



**DATA SPACE FOR
SMART AND SUSTAINABLE
CITIES AND COMMUNITIES**

Deliverable 4.2

**Roadmap for implementing a European data
space for smart and sustainable cities and
communities**

WP 4 – Implementation

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Abbreviations

<i>APIs</i>	<i>application programming interfaces</i>	<i>MIM</i>	<i>Minimal Interoperable Mechanism</i>
<i>DS4SSCC</i>	<i>Data Space for smart and sustainable cities and communities</i>	<i>MVP</i>	<i>Minimum Viable Product</i>
<i>DSSC</i>	<i>Data Space Support Centre</i>	<i>PPI's</i>	<i>Pivotal Points of Interoperability</i>
<i>EC</i>	<i>European Commission</i>	<i>PPPs</i>	<i>Public-Private Partnerships</i>
<i>EU</i>	<i>European Union</i>	<i>NAPs</i>	<i>National Access Points</i>
<i>FAIR</i>	<i>Findability, accessibility, interoperability, reusability</i>	<i>OASC</i>	<i>Open and Agile Smart Cities and Communities</i>
<i>GDPR</i>	<i>General Data Protection Regulation</i>	<i>PoC</i>	<i>Proof of Concept</i>
<i>ISO</i>	<i>International Organization for Standardization</i>	<i>SEI</i>	<i>Software Engineering Institute</i>
<i>IEC</i>	<i>International Electrotechnical Commission</i>	<i>SLA</i>	<i>Service Level Agreement</i>
<i>ITU</i>	<i>International Telecommunication Union</i>	<i>SSCC</i>	<i>Smart and Sustainable Cities and Communities</i>
<i>KPI</i>	<i>Key Performance Indicator</i>	<i>SME</i>	<i>Small and Medium Sized Enterprise</i>
<i>MIMs Plus</i>	<i>European Minimal Interoperability Mechanisms</i>	<i>WP</i>	<i>Work Package</i>
<i>MM4DS</i>	<i>Maturity Model for Data Spaces</i>		



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Executive Summary

This deliverable presents the roadmap for implementing a European data space for smart and sustainable cities and communities, covering both local and European implementation as well as implementation at various levels of scale (intercommunal, regional, and national). In doing so, this work builds on the results of the Data Space for Smart and Sustainable Cities and Communities (DS4SSCC) Preparatory Action - the multistakeholder governance scheme¹, data space technological architecture², and priority datasets³ - and provide these findings with practical guidance and recommendations to deploy a data space for smart cities and communities (SSCC).

The document describes an action plan for local implementation that is then adapted to intercommunal, regional, national and European contexts. The plan takes into account 6 maturity levels for individual use cases as they might be at different levels of development in terms of governance, technological readiness or data-related properties. Capacity building exercises, and useful tools such as the data cooperation canvas, the action plan cheat sheet, and a glossary are provided to complement deployment efforts.

While this document guides those interested in deploying a cross-domain, cross-border, and cross-sectorial data space, it also acts as the foundation of the Data Space for Smart and Sustainable Cities and Communities Deployment action⁴ which realises the data spaces and refines the work of the preparatory action.

The document is structured into eight chapters:

- **Chapter 1 “Introduction”** nests the preparatory action in the European smart cities and communities environment and clearly points to the DS4SSCC deliverables that describe the blueprint to better understand the roadmap for deployment.
- **Chapter 2 “Federation: European to Local”** describes DS4SSCC within the federation of European data spaces and the principles that federation of data

¹ <https://www.ds4sscc.eu/multi-stakeholder-governance-scheme>


² <https://www.ds4sscc.eu/architecture-model>

³ <https://www.ds4sscc.eu/data-space-blueprint-and-priority-data-sets>

⁴

<https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/digital-2022-cloud-ai-03-ds-smart>



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spaces is grounded on. Furthermore, it explores the interdependencies across geographic scales: from European to local level.

- **Chapter 3 “Introducing the DS4SSCC Maturity Model”** provides a short description of maturity levels in general and defines maturity levels developed for DS4SSCC more specifically. A clear understanding of the different maturity levels is imperative for implementing a data space.
- **Chapter 4 “Implementation”** presents an actionable roadmap to implement a data space on local (4.1), intercommunal, regional and national (4.2) and European (4.3) level.
- **Chapter 5 “Capacity Building”** provides an overview of capacity building activities within the DS4SSCC project, their scope and structure, fostering mutual learning and knowledge-sharing within European data ecosystems.
- **Chapter 6 “Recommended Actions for Standardisation”** outlines the importance of standardisation to create interoperable dataspace and thereby contribute to a harmonised European digital landscape. It relates suggested actions to Minimum Interoperable Mechanisms (MIMs Plus), supporting standardisation and interoperability for the DS4SSCC blueprint.
- **Chapter 7 “Conclusion and Next Steps”** provides a summary of outcome and an outlook into following steps for the DS4SSCC.
- **Chapter 8 “Annex”** provides following Annex to this document:
 - Annex A** – Action Plan Cheat Sheet
 - Annex B** – Template of Data Cooperation Canvas
 - Annex C** – Glossary



