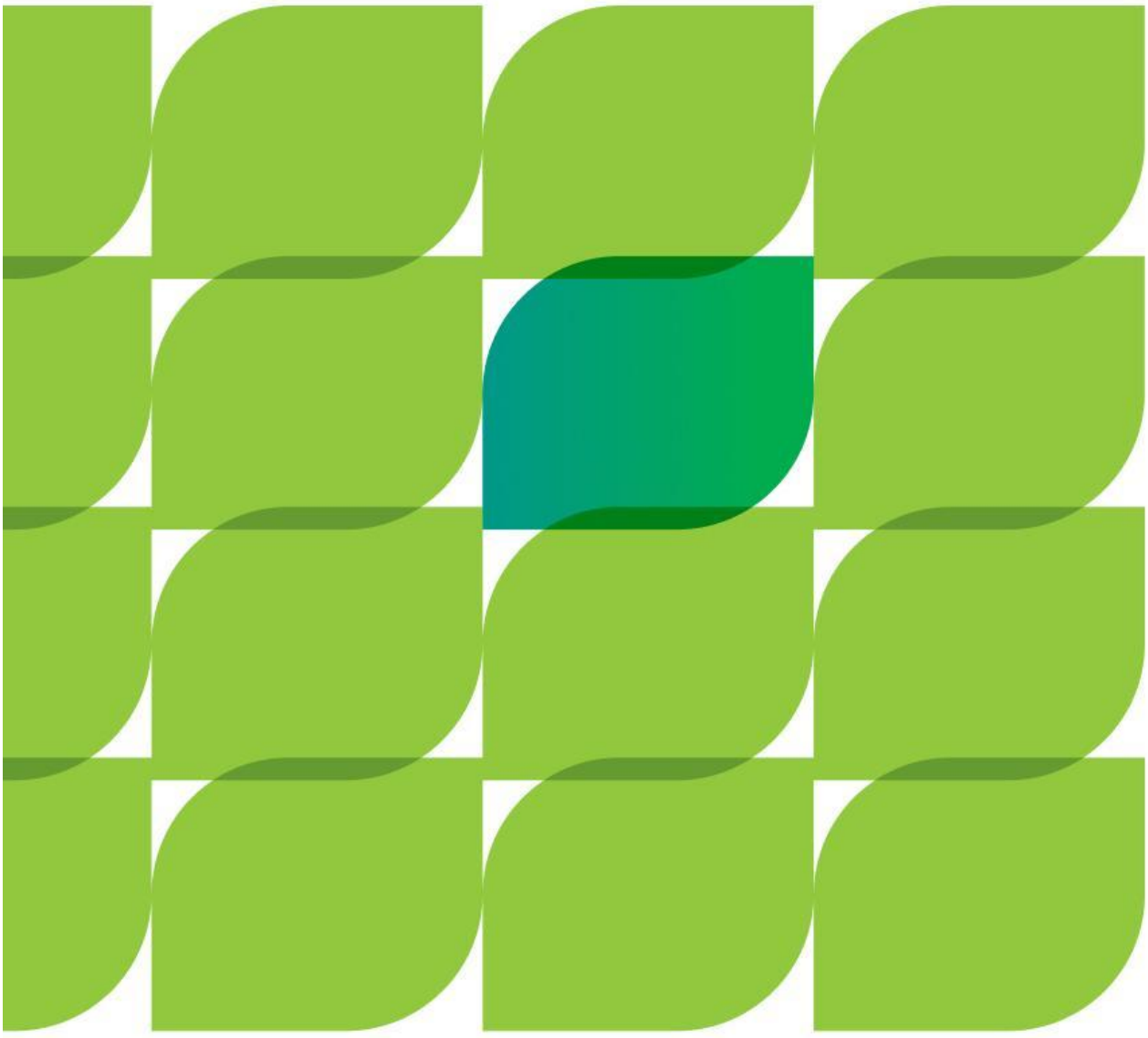
Digital 4 Sustainability
Skills for Europe's Twin Transition

D3.4: Digital sustainability learning materials



Co-funded by the European Union

Document Control Information

Project	Digital4Sustainability
Project number	101140316
Document Title	Digital4Sustainability
Work Package Number	WP3
Lead Beneficiary	Profil Klett Ltd.
Project Coordinator:	European DIGITAL SME Alliance
Dissemination Level	Public - fully open
Authors	Katarina Cicvarić, Profil Klett Ltd. Kristina Ferara Blašković, Profil Klett Ltd.
Reviewers	Liis Vaino, BCS Koolitus Mahmood Al-Doori, Universität Koblenz
Description	Package of training materials and resources for both the urgent and pilot training programmes. (Digital in EN and localised as needed)
Status	Final Document
Delivery Date	30/04/2026
Due Date	30/04/2026

Disclaimer

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

Document history

	Date	Modified by	Comments
1	10. 4.2026	Katarina Cicvarić (PK)	First draft
2	20.4.2026	Kristina Ferara Blašković (PK)	Final draft
3	28.4.2026.	Liis Vaino (BCS Koolitus) Mahmood Al-Doori (Uni Koblenz)	QA Review
4	28.4.2026.	Katarina Cicvarić (PK)	Reviewers' comments integration
5	29.4.2026	Rachele Immesi (Matrix Internet)	Layout check
6	29.4.2026	Brian Cochrane (Cochrane Marketing) Serena Dell'Agli (Digital SME Alliance)	Final QC Review

About the Digital4Sustainability project

Digital4Sustainability is a pioneering initiative aimed at accelerating Europe's twin transition by equipping the workforce with the essential skills needed to drive sustainability-focused innovation. In response to the pressing need to achieve climate neutrality and meet the Sustainable Development Goals (SDGs), the project will develop a forward-thinking Digital Sustainability Skills Strategy as well as cutting-edge learning programmes. These efforts will address the urgent and emerging skills needs of the European industry, empowering the workforce to develop sustainable technologies that support Environmental, Social, and Governance (ESG) practices. By aligning closely with industry needs throughout the project, Digital4Sustainability will help European companies, particularly small and medium-sized enterprises (SMEs), achieve long-term competitiveness and growth through digital and sustainable transformation.

Funded by the Erasmus+ Programme of the European Union, this 4-year project unites 29 members of the Digital Large-Scale Partnership (Digital LSP) under the Pact for Skills, spanning 13 EU countries. The consortium includes digital and sustainability experts, business associations, universities, and Vocational Education and Training (VET) providers.

The Digital4Sustainability Project Consortium

The Digital4Sustainability project consortium is an Erasmus+ Alliance for Sectoral Cooperation on Skills, bringing together 28 partners and Associated partners from 13 EU countries.

