SMACITE

SMA CITE
Enhancing skills
for smart city tech

Boosting the technical
and non-technical skills
and competences
of smart cities technicians
and engineers

WP2: Smart Cities competences map and curriculum

D2.4: Methodology for the certification of competences of Smart Cities technicians and engineers

Version 1.0

DELIVERABLE FACTSHEET

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PROJECT SUMMARY

The project aims to address the skills gap of Smart Cities technicians and engineers, by designing and testing a vocational education and training program that is based on a novel and multi-disciplinary curriculum combining digital skills on Smart Cities enabling technologies, with soft, entrepreneurship and green skills.

The expected project outputs are:

- A Smart Cities competences map and ESCO-compliant Smart Cities role profiles.
- A Smart Cities curriculum combining both technical and non-technical skills and competences and promoting personalized learning pathways.
- Learning resources for Smart Cities enabling technologies and for building the soft, entrepreneurship and green skills of Smart Cities technicians and Engineers.
- A diagnostic tool to identify personalized learning pathways.
- A MOOC for Smart Cities enabling technologies.
- Virtual Worlds for building the soft, green and entrepreneurship skills of Smart Cities technicians and engineers.

The main project beneficiaries are Smart Cities technician and engineers either from the public sector (i.e. municipalities) or from enterprises providing Smart Cities solutions, as well as HEI and VET students interested in Smart Cities.

The curriculum will be tested through four national pilots in Greece, Bulgaria, Spain and Italy with at least 160 trainees. The certification of the skills and competences will follow a two-fold approach: (a) using micro-credentials to recognize the knowledge and skills gained through the successful completion of each online training module at the MOOC and Virtual Worlds and (b) designing the "Smart Cities Specialization Certification" that will be awarded to those passing online certifications exams with e-proctoring after the completion of the training modules.

The project will create an ecosystem for the co-design and co-development of an innovative curriculum and technology-enhanced learning tools for the upskilling/reskilling of Smart Cities technicians and engineers.

1. Introduction

This deliverable describes the methodology for the certification of the competences of Smart Cities technicians and engineers going through the SMACITE curriculum. Moreover, it describes how micro-credentials will be integrated in the MOOC platform of the project to verify the knowledge and skills students gained through the online courses.

1.1 Structure of the deliverable

The deliverable is divided into 4 main sections.

- Section 1 introduces the deliverable. More specifically, Section 1.1 describes the structure of the deliverable, Section 1.2 outlines the target audience and finally Section 1.3 outlines the dependencies with other WPs and deliverables and finally.
- Section 2 describes the certification framework.
- Section 3 describes the methodology for the development of the certification scheme.
- Finally, Section 4 describes how micro-credentials will be integrated in the MOOC platform of the project.

1.1 Target audience

The target audience of the deliverable includes the following stakeholders:

- The SMACITE granting authority.
- The SMACITE participating organizations (the project coordinator and the project partners).
- Key SMACITE project stakeholders.
- Any other stakeholder that is interested in the domain of knowledge and skills certification (e.g. certification bodies).

1.2 Dependencies with other WPs and deliverables

The deliverable D2.4 has direct connections with the following WPs and deliverables:

- D2.2 The SMACITE curriculum for Smart Cities of WP2: this deliverable defines the curriculum framework, the structure and content of each training module.
- D4.2 MOOC for Smart Cities (1st edition) of WP4: this deliverable describes the SMACITE MOOC.

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2 Certification Framework

UNICERT S.A. will develop the certification framework for the project participants' gained knowledge, competencies, and skills, as well as the certification process.

The certification will be accepted on the market because it will be made using a finalmethod of accreditation that is recognized by the EU and is in line with the rules and procedures of the national accreditation bodies of E.A. countries and states (European Cooperation for Accreditation).

Within the certification framework we offer the information required for the validation and certification of knowledge for the people who attend the online courses, throughout the consortium's member countries.

In the framework of SMACITE project we will develop 2 Certifications:

- • **SMACITE Certification for Engineers with Technical Specialization**

- • **SMACITE Certification for Technician with Technical Specialization**

The compulsory steps for the certification will be:

1) **Attend and complete the Smart Cities Course**

2) **Attend and complete at least one of the other technical courses**

3) **Attend and complete at least one of the non-technical courses**

3 Methodology: Development of Certification Scheme

3.1 Application for new schemes (UNICERT S.A. and Partners)

Developing and implementing new certification schemes often involves a structured process that includes the submission of an application.

