



D5.1: A Framework to Develop an Eco-System for the Acquisition and Issuance of Micro-Credentials

DSW
DIGITAL SKILLS WALLET



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DigitalSkillsWallet

An Eco-System for Acquisition and Assessment of Digital Competence using Micro-Credentials

DELIVERABLE D5.1

A Framework to Develop an Eco-System for the Acquisition and Issuance of Micro-Credentials

Work Package 5 Report

Led by: Mediterranean Management Centre (MMC) — Cyprus

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Executive Summary

This document, Deliverable D5.1 of the DigitalSkillsWallet Erasmus+ project, presents a reusable framework for developing an eco-system for the acquisition and issuance of micro-credentials. It captures the journey of the DigitalSkillsWallet consortium — eight partner organisations across five European countries — which spent 39 months designing, building, and validating a complete digital competence eco-system grounded in the EU Digital Competence Framework for Citizens (DigComp 2.1).

The framework is intended as a practical guide for any education institution, training provider, professional body, employer network, or policy maker wishing to replicate or adapt the approach for a different competence domain. While the DigitalSkillsWallet project used digital skills as its case study, every methodological step, technological design decision, and quality mechanism described here can be transposed to other competence areas — from entrepreneurship (EntreComp) to sustainability (GreenComp), from e-leadership (e-CF) to media literacy (UNESCO MIL).

The document is structured around five core development steps: (1) Analysing a competence framework into Learning Outcomes; (2) Designing a micro-credential taxonomy; (3) Building the digital platform infrastructure; (4) Creating assessment and learning content; and (5) Piloting and scaling the eco-system. For each step, the framework explains what was done, how it was done, what was produced, and what the adopting organisation needs to consider when applying the same approach.

Two sections of the document — Chapter 8 (Best Practices) and Chapter 9 (Obstacles Encountered) highlight points to be taken under consideration to enhance or avoid obstacles in similar ecosystem developments in the future.

At a Glance

Case study competence: DigComp 2.1 — 5 areas, 21 descriptors, 8 proficiency levels

Micro-credentials produced: 168 (all areas, all levels, 4 languages)

Platform modules: 3 (Authoring Tool, MOOC System, Intelligent Agent - AI)

Content for Area 1: 600 assessment questions + 120 bite-sized courses

Pilot validation: 1,000 learners across CY, GR, IT, RO, IE

Framework re-use potential: Any structured competence framework with descriptors and levels

1. Introduction

1.1 Why a Framework?

The development of the DigitalSkillsWallet eco-system required the consortium to navigate complex, interrelated decisions across curriculum design, platform engineering, content production, and evaluation methodology. These decisions were not obvious at the outset; they emerged through practical experience, expert input, iterative testing, and honest reflection on what worked and what did not. The value of capturing this experience in a structured framework lies precisely in making that hard-won knowledge available to others — so that organisations wishing to create similar eco-systems for their own competence domains do not need to start from scratch or repeat avoidable mistakes.

Micro-credentials are a rapidly growing instrument in European education and training policy. The 2022 Council Recommendation on a European Approach to Micro-credentials endorsed four defining characteristics — Learning Outcomes, workload, level, and assessment — and encouraged Member States and institutions to develop micro-credential offerings aligned to qualification frameworks. The DigitalSkillsWallet project was designed from the outset to operationalise precisely this recommendation: building an end-to-end eco-system that takes a learner from zero knowledge of their own competence level through assessment, personalised learning, and formal micro-credential recognition, all within a single, coherent digital environment.

The lessons from this process — including both the practices that proved effective and the obstacles that needed to be overcome — constitute a practical contribution to the EU knowledge base on micro-credential implementation that goes beyond the project's own outputs.

1.2 Scope and Audience

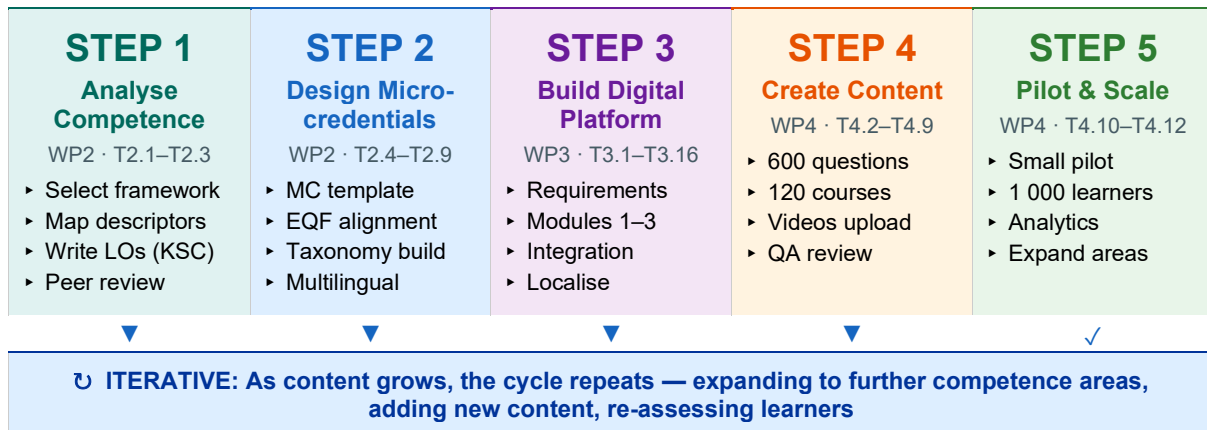
This framework is addressed to four primary audiences. Educators and curriculum designers will find detailed guidance on translating a competence framework into Learning Outcomes and micro-credential specifications. Technology developers and platform architects will benefit from the technical design decisions documented in the platform development chapters. Project managers and institutional leaders will find the process overview and quality assurance mechanisms useful when planning a comparable initiative. Policy makers and funding bodies will find the scalability analysis and sustainability model relevant to decisions about investing in or mandating micro-credential infrastructure.

The document does not assume prior experience of micro-credential design or learning platform development. Each chapter begins with a conceptual orientation before moving to practical guidance. Readers already familiar with specific topics may wish to use the document as a reference rather than reading linearly.

1.3 Structure of the Framework

Chapter 2 provides an orientation to the DigitalSkillsWallet project — its context, consortium, and the concept of the eco-system. Chapters 3 through 7 present the five core development steps in sequence, each aligned to one or more project work packages. Chapter 8 (Best Practices) and Chapter 9 (Obstacles) highlight the key points for enhancement and avoidance during implementation providing valuable input to future efforts on the development of similar ecosystems. Chapter 10 presents guidance on re-configuring the eco-system for other competence areas. Chapter 11 contains conclusions and a call to action for the wider community.

