



Competences for Resilient Smart Cities' Staff

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HED-000032257
Erasmus+ Program,
KA2: Cooperation Partnership in
Higher Education

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SCRO
Curriculum



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1 Document Metadata

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Abstract:

The purpose of this document is to present the curriculum for the SCRO job profile. The curriculum details what should be taught to meet a set of educational intentions while it intends to act as a framework for guiding teaching and learning processes as a steering mechanism for quality.

1.1 Document information

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1.2 Document Change History

Version	Who	When	Action	Description
0.1	P. Tsoutsas	11/06/2022	Create	SCRO Curriculum
0.5	P. Tsoutsas	11/08/2022	Under review	Incorporate comments from SC meeting, module dependencies
0.7	P. Tsoutsas	7/9/2022	Under review	Incorporate TBs
0.81	P. Tsoutsas	7/11/2022	Final version	Update TB4



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2 Introduction

Cities are becoming smarter and smarter and while this development increases the challenges to cities' resilience, it also gives future cities more tools to reach acceptable resilience levels. By concentrating on these expanding needs, it appears that we need to close the gap between the present abilities of the municipal personnel and the desired future competencies that will equip them.

The CRISIS project has a holistic approach for the professional development of trainees envisioning to enrich their competences and increase their employability. Under these circumstances, a new job profile named "Smart City Resilience Officer - SCRO" is defined, which sufficiently describes the required competences for facing resilience needs in the context of smart cities. Overall, the objectives of CRISIS project are to:

- a) Increase the awareness of the Member States, Local Authorities, Municipalities and of various stakeholders that resilience of smart cities is complex and difficult to acquire competences
- b) Develop an innovative curriculum for SCROs
- c) Provide innovative learning tools to implement the curriculum
- d) Close the competence and skills gap for municipalities officials
- e) Build-up on important work delivered from other ERASMUS+ projects, such as SmartDevOps project
- f) Provide in a structured and systematic way a framework for educating smart cities staff on resilience
- g) Promote the European Collaboration on smart cities' education

The SCRO curriculum aims to define the necessary competences for the new job profile, named "Smart City Resilience Officer", dealing with resilience issues in the context of smart cities. It integrates the innovative pedagogical model for exploitation of a self-assessment tool that identify the gaps in SCRO competences and combines these with recommendations about what learners should study (learning journey) and how they should do it (educational strategy) to offer flexible learning paths through its modular structure. It is designed to directly address the shortage of knowledge and experience of prospective SCROs, while is targeted at (i) smart cities authorities, (ii) existing municipalities' human resources, (iii) students of sciences related to public administration, (iv) self-employed and unemployed people having relative studies or working experience and other (v) sectoral organizations and smart city associations. In view of the upcoming challenges in the SC resilience, it is expected that it will have a positive impact among SC stakeholders, since it will contribute to acquire and develop relevant basic skills and key competences. Furthermore, the curriculum document will explain what should be taught and how to satisfy a set of educational intents, as well to offer stakeholders a dynamic framework for guiding teaching and learning processes to guarantee a quality-control mechanism.

The rest of this document is structured as follows: Section 2 describes the SCRO Job Profile, Section 3 presents the objectives of the curriculum, Section 4 provides an outline

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of included competences in categories, Section 5 presents different learning journeys learners could follow and the dependencies among the modules while Section 6 describes the content design of competences.

3 SCRO Job Profile

The Europe 2020 plan recognizes the need to address the overall lack of skills required to make cities resilient, while also establishing new learning and teaching approaches to improve the end result. The designed curriculum aims to meet the aforementioned societal and city needs that are both important and vital, especially in light of the present COVID-19 problem which demonstrated that European societies were not well equipped, by incorporating them into the SCRO job profile. The context of the competences revealed after research was done for the most competitive and high valued relative skills, considering:

- i. a literature review to get an overall view of the competencies that have been developed in in the context of resilience for several case studies (January 2021)
- ii. the findings of a research study conducted among municipal officials and experts who are smart city stakeholders (March 2021)
- iii. an updated literature review to incorporate new research and trends to develop the curriculum (April 2022)
- iv. results from the observations were risen from discussion among project partners - focus groups- to decide for those that address the project's objectives (April 2022)

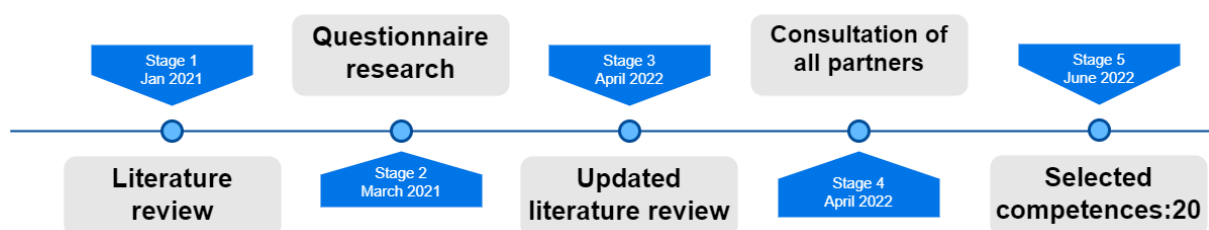


Figure 1.: Competences selection

Above all, in the first step, we had to determine the necessary skills according to the bibliography, consequently we elaborated a first literature review, aided to develop an understanding of the skills and the knowledge framework for progression to design the research. This helped in identifying and analyzing training needs, resulting in better choices for structuring a specific needs assessment [TR Tsoutsas].

In the next step, the project team conducted research, where they asked public and private sector employees to fill out a questionnaire about their roles, responsibilities, educational background, abilities, and competences that according to their opinion should

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be included at the job description for the SCRO. The data gathered was integrated with pertinent data results at the EU level to create a complete study on European countries' needs [Article Panagiotakopoulos].

Afterwards, an updated literature review was elaborated to find recent trends and research is done in the field [Article Tsoutsas]. Finally, the consortium, after discussing the research results selected the 20 competences considered that should be included in the SCRO curriculum. Additionally, it was outlined the SCRO curriculum by making strategic decisions about:

- what courses and modules the curriculum will cover
- module's aims and objectives
- how modules connect
- criteria for successful completion
- how in-depth lessons will be taught to achieve both breadth and balance within and across subjects
- learning paths
- weekly study time
- the training plans
- the course calendar and the distribution of modules and learning units throughout the calendar

3.1 SCRO curriculum learning objectives

In the EQF framework, the learning objectives are defined as 'statements of what a learner should know, understand and is able to do on completion of a learning process'[EQF framework]. Broadly defined, the learning objectives of the modules included in this curriculum are to acquire competences in the knowledge, comprehension, application, analysis, synthesis and evaluation level regarding:

- Principles and main concepts of resilient cities and urban resilience
- Promote sustainable urban development and resilience activities
- Tools to improve resilience of a city
- Understanding and measuring the risk, issues that affect the resilience of cities
- Standards and performance indicators for SC resilience
- Developing and planning disaster risk reduction action plans
- Response planning in SC
- Strategic management of resilience SC
- Transformation of SC to resilient SC

3.2 Groups of Competences

With the goal of covering all areas of the SCRO body of knowledge, the consortium endeavored to classify competencies, which resulted in four clusters. These four clusters, as they are presented in Figure 2, are the following:

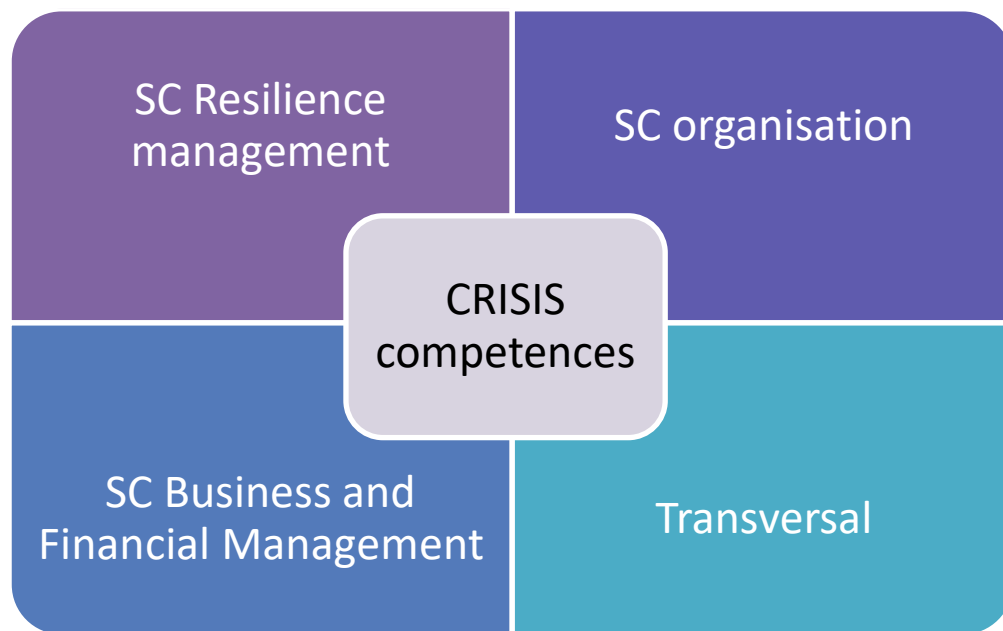


Figure 2. Four categories of skills and competences for SCO

- a) Resilience management and response planning skills (e.g., risk assessment and quantification, evaluating smart city assets etc.) including in risk response planning and effective disaster response (e.g., smart city response planning, coordination of critical systems, etc.),
- b) Smart Cities planning and organizational skills (e.g., smart city stakeholder management and citizen engagement, smart city standards for resilience, etc.),
- c) Business and Financial Management skills (e.g., planning financial recovery programs), and
- d) Transversal skills (e.g., crisis management, decision making and problem solving, etc.).

4 SCRO Job Profile's Competences

4.1 SCRO Competences

4.1.1 Resilience Management competences

This group contains the competencies that a smart city professional's educational background should provide, in order to deal effectively with the abrupt changes, pressures, and strains that a smart city will experience. It involves designing, managing,

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coordinating, and directing actions across many organizations within the city's ecosystem in order to achieve the required level of resilience and overcome unpleasant situations.

