



# WP2-A4. Determine the most appropriate learning methodology for calculation of stone waste applying Blockchain technology.



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## CONTENTS

1. INTRODUCTION.....	3
2. TEACHING METHODOLOGY .....	4
2.1 Work plan and learning activities (indicative workload: 50 hours).....	6
2.2 Learning pathway and integration with RockChain platform.....	7
3. ASSESSMENT METHODOLOGY .....	8
3.1 Learning pathway and integration with RockChain platform.....	8
3.2 Components and indicative weighting .....	9
3.3 Evidence collection and feedback cycle .....	10
4. CONCLUSIONS.....	11



## 1. INTRODUCTION

This deliverable presents the proposed learning methodology for the RockChain curriculum in the context of activity WP2-A4, which aims to determine the most appropriate pedagogical approach for enabling adult learners to understand, calculate, and manage stone waste flows while applying blockchain logic to traceability and compliance processes.

RockChain is positioned at the intersection of three domains: (i) the ornamental stone and mining industry and its waste streams; (ii) circular economy principles and waste valorisation; and (iii) digital trust technologies, especially blockchain and smart contracts, as enablers of secure data exchange among multiple stakeholders. The course is designed primarily for adult learners (with a focus on professionals over 45) and technical staff working in the stone, construction, and waste-management ecosystems.

From a pedagogical perspective, the methodology proposed here serves as a bridge between the learning outcomes (defined in WP2-A3) and the concrete teaching plan and workload distribution consolidated in the RockChain curriculum (WP2-A6). It also anticipates the implementation requirements of the RockChain learning tool (WP4), ensuring that learners can progress from conceptual understanding to hands-on simulation of traceability registration, waste-flow calculation, and smart-contract behaviour in a guided learning environment.



## 2. TEACHING METHODOLOGY

The RockChain teaching methodology is grounded in adult-learning principles (andragogy) and is specifically tailored to the profile of the target group: experienced professionals (often 45+) working in the ornamental stone, construction, and waste-management ecosystems, who may have high sectoral expertise but uneven digital confidence. The approach therefore prioritises relevance, practicality, autonomy and respect for prior experience, while ensuring a supportive learning environment that reduces fear of failure when engaging with digital tools. Learning is organised through progressive scaffolding, moving step-by-step from the sectoral context (industry processes and waste flows) towards digital application (traceability models, blockchain logic and smart-contract simulation), so that participants can build competence incrementally and meaningfully.

The methodology combines several complementary teaching modes. Active learning is implemented through structured tasks, demonstrations and guided practice, enabling participants to learn by doing (e.g., mapping waste streams, identifying traceability checkpoints, drafting simple data-record structures). Collaborative learning is emphasised via small-group work and peer exchange, leveraging participants' professional knowledge and enabling mutual support, particularly helpful when groups include mixed digital skill levels. Problem- and case-based learning forms the core of the pedagogical flow, using realistic scenarios from stone waste management and logistics (generation, storage, transport, treatment, reporting) to frame learning activities and anchor abstract concepts in workplace realities. This ensures that blockchain is presented as a response to concrete operational and compliance needs, rather than as an isolated technology topic.

The programme also relies on technology-enhanced learning, primarily through the RockChain platform and app, which provide a safe environment for experimentation with blockchain concepts—such as immutable records, actor roles, transaction validation and traceability chains—without requiring advanced IT knowledge. Participants engage with simplified interfaces and guided templates to simulate real workflows (e.g., registering waste origin, documenting transfers, verifying destination treatment steps, and visualising how a “blockchain-like” log prevents tampering). Throughout the course, continuous formative feedback (tutorials, checkpoints, rapid feedback on tasks, peer review and self-evaluation questionnaires) is combined with summative assessment (tests, individual assignments and group deliverables). This dual approach strengthens motivation and confidence, supports persistence, and ensures that learners receive timely guidance to correct misunderstandings before they become barriers.



In summary, the RockChain methodology is built around adult-learning principles (andragogy), progressive scaffolding, and a practice-driven pathway from sectoral context to digital application. It combines:

- Active learning through structured tasks, demonstrations and guided practice.
- Collaborative learning via small-group work and peer exchange, leveraging participants' professional experience.
- Problem and case-based learning using realistic waste management and logistics scenarios.
- Technology-enhanced learning through the RockChain platform and app, enabling safe experimentation with blockchain logic.
- Continuous formative feedback alongside summative assessment, to support confidence-building in low-digital profiles.

In conclusion, the methodology is fully aligned with the five-unit course structure and is designed so that each unit produces a tangible learning output that feeds into the final integrative project (Unit 5). For example, Unit 1 produces a shared understanding of the value chain and waste hotspots; Unit 2 establishes a basic blockchain vocabulary and logic; Unit 3 provides circular-economy criteria for waste valorisation; Unit 4 translates these into blockchain-enabled traceability workflows; and Unit 5 consolidates all outputs into a documented case study implemented through the RockChain tool. This ensures coherence, strengthens transferability to workplace settings, and supports measurable learning progression from initial engagement to applied competence.