1 Introduction

Given the constant growth of data produced by business and public bodies, the European Commission created the Data Strategy to leverage on data's potential⁵. In doing so, data spaces were conceptualised as an enabler of data-sharing across environments due to their governance and technical elements that create an infrastructure to support trustworthy data-exchange. In line with the (current) description of a data space developed by the Data Space Support Centre (DSSC)⁶, the Data Space for Smart and Sustainable Cities and Communities Preparatory Action (DS4SSCC) defines a data space as:

*'A distributed system defined by a governance framework that enables secure and trustworthy data transactions between participants while supporting trust and data sovereignty. A data space is implemented by one or more infrastructures and enables one or more use cases.'*⁷

The European Commission also formulated the need for data spaces in strategic fields with the crosscutting key priority of meeting the Green Deal objectives⁸ - hence, the launch of the DS4SSCC. This preparatory action views communities as an enabler of the data economy as they can be both data providers and users. Using data can help communities' efficiency, create better services and ultimately benefit citizen's lives. However, localities, cities, regions, rural areas are challenged by the lack of available data, their lack of portability and interoperability, and the lack of incentives to overcome these challenges. The DS4SSCC aims to help overcome these challenges by analysing European data-sharing practices and accumulating its findings into a data space blueprint, a list of high-priority datasets, and finally, an action plan to deploy a data space accompanied by capacity building materials.

This document guides those interested in deploying data spaces in their respective smart communities on a local, regional, national and European level. The guidelines pertain to implementation on a local, intercommunal, regional, national and

⁵ <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0066>

⁶ <https://dssc.eu/>

⁷

<https://dssc.eu/space/Glossary/176553985/DSSC+Glossary+%7C+Version+2.0+%7C+September+2023>

⁸ <https://data.consilium.europa.eu/doc/document/ST-6532-2022-INIT/en/pdf>



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European level (chapter 4), and describe their interdependencies (chapter 2) that serve as a context for any data space to be created. These action points serve as a foundation for the DS4SSCC-Deployment phase⁹ and are to be further developed on real-life use cases. The deployment phase kicks off on the 1st of October 2023 to oversee the realisation of the blueprint by building on this action plan across 10 to 12 pilot sites.

1.1 Blueprint for DS4SSCC

Following the definition of the blueprint provided by the Data Spaces Support Center in their glossary¹⁰, a *Data Space Blueprint* is a consistent, coherent and comprehensive set of guidelines to support the implementation, deployment and maintenance of data spaces. Thus, the DS4SSCC blueprint defines the guidelines and mechanisms required for the deployment of the DS4SSCC data space. The specific elements that make up the DS4SSCC blueprint are spread across other work packages and deliverables of the DS4SSCC initiative¹¹.

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<https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/digital-2022-cloud-ai-03-ds-smart>

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<https://dssc.eu/space/Glossary/176553985/DSSC+Glossary+%7C+Version+2.0+%7C+September+2023>

¹¹ <https://www.ds4sscc.eu/multi-stakeholder-governance-scheme> ,
<https://www.ds4sscc.eu/technical-blueprint> ,
<https://www.ds4sscc.eu/data-space-blueprint-and-priority-data-sets>

