

Upskilling and reskilling the textile industry sector to face the challenges in recycling, traceability and certification of recycled products

Reactive Training Modules for the Urgent Textile Skills Needs: Syllabus Booklet



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Foreword

The textile industry sits at the centre of the European circular economy transition. It is one of the most resource-intensive sectors in Europe, and one of the most exposed to the practical consequences of new regulation, from the Ecodesign for Sustainable Products Regulation to the separate collection obligation for textile waste established in the Waste Framework Directive, or the forthcoming Digital Product Passport. These developments raise a common question: do the people working in the sector have the skills to deliver circularity in practice?

The Skills4Circularity (S4C) Blueprint Alliance responds to this challenge. Within the first phase of the project, the consortium has designed three masterclasses that cover the most pressing upskilling needs of the European textile industry which were identified in a needs assessment: Recycling Technology, Eco-design for the Circular Economy, and Sustainable Manufacturing. Each masterclass consists of four different learning outcomes across four three-hour live online sessions, followed by a micro-credential for participants who complete the assessment.

This booklet presents the full syllabus of the three S4C masterclasses. For each lesson, the booklet provides an overview of the topics covered, the interactive learning activities, and the corresponding micro-credential specification. Together, these twelve lessons form the foundation of the S4C reactive training offer. The training programme will be delivered through live online masterclass sessions to European textile professionals in 2026 and subsequently integrated into the MOOC to ensure wider accessibility and open access to the learning content through the Skills4Circularity Website (<https://www.skills4circularity.eu/>)

This booklet represents not only a description of what will be taught, how it will be delivered, and how learning outcomes will be assessed, but also a commitment to keep the training relevant, rigorous, and closely aligned with the operational needs of the European textile industry.

On behalf of the S4C Consortium

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1. Introduction

1.1 Purpose of this booklet

This booklet presents the detailed syllabus of the three S4C masterclasses developed in response to the urgent skills needs to be identified in the areas of Recycling Technology, Eco-design for the Circular Economy, and Sustainable Manufacturing. For each lesson, the booklet presents the intended learning outcomes, lesson content, interactive learning activities, and the associated skills and knowledge. The common delivery framework, assessment methodology, and micro-credential approach are described in Section 3.

This deliverable is intended for three main target audiences: the European Education and Culture Executive Agency (EACEA), as the funding authority; the consortium partners responsible for delivering and further developing the masterclasses; and the wider European textile community, including companies, clusters, higher education institutions (HEIs), and vocational education and training (VET) providers, who wish to understand, implement, or promote the S4C training offer.

1.2 Scope and context in the S4C project

Skills4Circularity is an Erasmus+ project that brings together higher education institutions (HEIs), vocational education and training (VET) providers, and stakeholders from the textile sector. The project addresses critical skills shortages by promoting the integration of circular economy principles, digital transformation, and sustainability into the textile industry. S4C is running from November 2025 to October 2029 and brings together 21 partners from 12 countries.

The project focuses on developing innovative training programmes in textile recycling, eco-design, and product certification. By strengthening the role of industry clusters as bridges between education and industry, the alliance aims to foster a textile ecosystem that is both globally competitive and resilient.

Skills4Circularity will deliver specialised MOOC-based training programmes, establish a permanent Textile Skills Observatory to support market intelligence, and implement a mobility programme consisting of interregional bootcamps and hackathons.

1.3 How to read this booklet

This booklet is organised into several sections to guide readers from the background of the training programme to the detailed description of each masterclass and its lessons.

Section 2 explains how urgent skills needs were identified and translated into training design, while Section 3 presents the delivery framework common to all three modules. Sections 4 to 6 present the full syllabi, one section per module. Each module section begins with a brief module overview and is followed by its four lesson entries in order of delivery. Each lesson entry comprises three parts: 1) lesson identification; 2) lesson content; and 3) the micro-credential specification. The annexes provide supporting information: the training templates (Annex A); guidance for describing skills and knowledge (Annex B); collection of skills and knowledge (Annex C); the abbreviations, acronyms and glossary (Annex D); and the micro-credential certificate issued to participants (Annex E).

2. Addressing Urgent Skills Needs: Designing the Courses

2.1 Identification of Skills Gaps

To identify and prioritise the most urgent skills gaps hindering the European textile industry's transition to a circular and sustainable model, two complementary evidence streams were collected and combined to ensure that the training design reflects both labour market demands and industry expectations:

a) Job advertisements analysis

A total of 313 recent job advertisements were collected and evaluated across key European textile hubs to identify market signals and analyse labour market demand. The objectives were to identify skills currently demanded by employers in relation to circularity, sustainability, and innovation in the textile sector; detect urgent skills gaps (understood as skills for which demand is already observable in the labour market but not yet sufficiently addressed by existing training and qualification systems); and provide a market-driven empirical basis to inform the qualitative research phases of the project (industry surveys and interviews).

The key evidence points from this analysis were as follows:

- Deep Digitalization Across the Value Chain shows high frequency and broad distribution across job ads (e.g., ERP-related competences, data analysis, database management, technical documentation, CAD-related tools). This indicates that digitalisation is not an “add-on” but a cross-cutting baseline for multiple roles, suggesting the need for training modules that combine textile-specific processes with data handling, documentation, and digital workflow management.
- Eco-Design Principles for Circularity emerges as another strong cluster (e.g., pattern making, product design, textile design, circular economy concepts, technical documentation). The evidence suggests that training should focus on design-for-circularity competences that connect creative and technical development tasks with documentation, specification checking, and circular product requirements. This area is particularly relevant for developing profiles able to translate circularity principles into tangible product and process decisions.
- Sustainable Materials Sourcing and Traceability is consistently represented (supplier management/relationships, material selection, compliance, textile materials knowledge, data collection systems, product data management). This points to a need for training that bridges procurement and sustainability: not only choosing materials but also ensuring traceability, supplier coordination, regulatory compliance, and data-driven product information management.
- Waste Management and Resource Minimization Strategies contain both specific competences (waste management, environmental legislation, lean manufacturing, resource management) and a very high frequency “Reporting” signal. This suggests that sustainability work in companies is strongly linked to monitoring, documentation, and reporting practices. Training should therefore include practical elements on sustainability documentation/reporting routines, KPI logic, and operational resource efficiency—anchored in the language and constraints of manufacturing environments.

2. ADDRESSING URGENT SKILLS NEEDS: DESIGNING THE COURSES

- Textile Recycling and Upcycling Technologies appear with a smaller but meaningful set of skills (recycling programs, recycling processing equipment, sorting textile items, repair/alteration-related competences). This indicates that recycling-related roles may be more specialised and less frequently advertised, but strategically central to the project. Training here should be modular and practice-oriented, targeting operational know-how (sorting, processing, quality sorting criteria) while connecting to traceability and circular economy requirements.
- Automation and Robotics in Manufacturing, and Artificial Intelligence (AI) Applications, are present as emerging clusters (production monitoring, automation technology, monitoring automated machines; plus, AI/ML/deep learning and computer vision). Their frequency suggests these competences are currently more concentrated in specific roles, but they represent clear signals of the twin transition in the sector. Training implications include advanced/specialisation tracks (rather than baseline training) focusing on how automation/AI supports process monitoring, defect detection, predictive maintenance, and production optimisation.
- Virtual and Augmented Reality (VR/AR) and 3D Printing / Additive Manufacturing show limited occurrences, but they are strategically relevant as innovation enablers (e.g., garment simulation and virtual try-on; 3D modelling). These signals suggest that training in these areas may be best framed as pilots or optional advanced units, integrated into design/development pathways rather than treated as stand-alone core modules

The full internal report can be found in the webpage of Skills4circularity Project (<https://www.skills4circularity.eu/wp-content/uploads/WP-1-%E2%80%93-Internal-Workshop.pdf>).

b) Industry survey and focused interviews

A total of 183 companies across 12 countries (Belgium, Czechia, Germany, Spain, France, Italy, Portugal, Romania, Sweden, Slovenia, Turkey and Austria) responded to the surveys, complemented by 22 responses from the focused interviews. The focus of the surveys was to detect immediate skills shortages in recycling technologies, eco-design for circular economy, and sustainable manufacturing. The focused interviews served as a qualitative validation of the survey results and helped to the identification of domain-specific domains. The first key finding was that regulations emerged as the highest-priority skills gap across the three modules analysed. Companies urgently need professionals who can navigate complex compliance actions and translate EU regulations into operational procedures. Moreover, specific findings emerged for each theme:

- Recycling Technology: Solving the sorting bottleneck: The data showed that recycling is rarely an integrated core process for traditional textile companies; it is treated as a sub-activity or external cooperation. The most urgent technical skills gaps lie upstream: «Preparation for recycling» (45.9%) and «Sorting» (35.5%). Material heterogeneity is a major obstacle, meaning the industry desperately needs professionals who can design basic workflows for receiving, preparing, and accurately sorting textile waste before complex mechanical or chemical recycling can occur.
- Eco-design - Enabling data-driven decisions: There is a strong market signal for professionals who can use data to validate circularity. Following regulations, the highest demands are for «Life cycle assessment & ecological footprint» (57.9%) and «Traceability» (50.3%). The interviews highlighted a critical nuance: LCAs are increasingly used but frequently interpreted incorrectly. The industry needs talent that understands how to decide; how to accurately read LCA results to choose materials and determine exactly what traceability information must be collected at each supply chain stage.
- Sustainable Manufacturing-System integration over pure tech: The raw data points to massive demand for «Efficient production» (54.6%) and «Waste-free / waste-reduced production» (53.6%). Interestingly, the interviews confirmed that sustainability fails on the factory floor not because of a lack of technology, but due to

2. ADDRESSING URGENT SKILLS NEEDS: DESIGNING THE COURSES

a lack of organization. The market demands hybrid skill profiles capable of finding waste points, choosing efficiency KPIs, and setting up rigorous monitoring systems to translate strategic guidelines into operational measures.