Definition of a Scheme:

The development of a new scheme requires the completion of the "Application Development Form", in order to communicate the purpose of the new scheme to all interested parties. Schemes can be introduced by governmental bodies, non-profit organizations, businesses, or other entities to address various needs within a community, sector, or industry.

Reasons for Introducing New Schemes:

1. Addressing Unmet Needs. New schemes are often developed to address gaps or unmet needs within a community or sector. This could include social, economic, or environmental challenges that require targeted interventions.

2. Policy Objectives. Governments may introduce new schemes as part of their broader policy objectives. These schemes are designed to implement and support policy goals, such as improving public health, enhancing education, or stimulating economic growth.

3. Innovation and Adaptation. Schemes can be created to encourage innovation, adapt to changing circumstances, or leverage emerging technologies. This allows organizations to stay relevant and effective in a dynamic environment.

Application Development Form:

The "Application Development Form" is a key component of the process for introducing a new scheme. This form serves several purposes:

1. Communication of Purpose. The form is a tool for clearly articulating the purpose and objectives of the proposed scheme. It should provide a detailed explanation of why the scheme is necessary, what issues it aims to address, and how it aligns with broader organizational or societal goals.

2. Stakeholder Engagement. By requiring completion of the form, the organization ensures that all relevant stakeholders are aware of and can provide input into the development of the scheme. This fosters transparency and inclusivity in the decision-making process

3. Evaluation Criteria. The form may include criteria for evaluating the feasibility, impact, and sustainability of the proposed scheme. This helps decision-makers

assess whether the scheme aligns with organizational priorities and can achieve its intended outcomes.

<u>Application Process Steps:</u>

1. Initiation. The process typically begins with the identification of a need or opportunity that warrants the development of a new scheme.

2. Formulation of Proposal. Stakeholders involved in scheme development work together to formulate a detailed proposal. This proposal includes the objectives, target beneficiaries, budgetary considerations, and anticipated outcomes.

3. Application Submission. The completed Application Development Form, along with the proposal, is submitted to the relevant authority or committee responsible for reviewing and approving new schemes.

4. Review and Evaluation. The submitted application undergoes a comprehensive review. This may include assessments of the scheme's feasibility, impact, budget, and alignment with organizational or policy goals.

5. Decision and Approval. Based on the evaluation, a decision is made regarding the approval, modification, or rejection of the proposed scheme. Approved schemes move forward to the implementation phase.

6. Implementation and Monitoring. Once approved, the scheme is implemented according to the outlined plan. Monitoring and evaluation mechanisms are put in place to assess progress and make adjustments as necessary.

The application for new schemes is a structured process designed to ensure that proposed initiatives are well-defined, purposeful, and aligned with broader organizational or societal objectives. The Application Development Form is a critical tool in this process, serving as a means of communication, stakeholder engagement, and evaluation. Through this process, organizations can introduce innovative and impactful schemes that contribute to positive social, economic, or environmental outcomes.

3.2 Application review (UNICERT S.A.)

The application review process is a crucial component of many decision-making contexts. The primary objectives of application review encompass a thorough assessment of the proposed scheme's feasibility, impact, and alignment with organizational priorities. Reviewers aim to identify the strengths and weaknesses of each application, considering factors such as innovation, sustainability, and the ability to address identified needs or challenges. The overarching goal is to select schemes that demonstrate the greatest potential for success and positive impact.

Responsible for reviewing the application is the Quality Management Department of UNICERT S.A. The department examines whether the Certification Body has the capacity to respond to the submitted application.

Reviewers employ predefined criteria to assess the quality of each application. These criteria may include clarity of objectives, feasibility of implementation, anticipated outcomes, budgetary considerations, and alignment with organizational strategies or policy objectives. The establishment of clear and measurable criteria ensures a standardized evaluation process, promoting fairness and transparency in decision-making.