FIGURE 1 — THE 5-STEP ECO-SYSTEM DEVELOPMENT PROCESS



Source: DigitalSkillsWallet Consortium, 2026 | Applicable to any structured competence framework

2. The DigitalSkillsWallet Journey

2.1 Project Context

The DigitalSkillsWallet project (ERASMUS-EDU-2022-PI-FORWARD) was funded under the Erasmus+ KA2 Forward-Looking Cooperation Projects priority, which invites consortia to develop innovative approaches with the potential to be mainstreamed across European education and training systems. The project ran from 2022 to 2026, spanning 44 months in total (with WP6 dissemination activities extending to Month 44 and the WP5 framework finalised at Month 41).

The consortium brought together eight organisations with deliberately complementary profiles: EDITC (Cyprus, coordinator) as a digital innovation company with expertise in platform development, IT training and project management; OMEGATECH (Greece) as a technology-focused organization with expertise in development; UNINETTUNO (Italy) as a research-active distance learning university; UDJG (Romania) as a regional university with strong community engagement; MTU (Ireland) as a higher education institution with qualifications design expertise; DIMITRA (Greece) as a large vocational training network; MMC (Cyprus) as an adult education and VET specialist; and CCS (Cyprus) as the national ICT professional body. No single organisation could have delivered all project components alone; the consortium's collective expertise was essential to the quality and completeness of the outputs.

2.2 The Eco-system Concept

The DigitalSkillsWallet eco-system is best understood as a closed loop rather than a linear pathway. A learner enters the system at the assessment stage, receives a placement on the DigComp proficiency scale, proceeds through personalised learning content, re-assesses, and earns micro-credentials that are stored in their personal Digital Skills Wallet. The process then iterates: as new content is added for additional competence areas, the learner can return to assess further areas, expanding their credential portfolio. It is noted that during the DigitalSkillsWallet Project the partnership developed assessments (and related content) only for the first competence for proof of concept.

This iterative, personalised model contrasts sharply with the traditional model of digital skills training — a single course followed by a pass/fail assessment — and represents a genuine pedagogical innovation. By decoupling assessment from delivery (the platform assesses first, then personalises learning to fill identified gaps), the system respects the learner's existing knowledge rather than requiring them to sit through content they already know. This efficiency is of particular relevance for adult learners and employed professionals who have limited time for training.

For educators, the eco-system provides an authoring environment that is more structured than a blank learning management system: the micro-credential taxonomy acts as a curriculum scaffold, ensuring that all content is mapped to defined Learning Outcomes at specified proficiency levels. This makes content quality more consistent and makes the assessment engine's job tractable — questions can be tagged by the descriptor and level they assess.

2.3 What Was Delivered

The project produced three major categories of output, corresponding to its three central work packages:

- WP2 — Micro-credential Taxonomy: A 1950-page document (D2.1) containing 534 micro-credential units covering all 21 DigComp descriptors across 4 proficiency levels, expressed in Knowledge/Skills/Competences (KSC) format, with EQF alignment and fully translated into Greek, Romanian, and Italian (D2.2). This document is the intellectual backbone of the entire eco-system.

- WP3 — Digital Platform: The DigitalSkillsWallet Platform (D3.1/D3.2) — a three-module web application comprising the Authoring Tool (Module 1), the MOOC System (Module 2), and the Intelligent Assessment System (Module 3). The platform incorporates a personal Digital Skills Wallet for each registered learner and is available in four languages.
- WP4 — Area 1 Content and Pilot: 1668 assessment questions and 130 bite-sized courses for DigComp Competence Area 1 (Information and Data Literacy), uploaded and tested on the live platform. A large-scale pilot targeting 1,000 learners across five countries validated the eco-system and generated the evidence base reported in D4.4. It is noted that the pilot testing is on-going until the end of the project aiming to reach even a higher number.

FIGURE 2 — PROJECT JOURNEY TIMELINE & KEY MILESTONES

Work Package	M1-6	M7-12	M13-18	M19-24	M25-30	M31-36	M37-41	M42-44
WP1 – Management & QA								
WP2 – Micro-credentials								
WP3 – DSW Platform								
WP4 – Content & Pilot (Area 1)								
WP5 – Framework Document								
WP6 – Dissemination & Exploitation								
Key Milestones		MS3: Area 1 prototype		MS4-5: All MCs + multilingual	MS7: Platform EN live	MS8: Multilingual platform	MS12: D4.4 pilot report D5.1: Framework	MS13: Conferences

Total project duration: 44 months | Total investment: approx. €982,000 | 8 partners, 5 countries

3. Step 1: Analysing a Competence Framework into Learning Outcomes

3.1 Why Learning Outcomes Are Central

The entire DigitalSkillsWallet eco-system rests on a foundation of well-written, level-differentiated Learning Outcomes (LOs). If the LOs are vague, inconsistently levelled, or not genuinely measurable, every downstream component is compromised: the micro-credentials lack credibility, the assessment questions cannot be properly targeted, and the personalised learning paths are poorly calibrated. Investing time in getting LOs right at the start — including the internal review and peer feedback cycles — is the single highest-return activity in the whole development process.

A Learning Outcome describes what a learner will know, be able to do, and/or be competent to do at the end of a defined learning experience or assessment. In the KSC format adopted by the DigitalSkillsWallet project, each LO has three components: Knowledge (declarative or procedural understanding), Skills (practical application of knowledge), and Competences (autonomous, responsible exercise of knowledge and skills in complex situations). This tripartite structure mirrors the EQF level descriptor format and ensures alignment with European qualification frameworks.

3.2 Choosing and Understanding the Competence Framework

The first task for any adopter of this methodology is to select and thoroughly understand the competence framework that will underpin the eco-system. The framework should have three features that make it amenable to this approach: it should describe competence at a granular level (individual descriptors or competence statements, not just broad domains); it should provide some indication of proficiency progression (ideally explicit proficiency levels); and it should be publicly available and widely recognised within the target sector.

DigComp 2.1 is exemplary in all three respects. Its 21 descriptors provide precise, distinct competence statements; its 8 levels with explicit cognitive progression descriptors provide a clear scaffolding for LO development; and its status as the de facto EU standard for digital competence ensures that credentials based on it will be understood by employers, educators, and policy makers across Europe. When considering other frameworks, adopters should assess: Is there an official or widely accepted version of the framework? Are the proficiency levels described with sufficient detail to differentiate LOs between levels? Are there existing examples of knowledge, skills, and attitudes that can seed the LO drafting process?

A key insight that emerged during the consortium's analysis of DigComp was the sheer breadth of competences covered by the framework—an aspect that had been underestimated at proposal stage. As the work progressed, it became clear that the scope of digital skills addressed by DigComp was far wider than initially anticipated. Fortunately, the consortium had already identified in the project application that, for proof-of-concept purposes, the development of assessments and training materials would focus on Competence Area 1. Even so, developing the Learning Outcomes for all competences remained a demanding task. This is reflected in the scale of the output: what had originally been expected to result in a document of around 150 pages ultimately became a 1,950-page taxonomy analysing all competences into detailed Learning Outcomes.