	Partners	Acronym	Country
1	Adecco Formazione Srl	Adecco Training	Italy
2	Adecco Italia Holding Spa	Adecco Holding	Italy
3	As Bcs Koolitus	BCS KOOLITUS	Estonia
4	Asociatia Cluj IT	CLUJ IT CLUSTER	Romania
5	Badgebox Srl	BadgeBox	Italy
6	CEFRIEL Società Consortile a Responsabilità Limitata	CEFRIEL	Italy
7	Cooperatie Eduserpro U.A.	Eduserpro	Netherlands
8	Digital Technology Skills Limited	DTSL	Ireland
9	DIGITALEUROPE AISBL	DIGITALEUROPE	Belgium
10	European DIGITAL SME Alliance	DIGITAL SME	Belgium
11	Fast Lane Institute For Knowledge Transfer GmbH	FAST LANE	Germany

12	Gospodarska Zbornica Slovenije	GZS CCIS	Slovenia
13	Gospodarska Zbornica Slovenije Center Za Poslovno Usposabljanje	GZS CPU	Slovenia
14	IVSZ - Digitalis Vallalkozasok Szovetsege	IVSZ	Hungary
15	Matrix Internet Applications Limited	MATRIX INTERNET	Ireland
16	National College Of Ireland	NCI	Ireland
17	Profil Klett D.O.O.	PK	Croatia
18	Sdruzenie Bulgarska Asociacia Na Softuernite Kompanii - Basscom	BASSCOM	Bulgaria
19	Stichting Hogeschool Utrecht	HU	Netherlands
20	Tekenable Limited	TEKenable	Ireland
21	Universidad De Alcala	UNI ALCALA	Spain
22	Universidad Internacional De La Rioja SA	UNIR	Spain
23	Universität Koblenz	UNI KO	Germany
24	National University of Science and Technology Politehnica Bucharest	POLITEHNICA Bucharest	Romania

	Associated partners	Acronym	Country
1	Asociacija Infobalt	INFOBALT	Lithuania
2	SKILLNET IRELAND Company Limited By Guarantee	SKILLNET IRELAND	Ireland
3	The Council of European Professional Informatics Societies	CEPIS	Belgium
4	Universidad Complutense De Madrid	UCM	Spain

Table of Contents

Introduction

Deliverable D3.4 – Digital Sustainability Learning Materials represents a key outcome of the Digital4Sustainability project, delivering a comprehensive, pilot-ready suite of learning materials designed to support the development of digital sustainability competences across Europe. **This document serves as the overarching technical descriptor, evidence of completion, and a structured access guide to the full package of outputs.**

The primary purposes of this deliverable are to:

- Develop modular and adaptable learning materials tailored to the needs of digital sustainability professionals, aligned with EQF Levels 5 and 6.
- Implement the six Rapid Upskilling Curricula defined in D3.1 as complete, pilot-ready learning packages, deployable by any qualified training provider in the WP4 pilot phase.
- Demonstrate the alignment of learning resources with programme Unit Learning Outcomes, real-world professional applications, and EQF quality standards.
- Enable easy access and usability for training providers and learners across Europe.
- Establish a structured basis for WP4 piloting and the subsequent development of the EU-wide Ready-to-Use Training Package (D4.3).

The deliverable presents a coherent and quality-assured set of resources that form Europe's first structured digital sustainability upskilling ecosystem. These materials are specifically designed to enable engaging, flexible, and effective learning experiences, equipping professionals with both theoretical understanding and practical skills required to navigate the twin green and digital

transition. Developed through a collaborative effort of 28 consortium partners, the materials leverage advanced instructional design approaches, digital platforms, and standardised development frameworks to ensure consistency, scalability, and relevance to labour market needs.

The development of the learning materials was implemented in two complementary phases. The following table provides a clear demarcation between these two stages of the project:

Project Phase	Task Reference	Key Objective
Phase 1 (Urgent Upskilling)	**Task 4.1**	**Rapid Response:** Providing immediate support to emerging digital sustainability skills needs through rapid-delivery webinars and presentations.
Phase 2 (Standardized Materials)	**Task 3.6**	**Sustainability & Quality:** Developing comprehensive, high-quality, and EQF Level 5-6 aligned learning packages for long-term EU-wide use.

Phase 1 (Urgent Upskilling), delivered between November 2024 and January 2025 and fully documented in Deliverable D4.1, focused on rapid-response training across ten core topics, providing immediate support to emerging skills needs through webinars, presentations, and practical resources. Building on this foundation, Phase 2 delivers six comprehensive upskilling curricula based on the educational profiles and Unit Learning Outcomes defined in Deliverable D3.1.

All materials are aligned with the European Qualifications Framework (EQF) at Levels 5 and 6, ensuring transparency, comparability, and quality. They are modular, adaptable, and designed for diverse training providers and target groups across Europe. The learning materials are further supported by the Train-the-Trainer Programme (D3.5), ensuring consistent and high-quality delivery across partner organisations.

1. The Urgent Upskilling Package - Early Implementation (Phase 1)

1.1 Overview and Purpose

The first phase of the Digital4Sustainability training initiative was focused on addressing immediate market needs for digital sustainability skills. Delivered between **November 2024 and January 2025**, these "Urgent Upskilling" pilots served as a rapid-response mechanism to test content relevance and delivery formats across the consortium. Phase 1 was designed to respond rapidly to the skills gap identified in the project's Needs Analysis (D2.1) and Digital Sustainability Skills Strategy (D2.2). Rather than waiting for the development of full curricula, partners were empowered to deploy existing and adapted content in their national contexts. This allowed the project to generate real-world impact within the first year while simultaneously generating evidence and learner feedback that directly informed the design of the Phase 2 curricula.

1.2 Impact and Reach

Based on the data consolidated in Deliverable D4.1 Learning Programmes to Address Urgent Digital Sustainability Skills Needs, Phase 1 was highly successful in terms of reach and engagement, significantly exceeding the initial project forecasts.

Key Performance Indicators (KPIs) of Phase 1:

- **Total Pilots Delivered:** 12 sessions.
- **Unique Training Programmes:** 10 distinct topics.
- **Geographical Reach:** 7 Countries (Ireland, Slovenia, Germany, Spain, Italy, the Netherlands, Estonia and Belgium).
- **Learner Reach: 468 participants** (Exceeding the target of 200 by over 200%).
- **Languages:** 5 (English, Spanish, Italian, Slovenian, and Dutch).
- **Delivery format:** Webinars, live seminars, in-person workshops, student lectures

1.3 Summary of Pilot Programmes

The package for Phase 1 consists of materials from ten core topics. These resources include presentation decks, reading lists, recorded webinars, and practice materials tailored to the specific expertise of the delivery partners.

Training Programme Title	Organising Partner	Delivery Format	Materials produced
Data Analytics & Sustainable Practices	BCS Koolitus	Webinar	Presentation deck, recorded webinar, case study materials
Introduction to Digital Twins as a Tool to Promote Sustainability	Universidad Internacional de La Rioja (UNIR)	In-person session	Presentation deck, reading list, practice exercises
Digital and Sustainability: Train the Trainers	Adecco Holding, Adecco Training, BadgeBox	In-person/ webinar	Presentation deck, recorded webinar, facilitator guide
Introduction to the Topic of the Twin Transition	Stichting Hogeschool Utrecht	Live seminar	Presentation deck, workshop activities, participant handout
Introduction to the application of smart data analytics for Sustainability	Universität Koblenz	Student lecture	Lecture slides, student exercises, reading materials
Digital Accessibility	Universidad de Alcalá (UAH)	In-person session	Presentation deck, accessibility checklist, recorded session

AI for Improved Sustainable Reporting	National College of Ireland (NCI) & Fast Lane	Hybrid webinar	Presentation deck, recorded webinar, tool comparison matrix
CSRD Data Readiness Training	European DIGITAL SME Alliance	Webinar	Presentation deck, recorded webinar, CSRD compliance guide
Digital Technologies for Sustainable Reporting (CSRD+ESG)	Gospodarska Zbornica Slovenije CPU	Online webinar	Presentation deck, recorded webinar, practice exercises
Cybersecurity and ESG	CEFRIEL	In-person session	Presentation deck, ESG risk framework handout, recorded session

All Phase 1 materials are available on the Digital4Sustainability project website at https://digital4sustainability.eu/learning-programmes/

1.4 Transition to Phase 2 (Standardised Pilots)

Phase 1 was not just about delivery — it was the consortium's first real-world test of content relevance and format preferences. Feedback from 468 learners and the delivering partners, together with findings from questionnaires completed by consortium training providers, produced four clear signals that were built directly into the Phase 2 design:

- Self-paced and interactive formats were strongly preferred over passive delivery.
- Shorter, focused sessions (maximum two hours) suited professional audiences better.
- Practical, applied exercises and sector-specific case studies were consistently requested.
- Multiple delivery modes were needed to serve diverse audiences.

