OpenDCO – Open Data City Officer
Project No.: 022-1-CY01-KA220-HED-000089196
Erasmus+ Strategic Partnerships Key Action 2

WP2 - T2.5 PUBLICATION TO A CONFERENCE

Development of the Pedagogical Educational Approach

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

Open Data City Officer

1. Document Metadata

Document Title: Intermediate Report of the Work Package WP2 (OpenDCO Development of Pedagogical Educational Approach).

Keywords: Competencies; self-assessment tool; learning journeys; learning goals.

Abstract: The purpose of this document is to describe the conduction of the tasks developed in WP2 related to the development of the self-assessment tool that identifies learning gaps in OpenDCO (Open Data City Officer) competencies and determines individual learning experiences and traits, detailing all the activities developed, the applied methodology and the description of the results.

1.1. Document information

Work package:	WP2 – OpenDCO Educational Strategy and Approach	
Type:	Report	
Dissemination level:		
Document Reference:	T2.5 Publication to a Conference	
Version:	2.0	
Delivery date:	November 2024	
Status:	Working, Draft, Under Review, **Final**	
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Submitted for Project QA		
Approved by Project QA		
Date:	Name:	Signature:
Comments		

1.2. Document Change History

Version	Who	When	Action	Description
0.1	Victor Barros	06/06/2023	Create	Create an Intermediate Report of the WP2 (OpenDCO Educational Strategy and Approach).
0.2	Leticia Cunico	12/06/2023	Review	Some updates
0.3	Victor Barros	16/06/2022	Draft Version	Report Updated after feedback from the reviewer
0.4	Theodor	26/06/2023	Under Review	Report Updated after feedback from partners
0.5	Kyriakos E. Georgiou	27/06/2023	Under Review	Report Updated after feedback from partners
1.0	Victor	28/06/2023	Final Version	Report Updated
2.0	Victor Barros, Gonçalo Regadas	1/11/2024	Final Version	Report Updated

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2. Introduction

The OPENDCO Project aims to create and strengthen a professional profile focused on open data in smart cities at the European level. The project is to develop a systematic curriculum to address all aspects of an Open Data City Officer (OpenDCO). This curriculum covers various competencies essential for success in the realm of open data, including strategic thinking, long-term planning, decision-making, transparency promotion, and data dissemination.

The purpose of the WP2 is the development of the pedagogical educational approach for the OpenDCO project, aiming to enhance the skills of professionals engaged in the use and management of open data in cities, ensuring effective and individually aligned learning outcomes, as well as benefiting the municipalities.

In this regard, WP2 focuses on the development of a pedagogical educational approach for the OpenDCO project. To achieve this, two specific objectives were identified, as follows:

1) Develop a self-assessment tool to evaluate the current competencies of OpenDCO professionals (knowledge, skills, and attitudes) and identify learning goals to enhance their competencies.

The purpose of this tool is to provide professionals with feedback on their level of knowledge, learning preferences, and experience in open data strategies and city management while recommending improvements. This tool will be directly linked to the OpenDCO curriculum and Training Kit, suggesting learning journeys tailored to individual needs.

2) Create a tool for designing personalized learning journeys, aligned with specific city needs and individual competence levels identified by the self-assessment tool.

The objective of this tool is to design personalized learning journeys that allow defining learning objectives, target skill levels, required training resources, and learning experiences that best suit the professional's circumstances. This tool also includes the evaluation of success in achieving the established learning goals, milestones of progress, and demonstration exercises that support their achievement. To fulfill the objectives of WP2, the following tasks have been outlined:

- Development of the self-assessment tool
- Development of a tool for designing personalized learning journeys
- Evaluation of the tools
- Organization of a multiplier event
- Publication in a conference/journal

For each of these tasks, a set of activities has been developed along with a schedule for their completion. The table below presents the activities and their corresponding timeline.

Table 1. WP2 Activity Schedule (in project proposal).

ID	Task	Start	End
T2.1	Development of the self-assessment tool	12/2022	05/2023
T2.2	Tool to design tailored learning journeys	12/2022	10/2023
T2.3	Evaluation of tools	01/2023	10/2023

T2.4	Organization of a multiplier event	10/2023
T2.5	Publication to a conference/journal	02/2024

The target participants for the developed tools include decision-makers, policymakers, municipal associations, and professionals involved in aspects of open data for smart cities. The tools will benefit European local governments, associations, and entities interested in innovation and urban development.

It is important to highlight that WP2 is an integral part of a series of WPs designed to accomplish the OpenDCO project. As such, the outcomes of this WP have a direct impact on the other WPs within the project. The diagram below illustrates the interconnection between WP2 and the other WPs of the OpenDCO project.

