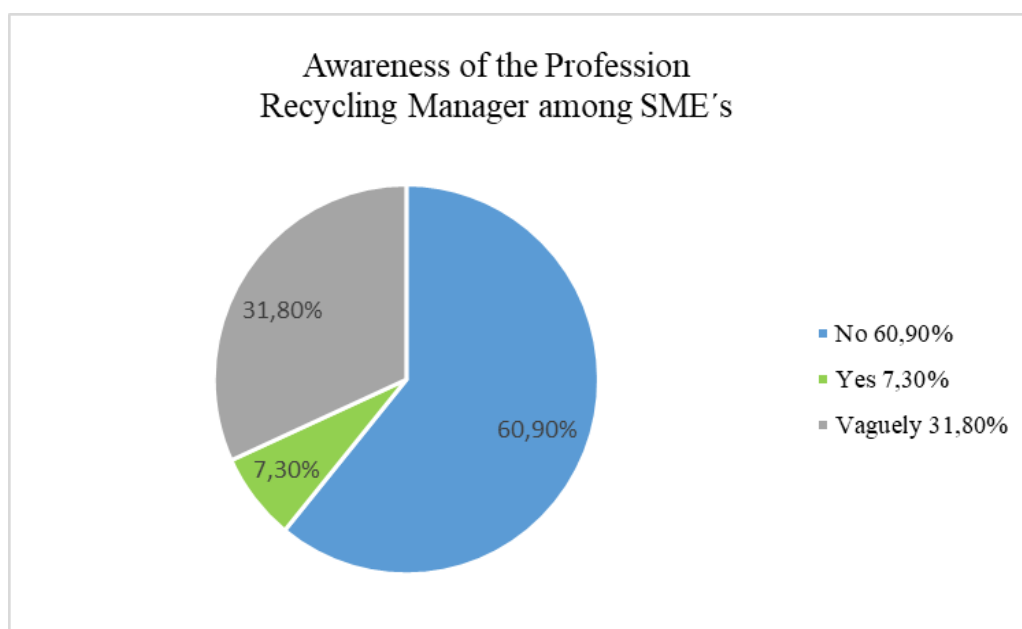


Figure 2.14. Awareness of the profession Recycling Manager among SMEs

A significant **60.9%** of respondents indicated that **they had not heard of this position, suggesting that the profession is still relatively unknown within the industry.** This may be surprising given the increasing focus on sustainability, circular economy practices, and the need to manage waste streams effectively. **31.8%** of respondents reported **vague awareness of the Recycling Manager role.** This group likely represents individuals who have



encountered discussions around recycling and sustainability but may not be fully aware of the need for specialized positions dedicated to these tasks. Only **7.3%** of respondents indicated **clear awareness of the Recycling Manager job**, representing a small minority. This reinforces the idea that the role is still niche and in need of further exposure. As recycling and waste management become more critical to corporate sustainability strategies, there is a clear opportunity to promote and define the role of a Recycling Manager more prominently.

Similar to HE/VET institutions, SMEs were asked to identify the **soft skills they consider most essential for Recycling Managers**. Identifying the key soft skills helps ensure that managers are equipped not only with technical know-how but also with the interpersonal and problem-solving abilities necessary to lead recycling initiatives effectively in an ever-evolving environmental landscape.

The evaluated soft skills included:

- **Communication skills:** proficiency in clearly and effectively communicating ideas, instructions, and feedback
- **Problem-solving:** capability to identify problems quickly and develop solutions, particularly when unexpected issues arise in the recycling process
- **Critical thinking:** ability to analyze information critically to make informed decisions that reflect the needs and strategic goals of the recycling initiatives
- **Team collaboration:** skills in fostering a collaborative environment
- **Adaptability:** ability to adapt to changing conditions, particularly in response to shifting regulations, market dynamics, and technological advancements in recycling

- **Leadership skills:** ability to inspire and lead teams, driving initiatives forward and ensuring that everyone is aligned with the recycling goals and objectives
- **Strategic thinking:** ability to think strategically about long-term implications of recycling initiatives, new technologies, market trends, and potential regulatory changes

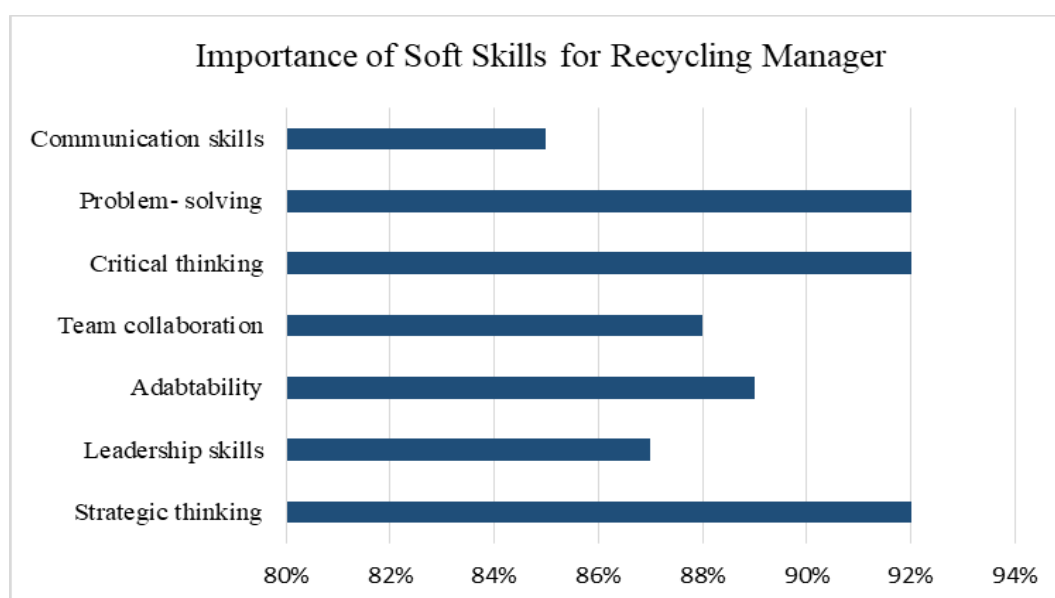


Figure 2.15. Importance of Soft Skills for Recycling Manager

The survey highlights the most important soft skills for Recycling Managers, with **strategic thinking** and **problem-solving** emerging as the top priorities: **92%** of respondents rated both skills as highly important. This indicates that Recycling Managers need to be able to anticipate future trends, navigate changing regulations, and incorporate new technologies into their planning, while also having the ability to quickly address and resolve issues that arise in the recycling process. Close behind, **critical thinking** was rated highly by **91%** of respondents. Recycling Managers must be able to analyze complex information and make informed decisions, especially in an industry that often deals with multifaceted problems. The



importance of **adaptability** was also clear, with **89%** of respondents identifying it as crucial. **Leadership skills** were similarly valued, with **87%** of respondents considering them essential. Effective leadership helps Recycling Managers inspire their teams and guide them towards achieving the company's sustainability goals. Finally, **team collaboration** and **communication skills** were rated as important by **88%** and **85%** of respondents, respectively. Collaboration is critical in recycling, where cross-functional teams and external partners must work together and effective communication ensures that everyone involved in the process is working cohesively toward the same outcomes.

SMEs were also asked to evaluate the importance of various **technical skills** for Recycling Managers on a scale from 1 (not important) to 5 (extremely important). These skills are crucial for driving innovation, ensuring regulatory compliance, and optimizing the recycling processes within the textile industry. Understanding which technical skills are most relevant helps organizations identify the key areas of expertise needed to manage recycling operations effectively and meet sustainability goals.

The technical competencies evaluated included:

- Knowledge of latest recycling technologies
- Understanding of waste management regulations, waste hierarchy, and Circular Economy principles
- Knowledge in material science
- Supply chain management
- Sustainability practices
- Chemistry and chemical engineering

The following chart illustrates the percentage of respondents who rated the importance of various technical skills with the highest scores, either 4 or 5.

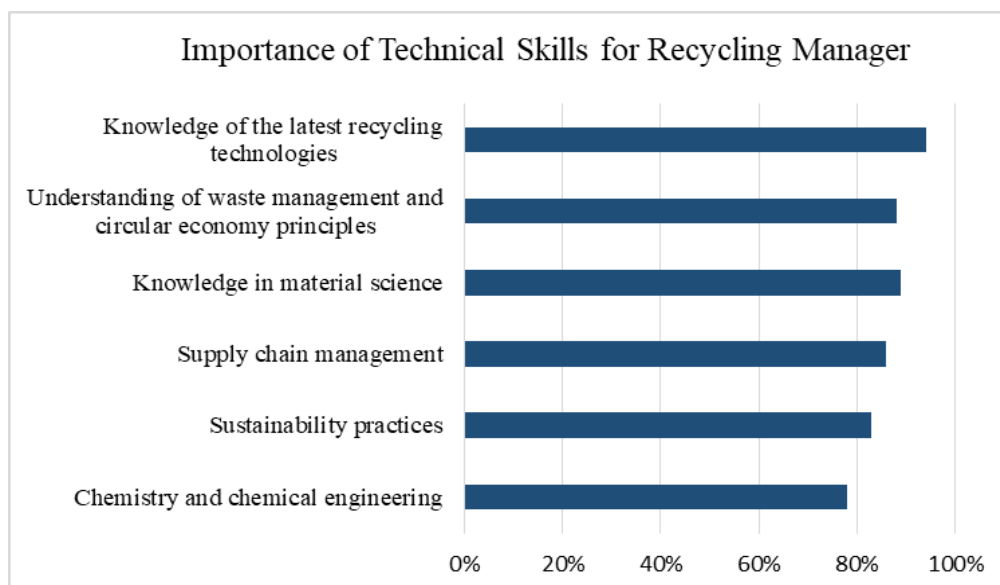


Figure 2.16. Importance of Technical Skills for Recycling Manager

The survey highlights that **knowledge of the latest recycling technologies** (rated by 94%) and **material science** (89%) are viewed as the most critical competences for Recycling Managers. This indicates that staying current with new technologies and understanding the properties and life cycles of textile materials are at the core of effective recycling management. Managers need to ensure that they can implement cutting-edge recycling technologies and optimize the recovery and reuse of materials through deep knowledge of their properties. **Knowledge of waste management regulations and circular economy principles** (88%) is another key area of focus. This reflects the growing importance of regulatory compliance in the recycling industry, especially as sustainability becomes a more central concern for businesses. Recycling Managers need to stay informed of changes in regulations and ensure that their practices align with the principles of circularity. **Supply chain management** (86%) is also seen as a critical competence, reflecting the logistical challenges involved in collecting, sorting, and redistributing textile waste materials. Efficient supply chain operations are essential to ensuring



that materials are recovered effectively and reused in a way that maximizes both economic and environmental benefits. **Sustainability practices** (83%), while rated slightly lower, are still considered important. This suggests that Recycling Managers must be aware of broader sustainability issues and practices in the industry, though this competence may be more integrated into other skills like material science and supply chain management. Lastly, **expertise in chemistry and chemical engineering** (78%) is essential for Recycling Managers, particularly for those dealing with advanced recycling processes that involve chemical analysis and process optimization. This skill helps improve the efficiency and effectiveness of textile recycling through scientific expertise.

The survey asked respondents to assess the **importance of specific regulatory knowledge areas for textile Recycling Managers**. The goal was to understand whether managers in this field need a strong grasp of various regulatory standards and certifications to perform effectively. The chart below provides a summary of the percentage of respondents who rated each regulatory competence as either 4 or 5 in terms of importance.

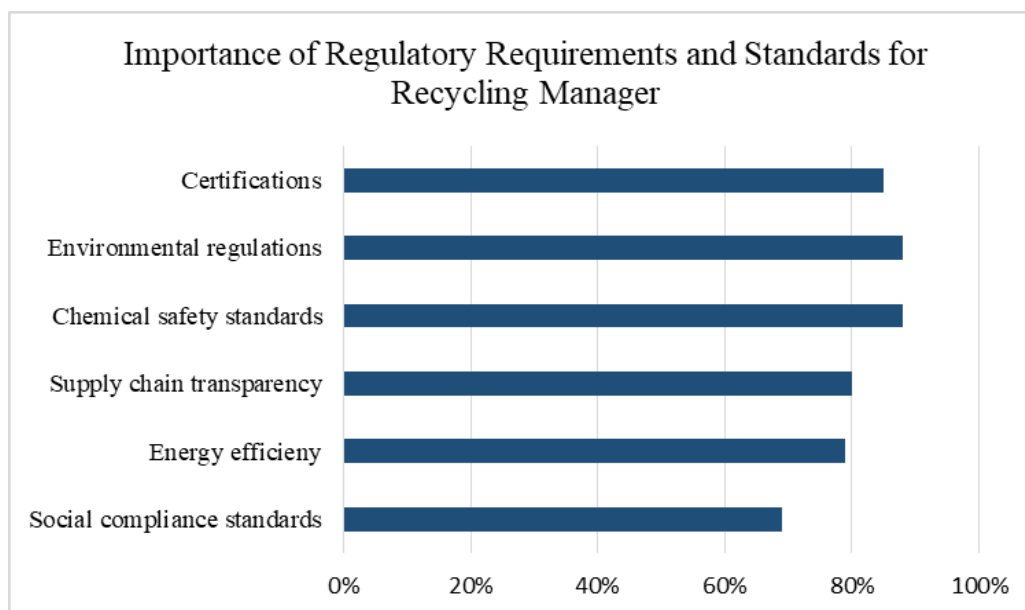


Figure 2.17. Importance of regulatory requirements and standards for Textile Recycling Manager

The strong emphasis on **environmental regulations (88%)** and **chemical safety (88%)** standards indicates that regulatory expertise in these areas is seen as crucial for textile Recycling Managers. These professionals need to skillfully navigate the intricate regulations surrounding waste management and chemical safety to ensure their operations remain compliant and secure. Similarly, **certifications for sustainable textiles (85%)** were also highly regarded, underscoring the increasing focus on sustainability in the industry. It is vital for Recycling Managers to be well-versed in relevant certifications, ensuring that the textiles they handle align with established sustainability benchmarks. **Supply chain transparency (80%)** was also highlighted as a key concern, reflecting the need for Recycling Managers to maintain traceability and accountability throughout the entire process. **Energy efficiency and renewable energy standards (79%)** were rated as essential as well, emphasizing the role of Recycling Managers in reducing their operations' environmental impact. While **social**

compliance (69%) standards received slightly lower importance, they **remain a vital part of the equation.**

SMEs preferred training methods for Recycling Managers

The survey sought to determine which types of **training and professional development opportunities** would be most valuable for enhancing the skills and knowledge of textile Recycling Managers. Several options were presented to respondents, who rated them on a scale from 1 (not beneficial at all) to 5 (very beneficial).