2.2 From Evidence to Training Design: Training Courses Structure

Based on the collected evidence, an Internal Workshop held on 28 January 2026 consolidated the findings into a prioritised Skills Gaps Framework and defined the Learning Outcomes for the Reactive Training Programme.

The programme agreed consists of three standalone masterclasses or modules, each addressing a specific priority area of the circular textile transition:

- **Module 1 – Recycling Technology**
Focuses on regulatory requirements, textile waste preparation and sorting, selection of appropriate recycling technologies, and coordination across the recycling value chain.
- **Module 2 – Eco-design for the Circular Economy**
Covers eco-design regulations, life cycle assessment (LCA), sustainable material and process selection, traceability planning, and circular product development.
- **Module 3 – Sustainable Manufacturing**
Addresses sustainable production systems, operational efficiency, waste reduction strategies, Digital Product Passport (DPP) requirements, and performance monitoring.

Each masterclass or module includes four lessons as follows:

PROGRAMME STRUCTURE AT A GLANCE

MODULE 1 — RECYCLING TECHNOLOGY	MODULE 2 — ECO-DESIGN FOR THE CIRCULAR ECONOMY	MODULE 3 — SUSTAINABLE MANUFACTURING
Legal compliance, waste workflows (sorting/prep), selecting recycling technologies, and supply-chain coordination.	Design regulations, LCA analysis, material traceability, and end-of-life product planning.	Legal compliance, efficiency KPIs, waste-reduction planning, and Digital Product Passport (DPP) requirements.
L1 EU legal requirements for textile recycling	L1 From eco-design regulations to textile design specifications	L1 EU requirements for sustainable textile production
L2 Workflow for recycling the textile waste	L2 Use LCA to select textile materials & processes	L2 KPIs definition and tracking in textile manufacturing
L3 Selecting the right textile recycling technology	L3 Traceability across textile value chain	L3 Waste reduction in textile manufacturing
L4 Coordination on textile recycling chain	L4 Design for textile circularity	L4 DPP requirements in the textile industry

2. ADDRESSING URGENT SKILLS NEEDS: DESIGNING THE COURSES

The training structure follows a progressive learning coherence in which participants move from understanding conceptual foundations towards applying knowledge through practical cases and operational decision-making. This approach ensures that learning outcomes remain directly connected to real industry challenges and support immediate workplace implementation.

Successful completion of each individual lesson/session leads to the award of the corresponding micro-credential, while participation without successful completion is recognised through a Certificate of Attendance.

3. Delivery Framework

This section describes the design principles and operating mechanics common to all three S4C masterclasses. Every lesson described in Sections 4 to 6 is delivered within this framework.

3.1 Programme-level Architecture

The S4C reactive training offer is organised as three standalone masterclasses, each one designed to address a distinct upskilling need identified through the urgent skills needs analysis described in Section 2. Each masterclass consists of four live three-hour sessions; and each session delivers a specific learning outcome. Participants may register for individual sessions, an entire masterclass, or a combination of sessions according to their learning needs. Micro-credentials are awarded upon successful completion of each lesson.

	MODULE 1 RECYCLING TECHNOLOGY	MODULE 2 ECO-DESIGN FOR THE CIRCULAR ECONOMY	MODULE 3 SUSTAINABLE MANUFACTURING
Learning outcomes (LOs)	4	4	4
Total sessions	4 × 3h	4 × 3h	4 × 3h
Total hours	12 hours	12 hours	12 hours
Credential after successful completion of the session	Micro-credential	Micro-credential	Micro-credential
Certificate after the attendance of the session	Certificate of Attendance	Certificate of Attendance	Certificate of Attendance

3.2 Session Structure

Each session follows the same three-hour delivery structure. This time commitment of 180 minutes includes a lecture component, a practical/interactive component, an assessment component, and an end-of-session participant survey. The lecture component is recorded and will be integrated into the MOOC following live delivery, whereas the practical and interactive activities are delivered live but are not recorded. The general session structure is shown below:

DURATION	COMPONENT	DESCRIPTION
5 min	Welcome & introductions	The host welcomes participants and introduces the speakers. Chat and Q&A guidelines are explained.
5 min	Session overview	Facilitator describes how the session works and what participants will learn. Assessment format is explained.

3. DELIVERY FRAMEWORK

DURATION	COMPONENT	DESCRIPTION
15 min	Topic 1 — Live lecture	First topic of the learning outcome. Delivered via slides and interactive tools. Recorded for MOOC integration.
5 min	Q&A	Open questions and discussion after Lesson 1.
15 min	Topic 2 — Live lecture	Second topic of the learning outcome. Recorded for MOOC integration.
5 min	Q&A	Open questions and discussion after Lesson 2.
15 min	Topic 3 — Live lecture	Third topic of the learning outcome. Recorded for MOOC integration.
5 min	Q&A	Open questions and discussion after Lesson 3.
10 min	Break	Participant rest break.
60 min	Interactive session	Case studies, group work, exercises, or polls. Not recorded. Materials are included in the MOOC as self-study resources after live delivery.
5 min	Q&A	Open questions after the interactive session.
5 min	Break	Short break before assessment.
15 min	Assessment	Quiz (5 questions) and structured task via Teams.
10 min	Post-training survey	Participants complete the EU Survey feedback link shared by the host.
5 min	Wrap-up & next steps	Facilitator summarises key takeaways, provides certificate information, and promotes the next session.

3.3 Learner's Journey

The participant journey is designed to provide a simple and accessible learning experience. Participants register for individual sessions according to their learning needs and attend the live online sessions on the scheduled dates. At the end of each session, participants complete the related assessment activity. Participants who successfully complete the assessment receive a micro-credential corresponding to that specific lesson/session. Participants who attend but do not successfully pass the assessment receive a Certificate of Attendance. The same learner journey and certification logic applies across all three masterclasses.

3. DELIVERY FRAMEWORK

3.4 Assessment Methodology

Assessment methods are designed to align with the intended learning outcomes of each session. Knowledge-based learning outcomes are evaluated through multiple-choice quizzes, whereas skill-based learning outcomes are assessed through practical exercises, case study analyses, or scenario-based tasks using predefined assessment rubrics. Assessment methods and credential awarding are applied independently to each lesson/session.

Notional workload	3 hours = 180 minutes total, including a lecture component, a practical and interactive component, an assessment component, and the end-of-session participant survey.
Type of assessment	Knowledge assessment: A multiple-choice quiz for the knowledge assessment, five questions, each with three answer options and one correct answer Skills assessment: A practical exercise for skills assessment, consisting of solving a problem
Assessment criteria	Knowledge evaluation criteria: For the quiz, each correct answer will value 2 points, a maximum score of 10 points. Skills evaluation criteria: For the practical exercise, the assessment will be based on the accuracy of the problem solution (0-10 points)
Pass threshold	11 points out of 20.
Estimated EQF level associable	EQF 4 to 7
Certificate	Micro-credential — issued upon successful completion of the assessment associated with the individual lesson/session. Certificate of Attendance — issued to participants who attend the lesson/session but do not successfully complete the assessment.
Awarding body	Skills4Circularity Partnership (Erasmus+ Blueprint Alliance, GAP-101243978)
Type of quality assurance used to underpin the micro-credential	Quality ensured by Skills4Circularity Partnership, composed by Universities, VET providers, textile associations and clusters.

3.5 Micro-credential Approach

Micro-credentials are awarded independently for each lesson/session to participants who successfully complete the corresponding assessment requirements. Each micro-credential certifies the achievement of the intended learning outcome associated with that specific lesson. The approach is aligned with the Council Recommendation on a European approach to micro-credentials for lifelong learning. The first page of the certificate includes the learner's identification, the lesson title, and the date of delivery. The second page provides the detailed micro-credential descriptor, including the course description, topics, provider information, skills, knowledge, language, country of the

3. DELIVERY FRAMEWORK

lesson developer, assessment details, form of participation, notional workload, and quality assurance information. An example of the micro-credential certificate, showing the common information applicable to all lessons, is provided in Annex E. The lesson-specific information for each short course is presented in Sections 4, 5, and 6.

3.6 Target Audience and Access

The masterclasses are designed for engineers, technicians, managers, mentors, and other professionals working across the European textile value chain. The delivery language is English. Sessions are delivered live online via Microsoft Teams, with participation free of charge during the Erasmus+ project period. After live delivery, session materials will be integrated into MOOCs and will be available in the Skills4Circularity website.

4. Module 1 — Recycling Technology

Module 1 introduces the legal, operational, and technological foundations of textile recycling. Through the four lessons, participants develop the knowledge and skills required to identify relevant legal requirements and compliance actions, design receiving and sorting workflows, evaluate recycling technology options, and analyse and address coordination challenges across the textile recycling value chain.

LESSONS AT A GLANCE

L	LESSON	LESSON DEVELOPER
L1	EU legal requirements for textile recycling	Gheorghe Asachi Technical University of Iasi (TUIASI)
L2	Workflow for recycling the textile waste	University of Borås (HB)
L3	Selecting the right textile recycling technology	Faculty of Textile Engineering at the Technical University of Liberec (TUL)
L4	Coordination in textile recycling chain	Universitat Politècnica de Catalunya (UPC)

M1-L1 · RECYCLING TECHNOLOGY · SESSION 1 OF 4

1	LESSON IDENTIFICATION
Module	M1 — Recycling Technology
Lesson Title	EU legal requirements for textile recycling
Learning Outcome	This lesson enables participants to understand and apply the EU regulatory framework for textile recycling. Participants will learn to identify which regulations apply to their operations and translate these legal requirements into concrete operational steps.
Session	Session 1 of 4
Lesson Developer	TUIASI (Romania)
Lesson Validator	IVGT (Germany)
2	Lesson content
Topic 1: Waste Frame Directive	After a short overall presentation of EU sustainability regulation applicable to the textile industry, the topic focuses on the content of the Waste Framework Directive.