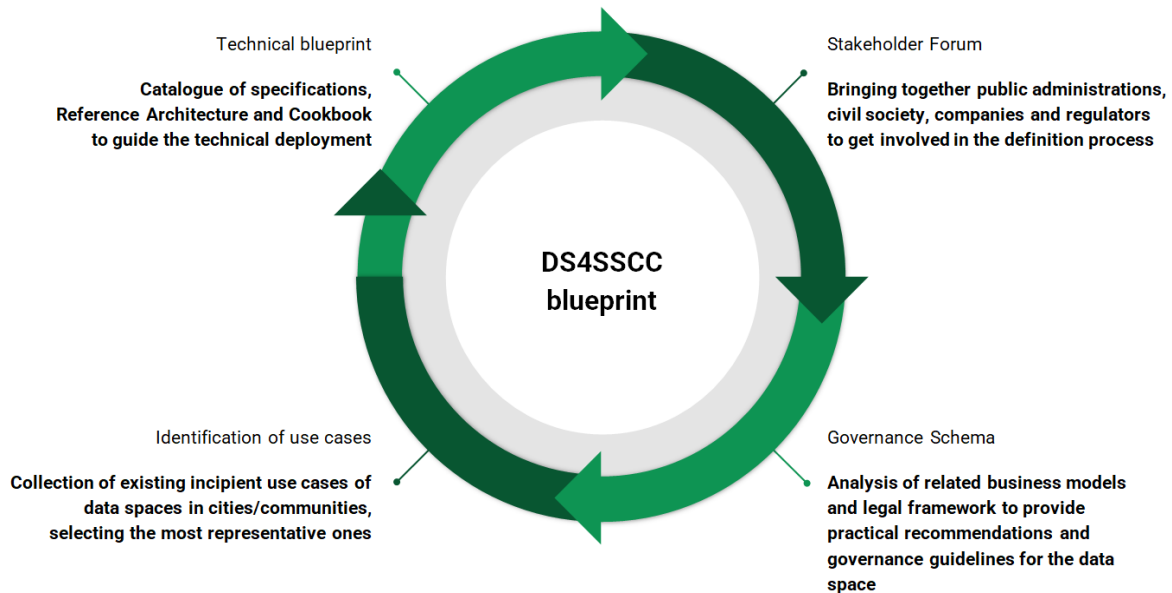


Figure 1. Development of the DS4SSCC blueprint

Figure 1 shows all the elements which form the blueprint. The preparatory action relied on its Stakeholder Forum to gather relevant information and validate its findings. The *Stakeholder Forum* is an important part of the DS4SSCC ecosystem bringing together relevant players in data spaces. This supports collaboration and coordination between stakeholders to create a useful blueprint and the success of the data space deployment. The *Stakeholder Forum* is the emerging smart and sustainable cities and communities **data space ecosystem** which is coordinated by WP5 and WP1. It builds on the community of the Living-in.eu movement that brings together communities (the demand) with suppliers (the supply). In doing so, it expands this community by bringing in relevant players in the data spaces ecosystem.

- The *Governance Scheme*¹² developed under the coordination of WP2 establishes the **principles and rules** to govern the data space and its ecosystem for the benefit of cities and local communities.

¹² <https://www.ds4sscc.eu/multi-stakeholder-governance-scheme>



- The *Technical Blueprint* developed by WP3 contributes to the overall blueprint with the Catalogue of **Specifications**¹³, **Reference Architecture**¹⁴ and **CookBook**¹⁵ to deploy the technical infrastructure for the data space.
- WP4 identified relevant and representative *Use Cases* in Europe that may bring tangible examples of incipient data spaces. The selected use cases showcase their **priority data sets** and commonly used technologies to bring to the data space¹⁶.

Therefore, the DS4SSCC blueprint is formed by all the above mentioned elements (the ecosystem, the data, the governance, the technology) and all need to be used and followed to deploy a data space for smart and sustainable cities.

¹³ <https://www.ds4sscc.eu/catalogueofspecifications>

¹⁴ <https://www.ds4sscc.eu/architecture-model>

¹⁵ <https://www.ds4sscc.eu/architecture-model>

¹⁶ <https://www.ds4sscc.eu/data-space-blueprint-and-priority-data-sets>



2 Federation: From European to Local

Cities and communities are complex entities, interrelating variables from a highly diverse background, defining physical (built), social, demographic and economic properties among others. When developing use cases and technical solutions for smart and sustainable cities and communities that rely on data-based information, this leads to the necessity of data availability over a broad variety - a *federation* - of data spaces.

2.1. The Federation of Data Spaces

A *Federation of Data Spaces* is a concept that envisions an interconnected network of data spaces, where data is shared and exchanged seamlessly, while respecting privacy, security, data sovereignty and governance requirements. It transcends traditional boundaries, allowing data to flow across organisations, sectors, and borders.

More specifically, in the vision set out by the European strategy for data, the creation of EU-wide common, interoperable data spaces in strategic sectors aims at overcoming legal and technical barriers to data sharing by combining the necessary tools and infrastructures and addressing issues of trust by way of common rules. A common European data space brings together relevant data infrastructures and governance frameworks in order to facilitate data pooling and sharing.

Key Elements of the Vision:

1. **Interoperability:** At the heart of the Federation of Data Spaces is the idea of interoperability. Data should be able to move freely between different data spaces, regardless of the technologies and standards used. This interoperability allows for the efficient exchange of data, unlocking its potential for innovation.
2. **Data Sovereignty:** Despite the free flow of data, individuals and organisations should retain control over their data. Data sovereignty ensures that data owners have the authority to decide who can access and use their data and under what conditions.
3. **Privacy and Security:** The Federation of Data Spaces prioritises robust privacy and security measures. Data should be protected from unauthorised



access and misuse, ensuring that individuals' and organisations' sensitive information remains confidential.

4. **Standards and Governance:** Establishing common standards and governance frameworks is crucial to enable the Federation of Data Spaces. These standards ensure consistency and compliance, promoting trust among data space participants.
5. **Inclusivity:** The vision encourages the inclusion of various stakeholders, from individuals and small businesses to large corporations and governments. Inclusivity fosters innovation and diversity of data sources.