No	Skill	
1	Managing the transformation to a resilient SC	Managing transformation to resilient Smart Cities (SC) involves several interconnected issues. The purpose of this training is to cover the foundations of resilient SC and why resilience is so critical. Technology does not only bring benefits but also some risks. Creating a resilient SC is a multidisciplinary endeavor that requires the right leadership approach, and an understanding of what influences SC resilience. The major technologies that create both vulnerabilities and resilience for SC are presented. Lastly, the training introduces some best practices and examples of resilient SC worldwide. Different SCs face different challenges. While we cannot have a detailed example for each challenge a SC might face it is useful to explore as many as possible.
2	Identifying risks in SCs	<p>Although they offer major advantages, smart cities present unprecedented risks and challenges, however, not all risks have been thoroughly understood by SC officers. The complexity of their dimension, the use of technology, and their integration bring the risk perspectives into the implementation of the smart city concept. If such risks are not adequately addressed and understood, they can create issues in terms of privacy and security and, therefore, the functioning of smart cities.</p> <p>This module aims to help learners identify the origin, trends, and categories of risks in SC as they are categorized into main themes in the literature while discussing the technical and non-technical risk parameters related to smart cities implementation.</p>
3	Assessing and quantifying SC risks	<p>The purpose of this module is to cover the most important risks a Smart City (SC) faces and how to assess and quantify them. A SC can face some significant risks such as natural disasters, climate-change, aging infrastructure and cybersecurity threats.</p> <p>Technology does not just create benefits but also vulnerabilities and cybersecurity threats. Each implementation of technology, every form of data collected, used and shared introduce risks.</p> <p>Cybersecurity risks to infrastructure, private data are introduced along with specific attacks like ransomware attacks. Various cybersecurity threats such as</p>

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		ransomware attacks must be assessed and mitigated. Where possible risks must be offset or prevented. This requires that they are quantified so planning can be accurate.
4	Planning for a SC resilience	As cities face the dual challenges of managing everyday stresses and preparing for worst-case scenarios, they need to improve their operational capabilities and future-proof their infrastructure. Smart technologies can help on both fronts, although digitizing the urban environment means that cybersecurity is another critical priority. Forward-looking investment in building robust, flexible infrastructure systems can position cities to absorb future growth and whether the shocks that come their way. The ability to manage things in the moment is one aspect of keeping cities resilient. Another is planning ahead to meet long-term challenges. Analyzing data sets at scale and using tools such as geospatial mapping can give city planners better insights and ultimately support smarter decisions about where to expand infrastructure systems to accommodate growth. But all of this requires a (project) plan for SC resilience.
5	Monitoring and controlling SC resilience	Resilience quantification and measurement for complex ecosystems like SC, is a challenge. In fact, resilience cannot be estimated through verifications like following regulations and norms. SC's performance and its ability to track and manage that performance over time must directly relate to how resilient the city itself is measured. A system that fails can nonetheless demonstrate resilience by surviving the failure and recovering from it. On the other hand, a system's success does not guarantee that it will continue to be successful. Due to the danger of complacency, it is believed that monitoring is essential for a system to maintain resilience.
6	Assessing and coordinating SC assets and services	Smart services that are used by fixed and digital assets in a SC represent the core of the smart city concept since they are key enablers for most activities in the world of smart cities. In this module, they will be presented different management models and indicators are used to successfully monitor, assess, and perform analysis of assets and services offered by cities. Moreover, it addresses coordination issues regarding the usage of SC assets and services especially during the critical period of responding to hazards and disasters as well the immediate benefits and the expected progressive benefits derive e.g., guidance management that relies on the asset's intelligence.
7	Improving SC Resilience using tools	Different planning and assessment tools, utilities and frameworks for smart cities have been established and developed to deal with urban threats, being them familiar

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		<p>ancient threats (earthquakes, volcano eruptions, floods and fires) plus a modern set that includes terrorism, health crises, and industrial accidents.</p> <p>Dealing with such dangers requires new design concepts for urban spaces, foremost of which is resilience. In this context, this module will train learners in tools and frameworks for SC to support SCCRO's in coordinating and making decisions for minimizing crucial problems, especially during the critical period of responding to hazards and disasters.</p> <p>The main tools include information sources of a structural or event-response nature, to be used alone or together with a decision-support module. Existing tools that monitor and assess the performance and sustainability of smart city resources will also be addressed.</p> <p>With the aid of exploiting these tools and technologies, SC may innovate for longer-lasting value development enforcing resilience.</p>
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4.1.2 Smart City organisation competences

The set of Smart City skills includes necessary abilities required of a higher-ranking official in order to create and implement a roadmap of projects, tasks, and activities necessary to change a city into a smart one and reach the intended result of resilient.

No	Skill	
8	Developing blue-green infrastructures in SC	Blue-green infrastructure (BGI) has gained popularity as a crucial instrument for urban sustainability. BGI has been welcomed by numerous efforts all around the world in recent years, spurred on by the need to quickly address various local concerns and increase SC resilience.
9	Transforming cities through digital innovation	<p>The advancement of citizens' quality of life is a major concern of smart cities. Climate change, economic and social instability, demographic changes and other changes that the world has witnessed have posed complex challenges to cities that require a solid commitment to innovation.</p> <p>Cities are ideal for testing and implementing innovative, sustainable and integrated solutions to address these challenges. City governments have been developing innovative practices to engage citizens in innovation, including adopting digital platforms to promote communication and collaboration between government</p>

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		<p>and citizens and/or among citizens in developing bottom-up innovations.</p> <p>Digital technologies have enabled cities to develop innovative services and products that are transforming how people live, work, collaborate and communicate. However, technology also poses privacy, security and accountability challenges that must be adequately addressed.</p>
10	Geoservices and Digital Twins of SC	<p>The concept of the digital twin, applied to cities, breaks completely new ground for geoinformation. The digital image of reality makes it possible, among other things, to better visualize and also communicate planning. Different scenarios can be tried out without risk in order to make predictions about their possible effects. In the context of city resilience, digital twins can be used to determine the effects of certain incidents in advance.</p>
11	Learning SC enabling technologies	<p>Information and communications technology (ICT) for smart and sustainable urban areas provide solutions for stimulating a city's development and manageability for the benefit of its inhabitants, its economy, and the city's entire ecosystem. In terms of the enhancements in prosperity and fulfilment attained through applying ICT advancements to build, define, produce, and the city foundation, this module will demonstrate how these technologies help a smart city.</p>
12	Managing SC stakeholders and developing citizen networks	<p>Stakeholders are diverse and play a key role in the innovation and resilience of cities. They can be grouped into different areas of influence such as government and public sector, financial sector and funding system, universities and R&D entities, business sector, IT sector, NGOs and civil society, social and third sector.</p> <p>The complexity and diversity of the challenges faced by cities makes it essential to engage stakeholders and citizens in the development of services and applications that allow the city to respond quickly and sustainably to those challenges.</p>
13	SC urban planning and critical city's infrastructures	<p>Planning for SC resilience requires a complete inventory of a city's existing (critical) infrastructure. For this, in addition to appropriate tools, cities must also be given the competence to identify critical infrastructure, classify existing measures and, as a result of this, also plan further steps for comprehensive SC resilience. It is important to enable SC to appropriately implement steps towards resilient SC. However, this requires that the SC is enabled to implement prioritized issues appropriately earlier.</p>

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14	Using SC standards for resilience	<p>Standardization is the process of “technological convergence”, as well as of innovation clarification. It is defined as “the consistent use of methodologies, procedures, tools, and techniques specified above the level of individual projects”.</p> <p>Resilience is a crucial quality for smart cities since it enables cities and people to respond most effectively to stress or unforeseen circumstances. However, in order to make educated judgments and assess the results of activities performed, cities must be aware of their risks, weaknesses, and strengths in a systematic and consistent way.</p> <p>The aim of this module is twofold: it will describe the resilient SC standardization process together with specifications and guidelines for the resilient SC development that are introduced at international, and national levels; and to describe in more details the most prominent frameworks, initiative, standards for resilient cities such as ISO 37123.</p>
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4.1.3 Business and Financial Management competences

Business management abilities are those that a professional in charge of an organization should possess to ensure that the firm's objectives are realized. Financial management abilities, on the other hand, are concerned with planning, organizing, directing, and managing financial activities such as money procurement and utilization, as well as applying general management principles to the organization's financial resources.

No	Skill	
15	Data analytics for SC Decision Making	<p>This module offers an introduction to data analysis for SC decision making to produce useful predictions and conclusions from data. Emphasis will be placed on modeling real problems, comparing different methods in terms of their practical effectiveness and scaling. Learners will also gain direct experience in collecting data from several sources and will develop the necessary skills to deal with data analysis problems in SC applications</p>
16	SC security and safety establishment	<p>Safety is defined as the state of being free from harm or danger. It comprises the steps taken to safeguard individuals from accidents, harm, and exposure to dangerous situations. Safety is frequently attained by following safety protocols and procedures.</p> <p>On the other hand, security can be defined as the protection from crime and violence. It contains all</p>

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		<p>measures needed to protect people from life risks, theft, vandalism, terrorism, and other threats. Security is often achieved through the implementation of security procedures and protocols.</p> <p>Smart cities as complex ecosystems where millions of citizens work and leave requires both. This, of course, creates urgency on governments and local authorities to improve public safety and security. In many cases today we rely heavily on those new technologies and devices for achieving SC safety and security requirements. These applications are crucial to police, medical and emergency teams so to make the best decision possible when dealing with emergency situations.</p>
17	Organizing the SC for resilience using agile principles	<p>Agile cities display uncommon resilience throughout the crises they face because they use resilience preparation as their base and are able to adapt and innovate by adding new practices to react to the challenges.</p> <p>These cities adopt an adaptive planning process that allows them to adapt to change in a flexible manner in the short and medium term. Understandings and responses evolve through evolutionary development, early delivery, continuous improvement and collaboration between stakeholders in self-organizing and cross-functional teams.</p> <p>The agility of the resilient city is expressed in several dimensions, namely sustainable buildings, agile planning and management of land, networked energy systems, flexible infrastructures, efficient and responsive IT assets, smart policing and prevention strategies, education models based on intensive formats with quick proof-of-concept approaches and shorter time cycles, and a culture of constant transformation.</p>
18	Establishing financial programs for resilient development and disaster recovery	<p>Given the volume of funds needed for infrastructure modernization, smart cities must think of creative finance ways to make their vision a reality. The funding of resilient smart cities suggests innovative substitutes for conventional infrastructure financing strategies. This module will provide guiding principles based on the paradigm of SC that have actively followed similar journeys.</p>

4.1.4 Transversal Skills

According to UNESCO, the skills are those typically considered as not specifically related to a particular job, task, academic discipline or area of knowledge but as skills that can be

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used in a wide variety of situations and work settings. These skills are increasingly in high demand for learners to successfully adapt to changes and to lead meaningful and productive lives.