In some cases, the review process involves input from various stakeholders, including experts in the relevant field, or other individuals affected by the proposed scheme. Engaging stakeholders ensures diverse perspectives are considered, contributing to a more comprehensive evaluation and fostering a sense of inclusivity in the decision-making process.

Based on the findings of the review, a decision is made regarding the approval, modification, or rejection of each application. The decision-making process may involve a committee or panel responsible for evaluating applications, and their decisions are often guided by the predefined evaluation criteria. Approved schemes move forward to the implementation phase, while rejected proposals may receive feedback to encourage improvement for future submissions.

The application review process is not only a mechanism for selecting schemes but also an opportunity for continuous improvement. Feedback provided to applicants, whether their proposals are accepted or declined, serves as a valuable tool for enhancing the quality of future submissions. This iterative feedback loop contributes to a culture of learning and refinement in the development and review of schemes.

In conclusion, the application review phase is a pivotal component of the scheme development process, ensuring that selected initiatives align with organizational goals and have the potential for meaningful impact. By employing systematic evaluation criteria, engaging stakeholders, and fostering a commitment to continuous improvement, organizations can enhance the effectiveness of their application review processes and ultimately contribute to the success of the implemented schemes.

3.3 Development of certification scheme regulations (UNICERT S.A. & Partners)

The development of a certification scheme regulation, often accompanied by a syllabus, is a meticulous and strategic process aimed at establishing a framework for assessing and validating individuals' knowledge and skills in a particular domain. Certification schemes play a vital role in various industries, ensuring that professionals meet predefined standards and competencies. The creation of a regulation and syllabus is essential for maintaining consistency, transparency, and credibility in the certification process.

The primary purpose of developing a certification scheme regulation is to provide a clear and comprehensive set of guidelines governing the certification process. This includes defining the scope and objectives of the certification, eligibility criteria for candidates, examination procedures, and the criteria for successful certification. Regulations help maintain the integrity of the certification scheme, instilling confidence in stakeholders and ensuring that certified individuals possess the necessary qualifications.

A well-crafted certification scheme regulation typically includes several key components. These may encompass a detailed description of the certification program, the qualifications and experience required for candidates, the structure of the examination, the grading system, and any ethical or professional standards that candidates must adhere to. The regulation serves as a reference document for both certification bodies and candidates, providing clarity on the expectations and requirements.

In conjunction with the regulation, the syllabus outlines the specific topics, skills, and knowledge areas that candidates are expected to master to achieve certification. The syllabus is a roadmap that guides the content of the examination and ensures that it is aligned with the industry or field's current standards and best practices. The development of the syllabus involves input from subject matter experts, industry stakeholders, and educators to ensure its relevance and comprehensiveness.

Certification scheme regulations and syllabi are typically designed to align with prevailing industry standards and practices. This alignment ensures that certified individuals possess the latest knowledge and skills required for success in their respective fields. Regular updates to the regulation and syllabus may be necessary to reflect advancements in the industry and maintain the certification's relevance.

The development of certification scheme regulations incorporates quality assurance measures to uphold the credibility of the certification process. This may include mechanisms for validating examination content, ensuring fair and unbiased evaluation, and implementing secure and standardized testing procedures. Standardization is crucial for fostering consistency in the certification process across different cohorts of candidates and examination sessions.

Successful development of certification schemes involves collaboration with various stakeholders, including industry experts, practitioners, educational institutions, and

regulatory bodies. Engaging these stakeholders ensures that the certification scheme's content and requirements are well-informed and reflective of the industry's needs. Transparent communication with stakeholders is essential to garner support and trust in the certification process.

The certification scheme regulation and syllabus are dynamic documents that should undergo periodic reviews and updates. Continuous improvement processes, informed by feedback from certified professionals, changes in industry trends, and advancements in knowledge, contribute to the ongoing relevance and effectiveness of the certification scheme.

The development of a certification scheme regulation and syllabus is a multifaceted process that requires careful consideration of industry standards, stakeholder input, and quality assurance measures. A well-defined and transparent certification framework ensures that certified individuals possess the necessary competencies, contributing to the overall professionalism and credibility of the industry or field in which the certification operates.