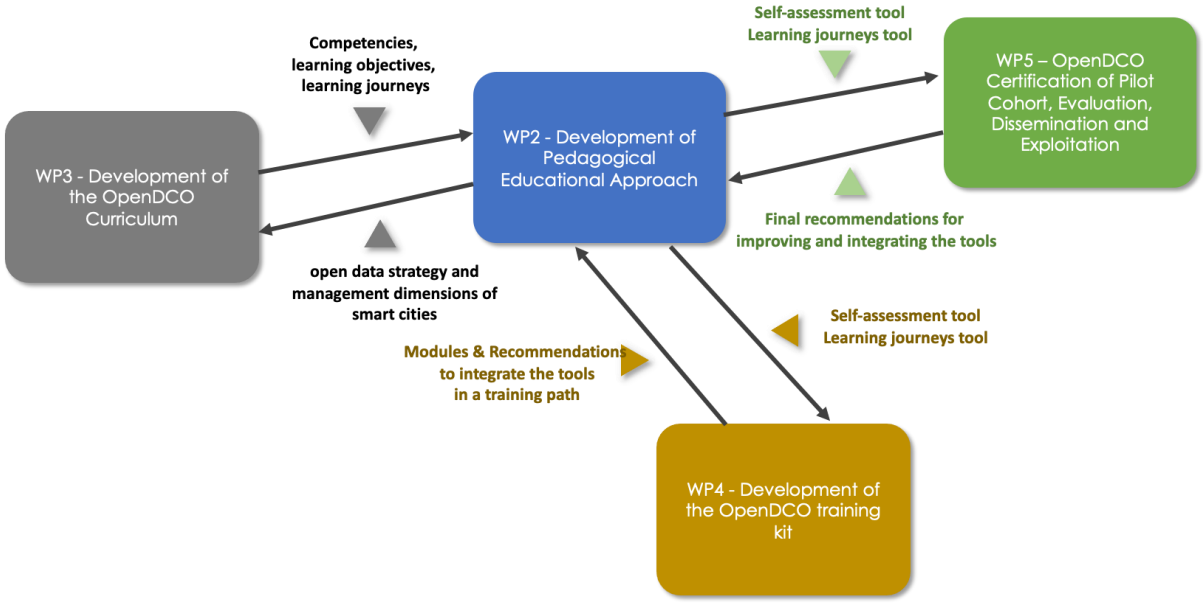

Figure 1. The diagram illustrates the interrelationship among the various WPs of the OpenDCO Project.

The following sections describe the implementation of WP2 and each of the activities (Table 1). As this is an intermediate report, the activities are based on the delivery date of May 2023.

It is worth noting that UMINHO (University of Minho) leads WP2 and oversees all its tasks. However, it should be emphasized that the partner organizations involved in the OpenDCO Project have been actively involved and collaborated in all the development tasks of WP2.

3. Publication to a conference/journal (T2.5)

This task involved sharing the educational strategy of the project and achieving results through the publication of articles in relevant conferences or journals within the project's domain.

As part of the dissemination process, the University of Minho (UMINHO) published two articles, focused on the activities conducted locally. These articles addressed the implementation of the educational strategy, the results of the tool evaluations, and their impact in the context of smart cities and open data.

The publications significantly contributed to the dissemination of knowledge and best practices in the field, expanding the reach of the results and reaffirming the importance of the OpenDCO project in the fields of education, technology, and smart cities.

In addition, a final discussion that compiles the global results of the project has been developed and is being prepared for submission to ECIS2025 (European Conference on Information Systems). This article aims to synthesize the lessons learned, proposed improvements, and best practices identified throughout the project. The submission to ECIS2024 is intended to expand the impact of the OpenDCO results and foster discussions within the academic and research communities.

The task of disseminating the project's educational strategy through publications in conferences and journals was successfully completed. The articles submitted to specialized events focused on the project's educational strategy, which contributed to increasing the reach and dissemination of knowledge and best practices in the field of education, open data, and smart cities.

ANNEX A. OPEN DCO COMPETENCIES

A. Smart City and Open Data Fundamentals Competencies (SCOD).

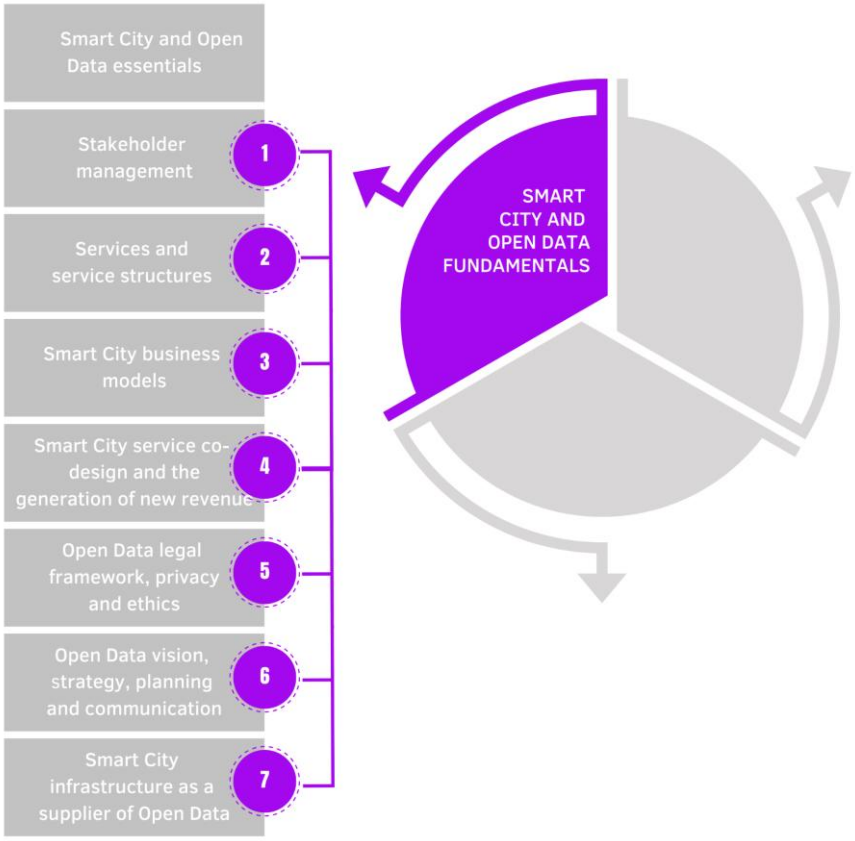

Figure 2. Smart City and Open Data Fundamentals Competencies (SCOD)

Table 2. Smart City and Open Data Fundamentals Competencies (SCOD)