The transition from Phase 1 to Phase 2 represents a qualitative shift in methodology. While Phase 1 was a rapid response to market demand, Phase 2 is the rigorous operationalisation of Deliverable D3.1 (Core Curricula), which served as the primary starting point for all material development. To ensure the feedback from Phase 1 was concretely used, we implemented mandatory Project-Based Learning (PBL) components in all Model B packages and designed the Student Handbooks to include the specific case-study depths requested by early learners.

2. Comprehensive Learning Material Packages - The 6 Curricula (Phase 2)

2.1 The Coordination Strategy: From Templates to Finished Content

Following Deliverable 3.1, the consortium aligned on prioritising the six Rapid Upskilling Curricula as the starting point for Phase 2 development. The second phase of the project involved the development of six comprehensive upskilling curricula learning materials, totalling **11,5 ECTS**. It is important to emphasise that these materials do not create new outcomes but are the direct implementation of the ULOs defined in D3.1. A standardised pedagogical framework ensures that, despite having multiple authors from different countries, the final output remains a **unified, high-level educational ecosystem (EQF Level 5-6)**.

Curriculum Title	Lead Authoring Partner(s)	Delivery Model	EQF	ECTS
Sustainability Data Essentials	BCS Koolitus, PK	Blended	6	2.5
Circular Economy in Digital Systems	NCI	Blended	6	2.5
Cybersecurity for Sustainable Systems	CEFRIEL, POLITEHNICA Bucharest	Blended	6	2.5

Green Software Fundamentals	POLITEHNICA Bucharest	Blended	5	2.5
Digital Sustainability Foundations (A)*	UNI Utrech, CPU	Self- paced (IZZI Digital)	5	0.5
Digital Sustainability Foundations (B)*	UNI Alcala	Self- paced (IZZI Digital)	5	0,5
EU Policy and Legislation	UNIR, Tekenable	Self- paced (IZZI Digital)	6	0.5

*The two versions of Digital Sustainability Foundations (A and B) represent alternative configurations of the same module; each aligned to different Unit Learning Outcomes (ULOs) to accommodate variation in learner entry points and competence expectations. As they are mutually exclusive in implementation and share the same scope and workload, they are counted as a single curriculum (0.5 ECTS) for ECTS calculation purposes.

3. Instructional Design of the Learning Materials

Instructional design is fundamental to ensuring the effectiveness, coherence, and engagement of learning materials, especially when addressing complex, professionally oriented content across diverse European contexts. The D3.4 materials were therefore not developed on an ad hoc basis but are rooted in a structured pedagogical framework informed by established educational theory and specifically adapted to the needs of adult professional learners in the context of the Twin Transition.

3.1 Pedagogical Framework: Constructive Alignment

The foundational principle applied across all D3.4 materials is Constructive Alignment (Biggs & Tang, 2011). This approach ensures a direct, verifiable link between three elements: the Unit Learning Outcomes (ULOs) defined in D3.1, the learning activities designed to help learners achieve those outcomes, and the assessment tasks that generate evidence of achievement.

In practice, this means that every topic, exercise, and assessment item in every D3.4 material traces back to a specific ULO from D3.1. There is no content that exists simply to fill space — every element has a pedagogical purpose. This approach also underpins the peer review criteria described in Section 3.3: reviewers explicitly check that the alignment between outcomes, activities, and assessments is maintained throughout.

3.2 Designing for Adult and Professional Learners

The D3.4 materials are primarily designed for adult professionals — learners with prior expertise, limited time, and a strong focus on practical application. At the same time, they are intentionally structured to be transferable to higher education and VET contexts, enabling their use with students as part of formal education programmes. This dual positioning ensures both immediate labour market relevance and alignment with academic standards.

Adult learners bring diverse professional experience to the learning environment. They are typically aware of their learning needs and value education that can be applied directly and

immediately in professional contexts. They are motivated by relevance and practical outcomes. At the same time, these characteristics are increasingly reflected in contemporary higher education and VET learners, particularly in professionally oriented programmes. Educational design must therefore emphasise applicability, build on existing knowledge, and connect concepts to real-world challenges.

In the D3.4 materials, these principles are reflected through:

- **Personalised learning pathways:** A modular structure enables learners to engage with individual modules independently, revisit content, and prioritise areas most relevant to their needs.
- **Problem-centred content:** Case studies, scenario-based tasks, and practical assignments are grounded in real European industry and regulatory contexts, including CSRD compliance, ESG reporting, cybersecurity governance, and software carbon measurement.
- **Application-focused learning:** Learners are expected not simply to recall theory, but to apply it — for example, by designing metrics frameworks, analysing supply chains, or evaluating software against sustainability criteria.
- **Flexible delivery:** Foundational topics are delivered through self-paced online modules, while more technical and applied content is supported through blended learning formats with hands-on workshop activities.
- **Immediate feedback:** Automated self-assessment quizzes within IZZI modules provide instant feedback, while structured trainer input is integrated into blended learning delivery.

3.3 Key Design Guidelines Applied Across All Materials

The following guidelines were applied by all authoring partners and enforced through the peer review process, ensuring consistency across all six curricula regardless of who authored them:

Design Principle	How it is applied in D3.4
Consistency across materials	Standardised naming conventions, visual style (Digital4Sustainability brand), and module structure across all curricula — learners navigate the same pattern in every module they open.
Learner-centred design	Learning Outcomes are stated clearly at the start of each module. Activities connect directly

	to real-world professional tasks. Tone is professional but accessible — not academic.
Interactive and engaging content	IZZI modules include clickable hotspots, scenario-based decision tasks, and automated quizzes. Blended packages include structured group activities, simulations, and discussion prompts.
Accessibility	All written materials are available in PDF and editable DOCX/PPTX formats. IZZI modules meet web accessibility standards. Alt text provided for all multimedia elements.
Professional visual standards	All materials use the Digital4Sustainability visual identity. Multimedia content, including videos and presentations, is produced in line with agreed project standards, ensuring consistency and quality across all materials.
Assessment alignment	Every assessment task (quiz, examination, or Capstone Project) is directly mapped to the ULOs from D3.1.

4. Structure and Development of the Learning Materials

Producing consistent and high-quality learning materials required a structured and well-coordinated development approach. The six curricula were designed using two complementary delivery models: fully self-paced digital modules and blended learning packages. Each model was supported by a dedicated authoring framework, including standardised templates, guidelines, and clearly defined content requirements. This ensured that all partners followed a common structure and pedagogical logic, while allowing flexibility in how content was developed and adapted to specific topics.

Particular attention was given to ensuring usability and consistency across all materials. For the self-paced modules, interactive elements and guided content structures support flexible, independent learning with built-in feedback. For the blended learning packages, a standardised set of documents — including learner materials, trainer guides, and supporting multimedia — enables straightforward implementation by different training providers. This dual-model approach ensures that materials are both pedagogically coherent and practically deployable across a range of educational and professional contexts.

4.1. Roles in Development of Ready-to-Use Learning Materials

Several distinct roles were involved in the development of the D3.4 learning materials. Each role carries specific responsibilities, and the collaboration between them is what ensures the final materials are pedagogically sound, technically accurate, professionally produced, and ready to use by any training provider in the consortium.

1. Author

The Author is the subject-matter expert responsible for writing the content of each module. Authors, drawn from the consortium's academic and industry partners — provide the theoretical foundations, case studies, exercises, and quiz items. They also draft narration scripts and video

concepts. Authors work within the standardised templates to ensure their content integrates seamlessly with the other components of the package. Authors are not required to produce final videos or handle platform integration.

2. Instructional Designer / Content Coordinator (Profil Klett)

Profil Klett's instructional design team oversees the pedagogical coherence of the entire D3.4 package. This role involves developing the authoring frameworks, templates, and guidelines; providing feedback to authors during drafting; and ensuring that all materials — across both Model A (IZZI) and Model B (blended) — are consistently aligned with the D3.1 Unit Learning Outcomes and the EQF level standards. The Instructional Designer also develops the interactive elements and multimedia components for IZZI modules, translating author scripts into engaging digital experiences.