## 2.1 Work plan and learning activities (indicative workload: 50 hours)

Learning activity*	Mode	Hours	Purpose	Typical evidence
Theoretical sessions (dialogue-based lectures)	Face-to-face / synchronous online	5	Introduce core concepts (sector, CE, blockchain) and frame practical application.	Participation; short in-class tasks
Problem solving and practical cases	Online / blended	2	Apply concepts to simplified waste-flow and traceability problems.	Solved exercises; short reflections
Searching for and expanding documentation	Online (self-directed)	5	Develop information literacy: regulations, standards, best practices, use cases.	Curated sources; annotated notes
Cooperative group work with RockChain tool	Online / blended	5	Collaborative simulation of traceability workflows and data registration.	Group logs; platform entries
Tutorials	Online / blended	5	Targeted support, troubleshooting, and personalised feedback.	Tutorial notes; action points
Seminars / expert sessions / possible visits	Face-to-face / synchronous online	4	Connect learning to professional practice and current sector challenges.	Q&A notes; seminar summary
Individual study on RockChain platform	Online (asynchronous)	20	Consolidate unit content via microlearning, videos, and guided reading.	Completion tracking; self-checks
Formative assignments (reports / short deliverables)	Online	2	Produce concise documentation and evidence for assessment.	Short report; checklist
Written test (platform-based)	Online / supervised where feasible	1	Verify acquisition of key concepts and vocabulary.	Test results
Exhibition / presentation of works	Face-to-face / synchronous online	1	Communicate outcomes and receive peer/teacher feedback.	Slides; presentation rubric

(\* ) Training providers may adapt the distribution to local constraints while maintaining the overall 50-hour workload and the balance between guided instruction, practice, and independent study.



## 2.2 Learning pathway and integration with RockChain platform

The learning pathway follows a progression from context to application:

- Unit 1 establishes the industrial and environmental baseline and introduces typical waste streams and stakeholders.
- Unit 2 develops the conceptual foundation of blockchain, focusing on distributed ledgers, immutability, and smart contracts.
- Unit 3 introduces circular economy thinking and waste valorisation options relevant to stone residues.
- Unit 4 translates these elements into applied traceability and compliance scenarios (e.g., digital records, material passports, and smart-contract triggers).
- Finally, Unit 5 consolidates learning through an integrative project implemented on the RockChain platform, where learners simulate actors, assets, flows and checkpoints, and produce auditable reporting outputs.

Within practical activities, learners are guided to:

- (i) identify a waste stream;
- (ii) define measurement units and data sources;
- (iii) calculate basic quantities and movements (generation, storage, transport, treatment, reuse);
- (iv) register events on the platform and;
- (v) observe how blockchain properties support integrity, transparency and non-manipulability of the records.



### 3. ASSESSMENT METHODOLOGY

Assessment within RockChain combines participation requirements, continuous formative feedback, and summative components to reflect the needs of adult learners and the practical nature of the curriculum. It is designed to encourage steady engagement—particularly for learners returning to training after a long period—while ensuring that both conceptual understanding (e.g., blockchain fundamentals, circular economy principles, regulatory context) and practical application (e.g., traceability workflows, data registration, compliance checkpoints) can be demonstrated in a structured and fair manner. The assessment model supports progressive learning by valuing improvement over time, promoting confidence-building for low-digital profiles, and ensuring that outcomes remain measurable and transferable to workplace contexts.

#### 3.1 Learning pathway and integration with RockChain platform

Assessment is integrated into the learning pathway and supported by the RockChain platform and app, ensuring coherence between what is taught, what is practised, and what is evaluated. Transparency is ensured by providing learners with clear assessment criteria, rubrics, and examples of expected outputs from the beginning of the course, including guidance on what constitutes a “complete” traceability record, workflow submission, or project report. Continuity is achieved by distributing assessment across all units (rather than relying on a single final exam), allowing learners to demonstrate progression and reducing stress associated with high-stakes evaluation—an especially important factor in adult education. Authenticity is central: assessment tasks mirror real industrial situations, such as documenting waste generation, tracking transport and treatment steps, validating data entries, and applying circularity logic to propose valorisation pathways.

Supportiveness is built into the process through timely, specific feedback oriented to improvement (“feed-forward”), including targeted recommendations on how to refine workflow logic, strengthen documentation, or correct misunderstandings. Finally, integrity is reinforced through platform features such as log records, versioned submissions and traceable entries, enabling instructors to verify learner work, track contributions in group tasks, and ensure that submitted outputs reflect genuine learning progress. More specifically:

- Transparency: learners receive clear criteria, rubrics and examples of expected outputs.
- Continuity: assessment is distributed across the course to avoid a single high-stakes evaluation point.
- Authenticity: practical tasks reflect real waste-management and traceability workflows.