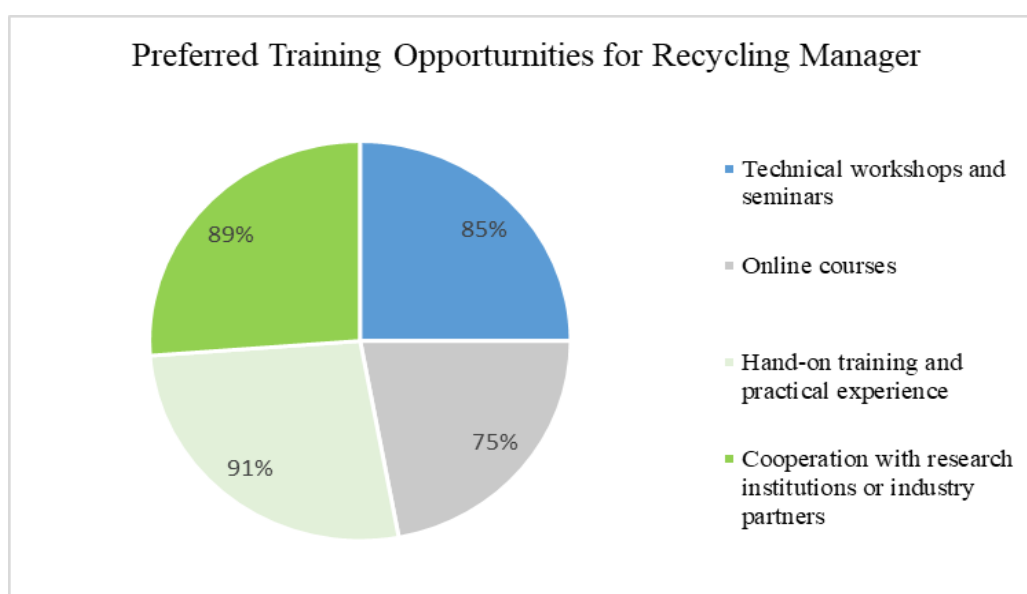


Figure 2.18. Beneficial Training opportunities for Textile Recycling Manager

The survey highlighted that **hands-on training and practical experience** stood out as the most valuable, with **91% of respondents** giving it top marks. This suggests that textile recycling professionals see real-world experience as critical to building the skills needed to effectively manage recycling operations. It is clear why this is the case: Practical training allows Recycling Managers to apply their knowledge directly, solve problems on the spot, and fine-tune their methods in ways that classroom-based learning cannot always achieve.



Collaboration with research institutions or industry partners also ranked highly, with **89% of respondents** finding it beneficial. This points to the importance of staying connected with the latest advancements in recycling technologies and sustainability efforts. Working alongside experts and organizations in the field not only sparks innovation but also ensures managers remain informed about cutting-edge practices in recycling processes, materials science, and regulatory compliance. **Technical workshops and seminars** were well-regarded by **85% of respondents**, showing that structured, in-person learning is still a key part of professional development. These sessions allow Recycling Managers to deepen their understanding of specific areas—whether it is new recycling technologies, sustainability certifications, or regulatory frameworks—blending theory with real-life case studies to enhance their practical knowledge. **Online courses and certifications** received a slightly lower rating of **75%**, they are still **considered a valuable resource for professional development**. The flexibility of online learning makes it an attractive option for busy Recycling Managers, though it may lack the hands-on component that other methods provide. Even so, online courses are effective for those looking to stay up-to-date with industry trends while balancing other responsibilities.

2.2.8. HE/ VET describing the Recycling Manager

Similarly to the SMEs, the HE and VET institutions were asked about **their awareness of the Recycling Manager profile**. The aim was to gauge how familiar these institutions are with this emerging role within the sustainability sector. The next pie chart reflects the awareness levels among HE and VET institutions regarding the Recycling Manager profession. The data reveals a significant lack of awareness, as 48% of respondents stated they had not heard of the profession. Meanwhile, 32% of the respondents indicated they had heard of the profession "to a small extent," suggesting a vague familiarity but lacking depth in understanding the role. Only 20% of respondents claimed to be aware of the profession.

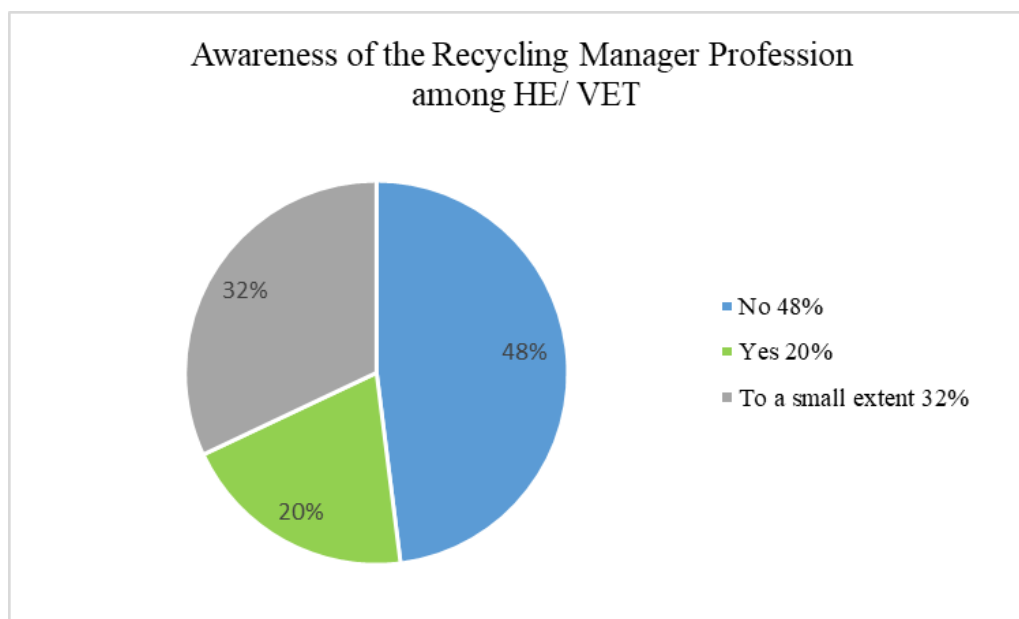


Figure 2.19. Awareness of the Recycling Manager profession among HE/VET institutions

HE institutions were also asked whether they offer formal, structured educational programs specifically designed to train Recycling Managers or if any related learning pathways exist within their institutions.

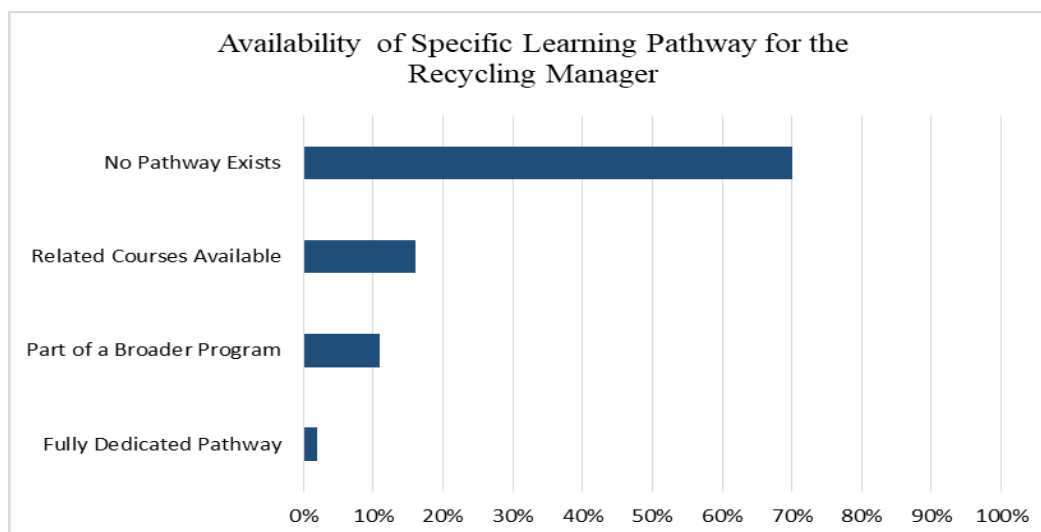


Figure 2.20. Availability of Specific Learning Pathway for Recycling Manager

The results reveal that the **majority of institutions (70%) do not offer any learning pathways specific to Recycling Manager roles, while 16% offer related courses but not a dedicated pathway. Only 11% of institutions include this profession as part of a broader program, and a mere 2% offer a fully dedicated pathway for Recycling Managers.** This data suggests a strong need for institutions to develop more targeted educational programs to adequately prepare professionals for this critical role.

Participants were asked to assess the relevance of **specific soft skills for the role of Recycling Manager**. By identifying the soft skills that are most valued, educational institutions and training programs can tailor their curricula to better prepare future Recycling Managers for the demands of the industry. Respondents were provided with a list of competencies and asked to rate each on a scale from 1 ("not important") to 5 ("extremely important"). These competencies included:



- Communication skills: to convey technical information, collaborate with colleagues, and interact with clients or stakeholders
- Problem-solving: to identify problems, analyze root causes, and develop practical solutions to overcome obstacles and achieve project objectives
- Critical thinking: to evaluate information, analyze data, and make informed decisions.
- Time management: to prioritize work, allocate resources efficiently, and meet project deadlines
- Adaptability: to be adaptable and open to learning, willing to embrace change and adapt to evolving industry trends, technologies, and methodologies
- Creativity and innovation- to think outside the box, experiment with unconventional materials or techniques, and push the boundaries of traditional textile manufacturing to develop sustainable and environmentally friendly products
- Strategic thinking: ability to think strategically about long-term implications of recycling initiatives, including integrating new technologies, market trends, and potential regulatory changes

The chart below illustrates the percentage of respondents who rated these soft skills as either a 4 or 5, reflecting their high importance across the board. These percentages highlight the value placed on specific competencies, with problem-solving, communication skills, and critical thinking being especially emphasized as crucial for Recycling Managers.

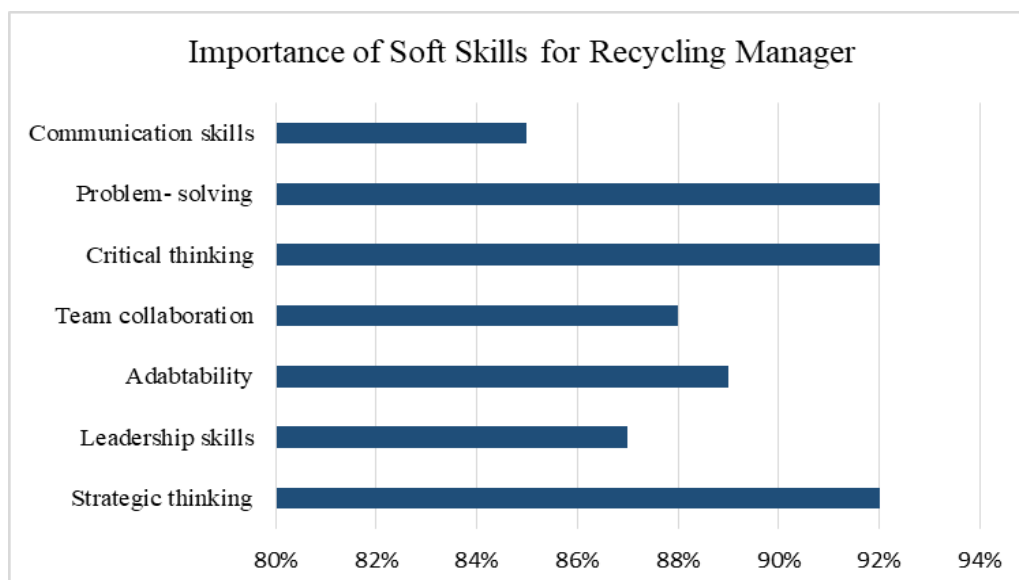


Figure 2.21. Importance of Soft Skills for Recycling Manager

Strategic thinking and **problem solving** emerged as the most critical skills, with **92%** of respondents rating them highly. This underscores the need for Recycling Managers to plan long-term, develop effective strategies, and anticipate potential challenges within the recycling process. Similarly, **critical thinking** was rated as important by **91%** of respondents, highlighting the value of analyzing information, assessing situations, and making informed decisions. **Adaptability** was identified as an essential skill by **89%** of respondents, indicating the need for flexibility in managing diverse and evolving challenges, such as adapting to new technologies and regulatory changes. **Team collaboration** followed closely, with **88%** of respondents recognizing the importance of effective cooperation. **Leadership skills (87%)** and **communication skills (85%)** received a slightly lower importance rating.

HE/VET representatives were asked to evaluate the relevance of various **technical skills** for a Recycling Manager specializing in textiles. This question aimed to identify the specific technical knowledge and skills considered essential for effectively managing textile recycling processes, which are crucial for advancing sustainability and optimizing material recovery.



They were asked to rate each competence on a scale from 1 (not important) to 5 (extremely important).

These competencies included:

- Knowledge of latest recycling technologies
- Understanding of waste management regulations, waste hierarchy, and circular economy principles
- Materials science: understanding the properties and lifecycle of various textile materials
- Supply Chain Management: skills in managing the logistics of collection, sorting, and redistribution of textile waste materials
- Sustainability practices: awareness of broader sustainability issues and practices within the textile industry
- Chemistry and chemical engineering: knowledge in the principles related to textile recycling

Knowledge of the latest recycling technologies was identified as the top priority, with **89%** of respondents rating it as essential. This underscores the need for managers to stay up-to-date with advancements in recycling processes, ensuring they can implement cutting-edge solutions within their operations. **Understanding of waste management regulations** and **materials science** followed closely, each rated highly by **88%** of respondents. **Sustainability practices** were also seen as crucial, with **86%** of respondents emphasizing their importance. This reflects the growing need for Recycling Managers to integrate sustainability principles into their operations. **Supply chain management** received a lower, but still significant, rating of **79%**, indicating that while logistical skills are important, they may be seen as more complementary to the core technical expertise in recycling technologies and materials. Finally, **chemistry and chemical engineering** was rated as important by **78%** of respondents.