The list of European data spaces as introduced in the European strategy for data initially included 9 data spaces (Health, Industrial, Agriculture, Finance, Mobility, Green Deal, Energy, Public Administration, and Skills)¹⁷. However, new data spaces are being constantly developed (such as the DS4SSCC presented here) in a broad variety of fields. Individual sectors or communities are expected to develop their own instances of data spaces, resulting in a multitude of data spaces. Being able to seamlessly share data across these data spaces provides clear advantages. It extends the reach and scope of accessible data and allows new business models and solutions to be developed across sectors and regions.

When it comes to smart cities and communities, topics, such as Cross-sectorial, Health, Energy, Mobility, and Public Administration are most relevant to the field, as presented in D4.1¹⁸ (see Table 1), and hence cooperation specifically with ongoing data space initiatives in these fields was initiated.

Cross	19
Health	10
Agriculture	3
Manufacturing	1
Energy	9
Mobility	23
Financial	2
Public administration	12
Skills	1
European Open Science Cloud	1
meeting the Green Deal objectives	1

Table 1. Selected use case distribution by Data Space strategic fields

¹⁷ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0066>

¹⁸ <https://www.ds4sscc.eu/data-space-blueprint-and-priority-data-sets>



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To envision how data spaces and their federation impact currently ongoing and future urban and communal development all over Europe, this deliverable next outlines the strong relationship of DS4SSCC with partner initiatives and projects within the smart cities and communities movement over different geographic scales.

2.2. Geographic Scales: From European to Local

DS4SSCC encompasses a variety of stakeholders ranging from communities, cities, regions, and public bodies to research institutions, non-profit organisations, and private corporations. Importantly, DS4SSCC is also a multi-level ecosystem including stakeholders at the (hyper) local level (e.g. municipalities, community groups, regional public bodies, SMEs), national level (e.g. national governments, National Data protection Boards, large companies), cross national, European, and global levels. This has implications for the deployment and coordination of this heterogeneous ecosystem.

While this deliverable details an action plan focusing on local decision makers that aim to set up a local data space it also explains how this guidance should be adopted in different geographical scales. This plan presents a set of actions that should be taken on city or community level, impacting higher levels of governance as well as cities and communities highly dependent on federal governments, institutions, and companies for their local operations. In order to understand these interdependencies this chapter details each potential stakeholder in the data space according to their geographical scale.


2.2.1. European

- **European Institutions:**

The European Union often sets overarching standards for data governance¹⁹ that member states are expected to follow. Harmonised standards ensure that data can be easily shared and utilised across member states, fostering a more integrated European data space.

¹⁹ European Data Governance Act: <https://www.european-data-governance-act.com/>



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European support, such as funding instruments, project calls or regulations, can help scale successful national initiatives and promote best practices across member states. Additionally, European level governance (i.e. the Data Governance Act), facilitates cross-border data sharing and collaboration.

- **Smart Communities Network:**

Concretely, the Smart Communities Network currently being set up is foreseen to be a relevant touchpoint for the local authorities to help them deploy their data spaces. This Smart Communities Network is part of the European Commission's Local Digital Twin toolbox projects (DG CNECT)²⁰ and the Living-in.EU movement and is expected to be operational by the autumn of 2025. This network will consist of Member State experts: people with strong local, regional, and national networks in their respective countries who are knowledgeable on digitalisation. They will also help to set up digital workshops and training sessions on the local level in their respective countries, in close collaboration with European networks such as OASC²¹, Eurocities²², and the overall Living-in.EU²³ community.

This network that is currently being built is also meant to test local digital twin toolboxes and to support the installation of shared platforms and other systems to enable data to be shared in a comprehensive and accessible manner. An additional objective of this Communities Network is also to share practices on software and artificial intelligence (AI) procurement, thereby focusing on a harmonisation of standards to simplify and to harmonise activities from the local to the European level.

- **EDICs - European Digital Infrastructure Consortia:**

An important new type of organisation is the European Digital Infrastructure Consortia (EDICs) which were introduced in spring 2023. They will provide a legal framework supporting national and regional governments with setting up and implementing new or already existing digital infrastructure projects.

²⁰ <https://digital-strategy.ec.europa.eu/en/library/local-digital-twins-forging-cities-tomorrow>

²¹ OASC - Open and Agile Smart Cities: <https://oascities.org/>

²² Eurocities: <https://living-in.eu/partners/eurocities>

²³ Living In EU: <https://living-in.eu/>



2.2.2 National

The national and European levels play distinct but interconnected roles in data governance and management. National governments often set the policy framework for data governance, including the establishment of National Access Points (NAPs) as with, for instance the mobility data spaces, providing a consistent set of rules and guidelines that govern how data is collected, stored and shared. National governments can allocate funding for the development and maintenance of data infrastructure, including NAPs. At the national level, governments can enforce data standards to ensure consistency across various sectors and regions. Furthermore, national bodies oversee compliance with data governance policies, including security protocols.

A successful example of NAPs that focus on mobility can be found in NAP Core²⁴ that is similar to central European Access Points, with the following additions:

- Each NAP will have its own agenda and budget; however, they can learn from each others' experiences and contacts with (international) businesses;
- Each NAP will adopt international technical standards; if these are not available the NAPs will have to cooperate intensely;
- All details of the implementation of existing technical standards are available.