No	Skill	
19	Crisis management	<p>A crisis is any unforeseen event which puts the operational viability and reputation of an entity or individual at risk.</p> <p>This course module examines the steps to take before, during and after a crisis, which will help determine an outlook once the crisis has passed. In addition, it offers tools for anticipating crises and processes for developing crisis management capabilities.</p>
20	Decision Making and Problem Solving	<p>Within the context of any organization, including Smart Cities, many multifaceted problems usually emerge. Being able to analyze them, devise alternative solutions and select the best alternative is fundamental to the efficient management of the organization at any time: during a crisis or even during everyday encounters.</p> <p>In this module, three main topics will be addressed, namely, problem solving, decision-making and best practices through case studies.</p>

Regarding transversal skills, learners could also exploit relevant open educational material developed in the DEVOPS project in the following links:

- Ability to work in teams
- Communication skills
- Leadership and management Skills
- Negotiation skills
- Social skills
- Teamworking
- Information and knowledge management
- Information security strategy development and management

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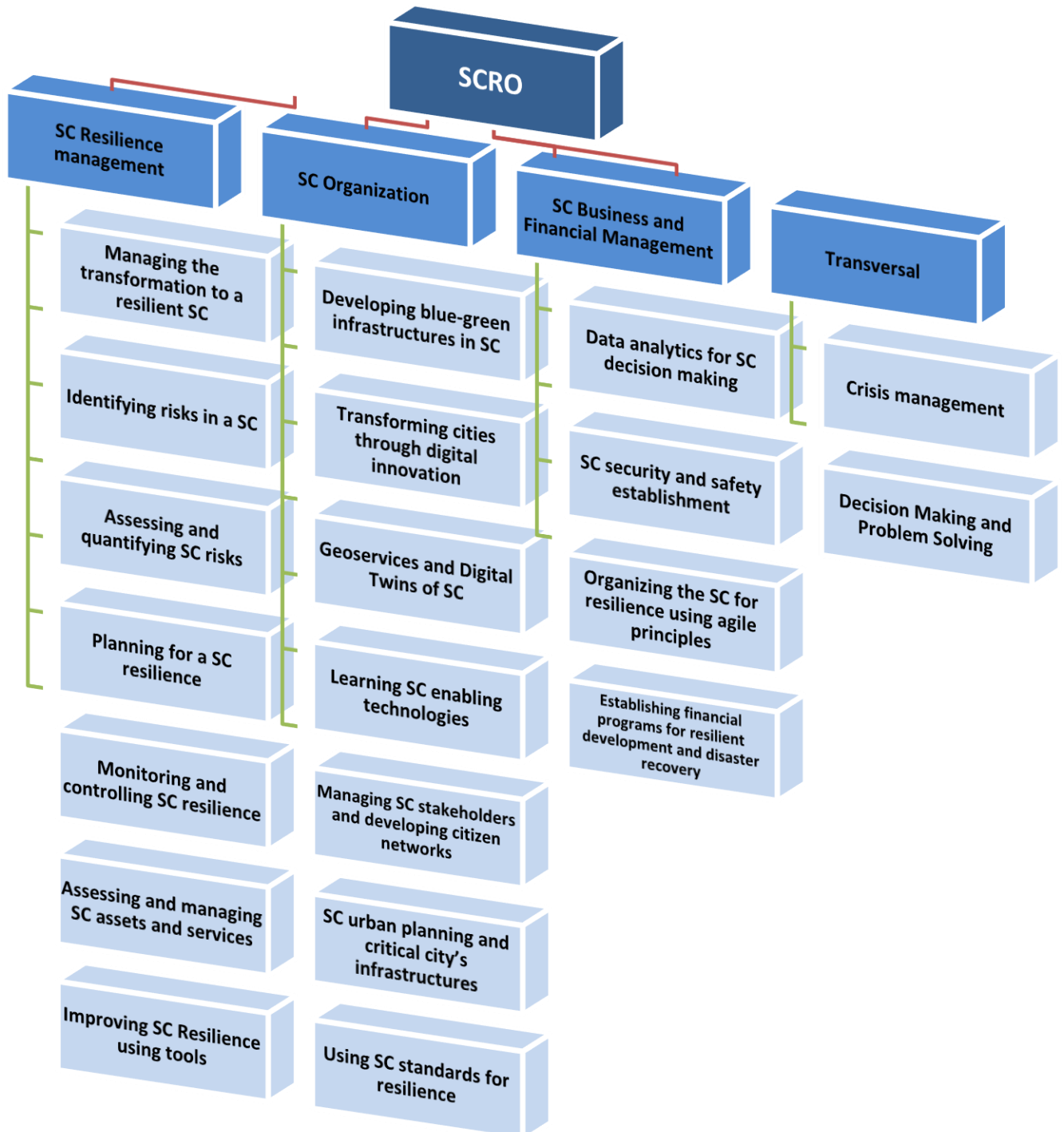


Figure 3: The set of competences that build the SCRO job profile

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5 Module designation and development

The course for acquiring the SCRO competences is build up by modules. Each competence that is taught in the course is assigned to one or more modules, with each module to contains units, and each unit is constituted from learning objects. Given that we aim to create a modular curriculum to be able to follow different learning paths, it is crucial to have a universal designation technique for all modules contained in the different learning paths are included in the curriculum.

5.3 Module Designation

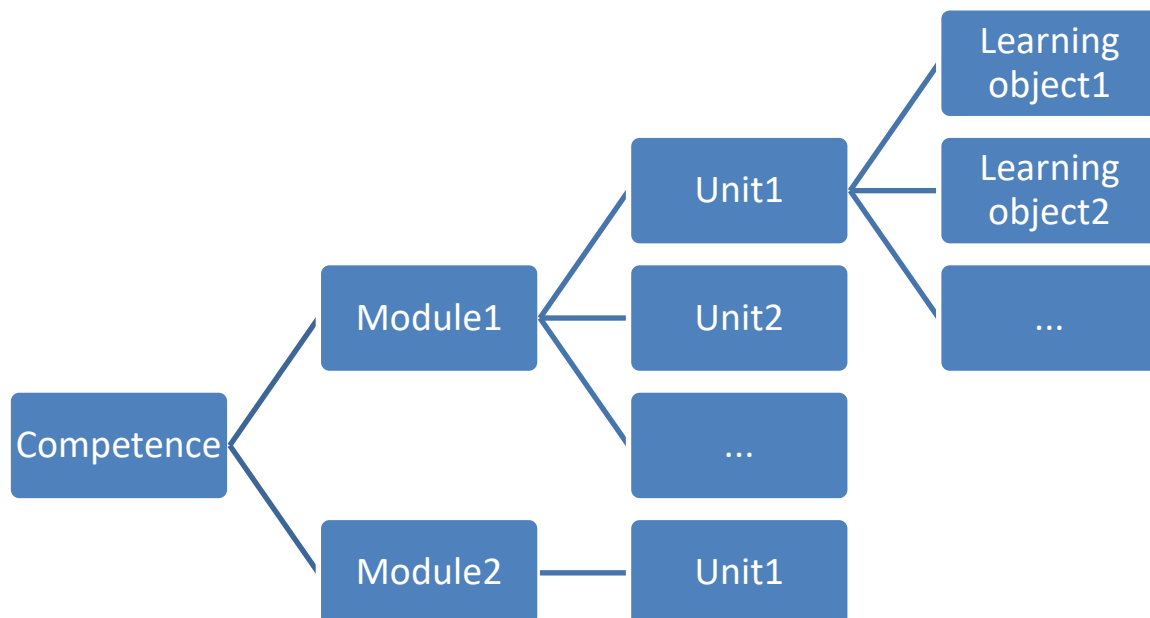


Figure 4.: Competence content hierarchy

5.4 Module development

To enable the designation of all training modules in a systematic and consistent way during the designation stage are defined the tables TB1, TB2, TB3, TB4 to write specifications for the units, learning objects like presentations, Podcasts, White papers and Assessment of the module.

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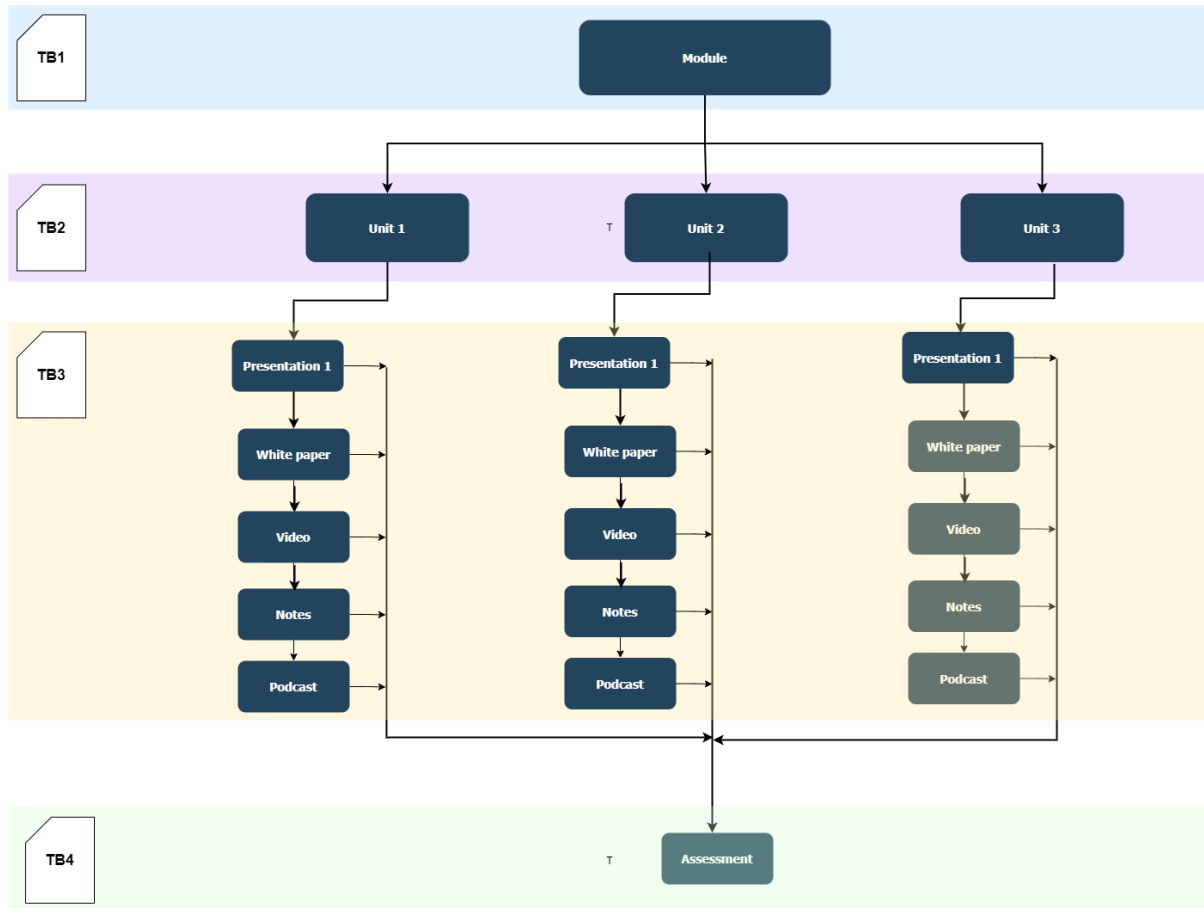


Figure 5.: TB tables for module specification

5.4.1 Module specification - TB1 template

For each module, during the designation stage, are defined: (i) the learning objectives, (ii) the learning activities, (ii) the educational technique, and (iii) the units of the module along with their learning outcomes. A template named TB1 that includes the above information along with extra information needed for its implementation will enable the designation of all training modules in a systematic and consistent way. The template will include the following fields:

Table filename: mm.TB1 (*mm: MODULE ID*)

mm.TB1: MODULE TITLE SPECIFICATION (<i>mm: MODULE ID</i>)		
1	Module ID	<i>Module ID, the unique ID for each module according to the curriculum</i>