3.3.1 Syllabus

The SMACITE syllabus (or curriculum) includes courses that fall in 4 different areas:

I.   Smart cities enabling technologies

   a. Smart Cities

   b. Internet of Things

   c. Cybersecurity

   d. Cloud computing

   e. Data analytics & visualization

   f. Machine learning & Big Data

   g. 3D printing

   h. Blockchain

   i. Drones

   j. Autonomous vehicles

II. Soft skills

III. Entrepreneurial skills

IV. Green skills

3.3.2 General Certification Specifications

To create the regulation concerning the sector, it needs to be given:

I.   the name of the subject of the certification of a professional, its scope and, where appropriate, its possible graduations or certification levels,

II.   the detailed description of the tasks and work duties of the individuals / professionals targeted by the subject,

III.   the subject of competence of the certified person and the corresponding knowledge framework,

IV.   the physical characteristics of the candidate such as vision, hearing, physical abilities, etc., when required,

V.   the prerequisites of the path to certification (e.g. education, work experience, physical characteristics, etc.), when required,

VI.   the code of conduct, where appropriate;

VII.   the requirements for getting a certificate in the first place, keeping it, getting it renewed, and suspending or taking it away,

VIII.   the methods of evaluation of the candidate for initial certification, for maintaining the certification, for recertification and

IX.   the criteria for possibly changing the field/level of the certified person.

Table 1. General Certification Specifications

Name of the Course	
Description	
Objective /knowledge	
Physical characteristics of the candidate	
Prerequisites (if required)	
Code of conduct (if required)	
Requirements	
Methods of evaluation	
Changing level of candidate	

This table will be filled-in for each training course.

Participation in the certification process of subject is possible for persons who compulsorily meet the age requirement to be over the age of 18. Additional requirements concerning educational background and professional experience may as well apply but this is a decision that will be made at a later stage.

3.3.3 Prerequisites for participation in the training programme and the certification

The compulsory (minimum) steps for the certification will be:

1) Attend and complete Smart Cities Course
2) Attend and complete one of the Technical Courses
3) Attend and complete one Non-technical courses

The potential prerequisites of the level of knowledge are evidenced by diplomas, while those of the work experience are supported by tax or insurance data accompanied by an appropriate employer's declaration or an employer's recommendation letter mentioning the participant's relevant job description and the period of the assignment. These documents will be requested during the applicants' expression of interest in participating in the certification and will be defined in detail at a later stage of the project.

3.3.4 Physical Characteristics of the Candidate – Prerequisites for Participation in the Examinations

The supporting documents for participation in the certification exams are submitted to UNICERT S.A. electronically and are the following:

- Signed application for certification of the candidate.
- A valid photocopy of the identity form of himself or his legal representative (with a corresponding valid authorization form).
  Valid identity forms must include:
- Identity card or relevant temporary certificate from the competent authority; passport; driver's license; individual insurance booklet for Greek citizens.
- Identity card and passport for citizens of a European Union member state.
- For citizens of countries other than the European Union: entry permit, residence permit, and work permit. A valid photocopy of a compulsory education qualification

In addition, people with disabilities can participate in the certification process as long as their difficulty does not affect the proper performance of the work duties of the subject under certification. In these cases, an opinion from an official and legal body is required.

3.3.5 The European Qualifications Framework (EQF)

The European Qualifications Framework (EQF) recommendation and its main reference level descriptors were taken into consideration:

- knowledge (the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories, and practices that are related to a field of work or study),
- skills (the ability to apply knowledge to complete tasks and solve problems),
- competences (the ability to use knowledge or skills in work or study situations)

The EQF's level must be specified. The table lists the following levels:

Table 2. EQF level

EQF Level	Knowledge	Skills	Competence
Level 1	Basic general knowledge	Basic skills required to carry out simple tasks	Work or study under direct supervision in a structured context
Level 2	Basic factual knowledge of a field of work or study	Basic cognitive and practical skills required to use relevant information to carry out tasks and to solve routine problems using simple rules and tools	Work or study under supervision with some autonomy
Level 3	Knowledge of facts, principles, processes, and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials, and information	Take responsibility for completion of tasks in work or study; adapt own behaviour to circumstances in solving problems
Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Exercise self- management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work

			of others, taking some responsibility for the evaluation and improvement of work or study activities
Level 5	Comprehensive, specialized, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems	Exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others
Level 6	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups
Level 7	Highly specialized knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research. Critical awareness of knowledge issues in a field and at the interface between different fields	Specialized problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields	Manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams
Level 8	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	The most advanced and specialized skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or	Demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study

		innovation and to extend and redefine existing knowledge or professional practice	contexts including research