2.2.3. Regional

The local and regional levels of governance are intertwined in multiple ways, each affecting the other in terms of policy, resource allocation and community development. Regional policies can set the framework within which local governments operate, making coordination essential. To make sure that the resources are adequately allocated, there is a need for a thorough understanding of the local needs and conditions which are often very specific and context-bound.

Therefore, close collaboration between these two governance levels is essential. Services like healthcare, education and public transportation may be funded or regulated at the regional level, but delivered locally. Regional levels can play a

²⁴ NAP Core: <https://napcore.eu/>



pivotal role in the field of data governance for the local level. They could create a centralised repository that local governments and stakeholders could tap into. This would allow for standardised, secure and effective data storage, making it easier for local governments and stakeholders to access and use data. They can implement or define data standards on a local level, ensuring that data from different local communities is compatible and can be shared or analysed seamlessly.

Training programmes on data governance can provide local authorities with the skills and knowledge they need to manage their data in an effective way. Regional governments can provide technical and financial support for inspiring and sustainable data governance initiatives. This can also help to overcome resource constraints. They can support local authorities via developing and offering framework agreements on digital support mechanisms for local authorities, or offering toolboxes and roadmaps for data governance. Security measures like protocols should be established to protect data integrity and confidentiality.

2.2.4. Intercommunal

The local and intercommunal levels are closely related in several ways, each influencing the other in the context of data governance, data management and community services. They can reinforce one another and make services more user-centric if they join data forces. For instance, both levels often share resources like water supply, waste management, electricity and public transportation. Shared resources require coordinated governance and data management to ensure efficiency and equity. In practice, local politicians may serve on boards or committees that make decisions at the intercommunal level, to ensure that local interests are represented in broader community decisions. Flanders offers different examples for this²⁵: IVAGO oversees waste management in the Flemish city of Ghent and its surrounding communities, while FARYS provides water management across 85 Flemish communities.

Data collected at the local level may be useful for intercommunal projects and vice versa. Hence, effective data sharing can lead to better decision-making and resource allocation at both levels. Therefore, alignment is necessary. For example, environmental issues like pollution require action at a larger scale, so more effective data governance models can be of benefit for local stakeholders.

²⁵ <https://www.vlaanderen.be/de-intercommunales-of-verenigingen-van-gemeenten>



Hence, it is key to identify which utility companies operate in your area, which politicians and officials serve on their boards and to establish data governance frameworks. The same steps can be taken as mentioned before, but at an intercommunal level. This requires the fostering of openness, trust and constructive collaboration. Additionally, the right profiles and governance structures will need to be defined to make sure that these data processes are effectively installed and managed.

2.2.5. Local

Cities and communities themselves manage a lot of data on the local level. When setting up a local data space, it is important to identify which data is controlled (and ideally owned) by the local government itself. To do this, stakeholders are encouraged to refer to any existing data governance plan. When in place, there should also be a Data Catalogue which details the ownership and governance of each data source. If no such catalogue exists, communities should look to implement data governance measures. This can be a serious endeavour which will require time and resources. Nevertheless, if no data governance plan exists, it will be very hard to maintain a functional local data space.

The following frameworks should be established:

1. Create a comprehensive list of all data sources that are managed or controlled by the local government.
2. Classify each data source based on its type, sensitivity and importance to the community.
3. Identify the department or individual who owns or is responsible for the data.
4. Define who has access to each data source and what level of access they have (read, write, modify, delete).
5. Create a set of rules and guidelines that dictate how each data source should be managed, used and shared.
6. Implement appropriate security measures for each data source.
7. Compile all this information into a centralised data catalogue, update and review it regularly.

Note that larger cities that are more advanced in this field can act as examples for others, sharing knowledge, best (and worst) practices and experiences with other communities.



3 Introducing the DS4SSCC Maturity Model

As the current development status of use cases in European cities and communities might differ from case to case, individual actions are needed to reach a higher degree of maturity depending on the status. Therefore the DS4SSCC action plan suggests to locate use cases within a maturity level scheme based on completed key performance indicators (KPIs) ensuring right guidance for the next actions to be taken.