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2	Module title	<i>Title of the module according to the curriculum</i>
3	Language	English
4	Module description	<i>Includes the description of the module, i.e., the training problem it addresses, the context of application, the learning goals, the learning objectives and the learners' needs that the module meets. (up to 100 words)</i>
5	Learning objectives	<i>LObj1. Learning objectives (4 up to 10) for the module</i>
<p>Learning outcomes for the Cognitive domain+ (Bloom Taxonomy) <i>{The learning outcomes of the module assigned to Comprehension, Application, Analysis, Synthesis and Evaluation level according to the Bloom taxonomy please underline the verb and the concept of the knowledge domain used}</i> Upon completion of this module, the learner will be able to:</p>		
1. Knowledge level		
LOut1	(Use verbs according to bloom taxonomy)	
LOut2		
2. Comprehension level		
Lout3		
3. Application level		
4. Analysis level		
5. Synthesis level		
6. Evaluation level		
mm-u TB2: UNIT SPECIFICATION		
Module Units	Unit ID*	Unit title
	mm-1	
	mm-2	
	mm-3	
	mm-4	

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5.4.2 Unit specification – TB2 template

Every module (competence) consists of 3 to 4 units. In TB2 template we state the units that the module includes which correspond to learning objects. Please fill in as many times as necessary for each module.

mm-u TB2: UNIT SPECIFICATION		
Module Units	Unit ID	Unit title
	ModuleID.1	mm-u (mm:MODULE ID, u UNIQUE UNIT ID from 1-4)
	ModuleID.2	
	ModuleID.3	
The following are repeated for each different unit is included in the module		
1	Unit ID	mm-u (mm:MODULE ID, u UNIQUE UNIT ID) <i>This corresponds to a unit of the module</i>
2	Unit title	The Unit title
3	Unit description	This unit content and what it includes, in bullets
4	Educational strategy	<i>presentation, video, article</i>
5	Unit Learning outcomes	mm.LOUT1 mm.LOUT2, etc
6	Unit core material (Learning object (LO)) (code and title)	
7	Unit additional material (code and title)	
8	Assessment objects (projects, self-evaluation exercises, etc.) (code and title)	
9	Unit schedule	

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5.4.3 Learning Object Specification – TB3 template

As regards to the development process of the learning objects, the module content will follow the design completed in the previous phases. The learning objects are developed according to the learning outcomes are specified in the unit outlines. The additional table template **TB3: Learning Object Description** is provided to record all the learning objects and their outcomes for unit contents (learning objects). The table TB3 is repeated for each different learning object is included in the unit.

mm-u-l - TB3: Learning Object Specification		
1	Learning object ID	mm-u-l (mm:MODULE ID, u UNIQUE UNIT ID, UNIQUE LO ID) <i>This corresponds to a LO of the unit (presentation, video, article, etc)</i>
2	Learning object title	
3	Language	English
4	Learning object description	Learning objects of this UNIT
5	Learning outcomes (LOut)	
6	Learning recourse type (IEEE LOM)	<i>Presentation, video, article, etc</i>
7	Technical type (IEEE LOM)	Text
8	Workload (Estimated study time) (min)	XX minutes

5.4.4 Module assessment – TB4 template

Finally, the table template **TB4-Module Assessment** is developed which defines the assessment methods that will be used for each unit of the module. These could include formative assessment of the trainees based on multiplechoice questions, online forms, exercises, projects, practical assignments, etc. Methodologically the assessment tests will be based on the learning outcomes approach, taking into account the units of learning outcomes per learning module. The table TB4 is repeated for the assessment of each unit.

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mm-u-A TB4: Unit Assessment Object			
1	Assessment Object ID	<i>mm-u-A (mm:MODULE ID, u UNIQUE UNIT ID)</i>	
3	Language	English	
4	Learning recourse type (IEEE LOM)	Multiple Choice Questions/ Report /	
5	Technical type (IEEE LOM)	<i>Text</i>	<i>Document</i>
6	Workload (Estimated study time) (min)	30	
7	Write down the assessment object (quiz)	<i>Use the template below as many times as needed and modify accordingly to specific question type (1 template for each question).</i>	

The Question template will be repeated *as many times as needed* for all questions used for the unit assessment.

Question template	
Question ID	<i>XX-Y-A-ZZ (XX:MODULE ID, Y UNIQUE UNIT ID, ZZ UNIQUE QUESTION ID)</i>
Question	Text of the question
Possible answers	
Correct answer	
Response to correct answer	e.g. Your answer is correct. Congratulations!
Response to wrong answer(s)	e.g Not quite right. The correct answer is b
Times the question can be taken	Number

6 Competences Dependencies and Schedule

The qualification for the competences will be applied in three stages covering the following phases of training:

- **Introductory modules**
 - Managing the transformation to a resilient SC
 - Learning SC enabling technologies
 - Managing SC stakeholders and developing citizen networks
 - Data analytics for SC decision making
 - SC security and safety establishment
 - Crisis management
 - Decision Making and Problem Solving
- **Mandatory modules**
 - Identifying risks in SC
 - Assessing and quantifying SC risks
 - Planning for a SC resilience
 - Monitoring and controlling SC resilience
 - Assessing and coordinating SC assets and services
 - Improving SC Resilience using tools
 - Transforming cities through digital innovation
 - SC urban planning and critical city's infrastructures
 - Organizing the SC for resilience using agile principles
 - Establishing financial programs for resilient development and disaster recovery
- **Specialization modules**
 - Developing blue-green infrastructures in SC
 - Transforming cities through digital innovation
 - Geoservices and Digital Twins of SC
 - Using SC standards for resilience
 - Organizing the SC for resilience using agile principles

ANEX I – Competences revealed

Competence/Article	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]
Communication with stakeholders during crisis		x		x	x						x				
Managing emergency smart city assets and resources		x		x		x						x	x		
Mobilizing external resources (nearby cities, governmental agencies, volunteers)					x		x			x	x				
Operating emergency control centers				x					x	x			x		
Risk management tools		x	x	x	x		x		x	x		x	x		
Risk monitoring and control		x	x	x		x			x	x	i		x		
Risk transference techniques (insuring)												x			
Smart cities risk identification		x	x	x					x	x	x	x	x		
Training stakeholders for effective disaster response		x	x		x					x	x	x			
Coordination and interoperability of critical systems and services		x		x	x		x		x	x	x				
Evaluating smart cities assets, services and resources				x	x					x	x	x	x	x	



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Competence/Article	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]
Risk assessment and quantification			x	x					x	x	x	x	x		
Smart city response planning			x	x						x	x	x		x	x
Citizens, Crowd Sourcing and Social Networking															
Smart city organization structure, role and accountability		x	x			x									
Smart city strategic vision and planning		x	x	x	x	x									
Blue-green infrastructures in cities											x	x			
Digital Innovation Management		x									x	x		x	x
GIS and Digital Twinning of Smart Cities										x					
Smart cities: context, policy and operation			x	x	x	x						x			
Enabling technologies for resilient SC (Smart city enabling technologies)		x	x	x			x								x
Smart City stakeholder management and citizen engagement					x										
Smart city standards for resilience		x		x							x	x	x		
Smart city urban planning and infrastructures											x	x	x		x
Agile Management						x		x							



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Competence/Article	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]
Creating and managing incentive schemas for non-profit organizations, businesses and citizens															
Project and portfolio management			X	X		X						X	X		
Smart cities financing and funding methods					X							X			
Data analytics and statistics		X		X		X		X	X	X			X		
Information security strategy development and management		X	X	X		X	X								
Planning financial recovery programs															

Competence/Article	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]	[25]	[26]	[27]	[28]	[29]	[30]
Communication with stakeholders during crisis		X							X	X		X	X		
Managing emergency smart city assets and resources									X			X	X	X	X
Mobilizing external resources (nearby cities, governmental agencies, volunteers)											X				
Operating emergency control centers									X			X		X	X

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Competence/Article	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]	[25]	[26]	[27]	[28]	[29]	[30]
Risk management tools				x					x	x				x	x
Risk monitoring and control		x		x	x				x	x		x	x	x	x
Risk transference techniques (insuring)															
Smart cities risk identification					x			x	x	x	x	x	x	x	x
Training stakeholders for effective disaster response		x							x						
Coordination and interoperability of critical systems and services	x							x	x		x	x	x	x	x
Evaluating smart cities assets, services and resources	x			x		x								x	
Risk assessment and quantification		x		x				x	x			x	x	x	
Smart city response planning		x		x	x			x	x		x	x	x		
Citizens, Crowd Sourcing and Social Networking				x							x		x		
Smart city organization structure, role and accountability													x		
Smart city strategic vision and planning		x		x		x		x	x		x			x	x
Blue-green infrastructures in cities				x		x								x	
Digital Innovation Management			x							x		x	x	x	x

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Competence/Article	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]	[25]	[26]	[27]	[28]	[29]	[30]
GIS and Digital Twinning of Smart Cities										X			X		
Smart cities: context, policy and operation						X			X					X	
Enabling technologies for resilient SC (Smart city enabling technologies)										X	X	X	X	X	X
Smart City stakeholder management and citizen engagement		X				X		X		X			X		
Smart city standards for resilience															X
Smart city urban planning and infrastructures				X		X		X	X		X		X	X	X
Agile Management											X				
Creating and managing incentive schemas for non-profit organizations, businesses and citizens															
Project and portfolio management															
Smart cities financing and funding methods															
Data analytics and statistics				X			X		X	X			X	X	
Information security strategy development and management									X		X				X



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Planning financial recovery programs

- [1] Dos Santos, HA; Santana, ED; Bueno, RE; Bonilla, SH'Technologies Helping Smart Cities to Build Resilience: Focus on COVID-19'
- [2] Tonmoy, FN; Hasan, S; Tomlinson, R'Increasing Coastal Disaster Resilience Using Smart City Frameworks: Current State, Challenges, and Opportunities'
- [3] Shayan, S; Kim, KP; Ma, T; Nguyen, THD'The First Two Decades of Smart City Research from a Risk Perspective'
- [4] Elvas, LB; Mataloto, BM; Martins, AL; Ferreira, JC'Disaster Management in Smart Cities'
- [5] Marana, P; Eden, C; Eriksson, H; Grimes, C; Hernantes, J; Howick, S; Labaka, L; Latinos, V; Lindner, R; Majchrzak, TA; Pyrko, I; Radianti, J; Rankin, A; Sakurai, M; Sarriegi, JM; Serrano, N'Towards a resilience management guideline - Cities as a starting point for societal resilience'
- [6] Konstantinou, C'Toward a Secure and Resilient All-Renewable Energy Grid for Smart Cities'
- [7] Kitchin, R; Dodge, M'The (In)Security of Smart Cities: Vulnerabilities, Risks, Mitigation, and Prevention'
- [8] Anjum, A; Ahmed, T; Khan, A; Ahmad, N; Ahmad, M; Asif, M; Reddy, AG; Saba, T; Farooq, N'Privacy preserving data by conceptualizing smart cities using MIDR-Angelization'
- [9] Motta, M; Neto, MD; Sarmento, P'A mixed approach for urban flood prediction using Machine Learning and GIS'
- [10] Kim, J; Park, J; Kim, K; Kim, M'RnR-SMART: Resilient smart city evacuation plan based on road network reconfiguration in outbreak response'
- [11] Galle, NJ; Nitoslawski, SA; Pilla, F'The Internet of Nature: How taking nature online can shape urban ecosystems'
- [12] Moglia, M; Frantzeskaki, N; Newton, P; Pineda-Pinto, M; Witheridge, J; Cook, S; Glackin, S'Accelerating a green recovery of cities: Lessons from a scoping review and a proposal for mission-oriented recovery towards post-pandemic urban resilience'
- [13] Shao, WW; Su, X; Lu, J; Liu, JH; Yang, ZY; Mei, C; Liu, C; Lu, JH'Urban Resilience of Shenzhen City under Climate Change'
- [14] Connelly, A; O'Hare, P; White, I'The best flood I ever had: Contingent resilience and the (relative) success of adaptive technologies'
- [15] Thaler, T; Witte, PA; Hartmann, T; Geertman, SCM'Smart Urban Governance for Climate Change Adaptation'
- [16] Ganin, AA; Mersky, AC; Jin, AS; Kitsak, M; Keisler, JM; Linkov, I'Resilience in Intelligent Transportation Systems (ITS)'
- [17] Wilk, J; Jonsson, AC; Rydhagen, B; del Callejo, I; Cerruto, N; Chila, G; Encinas, S; Kumar, A; Rani, A'Assessing vulnerability in Cochabamba, Bolivia and Kota, India: how do stakeholder processes affect suggested climate adaptation interventions?'
- [18] Serrano, W'The Blockchain Random Neural Network for cybersecure IoT and 5G infrastructure in Smart Cities'