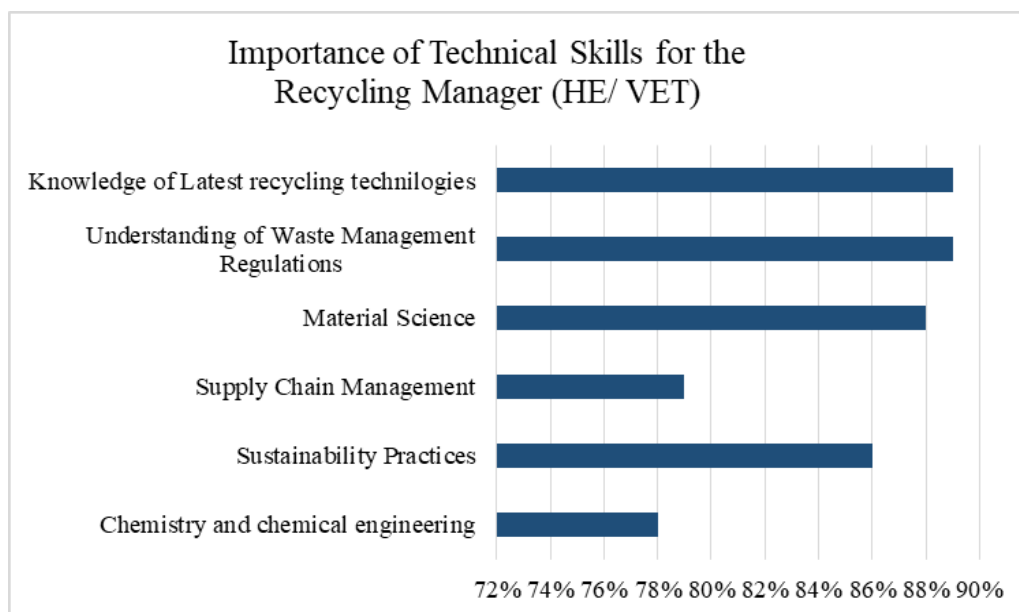


Figure 2.22. Importance of Technical Skills for Recycling Manager (HE/VET)

2.2.9. Summary of the Recycling Manager profile and competence needs

The survey responses revealed that, as a whole, the **Recycling Manager** can play a pivotal role within the textile industry, particularly as companies adopt more sustainable and circular economy practices. The profession is still relatively new, and awareness of this role among small and medium-sized enterprises (SMEs) remains limited. However, the growing focus on waste management, material recovery, and recycling processes highlights the importance of this profession.

2.2.10. Key Competencies for a Recycling Manager

The survey outlined several essential competencies for Recycling Managers, divided into three broad categories: technical skills, soft skills, and regulatory knowledge.



Technical Competencies:

- **Knowledge of recycling technologies.** This skill emerged as one of the most important, with respondents stressing the need to stay updated with advancements in recycling technologies.
- **Material science:** Understanding the properties and lifecycle of textile materials was also rated highly. Recycling Managers must be able to identify the best methods to recover, reuse, or repurpose materials effectively.
- **Waste management regulations and Circular Economy principles:** This competence was highly valued, emphasizing the need for a deep understanding of national and international waste management regulations.
- **Supply chain management:** Survey respondents considered supply chain management skills critical, reflecting the logistical challenges in collecting, sorting, and redistributing textile waste. Effective coordination across the supply chain ensures that materials are recovered efficiently, maximizing both economic and environmental benefits.
- **Sustainability practices:** Although rated slightly lower than other skills, knowledge of broader sustainability practices remains important.
- **Chemistry and chemical engineering:** Proficiency in chemistry, especially in chemical analysis and polymer recycling, was viewed as important for those involved in advanced recycling operations. This expertise allows Recycling Managers to optimize chemical processes and improve material recovery efficiency.



Soft Skills:

- **Problem-solving:** This was highlighted as a critical soft skill, with many respondents emphasizing the importance of being able to quickly diagnose problems, analyze their causes, and develop effective solutions to keep operations running smoothly.
- **Communication skills:** Effective communication was widely recognized as important.
- **Critical thinking:** Many respondents viewed critical thinking as essential. This skill enables Recycling Technicians to analyze data and make informed decisions that align with broader sustainability goals.
- **Team collaboration:** Collaboration was identified as key, involving multiple stakeholders from external partners to internal teams.
- **Adaptability:** Given the constantly evolving regulations and industry dynamics, adaptability was considered essential for staying effective in the role. Recycling Managers need to be open to learning new techniques and embracing technological advancements.
- **Time management:** Recycling operations often involve tight deadlines, making time management crucial for efficiently prioritizing tasks and managing resources effectively.
- **Leadership Skills.** Leadership was considered important for inspiring and guiding teams toward sustainability goals.



Regulatory Knowledge:

- **Chemical safety standards:** This was seen as the most critical regulatory area, with respondents stressing the importance of ensuring the safe handling of chemicals to protect both workers and the environment.
- **Environmental regulations:** Knowledge of environmental regulations, such as waste management laws and chemical standards, was rated highly.
- **Certifications for sustainable textiles:** Many respondents emphasized the importance of understanding sustainability certifications. Recycling Managers must ensure that recycling processes meet industry standards and consumer expectations for eco-friendly practices.
- **Supply chain transparency.** Transparency throughout the supply chain was viewed as essential, reflecting the need for accountability in material sourcing and recycling processes, particularly as consumers demand more ethical and transparent practices.
- **Energy efficiency and renewable energy.** This was rated slightly lower in importance, but respondents still acknowledged its relevance.
- **Social compliance standards:** Ethical labor practices and social responsibility were also viewed as important.

2.2.11. Training and Professional Development

The survey explored training and development opportunities for Recycling Managers, with hands-on training and practical experience rated as the most valuable methods. Many respondents emphasized that real-world applications are crucial for mastering recycling processes. Collaboration with research institutions and industry partners was also seen as highly beneficial, as it fosters innovation and keeps professionals up-to-date with the latest developments in recycling technologies. Certifications and technical workshops were recognized as important for professional development. Survey results indicated that while online courses were seen as less effective compared to hands-on training, it is still crucial to explore solutions for delivering as many of the key competencies and knowledge areas as possible through online platforms. This would ensure broader access to training while maintaining the practical and technical focus necessary for the role.

2.2.12. Competency Mapping Table for Recycling Manager

This mapping takes into account the insights and priorities highlighted in **both the semi-structured interviews and survey documents**.

Competence Category	Competences/Skills	Description
Functional Competencies	Knowledge of Recycling Technologies	Updated with the latest recycling technologies for effective operation.
	Material Science	Understanding the properties and lifecycle of textile materials for effective recovery and reuse.

	Waste Management Regulations and Circular Economy Principles	Comprehensive knowledge of national and international waste management regulations for circular economy.
	Supply Chain Management	Coordination of logistical challenges in collecting, sorting, and redistributing textile waste.
	Sustainability Practices	Understanding and implementing broader sustainability practices in recycling processes.
	Chemistry and Chemical Engineering	Proficiency in chemical analysis and polymer recycling to optimize material recovery efficiency.
	Process optimization and efficiency	Implementing process improvements to minimize waste, reduce energy consumption, and optimize resource usage.
	Machinery operation and maintenance	Ability to operate and maintain modern recycling machinery to ensure smooth production.
	Quality control and testing methods	Ensuring recycled materials meet quality and durability standards through thorough testing methods.
Green Competences	Environmental regulations and standards	Knowledge of environmental and chemical safety regulations in recycling operations.
	Sustainable sourcing and supply chain transparency	Managing sourcing processes to ensure transparency and compliance with eco-friendly standards.

	Energy efficiency and renewable energy	Utilizing renewable energy sources and improving energy efficiency to reduce environmental impact.
	Sustainable innovation and research	Continuously researching and implementing innovations in recycling processes and materials.
	Life Cycle Assessment (LCA)	Assessing the environmental impact of textiles throughout their lifecycle from production to disposal.
Transversal Competences	Problem-solving and decision-making	Diagnosing and solving issues in recycling processes to ensure efficiency and alignment with sustainability goals.
	Critical thinking and analytical skills	Analyzing data to develop innovative solutions for textile recycling challenges.
	Creativity and innovation	Developing creative approaches to overcome recycling challenges, fostering innovations in recycling methods.
	Communication and collaboration	Collaborating with teams, stakeholders, and clients to achieve recycling and sustainability goals.
	Leadership and team management	Leading recycling projects while ensuring alignment with environmental objectives.
	Time management and organizational skills	Managing time and resources effectively to meet project deadlines in recycling operations.

	Adaptability and continuous learning	Adapting to new recycling techniques and regulations, ensuring continuous improvement.
	Digital literacy and technological proficiency	Using digital tools and technologies to enhance recycling operations and efficiency.

Figure 2.23 Competency Mapping Table for Recycling Managers

2.2.13. Current Challenges in the TCLF sector

The survey included also a section on identifying key challenges and opportunities within the TCLF industries, specifically in relation to the adoption of sustainable practices and technologies. Respondents, primarily SMEs, were asked to highlight the most significant obstacles they face in implementing green initiatives, as well as the ease of finding skilled workers in the national labor market. The survey also explored the perceived effectiveness of vocational and higher education systems in preparing students for careers in the TCLF sector and gauged the importance of collaboration between educational institutions, industry stakeholders, and policymakers in fostering green skills development. Additionally, respondents were asked to rate the challenges professionals face in adopting green practices and to provide insights on the availability of suitably skilled workers in the sector.

The first question asked respondents to identify the **most significant challenges** in the TCLF sector when it comes to adopting green practices and technologies, offering multiple options for selection. The bar chart highlights the key challenges faced by the TCLF sector in adopting a green transition. **Cost considerations** emerged as the most significant concern, with **79%** identifying it as a primary issue. **Consumer trends and fast fashion** was also highlighted, with **56%** of respondents acknowledging its impact. The need for a **qualified workforce** ranked next, at **55%**, indicating that skill shortages and the availability of properly trained personnel remain a concern. **Skills and training** also appeared as a separate factor at **46%**,

emphasizing the need for continuous development and upskilling to meet the evolving demands of the industry. **Technological integration** was identified by **44%** of respondents as a key factor and **supply chain complexity** and **consumer demand and awareness** both received **41%**. **Regulatory compliance** and **market competition** were each considered significant by **34%** of respondents. Finally, **environmental impact of production** was a concern for **38%** of respondents. Although not as prominently rated as cost considerations, it underscores the ongoing need to address the ecological effects of production processes in the TCLF sector.

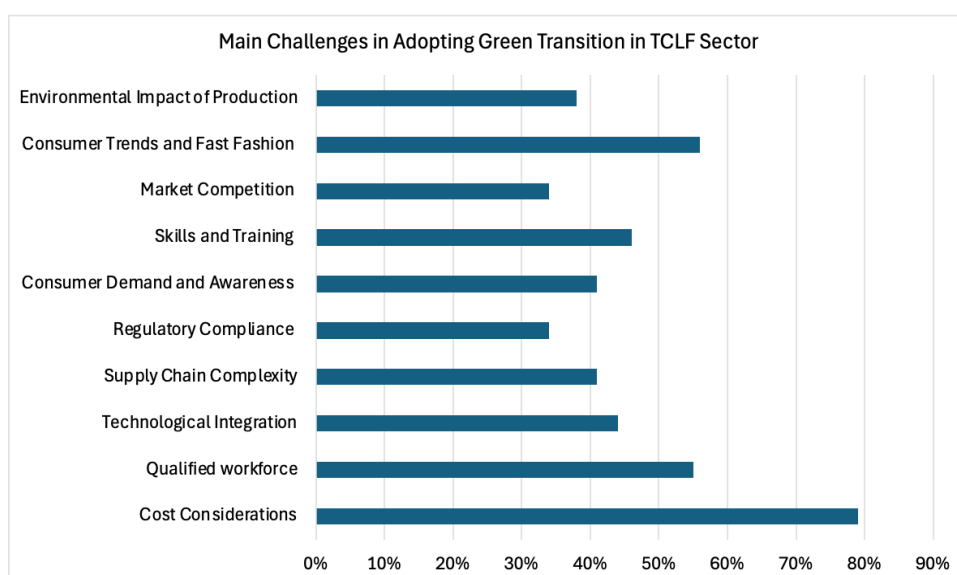


Figure 2.24. Main Challenges in Adopting Green Transition in TCLF Sector

SMEs in the TCLF sector were also asked to rate the **difficulty of finding a skilled workforce** in the national labor market on a scale of 1 to 5, where 1 is "Extremely easy" and 5 is "Extremely difficult." The following chart presents the results.

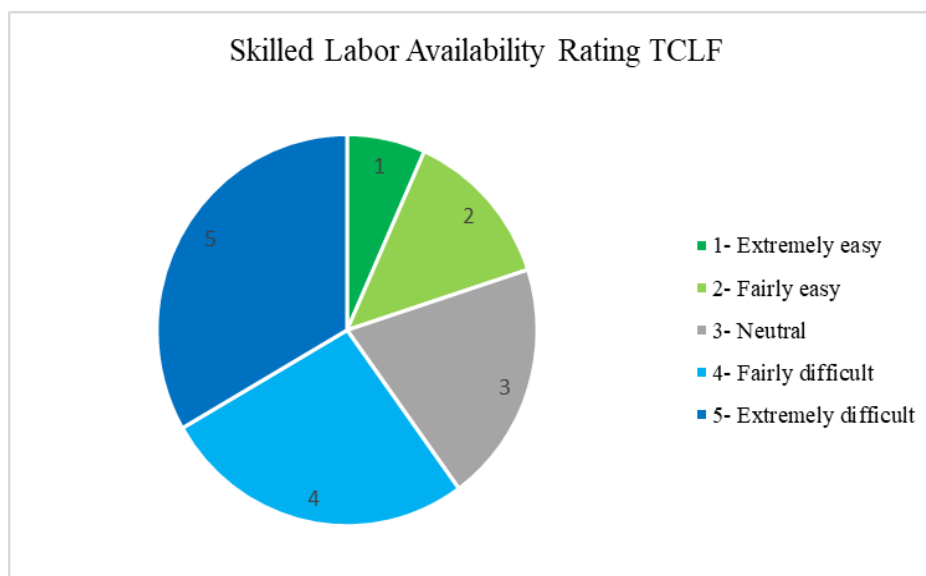


Figure 2.25. Skilled Labor Availability Rating TCLF

The majority of respondents indicated that **finding a skilled workforce is quite challenging**, with **25%** rating it as "**Fairly difficult**" and **26%** as "**Extremely difficult**." This suggests that many companies struggle significantly with sourcing talent, highlighting a critical skills gap in the sector. Only a small portion of respondents rated the process as "**Extremely easy**" (**4%**) or "**Fairly easy**" (**5%**), showing that it is rare for SMEs to find skilled workers without difficulty. Additionally, **39%** of respondents provided a **neutral rating**, indicating that while the task is not insurmountable for some, challenges still persist across the board. Respondents were asked to rate the most significant challenges faced by professionals in the TCLF sector when adopting green practices and technologies. The challenges were rated on a scale from 1 (not important) to 5 (extremely important). The following are the key insights (also shown in the chart below) based on the responses, along with the corresponding percentages of respondents who rated these challenges as highly important (4 or 5).