ID	Competence	Description
1	**Stakeholder Management (SCOD_01)**	The ability to organize, plan and control the relationship with the smart city stakeholders in order for them to be fully motivated to engage. It includes being able to present and explain the different perspectives that different stakeholders have about the services and resources of a smart city.
2	**Services and Service Structures (SCOD_02)**	The ability to manage smart services and infrastructures of a smart city as a way to balance the interests of different city actors. It includes being able to (i) describe the implications emerging from adopting new management approaches to services; and (ii) create value

		for public authorities, companies, and citizens from sociotechnical cooperation.
3	**Smart City Business Models (SCOD_03)**	The ability to analyze the most important existing business models; examine innovative business models; and keep up-to-date with the emerging business models for smart cities.
4	**Smart City Service Co-Design and the Generation of New Revenue (SCOD_04)**	The ability to design e-services by considering the complexity of smart city environments and the involvement of citizens and users in order to address more efficiently the development and sustainability challenges. It involves open innovation and citizen science.
5	**Open Data Legal Framework, Privacy, and Ethics (SCOD_05)**	The ability to cover the rights, licenses, and data protection regarding what people can do with the data. It includes being able to (i) understand the ethical and commercial interests that can affect the cities if the data has to be open access; (ii) to know of intellectual property law in science projects with companies and with other stakeholders of the cities.
6	**Open Data Vision, Strategy, Planning, and Communication (SCOD_06)**	The ability to lead data initiatives and manage projects from conception to implementation. It includes being able to (i) develop and manage budgets, and timelines and to work with different stakeholders; (ii) think strategically and develop long-term plans for data management and use; (iii) introduce the decision-making process and problem-solving approaches to trainees that will be able to first realize the general characteristics and scope of decision-making problems, as well as the fundamentals, methods, and techniques of Decision Theory; (iv) increase the transparency of cities helping to accelerate innovation and facilitate collaborative work; (v) define and implement adequate approaches to share and disseminate publicly available data to a wide range of stakeholders, including citizens, businesses, researchers, and policymakers in a transparent, accountable, and inclusive manner; (vi) use various communication channels and strategies to promote the use and understanding of open data, as well as to engage with different communities and solicit feedback and input.
7	**Smart City Infrastructure as a Supplier of Open Data (SCOD_07)**	The ability to foster open and user-driven innovation in the public sector by leveraging open data, open sensor networks, and existing crowdsourcing platforms and tools. It includes being able to: (i) do cost management in the implementation of open data programs and

		infrastructures; (ii) explain smart cities infrastructures and explore the role of open data in cities; (iii) introduce to cost management in the implementation of Open Data programs and infrastructures to way to know where costs can be reduced, what are the priorities in technical infrastructure/data security/human resources to be used; and the target/actual cost that must always take place in order to stay within the budget.

B. Open Data Management Fundamentals Competencies (OPM).

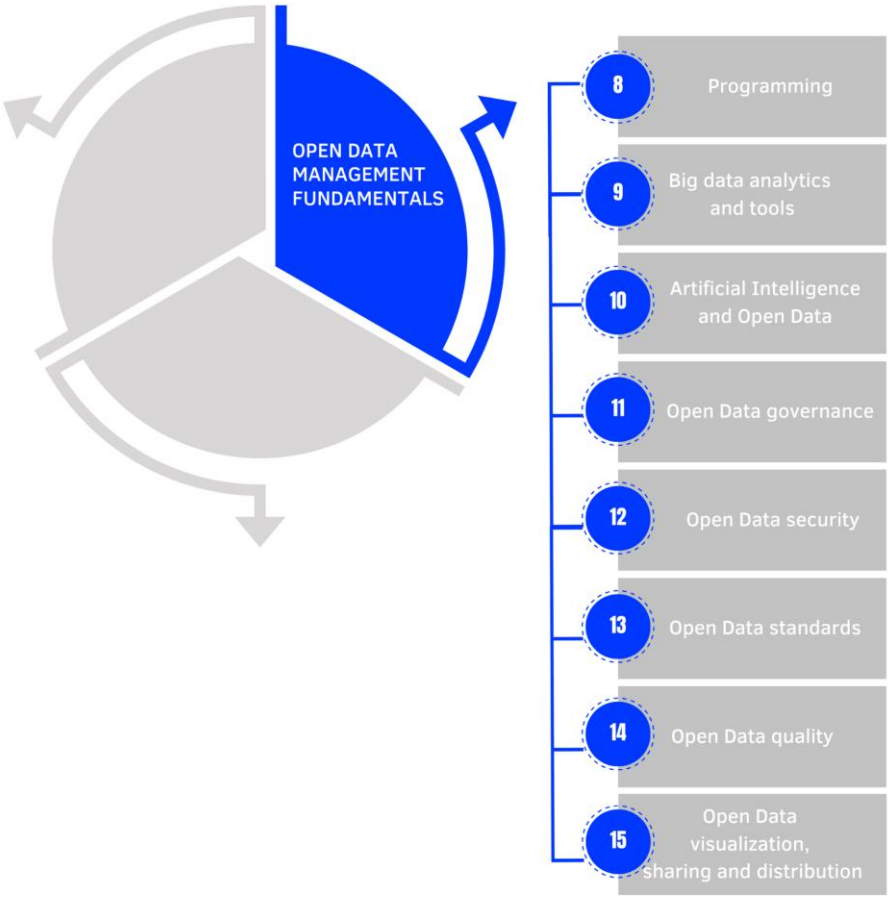

Figure 3. Open Data Management Fundamentals Competencies (OPM)

Table 3. Open Data Management Fundamentals Competencies (OPM)

ID	Competence	Description
8	**Programming (OPM_01)**	The ability to develop open data and data mining including programming skills and knowledge of programming