Source: European Qualifications Framework for Lifelong Learning, 2008

Table 3 Template for EQF modules

Name of Modules		
EQF Level		
Learning Outcomes	This module aims to:	
Knowledge	Skills	Competence
Assessment methods		
Total Training Hours		

This table will be filled-in for each training module.

3.4 Syllabus control (UNICERT S.A.)

The primary purpose of syllabus control is to maintain the currency, relevance, and effectiveness of educational programs. It ensures that course content reflects the latest developments in the field, incorporates feedback from learners and educators, and aligns with broader educational goals. Syllabus control is integral to fostering a dynamic and responsive learning environment that equips students with the knowledge and skills needed for success in their chosen disciplines.

One of the key aspects of syllabus control is ensuring alignment with predefined learning objectives. Syllabi should articulate clear and measurable learning outcomes that guide instructional design and assessment strategies. Regular reviews help educators assess whether the content and activities outlined in the syllabus contribute to the achievement of these objectives, allowing for adjustments as needed.

Syllabus control involves a feedback loop that includes input from both educators and learners. Educators provide insights into the effectiveness of the syllabus in facilitating learning, while learners offer perspectives on the clarity of instructions, relevance of content, and overall educational experience. Integrating this feedback into syllabus revisions promotes a student-cantered approach to curriculum design and enhances the overall quality of the educational program.

In dynamic fields, such as technology, science, or business, syllabus control becomes particularly crucial. Regular updates ensure that course content remains in line with industry best practices, emerging trends, and the latest research findings. This adaptability is essential for preparing students to navigate evolving professional landscapes and remain competitive in their chosen fields.

Syllabus control contributes to quality assurance by establishing standards for curriculum development and delivery. It ensures consistency in course content, assessment methods, and learning outcomes. Standardization through syllabus control supports equitable educational experiences for all students and facilitates comparisons across different courses or institutions.

In educational settings, syllabus control also plays a role in ensuring compliance with regulatory standards and accreditation requirements. By regularly reviewing and updating syllabi, educational institutions can demonstrate their commitment to meeting established benchmarks for curriculum quality and academic rigor.

Syllabus control has evolved in response to technological advancements. Educational institutions increasingly use digital platforms to manage and distribute syllabi, enabling real-time updates and seamless communication between educators and students. This integration of technology enhances the efficiency of syllabus control processes.

3.5 Developing Questions (Partners who developed learning content)

The process of developing questions requires careful consideration of educational goals, cognitive levels, and the diverse needs of learners. The first step in developing questions is to align them closely with the learning objectives of the lesson or course. Questions should be explicitly tied to what learners are expected to know or be able to do. This alignment ensures that assessments are meaningful and directly contribute to the overall educational goals, providing a clear roadmap for both educators and learners.

Effective question development involves employing a variety of question types to engage learners and assess different skills. The choice of question type should align with the learning objectives, the nature of the content, and the desired depth of understanding.

Clear and precise language is crucial in question development. Ambiguity or vagueness can lead to misinterpretation and inaccurate assessment of students' knowledge. Well-constructed questions are specific, avoiding double negatives or complex sentence structures that may confuse learners. Additionally, questions should be free from bias to ensure fair assessment.

Questions should be relevant to the content being assessed and presented in a context that resonates with students. Real-world scenarios or examples that connect the material to practical applications can enhance the authenticity of assessments. This relevance

fosters a deeper understanding of the subject matter and demonstrates the practical value of the knowledge being acquired.

Inclusive question development involves considering the diverse needs and backgrounds of learners. Questions should be accessible to learners with different learning styles, linguistic abilities, and cultural perspectives. Providing options for demonstrating understanding, such as through written or verbal responses, can accommodate diverse learner needs.