- **High implementation costs** (84%) were seen as the most significant challenge. This result reflects the financial burden that companies face when investing in new green technologies and processes.
- **Lack of expertise** (78%) also emerged as a critical issue, highlighting the shortage of professionals trained in sustainable technologies and practices.
- **Supply chain complexity** (77%) was identified as another major challenge, with respondents emphasizing the difficulty in modifying or overseeing the supply chain to ensure sustainability at every stage.
- **Regulatory compliance difficulties** (74%) were frequently cited, particularly regarding keeping up with changing environmental regulations and ensuring compliance across different jurisdictions.
- **Consumer demand uncertainty** (74%) underscores concerns about whether consumers are willing to pay a premium for green products, which could impact the return on investment in sustainable technologies.
- **Limited access to sustainable materials** (82%) and **limited knowledge of sustainable materials** (72%) were both rated highly, indicating difficulties in sourcing eco-friendly materials that meet industry performance standards, as well as insufficient understanding of how to apply these materials in production.
- **Technology adaptation challenges** (73%) reflect concerns about the integration of new green technologies into existing production processes without disrupting workflow or productivity.

- Lastly, **market competition** (82%) was also seen as a significant challenge, driven by competitive pressures from companies that prioritize cost-cutting over sustainability, often offering cheaper products by bypassing green practices.

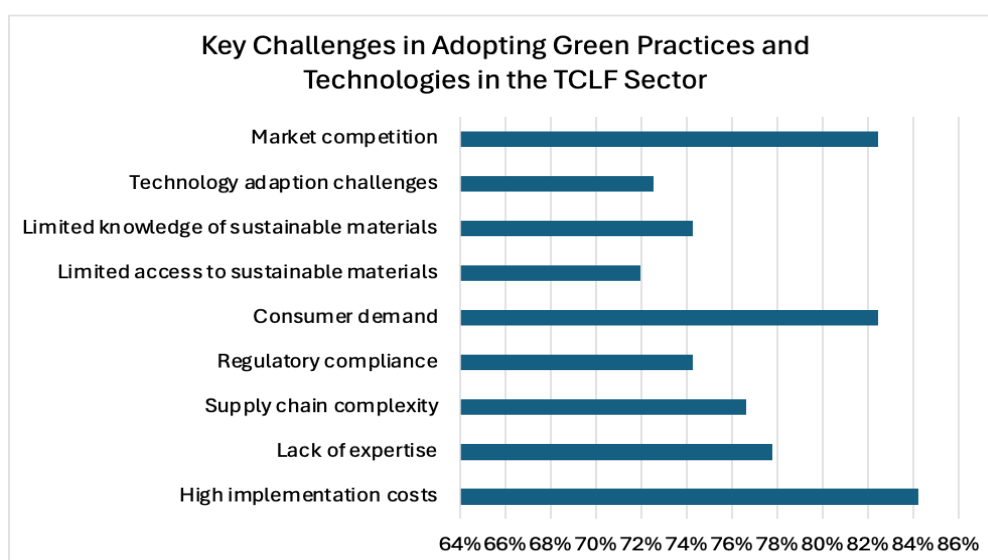


Figure 2.26. Key Challenges in Adopting Green Practices and Technologies in the TCLF Sector

2.3. Skills required to meet the competencies needed for a Bio-Textile Technician according to the ESCO model

Description: A Bio-Textile Technician specializes in creating and innovating sustainable textiles using bio- based materials. These professionals work with renewable resources, biodegradable textiles, and innovative production techniques to promote sustainability in the textile industry. Their work involves research and development of bio-fibers, the implementation of sustainable production methods, and ensuring environmentally friendly processes in textile manufacturing. The role also requires collaboration with research



institutions, industry stakeholders, and adherence to regulations concerning environmental standards and product life cycles.

Essential Skills and Competences:

Sustainability Awareness

- Understanding the broader implications of sustainability, including social, economic, and environmental aspects, beyond just materials and processes
- Knowledge of sustainable development goals (SDGs) and how the textile industry contributes to these global objectives

Material Science and Processing

- Ability to develop and optimize bio- based materials for specific textile applications (e.g., technical textiles for performance, fashion textiles, etc.)
- Proficiency in scaling lab-based innovations into mass production while maintaining sustainability standards

Bio- technology and Bioengineering Expertise

- Familiarity with the latest advancements in bio- fabrication, including the use of microorganisms in material production
- Skills in integrating nanotechnology with bio- textiles for enhanced properties like strength, flexibility, or water resistance



Sustainable Production Techniques

- Expertise in reducing water and energy consumption during textile production processes
- Knowledge of waste minimization techniques during textile production, such as zero-waste pattern cutting and sustainable dyeing methods

Product Life Cycle Assessment (LCA)

- Capability to implement closed-loop recycling systems, where waste materials are reused within the same production cycle
- Experience in environmental impact modeling and forecasting the sustainability effects of new bio- textile innovations

Quality Control and Testing

- Skills in advanced testing methods for biodegradability and compostability of bio- textiles
- Expertise in managing quality across different stages of production to ensure consistent performance in bio- textiles

Essential Knowledge:

Textile Chemistry

- Knowledge of green chemistry principles and the ability to select eco-friendly chemical alternatives for textile treatment and finishing
- Proficiency in natural dyeing processes and the use of plant-based or microbial dyes for sustainable textile coloring



Regulatory Compliance

- Familiarity with international environmental certifications and their application in bio- textile production
- Understanding of policies related to bio- based materials, including the EU's regulations on renewable resources and biodegradable materials

Circular Economy Principles

- Skills in designing products for disassembly, ensuring that textiles can be efficiently deconstructed and repurposed at the end of their life
- Knowledge of global best practices in circular economy models specific to textiles

Optional Skills and Competences:

Digital Literacy

- Proficiency in using industry-specific software for material simulations, digital textile printing
- Familiarity with blockchain technology for ensuring supply chain transparency and material traceability

Global Developments in Sustainable Fashion

- Awareness of global developments in sustainable fashion, including slow fashion, circular fashion, and the zero-waste movement (also see interview overviews)



- Understanding of consumer trends toward sustainable products and the role of marketing and branding in promoting bio- textile innovations (also see interview overviews)

Collaboration and Teamwork

- Ability to manage interdisciplinary projects involving biologists, engineers, designers, and supply chain experts to ensure cohesive bio- textile solutions
- Skills in stakeholder engagement, ensuring alignment across diverse groups such as consumers, regulators, and industry partners

Creativity and Innovation

- Expertise in incorporating innovative design methods that align with bio-textile material properties while also ensuring aesthetic appeal
- Ability to think laterally and develop out-of-the-box solutions for current sustainability challenges in textiles

Adaptability

- Capacity to adjust to rapid changes in market demands, technological advancements, and regulatory frameworks within the textile industry.
- Ability to quickly integrate new bio- based materials and processing technologies into existing production systems.



2.4. Skills required to meet the competencies needed for a Textile Recycling Manager according to the ESCO model

Textile Recycling Manager: Description

A Textile Recycling Manager oversees and optimizes textile recycling processes. Their role involves managing the collection, sorting, and repurposing of textile waste, ensuring adherence to environmental regulations and sustainability goals. This professional works closely with stakeholders across the supply chain to improve recycling efficiency, integrate circular economy principles, and reduce the environmental impact of textile production and waste.

Essential skills and competences:

Recycling Process Management

- Organize and coordinate textile waste recycling, from collection through processing to final redistribution
- Implement sustainable recycling practices that align with circular economy principles

Regulatory Compliance and Waste Management

- Ensure operations meet local, national, and international waste management regulations
- Stay updated on evolving environmental standards and certifications



Materials Science in Recycling

- Understand the properties and lifecycle of textile materials to optimize their recovery, reuse, and recycling
- Apply knowledge of natural and synthetic fibers in recycling processes

Project and Resource Management

- Lead and manage textile recycling projects, ensuring timely completion within budget constraints
- Allocate resources efficiently to maximize productivity while adhering to sustainability standards

Essential knowledge:

Recycling Technologies and Innovations

- Familiarity with textile recycling technologies such as mechanical and chemical recycling, fiber regeneration
- Knowledge of advanced sorting technologies

Waste Management and Circular Economy Principles

- Comprehensive understanding of the waste hierarchy (reduce, reuse, recycle) and how it applies to textiles
- Knowledge of circular economy models, including product lifecycle management, extended producer responsibility (EPR), and closed-loop recycling systems



Environmental Impact Assessment

- Familiarity with the environmental impacts of textile production and recycling, including life cycle assessments (LCA)
- Ability to evaluate and minimize the carbon footprint and energy use in recycling operations

Sustainability Practices in Textile Recycling

- Awareness of sustainable textile production practices, focusing on reducing water and energy usage and minimizing chemical inputs
- Knowledge of different textile certifications

Optional Skills and Competences:

Supply Chain Management

- Skills in managing logistics for textile waste collection, sorting, and redistribution, ensuring efficiency throughout the recycling process
- Collaborate with suppliers, manufacturers, and stakeholders to enhance the recycling supply chain

Data Analysis and Reporting

- Ability to analyze environmental data to track the efficiency and sustainability of recycling efforts
- Generate reports on recycling outputs, resource use, and environmental impact to inform future improvements



Innovation and Creativity

- Develop and implement innovative approaches to improve textile recycling methods, including exploring new materials and techniques for better recovery
- Foster a culture of continuous improvement within the recycling team

Leadership and Team Management

- Lead teams effectively to foster a collaborative environment and ensure productivity in recycling operations
- Motivate and guide staff to embrace sustainability initiatives and continuously improve recycling processes

Problem-solving and Critical Thinking

- Identify challenges in recycling operations, analyze root causes, and develop innovative solutions to overcome them
- Apply critical thinking to optimize resource use, improve recycling efficiency, and address unforeseen issues in the supply chain

Adaptability and Flexibility

- Adapt to new technologies, evolving regulations, and market changes in the recycling and textile industries
- Stay open to learning and integrating new practices that can enhance recycling processes and sustainability outcomes



Creativity and Innovation

- Encourage out-of-the-box thinking to develop new methods of recycling and repurposing textile materials
- Explore unconventional recycling techniques and alternative materials to push the boundaries of traditional recycling processes

2.5. Survey results regarding the GreenComp areas and green skills

The survey first addressed four general green competence areas and 12 sustainability competencies that promote sustainability as originally stated in the European Commissions' GreenComp framework. The table below shows the percentage of respondents who rated these competences as important or very important.

Competences	% Important or Very Important
Embodying Sustainability Values	92,35
Reflect and realign personal and corporate sustainability values	89.29%
Promote equity and justice in labor and trade practices	92.86%
Respect and protect ecosystems and biodiversity	94.90%
Embracing Complexity in Sustainability	86,90



Understand and optimize interconnected systems	88.27%
Evaluate and challenge existing practices and assumptions	85.20%
Identify and articulate specific sustainability challenges	87.24%
Envisioning Sustainable Futures	92,35
Imagine and plan for sustainable scenarios	92.86%
Manage and adapt to sustainability transitions and uncertainties	91.33%
Innovate through creative and interdisciplinary approaches	92.86%
Acting for Sustainability	86,05
Engage with policy-making for environmental advocacy	84.18%
Collaborate on industry-wide sustainability initiatives	88.78%
Take personal action to foster sustainability	85.20%

Table 1: GreenComp areas and competencies

The survey findings indicate that there is a strong emphasis on integrating sustainability values and envisioning sustainable futures across various competencies. A significant percentage of respondents see these competencies as "Important" or "Very Important."

1. **Embodying Sustainability Values:** This category reflects a near-universal commitment to aligning values with sustainable practices. High importance is placed on promoting equity and justice in labor (92.86%), respecting and protecting ecosystems (94.90%), and continuously realigning values for sustainability (89.29%). This suggests an industry-wide recognition that sustainability begins with fundamental values, encompassing both ethical and ecological considerations.
2. **Embracing Complexity in Sustainability:** The focus on complexity highlights the necessity of understanding interconnected systems (88.27%) and evaluating current practices (85.20%). These skills are critical for industry professionals to grasp the nuanced challenges and drive innovation that is responsive to the complexities of environmental sustainability.
3. **Envisioning Sustainable Futures:** Nearly all respondents see the importance of imagining and planning for sustainable scenarios (92.86%), managing transitions (91.33%), and fostering creative, interdisciplinary solutions (92.86%). This indicates a strong commitment to future-oriented thinking, underscoring the need for strategic foresight and adaptability in sustainable development.
4. **Acting for Sustainability:** Engaging in concrete actions, such as advocating for environmental policies (84.18%) and collaborating on industry-wide initiatives (88.78%), also ranks high, though slightly lower than other areas. This may suggest that while action is crucial, some barriers might still exist in translating vision into practical, collective action.

Overall, these findings underscore **the importance of integrating sustainability in thought, planning, and action within industry practices**, emphasizing not just individual

responsibility but also a systemic approach that values ethical considerations and prepares for future uncertainties.

Survey results regarding specific green competencies for the TCLF sector

The survey also lists **specific green competencies and skills that were identified and formulated by SIT project as important specifically for the TCLF sector** so the project could identify green competencies and skills considered crucial for the industry's transformation towards sustainability. These competencies address both practical and strategic aspects of sustainability, supporting TCLF professionals to adapt to eco-friendly practices and meet the growing demand for responsible production and consumption.

There were **eight competence areas** analyzed in the survey and the table below shows the percentage of respondents who rated these competencies as important or very important.

Green Competence Area	Specific Skill	% Important or Very Important
Foundational Knowledge and Compliance	Knowledge of the EU strategic and legal framework for the textile sector	85.20%
	Knowledge of the national/regional legal framework for the textile sector	93.37%

	Ability to prepare the company for the new extended producer responsibility (EPR) system	87.24%
Design and Materials Selection	Apply design requirements for durable and sustainable fashion	89.29%
	Ability to select materials in accordance with ecological standards	92.35%
	Ability to generate innovative and creative circular design solutions	90.82%
	Ability to apply effective practices for recycling and reuse of materials	91.84%
Supply Chain and Production Processes	Ability to apply sustainable transformation to minimize supply chain impact	89.80%
	Ability to select suppliers based on sustainable criteria	86.22%
	Ability to predict how decisions made during product prototype development affect sustainability	86.73%
Environmental Impact Assessment and Management	Measuring the environmental impact of raw materials used	90.82%

	Use of tools for measuring fashion brands' sustainability	83.16%
	Assess harmfulness of chemical agents and replace them with less harmful alternatives	92.35%
Circular Economy	Ability to plan and implement necessary changes for reducing textile waste	92.86%
	Apply circular textiles and fashion principles and strategies	89.90%
	Identify value creation opportunities towards circularity in business	84.18%
Greenwashing and Ethical Practices	Capacity to recognize greenwashing practices and ensure transparency	87.76%
	Ability to select methods to substantiate environmental claims	83.67%
Social and Environmental Responsibility	Understand how to prevent, monitor, and solve social/environmental issues in the global value chain	88.78%
Technological Innovations	Ability to use technological innovations to increase sustainability	94.90%

	Promote and/or implement energy-saving measures and renewable energy use	89,29
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Table 2: Specific green competencies and skills

The data reveals a high prioritization of green competencies across various areas in the TCLF sector, indicating broad recognition of sustainability as central to industry practices.