3. Editor

The Editor is responsible for: reviewing and refining content; ensuring consistency across material, validating information, enhancing visual and interactive elements, preparing content for final delivery, coordinating revision. The Editor is coordinating all roles and responsibilities.

4. Production Team (Profil Klett)

The Production Team is responsible for the technical integration of all finalised content into delivery-ready formats. For Model A materials, this means building and testing modules in the IZZI platform — structuring content, embedding interactive elements, configuring quizzes, and verifying accessibility. For Model B materials, the Production Team produces all final videos (AI avatar or animated, based on author scripts), standardises all PowerPoint presentation decks, and ensures all documents are properly branded and formatted. The Production Team also conducts technical testing before any material is considered complete.

5. Internal Peer Reviewer

Every set of D3.4 learning materials was reviewed by a peer reviewer, a consortium partner who did not author the materials being reviewed. Reviewers used the standardised Peer Review Questionnaire, which covers workload accuracy, handbook depth, active learning design, assessment alignment, content accuracy, language quality, and practical usability. Reviewers submitted structured feedback; authors were required to respond to all significant comments. This cross-consortium review model ensures that the materials genuinely work for users outside the authoring team's own context.

4.2 The Development Process

The following process was applied to every set of D3.4 materials, for both Model A (IZZI) and Model B (blended):

	Step	Description
1	Curriculum mapping	Curriculum Owner completes the Curriculum Information Document, mapping ULOs from D3.1 to content structure and verifying workload hours.
2	Content drafting	Author produces module content using standardised templates. For IZZI: text, interactive elements, and quiz items. For blended: Learner Handbook) and Practical Delivery Guide.
3	Video & presentation scripting	Author submits narration scripts and video concepts.
4	Instructional review	Instructional Designer reviews content against ULOs, EQF level, and design guidelines. Feedback provided to Author.
5	Production	Production Team produces all videos and standardised presentation decks. For IZZI: full platform integration and technical testing.
6	Peer review	An independent consortium partner reviews the completed materials using the Peer Review Questionnaire. Author responds to all significant comments.
7	Final QA	Proofreading of all finalised materials. Final quality check by coordination team.
8	Publication	Materials published on project website. Permanent access links confirmed.

5. The Complete Package: Materials Ready for Piloting

This section provides the full inventory of D3.4 learning materials, with access links for all digital content. All materials are currently available on the Digital4Sustainability project website at https://digital4sustainability.eu/learning-programmes/. These materials are complete and pilot-ready — they have been authored by subject-matter experts, quality-assured through an internal peer review process, and professionally produced to a standard that enables delivery in the WP4 pilot phase.

Following piloting, learner feedback and trainer observations collected in WP4 will inform the final refinement of these materials. The refined and validated package will be published as Deliverable D4.3 – Ready-to-Use VET Training Package for EU Rollout, which constitutes the definitive version for broad European dissemination.

5.1 Self-Paced Digital Curricula (Model A — IZZI Platform)

The following modules are fully embedded on the project website and available for immediate autonomous use. Permanent public URLs are provided below.

Curriculum	Module Title	Access Link
EU Policy & Legislation (0.5 ECTS | EQF 6)	Introduction to EU Sustainability Legislation – Part 1	https://d4sus.izzi.digital/DOS/1454337/1454340.html
	Introduction to EU Sustainability Legislation – Part 2	
	Sustainability International Standards	
	EU Legislation: Foundations and Framework	
	ESG Reporting Essentials	
Digital Sustainability Foundations – Version A (0.5 ECTS | EQF 5)	Introduction to Digital Sustainability 1	https://d4sus.izzi.digital/DOS/1454356/1463670.html
	Three Different Perspectives on the Twin Transition	
	A Digital Perspective on Sustainability (D > S)	
	Real-World Cases of Twin Transition & Negative Rebound Effects	
	A Sustainability Perspective on Digitalisation (S > D)	
	Implications for the Organisation (D >< S)	

Digital Sustainability Foundations – Version B (0.5 ECTS | EQF 5)	Introduction to Digital Sustainability 2	https://d4sus.izzi.digital/DOS/1454375/1454378.html
	Concept of Digital Sustainability	
	Environmental Impact of Digital Professional Activity	
	Economic Feasibility of Digital Professional Activity	
	Social Impact of Digital Professional Activity	

Download PDF
Click to access the essential learning materials and read about the topic "Social impact of digital professional activity".

Introduction

As commented in the introductory topic, digital sustainability also includes social sustainability, which ensures technology is designed to promote social equity and well-being (see Fig. 1). This requires digital systems to benefit all people, especially the most vulnerable. The key pillars of the social sustainability of ICT activity include ensuring digital usability and accessibility for everybody, implementing wide localisation for preserving linguistic and cultural diversity and ethically addressing misinformation and digital overuse while also embedding ethics into digital and AI systems to ensure privacy, fairness and information safeness. Digital activity socially sustainable must also address how to bridge the digital divide to provide proper access and skills, especially to disadvantaged groups, without forgetting the promotion of fair working conditions across the technology supply chain.

Fig. 1. Social vision of digital sustainability

Figure 1. Screenshot from IZZI platform -Topic introduction

Practical application

Awareness on digital accessibility with a website page (Page of Content to Analyze Digital Accessibility, n.d.):

You must analyse several possible problems for digital accessibility at that page:

- Use the free tool Colour Contrast Analyser (CCA) available at Colour Contrast Analyser (CCA), n.d. to check the page and report possible problems in perception of information due to poor contrast (both at AA and AAA level) and suggest solutions.
- Analyse if the image is appropriate for people with visual disability using screen readers and report problems with possible solutions: read Understanding Guideline 1.1: Text Alternatives, n.d. for guidance.
- Analyse if the link on the page is appropriate for digital accessibility and report problems with possible solutions: read G91: Providing Link Text That Describes the Purpose of a Link, n.d.

Topic conclusions

1. **Universal design is key:** digital systems must prioritize usability and accessibility to ensure all users, especially vulnerable groups and people with disabilities, can effectively interact with and benefit from technology.
2. **Preserve diversity:** technology must implement wide localization principles to support multiple languages and cultural contexts, preventing the exclusion of minority language communities and actively preserving diversity.
3. **Embedded ethics:** ethical principles, including data privacy and protection (e.g., with GDPR and strong cybersecurity), fairness, and transparency (e.g., EU AI Act), must be integrated into all digital and AI systems to prevent bias, discrimination, and the reinforcement of existing societal inequalities.
4. **Combat misinformation and overuse:** social sustainability requires actively fighting the spread of misinformation (e.g., fake news) to protect democratic discourse and tackling digital overuse/addiction to safeguard individual well-being and autonomy, promoting critical thinking against unfair digital marketing and propaganda tactics (e.g., clickbait or astroturfing).
5. **Ensure inclusion and fair labour conditions:** professionals must contribute to bridge the digital divide by promoting access and skills, while also demanding fair working conditions (e.g., safe workplaces or fair pay) throughout the entire global technology supply chain, from assembly to services.

Check your understanding

1. Which of the following is NOT explicitly mentioned as a key pillar of the social sustainability of ICT activity?

- Ethically addressing misinformation and digital overuse
- Developing renewable energy sources for all data centres
- Ensuring digital usability and accessibility for everybody
- Implementing wide localisation for cultural diversity

Check

Figure 2. Screenshot from IZZI platform – interactive part

Co-funded by the European Union

5.2 Blended Learning Packages (Model B)

All blended learning materials are hosted on the project website and the consortium's internal file-sharing platform.