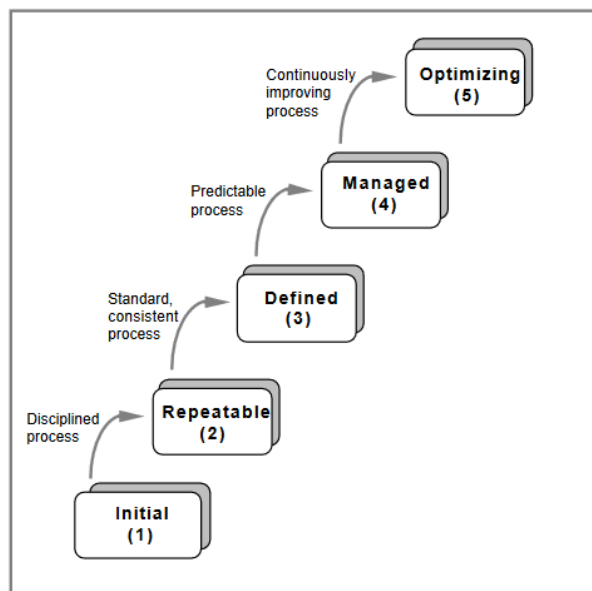


Figure 2. The original Capability Maturity Model, showing 5 levels of maturity for software development processes, as suggested by Software Engineering Institute SEI

Based on the Capability Maturity Model developed between 1987 and 1997 at Carnegie Mellon University by the Software Engineering Institute (SEI)²⁶ (see Fig. 2), maturity models are conceptual models that outline anticipated, typical, logical, and desired evolution paths toward maturity, where maturity is a measure to evaluate the capabilities of an organisation concerning a particular discipline.²⁷ In doing so, maturity models are tools that have been used to improve many capabilities within

²⁶ Capability Maturity Model for Software, version 1.1.: www.sei.cmu.edu/reports/93tr024.pdf

²⁷

<http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Application+of+a+Holistic+Model+for+Determining+BPM+Maturity#0>



organisations, from business process management and project management to software engineering among others.

A defined maturity curve serves two important purposes. First, it is the basis of an assessment process that helps determine the current maturity level. Second, it provides a view of the growth path by identifying the next set of capabilities an organisation should develop to drive business value.

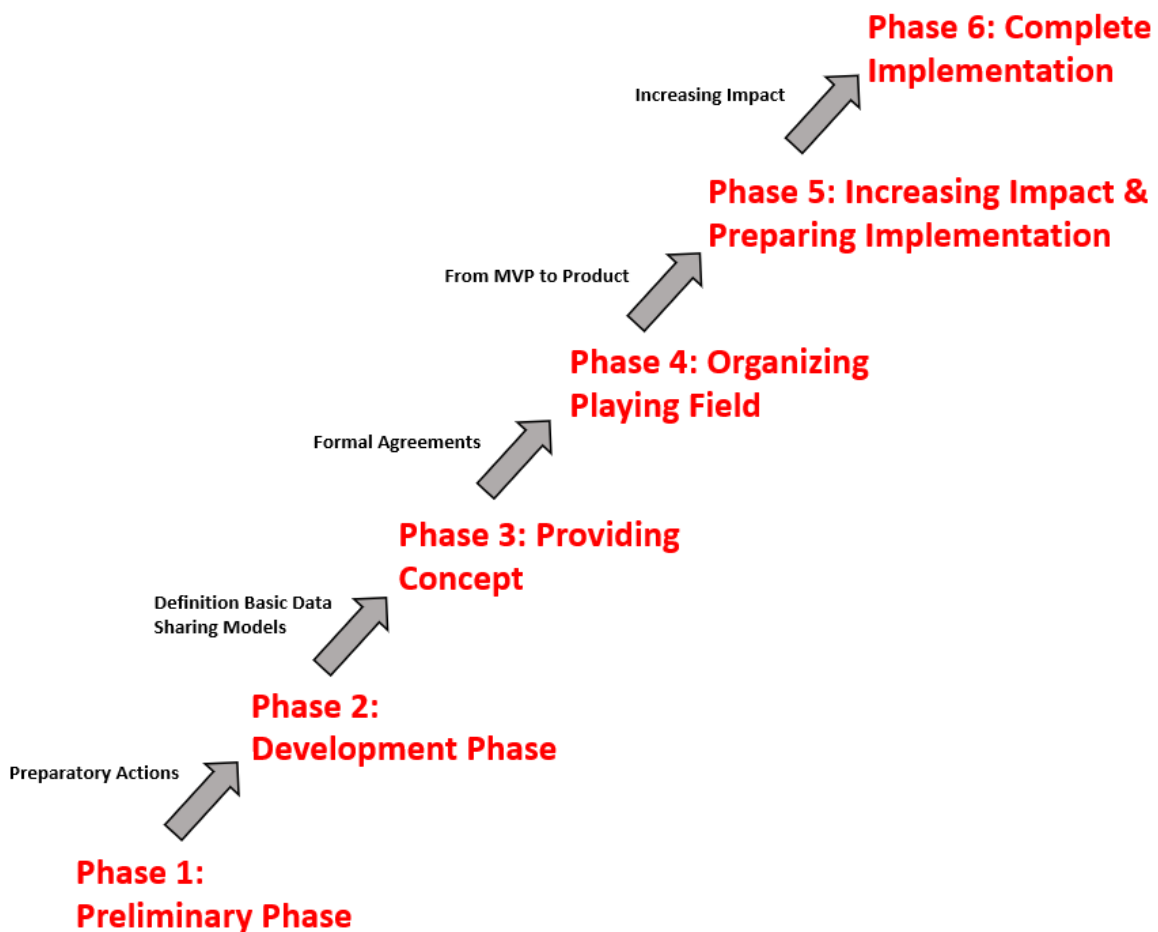


Figure 3. The DS4SSCC Maturity Model

For DS4SSCC in particular, maturity levels are used to offer guidance on identifying the current maturity level of a pilot project, as well as to provide a view of the growth path by identifying the next set of capabilities or actions a city should develop to drive business value from data spaces, reaching next levels of maturity.