The development of questions is an iterative process that benefits from feedback and continuous improvement. Educators can assess the effectiveness of questions through student performance and adjust future assessments accordingly. Analyzing the results of assessments helps educators identify areas where students may be struggling and refine questions to better meet the learning objectives.

Ethical considerations are paramount in question development. Questions should avoid unintentional bias, respect cultural sensitivities, and uphold the principles of fairness. Educators should be mindful of the potential impact of questions on different groups of students and strive to create a supportive and inclusive assessment environment.

3.5.1 Criteria and methods of certification

The assessment of the examinee includes only theoretical certification exams.

The "SMACITE" Certification Exam will consists from at least 3 part which will be corresponding to the three essentials courses. Each course will last **forty (40) minutes** and is composed of **thirty five (35) questions** (closed-ended questions), which are distinguished based on their degree of difficulty into introductory, core, advanced and are separated by **40%, 35% and 25%**, respectively.

- *Selecting the correct answer from a list of options (problems with selecting the correct answer from a list of options)*
- *Choose at least two correct answers from the given options (there are many correct options from many).*
  *Successful participation in the exam means giving the correct answer to at least **70% of the examination subjects, in which case the corresponding certificate is issued.***

If the examinations fail, the candidate has the option of retaking them up to two times within the same year. If he fails the third time he is examined after the end of a calendar year since the last exam.

3.5.2 Selection of exam questions

The examination topics are drafted in the English language and are adapted to modern requirements, depending on the nature of the certification.

For example, if special computer software is required, on a specific platform and software version, the examination system is adapted to them.

The examination system of the Institution is configured in such a way that it selects for each test at least one question of low, one of medium and one of high difficulty from each section to be examined.

For each examinee, a different set of examination subjects is selected, and each test is unique.

The examinations are designed to assess a person's ability in accordance with the scheme's requirements and may include both a theoretical and a practical component.

The evaluation is carried out through questions that belong to the following categories:

- **Low-difficulty questions (Introductory) - 40% of all questions in each exam**

- **Moderate difficulty (Core) - 35% of all questions in each exam**

- **High degree of difficulty (Advanced) - 25% of all questions in each exam**

The software of the examination system automatically selects questions from all the cognitive units of the syllabus, respecting the above proportions of introductory, core, advanced questions. The percentage of each cognitive unit is produced in a random way. This ensures that there will be no cognitive sections in the exam that do not correspond to questions.

Each question's level of difficulty:

- Introductory
- Core
- Advanced

As a result, **each course contains:**

- **fourteen (14) Introductory,**

- **twelve (12) Core, and**

- **nine (9) Advanced questions.**

Table 4. Sample of Question pool

Each Course		
Degree of difficulty	Introductory	14
	Core	12
	Advanced	9
Total		**35**

Table 5. Template for gathering questions for each training module.

QUESTION No	COURSE	QUESTION	CHOICE1	CHOICE2	CHOICE3	CHOICE4	CORRECT	DIFFICULTY
1	1							
2	1							

The above-mentioned table is a template for the provided questions for the certification scheme.

The total number of questions which must be created is **multiplied 4 times.** For example, assuming that the exam of a course will contain 35 questions, a set of 140 questions must be created in total for this specific course (keeping in mind the analogy 40%, 35% and 25%).

3.5.3   Scoring

The certification examination platform will automatically award one (1) point for each correct answer and zero (0) point for each incorrect answer. There is no negative score.

3.5.4   Duration of certification and retention criteria

The validity period of the "SMACITE" certification is five (5) years from the date of certification indicated on the Certificate of Competency.

The five-year period was chosen as a parameter of the scheme based on the fact that within 5 years it can be considered that the Special Regulation for the Certification of Subject Matter "Smart City" that does not rapidly change the sector, the technology and equipment used, the methodologies and techniques and the certified competence is finally kept relevant, while the possibility of someone certified losing his ability due to a decrease in his contact with the work object is considered moderate.

In the event that there is a change in the legislation or technology and method concerning the "Smart City" sector in the new digital environment, then the certification ceases to be valid as it is. UNICERT S.A informs all certified persons of the termination of the certification, as well as the conditions and the way in which they can obtain the certification under the new regulation.