4. MODULE 1 — RECYCLING TECHNOLOGY

1	LESSON IDENTIFICATION
Topic 2: Extended Producer Responsibility	This topic is intended as an introduction to the application of EPR regulations in the textile sector, and what will be required from the textile companies considered producers. Mandatory and voluntary textile EPR schemes in the EU are presented. The calculation of EPR fees is discussed.
Topic 3: Waste classification	In this topic, participants will learn about the standards and systems used for textile waste classification. The lesson also discusses end-of-waste criteria and their applicability for textile waste, and specific regulations for the shipment of textile waste.
Interactive Activity	The activity includes a case study (based on specific scenarios, the participants will choose what to do when preparing for and complying with an EPR scheme), and a practical exercise (calculating the EPR fees, including eco-modulation fees).
3	Micro-credential specification
Lesson Title	EU legal requirements for textile recycling
General Description of the Short Course	The session aims at familiarizing the participants with the existing EU legal framework concerning textile recycling and preparing for the regulations that will be adopted in the near future. The participants will grasp the implications for textile companies in terms of compliance and what actions must be taken within the companies to meet these demands.
Skills	Skill label: Apply EU regulations regarding textile recycling Skills description: Identify specific demands of legislation and adapt activities to apply and comply with the legislation.
Knowledge	Knowledge label: EU Regulations on textile recycling Knowledge Description: Sustainability and circularity legislation, governing bodies and regulatory authorities responsible for decision-making and enforcement regulating textile recycling that textile companies must comply with. Knowledge label: Waste management Knowledge description: The methods, materials and regulations used to collect, transport, treat and dispose of waste. This includes recycling and monitoring of waste disposal. It excludes procedures related to waste incineration.
Keywords	Waste Framework Directive/EPR compliance/Textile waste classification/ End-of-waste criteria/Waste shipment /Regulation specific provisions

4. MODULE 1 — RECYCLING TECHNOLOGY

M1-L2 · RECYCLING TECHNOLOGY · SESSION 2 OF 4

1	LESSON IDENTIFICATION
Module	M1 — Recycling Technology
Lesson Title	Design a basic workflow for receiving, preparing, and sorting textile waste
Learning Outcome	This lesson enables participants to design and improve workflows for receiving, preparing, and sorting textile waste. Participants will learn to establish intake procedures, manage contamination and mixed materials, apply sorting principles based on material characteristics and end-use, and identify quality control measures and common operational bottlenecks in recycling processes.
Session	Session 2 of 4
Lesson Developer	HB (Sweden)
Lesson Validator	CS Pointex (Italy)
2	Lesson content
Topic 1: Receiving and preparing	The challenge of getting EOL textiles into the reverse value chain is described. The lecture outlines the role of the consumers and how to facilitate their quantity and quality of the donated goods. There is also a discussion of the different actors that collect donated items. The topic covers the receiving and preparation stages of textile waste, including challenges from mixed, heterogeneous materials and unstructured collection systems. It also addresses key processes such as contaminant removal and material handling, alongside action plans on separate collection, governance, and traceability.
Topic 2: Sorting techniques	The topic focuses on various techniques and technologies used for sorting textile material. It briefly talks about the principles behind those sorting technologies and what kind of sorting (fibre, colour, etc.) they can achieve.
Topic 3: Quality control and bottlenecks	Identification of potential quality checkpoints during recycling of textiles to ensure continuous improvement and process control. Discuss common bottlenecks in preparation and sorting and how to adjust them through proposed solutions.
Interactive Activity	Case study title: Bottlenecks in large scale sorting. Case company: NewRetex – an automated textile sorting company with traceability system.
3	Micro-credential specification

4. MODULE 1 — RECYCLING TECHNOLOGY

1	LESSON IDENTIFICATION
Lesson Title	Design a basic workflow for receiving, preparing, and sorting textile waste
General Description of the Short Course	The session equips participants to design or improve workflows for the critical pre-recycling stages: intake of textile waste, preparation (cleaning, removing non-textile components), and sorting by material type and quality. Effective workflows at these stages are essential for successful recycling operations.
Skills	Skill label: Design workflows for textile waste preparation and sorting Skills description: Establish intake and preparation procedures, apply sorting principles based on material characteristics and end-use requirements
Knowledge	Knowledge label: Properties of textile materials Knowledge description: The characteristics and properties of different textile and fabric materials. These include strength, flexibility, elasticity, softness, durability, heat insulation, low weight, water absorbency/repellence, dyeability and resistance to chemicals. Moreover, the influence of chemical composition and molecular arrangement of yarn and fibre properties and fabric structure on the physical properties of textile fabrics; the different fibre types; the materials used in different processes and the effect on materials as they are processed
Keywords	Textile waste stream, contamination removal, pre- and postconsumer waste, composition identification, cleaning, sorting principles, sorting mechanisms, Process bottlenecks, quality control, traceability, economic feasibility

M1-L3 · RECYCLING TECHNOLOGY · SESSION 3 OF 4

1	LESSON IDENTIFICATION
Module	M1 — Recycling Technology
Lesson Title	Selecting the right textile recycling technology
Learning Outcome	This lesson enables participants to evaluate the suitability of textile recycling technologies for different textile materials. Participants will be able to explain the role of circularity in reshaping the TCLF industry, compare textile recycling pathways, assess recycled fibre quality for spinning applications, and select appropriate recycling and spinning routes according to target end-use requirements.
Session	Session 3 of 4

4. MODULE 1 — RECYCLING TECHNOLOGY

1	LESSON IDENTIFICATION
Lesson Developer	TUL (Czech Republic)
Lesson Validator	Techtera (France)
2	Lesson content
Topic 1: Global Textile Landscapes and Recycling Dynamics	This part introduces the key forces reshaping the textile industry toward circularity. You will explore major policy drivers and understand how they influence global production and recycling systems. The session highlights the scale of global fibre production while clearly identifying the critical barriers that must be overcome to move from basic collection to efficient fibre-to-fibre recycling.
Topic 2: Technological Pathways: Transforming Recycled Fibers into Yarn	This part focuses on the technical realities of processing recycled materials. You will gain insight into the challenges caused by reused cotton fibre variability, including high levels of short fibres and impurities. The session presents practical industrial strategies and advanced tools that enable process optimization and support the production of yarns with quality comparable to those made from virgin fibres.
Topic 3: From Yarn to Fabric: Processability, Structural Stability, and Quality	This topic includes a description of basic key operations and their critical parts in knitting and weaving technology when the input material is from recycled and waste materials.
Interactive Activity	Practical Part I: Fibres (Fiber Quality vs. Spinnability) This part focuses on the critical assessment of raw material and its suitability for spinning. Practical Part II: Yarn (Yarn Quality vs. Performance) The second part addresses the evaluation of the final yarn and the influence of process settings on its properties.
3	Micro-credential specification
Lesson Title	Selecting the right textile recycling technology
General Description of the Short Course	This course provides a concise and practice-oriented overview of transforming textile waste into high-value products within a circular economy. Participants will explore global textile systems and key drivers of change, including policy developments and market trends. The course focuses on fibre-to-yarn recycling technologies, highlighting challenges related to recycled fibre variability and industrial solutions for process optimisation. It concludes with fabric-level considerations, demonstrating how material properties influence processability and end-use performance. Combining theory with real industrial practice, the course equips participants to evaluate recycling

4. MODULE 1 — RECYCLING TECHNOLOGY

1	LESSON IDENTIFICATION
	pathways and select suitable technologies for sustainable textile production.
Skills	Skill label: Evaluate textile materials and select appropriate recycling and spinning technologies Skills description: Assess the suitability of textile materials for recycling and spinning processes, evaluate material quality and process requirements, and select appropriate technologies according to intended product performance and end-use.
Knowledge	Knowledge label: Spinning technologies; Yarn manufacturing processes; Characteristics of fibres Knowledge description: Understand the characteristics of textile fibres and the principles of recycling and spinning technologies, including how material properties influence processability, yarn quality, and final product performance.
Keywords	Mechanical fibre recycling, chemical fibre recycling, fibre regeneration processes, textile waste valorisation, processing of staple fibre by spinning technology (ring, rotor, ...), yarn quality assessment, impact of fibre quality on final product, knitting and weaving performance, processing stability, apparel textiles, home textiles, technical textiles, sustainability–performance trade-off

M1-L4 · RECYCLING TECHNOLOGY · SESSION 4 OF 4

1	LESSON IDENTIFICATION
Module	M1 — Recycling Technology
Lesson Title	Coordination on textile recycling chain
Learning Outcome	This lesson enables participants to identify coordination challenges across textile recycling value chains and evaluate practical solutions to improve collaboration among collectors, sorters, recyclers, and brands. Participants will be able to analyse information flows, material constraints, and operational interfaces, and propose integrated approaches to improve efficiency and coordination across the recycling chain.
Session	Session 4 of 4
Lesson Developer	UPC (Spain)
Lesson Validator	Tèxtils.CAT (Spain)

4. MODULE 1 — RECYCLING TECHNOLOGY

1	LESSON IDENTIFICATION
2	Lesson content
Topic 1: Introduction to the recycling chain	The typical recycling chain is overviewed and explained to introduce the participants to the complexity of the textile recycling system and to the multiple actors involved in the process.
Topic 2: Coordination issues	The topic identifies the main issues typically found in the recycling chain: material quality and volume fluctuations, information gaps, and logistics restrictions.
Topic 3: Proposed solutions	The topic sets the key in the interfaces of exchange (goods or information) and proposes integrated solutions that span the entire recycling value chain to ensure a more coordinated and effective system.
Interactive Activity	The interactive session is a role playing in which each participant will have to act as one of the actors of the textile recycling chain to reach an agreement to the problem set as the context. The output of the task is the agreement itself, which will be presented.
3	Micro-credential specification
Lesson Title	Coordination on textile recycling chain
General Description of the Short Course	This course examines the critical coordination misalignments within the textile recycling chain, specifically addressing systemic challenges such as material quality and volume fluctuations, information gaps, and logistics restrictions. The lesson aims to identify these inefficiencies and propose integrated solutions that span the entire recycling value chain to ensure a more coordinated and effective system.
Skills	Skill label: Coordinate waste management procedures Skills description: Coordinate the operations of a facility, organisation or a complex system with different actors which deal with the management of waste, such as waste collection, sorting, recycling, and disposal, excluding waste incineration, to ensure optimal efficiency of operations, improve methods for waste reduction, and ensure compliance with legislation.
Knowledge	Knowledge label: Business management principles Knowledge description: Principles governing business management methods such as strategy planning, methods of efficient production, people and resources coordination. Knowledge label: Supply chain management

4. MODULE 1 — RECYCLING TECHNOLOGY

1

LESSON IDENTIFICATION

Knowledge description: The flow of goods in the supply chain, movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption.