3.3 The Prototype Approach

The DigitalSkillsWallet consortium adopted a prototype-then-scale approach that proved highly effective. Rather than attempting to write Learning Outcomes for all 21 descriptors simultaneously, the team focused intensively on the three descriptors within Competence Area 1, using this as a methodological laboratory that could be peer reviewed, revised, and validated before wider application. This phased approach enabled the consortium to refine its methodology on a

manageable scale while establishing a solid foundation for future expansion. The partnership intends to seek further funding to extend the development to the remaining competences.

This approach has several advantages. It concentrates collective learning on a manageable dataset. It produces a concrete reference example that all partners can consult when drafting content for other areas. It allows methodological problems to be identified and resolved before they are replicated across hundreds of LO statements. And it generates a shared vocabulary and set of quality norms that reduce inconsistency when work is distributed across multiple partners. We strongly recommend adopters follow the same pattern, regardless of the total size of their competence framework.

3.4 Writing Learning Outcomes: A Step-by-Step Guide

Step 1 — Assemble a small, skilled drafting team. LO writing requires both subject matter expertise (understanding the competence) and writing skills (translating that expertise into clear, measurable statements). Assign each descriptor cluster to a team of two or three people who have relevant expertise, and ensure at least one team member has experience with qualification design.

Step 2 — Study the framework's examples. Most structured frameworks include illustrative examples of knowledge, skills, and attitudes at each proficiency level. Use these as primary source material, but do not simply transcribe them — the examples are illustrations, not LOs. They need to be transformed into precise, verb-driven statements that specify what the learner can do, not just what the competence involves.

Step 3 — Apply the verb taxonomy. Select action verbs appropriate to the cognitive complexity of each proficiency level. Use a reference grid (see below) to ensure consistency across your team. The most common error at this stage is using advanced-level verbs (evaluate, design, innovate) for Foundation-level LOs, which makes assessment impossible.

Proficiency Level	Recommended Action Verbs (indicative)
Level 1–2 (Foundation)	identify, recall, recognise, name, list, locate, navigate (with guidance), follow step-by-step instructions
Level 3–4 (Intermediate)	use, apply, describe, explain, demonstrate, select, distinguish, organise, solve (familiar problems)
Level 5–6 (Advanced)	evaluate, analyse, adapt, justify, compare, design (solutions), synthesise, manage, advise others
Level 7–8 (Highly Specialised)	create, innovate, lead, develop novel approaches, contribute to field knowledge, mentor, strategise

Step 4 — Write the KSC triple for each descriptor at each level. The Knowledge statement should complete: "The learner can recall/explain/synthesise..."; the Skills statement: "The learner can use/apply/design..."; the Competences statement: "The learner can autonomously/responsibly/innovatively...". Keep each statement to one or two sentences; avoid multi-part LOs that combine distinct competences.

Step 5 — Peer review using a structured rubric. Circulate each LO to reviewers not involved in drafting. Ask them to assess: Is the verb appropriate for the level? Are the three KSC components genuinely distinct? Is the statement measurable (could an assessor definitively judge whether a learner has achieved it)? Is it specific to the competence domain rather than generic? Provide a two-round review cycle — initial feedback and revised version review.

3.5 Common Pitfalls and How to Avoid Them

- Verb mismatch: Using a higher-level verb at a lower level (e.g., "evaluate" at Level 2) makes the LO unachievable and assessment criteria impossible to write. Use the verb taxonomy consistently.
- KSC overlap: Writing Knowledge and Skills components that say essentially the same thing in different words. The Knowledge component should describe understanding; the Skills component should describe doing. If they look the same, one is redundant.
- Generic language: Writing LOs that could apply to any field ("The learner can communicate clearly") rather than being specific to the competence area ("The learner can share data files using appropriate collaboration platforms, applying correct access permissions").
- Level compression: Writing LOs for adjacent levels (e.g., Level 3 and Level 4) that are barely distinguishable. If you cannot articulate what is meaningfully different between two adjacent levels, they may need to be merged or one may need a more ambitious cognitive demand. It is noted that in the DigitalSkillsWallet the partnership has merged Level 1 & Level 2 into one Level, Foundation, Level 3 and 4 into Intermediate, Level 5 and 6 Advanced and Level 7 and 8 into Expert.
- Quantity before quality: Rushing through LO drafting to complete all descriptors before the prototype has been validated is one of the most effective ways to propagate errors across the entire document. Finish the prototype, refine it thoroughly, and then scale. In the DigitalSkillsWallet project, this challenge was encountered because the deliverable covering the analysis of the five competence areas had to be completed before the prototype phase was finalised.

4. Step 2: Designing the Micro-credential Taxonomy

4.1 What Is a Micro-credential?

A micro-credential is a documented record of the learning outcomes achieved following a short learning experience. In the DigitalSkillsWallet context, each micro-credential corresponds to one DigComp descriptor at one proficiency level: a learner who achieves the Level 3 standard on descriptor 1.1 (Browsing, Searching and Filtering) has earned a specific micro-credential for that descriptor-level combination, which is stored in their wallet and verifiable by any interested party.

The 2022 Council Recommendation defines four essential elements of a micro-credential: (1) the Learning Outcomes that the credential certifies; (2) the volume of learning required to achieve them (expressed as notional hours); (3) the level within a recognised qualification framework; and (4) the assessment method used to verify achievement. The DigitalSkillsWallet micro-credential specification includes all four of these elements, plus: the credential title; the competence framework and descriptor it maps to; assessment criteria; a digital badge specification; and a unique identifier linking to the issuing institution's verification infrastructure.

4.2 The Micro-credential Specification Template

Each micro-credential unit in the DigitalSkillsWallet taxonomy was designed using a standard template developed by MTU (Ireland) and refined through the WP2 peer review process. Adopters of this framework are invited to use the same template, adapting the competence framework fields to their chosen domain. The key fields are:

- **Basic Information**
 - Identification of the learner
 - Title and code of the micro-credential
 - Country(ies)/Region(s) of the issuer
 - Awarding body(ies)
 - Date of issuing
 - Notional workload needed to achieve the learning outcomes-
 - Level of the learning experience leading to the micro-credential
 - Type of assessment
 - Form of participation in the learning activity
 - Type of quality assurance used to underpin the micro-credential
- **Learning Outcomes**
- **Description**
- **Questions**

4.3 Building the Taxonomy: Scale and Structure

Once the prototype micro-credentials are completed and validated, scaling the taxonomy to additional competence areas or descriptors follows the same process. The key structural decision is how to organise the taxonomy for both human readability and machine processability: the taxonomy should be stored in a format that can be imported into the platform's admin panel (typically JSON or CSV with defined field names) as well as presented in a human-readable document.