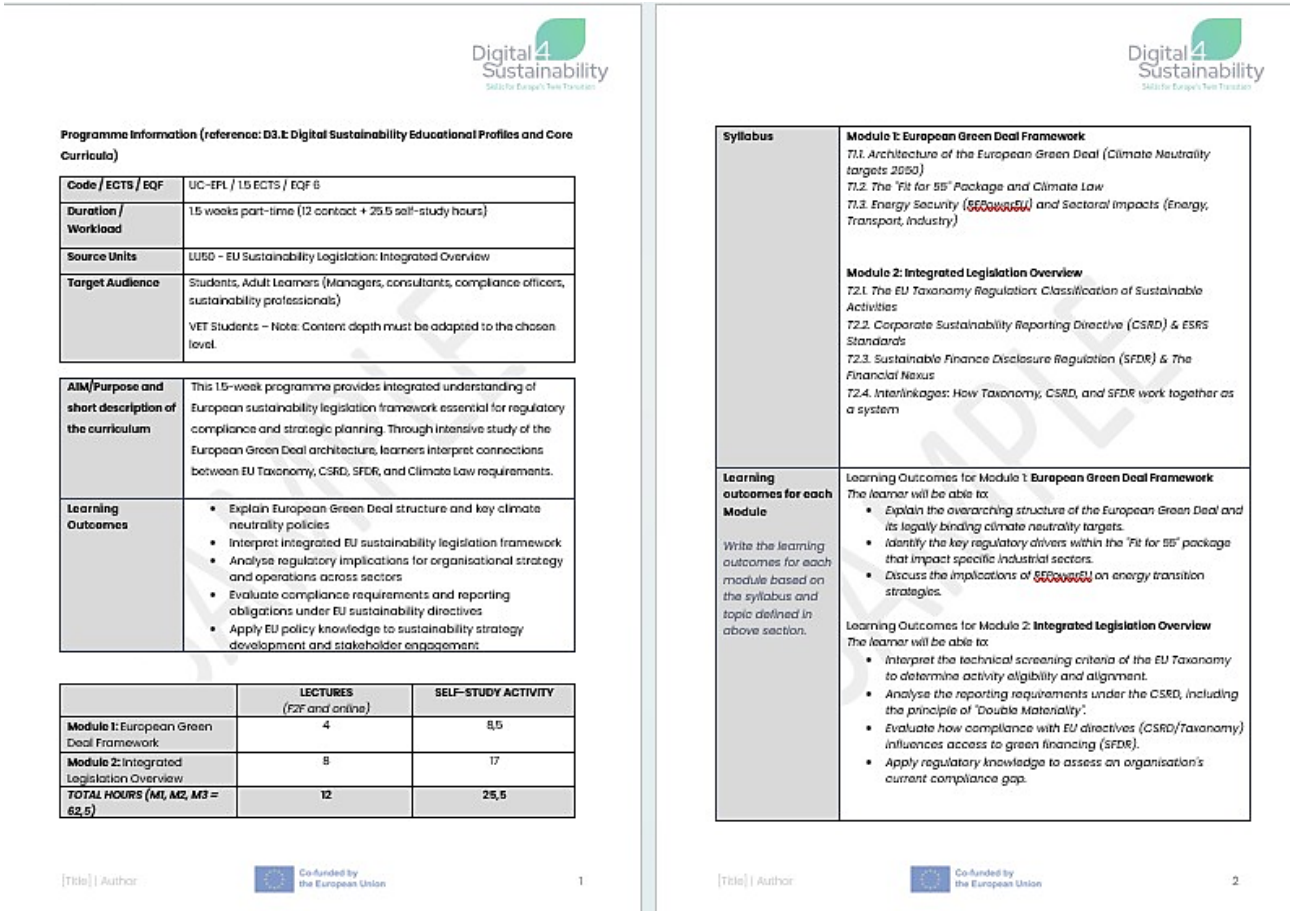
Curriculum	Document	Format	Access link
Sustainability Data Essentials	Curriculum Information Document	PDF	Sustainability Data Essentials folder
Sustainability Data Essentials	Learner Handbook	PDF	
Sustainability Data Essentials	Practical Delivery Guide	PDF	
Sustainability Data Essentials	PPT Decks + Videos	PPTX/MP4	
Circular Economy in Digital Systems	Curriculum Information Document	PDF	Circular Economy in Digital Systems
Circular Economy in Digital Systems	Learner Handbook	PDF	
Circular Economy in Digital Systems	Practical Delivery Guide	PDF	
Circular Economy in Digital Systems	PPT Decks + Videos	PPTX/MP4	

Cybersecurity for Sustainable Systems	Curriculum Information Document	PDF	Cybersecurity for Sustainable Systems
Cybersecurity for Sustainable Systems	Learner Handbook	PDF	
Cybersecurity for Sustainable Systems	Practical Delivery Guide	PDF	
Cybersecurity for Sustainable Systems	PPT Decks + Videos	PPTX/MP4	
Green Software Fundamentals	Curriculum Information Document	PDF	Green Software Fundamentals
Green Software Fundamentals	Learner Handbook	PDF	
Green Software Fundamentals	Practical Delivery Guide	PDF	
Green Software Fundamentals	PPT Decks + Videos	PPTX/MP4	

Each package provides a complete "ready-to-use" toolkit for trainers and learners.

Document 1: Curriculum Information Document (Master Reference)

- Content: Defines the programme structure, precise workload (Face-to-face/Self-study/Project-based learning hours), and assessment models.
- Purpose: Acts as the "Master Roadmap" to ensure consistency across different training providers.



Programme Information (reference: D3.1: Digital Sustainability Educational Profiles and Core Curricula)

Code / ECTS / EQF	UC-EPL / 1.5 ECTS / EQF 6
Duration / Workload	1.5 weeks part-time (12 contact + 25.5 self-study hours)
Source Units	LU50 – EU Sustainability Legislation: Integrated Overview
Target Audience	Students, Adult Learners (Managers, consultants, compliance officers, sustainability professionals) VET Students – Note: Content depth must be adapted to the chosen level.
Aim/Purpose and short description of the curriculum	This 1.5-week programme provides integrated understanding of European sustainability legislation framework essential for regulatory compliance and strategic planning. Through intensive study of the European Green Deal architecture, learners interpret connections between EU Taxonomy, CSRD, SFDR, and Climate Law requirements.
Learning Outcomes	• Explain European Green Deal structure and key climate neutrality policies • Interpret integrated EU sustainability legislation framework • Analyse regulatory implications for organisational strategy and operations across sectors • Evaluate compliance requirements and reporting obligations under EU sustainability directives • Apply EU policy knowledge to sustainability strategy development and stakeholder engagement

	LECTURES (F2F and online)	SELF-STUDY ACTIVITY
Module 1: European Green Deal Framework	4	8,5
Module 2: Integrated Legislation Overview	8	17
TOTAL HOURS (M1, M2, M3 = 62,5)	**12**	**25,5**