Keywords

Textile recycling chain, material quality, volume fluctuation, information gaps, logistics, traceability, quality assessment, eco-design

5. Module 2 — Eco-design for the Circular Economy

Module 2 focuses on the design decisions that determine the circularity of a textile product. The four lessons equip participants to interpret and apply eco-design regulations, use life cycle Assessment (LCA) results to make material and process choices, plan traceability data collection across the value chain, and apply end-of-life thinking to concrete product decisions.

LESSONS AT A GLANCE

L	LESSON	LESSON DEVELOPER
L1	From eco-design regulations to textile design specifications	Universitat Politècnica de Catalunya (UPC)
L2	Use LCA to select textile materials & processes	Technological Centre for Textile and Clothing of Portugal (CITEVE)
L3	Traceability across textile value chain	University of Ljubljana (UL)
L4	Design for textile circularity	University of Minho (UMinho)

M2-L1 · ECO-DESIGN FOR THE CIRCULAR ECONOMY · SESSION 1 OF 4

1	LESSON IDENTIFICATION
Module	M2 — Eco-design for the Circular Economy
Lesson Title	From eco-design regulations to textile design specifications
Learning Outcome	This lesson enables participants to navigate the evolving regulatory landscape for eco-design (particularly the EU's Ecodesign for Sustainable Products Regulation - ESPR and Digital Product Passport requirements) and translate legal obligations into actionable design specifications.
Session	Session 1 of 4
Lesson Developer	UPC (Spain)
Lesson Validator	ETP (Belgium)
2	Lesson content

5. MODULE 2 — ECO-DESIGN FOR THE CIRCULAR ECONOMY

1	LESSON IDENTIFICATION
Topic 1: Eco-design and main eco-design-related regulations	The topic introduces eco-design concept and revises briefly the main regulations related to the eco-design of textile products. Ecodesign for Sustainable Products Regulation (ESPR), and its differences with the previous 2009/125/EC Ecodesign Directive, and its product aspects will be also introduced.
Topic 2: Current situation of the eco-design specifications	The topic defines delegated acts and the current state of these delegated acts related to the ESPR for textiles. It will connect this with the Digital Product Passport (DPP).
Topic 3: Translating regulations into design specifications	The topic is focused on how to translate legal obligations into actionable design specifications.
Interactive Activity	The interactive session is a case study in which participants will work in groups around a textile product. The problem solving will consist of the discussion and definition of design specifications for the assigned product. The output of the task is the list of requirements and its justification, since it will be presented.
3	Micro-credential specification
Lesson Title	From eco-design regulations to textile design specifications
General Description of the Short Course	This course examines the evolving regulatory framework for eco-design, and specifically the EU's Ecodesign for Sustainable Products Regulation (ESPR) requirements. The lesson focuses on how to translate these legal obligations into actionable design specifications, ensuring that sustainability standards are effectively integrated into the textile product development process.
Skills	Skill label: Apply eco-design specifications for textile products Skills description: Apply EU eco-design regulations by translating legal mandates and requirements into technical specifications during the textile product development process to ensure compliance and circularity.
Knowledge	Knowledge label: Textile sustainability regulations Knowledge description: Textile regulations to design, manufacture, evaluate relevant textile properties, and recycle textile products. Include the ban of substances during the manufacturing processes.
Keywords	Eco-design / Design Specifications / Regulation / ESPR (Ecodesign for Sustainable Products Regulation) / Digital Product Passport (DPP) / Durability / Repairability / Recyclability
M2-L2 · ECO-DESIGN FOR THE CIRCULAR ECONOMY · SESSION 2 OF 4	

5. MODULE 2 — ECO-DESIGN FOR THE CIRCULAR ECONOMY

1 LESSON IDENTIFICATION	
Module	M2 — Eco-design for the Circular Economy
Lesson Title	Use LCA to select textile materials & processes
Learning Outcome	This lesson enables participants to understand the concept and applications of Life Cycle Assessment (LCA), identify the stages of a textile product's life cycle, evaluate environmental impacts across each stage, develop and analyse life cycle inventories, and use these insights to support more informed and sustainable environmental decision-making.
Session	Session 2 of 4
Lesson Developer	CITEVE (Portugal)
Lesson Validator	STA (Slovenia)
2 Lesson content	
Topic 1: LCA – concept, applications and methodology	Present the concept and methodology of LCA, as well as its main advantages and limitations. Participants will understand how to benefit from the use of this methodology.
Topic 2: LCI – the life cycle of textile products	The participants will understand the main environmental aspects of a textile product life cycle and how to build a proper Life Cycle Inventory.
Topic 3: LCIA and Environmental impact categories	The participants will get in touch with the environmental impact categories and methods to calculate them. Examples of impact categories values for different textile products will be presented.
Interactive Activity	Practical exercise to determine carbon footprint of two materials and choose between them based on their impact. Exercise to be solved individually, with facilitator supervisor and orientation. A Google forms will be used to collect answers.
3 Micro-credential specification	
Lesson Title	Use LCA to select textile materials & processes
General Description of the Short Course	This course aims to familiarize participants with the understanding and practical application of Life Cycle Assessment (LCA) methodology within the context of the circular economy, particularly in the textile sector. It provides a comprehensive

5. MODULE 2 — ECO-DESIGN FOR THE CIRCULAR ECONOMY

Lesson Title	Use LCA to select textile materials & processes
	overview of the different stages of a product's life cycle, from raw material extraction to end-of-life, highlighting the associated environmental impacts at each phase. In addition, the course focuses on developing the ability to interpret LCA results and use them as a decision-making tool. Learners will be equipped to identify critical environmental hotspots and evaluate alternative materials and processes, enabling them to make more informed and sustainable choices in product design and development.
Skills	Skill label: Assess environmental impact Skills description: Identify environmental impacts in order to reduce the organisation's environmental risks while taking costs into account. Skill label: Assess the life cycle of resources Skills description: Evaluate the use and possible recycling of raw materials in the whole product life cycle. Consider applicable regulations, such as the European Commission's Circular Economy Policy Package.
Knowledge	Knowledge label: Product life cycle Knowledge description: The management of the life cycle of a product from the development stages to the market entry and market removal. Knowledge label: Systems development life cycle Knowledge Description: The sequence of steps, such as planning, creating, testing and deploying and the models for the development and life-cycle management of a system.
Keywords	Life Cycle / Environmental aspects / Life cycle assessment / Life Cycle Inventory / Environmental impact category

M2-L3 · ECO-DESIGN FOR THE CIRCULAR ECONOMY · SESSION 3 OF 4

1	LESSON IDENTIFICATION
Module	M2 — Eco-design for the Circular Economy
Lesson Title	Traceability across textile value chain

5. MODULE 2 — ECO-DESIGN FOR THE CIRCULAR ECONOMY

1	LESSON IDENTIFICATION
Learning Outcome	This lesson enables participants to apply traceability principles in textile eco-design, including tracking materials and processes across the product life cycle. Participants will be able to identify and track relevant materials and processes, interpret sustainability standards and certification requirements, and use traceability information to promote environmental responsibility and transparency.
Session	Session 3 of 4
Lesson Developer	UL (Slovenia)
Lesson Validator	MAVI (Türkiye)
2	Lesson content
Topic 1: Traceability as the foundation of sustainable textile design	This topic introduces traceability as a fundamental concept in sustainable textile design. It explains how traceability goes beyond compliance, enabling transparency, accountability, and evidence-based decision-making across the supply chain. Participants will understand how traceability transforms sustainability from a claim into a verifiable design practice.
Topic 2: Tools, standards and digital systems for traceability	Building on the concept of traceability, this topic focuses on how it is implemented in practice. We look at the tools, standards, and digital systems that make it possible to collect, manage, and share supply chain data. The aim is to understand traceability as an operational system that enables transparency and circularity.
Topic 3: Traceability as a design and trust-building tool	This topic explores how traceability supports sustainable and responsible decision-making in textile design. As products are increasingly evaluated based on their environmental and social impact—particularly within evolving EU regulations—traceability is becoming a key enabler of transparency and accountability. It allows companies to track materials, processes, and decisions across the entire product life cycle.
Interactive Activity	The case study explores real-world challenges of traceability in global textile supply chain. Participants work in groups to analyse different sourcing scenarios, evaluate risks, and make evidence-based decisions using a combination of certification, audits, and scientific methods. The case highlights the complexity of achieving credible traceability and the need for informed decision-making under uncertainty.
3	Micro-credential specification
Lesson Title	Traceability across textile value chain
General Description of the Short Course	This course introduces traceability in the textile value chain as a key element of eco-design and the circular economy. Participants will learn how traceability enables transparency, supports sustainability and compliance, and informs decision-making in real-world textile systems. The course