3.5.5   Recertification

Before the expiry of the validity period of the certificate, the holder may be renewed for a new period by UNICERT S.A. Recertification includes participation only in exams corresponding to the original. In the event that the subject matter has changed, he is obliged to follow the new procedure from the beginning.

People with disabilities can participate in the certification process as long as their difficulty does not affect the proper performance of the work duties of the subject under certification. In these cases, an opinion from an official and legal body is required.

3.6 Review and Check Questions (UNICERT S.A.)

Reviewing and checking questions is an essential step in the assessment. This systematic review process is crucial for identifying potential issues, refining questions, and improving the overall effectiveness of assessments. It involves careful scrutiny of question clarity, alignment with learning objectives, appropriateness of language, and consideration of diverse learner needs.

The first aspect of reviewing questions involves assessing their alignment with the learning objectives. Each question should directly contribute to the measurement of specific knowledge, skills, or abilities outlined in the educational goals. This alignment ensures that assessments are focused, meaningful, and contribute to the overall learning outcomes of the instructional program.

Reviewing questions for clarity and precision is fundamental to avoiding ambiguity and misinterpretation. Ambiguous or confusing language can lead to inaccurate assessments of learners' understanding. Reviewing questions involves an examination of their fairness and inclusivity. Questions should be free from cultural bias and avoid language or references that may disadvantage specific groups of learners. The review process ensures that questions are accessible to students with diverse backgrounds, linguistic abilities, and learning styles, promoting a fair and equitable assessment environment. Questions must be contextually relevant to the material being assessed.

Validity and reliability are critical considerations in question review. Validity ensures that questions measure what they are intended to measure, while reliability ensures consistency in assessment outcomes. The review process involves examining whether questions effectively gauge the targeted constructs and whether they yield consistent results across different administrations.

The step-by-step process:

- For the review and approval of the questions of each subject, a meeting with the partners who developed the questions with the members of the Technical Committee is held.
- The Technical Committee is set up to discuss the examination topics of the new schemes and the methodology for selecting the examination topics.
- Specifically, the observance of the methodology of the examination subjects, the number of examination subjects, the correct performance of the subjects and the difficulty of their understanding by the certified candidates are checked.
- In addition, syntactic and grammatical errors are checked.

3.7 Pilot exams (UNICERT S.A.)

Pilot exams, also known as trial or experimental exams, are a crucial component of the assessment development process. These exams serve as a preliminary testing phase before the official administration of assessments, providing educators and assessment designers with valuable insights into the effectiveness, fairness, and validity of the test items. Conducting pilot exams is a systematic and strategic approach to refining assessment instruments, ensuring that they accurately measure the intended learning outcomes.

The primary purpose of pilot exams is to identify and address potential issues with test items, instructions, and overall assessment design. By administering a smaller-scale version of the exam to a representative sample of the target population, educators can gather data on the clarity of questions, the appropriateness of difficulty levels, and any unforeseen challenges that may arise during the actual administration. This process contributes to the enhancement of the assessment's overall quality.

Pilot exams allow for in-depth item analysis and psychometric evaluation. Analyzing the performance of each test item provides valuable information about its discriminatory power, difficulty level, and effectiveness in distinguishing between high and low performers.

Pilot exams simulate actual testing conditions to a certain extent, providing an opportunity to identify and address logistical challenges. This includes considerations such as timing constraints, technological issues (if applicable), and any unforeseen difficulties that may arise during the administration. Identifying and resolving these issues during the pilot phase contributes to a smoother and more reliable administration during the official exam.

When conducting pilot exams, it is essential to select a representative sample of the target population. This ensures that the feedback obtained is reflective of the diverse characteristics and abilities of the intended test-takers. A well-chosen sample helps identify potential biases and ensures that the final assessment is fair and valid for all individuals within the target population. They provide a valuable testing ground for refining test items, simulating real testing conditions, addressing logistical challenges, and ensuring ethical practices.

3.8 Application to the national accreditation system - Accreditation of a new subject (UNICERT S.A.)

The application for the accreditation of a new subject within the National Accreditation System is a comprehensive process that involves the submission of detailed documentation to ensure that the proposed subject meets established standards and contributes to the overall quality of education. This theoretical overview outlines the key components and considerations involved in the application process for accrediting a new subject.