[Title] | Author — Co-funded by the European Union — 1

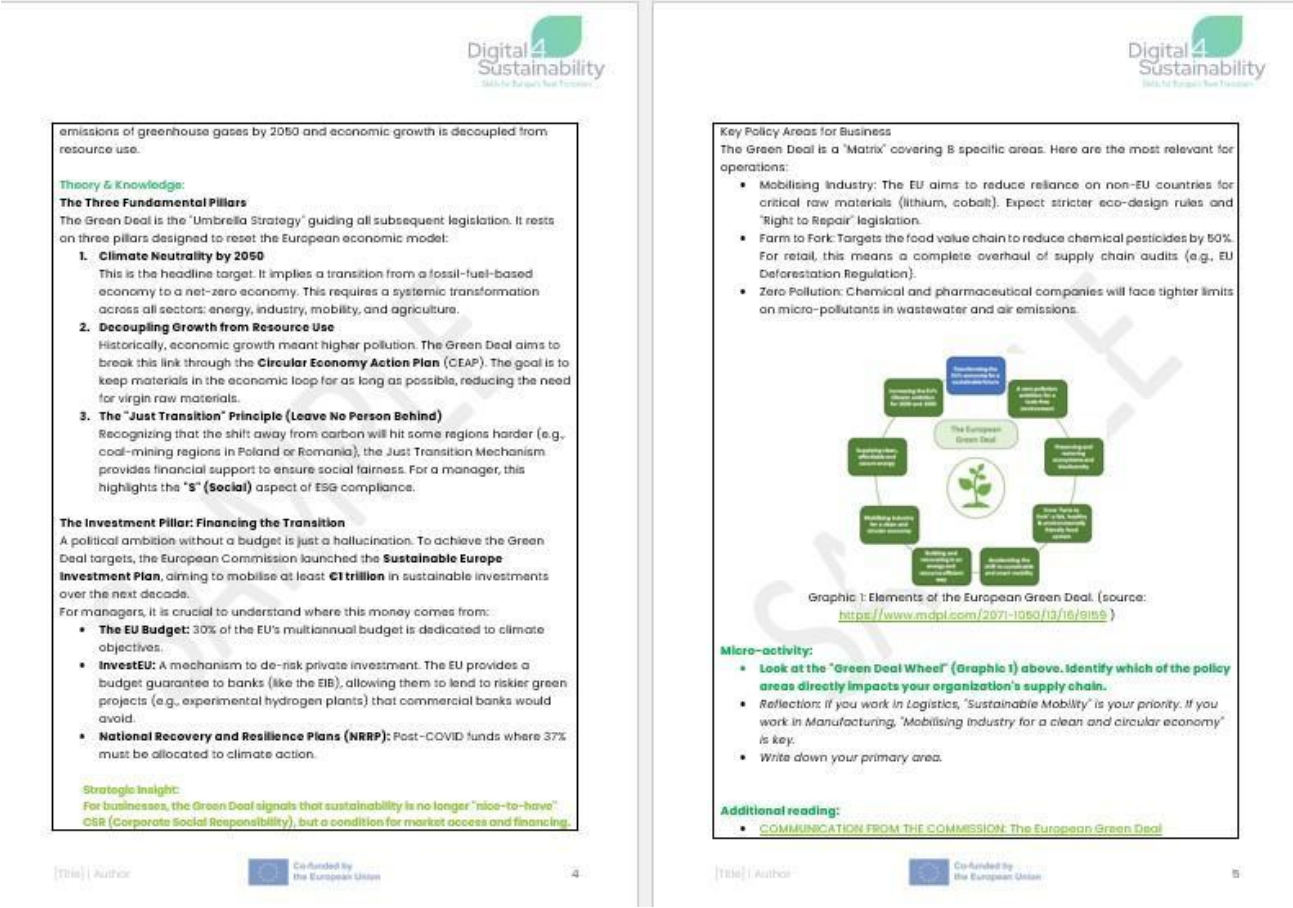
Syllabus	**Module 1: European Green Deal Framework** *T1.1. Architecture of the European Green Deal (Climate Neutrality targets 2050)* *T1.2. The "Fit for 55" Package and Climate Law* *T1.3. Energy Security (REPowerEU) and Sectoral Impacts (Energy, Transport, Industry)* **Module 2: Integrated Legislation Overview** *T2.1. The EU Taxonomy Regulation: Classification of Sustainable Activities* *T2.2. Corporate Sustainability Reporting Directive (CSRD) & ESRS Standards* *T2.3. Sustainable Finance Disclosure Regulation (SFDR) & The Financial Nexus* *T2.4. Interlinkages: How Taxonomy, CSRD, and SFDR work together as a system*
Learning outcomes for each Module *Write the learning outcomes for each module based on the syllabus and topic defined in above section.*	Learning Outcomes for Module 1: **European Green Deal Framework** *The learner will be able to:* • *Explain the overarching structure of the European Green Deal and its legally binding climate neutrality targets.* • *Identify the key regulatory drivers within the "Fit for 55" package that impact specific industrial sectors.* • *Discuss the implications of REPowerEU on energy transition strategies.* Learning Outcomes for Module 2: **Integrated Legislation Overview** *The learner will be able to:* • *Interpret the technical screening criteria of the EU Taxonomy to determine activity eligibility and alignment.* • *Analyse the reporting requirements under the CSRD, including the principle of "Double Materiality".* • *Evaluate how compliance with EU directives (CSRD/Taxonomy) influences access to green financing (SFDR).* • *Apply regulatory knowledge to assess an organisation's current compliance gap.*

[Title] | Author — Co-funded by the European Union — 2

Figure 3. Document 1: Curriculum Information Document

Document 2: Learner Handbook (Theory & Self-Study)

- Content: 20–30 pages of professional theory per module, micro-activities, and key takeaways.
- Coordination Result: Over 500+ pages of high-quality theoretical content were produced, branded, and aligned with EQF Level standards.



emissions of greenhouse gases by 2050 and economic growth is decoupled from resource use.

Theory & Knowledge:

The Three Fundamental Pillars

The Green Deal is the "Umbrella Strategy" guiding all subsequent legislation. It rests on three pillars designed to reset the European economic model:

1. **Climate Neutrality by 2050**
   This is the headline target. It implies a transition from a fossil-fuel-based economy to a net-zero economy. This requires a systemic transformation across all sectors: energy, industry, mobility, and agriculture.
2. **Decoupling Growth from Resource Use**
   Historically, economic growth meant higher pollution. The Green Deal aims to break this link through the **Circular Economy Action Plan** (CEAP). The goal is to keep materials in the economic loop for as long as possible, reducing the need for virgin raw materials.
3. **The "Just Transition" Principle (Leave No Person Behind)**
   Recognizing that the shift away from carbon will hit some regions harder (e.g., coal-mining regions in Poland or Romania), the Just Transition Mechanism provides financial support to ensure social fairness. For a manager, this highlights the **"S" (Social)** aspect of ESG compliance.

The Investment Pillar: Financing the Transition

A political ambition without a budget is just a hallucination. To achieve the Green Deal targets, the European Commission launched the **Sustainable Europe Investment Plan**, aiming to mobilise at least **€1 trillion** in sustainable investments over the next decade.

For managers, it is crucial to understand where this money comes from:

- **The EU Budget:** 30% of the EU's multiannual budget is dedicated to climate objectives.
- **InvestEU:** A mechanism to de-risk private investment. The EU provides a budget guarantee to banks (like the EIB), allowing them to lend to riskier green projects (e.g., experimental hydrogen plants) that commercial banks would avoid.
- **National Recovery and Resilience Plans (NRRP):** Post-COVID funds where 37% must be allocated to climate action.

Strategic Insight:

For businesses, the Green Deal signals that sustainability is no longer "nice-to-have" CSR (Corporate Social Responsibility), but a condition for market access and financing.

[Title] | Author

Co-funded by the European Union

4

Key Policy Areas for Business

The Green Deal is a "Matrix" covering 8 specific areas. Here are the most relevant for operations:

- Mobilising Industry: The EU aims to reduce reliance on non-EU countries for critical raw materials (lithium, cobalt). Expect stricter eco-design rules and "Right to Repair" legislation.
- Farm to Fork: Targets the food value chain to reduce chemical pesticides by 50%. For retail, this means a complete overhaul of supply chain audits (e.g., EU Deforestation Regulation).
- Zero Pollution: Chemical and pharmaceutical companies will face tighter limits on micro-pollutants in wastewater and air emissions.