5. MODULE 2 — ECO-DESIGN FOR THE CIRCULAR ECONOMY

1	LESSON IDENTIFICATION
	combines expert lectures with an interactive case study, allowing participants to apply concepts in practice.
Skills	Skill label: Identify key processes of traceability systems Skills description: Identify the different key processes, documentation and regulations for the implementation and follow-up of traceability in the company.
Knowledge	Knowledge label: Supply chain management Knowledge description: The flow of goods in the supply chain, movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption.
Keywords	Supply chain traceability and transparency / Material tracking concepts / Certifications and standards / Ethical practices / Design decision-making / Responsible sourcing / Data sharing practices

M2-L4 · ECO-DESIGN FOR THE CIRCULAR ECONOMY · SESSION 4 OF 4

1	LESSON IDENTIFICATION
Module	M2 — Eco-design for the Circular Economy
Lesson Title	Design for textile circularity
Learning Outcome	This learning outcome enables participants to integrate end-of-life considerations into textile product design to enhance circularity. Participants will be able to identify barriers to reuse and recycling, evaluate industrial trade-offs related to material performance, and propose design solutions that improve repairability, disassembly, and recyclability.
Session	Session 4 of 4
Lesson Developer	UMinho (Portugal)
Lesson Validator	STA (Slovenia)
2	Lesson content
Topic 1: End-of-life thinking in textile product design	The topic will focus on change from linear to circular textile design, end-of-life thinking, end-of-life options (reuse, repair, refurbish, remanufacture, recycle), how design affects these options.

5. MODULE 2 — ECO-DESIGN FOR THE CIRCULAR ECONOMY

1	LESSON IDENTIFICATION
Topic 2: Design features that enable textile circularity	The topic will focus on material selection for circularity, mono vs multi-material, design for durability, repair and reuse, design for disassembly and recycling.
Topic 3: Design barriers and industrial decision-making	The topic will focus on the common barriers, both for reuse and recycling, such as fibre blends, coatings, elastane presence, etc. It will also focus on trade-offs between aesthetics/performance and design for circularity.
Interactive Activity	The interactive activity will be based on a case study of a firefighter jacket. The participants will be divided into 4 groups (3-5). They will receive a simplified product sheet describing the jacket's main layers, components, functions, and typical materials. Each group will identify the main circularity barriers, select appropriate end-of-life strategies, and propose circular redesign solutions to improve repairability, disassembly, and recyclability without compromising certified safety performance. The groups will perform a pitch of 1 min followed by discussion.
3	Micro-credential specification
Lesson Title	Design for textile circularity
General Description of the Short Course	The short course aims at familiarizing participants with the principles of design for textile circularity, focusing on how end-of-life considerations can be integrated into the product design. Participants will understand how design decisions influence the potential for reuse, repair, refurbishment, remanufacturing and recycling, the features may enable the circularity and the barriers that can affect industrial trade-offs.
Skills	Skill label: Design for textile circularity Skills description: Apply end-of-life thinking during the textile product design.
Knowledge	Knowledge label: End-of-life strategies for textile products Knowledge Description: Strategies and options for extending product durability for repair and reuse Knowledge label: Circular textile design principles Knowledge description: Design approaches that enable textile circularity, including disassembly and recycling
Keywords	Circular design / End-of-life thinking / Design for disassembly / Eco-design / Repairability / Recyclability / Mono-materials / Durability / Recycling barriers / Standardization

6. Module 3 — Sustainable Manufacturing

Module 3 addresses sustainability at the production stage. The four lessons allow participants to identify and interpret the regulatory requirements affecting textile production, define and monitor efficiency KPIs across water, energy, waste, and carbon, identify waste generation points and develop a reduction action plan, and prepare for reporting and Digital Product Passport data obligations.

LESSONS AT A GLANCE

L	LESSONS	LESSON DEVELOPER
L1	EU requirements for sustainable textile production	Ege University (EGE)
L2	KPIs definition and tracking in textile manufacturing	Polo Universitario Città di Prato (PIN)
L3	Waste reduction in textile manufacturing	Ege University (EGE)
L4	DPP application in the textile and apparel industry	Hogeschool Gent (HOGENT)

M3-L1 · SUSTAINABLE MANUFACTURING · SESSION 1 OF 4

1	LESSON IDENTIFICATION
Module	M3 — Sustainable Manufacturing
Lesson Title	EU requirements for sustainable textile production
Learning Outcome	This lesson enables participants to identify and apply relevant EU regulatory frameworks and compliance requirements in textile production facilities. Participants will be able to determine the applicable EU directives (IED, REACH, and BAT) for specific textile operations, assess compliance gaps across production stages, and develop prioritised corrective action plans to support alignment with EU sustainability regulations.
Session	Session 1 of 4
Lesson Developer	EGE (Türkiye)
Lesson Validator	DENİZLİ ABİGEM (Türkiye)
2	Lesson content
Topic 1: EU Regulatory Frameworks for Textile Manufacturing (IED, REACH, BAT)	Overview of key EU directives relevant to textile production, including the Industrial Emissions Directive (IED), REACH regulation, and Best

6. MODULE 3 — SUSTAINABLE MANUFACTURING

1	LESSON IDENTIFICATION	
		Available Techniques (BAT) reference documents. Understanding how these frameworks define compliance obligations for production facilities.
Topic 2: Compliance Requirements in Textile Production		Identifying specific legal obligations related to wastewater discharge permits, air pollutant emission thresholds, hazardous substance restrictions, and occupational health standards for textile workers.
Topic 3: Compliance Procedures and Environmental Management		Developing compliance procedures including environmental management systems (ISO 14001), production facility licensing, regulatory inspection protocols, and environmental performance reporting.
Interactive Activity		Case study: EcoTex Europe — Regulatory Readiness Assessment. Participants work in groups to identify applicable EU regulations for a fictional textile company and propose a corrective action plan with priorities and timelines. Uses Teams Chat for group comparison. Also serves as the skills assessment component, evaluated against a rubric.
3	Micro-credential specification	
Lesson Title		EU requirements for sustainable textile production
General Description of the Short Course		This session provides participants with an understanding of the EU regulatory landscape applicable to sustainable textile production, equipping them with the knowledge to identify compliance gaps in real textile operations. The session covers the main EU directives (IED, REACH and BAT reference documents), the specific compliance requirements they impose on textile facilities and the management systems and procedures that ensure ongoing compliance. The session combines a lecture component with a practical case study (EcoTex Europe — Regulatory Readiness Assessment), in which participants develop a structured corrective action plan.
Skills		Skill label: Analyse EU regulatory compliance gaps in textile production and develop corrective action plans. Skill description: Identify the EU directives applicable to a given textile operation, assess compliance gaps across production stages (wastewater discharge, emissions, hazardous substances, occupational health), and develop prioritised, feasible corrective action plans with realistic timelines and verification criteria.
Knowledge		Knowledge label: EU regulatory frameworks for sustainable textile manufacturing. Knowledge description: Key EU directives applicable to textile production (Industrial Emissions Directive, REACH, BAT reference documents); specific compliance requirements (wastewater discharge permits, air pollutant emission thresholds, hazardous substance

6. MODULE 3 — SUSTAINABLE MANUFACTURING

1	LESSON IDENTIFICATION
	restrictions, occupational health standards); compliance procedures and environmental management systems (ISO 14001, facility licensing, regulatory inspection protocols, environmental performance reporting).
Keywords	EU regulations / Industrial Emissions Directive (IED) / REACH / Best Available Techniques (BAT) / Textile compliance / Wastewater discharge permits / Environmental management systems (ISO 14001) / Regulatory readiness / Sustainable textile manufacturing

M3-L2 · SUSTAINABLE MANUFACTURING · SESSION 2 OF 4

1	LESSON IDENTIFICATION
Module	M3 — Sustainable Manufacturing
Lesson Title	KPIs definition and tracking in textile manufacturing
Learning Outcome	This lesson enables participants to measure and improve textile production efficiency through the definition, monitoring, and interpretation of key performance indicators (KPIs). Participants will be able to identify relevant performance metrics related to energy, water, time, and material use, apply data collection methods, and use KPI results to support continuous improvement and operational decision-making.
Session	Session 2 of 4
Lesson Developer	PIN (Italy)
Lesson Validator	NTT (Italy)
2	Lesson content
Topic 1: Textile production efficiency: managing energy, water, time, and materials	Textile production efficiency relies on a synchronized approach to optimizing critical resources: energy, water, time, and materials. By streamlining high-impact processes like dyeing to reduce utility consumption and implementing lean workflows to minimize material waste and downtime, manufacturers can lower their environmental impact.
Topic 2: Data Collection methods and measurement	Data collection methods and measurement establish the framework for gathering and quantifying accurate, reliable information across research and operational workflows. By leveraging diverse tools—from automated sensors to structured surveys—this process captures raw variables and translates them into standardized, high-quality metrics. Ultimately, a rigorous

1 LESSON IDENTIFICATION

approach ensures data integrity, transforming raw information into a trustworthy foundation for analysis and decision-making.

Topic 3: KPIs and improvement

KPIs and improvement focus on establishing critical benchmarks to evaluate operational performance and drive continuous optimization. By analysing KPIs derived from collected data, organizations can pinpoint hidden inefficiencies and track the success of targeted upgrades. Ultimately, this final phase transforms raw metrics into actionable strategies, ensuring sustained growth and long-term operational excellence.