The DigitalSkillsWallet taxonomy for DigComp 2.1 comprises 534 micro-credentials covering (21 descriptors and 4 levels). Adopters working with smaller frameworks may have significantly fewer units; those working with larger or multi-domain frameworks may have more. The critical design principle is completeness: every descriptor at every level in the target framework should have a

corresponding micro-credential specification before the platform is populated, otherwise the assessment engine cannot generate coherent learning paths across the full proficiency range.

4.4 EQF and National Qualification Framework Alignment

One of the most policy-significant features of the DigitalSkillsWallet micro-credential design is its explicit alignment to the European Qualifications Framework (EQF). By mapping DigComp proficiency levels to EQF levels, the project creates a bridge between digital competence micro-credentials and the formal qualification system: a learner who holds Level 6 micro-credentials across multiple DigComp descriptors has evidence of competences aligned to EQF Level 6 (equivalent to a Bachelor's degree level of autonomy and complexity).

This alignment is advisory rather than formal — it does not grant EQF-level qualifications — but it provides employers and education institutions with a meaningful context for understanding what a Digital Skills Wallet credential represents. Adopters should engage their national NQF authority early in the design process to explore whether a similar alignment can be established for their target competence area, ideally with formal endorsement.

4.5 Multilingual Design

The micro-credential taxonomy was translated into Greek, Romanian, and Italian (in addition to English) as part of WP2. This decision reflected the practical necessity of making the platform accessible to learners in all partner countries, and the pedagogical principle that assessment in one's first language is more valid for lower-proficiency learners. Adopters should consider language provision early in the design phase: translation of LO statements is not a mechanical task and requires expert review to ensure that action verbs retain their intended cognitive meaning in the target language. Budget accordingly — professional translation of a technical document is a significant cost item.

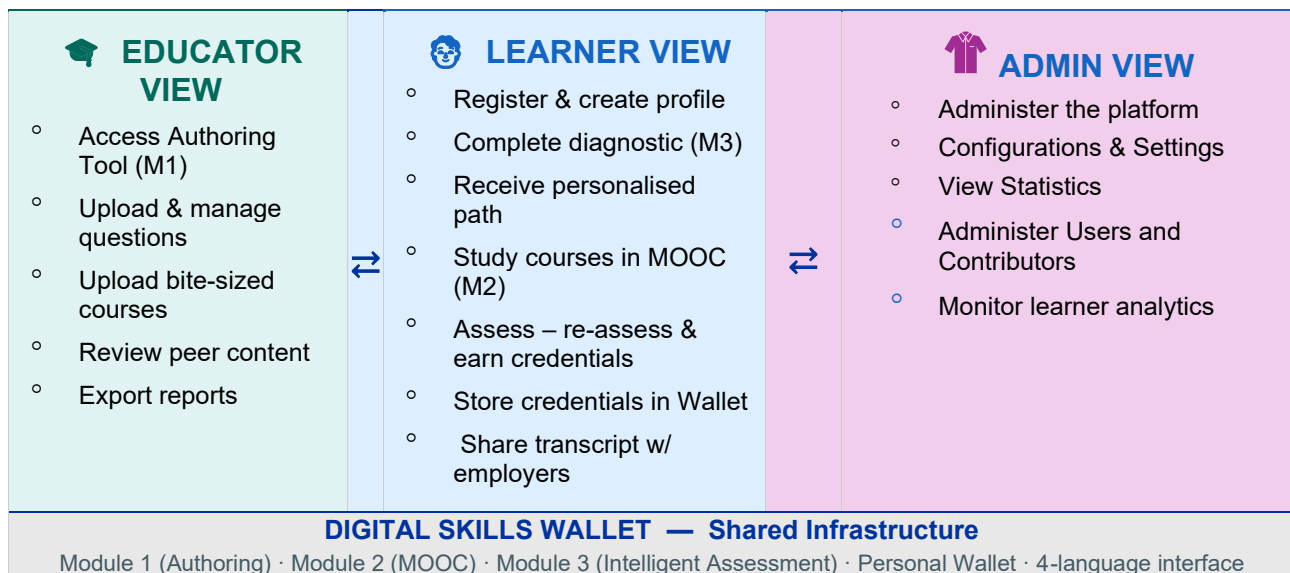
5. Step 3: Building the Digital Platform

5.1 Architecture Overview

The DigitalSkillsWallet Platform was designed as a three-module system serving two distinct user groups: educators (who create and peer review content – in the DSW platform they have the role of contributors) and learners (who consume content and earn microcredentials). The three modules are architecturally independent but share a common database, authentication system, enabling seamless user experience across the full learning cycle.

Module 1 (Authoring Tool) serves educators: it is the environment through which assessment questions and bite-sized courses are created, uploaded, tagged, and managed. Module 2 (MOOC System) serves learners: it delivers courses in a self-paced online environment. Module 3 (Intelligent Assessment System) serves learners: it administers the adaptive diagnostic assessment, generates personalised learning paths. The Digital Skills Wallet is a layer that spans all three modules, recording each learner's credential achievements as they are earned.

FIGURE 3 — PLATFORM ECO-SYSTEM: EDUCATOR & LEARNER PERSPECTIVES



5.2 Requirements and Technology Stack

The platform was built as a standard three-tier web application (presentation layer / application logic layer / database layer) with a RESTful API enabling future integration with third-party systems. Key technology decisions included: a cloud-hosted deployment (enabling scalability for large pilot numbers without on-premise infrastructure investment); self registration and authentication system; SCORM 1.2, SCORM 2004 and MP4 compliance (ensuring compatibility with content created in any standard authoring tool); and W3C Verifiable Credentials for the Digital Skills Wallet (ensuring that issued credentials can be verified by any relying party without checking back with the issuing platform).

Adopters building a new platform based on this framework should prioritise standards compliance over bespoke solutions wherever possible. SCORM compliance for the MOOC module, for example, allows content creators to use any authoring tool they prefer (Articulate, iSpring, Adobe Captivate, H5P, or any tool that allows creation of MP4 content) without being locked into a specific software

vendor. W3C Verifiable Credentials future-proofs the wallet against changes in the broader credentials ecosystem.

5.3 The Assessment Engine and AI Assistant – Personalized Learning Path

The most technically complex component of the platform is the adaptive assessment engine in Module 3. Rather than following a linear path of acquiring micro-credentials, the engine uses AI to estimate the learner's current ability level in real time and suggests the next micro-credentials the learner should attempt based on the learner's current status (assessments achieved/failed) maximizing the learner's motivation to keep learning and acquiring MCs. that maximise the information gain at that estimated level. This approach produces an achievable learning path — a significant advantage for learner engagement.