The following section provides an analysis of each area, and the degree of importance attributed to each skill:

1. Foundational Knowledge and Compliance

- The competencies in this area are deemed highly important, with knowledge of national/regional legal frameworks ranking highest (93.37%). This reflects the emphasis on regulatory compliance as a foundation for sustainable practice. Preparing for extended producer responsibility (EPR) is also critical (87.24%), suggesting awareness of the importance of aligning business operations with emerging regulatory standards on waste management and recycling responsibilities.

2. Design and Materials Selection

- This category highlights the significance of sustainable design principles, with skills such as selecting ecological materials (92.35%) and creating circular design solutions (90.82%) rated very important. Recycling and reuse practices are also prioritized (91.84%), underscoring the role of sustainable design in product lifecycle management and resource



conservation. This area is essential as it directly influences the material and environmental impact of products.

3. Supply Chain and Production Processes

- Skills for sustainable transformation of the supply chain, such as minimizing impact (89.80%) and selecting sustainable suppliers (86.22%), are highlighted as crucial. This focus reflects the need to extend sustainability practices beyond design to include responsible sourcing and production. Sustainability-oriented prototyping (86.73%) is also emphasized, showing an awareness of how early design decisions impact overall sustainability.

4. Environmental Impact Assessment and Management

- With a strong focus on assessing environmental impacts, this area includes the measurement of raw materials' impact (90.82%) and the substitution of harmful chemicals (92.35%). This high importance suggests that understanding and mitigating the environmental effects of materials and processes is viewed as essential for sustainable production. Slightly lower priority is placed on the use of sustainability assessment tools (83.16%), which may indicate limited access to or familiarity with these tools.

5. Circular Economy

- Planning for waste reduction (92.86%) is highly prioritized, alongside applying circular principles (89.90%) and identifying opportunities for circularity (84.18%). This reflects a strong commitment to transitioning from linear to circular models, which can reduce waste, extend product life, and create new business opportunities.



6. Greenwashing and Ethical Practices

- The need to recognize greenwashing (87.76%) and substantiate environmental claims (83.67%) highlights the sector's focus on transparency and ethical communication in sustainability claims. As consumer awareness grows, companies are increasingly expected to validate their environmental claims to maintain credibility and avoid misleading practices.

7. Social and Environmental Responsibility

- Understanding how to address social and environmental issues in the global value chain (88.78%) is deemed highly important, showing an industry-wide awareness of the need to monitor and improve working conditions, labor practices, and environmental standards across the entire supply chain.

8. Technological Innovations

- Technological innovation (94.90%) and energy-saving measures (89.29%) are rated as essential, pointing to the importance of adopting new technologies to drive sustainable practices and improve energy efficiency. This high prioritization suggests that the TCLF sector sees technology as a powerful tool in advancing sustainability goals.

It can be concluded that the **strongest priorities relate to** competencies in technological innovation, sustainable design with emphasis on circularity, innovation, transparency and regulatory alignment. This data highlights a sector-wide push toward integrated, ethical, and innovative approaches to sustainability.



The survey results also provide insightful **contrasts and shared perspectives between SMEs and HE/VET** institutions regarding green competencies in the textile industry. Here are the key findings:

Familiarity with GreenComp

- HE/VET institutions show a much higher familiarity with the term GreenComp (75%) than SMEs (40%), indicating that educational institutions are more aligned with contemporary sustainability frameworks and terminology. This could be due to their role in shaping future professionals, driving them to stay informed on emerging sustainability topics. In contrast, SMEs, focused on day-to-day operations, may not yet fully integrate sustainability frameworks such as GreenComp into their strategies. It strongly suggests the need to increase the awareness of GreenComp among SMEs.

Importance of sustainability competencies

- Both HE/VET institutions (95%) and SMEs (92%) recognize the critical importance of sustainability competencies, underscoring a shared understanding that sustainability is not just a trend but a necessity for the textile sector's survival. However, HE/VET institutions seem to emphasize more foundational elements such as empathy, responsibility, and sustainable action, reflecting their role in shaping mindsets and long-term perspectives.
- SMEs focus more on immediate, practical competencies like sustainable fashion design and material selection, showcasing their need for actionable, industry-specific green skills that directly impact production and the supply chain.



Environmental issues and key Green Competencies

- HE/VET respondents strongly value green skills related to regulatory knowledge, environmental impact measurement, and technological innovation with an average score of 4.5 on a 5-point scale. Their emphasis on supply chain transformation and reducing textile waste indicates a deep understanding of the need for systemic changes in the industry.
- On the SMEs side, the key green competencies highlight practical applications, with a focus on sustainable fashion design, circularity, and recycling practices. This aligns with their immediate operational needs but reveals a gap in longer-term planning and strategic foresight, such as engagement in environmental advocacy.

Weak and strong areas

- For HE/VET institutions, regulatory preparedness for strategic and legal regulations within EU and national frameworks was identified as weakness. On the other hand, the ability to leverage technological innovations to increase sustainability was strong, reflecting their access to cutting-edge resources and research.
- SMEs, while recognizing the importance of sustainability, continue to struggle with gaps in practical application. The difficulty in finding green-skilled applicants—especially in areas like sustainable design, supply chain impact minimization, and regulatory knowledge—suggests that more work is needed to align workforce skills with industry needs.



Integration into educational programs

- Both groups agree that integrating sustainability competencies into educational programs is critical. However, SMEs prioritize skills related to ecosystem protection, material selection, and recycling over policy-making, while HE/VET institutions focus on fostering broader competencies like empathy and responsibility. This disconnect shows that education providers may need to adjust curricula to better meet the practical needs of the industry.

Hard-to-find skills

- SMEs identified several hard-to-find skills, such as sustainable fashion design principles, environmental impact measurement, and understanding of the EU's regulatory framework. This suggests that while new entrants have basic green knowledge, they lack the in-depth practical expertise needed by companies. This gap indicates the need for better hands-on training and closer collaboration between industry and educational institutions.
- For HE/VET institutions, the hard-to-find skills are those that focus on bridging the gap between theoretical knowledge and practical application translating it into hands-on industry practice.

Conclusion

These results suggest a strong commitment to sustainability values and green competencies in the sector. The high scores across various categories indicate that professionals in this industry recognize the critical importance of sustainability in shaping future practices. However, there is also an acknowledgment of the complexities involved, highlighting the need for ongoing



education, collaboration, and innovation to address the challenges of sustainable development effectively.

The survey reveals that both SMEs and HE/VET institutions recognize the vital role of green competencies in driving sustainability in the textile sector. HE/VET institutions are more familiar with sustainability frameworks and offer a long-term, empathy-driven view of sustainability, while SMEs are more focused on immediate, practical applications. However, the gap between theoretical knowledge and practical application remains a significant challenge for both groups. To address this, there is a clear need to strengthen sustainability education and bridge the gap between industry demands and the skills being taught in educational institutions. This would ensure the textile sector is equipped to meet both current sustainability challenges and future demands. A sector specific TCLF GreenComp is an important step in this direction.



SECTION 3

3.1. Introduction to the SiT TCLF GreenComp

This section of the report outlines the selected green or sustainability competencies that we consider key for sustainable development in the TCLF sector. Apart from the detailed analysis of the surveys and interviews in the previous sections, we based the development of our SiT TCLF GreenComp on the existing GreenComp framework provided by the European Commission and Joint Research Centre,² ensuring alignment with well-established sustainability competencies. In the foreword to the GreenComp, the editors state:

To protect the health of our planet and our public health, it is crucial to integrate sustainability into our education and training systems. Education and training enable learners to develop competences and acquire the knowledge, skills and attitudes needed to truly value our planet and take action to protect it. This will help achieve the transition to a fairer, greener economy and society. To this end, and among other priorities, the European Commission has made learning for environmental sustainability a priority for the upcoming years. (p. 1)

The acquisition of green competencies has a crucial role as envisioned in the EU. The GreenComp framework aims to cultivate a sustainability mindset by equipping users with the knowledge, skills, and attitudes needed to think, plan, and act with empathy, responsibility, and care for the planet.

The TCLF industry must equally embrace sustainability, develop a competent workforce, and prioritize social responsibility. To develop a new GreenComp framework adapted specifically

² European Commission: Joint Research Centre. (2022). *GreenComp, the European sustainability competence framework*. Publications Office of the European Union. <https://data.europa.eu/doi/10.2760/13286>.



to the TCLF sector, we used the results from our sector-specific survey, in particular the section on the relevant green competencies from the GreenComp, in order to be able to address the unique needs of the sector with the TCLF GreenComp framework. This adaptation allowed us to incorporate industry-specific key competencies, such as material sustainability, circular economy practices and innovative design, and regulatory compliance, ensuring that the TCLF GreenComp is highly relevant and practical for advancing sustainability in this sector.

Together with functional and transversal competencies, the training programs based on this framework can:

- equip professionals in the textile and fashion industry with the necessary knowledge and skills to adopt and implement sustainable practices throughout the product life cycle, from design to disposal.
- facilitate compliance with regulations by providing a structured approach that helps organizations and individuals understand and comply with existing and emerging rules and other sustainability standards and strategies thereby minimizing legal and financial risks.
- promote circular economy by promoting innovative practices that focus on reusability, recyclability, and sustainable sourcing, ultimately reducing waste and environmental impact.
- develop a skilled workforce that is knowledgeable about sustainable practices, technologies, and innovations in the textile and fashion sector, ensuring that companies can adapt to changing market demands and consumer preferences.



- drive innovation in sustainable materials, processes, and business models, thereby positioning the textile and fashion industry as a leader in sustainable development and responsible production.

promote continuous learning and ongoing professional development within the industry, fostering a new and up-to-date education that is quickly adapted to new challenges and opportunities in the global market.

3.2. The SiT TCLF GreenComp Framework

According to the overall results of the survey, and in line with the existing GreenComp framework, we developed the **SiT TCLF GreenComp Framework**: It is divided into **4 competence areas** which are sub-divided into topics and sub-topics. Within these areas, the framework defines the knowledge and skills required for the two emerging professions of the Bio-Textile Technician and the Recycling Manager. These 4 competence areas are:

- 1. Environmental regulations and standards within TCLF sector**
- 2. Circular Economy and sustainability**
- 3. Innovations with circular design**
- 4. Sustainable supply chain management**

Each competence area is introduced with a description summarizing the key knowledge, skills, and attitudes for both the Recycling Manager and the Bio-Textile Technician.

The SiT TCLF GreenComp framework is the basis for the SiT training program to be developed within the project and the training structure lined out in this report (see Section 4).



Competence Area 1: Key Skills and Competencies

Bio-Textile Technician (EQF Level 5):

- **Key Knowledge:** Focuses on understanding regulations around sustainable textile production, particularly regarding circular economy strategies and chemicals regulation.
- **Key Skills:** Involves applying design and production strategies that comply with EU sustainability regulations, green claims, and EPR/ESPR guidelines. The technician plays an active role in ensuring bio- textiles adhere to non-toxic and waste reduction policies.
- **Responsibilities:** Implement sustainable production techniques, avoid greenwashing in sustainability claims, and use tools to verify compliance with regulatory frameworks.
- **Attitudes:** Committed to ethical responsibility and proactive sustainability mindset on operational level.



Recycling Manager (EQF Level 6):

- **Key Knowledge:** In-depth understanding of EU regulations related to EPR/ESPR and chemicals, with a strong focus on managing waste streams and ensuring the business meets its environmental obligations.
- **Key Skills:** Overseeing large-scale recycling initiatives and leading efforts to minimize the environmental impact of textiles through compliance with EU legal standards, particularly in managing chemicals, sustainability claims, and EPR/ESPR systems.
- **Responsibilities:** Lead the company's compliance efforts with EPR/ESPR policies, supervise waste management and recycling operations, and manage the accurate representation of sustainability claims to avoid greenwashing.
- **Attitudes:** Strategic view on compliance and sustainability leadership.



Environmental regulations and standards within TCLF sector

Topic	Sub-topic	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
1.1 EU Strategic and Legal Framework	EU Circular Economy Action Plan for Textiles	Knowledge: • EU circular economy directives: Familiarity with EU circular economy directives specifically impacting textile design and production. • Sustainability standards: Understanding EU standards for sustainable textiles, and on design criteria for eco-friendly products.	Knowledge: • Comprehensive regulatory framework: In-depth understanding of EU regulations governing circularity in textile production, recycling, and waste management. • Producer responsibility: Knowledge of EU frameworks requiring companies to take responsibility for their products' lifecycle.



Topic	Sub-topic	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		Skills: • Application of EU design principles: Ability to integrate EU sustainability requirements into bio-textile designs. • Compliance assurance in design: Skills to ensure that textile designs meet EU legal standards for sustainability, focusing on material choice, durability, and recyclability	Skills: • Operational compliance oversight: Ability to oversee and ensure compliance with EU circular economy regulations throughout the company's operations, including material sourcing, recycling, and waste management. • Regulatory process management: Skill in managing and aligning company recycling processes with EU sustainability and circularity goals, preparing for audits and regulatory reviews.