Interactive Activity

The session will open with the presentation of a case study (based on specific scenarios). Participants will then work in two separate groups. They will focus on optimizing the impacts of energy, water, time, and materials. They will apply the course concepts to diagnose resource waste, select appropriate data collection methods, and define targeted KPIs for improvement. Finally, the groups will present their optimization plans, simulating a real management alignment meeting.

3 Micro-credential specification

Lesson Title

KPIs definition and tracking in textile manufacturing

General Description of the Short Course

The purpose of this session is to understand the main KPIs for measuring production efficiency and the data collection methods. The factors considered will be water and energy consumption, material yield, production time, and downtime. Starting from measurement, methods for measuring improvement targets will be analysed.

Skills

Skill label: Set production KPI

Skill Description: Set and achieve KPIs in line with company strategy and ensure customer requirements are met.

Skill label: Advise on efficiency improvements

Skills description: Analyse information and details of processes and products in order to advise on possible efficiency improvements that could be implemented and would signify a better use of resources

Knowledge

Knowledge label: Resource-efficient technologies

Knowledge description: Sustainable technologies which allow to produce more value using limited resources while reducing the impact on the environment, restraining the risks of scarcity.

6. MODULE 3 — SUSTAINABLE MANUFACTURING

Lesson Title	KPIs definition and tracking in textile manufacturing
	Knowledge label: Challenging issues in the textile industry Knowledge description: The efficiency aims and environmental issues posed by challenges in the textile industry.
Keywords	Carbon management / Environmental Impact / Environmental Goals/ Tracking system / AI and automation / Water and energy management/ Setting KPIs / Improvement strategies

M3-L3 · SUSTAINABLE MANUFACTURING · SESSION 3 OF 4

1	LESSON IDENTIFICATION
Module	M3 — Sustainable Manufacturing
Lesson Title	Waste reduction in textile manufacturing
Learning Outcome	This lesson enables participants to identify waste generation points in textile manufacturing processes and develop practical waste reduction action plans. Participants will be able to classify textile waste types, analyse root causes of waste generation, quantify waste using standard indicators, and design structured and prioritised measures to improve resource efficiency and reduce waste.
Session	Session 3 of 4
Lesson Developer	EGE (Türkiye)
Lesson Validator	CLUTEX (Czech Republic)
2	Lesson content
Topic 1: Mapping textile waste — generation points and waste types	Systematic identification of waste generation points across the main textile production stages (spinning, weaving/knitting, dyeing, finishing, garmenting) and classification of textile waste types including material losses, chemical effluents, water, energy, and resource losses.
Topic 2: Root cause analysis and waste quantification	Methods to analyse the root causes of waste generation (process inefficiencies, quality deviations, planning issues) and to quantify waste using indicators such as material yield, percentage waste, and cost-impact analysis. Provides the analytical tools for evidence-based decision-making.
	Techniques for waste minimisation and resource efficiency improvement in textile operations, followed by a structured methodology for developing a

6. MODULE 3 — SUSTAINABLE MANUFACTURING

1	LESSON IDENTIFICATION
Topic 3: Waste minimization strategies and action plan development	practical, prioritised waste reduction action plan with defined targets, owners, and timelines.
Interactive Activity	Case study and practical exercise: participants analyse a textile production scenario, identify key waste generation points and root causes, and develop a feasible waste reduction action plan with priorities and timelines. Group discussion in Teams breakout rooms supports peer comparison.
3	Micro-credential specification
Lesson Title	Waste reduction in textile manufacturing
General Description of the Short Course	This session enables participants to systematically identify waste generation points across textile manufacturing processes (spinning, weaving/knitting, dyeing, finishing, garmenting) and to develop structured, data-driven waste reduction action plans. It combines analytical methods (waste classification, root cause analysis, waste quantification) with practical tools for resource efficiency improvement, equipping participants to translate findings into prioritised, feasible interventions in their own textile operations.
Skills	Skill label: Analyse textile manufacturing processes to identify waste generation points and develop resource efficiency improvement strategies. Skill description: Apply waste mapping, root cause analysis, and waste quantification methods to evaluate textile production inefficiencies and design feasible waste reduction action plans.
Knowledge	Knowledge label: Waste generation and resource efficiency in textile manufacturing. Knowledge description: Sources and types of waste across textile production stages (material, chemical, water, energy, process losses); waste classification frameworks; root cause analysis techniques; waste quantification indicators (material yield, percentage waste, cost-impact analysis); waste minimisation and resource efficiency techniques applicable in textile operations.
Keywords	Textile waste / Waste generation points / Waste classification / Root cause analysis / Waste quantification / Resource efficiency / Waste reduction action plan / Lean manufacturing in textiles
M3-L4 · SUSTAINABLE MANUFACTURING · SESSION 4 OF 4	

6. MODULE 3 — SUSTAINABLE MANUFACTURING

1	LESSON IDENTIFICATION
Module	M3 — Sustainable Manufacturing
Lesson Title	Digital Product Passport (DPP) application in the textile and apparel industry
Learning Outcome	This lesson enables participants to identify and apply Digital Product Passport (DPP) data requirements in textile and apparel operations. Participants will be able to determine relevant product and process data, recognise stakeholder responsibilities across the value chain, and define practical actions for data collection and organisational readiness to support DPP implementation and compliance.
Session	Session 4 of 4
Lesson Developer	HOGENT (Belgium)
Lesson Validator	IVGT (Germany)
2	Lesson content
Topic 1: Digital Product Passport (DPP) implementation in textile and apparel sector: opportunities and challenges	The topic focuses on the requirements and opportunities that DPP brings.
Topic 2: DPP stakeholders, data points and requirements across the product life	The key stakeholders involved in the Digital Product Passport (DPP) for textile apparel will be introduced, along with the product data they contribute and how this information enables and promotes circularity throughout the product life cycle .
Topic 3: Digital Infrastructure & Technologies for data collection and management	Participants will learn about Digital Infrastructure & Technologies for DPP data collection and management.
Interactive Activity	The session will feature a successful Digital Product Passport (DPP) case study for mattresses, covering infrastructure and data management aspects, followed by an interactive workshop on data collection points and product traceability.
3	Micro-credential specification
Lesson Title	DPP application in the Textile and Apparel industry
General Description of the Short Course	This course introduces the principles and data requirements of Digital Product Passports (DPP) within the textile and apparel sector. Participants will gain insight into upcoming EU DPP

6. MODULE 3 — SUSTAINABLE MANUFACTURING

1

LESSON IDENTIFICATION

regulations, key stakeholders across the textile value chain, and the data needed to support compliance, traceability, and transparency throughout the product life cycle.

The course also provides practical guidance on identifying relevant product and process data, understanding digital infrastructures and technologies for data management, and defining realistic first steps for data collection and implementation within small and medium-sized manufacturing environments.

Skills

Skill label: Align organisational processes with Digital Product Passport data requirements for textile/apparel

Skills description: Identify DPP data requirements and translate them into organisational process adjustments to support compliance with DPP regulations.

Knowledge

Knowledge label: Digital Product Passport (DPP) requirements in Textiles

Knowledge description: Understanding the data requirements for Digital Product Passport (DPP) in the textile/apparel sector and the opportunities it creates.

Keywords

Digital Product Passport (DPP), ESPR, Circularity, Product data, Regulatory compliance, traceability, transparency.

7. Annexes

Annex A — Templates

Each lesson developer partner completes a common set of templates designed for the S4C reactive training. Together they ensure that every lesson follows the same structure, assessment logic and visual identity across the three modules. The six templates are reproduced below in the order in which a partner uses them when preparing a lesson.

A.1 Reactive Training Agenda

Sets out the run-sheet of a three-hour live session — segments, timing, presenter and a short description of each topic and activity.

[Mx Lx] — [Lesson title]

Session segment	Time	Presenter	Description
Welcome and Introductions	5 min	[Name]	Welcome participants and speaker introductions
Session Overview	5 min	[Name]	Overview of webinar objectives and structure
Topic 1: [Title of the topic]	15 min	[Name]	<i>[Provide 2–3 sentences introducing the topic]</i>
Q&A	5 min		Open discussion and questions
Topic 2: [Title of the topic]	15 min	[Name]	<i>[Provide 2–3 sentences introducing the topic]</i>
Q&A	5 min		Open discussion and questions
Topic 3: [Title of the topic]	15 min	[Name]	<i>[Provide 2–3 sentences introducing the topic]</i>
Q&A	5 min		Open discussion and questions
Break	10 min		
Interactive Session	60 min	[Name]	<i>[Provide a 2–3 sentence description of the interactive activity]</i>
Q&A	5 min		Open discussion and questions
Break	5 min		

ANNEX A — TEMPLATES

Assessment Quiz	15 min	[Name]	Participants complete an assessment of five multiple-choice questions on the session content; at least four of five correct answers are required to pass.
Post-Training Survey	10 min	[Name]	Participants complete the feedback survey
Wrap-Up & Next Steps	5 min	[Name]	Summary of key points and information

A.2 Micro-credential Description

Defines the micro-credential awarded for the lesson, following Council Recommendation 2022/C 243/02.