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- [19] Wang, Z; Deng, XZ; Wong, C; Li, ZH; Chen, JC'Learning urban resilience from a social-economic-ecological system perspective: A case study of Beijing from 1978 to 2015'
- [20] Kousis, I; Pigliautile, I; Pisello, AL'Intra-urban microclimate investigation in urban heat island through a novel mobile monitoring system'
- [21] Monstadt, J; Coutard, O'Cities in an era of interfacing infrastructures: Politics and spatialities of the urban nexus'
- [22] Yang, DL; Liu, YL'Finite-Element Analysis of Vertical Displacement of Laminated Rubber Bearing under Earthquake Action for Disaster Resilience of the Smart City'
- [23] Rus, K; Kilar, V; Koren, D'Resilience assessment of complex urban systems to natural disasters: A new literature review'
- [24] Moraci, F; Errigo, MF; Fazio, C; Campisi, T; Castelli, F'Cities under Pressure: Strategies and Tools to Face Climate Change and Pandemic'
- [25] Cureau, RJ; Pigliautile, I; Pisello, AL'A New Wearable System for Sensing Outdoor Environmental Conditions for Monitoring Hyper-Microclimate'
- [26] Suarez-Inclan, AM; Allende-Prieto, C; Roces-Garcia, J; Rodriguez-Sanchez, JP; Sanudo-Fontaneda, LA; Rey-Mahia, C; alvarez-Rabanal, FP'Development of a Multicriteria Scheme for the Identification of Strategic Areas for SUDS Implementation: A Case Study from Gijon, Spain'
- [27] Sahil; Sood, SK'Fog-Cloud centric IoT-based cyber physical framework for panic oriented disaster evacuation in smart cities'
- [28] Fan, C; Jiang, YC; Mostafavi, A'Social Sensing in Disaster City Digital Twin: Integrated Textual-Visual-Geo Framework for Situational Awareness during Built Environment Disruptions'
- [29] Li, JY; Nassauer, JI'Technology in support of nature-based solutions requires understanding everyday experiences'
- [30] Boubakri, W; Abdallah, W; Boudriga, N'ZAO-AKA : a zero knowledge proof chaotic authentication and key agreement scheme for securing smart city cyber physical system'

ANEX II – TB1s: Module Specifications for the competences

1. Managing the transformation to a resilient SC – EDEX

TB1: MODULE OUTLINE		
1	Module ID	1
2	Module title	Managing the transformation to a resilient SC
3	Language	English
4	Module description	<p>Managing transformation to resilient Smart Cities (SC) involves several interconnected issues. The purpose of this training is to cover the foundations of resilient SC and why resilience is so critical. Technology does not only bring benefits but also some risks. Creating a resilient SC is a multidisciplinary endeavor that requires the right leadership approach, and an understanding of what influences SC resilience. The major technologies that create both vulnerabilities and resilience for SC are presented. Lastly, the training introduces some best practices and examples of resilient SC worldwide. Different SCs face different challenges (Fitsilis, 2022). While we cannot have a detailed example for each challenge a SC might face it is useful to explore as many as possible.</p> <p>Reference</p> <p>Fitsilis, P. (2022) Building on Smart Cities Skills and Competences. Edited by P. Fitsilis. Cham: Springer International Publishing (Internet of Things). doi: 10.1007/978-3-030-97818-</p>
5	Learning objectives	<p>The module focuses on managing the transformation to a resilient SC, and its learning objectives are:</p> <p>Learn fundamental concepts of a resilient SC</p> <p>Challenges to resilient SC in the global context</p>

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		<p>Current approaches to resilience in cities</p> <p>The main principles of resilient SC</p> <p>Leadership and strategy for resilient SC</p> <p>The consequences of global events with a high impact (pandemics and wars)</p> <p>The contribution of recent technologies to SC resilience</p> <p>Learning from case studies of resilient SC</p>
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Learning outcomes for the Cognitive domain+ (Bloom Taxonomy)

Code	Learning Outcome { <i>please underline the verb and the concept of the knowledge domain used</i> } Upon completion of this module, the learner will be able to:
1. Knowledge level	
Lout1	Describe the main aspects of a resilient SC
Lout2	Describe what the main challenges of a resilient SC are
Lout3	Outline the typical successful models of resilient SCs
Lout4	Identify the main principles of a resilient SC
Lout5	Identify the typical leadership styles and strategies for a resilient SC
Lout6	Describe some typical impacts of global events like pandemics and wars
Lout7	Describe four technologies that are making cities more resilient and smarter
2. Comprehension level	
Lout8	Explain the impact of different technologies on a resilient SC
Lout9	Give examples from case studies of resilient SCs
3. Application level	
4. Analysis level	
5. Synthesis level	

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6. Evaluation level

Lout10	Argue about the level of resilience a SC must achieve
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2. Identifying risks in a SC - UTH

02.TB1: <i>Identifying risks in a SC</i>		
1	Module ID	02
2	Module title	<i>Identifying risks in SCs</i>
3	Language	English
4	Module description	<p>Although they offer major advantages, smart cities present unprecedented risks and challenges, however, not all risks have been thoroughly understood by SC officers. The complexity of their dimension, the use of technology, and their integration bring the risk perspectives into the implementation of the smart city concept. If such risks are not adequately addressed and understood, they can create issues in terms of privacy and security and, therefore, the functioning of smart cities.</p> <p>This module aims to help learners identify the origin, trends, and categories of risks in SC as they are categorized into main themes in the literature while discussing the technical and non-technical risk parameters related to smart cities implementation.</p>
5	Learning objectives	<p>The course module focuses on Smart City risk identification and its learning objectives is to introduce trainees to the following issues:</p> <ul style="list-style-type: none"> • Identify fundamental risks that a SC faces • Identify the origin, trends, and fundamental risks in SCs • Categorize risks in smart cities • Understand the methods that can be used to identify the complexity of risks dimension in a SC • Discussing the technical and non-technical risk parameters related to smart cities implementation • Understand the dominant technology used in SC's applications, e.g. Internet of Things, Artificial Intelligence, and blockchain
<p>Learning outcomes for the Cognitive domain+ (Bloom Taxonomy) <i>{The learning outcomes of the module assigned to Comprehension, Application, Analysis, Synthesis and Evaluation level according to the Bloom taxonomy please underline the verb and the concept of the knowledge domain used}</i> Upon completion of this module, the learner will be able to:</p>		
1. Knowledge level		
LOut1	Label fundamental risks that a SC faces	

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2. Comprehension level		
LOut2	Understand the origin, trends, and fundamental risks in SCs	
3. Application level		
LOut3	Apply methods that can be used to identify the complexity of risks dimension in a SC;	
4. Analysis level		
LOut4	Categorize risks in smart cities	
5. Synthesis level		
LOut5	Explain the technical and non-technical risk parameters related to smart cities implementation	
6. Evaluation level		
LOut6	Describe the dominant technology used in SC's applications, e.g. Internet of Things, Artificial Intelligence, and blockchain	
mm-u TB2: UNIT SPECIFICATION		
Module Units	Unit ID*	Unit title
	mm-1	
	mm-2	
	mm-3	
	mm-4	

3. Assessing and quantifying SC risks – EDEX

TB1: MODULE OUTLINE		
1	Module ID	3
2	Module title	Assessing and quantifying SC risks
3	Language	English

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4	Module description	<p>The purpose of this module is to cover the most important risks a Smart City (SC) faces and how to assess and quantify them. A SC can face some significant risks such as natural disasters, climate-change, aging infrastructure and cybersecurity threats (Fitsilis, 2022).</p> <p>Technology does not just create benefits but also vulnerabilities and cybersecurity threats. Each implementation of technology, every form of data collected, used and shared introduce risks.</p> <p>Cybersecurity risks to infrastructure, private data are introduced along with specific attacks like ransomware attacks. Various cybersecurity threats such as ransomware attacks must be assessed and mitigated (Zarifis et al., 2021). Where possible risks must be offset or prevented. This requires that they are quantified so planning can be accurate.</p> <p>References Fitsilis, P. (2022) Building on Smart Cities Skills and Competences. Edited by P. Fitsilis. Cham: Springer International Publishing (Internet of Things). doi: 10.1007/978-3-030-97818-1. Zarifis, A. et al. (2021) 'Can Global, Extended, and Repeated Ransomware Attacks Overcome the User's Status Quo Bias and Cause a Switch of System?', International Journal of Information Systems in the Service Sector, 14(1), pp. 1–16. doi: 10.4018/ijisss.289219.</p>
5	Learning objectives	<p>The course focuses on assessing and quantifying risks to a SC and the learning objectives are:</p> <ol style="list-style-type: none"> 1. Learn fundamental risks a SC faces and how to quantify them. 2. Assess the cybersecurity risks to a SC. Understand the risks to a SC from an over-reliance on technology and people losing some skills. 3. Understand the methods that can be used to quantify risk in a SC. 4. Learn how to use risk quantifying tools and see examples of their application.