Beyond the assessment Engine, the AI assistant can help the learner choose among the mcs based on difficulty, topic or ask to suggest the next MC based on the learner's progress.

5.4 Guide for Educators: Using the Platform

5.4.1 Why Use DigitalSkillsWallet?

DigitalSkillsWallet provides educators with a structured, standards-aligned environment for creating and delivering digital competence assessment and learning. Unlike a general-purpose learning management system, the platform is purpose-built around the micro-credential taxonomy: every piece of content is linked to a specific descriptor and proficiency level, every assessment question is mapped to a Learning Outcome, and every learner's progress is tracked against the full DigComp framework. This means that the data generated by learner activity is pedagogically meaningful — it tells you not just whether learners completed content, but whether they are achieving proficiency at specific levels of the competence framework.

5.4.2 Access Requirements for Educators

To access the Authoring Tool as a content creator, an organisation must: (1) register as an institutional partner via the platform administrator (EDITC); (2) have at least one designated content co-ordinator who has completed the Guide for Content Creators orientation (D4.1); (3) accept the platform's content quality standards and GDPR-compliant data processing terms; and (4) agree to the peer review workflow (all uploaded content is reviewed by one other partner before being made live).

Individual educator accounts within an institution are created by the institutional co-ordinator. Educators log in using their institutional email address and are assigned permissions corresponding to their role (content creator / reviewer / administrator). A self-paced orientation tour is built into the platform interface, taking approximately 20 minutes.

5.4.3 Privacy and Ethics of the DSW Platform

The platform processes two categories of personal data: registration and profile data (name, email, organisation, language preference, declared target competence level) and learning activity data (question responses, course completion records, assessment scores, credential issuance events). Both categories are processed in compliance with GDPR. Data is stored on EU-based servers, pseudonymised at rest, and retained only for the period necessary for the educational and research purpose for which it was collected.

Learners have the right to: access a copy of all their personal data; correct inaccurate data; request deletion of their data (which triggers credential revocation from the wallet); export their credential data in standard formats; and object to research use of anonymised data. These rights are exercised

through the learner's account settings panel. Educators do not have access to individual learner response data from other institutions; they can only see aggregated analytics for their own cohort.

5.4.4 Using the Authoring Tool — Key Workflows

Creating a question: Navigate to Authoring Tool → Question Bank → Create New Question. Select the Competence Area, Descriptor, and Proficiency Level from the dropdown menus (populated from the MC taxonomy). Select the Question Type (multiple choice, true/false, matching, ordering, or drag-and-drop). Enter question text, answer options, correct answer indication, and explanatory feedback for each option. Select a Difficulty rating (1–5 within the assigned level). Submit for peer review. Questions enter a review queue and are visible to designated reviewers at other partner organisations.

Creating a course: Navigate to Authoring Tool → Course Library → Create New Course. Assign the course to a Competence Area, Descriptor, and Proficiency Level. Use the rapid course builder to add content blocks (text, image, embedded video, H5P interactive, multiple choice activity) or upload a SCORM package. Set estimated completion time. Add a short description for the course catalogue. Submit for peer review.

5.4.5 Quality Control Mechanisms

All content undergoes a two-stage quality assurance process before being made available to learners. Both stages consist of peer review: a reviewer assesses the content against the quality rubric (alignment, measurability, level-appropriateness, accessibility, and language accuracy) and then either approves it, requests revisions, or rejects it. Only content that successfully passes both review stages is published in the live course catalogue and question bank.

6. Step 4: Developing Assessment Content and Bite-Sized Courses

6.1 The Content Creation Philosophy

The DigitalSkillsWallet content creation philosophy rests on two principles: content must be mapped and content must be current. Every question and every course must be explicitly linked to a specific Learning Outcome, with no orphaned content that simply fills space. And every course must cover the needed content to achieve the LOs in a micro-credential. These principles were operationalised through the Guide for Content Creators (D4.1) and the peer review rubric, both of which used them as primary quality criteria.

Content for Area 1 was produced collaboratively across all eight partner organisations over approximately eight months (Tasks T4.3–T4.9, Months 24–34). The workload was distributed by descriptor-level cluster, with each partner contributing questions and courses for the areas where their subject matter expertise was strongest. Coordination was managed by UDJG through a shared content planning tracker that ensured no cluster was over- or under-resourced and that quality standards were applied consistently.

6.2 Assessment Question Design Principles

Well-designed assessment questions for competence-based micro-credentials share several characteristics that distinguish them from general knowledge tests. They are anchored in the Learning Outcome: the question stem presents a realistic scenario or task that requires the learner to exercise the specific knowledge, skill, or competence described in the LO, not merely recall a fact. They discriminate clearly: the correct answer is correct because the competent learner would choose it; the distractors are plausible but incorrect because they reflect specific, identifiable misconceptions or errors.

6.3 Bite-sized Course Design Principles

The bite-sized course format — three to five minutes of learning content addressing one specific aspect of a descriptor at one proficiency level — is a deliberate design constraint that serves multiple purposes. It makes content creation manageable: a skilled educator can draft, test, and finalise a five-minute course in a day. It makes learning flexible: a learner can complete one course during a lunch break or commute. It also makes the adaptive pathway more granular: with the AI use to take into account the micro-credentials already achieved, the system can generate a more individualised learning path that empowers and motivates the learner to progress in a structured and achievable way.

The three-part structure adopted for all DigitalSkillsWallet courses — framing (context), learning, and consolidation (individualized learning path - next steps) — ensures a consistent learner experience across the platform regardless of which partner authored each course. Consistency of structure reduces the cognitive overhead for learners navigating the library and makes peer review more straightforward (reviewers know what to look for in each part of the course).

6.4 Course creation and Upload

All courses are delivered as Videos. Although SCORM is also supported we chose mp4 as a standardized format that allowed us to use storage capabilities of youtube, enabling all educators to contribute (SCORM like tools are not widely known to the teachers/ trainers community).

6.5 Content Volume Planning

The DigitalSkillsWallet project targeted 600 questions and 120 courses for a single competence area (Area 1, three descriptors, eight levels) although we exceeded these numbers due to the wide range of the competence (1668 questions and 130 courses were developed). This translates to approximately 25 questions and 5 courses per descriptor per level. Adopters should use these figures as a minimum rather than a target: below 20 questions per descriptor-level combination, the adaptive assessment engine has insufficient items to run multiple test sessions for the same learner without question repetition (which degrades measurement accuracy). Above 40 questions per combination, the marginal return on additional content diminishes significantly.

The time required to produce 1668 questions and 130 courses (in 4 languages, a total of 520 courses) across eight partner organisations over eight months was substantial but manageable. Based on project experience, a single content creator working to the quality standard required can produce approximately 5–8 questions per hour and 1 course per working day. Teams should budget accordingly and build in a 20% contingency for the revision cycles that peer review will generate.