Topic	Sub-topic	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
	Chemicals Regulation	Knowledge: • Chemical safety standards: Understanding EU regulations related to safe chemical usage in textile production, including REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals) and other safety guidelines. • Environmental and health impacts: Knowledge of how chemicals used in textile processing impact environmental and human health, focusing on the textile technician's direct use of safe, compliant substances. Skills:	Knowledge: • Comprehensive chemical compliance: In-depth understanding of chemical regulations impacting recycling processes, including safe handling, processing, and disposal of chemicals within recycled textiles. • Risk assessment of chemical use: Knowledge of methods for assessing chemical risks in recycling operations and familiarity with EU chemical restrictions for recycled materials. Skills:



Topic	Sub-topic	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		• Safe chemical application: Ability to safely handle, apply, and monitor chemicals in line with EU safety standards, ensuring that all materials used meet regulatory requirements. • Chemical substitution and compliance in design: Skill in identifying and substituting harmful chemicals with approved, less harmful alternatives in bio-textile processes to meet chemical safety requirements.	• Oversight of chemical compliance in recycling: Ability to monitor and ensure compliance with chemical safety standards in recycling operations, ensuring that recycled textiles are free from restricted or harmful chemicals. • Process management for safe chemical use: Skill in managing and implementing procedures to minimize chemical risks, ensure safe disposal, and replace restricted substances in recycling processes, in line with regulatory requirements.
1.2 EU Textile	Ecodesign for	Knowledge:	Knowledge:



Topic	Sub-topic	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		• Eco design standards: Understanding the principles and standards of ecodesign, particularly those related to durability, recyclability, and the overall lifecycle impact of textile products under the ESPR. • ESPR compliance: Familiarity with the specific criteria and certifications under the ESPR for sustainable product design in textiles, including material efficiency, reduced environmental impact, and extended product life. Skills: • Application of eco design standards: Ability to design bio-textile products that meet ESPR standards, focusing on durability, repairability, and efficient use of materials.	• Eco design and ESPR frameworks: In-depth understanding of how ESPR standards affect recycling processes, focusing on how ecodesigned products can be more efficiently recycled and the role of recycling in meeting ESPR goals. • Monitoring and compliance for recycling: Knowledge of ESPR compliance requirements within recycling processes, including how to document and validate compliance with ecodesign standards in post-consumer textiles. Skills: • Process compliance with ESPR standards: Ability to monitor and adapt recycling processes to meet ESPR standards, ensuring that recycled materials



Topic	Sub-topic	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		• Product compliance in design: Skill in ensuring that new designs comply with ESPR certifications by applying eco design principles in material choice, construction, and end-of-life considerations.	align with eco design principles and support sustainable product goals. • Quality control and reporting: Skill in overseeing the recycling operation's adherence to ESPR standards, managing documentation, and preparing compliance reports to certify that the recycling process meets eco design criteria.
	EPR Systems	Knowledge: • Basics of EPR systems: Understanding the fundamental principles of EPR, including the concept of producer responsibility and the role of fees in supporting recycling and waste management. • Product design impact on EPR: Awareness of how product design choices (e.g., material selection,	Knowledge: • Comprehensive understanding of EPR legislation: In-depth knowledge of EPR legislation specific to textiles, including producer fees, responsibilities, and reporting requirements under EU regulations. • Lifecycle cost implications: Understanding of how EPR fees impact overall product lifecycle costs and



Topic	Sub-topic	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		recyclability) impact EPR fees and obligations for the company. Skills: • Design for EPR compliance: Ability to incorporate EPR requirements into product design by selecting materials and designs that minimize waste and reduce EPR-related costs. • Collaboration with compliance teams: Skill in working with compliance or regulatory teams to align product designs with the company's EPR responsibilities and minimize potential EPR fees.	the importance of recycling efficiency in reducing long-term EPR liabilities. Skills: • EPR compliance management: Ability to oversee recycling processes in line with EPR requirements, ensuring that post-consumer products are processed in a way that fulfills producer responsibilities. • Cost analysis and reporting: Skill in assessing and documenting the impact of EPR fees on recycling processes, managing EPR-related records, and preparing reports that demonstrate compliance and cost-effectiveness.



Topic	Sub-topic	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
1.3 Green Claims for Textiles	Greenwashing Prevention	Knowledge: • Sustainability claims standards: Understanding EU regulations and standards for making accurate, transparent sustainability claims in textile products, including labeling requirements. • Greenwashing awareness: Knowledge of what constitutes greenwashing and how misleading claims can impact consumer trust and regulatory compliance. Skills: • Verification of sustainability claims: Ability to verify that sustainability claims on bio-textile	Knowledge: • Comprehensive understanding of greenwashing regulations: In-depth knowledge of EU regulations governing sustainability claims and labeling requirements across production and recycling. • Compliance requirements for sustainability claims: Understanding of legal responsibilities and practices to ensure that recycling processes and claims meet EU standards and avoid greenwashing. Skills: • Management of sustainability claims compliance: Ability to oversee and ensure that sustainability



Topic	Sub-topic	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		products are based on accurate data, ensuring transparency in materials and processes. • Collaboration on labeling accuracy: Skill in working with design and compliance teams to ensure that product labels and claims meet EU standards, helping avoid greenwashing risks.	claims made in recycling and production processes are accurate, documented, and compliant with EU standards. • Prevention of greenwashing across operations: Skill in implementing checks and controls to prevent greenwashing, managing claims verification across the product lifecycle, and preparing compliance documentation.
	Sustainable Brand Index	Knowledge: • Basics of brand sustainability metrics: Understanding the key metrics and indicators used in sustainability indexes, focusing on areas such as	Knowledge: • Comprehensive understanding of sustainability metrics: In-depth knowledge of brand sustainability metrics and how they reflect the environmental and



Topic	Sub-topic	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		resource efficiency, environmental impact, and product lifespan. • Digital tools for sustainability tracking: Familiarity with basic digital tools or platforms used to track sustainability metrics in bio-textile production, such as carbon footprint calculators or life cycle assessment (LCA) software. Skills: • Data collection for sustainability metrics: Ability to gather and input data into digital tools to assess the sustainability of bio-textile products, ensuring data accuracy and completeness. • Support in brand sustainability assessments: Skill in assisting the sustainability team with the brand's	social performance of recycling processes and overall operations. • Advanced digital tools for sustainability measurement: Understanding of advanced digital platforms and tools, such as life cycle assessment software and supply chain tracking tools, used to monitor sustainability across recycling and production stages. Skills: • Management of sustainability measurement processes: Ability to oversee the use of digital tools to measure brand sustainability, ensuring metrics are accurately captured across recycling processes and align with Sustainable Brand Index standards. • Data analysis and reporting for sustainability: Skill in analyzing sustainability data from digital



Topic	Sub-topic	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		sustainability measurement, using digital tools to monitor relevant bio-textile production metrics.	tools to generate reports that showcase the brand's performance, identify improvement areas, and support strategic sustainability goals.



Competence Area 2: Key Skills and Competences

Bio-Textile Technician (EQF Level 5):

- **Key Knowledge:** Focuses on understanding the sustainable properties of bio- textiles, including bio- based materials like biodegradable fabrics and lab-grown textiles.
- **Key Skills:** Involves applying sustainable design and production methods such as zero-waste design, eco-friendly dyeing processes, and life cycle thinking. They are responsible for ensuring that bio-textiles meet both design and sustainability requirements.
- **Responsibilities:** Implement and maintain sustainable production techniques, support the development of innovative textiles, and use tools like Life Cycle Assessments (LCA) to track the environmental impact of bio- textile products.
- **Attitudes:** Focused on innovative sustainable design and production.



Recycling Manager (EQF Level 6):

- **Key Knowledge:** In-depth understanding of recycling systems, circular business models, and material recovery processes. Strong focus on ensuring that materials are reused efficiently through advanced recycling technologies and sustainable production.
- **Key Skills:** Involves managing the transition to circular economy practices across large-scale operations, integrating technologies like chemical recycling, and ensuring compliance with environmental standards.
- **Responsibilities:** Lead recycling initiatives, supervise sustainable sourcing and product recovery, and oversee the adoption of circular business models across the organization. Manage teams, providing strategic oversight on how materials are sourced, used, and recycled.
- **Attitudes:** Strategic view on initiatives that focus on circular economy strategies and advanced recycling technologies.



Circular Economy and Sustainability

Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
2.1 Circular Economy Principles	Circular Product Design	Knowledge: • Principles of sustainable product design: Understanding the fundamentals of sustainable design, including circular economy concepts, design for disassembly, and zero-waste practices. • Eco-friendly materials and processes: Familiarity with sustainable materials and eco-friendly processes that align with circular economy goals in textile design.	Knowledge: • Comprehensive circular economy frameworks: In-depth knowledge of circular economy principles and their application in production and recycling processes, with a focus on creating closed-loop systems. • Strategies for circular product life cycle: Understanding of strategies for extending product life through recycling, remanufacturing, and reuse, aligning with circular economy goals across operations.



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		Skills: • Application of zero-waste design methods: Ability to apply design techniques that minimize material waste, such as zero-waste pattern making and design for disassembly, within bio-textile development. • Implementation of eco-friendly techniques: Skill in selecting materials and processes that reduce environmental impact and support circularity within bio-textile products.	Skills: • Oversight of circular economy transitions: Ability to lead and oversee the company's transition to circular economy models, ensuring practices like disassembly, recycling, and waste minimization are adopted across the production chain. • Implementation of business-wide circular strategies: Skill in managing processes that integrate circular economy principles across departments, aligning company-wide practices with circular product lifecycle goals and tracking the sustainability impact.



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
2.2 Sustainable Sourcing and Materials	Bio- based and Recyclable Materials	Knowledge: • Types of sustainable materials: Understanding of bio-based, biodegradable, and recyclable materials, including natural fibers, biodegradable fabrics, and lab-grown textiles. • Material properties and environmental impact: Knowledge of the characteristics and environmental impacts of various sustainable materials to make informed choices during product design. Skills: • Material selection for sustainability: Ability to select appropriate bio-based and recyclable materials	Knowledge: • Advanced knowledge of sustainable material sourcing: In-depth understanding of sustainable sourcing practices, focusing on bio-based, recyclable, and lab-grown materials within supply chains. • Life cycle and end-of-life considerations: Knowledge of the full lifecycle impact of bio-based and recyclable materials, including end-of-life scenarios such as biodegradability, recyclability, and resource efficiency. Skills:



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		that align with sustainability goals and product requirements in bio-textile design. • Incorporation of biodegradable fabrics: Skill in incorporating biodegradable materials and lab-grown textiles into bio-textile products to minimize environmental impact and enhance product sustainability.	• Oversight of sustainable material sourcing: Ability to oversee and manage sustainable sourcing strategies, ensuring that all materials used in recycling processes are bio-based, recyclable, or lab-grown to align with company sustainability goals. • Implementation of closed-loop material use: Skill in establishing and overseeing processes that promote the use of recyclable and biodegradable materials in a closed-loop system, supporting full lifecycle sustainability in production and recycling.
Ethical Sourcing		Knowledge:	Knowledge: • Advanced knowledge of Blockchain and ethical sourcing: In-depth understanding of blockchain technology



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		• Basics of ethical sourcing: Understanding the principles of ethical sourcing, including fair labor practices, sustainable materials, and supply chain transparency. • Introduction to Blockchain in textiles: Familiarity with blockchain technology and its applications in creating traceable and transparent supply chains for textile materials. Skills:	as it applies to textile supply chains, including how it enhances traceability, transparency, and accountability. • Regulatory standards and compliance in ethical sourcing: Knowledge of global standards and regulations for ethical sourcing and transparency, including specific compliance requirements for textile and recycling industries. Skills: • Management of Blockchain traceability Systems: Ability to manage and oversee blockchain systems to ensure that all stages of the recycling and production process are transparent, traceable, and documented.



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		• Data entry for Blockchain traceability: Ability to accurately input relevant sourcing information into blockchain systems to support product traceability. • Verification of ethical sourcing data: Skill in verifying that sourced materials meet ethical standards and ensuring accurate documentation in blockchain systems for transparency.	• Implementation of ethical sourcing protocols: Skill in developing and enforcing ethical sourcing practices across the supply chain, ensuring that all materials and processes meet industry standards and are transparently recorded in blockchain.
2.3 Life Cycle Impact of Textiles	Life Cycle Assessment (LCA)	Knowledge: • Basics of Life Cycle Assessment: Understanding the foundational principles of Life Cycle Assessment (LCA) and how it applies to measuring the environmental impact of bio-textile products.	Knowledge: • Advanced understanding of Life Cycle Impact assessment: In-depth knowledge of LCA methodologies and the comprehensive environmental, economic, and social impacts of textiles throughout the product life cycle.



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		• Introduction to LCA tools: Familiarity with commonly used LCA tools like SimaPro and their applications in assessing different stages of the textile production process. Skills: • LCA data input and analysis: Ability to use LCA tools such as SimaPro to assess environmental impacts in bio-textile production, including data entry, analyzing environmental footprints, and interpreting results. • Application of LCA findings to design: Skill in adjusting design choices based on LCA outcomes to	• Proficiency with LCA tools and standards: Understanding of advanced LCA tools like SimaPro, including best practices for setting parameters and interpreting data to align with sustainability standards in recycling. Skills: • Oversight and interpretation of LCA results: Ability to manage LCA processes across recycling operations, evaluate data for sustainability impacts, and generate insights on product lifecycle sustainability. • Integration of LCA in strategic decision-making: Skill in using LCA findings to guide sustainability strategies, reduce life cycle impacts, and support



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		minimize the environmental footprint of bio-textile products.	compliance and sustainability reporting across the company.
2.4 Circular Business Models	Product Recovery and Recycling Systems	Knowledge: • Fundamentals of product recovery: Understanding the principles of product recovery in the textile industry, including take-back and recycling systems aimed at closing the loop in bio-textile lifecycles. • Design for recovery: Familiarity with design principles that facilitate product recovery, focusing on materials and processes that simplify collection, disassembly, and recycling.	Knowledge: • Comprehensive knowledge of circular business models: In-depth understanding of various circular business models, including closed-loop and take-back systems, and their application in textile recycling and product recovery. • Regulations and best practices in recycling: Knowledge of regulatory requirements and best



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		Skills: • Support in developing take-back Systems: Ability to assist in establishing take-back and collection systems for bio-textiles, ensuring product designs incorporate features that enhance recovery and recyclability. • Collaboration for circular design: Skill in collaborating with design and production teams to incorporate recovery-focused elements, making bio-textiles easier to recycle and reintroduce into production.	practices for efficient recycling processes that align with circular business models in the textile industry. Skills: • Management of recycling and recovery systems: Ability to oversee and optimize recycling and recovery systems, ensuring they are efficient, compliant, and aligned with the company's circular business model. • Implementation of circular strategies across operations: Skill in enforcing and refining circular strategies throughout recycling operations, ensuring the company's recycling and recovery processes continuously support product circularity and reduce waste.



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
2.5 Technological Advancements	Innovations in Manufacturing	Knowledge: • Introduction to eco-friendly manufacturing techniques: Understanding of innovative manufacturing methods like waterless dyeing, upcycling, and 3D printing, particularly those that reduce resource use and environmental impact. • Sustainable materials for advanced techniques: Familiarity with materials compatible with advanced manufacturing techniques, ensuring designs align with eco-friendly production goals. Skills:	Knowledge: • Advanced knowledge of recycling technologies: In-depth understanding of cutting-edge recycling innovations, such as chemical recycling and closed-loop systems, that enhance the sustainability of textile recycling processes. • Evaluation of technological impact on sustainability: Knowledge of the environmental and economic impacts of new technologies in recycling, assessing their role in reducing resource consumption and improving process efficiency. Skills:



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		• Implementation of new manufacturing techniques: Ability to apply waterless dyeing, upcycling, and similar sustainable methods in textile manufacturing processes to support eco-design in bio-textiles. • Application of 3D printing for sustainable design: Skill in using 3D printing technology to prototype and develop eco-designs that minimize waste and resource usage in bio-textile production.	• Leadership in adopting advanced recycling technologies: Ability to lead the adoption of advanced recycling technologies like chemical recycling, ensuring the integration of these innovations optimizes process efficiency and meets sustainability goals. • Strategic implementation of eco-friendly manufacturing innovations: Skill in evaluating, selecting, and implementing new manufacturing technologies across operations to enhance sustainability and resource efficiency throughout the recycling process.



Competence Area 3: Key Skills and Competences

Bio-Textile Technician (EQF Level 5):

- **Key Knowledge:** The technician gains theoretical knowledge of circular fashion concepts and uses digital tools for bio- textile product development.
- **Key Skills:** Involves applying circular design principles, such as design for disassembly or reuse, to develop innovative and sustainable bio- textile products. The technician plays a role in optimizing designs for longevity and recyclability. Experiments with bio- based materials, works on integrating them into new designs, and assists with sustainable material sourcing decisions.
- **Responsibilities:** Ensure bio- textile products are developed with circularity in mind, from material sourcing to production processes. They also use digital innovations to support product lifecycle improvements.
- **Attitudes:** Commitment to circular fashion principles, openness to new technologies.