Learning outcomes for the Cognitive domain⁺ (Bloom Taxonomy)

Code	Learning Outcome <i>{please underline the verb and the concept of the knowledge domain used}</i>
	Upon completion of this module, the learner will be able to:

1. Knowledge level

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Lout1	Describe the fundamental risks a SC faces and how to quantify them
Lout2	Outline the regular risks a SC faces such as risks from heat and pollution and aging infrastructure
Lout3	Outline the risks to SC from natural disasters and climate change
Lout4	Understand the risks to a SC from global events like disruptions to supply chains, economic instability and high inflation
Lout5	Understand the cybersecurity risks to a SC
Lout6	Describe the risks to SC from an over-reliance on technology and people losing other skills
Lout7	Describe methods to quantify risk in a SC.
Lout8	Develop a risk management plan and a risk mitigation plan.
2. Comprehension level	
Lout9	Give examples of risk quantifying tools
Lout10	Explain the different benefits of risk quantifying tools
3. Application level	
4. Analysis level	
5. Synthesis level	
6. Evaluation level	
Lout11	Argue about which are the greatest risks facing a SC and how to quantify them

4. Planning for a SC resilience - FUH

TB1: MODULE OUTLINE		
1	Module ID	4
2	Module title	Planning for a SC resilience
3	Language	English
4	Module description	As cities face the dual challenges of managing everyday stresses and preparing for worst-case scenarios, they need to improve their operational capabilities and future-proof their infrastructure. Smart technologies can help on both fronts, although digitizing the urban environment means that cybersecurity is another critical priority. Forward-looking investment in building robust, flexible infrastructure systems can position cities to absorb future growth and whether the shocks that come their way. The ability to manage things in the moment is one aspect of keeping cities resilient. Another is

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		planning ahead to meet long-term challenges. Analyzing data sets at scale and using tools such as geospatial mapping can give city planners better insights and ultimately support smarter decisions about where to expand infrastructure systems to accommodate growth. But all of this requires a (project) plan for SC resilience.
6	Learning objectives	<p>The course module focuses on Smart City (SC) services and assets and its learning objectives is to introduce trainees to the following issues:</p> <ol style="list-style-type: none"> 1. Creation of a project plan for the implementation for a SC resilience 2. Identification of milestones 3. Monitoring of the implementation for a SC resilience 4. Evaluation of the implementation for a SC resilience 5. Conflict management and problem-solving skills

Learning outcomes for the Cognitive domain⁺ (Bloom Taxonomy)

Code	<p>Learning Outcome {<i>please underline the verb and the concept of the knowledge domain used</i>}</p> <p>Upon completion of this module, the learner will be able to:</p>
1. Knowledge level	
LOut1	Describe the creation of the project plan for the implementation for a SC resilience.
LOut2	Describe what relevant milestones are and how to identify.
2. Comprehension level	
LOut3	Recognize what are the challenges in planning a SC resilience.
LOut4	Explain the different perspective that stakeholders have in planning a SC resilience.
3. Application level	
LOut5	What are appropriate tools for planning and monitoring?
4. Analysis level	
LOut6	How can conflicts and problems be identified at an early stage?
5. Synthesis level	
6. Evaluation level	
LOut7	Argue whether a city has the qualifications to be a SC

5. Monitoring and controlling SC - HOU

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6. Assessing and managing SC assets and services – UTH

06.TB1: <i>Assessing and coordinating SC assets and services</i>		
1	Module ID	06
2	Module title	<i>Assessing and coordinating SC assets and services</i>
3	Language	English
4	Module description	Smart services that are used by fixed and digital assets in a SC represent the core of the smart city concept since they are key enablers for most activities in the world of smart cities. In this module, they will be presented different management models and indicators are used to successfully monitor, assess, and perform analysis of assets and services offered by cities. Moreover, it addresses coordination issues regarding the usage of SC assets and services especially during the critical period of responding to hazards and disasters as well the immediate benefits and the expected progressive benefits derive e.g., guidance management that relies on the asset's intelligence.
5	Learning objectives	<p>The course focuses on presenting management, assessment tools and key performance indicators to assess Smart City assets and services and its learning objectives are to introduce trainees to the following issues:</p> <ol style="list-style-type: none">1. Have a holistic view of SC Infrastructures, major assets and services2. Measure the Efficiency of Smart Solutions3. Rigorous and pervasive asset and service management4. Assessment tools and Key Performance Indicators sets5. Security issues and Asset tracking6. Understand benefits from asset management that relies on the evolvement of asset's intelligence.
<i>Learning outcomes for the Cognitive domain+ (Bloom Taxonomy)</i> <i>{The learning outcomes of the module assigned to Comprehension, Application, Analysis, Synthesis and Evaluation level according to the Bloom taxonomy please underline the verb and the concept of the knowledge domain used}</i> Upon completion of this module, the learner will be able to:		
1. Knowledge level		
LOut1		Label major assets and services;
2. Comprehension level		
LOut2		Measure the Efficiency of Smart Solutions
3. Application level		
LOut3		Apply rigorous and pervasive asset and service management
4. Analysis level		
LOut4		Analyze Security issues and Asset tracking
5. Synthesis level		

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LOut5		Explain assessment tools and Key Performance Indicators sets
6. Evaluation level		
LOut6		Appraise benefits from asset management that relies on the involvement of asset’s intelligence.
mm-u TB2: UNIT SPECIFICATION		
Module Units	Unit ID*	Unit title
	mm-1	
	mm-2	
	mm-3	
	mm-4	

7. Improving SC Resilience using tools – UMINHO

1	Module ID	7
2	Module title	Improving SC Resilience using tools
3	Language	English
4	Module description	<p><i>Different planning and assessment tools, utilities and frameworks for smart cities have been established and developed to deal with urban threats, being them familiar ancient threats (earthquakes, volcano eruptions, floods and fires) plus a modern set that includes terrorism, health crises, and industrial accidents.</i></p> <p><i>Dealing with such dangers requires new design concepts for urban spaces, foremost of which is resilience. In this context, this module will train learners in tools and frameworks for SC to support SCCRO's in coordinating and making decisions for minimizing crucial problems, especially during the critical period of responding to hazards and disasters.</i></p> <p><i>The main tools include information sources of a structural or event-response nature, to be used alone or together with a decision-support module. Existing tools that monitor and assess the performance and sustainability of smart city resources will also be addressed.</i></p> <p><i>With the aid of exploiting these tools and technologies, SC may innovate for longer-lasting value development enforcing resilience.</i></p>
5	Learning objectives	<p><i>LObj2. Identify the indicators capable to assess the resilience of a city to specific threats.</i></p> <p><i>LObj3. Develop a monitoring plan for these indicators.</i></p> <p><i>LObj4. Define a plan to improve the resilience of a city.</i></p>

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Learning outcomes for the Cognitive domain+ (Bloom Taxonomy)	
{The learning outcomes of the module assigned to Comprehension, Application, Analysis, Synthesis and Evaluation level according to the Bloom taxonomy please underline the verb and the concept of the knowledge domain used}	
Upon completion of this module, the learner will be able to:	
1. Knowledge level	
LOut1	To state the main threats a smart city may be subjected to.
2. Comprehension level	
LOut2	To describe the factors that influence the resilience level of a smart city
3. Application level	
LOut3	To use tools to assess and monitor the resilience of a city
4. Analysis level	
LOut4	To examine the potential of IT applications to strengthen the resilience of a city
5. Synthesis level	
LOut5	To critique the various options to increase the resilience of a city
6. Evaluation level	
LOut6	To develop a monitoring plan that integrates <i>indicators capable to assess the resilience of a city</i>
LOut7	To develop a plan <i>to improve the resilience of a city.</i>

7. Developing blue-green infrastructures in SC – HOU

TB1: MODULE OUTLINE		
1	Module ID	8
2	Module title	Developing blue-green infrastructures in SC
3	Language	English
4	Module description	<p>Literature and practice have showcased the determining role of adapting blue-green infrastructure strategies when planning for urban environment resilience, sustainability and viability.</p> <p>This module focuses on highlighting the benefits of engaging smart technologies in developing blue-green infrastructure and on showing that a smart city constitutes the ideal platform to apply these technologies. It will also focus on exploring proven methods and means of applying such technologies.</p>
5	Learning objectives	<p>LObj1. Explain the role of blue green infrastructure for the urban ecosystem</p> <p>LObj2. Introduce blue green infrastructure component elements</p>

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		<p>LObj3. Explore how smart technologies benefits blue green infrastructure</p> <p>LObj4. Present blue green infrastructure cases</p>
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9. Transforming cities through digital innovation

1	Module ID	9
2	Module title	<i>Transforming cities through digital innovation</i>
3	Language	English
4	Module description	<p>The advancement of citizens' quality of life is a major concern of smart cities. Climate change, economic and social instability, demographic changes and other changes that the world has witnessed have posed complex challenges to cities that require a solid commitment to innovation.</p> <p>Cities are ideal for testing and implementing innovative, sustainable and integrated solutions to address these challenges. City governments have been developing innovative practices to engage citizens in innovation, including adopting digital platforms to promote communication and collaboration between government and citizens and/or among citizens in developing bottom-up innovations.</p> <p>Digital technologies have enabled cities to develop innovative services and products that are transforming how people live, work, collaborate and communicate. However, technology also poses privacy, security and accountability challenges that must be adequately addressed.</p>
5	Learning objectives	<p><i>LObj5.</i> Identify the concepts and enablers that motivate digital transformation in a city;</p> <p><i>LObj6.</i> Identify the strategic resources needed to implement digital transformation addressing the main challenges of the city;</p> <p><i>LObj7.</i> Develop a plan to innovate the services and/or products that take advantage of data technology.</p> <p><i>LObj8.</i> Define an innovation process for a smart city that encourages the engagement of citizens and takes into account legal and ethical constraints.</p>
<i>Learning outcomes for the Cognitive domain+ (Bloom Taxonomy)</i> <i>{The learning outcomes of the module assigned to Comprehension, Application, Analysis, Synthesis and Evaluation level according to the Bloom taxonomy please underline the verb and the concept of the knowledge domain used}</i> Upon completion of this module, the learner will be able to:		
1. Knowledge level		
LOut1	To list enablers and barriers of urban digital transformation;	
2. Comprehension level		
LOut2	To explain proven strategies to motivate initiating and participation in urban digital transformation;	

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LOut3	To identify the resources, including technological resources, typically involved in urban digital transformation;
3. Application level	
LOut4	To demonstrate the relevance of advanced technologies (e.g., IoT, Cloud, IA, Blockchain) for urban transformation;
4. Analysis level	
LOut5	To examine the privacy, security and accountability issues associated with the adoption of data technology to innovate services and products;
LOut6	To compare existing frameworks guiding urban innovation;
5. Synthesis level	
LOut7	To design an innovation process for a smart city;
6. Evaluation level	
LOut8	To assess the effectiveness of the designed process against the processes implemented in specific cities.

10. Geoservices and Digital Twins of SC – FUH

TB1: MODULE OUTLINE		
1	Module ID	10
2	Module title	Geoservices and Digital Twins of SC
3	Language	English
4	Module description	The concept of the digital twin, applied to cities, breaks completely new ground for geoinformation. The digital image of reality makes it possible, among other things, to better visualize and also communicate planning. Different scenarios can be tried out without risk in order to make predictions about their possible effects. In the context of city resilience, digital twins can be used to determine the effects of certain incidents in advance.
6	Learning objectives	<p>The course module focuses on digital twins of a Smart City (SC) and assets, and its learning objectives is to introduce trainees to the following issues:</p> <ol style="list-style-type: none"> 1. Creation of a project plan for the development of a digital twin of a SC 2. Identification of milestones 3. Monitoring of the implementation development of a digital twin of a SC

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		<div>4. Evaluation of the implementation development of a digital twin of a SC</div> <div>5. Derive key resilience aspects from the application of different scenarios to the digital twin of the SC</div>
Learning outcomes for the Cognitive domain ⁺ (Bloom Taxonomy)		
Code	<div>Learning Outcome {<i>please underline the verb and the concept of the knowledge domain used</i>}</div> <div>Upon completion of this module, the learner will be able to:</div>	
1. Knowledge level		
LOut1	Describe the creation of the project plan for the development of a digital twin of a SC.	
LOut2	Describe what relevant milestones are and how to identify.	
2. Comprehension level		
LOut3	Recognize what are the challenges in planning of a digital twin of a SC.	
LOut4	Explain the different perspective that stakeholders have in planning of a digital twin of a SC.	
3. Application level		
LOut5	What are appropriate tools for planning and monitoring?	
4. Analysis level		
LOut6	How can conflicts and problems be identified at an early stage?	
5. Synthesis level		
6. Evaluation level		
LOut7	Argue whether a city has the qualifications to develop a digital twin of a SC.	