Graphic 1: Elements of the European Green Deal. (source: https://www.mdpi.com/2071-1050/13/16/9159)

Micro-activity:

- **Look at the "Green Deal Wheel" (Graphic 1) above. Identify which of the policy areas directly impacts your organization's supply chain.**
- *Reflection: If you work in Logistics, "Sustainable Mobility" is your priority. If you work in Manufacturing, "Mobilising Industry for a clean and circular economy" is key.*
- *Write down your primary area.*

Additional reading:

- COMMUNICATION FROM THE COMMISSION: The European Green Deal

[Title] | Author

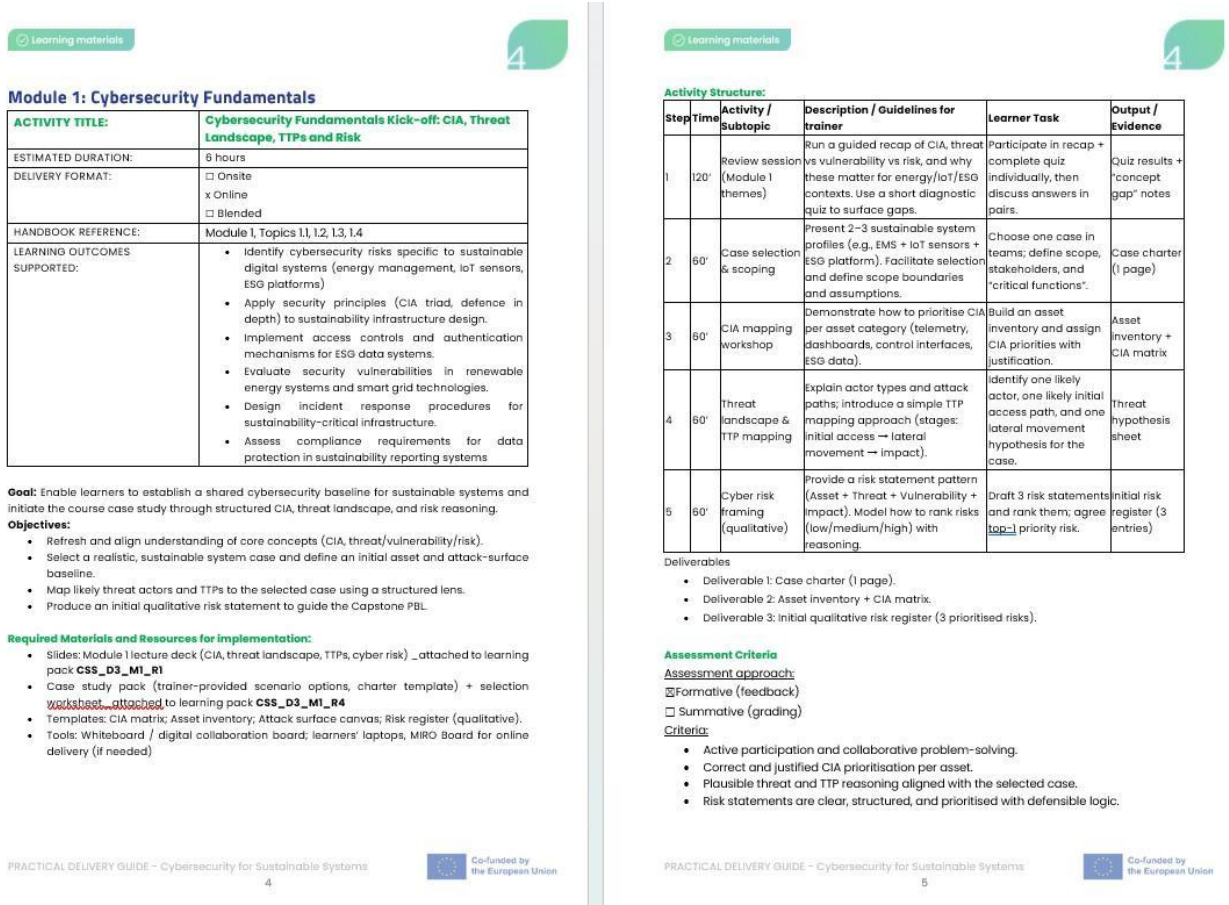
Co-funded by the European Union

5

Figure 4. Document 2: Learner Handbook

Document 3: Practical Delivery Guide for Trainers (F2F & PBL)

- **Content:** Detailed trainer instructions for **Face-to-Face (F2F)** workshops and sessions, **Project-Based Learning (PBL)** assignments and final assessment description.
- **Feature:** Includes specific "Step-by-Step" session plans, making the materials accessible even for trainers who were not involved in the content creation.



Learning materials

Module 1: Cybersecurity Fundamentals

ACTIVITY TITLE:	Cybersecurity Fundamentals Kick-off: CIA, Threat Landscape, TTPs and Risk
ESTIMATED DURATION:	6 hours
DELIVERY FORMAT:	☐ Onsite x Online ☐ Blended
HANDBOOK REFERENCE:	Module 1, Topics 1.1, 1.2, 1.3, 1.4
LEARNING OUTCOMES SUPPORTED:	• Identify cybersecurity risks specific to sustainable digital systems (energy management, IoT sensors, ESG platforms) • Apply security principles (CIA triad, defence in depth) to sustainability infrastructure design. • Implement access controls and authentication mechanisms for ESG data systems. • Evaluate security vulnerabilities in renewable energy systems and smart grid technologies. • Design incident response procedures for sustainability-critical infrastructure. • Assess compliance requirements for data protection in sustainability reporting systems

Goal: Enable learners to establish a shared cybersecurity baseline for sustainable systems and initiate the course case study through structured CIA, threat landscape, and risk reasoning.
Objectives:
- Refresh and align understanding of core concepts (CIA, threat/vulnerability/risk).
- Select a realistic, sustainable system case and define an initial asset and attack-surface baseline.
- Map likely threat actors and TTPs to the selected case using a structured lens.
- Produce an initial qualitative risk statement to guide the Capstone PBL.

Required Materials and Resources for implementation:
- Slides: Module 1 lecture deck (CIA, threat landscape, TTPs, cyber risk) _attached to learning pack **CSS_D3_M1_R1**
- Case study pack (trainer-provided scenario options, charter template) + selection worksheet _attached to learning pack **CSS_D3_M1_R4**
- Templates: CIA matrix; Asset inventory; Attack surface canvas; Risk register (qualitative).
- Tools: Whiteboard / digital collaboration board; learners' laptops, MIRO Board for online delivery (if needed)

PRACTICAL DELIVERY GUIDE – Cybersecurity for Sustainable Systems 4 Co-funded by the European Union

Learning materials

Activity Structure:

Step	Time	Activity / Subtopic	Description / Guidelines for trainer	Learner Task	Output / Evidence
1	120'	Review session (Module 1 themes)	Run a guided recap of CIA, threat vs vulnerability vs risk, and why these matter for energy/IoT/ESG contexts. Use a short diagnostic quiz to surface gaps.	Participate in recap + complete quiz individually, then discuss answers in pairs.	Quiz results + "concept gap" notes
2	60'	Case selection & scoping	Present 2–3 sustainable system profiles (e.g., EMS + IoT sensors + ESG platform). Facilitate selection and define scope boundaries and assumptions.	Choose one case in teams; define scope, stakeholders, and "critical functions".	Case charter (1 page)
3	60'	CIA mapping workshop	Demonstrate how to prioritise CIA per asset category (telemetry, dashboards, control interfaces, ESG data).	Build an asset inventory and assign CIA priorities with justification.	Asset inventory + CIA matrix
4	60'	Threat landscape & TTP mapping	Explain actor types and attack paths; introduce a simple TTP mapping approach (stages: initial access → lateral movement → impact).	Identify one likely actor, one likely initial access path, and one lateral movement hypothesis for the case.	Threat hypothesis sheet
5	60'	Cyber risk framing (qualitative)	Provide a risk statement pattern (Asset + Threat + Vulnerability + Impact). Model how to rank risks (low/medium/high) with reasoning.	Draft 3 risk statements and rank them; agree top-1 priority risk.	Initial risk register (3 entries)

Deliverables
- Deliverable 1: Case charter (1 page).
- Deliverable 2: Asset inventory + CIA matrix.
- Deliverable 3: Initial qualitative risk register (3 prioritised risks).