7. Step 5: Piloting and Scaling the Eco-system

7.1 The Case for Piloting

A digital eco-system of this complexity — involving three integrated software modules, hundreds of content items authored by multiple teams, an adaptive assessment engine, and a multilingual interface — will always contain issues that cannot be identified through internal testing alone. Learners use systems in unexpected ways; content that appears clear to its authors can confuse real users; technical issues that are invisible in controlled test environments emerge under real load. A structured pilot is therefore not optional — it is an essential quality gate before the system goes live with a general audience.

The DigitalSkillsWallet project ran two pilots in sequence: an internal small-scale pilot (T4.10, 40 participants recruited from partner organisations) followed by a large-scale open pilot (T4.12, 1,047 learners from the general population across five countries). The small-scale pilot was primarily diagnostic — it identified and documented issues for correction. The large-scale pilot was primarily evaluative — it generated evidence of effectiveness, usability, and reach at the scale required to validate the eco-system as a proof of concept.

7.2 Designing the Pilot

A well-designed pilot answers specific questions rather than simply observing what happens. Before launching the small-scale pilot, UDJG as WP4 lead defined four evaluation questions: (1) Does the platform function reliably across browsers and devices? (2) Do learners understand how to navigate the system and complete the full learning cycle without assistance? (3) Do assessment questions perform as intended (appropriate difficulty, unambiguous wording)? (4) Do courses meet the learning experience quality standard (correct level, format, appropriate length)?

These questions were operationalised through a systematic feedback loop between partners aiming to address UI/UX shortages, course content, questions clarity and platform's robustness. Feedback was reviewed by the WP leader and the coordinator and any issues were resolved. These feedback loops allowed for a multi-perspective view of the system's performance and content.

7.3 Recruitment for Large-Scale Pilots

Reaching 1,000 genuinely diverse learners — across age groups, digital skill levels, employment statuses, and national contexts — is a significant logistical undertaking. The DigitalSkillsWallet consortium drew on several recruitment channels: partner organisation networks (staff, students, alumni, clients); paid social media advertising; referrals from stakeholder organisations engaged through T6.5; and integration with national digital skills initiatives where partners had existing relationships with trainees engaged in digital upskilling courses and other non-ICT related VET trainings

Key lessons from the recruitment phase: set a realistic timeline allow 6–8 weeks for enrolment before the active pilot window opens; diversify your channels and do not rely on a single partner's network to reach the full target; offer a light induction before accessing the platform (EDITC used a 15 min induction during their trainings to offer explanation and guidance on the use of the DSW platform); and communicate clearly what the pilot involves and what learners will gain (the micro-credential incentive was the single most effective recruitment message).

7.4 Measuring Impact and Learning Effectiveness

The large-scale pilot, once completed will generate important evidence about the platform's usability (ease of navigation), learning materials offering helpful information on achieving relevant micro-credential, how well DSW supports effective learning and how AI helps with suggestion on the learning path. The pilots are ongoing officially until the end of June but will continue until the end of the project and beyond.

These findings should be interpreted as promising rather than conclusive: the absence of a control group means that some portion of the observed gains could reflect practice effects or external learning between assessment sessions.

7.5 From Pilot to Mainstreaming

The transition from a time-limited funded pilot to a sustainable mainstream service requires attention to three dimensions: institutional sustainability (which organisation will host, maintain, and develop the platform beyond the project?); financial sustainability (how will ongoing costs be met?); and content sustainability (who will create new content and maintain existing content as the framework and technology evolve?). The DigitalSkillsWallet project has addressed all three: EDITC has committed to platform hosting and maintenance for a minimum of three years post-project; a freemium revenue model (free individual access) is being developed; and a content governance framework defines how new partner organisations can be onboarded as content contributors. Adopters should address these dimensions before the pilot phase concludes, not after.

8. Best Practices

This chapter documents the most effective practices identified by the DigitalSkillsWallet consortium during the project. It will be completed through the T5.1 brainstorming session involving all eight partner organisations. Each best practice entry should include: the practice itself (what was done); the context (when and why it arose); the evidence of effectiveness (how we know it worked); and transferability guidance (how other organisations can adopt it).

Best Practice 1: Developing a Prototype

In DigitalSkillsWallet, the consortium chose to develop a full prototype for only one competence area. This proved to be a highly effective approach, as it allowed the partnership to concentrate on validating the platform's functionality, testing the peer review workflow, and assuring the quality of the assessment and learning content within a manageable scope.

Best Practice 2: Developing Content for only one competence Area

While the Learning Outcomes — which form the backbone of the content architecture — were developed for all five DigComp competence areas, the actual assessment and course content was produced only for Competence Area 1. Attempting to develop full content for all five areas simultaneously would have introduced significant complexity and made the overall workload difficult to manage. Given the breadth of the DigComp framework, even a single competence area represented a substantial development effort. This phased approach is therefore highly relevant for future initiatives seeking to build similar platforms.

Best Practice 3: Designing the Platform for Transferability Across Frameworks

A further best practice lies in the platform's deliberate design for transferability. The DSW platform was developed so that it can be adapted to other competence domains based on different frameworks without requiring fundamental structural changes. Once the relevant Learning Outcomes are integrated and the corresponding assessment questions and learning content are uploaded, the platform can support a new competence area while retaining the same underlying architecture and workflow. This makes the model particularly valuable for future initiatives seeking to apply the DigitalSkillsWallet approach beyond DigComp.

Best Practice 4: Embedding a Structured Peer Review Workflow

A key best practice in the DigitalSkillsWallet platform is the integration of a structured peer review workflow for all assessment questions and bite-sized courses. Contributors can create and store content in their personal repository within the platform, where they may view, edit, or delete items at any time before submission.

Before content can be published and made available for learner use, each question or course must pass through a peer review process. Once submitted, the item is routed to other registered contributors for review. Reviewers assess its quality, accuracy, clarity, and alignment with the relevant Learning Outcome, and provide feedback where revisions are needed. The workflow 3 steps are:

- The question or course is submitted for review by other registered contributors.
- Reviewers assess its quality, accuracy, clarity, and alignment with the selected Learning Outcome.
- Feedback is provided and, where necessary, the contributor revises and resubmits the content.

Once approved, the question or course becomes active and can be used within personalised assessments and learning pathways linked to the relevant micro-credential.

This workflow helps maintain consistent quality standards, strengthens content reliability, and ensures that both questions and courses are aligned with the pedagogical and technical requirements of the platform.

Best Practice 5: Reducing Entry Barriers by Allowing Assessment Before Registration

One particularly effective practice in the DigitalSkillsWallet platform is the option for users to begin an assessment without creating an account in advance. This feature lowers the psychological and practical barriers that often discourage first-time users from engaging with a new digital platform. Rather than requiring an immediate commitment through registration, the system allows prospective learners to experience the platform's value first-hand by exploring the assessment process and gaining an initial sense of their digital competence level.