11. Learning SC enabling technologies – HOU

mm.TB1: MODULE SPECIFICATION {Table name: mm.TB1 (mm: MODULE ID)}		
1	Module ID	11
2	Module title	Learning SC enabling technologies
3	Language	English
4	Module description	A smart city (SC) enabling technology is used in the development of SCs to establish a holistic environment that is transparent, automated, inclusive, extensible, secured, flexible, and easily manageable. Such technologies are sensory devices and the Internet of Things (IoT), wireless sensor networks (WSNs), cloud/edge computing, and big data analytics, and play a key role in the resilience of SCs. The integration of these technologies can support the development of a connected network of devices and

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		entities of an SC.
5	Learning objectives	<p>The course module focuses on SC enabling technologies. Its learning objective is to introduce trainees to the following issues:</p> <p>LObj9. Describe the technical and user requirements involved in a SC.</p> <p>LObj10. List the categories of SC enabling technologies.</p> <p>LObj11. List the components of a sensory device.</p> <p>LObj12. List the key components of IoT.</p> <p>LObj13. Summarize the main tasks of IoT.</p> <p>LObj14. Describe the types of monitoring and what a clustered-based WSN is.</p> <p>LObj15. List the characteristics and advantages of a WSN.</p> <p>LObj16. Describe what the Cloud computing paradigm offers in a smart city (SC) context.</p> <p>LObj17. List the drawbacks of the Cloud.</p> <p>LObj18. Describe the advantages of Edge computing in performing quick and lighter computations nearer to the IoT data sources.</p> <p>LObj19. Describe 5 characteristics of Big data</p> <p>LObj20. Describe the types of Analysis Tasks.</p> <p>LObj21. Describe the role of Machine Learning in Big Data Analytics.</p>
Learning outcomes for the Cognitive domain+ (Bloom Taxonomy) {The learning outcomes of the module assigned to Comprehension, Application, Analysis, Synthesis and Evaluation level according to the Bloom taxonomy please underline the verb and the concept of the knowledge domain used} Upon completion of this module, the learner will be able to:		
1. Knowledge level		
LOut1	Describe the technical and user requirements involved in a SC.	
LOut2	List the categories of SC enabling technologies.	
LOut3	List the components of a sensory device.	
LOut4	List the key components of IoT.	
LOut5	Summarize the main tasks of IoT.	
2. Comprehension level		
LOut6	Describe the types of monitoring and what a clustered-based WSN is.	
LOut7	List the characteristics and advantages of a WSN.	
LOut8	Describe what the Cloud computing paradigm offers in a smart city (SC) context.	
LOut9	List the drawbacks of the Cloud.	
LOut10	Describe the advantages of Edge computing in performing quick and lighter computations nearer to the IoT data sources.	
LOut11	Describe 5 characteristics of Big data	
LOut12	Describe the types of Analysis Tasks.	

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LOut13	Describe the role of Machine Learning in Big Data Analytics.
3. Application level	
4. Analysis level	
5. Synthesis level	
6. Evaluation level	

12. Managing SC stakeholders and developing citizen networks -UMINHO

12.TB1: MODULE SPECIFICATION		
1	Module ID	12
2	Module title	<i>Managing SC stakeholders and developing citizen networks</i>
3	Language	English
4	Module description	Stakeholders are diverse and play a key role in the innovation and resilience of cities. They can be grouped into different areas of influence such as government and public sector, financial sector and funding system, universities and R&D entities, business sector, IT sector, NGOs and civil society, social and third sector. The complexity and diversity of the challenges faced by cities makes it essential to engage stakeholders and citizens in the development of services and applications that allow the city to respond quickly and sustainably to those challenges.
5	Learning objectives	LObj22. Identify factors that motivate engagement and collaboration. LObj23. Identify methods and practices to manage stakeholders effectively LObj24. Identify methods and practices to develop citizen networks. LObj25. Define strategies to engage stakeholders and citizens in developing solutions to SC problems and threats.
<i>Learning outcomes for the Cognitive domain+ (Bloom Taxonomy)</i> <i>{The learning outcomes of the module assigned to Comprehension, Application, Analysis, Synthesis and Evaluation level according to the Bloom taxonomy please underline the verb and the concept of the knowledge domain used}</i> Upon completion of this module, the learner will be able to:		
1. Knowledge level		
LOut1	To list factors relevant to stakeholders and citizen engagement	
LOut2	To identify the key stakeholders that impact the SC sustainability	
2. Comprehension level		
Lout3	To understand strategies, platforms and techniques for effective communication and collaboration in the development of services and applications for SC	

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LOut4	To understand the transformative power of citizen networks as a positive social transformation tool for SC.
3. Application level	
LOut5	To articulate technologies and analytics to support innovative citizen-driven innovation
4. Analysis level	
LOut6	To explain multi-stakeholder approaches
5. Synthesis level	
LOut7	To design co-creation initiatives with citizens and stakeholders
6. Evaluation level	
LOut8	To assess the effectiveness of approaches to stakeholder management;

13. SC urban planning and critical city's infrastructures – FUH

TB1: MODULE OUTLINE

1	Module ID	13
2	Module title	SC urban planning and critical city's infrastructures
3	Language	English
4	Module description	Planning for SC resilience requires a complete inventory of a city's existing (critical) infrastructure. For this, in addition to appropriate tools, cities must also be given the competence to identify critical infrastructure, classify existing measures and, as a result of this, also plan further steps for comprehensive SC resilience. It is important to enable SC to appropriately implement steps towards resilient SC. However, this requires that the SC is enabled to implement prioritized issues appropriately earlier.
6	Learning objectives	<p>The course module focuses on Smart City (SC) critical city's infrastructures and its learning objectives is to introduce trainees to the following issues:</p> <ol style="list-style-type: none"> 1. Creation of an overview for the SC critical city's infrastructures 2. Identification of urgency 3. Monitoring of the hedging of the SC critical city's infrastructures 4. Evaluation of the hedging 5. Conflict management and problem-solving skills

Learning outcomes for the Cognitive domain⁺ (Bloom Taxonomy)

Code	Learning Outcome {please underline the verb and the concept of the knowledge domain used}
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	Upon completion of this module, the learner will be able to:
1. Knowledge level	
LOut1	Describe the creation of the overview for the SC critical city's infrastructures.
LOut2	Describe what urgency infrastructure are and how to identify.
2. Comprehension level	
LOut3	Recognize what are the challenges in identifying SC critical city's infrastructures.
LOut4	Explain the different perspective that stakeholders have identifying SC critical city's infrastructures.
3. Application level	
LOut5	What are appropriate tools for planning and monitoring?
4. Analysis level	
	How can conflicts and problems be identified at an early stage?
5. Synthesis level	
6. Evaluation level	
LOut6	Argue whether a city has the qualifications to be a SC

14. Using SC standards for resilience – UTH

14.TB1: Using SC standards for resilience		
1	Module ID	14
2	Module title	Using SC standards for resilience
3	Language	English
4	Module description	<p>Standardization is the process of “technological convergence”, as well as of innovation clarification. It is defined as “the consistent use of methodologies, procedures, tools, and techniques specified above the level of individual projects”.</p> <p>Resilience is a crucial quality for smart cities since it enables cities and people to respond most effectively to stress or unforeseen circumstances. However, in order to make educated judgments and assess the results of activities performed, cities must be aware of their risks, weaknesses, and strengths in a systematic and consistent way.</p> <p>The aim of this module is twofold: it will describe the resilient SC standardization process together with specifications and guidelines for the resilient SC development that are introduced at international, and national levels; and to describe in more details the most prominent frameworks, initiative, standards for resilient cities such as ISO 37123.</p>

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5	Learning objectives	<p><i>The learning objectives of this module are the following:</i></p> <ul style="list-style-type: none"><i>To understand key principles in smart city resilience (SC) standardization.</i><i>To be familiar with existing SC resilient standards and for resilience, specifications and techniques and with European and International norms.</i><i>To be able compare competitive standards.</i><i>To be able to apply some of the principles introduced at the standards at city level.</i>
<p>Learning outcomes for the Cognitive domain+ (Bloom Taxonomy) {The learning outcomes of the module assigned to Comprehension, Application, Analysis, Synthesis and Evaluation level according to the Bloom taxonomy please underline the verb and the concept of the knowledge domain used} Upon completion of this module, the learner will be able to:</p>		
1. Knowledge level		
LOut1	Define the terms standardization, smart and resilience city standardization.	
LOut2	Describe the resilience SC technological and service context according to UN, ISO and ITU international standards	
LOut3	List the international standardization bodies that work with SC resilience	
LOut4	Outline different resilience SC standardization areas	
2. Comprehension level		
LOut5	Describe UN Sendai Framework	
LOut6	Describe ISO ISO 37123	
LOut7	Describe key indicators for smart city resilience	
3. Application level		
LOut8	Apply concepts of smart city resilience at practical level	
LOut9	Be able to measure key indicators for smart city resilience	
4. Analysis level		
5. Synthesis level		
6. Evaluation level		
mm-u TB2: UNIT SPECIFICATION		
Module Units	Unit ID*	Unit title
	14-1	Introduction to standardization process and smart and resilience cities standardization initiatives
	14-2	Sendai Framework and ISO 37123
	14.3	Smart and resilient cities key indicators
	mm-4	

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15. Data analytics for SC decision making – UTH

For each competence a TB1 table is filled in (white fields).