		techniques. It includes being able to include programming skills and knowledge of programming techniques offered by a modern programming language such as Python.
9	**Big Data Analytics and Tools (OPM_02)**	The ability to understand the key aspects of Data Analytics and Visualization. It includes being able to (i) explore the fundamentals of gathering data, analyzing, and sharing data with the use of visualizations and dashboard tools; (ii) discover the major vendors within the data ecosystem and explore the various tools on-premise and in the cloud; (iii) provide statistics through analyzing raw data to discover trends and metrics and eventually make conclusions about the hidden information included in useful datasets regarding smart cities; (iv) interpreting data to help us to unlock insight.
10	**Artificial Intelligence and Open Data (OPM_03)**	The ability to understand Artificial Intelligence (AI) for open data. It includes being able to (i) Apply Artificial Intelligence Principles; (ii) Distinguish different types of Artificial Intelligence; (iii) Identify problems that use Artificial Intelligence; (iv) Introduction to Artificial Intelligence; and (v) Artificial Intelligence approaches and algorithms.
11	**Open Data Governance (OPM_04)**	Defining the policies, practices, and technologies that promote the release and use of publicly available data in a transparent, accountable, and inclusive manner. It involves ensuring that the city's data assets are open, accessible, and easily usable by citizens, businesses, and other stakeholders.
12	**Open Data Security (OPM_05)**	The ability to protect data, such as those in an open data platform, from destructive forces and from the unwanted actions of unauthorized users, such as a cyberattack or a data breach. It includes being able to course gives an overview of the different types of potential attacks and security, data security capabilities and solutions, and data security strategies.
13	**Open Data Standards (OPM_06)**	An overview of open data standards and best practices as a way to (i) make it easier to create, share, and integrate data by ensuring that they are represented and interpreted correctly; (ii) cuts down on the time it takes to clean and translate data; (iii) correctly represent, interpret, and publish Open Data for governments and boost Open Data interoperability on a global scale; (iv) ensuring the ability of different data systems and applications to exchange, process, and use data in a standardized, seamless, and efficient manner.

14	**Open Data Quality (OPM_07)**	The ability to collect, organize, and make publicly available data that is freely accessible and usable by anyone and also, the identification and management of appropriate infrastructures that will be made available to the organization for long-term storage. It involves being able to: (i) ensure that the data are accurate, secure, and conform to open data standards and best practices (Metadata/Dispositive Data/Operative Data); (ii) introduce the importance of data quality for projects and innovation and explore it in the city context; (iii) standardize data and ensure data usability; (iv) introduce to different data sources and application examples.
15	**Data Visualization, Sharing, and Distribution (OPM_08)**	The ability to use Linked Data solutions for structuring data from different sources in a meaningful way and linking them. It includes being able to integrate heterogeneous repositories and publish their metadata as linked data.

C. Open Data Exploitation and Application Competencies (ODEA).

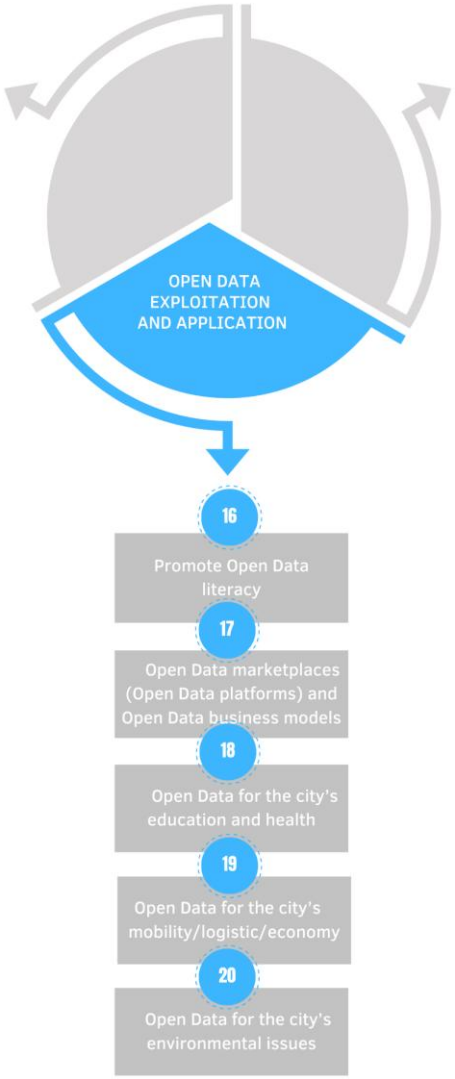

Figure 4. Open Data Exploitation and Application Competencies (ODEA)

Table 4. Open Data Management Fundamentals Competencies (ODEA)

ID	Competence	Description
16	**Promote Open Data Literacy (ODEA_01)**	Offer opportunities to develop the ability of citizens, policymakers, and other stakeholders to understand, analyze, and use data in their decision-making and problem-solving processes. It involves developing the skills and knowledge to access, process, interpret, and communicate data effectively and ethically.
17	**Open Data Marketplaces (Open Data Platforms) and Open Data Business Models (ODEA_02)**	The ability to generate revenue for cities through various means, such as Open Data platforms. It involves being able to (i) impart relevant knowledge regarding some of the available open data platforms and explore them in the city's context; (ii) understand the usage of data platforms and data marketplaces and how their use facilitates and streamlines the publishing process; (iii) use some of the main open data platforms such as (CKAN, DKAN, EDP, Socrata and OpenDataSoft); (iv) publish a dataset, undertake a simple visualization or identify and download different datasets.
18	**Open Data for the City's Education and Health (ODEA_03)**	The ability to introduce open data in the context of health and education in Smart Cities. It includes being able to look at opportunities, barriers, and case studies of open data in this domain.
19	**Open Data for the City's Mobility/Logistics/Economy (ODEA_04)**	The ability to explain the smart city fields of mobility, logistics, and the economy and the possible impact of open data on these sectors of a city.
20	**Open Data for the City's Environmental Issues (ODEA_05)**	The ability to introduce open data in the context of the blue-green infrastructure in a city. It includes being able to look at the relevance of open data for environmental issues like control of the smart city field energy and water.

ANNEX B. LIST OF PROFICIENCY LEVELS

A. Smart City and Open Data Fundamentals Competencies (SCOD).

Table 5. Levels of proficiency of the Smart City and Open Data Fundamentals Competencies (SCOD)

ID	Competence	Proficiency Level	Indicative
1	**Stakeholder Management (SCOD_01)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** understand stakeholder management concepts.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** discriminate and identify the role of stakeholders in the smart city management.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** present and explain the different perspectives that different stakeholders have about the services and resources of a smart city.
		SPECIALIZED	**4) At a specialized level, I can** organize, plan and control the relationship with the smart city stakeholders in order for them to be fully motivated to engage.
2	**Services and Service Structures (SCOD_02)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** detect common assets, services, and resources that are available in smart cities.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** describe the implications emerging from adopting new management approaches to services.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** create value for public authorities, companies, and citizens from sociotechnical cooperation.
		SPECIALIZED	**4) At a specialized level, I can** manage smart services and infrastructures of a smart city as a way to balance the interests of different city actors.
3	**Smart City Business Models (SCOD_03)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** identify the most important existing business models.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** explain different business models.