The first and foremost consideration in the accreditation process is ensuring that the new subject aligns with established accreditation standards set by the national education authority or accrediting body. These standards typically encompass aspects such as curriculum design, learning outcomes, assessment strategies, and the qualifications of instructors. The application must clearly demonstrate how the proposed subject meets or exceeds these standards.

The steps for this procedure are:

- After the completion of the validation process of the new subject by the Institution, an application is sent to the ESYD for its accreditation
- ESYD appoints an evaluation team with experts specialized in the subject of accreditation
- After the end of the evaluation and if the procedure is accepted, the ESYD approves the accreditation of the new subject and the Certification Body can now conduct examinations.

4 Integration of micro-credentials in the MOOC platform

A micro-credential is the record of the learning outcomes that a learner has acquired following a small volume of learning. These learning outcomes have been assessed against transparent and clearly defined standards. Micro-credentials certify the learning outcomes of short-term learning experiences, for example a short course or training. They offer a flexible, targeted way to help people develop the knowledge, skills and competences they need for their personal and professional development.

In the SMACITE project we will use a two-fold approach for the integration of micro-credentials in Moodle which is the underlying MOOC platform used for the delivery of online courses:

- Issuing a **digital badge** when a student successfully completes a module of an online course.
- Issuing a **certification of achievement** when a student successfully completes an online course.

Digital badges

Digital badges in online learning serve as a visual representation of a learner's achievements, skills, or competencies. They are a form of digital credential that can be earned by students in various educational contexts, including online courses and training programs. These badges are often used to recognize and validate specific accomplishments, providing a more detailed and granular view of a learner's capabilities

compared to traditional academic degrees or certificates. Post University[1] adds that a digital badge "acts as a visual representation of the micro-credential" for sharing purposes.

Digital badges have gained popularity in the online learning space as a way to recognize and communicate the diverse skills and accomplishments of learners. They offer a more dynamic and flexible approach to credentialing, contributing to a more comprehensive understanding of an individual's capabilities.

The information that integrates a digital badge issued in Moodle is the following:

- **Name**. It is the name of the digital badge.
- **Version**. May be used to keep track of the badge's development. If specified, the version is depicted on the badge's page.
- **Language**. The language used on the badge page.
- **Description**. The description of the badge.
- **Image**. The image of the badge.
- **Image author's name**. If specified, the name of the badge image author is displayed on the badge page.
- **Image author's email**. If specified, the email address of the badge image author is displayed on the badge page.
- **Image author's URL**. If specified, a link to the badge image author's website is displayed on the badge page.
- **Badge expiry**. Never of a fixed day.

Different options exist for the issue of a digital badge: Manual issue by role, course completion, activity completion, previously awarded badges, and competencies. In the case of SMACITE online courses, the criteria we use is "activity completion", as a digital badge is issued once a student successfully completes a module of a course.

Below is provided a demo of a digital badge at SMACITE MOOC.

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[1] Post University. (2022). [Badges and micro-credentials – What's the difference?](). Retrieved on 27/11/2023,

Activitiy badge

Awarded to Vasileios Gkamas

Issued 9 November 2023, 5:17 PM

Issued by SMACITE Massive Open Online Courses Platform

Course: Smart City Test/Demo Course

You have completed a Smart Citty Activity

Criteria

- **ANY** of the following activities are completed:
  - "Lesson - Smart Cities, how they work and how to tackle change"
  - "Book - Smart Cities, how they work and how to tackle change"

More details
  Language
  English

Figure 1: Demo badge at SMACITE MOOC

Certificate of achievement

The learners at Moodle will gain a certificate of achievement when they successfully complete a course. The information depicted in a certificate of achievement is at least the following:

- Identification of the learner
- Title of the certificate
- Awarding body
- Date of issuing
- Date of expiring (if any)
- Workload needed to achieve the learning outcomes (in ECVET credits, wherever possible)
- Learning outcomes
- Project and EU logos

The certificate of achievement will also have a QR code. Below we provide the sample design of a certificate of achievement which will be completed by the list of acquired learning outcomes.

Figure 2: Demo certification of achievement at SMACITE MOOC

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