Lesson title

General description of the short course

Identification of the learner

Learning outcomes

Topics

Skills

Skill label:

Skill description:

Knowledge

Knowledge label:

Knowledge description:

Keywords

Notional workload

Type of assessment

Knowledge assessment:

Skills assessment:

Assessment criteria

Knowledge:

Skills:

Pass threshold

Form of participation (learning approach)

Estimated EQF level

Country / region of the issuer

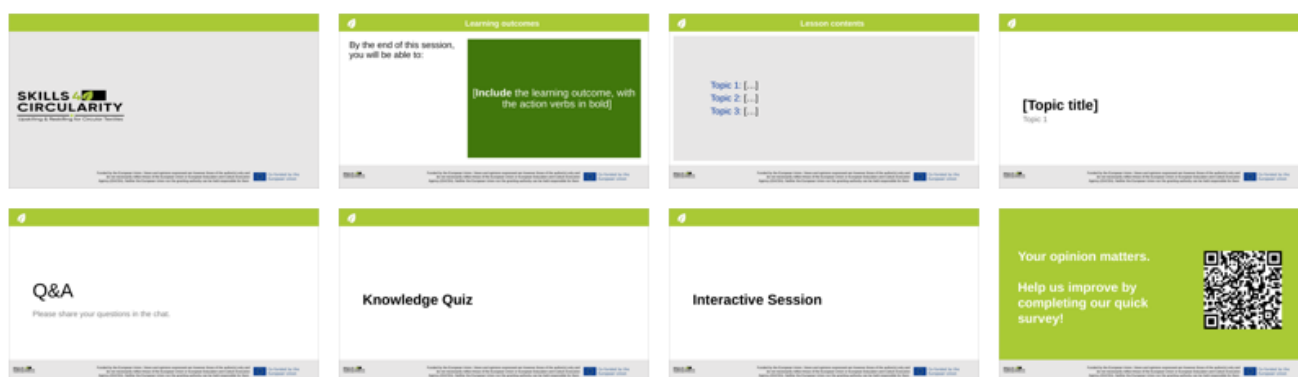
ANNEX A — TEMPLATES

Awarding body

Quality assurance

A.3 Lesson Slide Deck

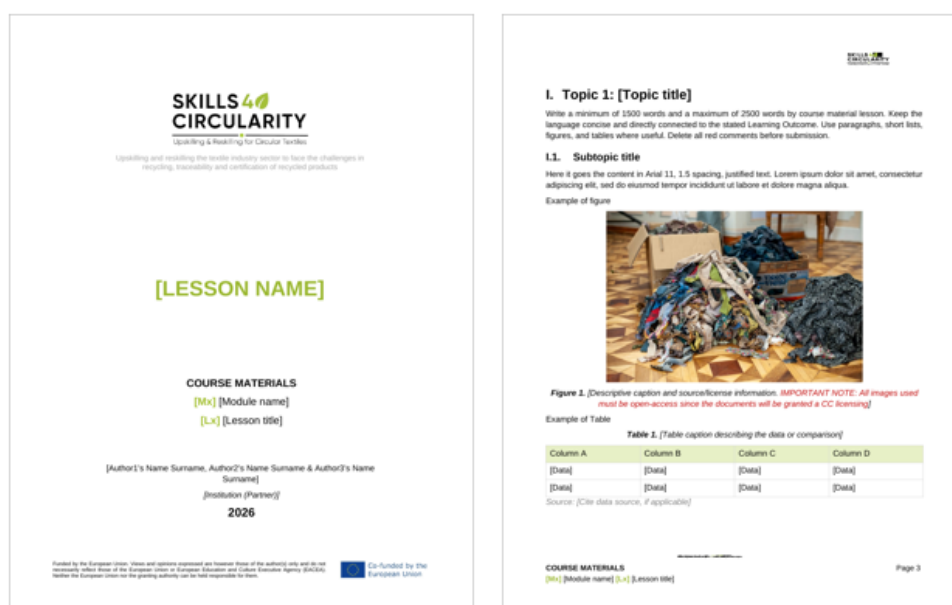
A branded PowerPoint deck used to deliver the live session. It provides ready-made layouts for the title, learning outcomes, lesson contents, each topic, Q&A, the knowledge quiz, the interactive session and the closing survey, keeping a consistent visual identity across all lessons.



Representative slides from the lesson slide-deck template.

A.4 Course Materials

A written document presenting the self-study content of the lesson (1,500–2,500 words), organised by topic and sub-topic, with figures, tables, “want to learn more” resource boxes and APA references. All images must be open-access to allow CC licensing.



Course-materials template: cover page and a sample content page.

A.5 Knowledge and Skills Assessment

ANNEX A — TEMPLATES

Defines the two assessment components of the lesson: a knowledge quiz of five multiple-choice questions (three options, one correct answer) and a skills assessment delivered live during the interactive session, each scored out of 10.

Question 1 (Questions 2–5 follow the same structure)

Question stem	<i>[Write the question. Be clear and specific. 1–2 sentences.]</i>
Option A	<i>[Plausible distractor or correct option]</i>
Option B	<i>[Plausible distractor or correct option]</i>
Option C	<i>[Plausible distractor or correct option]</i>
Correct answer	A, B or C

Knowledge rubric — one correct answer per question; each correct answer scores 2 points (maximum 10).

Skills assessment rubric (example)

Criterion	Description	Score
Participation	The trainee has actively participated in the activity	0–2
Context awareness	The trainee has understood the context proposed in the activity	0–2
Communication skills	The trainee has used technical concepts for communication	0–2
Critical thinking	The trainee has shown critical-analysis skills	0–2
Solution development	The trainee has presented a feasible solution to the problem	0–2
Total		0–10

Combined scoring — knowledge (0–10) + skills (0–10) = 20 maximum. Pass threshold: 11 points or higher.

A.6 Interactive Activity / Case Study Materials

Provides the brief for the live interactive session: context and background, a clearly stated problem, the available data and information, the task instructions and the expected output, with optional annexes for larger datasets.



Upskilling and Reskilling for Circular Textiles

Upskilling and reskilling the textile industry sector to face the challenges in recycling, traceability and certification of recycled products

[LESSON NAME]

[CASE STUDY/PRACTICAL EXERCISE] MATERIALS

[M-x] [Module name]
[L-x] [Lesson title]

[Author1's Name Surname, Author2's Name Surname & Author3's Name Surname]
[Institution (Partner)]
2026

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I. Context

I.1. Background

Provide the setting and background information. Describe the company/organisation, industry sector, geographical context, and any relevant history. Keep it concise but sufficient for participants to understand the situation. Approximately 150-250 words.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

I.2. Problem statement

Clearly state the problem or challenge that the participants will analyse. What decision needs to be made? What issue needs to be solved? Be specific and realistic. Approximately 100-150 words. Then, summarise the problem statement in the green box below for higher visibility.

Goal

Write the goal of the activity in 1-3 sentences. The idea is to remark the question/problem statement... e.g. Given the background provided, you need to **define the waste flow** (steps of the waste management chain) to ensure appropriate collection and recycling.

[CASE STUDY/PRACTICAL EXERCISE] MATERIALS
[M-x] [Module name] [L-x] [Lesson title]

Page 3

Interactive-activity template: cover page and a sample context page.

Annex B — Guidance for Describing Skills and Knowledge

This annex provides guidelines for describing skills and knowledge in a consistent, ESCO-compatible manner.

Learning Outcome

Learning outcomes are statements of what a learner knows, understands and is able to do on completion of a learning process, defined in terms of knowledge and skills. Education and training institutions are increasingly describing their qualifications in terms of learning outcomes following the approach adopted by the European Qualifications Framework (EQF).

Knowledge

Knowledge is the outcome of the assimilation of information through learning — the body of facts, principles, theories and practices related to a field of work or study. Descriptions of knowledge concepts explain in more depth the content of the concept.

Guidelines:

- Be concise.
- Use simple expressions.
- Aim for 50–300 characters.
- Do not simply restate the label.
- Avoid national references.
- Do not use underline, bold or images.

EXAMPLE — KNOWLEDGE

LABEL: GEOGRAPHIC INFORMATION SYSTEMS

DESCRIPTION: THE TOOLS INVOLVED IN GEOGRAPHICAL MAPPING AND POSITIONING, SUCH AS GPS, GIS, AND RS (REMOTE SENSING).

Skill

Skill means the ability to apply knowledge and use know-how to complete tasks and solve problems. Skills can be cognitive (involving logical, intuitive and creative thinking) or practical (involving manual dexterity and use of methods, materials, tools and instruments). Action verbs are used in skill descriptions to clarify the level of expertise expected. Terms like 'to recall', 'to describe', 'to diagnose' and 'to synthesise' indicate different levels of complexity. In ESCO, lists of action verbs maintained by Cedefop are used to ensure consistent and clear language.

ANNEX B — GUIDANCE FOR DESCRIBING SKILLS AND KNOWLEDGE

EXAMPLE — SKILL

LABEL: *ANALYSE HEALTH DAMAGING BEHAVIOURS*

DESCRIPTION: EXAMINE BEHAVIOURS THAT MAY BE DAMAGING TO AN INDIVIDUAL'S HEALTH, SUCH AS SMOKING, DRUG ABUSE, OR POOR DIET. USE PSYCHOLOGICAL THEORIES AND INTERVENTIONS FOR PRIMARY PREVENTION AND HEALTH RELATED BEHAVIOURAL CHANGE.

Annex C — Collection of skills and knowledge

This annex collects the skills and knowledge developed across the twelve lessons of the three masterclasses, as declared in each lesson's Micro-credential Description.

LESSON	SKILL LABEL	SKILL DESCRIPTION
Module 1 — Recycling Technology		
M1-L1 — EU legal requirements for textile recycling	Apply EU regulations regarding textile recycling	Identify specific demands of legislation and adapt activities to apply and comply with the legislation.
M1-L2 — Design a basic workflow for receiving, preparing, and sorting textile waste	Design workflows for textile waste preparation and sorting	Establish intake and preparation procedures, apply sorting principles based on material characteristics and end-use requirements.
M1-L3 — Selecting the right textile recycling technology	Evaluate textile materials and select appropriate recycling and spinning technologies	Assess the suitability of textile materials for recycling and spinning processes, evaluate material quality and process requirements, and select appropriate technologies according to intended product performance and end-use.
M1-L4 — Coordination on textile recycling chain	Coordinate waste management procedures	Coordinate the operations of a facility, organisation or a complex system with different actors which deal with the management of waste, such as waste collection, sorting, recycling, and disposal, excluding waste incineration, to ensure optimal efficiency of operations, improve methods for waste reduction, and ensure compliance with legislation.
Module 2 — Eco-Design for the Circular Economy		
M2-L1 — From eco-design regulations to textile design specifications	Apply eco-design specifications for textile products	Apply EU eco-design regulations by translating legal mandates and requirements into technical specifications during the textile product development process to ensure compliance and circularity.
M2-L2 — Use LCA to select textile materials & processes	Assess environmental impact Assess the life cycle of resources	Identify environmental impacts in order to reduce the organisation's environmental risks while taking costs into account.