		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** examine innovative business models.
		SPECIALIZED	**4) At a specialized level, I can** keep up-to-date with the emerging business models for smart cities.
4	**Smart City Service Co-Design and the Generation of New Revenue (SCOD_04)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** understand the concept of open innovation and citizen science.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** describe approaches to smart city service co-design.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** analise challenges and potential from different points of views to co-design service.
		SPECIALIZED	**4) At a specialized level, I can** design e-services by considering the complexity of smart city environments and the involvement of citizens and users.
5	**Open Data Legal Framework, Privacy, and Ethics (SCOD_05)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** understand the ethical and commercial interests that can affect the cities if the data has to be open access.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** know about intellectual property law in science projects with companies and with other stakeholders of the cities.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** analyze Open Data legal framework, privacy and ethics.
		SPECIALIZED	**4) At a specialized level, I can** develop projects applying the knowledge about rights, licenses, and data protection regarding what people can do with the data.
6	**Open Data Vision, Strategy, Planning, and Communication (SCOD_06)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** think strategically and develop long-term plans for data management and use.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** develop and manage budgets, and timelines and to work with different stakeholders.

		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** introduce the decision-making process and problem-solving approaches to trainees that will be able to first realize the general characteristics and scope of decision-making problems, as well as the fundamentals, methods and techniques of Decision Theory.
		SPECIALIZED	**4) At a specialized level, I can** define and implement adequate approaches to share, disseminate publicly available data to a wide range of stakeholders and increase the transparency of cities helping to accelerate innovation and facilitate collaborative work.
7	**Smart City Infrastructure as a Supplier of Open Data (SCOD_07)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** recognize smart city infrastructure as a supplier of Open Data.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** do cost management in the implementation of open data programs and infrastructures.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** explain smart cities infrastructures and explore the role of open data in cities.
		SPECIALIZED	**4) At a specialized level, I can know where costs can** be reduced in the implementation of Open Data programs and infrastructures, what are the priorities in technical infrastructure/data security/human resources to be used; and the target/actual cost that must always take place in order to stay within the budget.

B. Open Data Management Fundamentals Competencies (OPM).

Table 6. Levels of proficiency of the Open Data Management Fundamentals Competencies (OPM)

ID	Competence	Proficiency Level	Indicative
8	**Programming (OPM_01)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** list possible programming techniques offered by a modern programming language.

		INTERMEDIATE	**2) Independently, according to my own needs, I can** explain the need for a database and data mining.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** develop open data and data mining.
		SPECIALIZED	**4) At a specialized level, I can** create solutions through open data development and data mining.
9	**Big Data Analytics and Tools (OPM_02)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** explore the fundamentals of gathering data, analyzing, and sharing data with the use of visualizations and dashboard tools.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** discover the major vendors within the data ecosystem and explore various on-premise and cloud-based tools.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** provide statistics by analyzing raw data to discover trends and metrics and draw conclusions about the hidden information in useful datasets related to smart cities.
		SPECIALIZED	**4) At a specialized level, I can** proficiently provide detailed statistics by analyzing raw data to uncover trends and metrics, and I possess the ability to interpret data to unlock valuable insights.
10	**Artificial Intelligence and Open Data (OPM_03)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** understand the concept of Artificial Intelligence for Open Data.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** distinguish different types of Artificial Intelligence.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** identify problems that use Artificial Intelligence.
		SPECIALIZED	**4) At a specialized level, I can** have some experiments with Artificial Intelligence approaches and algorithms.
11	**Open Data Governance (OPM_04)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** understand the basic concepts and principles of open data governance. I can follow established policies and

			practices for releasing and using publicly available data in a transparent manner.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** apply the principles of open data governance to define policies, practices, and technologies that promote the release and use of publicly available data. I can ensure the city's data assets are open, accessible, and easily usable by citizens, businesses, and stakeholders.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** design and implement comprehensive open data governance frameworks. I can create and enforce policies and practices that ensure transparency, accountability, and inclusivity in the release and use of data.
		SPECIALIZED	**4) At a specialized level, I can** lead and advise on open data governance initiatives. I have extensive knowledge and expertise in developing and implementing open data policies, practices, and technologies.
12	**Open Data Security (OPM_05)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** understand the basic principles of data security in the context of an open data platform.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** follow established guidelines and procedures to protect data from destructive forces and unauthorized access.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** identify potential types of attacks and vulnerabilities, and apply appropriate data security capabilities and solutions to mitigate risks.
		SPECIALIZED	**4) At a specialized level, I can** develop and deploy advanced data security capabilities and solutions, considering the specific requirements of the platform and its users. I can also formulate data security strategies that align with organizational goals and regulatory requirements.
13	**Open Data Standards (OPM_06)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** understand the basic concepts of open data standards and best practices to make it easier to create, share,

			and integrate data by ensuring that they are represented and interpreted correctly.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** apply basic techniques to clean and translate data efficiently, cutting down on the time it takes to clean and translate data.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** correctly represent, interpret, and publish Open Data for governments and boost Open Data interoperability on a global scale.
		SPECIALIZED	**4) At a specialized level, I can** ensure the ability of different data systems and applications to exchange, process, and use data in a standardized, seamless, and efficient manner.
14	**Open Data Quality (OPM_07)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** understand the importance of data quality for projects and innovation and explore it in the city context.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** ensure that the data are accurate, secure, and conform to open data standards and best practices (Metadata/Dispositive Data/Operative Data).
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** standardize data and ensure data usability.
		SPECIALIZED	**4) At a specialized level, I can** introduce different data sources and application examples.
15	**Data Visualization, Sharing, and Distribution (OPM_08)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** understand the basic concepts of data visualization, sharing, and distribution.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** effectively utilize linked data solutions for data visualization, sharing, and distribution.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** structure data from various sources and establish meaningful links using Linked Data techniques.