Related to the Maturity Model for Data Spaces (MM4DS),²⁸ a 6-phase maturity model (5 maturity phases + 1 preliminary phase) has been identified for identifying and developing DS4SSCC capabilities (see Fig. 3), which will be described in more detail in the following chapters of this deliverable. In summary the schema describes following phases:

1. **Preliminary Phase:** Including a number of preparatory actions that need to be taken before the actual project starts, ensuring a sustainable base for the pilot. This includes the formation of an organisation or consortia to drive the project content, work-wise and financially. The budget needs to be clarified, possible legal challenges discussed.
2. **Development Phase:** Including the determination whether a concept at MVP stage can work for a defined use case for initially two partners in the network or not. Basic data sharing and governance models are being defined and an independent body for data-exchange purposes strategically positioned. The largest investments at this phase are to set up the network of committed pilot partners and supporting partners and to set up a non profit organisation, for the development of an MVP and for legal work.
3. **Proof of Concept:** In this phase, the concept that has been developed for the pilot partners in phases 1 and 2 is tested to see if it can be proven to work for the assistant partners or whether minimal adjustments are needed. Formal agreement for data sharing between pilot partners and API's for data sharing are established and all DS4SSCC components (governance, technological and data-related standards) are put in place.
4. **Organising Playing Field:** Including the continuation of development of the MVP to an effective product for data exchange. All potential business partners are connected to the network and DS4SSCC components and standards have been well established and tested due to the course of the pilot. Onboarding for additional partners (such as private corporations, cities, communities, public bodies, research institutions, and non-profit organisations) has been established. Investments in this phase mostly are spent on MVP development and organisation.
5. **Increasing Impact & Preparing Implementation:** In this phase, more additional use cases are being developed on the top of established framework to raise attractiveness and awareness of the solution. Investments are mostly spent on further development and technical applications of such

²⁸ https://link.springer.com/chapter/10.1007/978-3-030-98636-0_2#Sec10




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use cases. Initial Preparation for complete implementation (phase 6) has started.

6. **Complete Implementation:** The final goal is the transformation of the solution into a fully-fledged and operational innovational product. New cities, communities and private corporations will be added to the network, governance of the non profit is professionalised, maintenance processes are operational, an inspiring innovation agenda for next 2-4 years is available including budgets, and financial management is under control.

The maturity levels described here frame the action plan as presented in chapter 4 of this deliverable, focussing on a city or community level and on supporting local decision makers aiming to set up a local data space. However, as local decisions impact higher levels of governance as well, chapter 5 outlines the implementation on a European level.



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4. Implementation

4.1 Local Level

This chapter presents the DS4SSCC Action Plan defined in a 6-phase roadmap, from Preliminary Phase (phase 1) to Complete Implementation (phase 6). Each phase contains a summary and detailed subsections on governance, datasets and technical architecture on:

- **goals** to be reached within this phase,
- the **process** to do so and
- **actions** to take to reach next levels.

At each phase the action plan provides a set of KPIs a use case should have accomplished to be considered at a certain stage. The KPIs allow relevant use cases A) to be located within this framework and B) to identify actions to take to reach next levels. In addition, Annex 1 presents a summary of the action plan including above mentioned KPIs and next actions, collected in a **Cheat Sheet** for interested stakeholders, having all essential information collected in one table.

As a common and transversal instrument supporting stakeholders to locate use cases within the action plan framework, the **Data Cooperation Canvas** has been developed over the course of the project to provide at a glance overview of the motivation, the governance and the technical dimensions of a data space (see Annex 2). The adaptation of the concept of the Business Model Canvas from Osterwalder,²⁹ defined the template (available in the Annex) produced by WP2.

Regarding the action plan presented here, the Data Cooperation Canvas allows interested stakeholders to assess their individual use case critically by outlining the governance environment the use case is set in, the technological and data-related backbone the use case will be developed on, as well as the maturity level in its current state. This maturity level will then allow stakeholders to make use of this action plan to develop the use case further to a complete implementation within the European data space environment.