From a user engagement perspective, this approach functions as a low-threshold entry point into the ecosystem. It helps attract participants who may be hesitant to register before understanding what the platform offers, and it supports wider outreach during piloting, dissemination, and exploitation activities. Once users recognise the relevance of the assessment and the personalised learning opportunities it can unlock, they are more likely to proceed with registration in order to save results, access learning pathways, and begin working towards micro-credentials.

As a best practice, this design choice illustrates the importance of learner-centred onboarding. For future initiatives developing comparable platforms, offering limited pre-registration access can be an effective strategy for increasing initial participation, building trust in the system, and improving conversion from casual visitors to active registered users.

Best Practice 6: Using AI to Recommend Personalised Learning Pathways

A particularly significant best practice in the DigitalSkillsWallet platform is the use of AI to recommend personalised learning pathways based on each learner's assessment results and previously achieved micro-credentials. Rather than directing all learners through the same sequence of courses, the system uses the evidence already available in the learner's profile to identify likely gaps, suggest the most relevant next steps, and avoid unnecessary repetition of content that has already been mastered.

This approach strengthens both efficiency and learner motivation. From an educational perspective, it supports a more targeted and adaptive model of progression, in which learners are guided towards content that is appropriate to their demonstrated competence level. From the learner's perspective, it creates a stronger sense of relevance and personalisation: the platform does not simply deliver generic training, but offers a pathway that responds to individual performance and evolving achievements within the Digital Skills Wallet.

As a best practice, this design choice demonstrates the value of combining assessment, credential records, and intelligent recommendation within a single ecosystem. For future initiatives developing comparable competence platforms, AI-supported pathway suggestion can enhance learner retention, improve the relevance of learning recommendations, and make large-scale personalised guidance feasible without requiring continuous manual tutoring. Its value is particularly strong in systems intended to support lifelong learning, micro-credential accumulation, and progression across multiple competence areas over time.

9. Obstacles Encountered

This chapter documents the significant obstacles and challenges encountered by the DigitalSkillsWallet consortium during the project, and how they were addressed. It will be completed through the T5.1 brainstorming session. Each obstacle entry should include: the obstacle description; the phase and work package where it arose; the impact (on timeline, quality, or scope); the resolution adopted; and the recommendation for future projects facing the same issue.

Obstacle 1: The Breadth of the DigComp Competence Areas

A major challenge encountered from the outset was the sheer breadth of the DigComp framework. During the proposal stage, the volume of Learning Outcomes required to analyse all competence areas in sufficient depth had been underestimated. As implementation progressed, it became clear that the framework was far too extensive to be fully operationalised — in terms of Learning Outcomes, assessment questions, and bite-sized courses — within a single project cycle.

The consortium mitigated this risk by having already limited full assessment and content development to Competence Area 1 for proof-of-concept purposes. Even with this restriction, however, the workload remained substantial, confirming that future initiatives should not assume that a broad competence framework can be fully covered within one standard Erasmus+ project. The key lesson is that framework selection must be accompanied by a realistic scoping exercise and a phased development plan from the very beginning.

Obstacle 2: The Complexity of the Eight-Level DigComp Progression

A second methodological difficulty concerned the eight proficiency levels of DigComp. Although the framework's level structure is conceptually rich, operationalising all eight levels for Learning Outcomes, assessment design, and course development proved highly demanding. In practice, distinguishing meaningfully between adjacent levels was not always straightforward, particularly when designing measurable outcomes and content that could be reliably differentiated by educators and understood by learners.

To make the system more manageable and pedagogically coherent, the consortium consolidated the eight DigComp levels into four broader stages: Foundation, Intermediate, Advanced, and Expert. This simplification reduced complexity in LO drafting, improved the usability of the platform for learners and educators, and created a clearer basis for content planning and credential progression. Future adopters should carefully assess whether the full level granularity of a framework is necessary for their purposes or whether a grouped model would provide a more workable solution.

Obstacle 3: Linear Deliverable Structures Limited Agile Development

A further obstacle arose from the linear structure of project deliverables. The project needed to submit formal outputs to the EACEA platform according to predefined deadlines, which encouraged a waterfall-style progression from one work package to the next. In practice, however, the development of a competence

eco-system of this kind benefits from a far more iterative and agile methodology, in which platform development, content creation, testing, and revision continuously inform one another.

This created tension between administrative reporting requirements and the practical need to refine outputs progressively. The experience suggests that future projects of this nature should design internal workflows that preserve agility even when external reporting remains linear. Wherever possible, consortia should treat formal deliverables as snapshots of an evolving process rather than as fixed end-points that limit revision and improvement.

Obstacle 4: SCORM Hosting and Content Production Constraints

The choice of content format also presented important practical constraints. While SCORM offers strong interoperability and tracking capabilities, it produces significantly heavier files than standard video formats and therefore places greater demands on hosting, storage, and large-scale delivery. Unlike video files, which can be hosted externally on widely available platforms such as YouTube, SCORM packages typically need to be hosted and managed within the project's own technical infrastructure.

A related challenge was that many educators and trainers were not familiar with SCORM authoring tools, which limited the feasibility of expecting widespread SCORM-based course production as the DSW platform moves towards long-term sustainability and broader community use. For this reason, the project adopted MP4 video as the main delivery format for bite-sized courses, as it was easier for contributors to produce and simpler to distribute through external hosting services. The broader lesson is that technical design decisions must take into account not only standards and functionality, but also the realistic digital production capacity of the educator community involved.

10. Re-configuring the Eco-system for Other Competence Areas

10.1 The Transferability Principle

Every component of the DigitalSkillsWallet eco-system was designed with transferability in mind. The micro-credential template is not DigComp-specific — it is a general KSC/EQF-aligned specification format that can be used for any competence framework. The platform's content taxonomy is configured through an admin panel, not hard-coded — a new framework can be loaded without modifying the underlying software. The assessment engine operates on whatever question bank is provided — it does not "know" that the current content is about digital skills. And the Guide for Content Creators describes a generic content design methodology, not a DigComp-specific one.

This transferability is not accidental. It reflects a deliberate architectural philosophy: build once, configure many times. The DigitalSkillsWallet platform should be understood as a competence eco-system engine, not a digital skills application. The DigComp content is the first configuration of that engine. Future configurations for EntreComp, GreenComp or any other structured competence framework require only new content and taxonomy data, not new software.