		SPECIALIZED	**4) At a specialized level, I can** integrate heterogeneous repositories and publish metadata as Linked Data, in a clear and compelling way.

C. Open Data Exploitation and Application Competencies (ODEA).

Table 7. Levels of proficiency of the Open Data Management Fundamentals Competencies (ODEA)

ID	Competence	Proficiency Level	Indicative
16	**Promote Open Data Literacy (ODEA_01)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** access, process, interpret, and communicate data effectively and ethically.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** identify opportunities to develop the ability of citizens, policymakers, and other stakeholders to understand, analyze, and use data in their decision-making and problem-solving processes.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** provide basic information and assistance to help them understand the importance of data in decision-making and problem-solving processes.
		SPECIALIZED	**4) At a specialized level, I can** actively promote Open Data literacy by developing and delivering comprehensive training programs that enhance participants' ability to access, process, interpret, and communicate data effectively and ethically.
17	**Open Data Marketplaces (Open Data Platforms) and Open Data Business Models (ODEA_02)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** understand the usage of data platforms and data marketplaces and how their use facilitates and streamlines the publishing process.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** use some of the main open data platforms such as (CKAN, DKAN, EDP, Socrata and OpenDataSoft).
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** impart relevant knowledge regarding some of the available open data platforms and explore them in the city's context.

		SPECIALIZED	**4) At a specialized level, I can** publish a dataset, undertake a simple visualization or identify and download different datasets.
18	**Open Data for the City's Education and Health (ODEA_03)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** have a basic understanding of Open Data in the context of health and education in Smart Cities.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** explore opportunities and barriers related to open data in these domains and review basic case studies of successful open data initiatives in health and education.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** analyze the application of Open Data in the city's health and education sectors.
		SPECIALIZED	**4) At a specialized level, I can** develop and implement strategies for leveraging open data to enhance health and education services in Smart Cities and collaborate with relevant stakeholders to design data-driven interventions and policies.
19	**Open Data for the City's Mobility/Logistics/Economy (ODEA_04)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** have a basic understanding of Open Data in the context of mobility, logistics and economy in Smart Cities.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** explore opportunities and barriers related to open data in these domains and review basic case studies of successful open data initiatives in mobility, logistics and economy.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** analyze the application of Open Data in the city's mobility, logistic and economic sectors.
		SPECIALIZED	**4) At a specialized level, I can** develop and implement strategies for leveraging open data to enhance mobility, logistic and economy services in Smart Cities and collaborate with relevant stakeholders to design data-driven interventions and policies.

20	**Open Data for the City's Environmental Issues (ODEA_05)**	**FOUNDATION**	**1) With appropriate guidance where needed, I can** have a basic understanding of Open Data in the context of environmental issues in Smart Cities.
		INTERMEDIATE	**2) Independently, according to my own needs, I can** explore opportunities and barriers related to open data in these domains and review basic case studies of successful open data initiatives in environmental issues.
		ADVANCED	**3) According to my own needs and those of others, and in complex contexts, I can** analyze the application of Open Data in the city's environmental issues.
		SPECIALIZED	**4) At a specialized level, I can** develop and implement strategies for leveraging open data to enhance environmental issues in Smart Cities and collaborate with relevant stakeholders to design data-driven interventions and policies.

ANNEX C. OPENDCO MOOC MODULES BY THEMATIC AREAS AND COMPETENCE DOMAIN

A. Smart City and Open Data Fundamentals Competencies (SCOD).

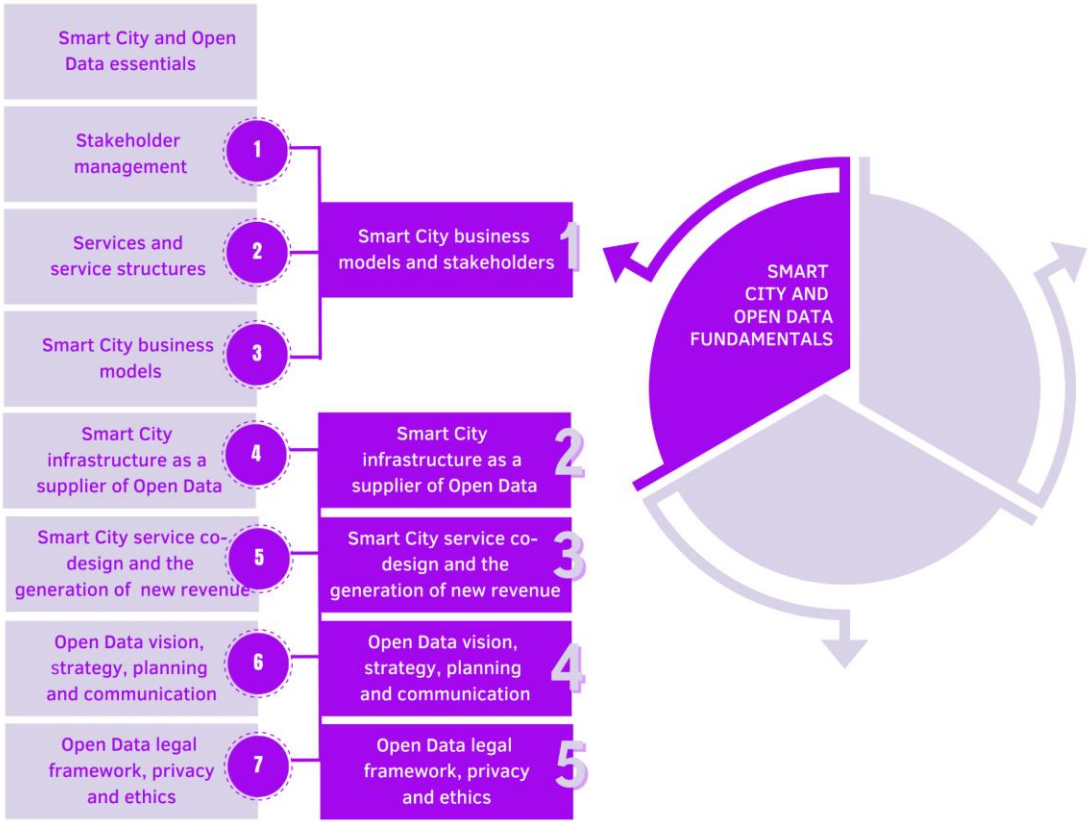

Figure 5. OpenDCO Modules associated with the Smart City and Open Data Fundamentals Competencies (SCOD)