Recycling Manager (EQF Level 6):

- **Key Knowledge:** Focuses on understanding the larger circular economy principles and managing product lifecycle processes. They also need knowledge of digital innovations to oversee design and development.
- **Key Skills:** The recycling manager applies circular economy strategies in managing the lifecycle of fashion products, ensuring that both production and post-production recycling processes are optimized. This role also involves using digital tools to enhance sustainability throughout the supply chain. Manages the company's strategy for adopting sustainable materials, ensuring the sourcing and recycling processes are aligned with circular economy principles. Oversees long-term material life cycle strategies to minimize waste.
- **Responsibilities:** Lead the company's strategic direction in circular fashion design and oversee the recycling and reuse processes across the product's lifecycle. The Recycling Manager ensures that products are designed to be fully recyclable and compliant with circular economy goals.
- **Attitudes:** Readiness to align production and recycling processes with circular economy strategies and technological advancements.



Innovations with circular design

Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
3.1 Circular Design	The role of design in a circular	Knowledge: • Basics of circular design principles: Understanding fundamental principles of circular design, including design for longevity, reuse, disassembly, and recyclability in bio-textile products. • Circular fashion strategies: Familiarity with strategies that support circularity in fashion, such as creating products with extended lifespans and designing for ease of recycling.	Knowledge: • Advanced understanding of circular fashion systems: In-depth knowledge of how design impacts the circular fashion system, including insights into product lifecycle management and strategies for reducing waste.



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		Skills: • Application of circular design strategies: Ability to incorporate circular design strategies into bio-textile production, ensuring products are designed to be durable, reusable, and recyclable. • Product design for longevity and disassembly: Skill in designing bio-textiles that can withstand prolonged use and are easily disassembled, facilitating recycling and reuse.	• Lifecycle optimization for circular economy: Knowledge of design strategies that extend product life cycles and support circularity, such as modular design, upcycling potential, and closed-loop systems. Skills: • Management of circular design implementation: Ability to oversee and ensure that design strategies are aligned with circular economy principles, optimizing products for longevity and recyclability throughout the lifecycle. • Strategic development of circular design protocols: Skill in developing and enforcing design protocols across the production and



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
Circular design strategies: Design			recycling stages, ensuring products are created to maximize lifecycle efficiency within the circular economy framework.
	Circular design strategies: Design	Knowledge: • Understanding circular design considerations: Theoretical knowledge of how to design products with circularity in mind, focusing on longevity, potential for reuse, and minimizing waste in bio-textile products. • Principles of sustainable product life cycle: Familiarity with concepts of sustainable design that prioritize environmental impacts, including how design choices affect the product's lifecycle and end-of-life options.	Knowledge: • In-depth knowledge of circular design strategies: Advanced understanding of theoretical frameworks for circular design that inform product development, including strategies for longevity, reuse, and cyclability in textiles. • Life cycle analysis and design integration: Knowledge of how life cycle assessments can influence design decisions and promote circularity by identifying key areas for improvement in product sustainability.



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		Skills: • Implementation of design for longevity: Ability to create bio-textile products that are durable and long-lasting, thereby reducing the frequency of replacement and waste generation. • Design for reuse and waste reduction: Skill in applying design techniques that facilitate reuse of products and materials, as well as strategies to minimize waste throughout the design and production processes. • Cyclability considerations: Competence in designing products that can be cycled back into the economy effectively, ensuring they can be recycled or repurposed at the end of their lifecycle.	Skills: • Strategic oversight of circular design implementation: Ability to lead initiatives that ensure design strategies prioritize longevity, reuse, and waste reduction, facilitating a seamless integration of circular design principles across all operations. • Management of design for cyclability processes: Skill in developing and enforcing design protocols that optimize cyclability, ensuring that products can be effectively reintegrated into the production cycle after use. • Collaboration on sustainability goals: Ability to work collaboratively with design teams to align product development



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
			with sustainability goals, fostering a culture of innovation that emphasizes circular design.
3.2 Digital Innovations in	Digital innovation tools	Knowledge: • Familiarity with digital design tools: Understanding of various digital tools and software used in fashion design, especially those that facilitate sustainable practices in bio-textile production. • Digital innovations for circular fashion: Knowledge of how digital innovations can support circular fashion, including tools	Knowledge: • Advanced understanding of digital innovations: In-depth knowledge of how digital innovations can transform product and service design in circular fashion, including the integration of data analytics, digital modeling, and automation in recycling processes. • Impact of digital tools on sustainability: Understanding of how digital innovations can enhance sustainability efforts,



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		that enhance product design, life cycle assessment, and materials selection. Skills: • Support for digital tool utilization: Ability to assist in the application of digital design tools to create bio-textile products that align with sustainability objectives, such as minimizing waste and optimizing material usage.	improve efficiencies in production and recycling, and facilitate transparency in material sourcing and product life cycles. Skills: • Supervision of digital tool implementation: Ability to oversee the implementation of digital tools across production and recycling operations, ensuring they are effectively utilized to drive innovation and sustainability. • Strategic management of digital innovations: Skill in evaluating and integrating digital tools into operational strategies that enhance the sustainability of recycling processes



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		• Prototyping and testing with digital tools: Skill in using digital tools to prototype and test designs, allowing for rapid iteration and refinement in alignment with sustainability criteria.	and bio-textile production, promoting a culture of continuous improvement.
3.3 Sustainable Materials	Innovations in bio-based textiles	Knowledge: • Understanding of Bio-Based and Sustainable Materials: Knowledge of various bio-based textiles and materials, including their properties, benefits, and environmental impacts. • Awareness of innovations in material science: Familiarity with current trends and innovations in sustainable materials, including biodegradable options and alternative fibers that reduce environmental impact.	Knowledge: • In-depth knowledge of material innovations: Comprehensive understanding of the latest innovations in sustainable and bio-based materials, including their life cycle impacts and recyclability. • Material sourcing and compliance: Knowledge of sourcing sustainable materials in compliance with environmental regulations and sustainability standards, focusing on their role in circular economy practices.



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		Skills: • Experimentation with sustainable materials: Ability to experiment with and test different bio-based and biodegradable materials to evaluate their performance and suitability for product designs. • Integration of sustainable materials into designs: Skill in assisting in the integration of sustainable materials into product designs, ensuring they meet both aesthetic and functional requirements while promoting sustainability.	Skills: • Management of sustainable material adoption: Ability to oversee and facilitate the adoption of sustainable materials across production processes, ensuring that practices are aligned with sustainability goals and industry standards. • Optimization for recyclability: Skill in managing processes that optimize the recyclability of materials used in production, ensuring that the entire lifecycle of products supports circular economy principles.



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
3.4 Sustainable material sourcing strategies	Understanding of sustainable material sourcing	Knowledge: • Fundamentals of sustainable sourcing: Understanding the principles of sustainable material sourcing, including the importance of selecting materials that are renewable, ethically sourced, and environmentally friendly. • Impact of material choices on circular design: Knowledge of how sourcing decisions influence circular design practices, including considerations for material longevity, waste reduction, and recyclability. Skills:	Knowledge: • Advanced understanding of sourcing strategies: In-depth knowledge of sustainable material sourcing strategies and their implications for circular design, including how to manage supply chains to favor sustainability. • Regulatory and market trends: Awareness of current regulations and market trends related to sustainable sourcing, including certification standards and consumer expectations for sustainability in materials. Skills:



Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		• Application of sustainable sourcing strategies: Ability to apply sustainable sourcing strategies in selecting bio-textile materials, ensuring that chosen materials align with sustainability goals and circular economy principles. • Assessment of material longevity: Skill in evaluating the longevity and sustainability of sourced materials to ensure they meet the durability requirements for bio-textile products.	• Strategic development of sourcing policies: Ability to develop and implement sourcing policies that prioritize sustainability, ensuring that materials used in production support circular economy goals. • Management of supplier relationships: Skill in managing relationships with suppliers to ensure compliance with sustainability criteria and fostering collaborations that enhance sustainable material sourcing practices.



Competence Area 4: Key Skills and Competences

Bio-Textile Technician (EQF Level 5):

- **Key Knowledge:** Focuses on understanding of ethical sourcing principles and sustainable practices specific to bio- textiles, has familiarity with supplier certifications and standards relevant to sustainable sourcing, possesses knowledge of the traceability systems and technologies used to track materials in the supply chain.
- **Key Skills:** include the ability to evaluate and select suppliers based on sustainability and ethical criteria and conduct supplier assessments and audits to ensure compliance with sustainability standards, implement traceability systems for monitoring bio- textile materials from sourcing to production, has strong communication skills for preparing sustainability reports and effectively sharing information with stakeholders.
- **Responsibilities:** assists in sourcing bio- textile materials, ensuring they meet ethical and sustainable sourcing criteria, conduct supplier audits to verify compliance with established sustainability standards, implement tracking systems for materials to ensure traceability throughout the supply chain, collaborate with other teams to communicate sustainability practices and support sustainability reporting efforts.
- **Attitudes:** Commitment to ensuring that bio-textile materials meet ethical and sustainable standards.



Recycling Manager (EQF 6):

- **Key Knowledge:** possesses in-depth understanding of ethical sourcing practices and supplier engagement strategies for sustainable supply chains, knows auditing processes and assessment criteria for evaluating supplier sustainability, has knowledge of tools and technologies for tracing materials in the supply chain, including software and reporting frameworks, is aware of industry standards and regulations governing sustainability and recycling practices.
- **Skills:** ability to lead supplier assessments and audits, ability to develop and maintain relationships with sustainable suppliers and stakeholders, can apply analytical skills for evaluating supply chain practices and identifying areas for improvement in sustainability, capability to oversee the preparation and dissemination of sustainability reports that accurately reflect supply chain practices.
- **Responsibilities:** manages the strategic selection of sustainable suppliers and ensure compliance with ethical sourcing policies, leads supplier audits and assessments to evaluate and enhance sustainable practices in the supply chain, ensures comprehensive tracking of materials and monitor compliance with sustainability initiatives across the supply chain, develop sustainability reporting processes and communicate findings to relevant stakeholders, promoting transparency and accountability.
- **Attitudes:** committed to promoting transparency, accountability, and continuous improvement in ethical sourcing and sustainability.

Sustainable Supply Chain Management

Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
4.1 Sustainable Sourcing Practices	Ethical sourcing and supplier	Knowledge: • Foundational knowledge of ethical Sourcing: Understanding the principles of ethical sourcing, including labor practices, environmental considerations, and the importance of sustainability in material selection. • Supplier certifications and standards: Familiarity with various certifications and standards related to ethical sourcing in the textile industry, such as Fair Trade, GOTS (Global Organic Textile Standard), and OEKO-TEX.	Knowledge: • In-depth understanding of ethical sourcing: Comprehensive knowledge of ethical sourcing principles and standards specific to textiles, including the implications of sourcing decisions on social and environmental sustainability. • Supplier engagement strategies: Awareness of effective strategies for engaging with suppliers, fostering partnerships that prioritize sustainability and ethical practices.

Area	Tonics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		Skills: • Evaluation of suppliers: Ability to evaluate and select suppliers based on sustainability criteria, ensuring that chosen suppliers align with ethical and environmental standards. • Implementation of ethical sourcing practices: Skill in applying ethical sourcing principles in the selection of bio-textile suppliers, promoting responsible practices throughout the supply chain.	Skills: • Development of supplier relationships: Ability to develop and maintain relationships with sustainable suppliers, ensuring compliance with ethical sourcing policies and promoting transparency throughout the supply chain. • Oversight of ethical sourcing policies: Skill in overseeing the implementation of ethical sourcing practices across procurement processes, ensuring alignment with organizational sustainability goals and regulatory requirements.

Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
	Supplier audits and assessments	Knowledge: • Understanding of audit procedures: Familiarity with the procedures and standards for conducting supplier audits, including what criteria to assess for compliance with sustainability and ethical practices. • Compliance standards: Knowledge of relevant sustainability standards and ethical practices that suppliers must adhere to in the textile industry. Skills: • Assisting in supplier audits: Ability to assist in supplier audits by gathering necessary documentation, performing preliminary assessments, and supporting the audit process to verify compliance with sustainability standards.	Knowledge: • In-depth knowledge of audit standards: Comprehensive understanding of industry-specific audit standards and frameworks used to evaluate suppliers' compliance with sustainability and ethical sourcing practices. • Risk assessment and management: Knowledge of how to assess risks associated with suppliers and their practices, particularly in relation to sustainability and compliance issues. Skills: • Leading supplier audits: Ability to lead supplier audits, ensuring adherence to sustainable sourcing and ethical practices while effectively communicating expectations and providing guidance to suppliers.

Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		• Data collection and reporting: Skill in collecting data during audits and preparing reports that summarize findings and highlight areas for improvement regarding sustainability practices among suppliers.	• Implementation of corrective actions: Skill in developing and implementing corrective action plans based on audit findings, ensuring that suppliers address any identified compliance issues and enhance their sustainability practices.
4.2 Transparency in the Supply Chain	Traceability and tracking of	Knowledge: • Understanding of traceability concepts: Familiarity with the concepts of traceability and its significance in establishing transparency within sustainable supply chains, particularly in the context of bio-textiles. • Traceability tools and technologies: Basic knowledge of tools and technologies used for tracking materials, including digital platforms and systems that facilitate material traceability from sourcing to production.	Knowledge: • Comprehensive understanding of supply chain transparency: In-depth knowledge of the importance of traceability for sustainable supply chains, including regulatory requirements and market expectations for transparency in sourcing and production. • Advanced traceability solutions: Awareness of advanced traceability solutions and technologies, such as blockchain and

Area	Tonics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		Skills: • Implementation of traceability Systems: Ability to assist in implementing traceability systems for bio-textile materials, ensuring that all sourced materials can be tracked throughout the production process. • Monitoring material compliance: Skill in monitoring the compliance of materials with sustainability standards and documenting traceability data to support transparency efforts within the supply chain.	IoT (Internet of Things), that can enhance tracking of materials throughout the supply chain. Skills: • Overseeing traceability system implementation: Ability to lead the implementation of comprehensive traceability systems for bio-textile materials, ensuring that all materials are tracked effectively from sourcing through production and distribution. • Ensuring compliance monitoring: Skill in establishing processes for continuous monitoring of compliance throughout the supply chain, identifying and addressing any issues related to traceability and material sourcing.