ANNEX C — COLLECTION OF SKILLS AND KNOWLEDGE

LESSON	SKILL LABEL	SKILL DESCRIPTION
		Evaluate the use and possible recycling of raw materials in the whole product life cycle. Consider applicable regulations, such as the European Commission's Circular Economy Policy Package.
M2-L3 — Traceability across textile value chain	Identify key processes of traceability systems	Identify the different key processes, documentation and regulations for the implementation and follow-up of traceability in the company.
M2-L4 — Design for textile circularity	Design for textile circularity	Apply end-of-life thinking during the textile product design.
Module 3 — Sustainable Manufacturing		
M3-L1 — EU requirements for sustainable textile production	Analyse EU regulatory compliance gaps in textile production and develop corrective action plans.	Identify the EU directives applicable to a given textile operation, assess compliance gaps across production stages (wastewater discharge, emissions, hazardous substances, occupational health), and develop prioritised, feasible corrective action plans with realistic timelines and verification criteria.
M3-L2 — KPIs definition and tracking in textile manufacturing	Set production KPI Advise on efficiency improvements	Set and achieve KPIs in line with company strategy and ensure customer requirements are met. Analyse information and details of processes and products in order to advise on possible efficiency improvements that could be implemented and would signify a better use of resources
M3-L3 — Waste reduction in textile manufacturing	Analyse textile manufacturing processes to identify waste generation points and develop resource efficiency improvement strategies.	Apply waste mapping, root cause analysis, and waste quantification methods to evaluate textile production inefficiencies and design feasible waste reduction action plans.
M3-L4 — Digital Product Passport (DPP) application in the textile and apparel industry	Align organisational processes with Digital Product Passport data requirements for textile/apparel	Identify DPP data requirements and translate them into organisational process adjustments to support compliance with DPP regulations

ANNEX C — COLLECTION OF SKILLS AND KNOWLEDGE

LESSON	KNOWLEDGE LABEL	KNOWLEDGE DESCRIPTION
Module 1 — Recycling Technology		
M1-L1 — EU legal requirements for textile recycling	EU Regulations on textile recycling Waste management	Sustainability and circularity legislation, governing bodies and regulatory authorities responsible for decision-making and enforcement regulating textile recycling that textile companies must comply with. The methods, materials and regulations used to collect, transport, treat and dispose of waste. This includes recycling and monitoring of waste disposal. It excludes procedures related to waste incineration.
M1-L2 — Design a basic workflow for receiving, preparing, and sorting textile waste	Properties of textile materials	The characteristics and properties of different textile and fabric materials. These include strength, flexibility, elasticity, softness, durability, heat insulation, low weight, water absorbency/repellence, dyeability and resistance to chemicals. Moreover, the influence of chemical composition and molecular arrangement of yarn and fibre properties and fabric structure on the physical properties of textile fabrics; the different fibre types; the materials used in different processes and the effect on materials as they are processed.
M1-L3 — Selecting the right textile recycling technology	Spinning technologies; Yarn manufacturing processes; Characteristics of fibres	Understand the characteristics of textile fibres and the principles of recycling and spinning technologies, including how material properties influence processability, yarn quality, and final product performance.
M1-L4 — Coordination on textile recycling chain	Business management principles Supply chain management	Principles governing business management methods such as strategy planning, methods of efficient production, people and resources coordination. The flow of goods in the supply chain, movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption.
Module 2 — Eco-Design for the Circular Economy		
M2-L1 — From eco-design regulations to textile design specifications	Textile sustainability regulations	Textile regulations to design, manufacture, evaluate relevant textile properties, and recycle

ANNEX C — COLLECTION OF SKILLS AND KNOWLEDGE

LESSON	KNOWLEDGE LABEL	KNOWLEDGE DESCRIPTION
		textile products. Include the ban of substances during the manufacturing processes.
M2-L2 — Use LCA to select textile materials & processes	Product life cycle Systems development life cycle	The management of the life cycle of a product from the development stages to the market entry and market removal. The sequence of steps, such as planning, creating, testing and deploying and the models for the development and life-cycle management of a system.
M2-L3 — Traceability across textile value chain	Supply chain management	The flow of goods in the supply chain, movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption.
M2-L4 — Design for textile circularity	End-of-life strategies for textile products Circular textile design principles	Strategies and options for extending product durability for repair and reuse. Design approaches that enable textile circularity, including disassembly and recycling.
Module 3 — Sustainable Manufacturing		
M3-L1 — EU requirements for sustainable textile production	EU regulatory frameworks for sustainable textile manufacturing.	Key EU directives applicable to textile production (Industrial Emissions Directive, REACH, BAT reference documents); specific compliance requirements (wastewater discharge permits, air pollutant emission thresholds, hazardous substance restrictions, occupational health standards); compliance procedures and environmental management systems (ISO 14001, facility licensing, regulatory inspection protocols, environmental performance reporting).
M3-L2 — KPIs definition and tracking in textile manufacturing	Resource-efficient technologies Challenging issues in the textile industry	Sustainable technologies which allow to produce more value using limited resources while reducing the impact on the environment, restraining the risks of scarcity. The efficiency aims and environmental issues posed by challenges in the textile industry.
M3-L3 — Waste reduction in textile manufacturing	Waste generation and resource efficiency in textile manufacturing.	Sources and types of waste across textile production stages (material, chemical, water, energy, process losses); waste classification frameworks; root cause analysis techniques; waste quantification indicators (material yield,

ANNEX C — COLLECTION OF SKILLS AND KNOWLEDGE

LESSON	KNOWLEDGE LABEL	KNOWLEDGE DESCRIPTION
		percentage waste, cost-impact analysis); waste minimisation and resource efficiency techniques applicable in textile operations.
M3-L4 — Digital Product Passport (DPP) application in the textile and apparel industry	Digital Product Passport (DPP) requirements in Textiles	Understanding the data requirements for Digital Product Passport (DPP) in the textile/ apparel sector and the opportunities it creates.

Annex D — Abbreviations, Acronyms and Glossary

Selected acronyms and terms used in this booklet.

Term	Definition
DPP	Digital Product Passport — a digital record carrying product-level data across the value chain, introduced under the Ecodesign for Sustainable Products Regulation (ESPR).
EACEA	European Education and Culture Executive Agency — the European Commission agency managing the Erasmus+ programme.
ECVET	European Credit system for Vocational Education and Training.
EPR	Extended Producer Responsibility — a policy approach making producers responsible for the end-of-life management of their products.
EQF	European Qualifications Framework — the EU common reference framework linking different national qualifications systems.
ESCO	European Skills, Competences, Qualifications and Occupations — the multilingual classification maintained by the European Commission.
ESPR	Ecodesign for Sustainable Products Regulation — the EU framework setting eco-design requirements for nearly all physical goods placed on the EU market.
L	Lesson
LCA	Life-Cycle Assessment — a methodology for evaluating the environmental impacts of a product across its life cycle.
LO	Learning Outcome — a statement of what a learner knows, understands, and is able to do on completion of a learning process.
Masterclass	A sequence of four 3-hour live online sessions covering one S4C module.
Micro-credential	A proof of the learning outcomes achieved by a learner following a short learning experience (European Council definition).
MOOC	Massive Open Online Course — the S4C open self-paced platform, populated after live delivery.
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals — the EU chemicals regulation.

Annex E — Micro-credential Certificate

Participants who pass the assessment of a lesson are awarded a micro-credential, issued as the certificate shown below. The front carries the participant's name, the lesson and the date of delivery; the reverse records the micro-credential descriptor — its learning outcomes, skills, knowledge, assessment and pass threshold — following Council Recommendation 2022/C 243/02.



CERTIFICATE

OF PARTICIPATION

THIS IS TO CERTIFY THAT

[NAME AND SURNAME]

has successfully completed the 3-hour micro-course **[Lesson Title]** organized by the Skills4Circularity project and conducted online on **[DD MM 2026]**



**SKILLS4CIRCULARITY
PARTNERSHIP**
(GAP-101243978)



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SKILLS4CIRCULARITY
Upskilling & Reskilling for Circular Textiles

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Micro-credential certificate — front.

ANNEX E — MICRO-CREDENTIAL CERTIFICATE

General description of the short course	
Topics	
Information of the provider	Skills4Circularity is an Erasmus+ project developed by a strategic consortium comprising Higher Education Institutions (HEIs), Vocational Education and Training (VET) providers, and key stakeholders from the textile sector. (https://www.skills4circularity.eu).
Learning outcomes	
Knowledge	
Skills	
Language	English
Country	
Assessment	• Multiple-choice quiz (maximum score 10 points) • Practical exercise (maximum score 10 points) Pass threshold: 11 points out of 20
Form of participation in the learning activity (Learning approach)	Synchronous distance learning , including a lecture component, a practical/interactive component, an assessment component, and the end-of-session participant survey.
Notional workload	3 hours
Type of quality assurance used to underpin the micro-credential	Quality ensured by Skills4Circularity Partnership, composed by Universities, VET providers, textile associations and clusters.

Date :

[DAY, MONTH, 2026]



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Micro-credential certificate — reverse (micro-credential descriptor).

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