10.2 Transferability Roadmap

Organisations wishing to adopt the DigitalSkillsWallet methodology for a different competence area should proceed through the same five steps described in this framework, with the following adaptations:

- **Step 1 (Analyse):** Identify your target competence framework and assess its suitability using the criteria in Chapter 3.2. If the framework lacks explicit proficiency levels, you will need to develop your own level progression — a significant additional effort. If it lacks KSC-format examples, the LO drafting team will need stronger subject matter expertise to seed the work.
- **Step 2 (Design MCs):** Use the DigitalSkillsWallet MC template directly. Adapt the EQF alignment if your target competence area maps more naturally to vocational (EQF 3–5) or professional (EQF 5–8) levels. Engage your national NQF authority early for endorsement.
- **Step 3 (Platform):** If using the existing DigitalSkillsWallet platform, contact EDITC to discuss institutional access and taxonomy configuration.
- **Step 4 (Content):** Use the Guide for Content Creators (D4.1) directly — it is written as a generic guide, not a DigComp-specific one. Adapt the example questions and courses to your competence domain. Budget as per the content volume guidelines in Chapter 6.5.
- **Step 5 (Pilot):** Follow the pilot design methodology in Chapter 7. Adapt the evaluation instruments (SUS, learning experience survey) as needed for your context.

FIGURE 4 — TRANSFERABILITY TO OTHER COMPETENCE AREAS

Adaptation Question	Guidance
Which competence framework?	Any structured framework with descriptors, levels and examples (DigComp, EntreComp, LifeComp, GreenComp...)
How many descriptors?	Any number; start with 3–5 as prototype before scaling. Fewer descriptors = faster first cycle.
How many proficiency levels?	Adapt to the framework. 3–4 levels work well. Ensure clear verb differentiation between levels.

What content volume?	Target minimum 40 questions and 5 courses per descriptor per level for a statistically valid assessment.
Can the platform be re-used?	Yes. Module 1 is content-agnostic. Reconfigure descriptor taxonomy in admin panel; no code changes needed for new areas.
What languages are needed?	Translate the MC document and platform interface; Courses can be re-authored or subtitled.

Compatible frameworks: DigComp · EntreComp · LifeComp · GreenComp

10.3 Framework Compatibility Assessment

Not all competence frameworks are equally amenable to this methodology. The DigComp 2.1 & 2.2 framework is particularly well-suited because of its granular descriptor structure and explicit eight-level progression. Other frameworks require more adaptation. The following assessment criteria can help potential adopters evaluate their chosen framework's readiness:

Assessment Criterion	What to Look For
Granularity	Does the framework have discrete, distinct competence descriptors (not just broad domain labels)? Minimum 3, recommended 5–25 for a usable content taxonomy.
Level differentiation	Does the framework provide explicit proficiency levels with qualitative descriptors? At least 3 levels are needed; 5–8 is optimal for granular personalisation.
KSC compatibility	Does the framework describe competences in terms of knowledge, skills, and/or competences/attitudes? If yes, LO drafting is straightforward. If not, additional conceptual work is needed.
Public availability	Is the framework publicly available and freely licensed? Commercially restricted frameworks create IP complications for content distribution.
Sector recognition	Is the framework recognised by employers, education institutions, or policy bodies in your target sector? Recognition is what makes the micro-credentials valuable to earners.

11. Conclusions and Call to Action

11.1 What This Framework Demonstrates

The DigitalSkillsWallet project has demonstrated that it is feasible, within a 39-month collaborative project involving eight organisations and a budget of approximately €970,000, to build a complete, validated eco-system for micro-credential acquisition and issuance that: is grounded in a widely recognised competence framework; produces high-quality, EQF-aligned micro-credential specifications; delivers personalised assessment and learning through an integrated digital platform; and generates evidence of learning effectiveness at scale through a large-scale pilot.

This is not a trivial achievement. It required sustained consortium commitment, significant methodological investment at the LO-writing stage, disciplined quality assurance throughout content development, and technically ambitious platform engineering. But the costs are not prohibitive — they are comparable to other Erasmus+ strategic partnership investments — and the outputs are far more comprehensive and sustainable than a typical training course or study material deliverable.

11.2 The Opportunity for Other Sectors

The five competence areas of DigComp represent only a fraction of the competence development needs facing European citizens and workers. EntreComp (entrepreneurship), GreenComp (sustainability), LifeComp (personal and social competences), and dozens of sector-specific competence frameworks all represent potential domains for eco-systems built on this model. Each would require its own consortium, its own content development effort, and its own sector-specific engagement strategy — but none would need to start from scratch on the methodology, the platform architecture, or the quality standards.

The DigitalSkillsWallet project team invites other consortia and organisations to engage with this framework, to contact the consortium for guidance on adaptation, and to consider collaborative approaches that could share content development costs across sectors (for example, the assessment engine and wallet infrastructure could serve multiple competence domains without duplication if hosted as a shared service).

11.3 Policy Recommendations

For national education authorities: consider formally recognising DigitalSkillsWallet micro-credentials as supplementary evidence of digital competence in public procurement processes, civil service recruitment, and vocational qualification frameworks.

For the European Commission: consider the DigitalSkillsWallet model as a prototype for a broader EU Competence Micro-credential Infrastructure — a shared platform that serves as the common assessment and credentialing layer across all EU competence frameworks (DigComp, EntreComp, GreenComp, LifeComp). Such an infrastructure would dramatically reduce the cost of building competence eco-systems for each new framework and would enable learners to hold credentials across all key EU competence domains in a single interoperable wallet.

For employers and professional bodies: engage with the Digital Skills Wallet platform as a tool for assessing digital competence in recruitment and continuous professional development. The DigComp-aligned micro-credentials provide a standardised language for communicating about digital skills that is more precise and evidenced than self-reported skill levels or informal course certificates.

11.4 Next Steps for the DigitalSkillsWallet Project

The immediate next steps for the consortium are: (1) formal publication of this framework document (D5.1) in all four languages; (2) completion of the five national conferences (WP6, T6.7) to present the framework and pilot results to national stakeholder audiences; (3) development of a funding proposal to extend the platform content to all five DigComp competence areas; (4) establishment of a governance structure for the ongoing development of the platform and content under EDITC's stewardship; and (5) submission of a policy brief to the European Commission summarising the project's contribution to the EU micro-credentials agenda.

Possible next steps to be discussed at the final partners' meeting in Cyprus in relation to exploitation include participation in the GTEX Conference and the identification of new funding opportunities to support the further development and sustainability of the platform, such as follow-up project proposals (e.g. SEEDS) or other suitable investment mechanisms.

The DigitalSkillsWallet consortium is proud of what has been achieved and is committed to ensuring that the investment made — by the European Commission, by partner organisations, and by the learners who participated in the pilots — continues to generate value for European citizens long after the project funding period has ended.

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Contact and Platform Access

Project website: <https://dsw.projectsgallery.eu>

DSW Platform: <https://dsw.app-host.eu/>

Platform access: Contact EDITC — info@editc.com

Framework document queries: Contact MMC — info@mmclearningsolutions.com

For adaptation support and partnership enquiries: Contact the project coordinator at info@editc.com

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