Area	Topics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
	Reporting and communication	Knowledge: • Understanding of sustainability reporting: Familiarity with the principles of sustainability reporting, including the importance of transparency and accountability in communicating sustainability practices. • Key performance indicators (KPIs): Knowledge of relevant KPIs related to sustainability in the textile industry that can be reported on, including material sourcing, waste management, and energy use. Skills: • Contributing to sustainability reporting: Ability to contribute to sustainability reporting efforts by gathering data	Knowledge: • Comprehensive understanding of sustainability reporting standards: In-depth knowledge of various sustainability reporting standards and frameworks (e.g., GRI, SASB, CDP) and their relevance to the textile industry. • Stakeholder engagement and communication strategies: Awareness of best practices for engaging stakeholders and effectively communicating sustainability initiatives and outcomes throughout the supply chain. • Skills: • Overseeing development of sustainability reports: Ability to oversee the development and dissemination of comprehensive sustainability reports related to the supply

Area	Tonics	Bio-Textile Technician (EQF 5)	Recycling Manager (EQF 6)
		and information on bio-textile materials and practices, ensuring accurate representation of sustainability efforts. • Effective communication: Skill in communicating sustainability practices clearly and effectively to various stakeholders within the supply chain, fostering a culture of sustainability awareness and engagement.	chain, ensuring alignment with industry standards and stakeholder expectations. • Strategic communication planning: Skill in developing strategic communication plans that highlight sustainability practices, promote transparency, and enhance the reputation of the organization among stakeholders.

SECTION 4

4.1. Training Structure

The final aspect of this report involves identifying the training structure for the SiT project, which will form the basis for developing two training curricula in Work Package 3 (WP3). This structure integrates both basic and specialized competencies to address the diverse needs of professionals in the TCLF sector. It takes into consideration the new SiT TCLF GreenComp framework, ensuring the relevance and effectiveness of the WP3 curricula in preparing the workforce for the sector's green transformation. Additionally, the structure is designed to be flexible and adaptable, allowing customization for national contexts and specific TCLF sub-sector needs, facilitating implementation across various educational and industry settings.

Training Format: This training program is designed to be suitable for online delivery, with additional practical components included wherever feasible. Although respondents indicated a preference for practical training, online training will be the primary means of delivery to increase accessibility and flexibility, allowing participants to learn at their own pace and accommodating those who may face geographical or scheduling constraints. This approach ensures that knowledge is shared widely and inclusively, even if hands-on sessions are valued. The format also makes the training more easily adaptable to different educational settings and learning environments, thus enhancing the transferability and sustainability of the project results.

Training Overview and Structure: The training is intended as a micro-degree, which can be organized into approximately 18-20 ECTS and divided into 7 key subjects. It is designed to cover the competencies which have emerged as essential in the survey results, providing a well-rounded approach to the various topics and skills that the training should encompass. This structure can be adapted to suit specific needs and contexts within the textile recycling industry.

General Time Structure: The micro-credential program is designed to be completed over a flexible timeline, with a suggested duration of approximately 6 to 12 months. Each subject can be structured to take around 2-4 weeks, allowing for in-depth study of both theoretical content and practical applications. A typical week in the program may involve the following schedule:

- **Theoretical learning:** online lectures, readings, and assessments focused on core subject matter
- **Collaboration and discussion:** group projects, discussions with peers, and interaction with instructors or industry professionals
- **Practical application:** Depending on the program's setup, this may include practical homework assignments, in-depth case studies, or hands-on workshops. These activities are designed to bridge the gap between theory and practice, allowing learners to apply their knowledge in real-world scenarios, refine their skills, and gain practical insights into the industry.

The program will be designed to be self-paced, allowing learners to balance their education with other responsibilities. However, regular check-ins and milestone assessments will ensure that learners stay on track.

To further support practical learning, a **work-based learning (WBL) component** is recommended. This element, developed with input from industry partners, aims to blend theoretical knowledge with practical, real-world applications, enriching the overall learning experience. The involvement of textile SMEs and sector representatives will play an important role, as they will work together with HE and VET providers to identify internship possibilities. Each participant will undertake a small practice-based project during their internship, allowing them to apply their skills directly within a real-world setting, with guidance and feedback from both tutors and industry partners.

Additional program details:

Most of the program will be delivered in an online learning format. While theoretical knowledge is provided through digital platforms, small-scale practical components may be integrated via virtual labs, collaborations with industry partners, or optional in-person workshops, depending on the national context and institutional capabilities.

Apart from the competences defined in the SiT TCLF GreenComp, the training program will also take into account the soft skills that have emerged as particularly relevant in the survey and the interviews.

The training structure is designed to be flexible and adaptable, allowing for customization based on national contexts and the specific needs of different sub-sectors within the industry. This adaptability ensures that the program can be effectively implemented across various educational institutions and industry settings.

The program is structured as a micro-degree and comprises a series of subjects that can be tailored to meet regional or sector-specific requirements. The training includes both foundational and advanced competences, ensuring that students are well-prepared for the evolving demands of the industry.

4.1.1. Bio-textile Technician Training Structure

This training structure for the emerging role of a Bio-Textile Technician is divided in seven thematic blocks which are lined out below. This structure is intended to foster both basic and specialized competences, as well as soft skills to support the bio-textile industry's transition towards sustainability.

1. Sustainability

This block introduces the core principles of sustainability and its importance in the textile industry. It emphasizes the integration of environmental, social, and economic dimensions in sustainable practices and explores how bio- textiles contribute to the circular economy.

Learning Outcomes aim to:

- Understand the concept of sustainability and circular economy and its relevance to the textile industry
- Analyze the role of bio-textiles in promoting circular economy models
- Apply Sustainable Development Goals (SDGs) within textile practices
- Master the EU circular economy action plan for textiles, including Circular Design principles
- Integrate ethical sourcing practices into textile production to ensure materials are sourced sustainably and transparently

2. Material Science for Bio-textiles

This block covers the properties of bio-based materials and their use in textiles. It focuses on optimizing materials for different applications, including fashion and technical textiles, and scaling lab innovations into mass production.

Learning Outcomes aim to:

- Demonstrate knowledge of bio-based material properties and their applications
- Optimize bio-based textiles for scalability and various textile sectors
- Assess material sustainability and performance in textile production

3. Bio-technology and Bioengineering

In this block, learners explore the integration of bio-technology into textile production, including bio-fabrication methods, microorganisms, and nanotechnology. The block highlights advanced techniques for improving textile properties.

Learning Outcomes aim to:

- Understand bioengineering principles in textile innovation
- Apply bio-fabrication techniques using microorganisms and bio- based processes
- Utilize nanotechnology to enhance textile properties, such as strength and durability

4 .Sustainable Production Techniques and Quality Assurance

This block emphasizes production techniques and maintaining product integrity throughout the lifecycle.

Learning Outcomes aim to:

- Implement sustainable production techniques that minimize resource consumption (e.g., energy, water)
- Conduct Quality Control testing for biodegradability, durability, and compostability

- Apply zero-waste design and production approaches, integrating practical examples like waste minimization during manufacturing.

5. Circular Economy Systems and Design

This block dives deeper into the operational and systemic aspects of the circular economy, with a strong focus on designing products and systems that promote reuse, recycling, and sustainability from the beginning.

Learning Outcomes aim to:

- Understand Circular Economy strategies aimed at reducing waste and promoting material regeneration
 - Design and implement closed-loop systems that prioritize material recovery, reuse, and recycling across the textile value chain
- Apply Circular Design principles to create bio-textiles that ensure a sustainable lifecycle from inception to disposal

6. Regulatory Compliance, Certifications, and Life Cycle Assessment (LCA)

This block focuses on understanding international textile certifications and regulatory frameworks for bio-based materials. Learners also explore life cycle assessment (LCA) methodologies to assess the environmental impact of textile production.

Learning Outcomes aim to:

- Gain understanding of key certifications and regulatory standards in bio-textile production
- Develop an awareness for Life Cycle Assessment (LCA) methods to understand and evaluate the environmental impact across the textile value chain

Build Awareness of compliance practices with global sustainability standards and certifications

7. Creativity, Innovation, and Collaboration

This block fosters creativity and interdisciplinary collaboration to address sustainability challenges in the textile industry. Learners engage in teamwork, innovation, and stakeholder collaboration to develop bio- textile solutions.

Learning Outcomes aim to:

- Demonstrate creativity in developing innovative bio-textile solutions
- Collaborate effectively across teams to solve sustainability challenges in textile production
- Engage with stakeholders to enhance innovation and sustainability in textile projects
- Apply problem-solving skills to overcome technical and environmental challenges in the bio-textile sector

4.1.2. Textile Recycling Manager Training Structure

This training structure for the emerging role of a Recycling Manager is divided in seven thematic blocks which are lined out below. This structure is intended to foster both basic and specialized competences, as well as soft skills to support the bio-textile industry's transition towards sustainability.

1. Sustainability and Circular Economy

This block introduces core concepts of sustainability and circular economy, focusing on how textile recycling contributes to resource efficiency and environmental goals.

Learning Outcomes aim to:

- Understand the principles of sustainability and their relevance to textile recycling
- Apply Circular Economy strategies to minimize waste and optimize resource recovery
- Implement Sustainability Goals in recycling operations to support environmental objectives

2. Recycling Process Management and Regulatory Compliance

This block combines managing textile waste recycling processes with an understanding of the regulatory framework, focusing on compliance with waste management laws, certifications, and safety standards.

Learning Outcomes aim to:

- Develop the ability to organize and oversee textile recycling processes, from collection to final redistribution

- Gain an understanding of recycling practices that align with circular economy principles and regulatory standards
- Build awareness for compliance requirements for waste management regulations and industry certifications
- Understand and promote chemical safety protocols to help protect workers and the environment during recycling operations

3. Material Science for Recycling

This block provides an understanding of the properties and lifecycle of textile materials and how to effectively recover and repurpose different fibers.

Learning Outcomes aim to:

- Understand the basic properties and lifecycle of synthetic and bio-based textile materials
- Knowledge of appropriate recycling techniques for different materials and incorporate sustainability practices
- Understand and use Life Cycle Assessment (LCA) thinking to evaluate and optimize material recovery and reuse processes

4. Waste Management Regulations and Circular Economy Systems

This block delves into waste management regulations and deeper principles of the circular economy systems, emphasizing practical applications in textile recycling.

Learning Outcomes aim to:

- Gain knowledge of national and international waste management regulations and their application to textile recycling

- Apply Circular Economy models to enhance the efficiency of textile recycling systems
- Ensure regulatory compliance with environmental laws while implementing closed-loop recycling practices

5. Recycling Technologies, Innovation, and LCA

Learners explore recycling technologies and innovations, focusing on mechanical and chemical recycling techniques and how to assess their environmental impact using Life Cycle Assessment (LCA).

Learning Outcomes aim to:

- Understand the core principles of textile recycling technologies and how to apply them
- Stay Updated on technological innovations and integrate new techniques into recycling processes
- Use LCA Tools to assess the environmental efficiency of different recycling technologies and optimize them for sustainability

6. Supply Chain Management and Transparency

This block focuses on managing the recycling supply chain, ensuring transparency, and ethical sourcing from the collection of materials to their final use.

Learning Outcomes aim to:

- Develop Skills to coordinate the logistics of textile waste collection, sorting, and redistribution across the supply chain
- Gain familiarity with transparency practices, including the use of tools like blockchain, to enhance traceability in recycling processes

- Build an understanding of compliance with ethical sourcing and supply chain standards, fostering transparency throughout the recycling chain

7. Leadership, Innovation, and Problem-solving

This block develops leadership and problem-solving skills, enabling learners to lead teams, foster innovation, and solve complex challenges in textile recycling operations.

Learning Outcomes aim to:

- Build leadership skills to effectively guide and motivate teams involved in recycling operations
- Apply critical thinking and problem-solving techniques to address challenges in textile recycling
- Foster creativity and innovation to continuously improve recycling methods and processes.

SUMMARY

The SiT Project's Training Structure Report aims to enhance sustainability within the Textile, Clothing, Leather, and Footwear (TCLF) sector by defining essential green competencies aligned with the European GreenComp framework. This project addresses the increasing need for sustainability-focused roles, such as the Recycling Manager and Bio-Textile Technician, by establishing core competencies, structured training, and bridging industry-education gaps in sustainability skills.

A survey was conducted among higher education and vocational training institutions (HE/VET) and small-to-medium enterprises (SMEs) in eight SiT Project countries in the EU shedding light on varying sustainability competency needs within the sector. Findings revealed that while HE/VET institutions are more familiar with the awareness of those new emerging roles, SMEs exhibit a noticeable gap in awareness. Both SMEs and HEI/VET institutions, however, reported difficulty in finding experts skilled in sustainable design and regulatory compliance—competencies essential to bridging education with industry demands.

The survey identified several high-priority competencies critical for advancing sustainability in the TCLF sector. Legal knowledge was highlighted as essential for regulatory compliance, while expertise in design and materials innovation was deemed invaluable for promoting circular economy practices. Supply chain management was identified as crucial, with room for improvement in ethical sourcing criteria. Additionally, the ability to assess environmental impact and integrate circular economy principles is necessary for waste reduction and increased transparency.

While there are overlaps, the competencies for Bio-Textile Technicians and Recycling Managers show some nuanced differences. Both roles emphasize technical expertise and sustainability, but with the Bio-Textile Technicians' role the focus is more on bio-based materials, traditional and modern textile techniques, and quality control, integrating sustainability into production. The role of Recycling Managers prioritizes expertise in

recycling technologies, waste management regulations, and supply chain management, reflecting the logistical and regulatory aspects of circular practices.

The role of a Recycling Manager is pivotal in ensuring efficient, compliant recycling processes that align with circular economy principles. This position requires a diverse skill set encompassing recycling management, regulatory knowledge, materials science, leadership, and innovation. Training for this role includes comprehensive modules covering sustainability basics, recycling process management, materials science, waste management, advanced recycling technologies, supply chain transparency, and leadership.

The role of Bio-Textile Technician focuses on developing bio-based textiles, leveraging biotechnology to promote sustainable production and circular design. Competencies for this role include sustainability integration, biomaterials science, bioengineering, and creative innovation. Training modules introduce sustainability foundations, biomaterial science, biotechnology applications, circular economy design, regulatory adherence, and collaborative innovation.

Based on the survey results, the SiT partnership has developed the TCLF GreenComp framework, which outlines four main competency areas for the sector: The first area, "Embodying Sustainability Values," focuses on aligning individual and organizational actions with environmental responsibility. "Embracing Complexity" highlights the need to understand interconnected systems and confront unsustainable practices. "Envisioning Sustainable Futures" encourages innovation and forward-thinking in planning sustainable transitions. Lastly, "Acting for Sustainability" emphasizes the importance of active engagement in policy, collaboration, and proactive sustainability efforts.

The SiT Project emphasizes the need for stronger integration of sustainability in TCLF education and industry collaboration. Addressing the identified competency gaps will support the TCLF sector's shift toward sustainability, preparing a workforce equipped to meet the demands of emerging green roles like the Recycling Manager and Bio-Textile Technician.