- Supportiveness: feedback is timely, specific, and oriented to improvement (feed-forward).
- Integrity: platform logs and versioned submissions support traceability of learner work.

### 3.2 Components and indicative weighting

The assessment model is structured into complementary components that reflect both the theoretical and applied dimensions of RockChain. Written test(s) delivered through the RockChain platform assess core terminology, conceptual understanding and the ability to interpret sector-related scenarios (indicative weighting 50%). Practical cases developed using the RockChain app/platform assess the learner’s capacity to apply traceability workflows, register data correctly, and interpret blockchain-enabled processes in realistic waste-management settings (20%).

Individual and group work—including short reports, structured exercises and the final capstone project—assess problem framing, solution design, documentation quality and presentation skills (30%). Participation in discussions, seminars and peer work is included as a qualitative component, as active involvement is a strong indicator of adult learning success and supports collaborative knowledge transfer. Training centres may operationalise participation either as a minimum attendance requirement (recommended: 80%) or as a qualitative factor embedded within the grading rubrics for practical work and project performance, depending on local assessment rules and delivery format.

Component	What is assessed	Indicative weighting
Written test(s) on the RockChain platform	Core theoretical-practical knowledge and terminology	50%
Practical cases using the RockChain app/platform	Application of traceability workflows and data registration	20%
Individual and group work (capstone project and short reports)	Problem framing, solution design, documentation and presentation	30%
Participation (discussions, seminars, peer work)**	Engagement and contribution to collaborative learning	Qualitative / centre-defined

*(\*\*) Centres may operationalise participation either as a minimum attendance requirement (recommended: 80%) or as a qualitative factor integrated into the grading rubric for practical work.*



### 3.3 Evidence collection and feedback cycle

Evidence of learning is collected through a combination of platform-based submissions and tutor-observed performance. This includes online tests, practical case solutions, workflow entries and traceability logs created in the RockChain environment, supplemented by short written reports and the final project presentation. Instructors provide feedback through scheduled tutorials, in-platform comments, and structured review sessions after each unit, ensuring that learners receive guidance while there is still time to improve. The feedback cycle follows a continuous improvement logic: learners submit an initial output, receive actionable feedback, and refine their work in subsequent iterations—particularly within the practical cases and the capstone project. Peer feedback is encouraged during group work, workshops and presentations to reinforce reflective practice, stimulate discussion across profiles with different levels of digital confidence, and strengthen real-world transfer by exposing learners to alternative approaches. This evidence-and-feedback loop ensures that assessment is not only evaluative but also actively formative, helping learners build competence, autonomy and confidence in applying blockchain-enabled traceability to circular waste management in the ornamental stone sector.

## 4. CONCLUSIONS

The methodology proposed in WP2-A4 directly supports RockChain’s core objective: enabling adult learners—particularly those with low digital confidence—to connect real industrial waste-management challenges in the ornamental stone sector with trustworthy, auditable and data-driven traceability approaches enabled by blockchain. The approach is intentionally designed to bridge the “sector reality” (waste streams, logistics constraints, compliance duties and limited digitisation) with “digital opportunity” (integrity of records, shared visibility between actors, and automation of certain verification steps through smart contracts). In doing so, it creates a practical pathway for learners to understand not only *what blockchain is*, but *why* it matters in circularity and waste governance.

A key strength of the methodology is its blended and progressive learning design. By combining short conceptual inputs with guided practice, case-based tasks and structured reflection, it reduces cognitive overload and supports incremental skill acquisition. Active learning formats—such as process mapping, role-based simulations and platform-enabled exercises—help learners translate concepts into operational workflows (e.g., registering waste origin, tracking transfers, validating destinations, documenting compliance checkpoints). Continuous feedback loops (tutorials, assignment feedback, peer review and self-evaluation) ensure that learning is monitored and adapted, while maintaining motivation and a sense of achievement across heterogeneous learner profiles.

Finally, the methodology is transferable and scalable across partner-country contexts because it is built around common denominators:

- (i) EU-aligned circular economy and waste management principles;
- (ii) reusable learning resources and templates, and;
- (iii) a consistent practical framework supported by the RockChain learning tool.

This enables replication in different organisational settings (SMEs, sector associations, training centres) and allows future iterations of the curriculum to incorporate new sector data, evolving regulations, and more advanced digital components. Overall, WP2-A4 provides a coherent pedagogical foundation for delivering measurable impact: improved sustainability awareness, higher digital readiness, and an increased capacity to design traceable, circular waste-management practices in the ornamental stone industry.