15.TB1: <i>Data analytics for SC decision making</i>		
1	Module ID	15
2	Module title	<i>Data analytics for SC decision making</i>
3	Language	English
4	Module description	This module offers an introduction to data analysis for SC decision making to produce useful predictions and conclusions from data. Emphasis will be placed on modeling real problems, comparing different methods in terms of their practical effectiveness and scaling. Learners will also gain direct experience in collecting data from several sources and will develop the necessary skills to deal with data analysis problems in SC applications
5	Learning objectives	<p>The learning objectives of this module are the following:</p> <ul style="list-style-type: none"> • To understand the concept of data collection, processing and analysis; • To demonstrate the basic relationships among the different variables of the data set; • Interpret the results of data analysis according to the framework; • To demonstrate the ability to make statistical propositions about a population; • To demonstrate the uses of real-world data and analytics in SC;
<p><i>Learning outcomes for the Cognitive domain+ (Bloom Taxonomy)</i> <i>{The learning outcomes of the module assigned to Comprehension, Application, Analysis, Synthesis and Evaluation level according to the Bloom taxonomy please underline the verb and the concept of the knowledge domain used}</i> Upon completion of this module, the learner will be able to:</p>		
1. Knowledge level		
LOut1	Understand the basic definitions of variables and data categorization;	

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LOut2	Recognize different levels of measurement;	
2. Comprehension level		
Lout3	Perform graphical interpretation of the data;	
Lout3	Find pattern in the data set;	
Lout4	Apply estimation theory in real – world problems;	
Lout5	Demonstrate ability to understanding of hypotheses testing for a single sample;	
Lout6	Discuss the results of statistical hypotheses	
3. Application level		
Lout7	Perform design and analysis of multifactor case study;	
4. Analysis level		
5. Synthesis level		
6. Evaluation level		
mm-u TB2: UNIT SPECIFICATION		
Module Units	Unit ID*	Unit title
	mm-1	
	mm-2	
	mm-3	
	mm-4	

16. SC security and safety establishment – UTH

16.TB1: SC security and safety establishment		
1	Module ID	16
2	Module title	SC security and safety establishment
3	Language	English
4	Module description	<i>Safety is defined as the state of being free from harm or danger. It comprises the steps taken to safeguard individuals from accidents, harm, and exposure to dangerous situations. Safety is frequently</i>

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		<p>attained by following safety protocols and procedures.</p> <p>On the other hand, security can be defined as the protection from crime and violence. It contains all measures needed to protect people from life risks, theft, vandalism, terrorism, and other threats. Security is often achieved through the implementation of security procedures and protocols.</p> <p>Smart cities as complex ecosystems where millions of citizens work and leave requires both. This, of course, creates urgency on governments and local authorities to improve public safety and security. In many cases today we rely heavily on those new technologies and devices for achieving SC safety and security requirements. These applications are crucial to police, medical and emergency teams so to make the best decision possible when dealing with emergency situations.</p>
5	Learning objectives	<p>The learning objectives of this module are the following:</p> <ul style="list-style-type: none">• To understand key principles and concepts of smart city safety and security.• To be aware on how modern technologies may improve safety and security.• To understand how modern technologies improve situational awareness and decision-making process.• To understand critical safety and security application requirements and architecture (e.g. augmented security screening, crowdsourcing security apps, data-based crime prevention)
<p>Learning outcomes for the Cognitive domain+ (Bloom Taxonomy)</p> <p>{The learning outcomes of the module assigned to Comprehension, Application, Analysis, Synthesis and Evaluation level according to the Bloom taxonomy please underline the verb and the concept of the knowledge domain used}</p> <p>Upon completion of this module, the learner will be able to:</p>		
1. Knowledge level		
LOut1	<u>Define</u> safety and security key concepts	
LOut2	<u>Describe</u> SC safety and security landscape.	
LOut3	<u>Describe</u> key SC safety procedures.	
LOut4	<u>Describe</u> key SC security procedures.	
2. Comprehension level		
LOut5	<u>Recognize</u> the role of technology and its influences	
LOut6	Being able to <u>describe</u> key safety and security risks	
LOut7	<u>Describe</u> the role and key functionalities of key safety application	
LOut8	<u>Describe</u> the role and key functionalities of key security application	
LOut9	<u>Describe</u> the role and the function of situational analysis at the SC level	
3. Application level		
LOut10	<u>Demonstrate</u> understanding of how technology can improve safety of a SC.	
LOut11	<u>Demonstrate</u> understanding of how technology can improve security of a SC.	
4. Analysis level		

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LOut12	Analyze the safety and security needs of a SC	
5. Synthesis level		
6. Evaluation level		
mm-u TB2: UNIT SPECIFICATION		
Module Units	Unit ID*	Unit title
	16-1	Introduction to safety and security key concepts. Present an overview of SC safety and security landscape
	16-2	Present SC key needs for improving safety and the corresponding critical applications
	16.3	Present SC key needs for improving security and the corresponding critical applications
	mm-4	

17. Organizing the SC for resilience using agile principles -UMINHO

1	Module ID	17
2	Module title	Organizing the SC for resilience using agile principles
3	Language	English
4	Module description	<p>Agile cities display uncommon resilience throughout the crises they face because they use resilience preparation as their base and are able to adapt and innovate by adding new practices to react to the challenges.</p> <p>These cities adopt an adaptive planning process that allows them to adapt to change in a flexible manner in the short and medium term. Understandings and responses evolve through evolutionary development, early delivery, continuous improvement and collaboration between stakeholders in self-organizing and cross-functional teams.</p> <p>The agility of the resilient city is expressed in several dimensions, namely sustainable buildings, agile planning and management of land, networked energy systems, flexible infrastructures, efficient and responsive IT assets, smart policing and prevention strategies, education models based on intensive formats with quick proof-of-concept approaches and shorter time cycles, and a culture of constant transformation.</p>
5	Learning objectives	<p>LObj26. Apply agile principles to urban adaptation to changes.</p> <p>LObj27. Define adaptive planning processes.</p> <p>LObj28. Assess the resilience's agility of a smart city.</p>
Learning outcomes for the Cognitive domain+ (Bloom Taxonomy)		

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<p><i>{The learning outcomes of the module assigned to Comprehension, Application, Analysis, Synthesis and Evaluation level according to the Bloom taxonomy please underline the verb and the concept of the knowledge domain used}</i></p> <p>Upon completion of this module, the learner will be able to:</p>	
1. Knowledge level	
LOut1	To list the 12 agility principles of software development;
2. Comprehension level	
LOut2	To understand how the 12 principles apply to urban adaptation;
3. Application level	
LOut3	To determine the characteristic of agile smart cities;
4. Analysis level	
LOut4	To explain how agility expresses itself in the various dimensions of a smart city;
5. Synthesis level	
LOut5	To define agile urban planning processes and governance strategies;
6. Evaluation level	
LOut6	To assess the resilience's agility of a smart city

18. Establishing financial programs for resilience development and disaster recovery – UTH

1	Module ID	18
2	Module title	<i>Establishing financial programs for resilience development and disaster recovery</i>
3	Language	English
4	Module description	<p><i>Cities are continuously facing disaster risks that can materialize in various forms and levels of intensity (i.e natural disasters (earthquakes, volcanic activity, extreme temperatures, storms, floods, drought, wildfires, etc), biological events (epidemics, insect infestation), technological or man-made disasters (industrial or nuclear incidents, terrorist or cyber-attacks).</i></p> <p><i>For a SC to be resilient and able to recover from such an event, it is important to reduce and manage these risks. A key component to achieving this is the development of disaster risk management (DRM) plans, which in order to be realized, a proper financial plan/strategy must be in place.</i></p> <p><i>This module focuses on the financial aspect of the SC resilience and recovery topics, the disaster risk financing (DRF), presenting and discussing the various steps towards establishing a suitable financial program for such a purpose, based on international standards and practices.</i></p>
5	Learning objectives	<p><i>The learning objectives of this module are the following:</i></p> <ul style="list-style-type: none"> <i>• To understand the main pillars of disaster risk management</i> <i>• To get acquainted with the financial instruments available that allow the delivery of disaster risk management plans</i> <i>• To select the proper DRF instrument for the purpose</i>
<i>Learning outcomes for the Cognitive domain+ (Bloom Taxonomy)</i>		

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{The learning outcomes of the module assigned to Comprehension, Application, Analysis, Synthesis and Evaluation level according to the Bloom taxonomy please underline the verb and the concept of the knowledge domain used} Upon completion of this module, the learner will be able to:	
1. Knowledge level	
LOut1	<u>List</u> the 5 pillars of disaster management
LOut2	<u>Describe</u> the content and purpose of each pillar
LOut3	<u>Recognize</u> the steps involved towards drafting a financial program
LOut4	<u>Describe</u> the financial instruments available
2. Comprehension level	
LOut5	<u>Identify</u> the differences between the financial instruments available
3. Application level	
LOut6	<u>Apply</u> concepts at practical level
4. Analysis level	
5. Synthesis level	
6. Evaluation level	

19.Crisis management – EDEX

TB1: MODULE OUTLINE		
1	Module ID	19
2	Module title	Crisis Management
3	Language	English
4	Module description	A crisis is any unforeseen event which puts the operational viability and reputation of an entity or individual at risk. This course module examines the steps to take before, during and after a crisis, which will help determine an outlook once the crisis has passed. In addition, it offers tools for anticipating crises and processes for developing crisis management capabilities.
5	Learning objectives	The course module focuses on the fundamentals of crisis management, covering 3 main areas: crisis leadership skills, crisis response plan and crisis communication skills.

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		<p>Its learning objectives introduce trainees to the following issues:</p> <ol style="list-style-type: none">1. Basic concepts of crisis management2. Challenges in developing and implementing crisis response plans.3. Steps to crisis management planning.4. Introduce critical crisis communication skills.5. Utilizing personal and team leadership skills in crisis situations.6. Introduce some best practices examples of crisis management worldwide.
Learning outcomes for the Cognitive domain ⁺ (Bloom Taxonomy)		
Code	Learning Outcome { <i>please underline the verb and the concept of the knowledge domain used</i> }	
	Upon completion of this module, the learner will be able to:	
1. Knowledge level		
Lout1	Describe main concepts related to crisis management.	
Lout2	Define what a crisis is and determine what constitutes a crisis.	
2. Comprehension level		
Lout3	Recognize the importance of a crisis response plan.	
3. Application level		
Lout5	Implement crisis response plans to be more prepared in the case a crisis occurs.	
Lout6	Illustrate critical crisis communication skills.	
4. Analysis level		
5. Synthesis level		
Lout4	Develop crisis response plans.	
Lout 7	Craft key messages and media statements.	
6. Evaluation level		

20. Decision Making and Problem Solving – EDEX

TB1: MODULE OUTLINE

1	Module ID	20
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2	Module title	Decision Making and Problem Solving
3	Language	English
4	Module description	<p>Within the context of any organization, including Smart Cities, many multifaceted problems usually emerge. Being able to analyze them, devise alternative solutions and select the best alternative is fundamental to the efficient management of the organization at any time: during a crisis or even during everyday encounters.</p> <p>In this module, three main topics will be addressed, namely, problem solving, decision-making and best practices through case studies.</p>
5	Learning objectives	<p>The course module focuses on problem solving and decision making and its learning objectives is to support trainees towards the following:</p> <ol style="list-style-type: none"> 1. Recognize fundamental concepts about problem-solving 2. Identify barriers in problem-solving process 3. Compare problem-solving techniques 4. Articulate problem-solving competencies 5. Define decision-making fundamentals 6. Understand decision-making process and online tools 7. Compare decision-making styles 8. Apply decision-making techniques and tools 9. Illustrate decision-making practices (quick, major or strategic) through reference to real life cases

Learning outcomes for the Cognitive domain⁺ (Bloom Taxonomy)

Code	<p>Learning Outcome {<i>please underline the verb and the concept of the knowledge domain used</i>}</p> <p>Upon completion of this module, the learner will be able to:</p>
1. Knowledge level	
LOut1	Recognize fundamental concepts about problem-solving
Lout2	Identify barriers in problem-solving process
Lout5	Define decision-making fundamentals
2. Comprehension level	
Lout3	Compare problem-solving techniques
Lout6	Understand decision-making process and online tools
Lout7	Compare decision-making styles



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3. Application level	
Lout4	Articulate problem-solving competencies
Lout8	Apply decision-making techniques and tools
4. Analysis level	
Lout9	Illustrate decision-making practices (quick, major or strategic) through reference to real life cases
5. Synthesis level	
6. Evaluation level	



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CRISIS is a consortium of four European Universities working together with esteemed colleagues on Smart City resilience, a topic that is of great interest to each of us and to our communities.



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