Table 8. OpenDCO Units and Modules associated with the Smart City and Open Data Fundamentals Competencies (SCOD)

ID	THEMATIC AREA	Description	Modules Related
1	**Smart City Business Models and Stakeholders**	This unit examines innovative business models in smart cities, explores stakeholder perspectives on available services and resources, and enables learners to engage with stakeholders effectively. It covers topics such as smart city infrastructure, service management, value creation for public authorities, companies, and citizens, and ensuring a balanced approach that considers the interests of all stakeholders.	**Stakeholder Management (SCOD_01)** **Services and Service Structures (SCOD_02)** **Smart City Business Models (SCOD_03)**

2	**Smart City Infrastructure as a Supplier of Open Data**	This unit covers smart city infrastructures and the importance of open data in driving innovation in the public sector. It explores the use of open data, sensor networks, and crowdsourcing platforms to foster user-driven innovation. Learners will gain insights into cost management, prioritizing technical infrastructure, data security, and human resources. They will also learn how to analyze costs and ensure budget compliance in open data programs and infrastructures.	**Smart City Infrastructure as a Supplier of Open Data (SCOD_07)**
3	**Smart City Service Co-Design and the Generation of New Revenue**	This unit focuses on designing e-services in smart city environments while considering the complexity of the ecosystem and actively involving citizens and users. By incorporating principles of open innovation and citizen science, learners will be able to address development and sustainability challenges more efficiently.	**Smart City Service Co-Design and the Generation of New Revenue (SCOD_04)**
4	**Open Data Vision, Strategy, Planning and Communication**	This unit emphasizes strategic thinking and long-term planning for open data management in diverse smart city contexts. Learners will develop skills in proposing decision-making processes, implementing data-sharing approaches, promoting open data use, and leading open data initiatives. The unit highlights the importance of considering the complexity of smart city environments, involving citizens and users, and addressing development and sustainability challenges to accelerate innovation, increase transparency, and facilitate collaborative work.	**Open Data Vision, Strategy, Planning, and Communication (SCOD_06)**
5	**Open Data Legal Framework, Privacy and Ethics**	This unit focuses on designing and implementing open data policies, standards, and frameworks to govern the release and use of publicly available data in cities. Learners will gain the ability to define policies, practices, and technologies that promote transparency, accountability, and inclusivity in data release and usage. The module aims to ensure that city data assets are open, accessible, and easily usable by the city government, citizens, businesses, and other stakeholders.	**Open Data Legal Framework, Privacy, and Ethics (SCOD_05)**

B. Open Data Management Fundamentals Competencies (OPM).

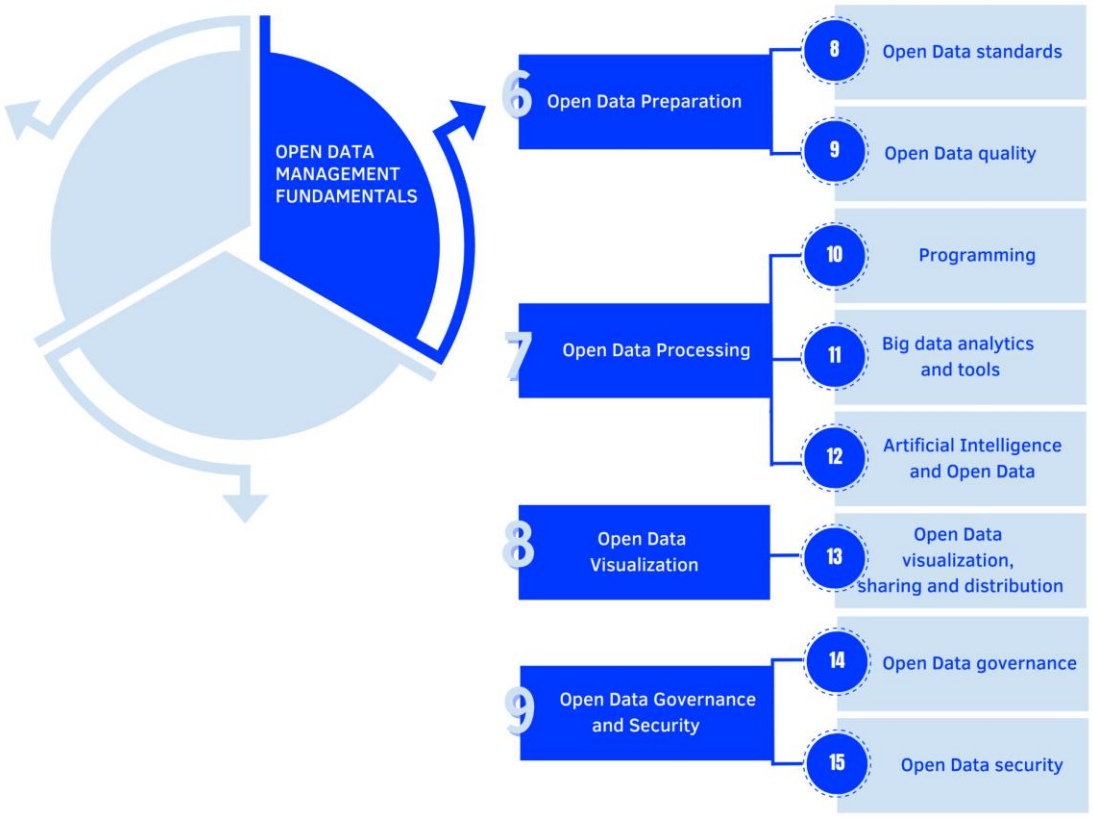

Figure 6. OpenDCO Modules associated with the Open Data Management Fundamentals Competencies (OPM)