Assessment Criteria
Assessment approach:
☒Formative (feedback)
☐ Summative (grading)
Criteria:
- Active participation and collaborative problem-solving.
- Correct and justified CIA prioritisation per asset.
- Plausible threat and TTP reasoning aligned with the selected case.
- Risk statements are clear, structured, and prioritised with defensible logic.

PRACTICAL DELIVERY GUIDE – Cybersecurity for Sustainable Systems 5 Co-funded by the European Union

Figure 5. Document 3: Practical Delivery Guide for Trainers

Document 4: Module Wrap-Up Videos & Presentations

To ensure that every module across the 6 curricula maintains a high visual and pedagogical standard, a specialised production workflow was implemented for Document 4:

- **Step 1: Narration & Scripting Guidelines**: Profil Klett first developed a comprehensive "Author Guide for Narration and Scriptwriting." This guide provided authors with a framework for translating complex theory into clear, high-impact storytelling for both videos and presentations.
- **Step 2: Script Development**: Using these guidelines, the authors created concise narration scripts for each module, focusing on summarizing core concepts and linking them to practical application.
- **Step 3: Professional Production**: Based on these finalised scripts, the Profil Klett production team developed:
    - Standardised PowerPoint Decks: Visually engaging slides for every module, ready for trainers to use in live sessions.
    - Module Wrap-Up Videos: High-quality 3–5 minute concluding videos (utilising AI avatars) that consolidate the learner's knowledge and provide a "bridge" to real-world practice.

This structured process ensures that all multimedia assets are pedagogically sound, visually consistent with the Digital4Sustainability brand, and optimised for professional learners.

Figure 6. Video screenshot

5.3 Assessment Framework

Defining how to measure the achievement of learning outcomes was a critical milestone in WP3. Following a consortium-wide survey and series of discussions, a strategic agreement was reached on a flexible yet standardized assessment model.

The assessment strategy is tailored to the specific nature of the content and the extent of the learner's participation:

1. **Full Curriculum Assessment (The Capstone Approach):**

   For partners and learners participating in a complete 2.5 ECTS upskilling curriculum, the final assessment will be a Capstone Project. This project requires learners to integrate knowledge from all modules and apply it to a complex, real-world workplace scenario, resulting in a measurable professional deliverable (e.g., a strategy report or a technical design).

2. **Online Curriculum Assessment (IZZI Path):**

   For the two curricula delivered via the IZZI platform (*Digital Sustainability Foundations* and *EU Policy & Legislation*), evaluation is conducted through a Final Examination. This automated exam validates the knowledge acquired across the interactive modules.

3. **Modular Assessment (Single Module Path):**

   Recognising the need for flexible "rapid upskilling," learners who choose to complete only a specific individual module (rather than the full curriculum) will also be evaluated via a Final Examination. This ensures that even bite-sized learning is validated and evidence of achievement is captured.

This dual approach—Capstone Projects for deep integration and Exams for modular or digital paths—ensures that the pilot phase generates robust data for project validation and future certification.

6. Access, Localisation, and the Path to the Ready-to-Use Package

The D3.4 materials are currently available to all consortium partners, piloting organisations, and the general public on the project website. This section describes how the materials are accessed, how they can be adapted for national delivery, and how this deliverable connects to the definitive Ready-to-Use Training Package that will follow the pilot phase.

6.1 Access to the Materials

All D3.4 learning materials are currently available on the Digital4Sustainability project website at https://digital4sustainability.eu/learning-programmes/ . During the WP4 pilot phase, access is open to all consortium partners and piloting organisations. Materials are also publicly accessible to any interested party.

- **IZZI digital modules**: Accessible as embedded interactive content on the project website. No LMS installation required.
- **Blended learning packages**: Available for download as PDF (handbooks, guides), editable PPTX (presentations), and MP4/streamed video. Platform-independent — usable in classrooms, on internal LMS systems, or directly from the website.
- **Pilot phase accessibility:** Materials are provided in editable formats to enable piloting partners to adapt examples, timing, and delivery mode while keeping the Unit Learning Outcomes unchanged.
- **Long-term availability:** The project website will remain active for a minimum of five years after the project's end. Following piloting, the refined D4.3 package will replace these pilot versions as the definitive publication for EU-wide use.

6.2 Localisation

The core materials are produced in English to ensure EU-wide consistency, EQF alignment, and cross-border usability. The project actively encourages and supports localisation. The companion Train-the-Trainer Programme (D3.5) provides detailed guidance with the following key principles:

- Replace generic case studies with local, sector-specific examples relevant to the national economic and regulatory context.
- Adapt the delivery format (online, hybrid, face-to-face) to fit local infrastructure and learner preferences.
- Translate materials into the national language where needed, keeping all Unit Learning Outcomes and assessment criteria unchanged to maintain EQF alignment and the validity of the D3.3 micro-credentialling framework.

Localisation status: Localisation activity will begin during the WP4 pilot phase. All completed localisations will be documented in Deliverable D4.2 (Pilot Results Report).

6.3 The Pathway to the Ready-to-Use Training Package (D4.3)

It is important to understand the relationship between D3.4 and the "'Ready-to-Use" package described in the Grant Agreement. The project's design deliberately separates development from validation:

- D3.4 (WP3, Month 27 — this deliverable): Complete, pilot-ready learning materials. Authored by subject-matter experts, quality-assured through peer review, professionally produced. Ready for piloting.
- WP4 Piloting (Months 27–42): The D3.4 materials are tested in live delivery by consortium partners across Europe. Learner feedback (via standardised questionnaires), trainer observations, and assessment data are collected.
- Task T4.4 Refinement: Based on pilot feedback, the learning resources are refined and adapted — updating case studies, clarifying explanations, adjusting timing, and responding to any content gaps identified.
- D4.3 – Ready-to-Use VET Training Package for EU Rollout (WP4): The refined, validated, and fully packaged version of the materials, published for broad European dissemination and uptake by providers beyond the consortium.

This sequential approach ensures that the materials reaching European VET providers and universities through D4.3 have been genuinely tested and refined with real learners — not simply published on the basis of design intentions alone.

6.4 Design for Sustainability and Future Updates

The D3.4 materials have been designed with long-term relevance in mind. The digital sustainability field evolves rapidly — regulatory frameworks change, new technologies emerge, and best practices are continuously refined. The modular approach ensures that updates can be incorporated without rebuilding entire curricula:

- **Modular structure:** Individual modules can be updated or replaced independently without rebuilding entire curricula. New modules can be added as new topics emerge.
- **Editable formats:** Blended learning materials are available in editable DOCX and PPTX formats, enabling partners to update examples, data, and references.
- **Post-pilot review:** The WP4 piloting feedback will be the primary driver of the first major content revision, informing the D4.3 package. A further content review will be conducted as part of the project's annual steering cycle.

Co-funded by
the European Union

7. Conclusion

Deliverable D3.4 represents a complete transition from "Curriculum Concept" to "Educational Reality." By coordinating the expertise of 29 partners into a unified set of 6 Curricula and a robust Train-the-Trainer framework, we have provided a scalable, "Ready-to-Pilot" ecosystem. This package is now fully equipped to support the pilot phase and serve as a cornerstone for future digital-sustainability training across Europe.

Legal Disclaimer

The European Commission's support to produce this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Project: 101140316 — D4Sustainability — ERASMUS-EDU-2023-PI-ALL-INNO

Co-funded by the European Union