Table 9. OpenDCO Units and Modules associated with the Open Data Management Fundamentals Competencies (OPM)

ID	THEMATIC AREA	Description	Modules Related
6	**Open Data Preparation**	This unit focuses on data standardization to facilitate the creation, sharing, and integration of data. Learners will develop the ability to ensure seamless and efficient data exchange, integration, and usage across different systems and applications. They will also learn to preserve the meaning and quality of data when it is produced and consumed by various city departments, agencies, and stakeholders. The unit emphasizes the importance of defining and following technical standards as rules, guidelines, specifications, definitions, and publishing protocols.	**Open Data Standards (OPM_06)** **Open Data Quality (OPM_07)**
7	**Open Data Processing**	This unit focuses on collecting, organizing, and providing public access to freely available and	**Programming (OPM_01)**

		usable data. Learners will gain the ability to ensure the accuracy, security, and compliance of data with open data principles. They will also develop programming skills and knowledge of techniques for data management and quality assurance. Additionally, learners will understand the significance of data quality for projects and innovation. They will be capable of identifying and managing suitable infrastructure for long-term data storage and enabling seamless integration and sharing of data among different city departments, agencies, and stakeholders while preserving its meaning and quality.	**Big Data Analytics and Tools (OPM_02)** **Artificial Intelligence and Open Data (OPM_03)**
8	**Open Data Visualization**	This unit delves into the fundamentals of data collection, analysis, and sharing, utilizing visualization and dashboard tools. Learners will gain the ability to explore various on-premise and cloud-based tools within the data ecosystem, while also understanding the significance of providing statistical insights through data analysis. They will be capable of visualizing and interpreting data to uncover valuable insights for cities and stakeholders. Additionally, learners will acquire knowledge about Linked Data solutions, enabling them to structure and link data from diverse sources effectively. Lastly, they will learn how to integrate heterogeneous repositories and publish city metadata as linked data.	**Data Visualization, Sharing, and Distribution (OPM_08)**
9	**Open Data Governance and Security**	This unit provides an understanding of various types of potential attacks and the security measures, capabilities, and strategies to safeguard data in cities. Learners will gain knowledge about data security solutions and techniques to protect data, particularly in open data platforms, from destructive forces and unauthorized access, such as cyberattacks and data breaches.	**Open Data Governance (OPM_04)** **Open Data Security (OPM_05)**

C. Open Data Exploitation and Application Competencies (ODEA).

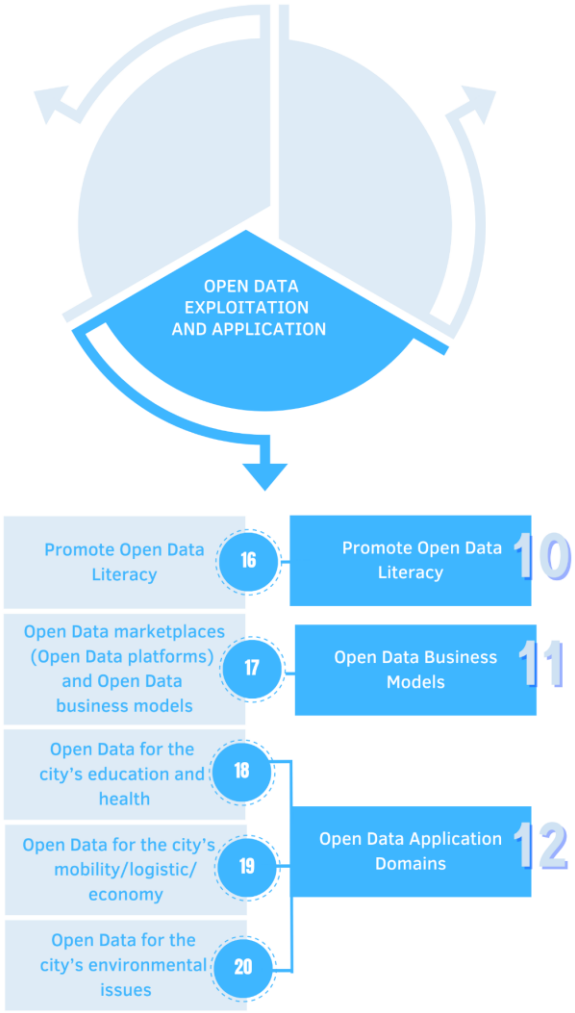

Figure 7. OpenDCO Modules associated with the Open Data Management Fundamentals Competencies (ODEA)

Table 10. OpenDCO Units and Modules associated with the Open Data Management Fundamentals Competencies (ODEA)

ID	THEMATIC AREA	Description	Modules Related
10	**Promote Open Data Literacy**	This unit focuses on developing the skills to access, process, interpret, and ethically communicate data. It aims to empower citizens, policymakers, and stakeholders by enhancing their abilities to understand, analyze, and utilize data in decision-making and problem-solving processes.	**Promote Open Data Literacy (ODEA_01)**
11	**Open Data Business Models**	This unit explores open data platforms and business models, providing learners with a comprehensive understanding of their	**Open Data Marketplaces (Open Data Platforms) and**

		potential. It enables learners to leverage open data platforms to generate revenue for cities through various strategies and approaches.	**Open Data Business Models (ODEA_02)**
12	**Open Data Application Domains**	This unit applies open data in various contexts within Smart Cities, including health, education, mobility, logistics, economy, blue-green infrastructure, and more. Learners will explore opportunities, barriers, and case studies of open data in these domains, analyze the impact of open data on city sectors, and examine its relevance for environmental issues such as energy and water management in the smart city field.	**Open Data for the City's Education and Health (ODEA_03)** **Open Data for the City's Mobility/Logistics/Economy (ODEA_04)** **Open Data for the City's Environmental Issues (ODEA_05)**

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Erasmus+
Co-funded by the
Erasmus+ Programme
of the European Union

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