²⁹

[https://www.scirp.org/\(S\(351jmbntvnsjt1aadkposzje\)\)/reference/ReferencesPapers.aspx?ReferenceID=2066965](https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=2066965)

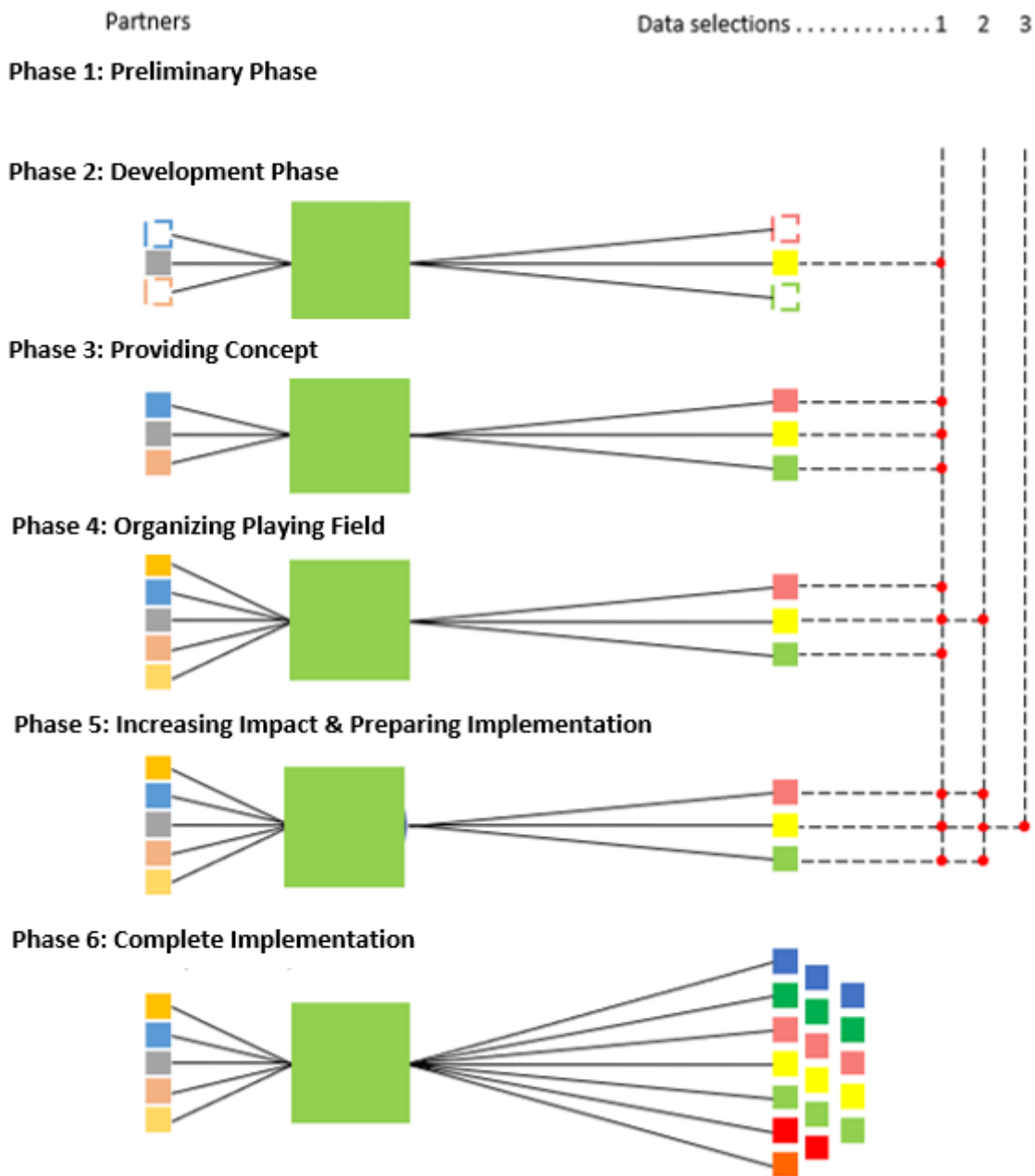



Figure 4. Overview Implementation Phases (Courtesy to IDEA Amsterdam)

Figure 4 provides an overview of the 6 implementation phases. The green box at the centre of each phase represents the consortia or non profit organisation (to mitigate



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bias) developing the use case. On the left side of it, the number of involved partners is indicated, on the right side of it, the number of communities is indicated where the use case is being implemented at each stage: While there is a small number of partners and only one community (or testbed) involved in the rather early Developing Phase, both sides grow along the course of maturity growth to a large consortium and a large number of communities as stakeholders with additional data sources, as shown in the final Complete Implementation Phase.

This chapter describes these phases in detail, including aspects of governance, datasets and technological architecture.

4.1.1 Phase 1: Preliminary Phase

Before the actual project starts, a number of preparatory actions need to be taken, ensuring a solid and sustainable base for the pilot. This includes the formation of an organisation or consortia to drive the project content, work-wise and financially. The budget needs to be clarified and possible legal challenges should be discussed.

In this maturity phase, the following KPIs should be achieved:

Field of Development	KPI
Governance	<ul style="list-style-type: none">- Scope and purpose of data sharing defined- Data sharing model defined- Preliminary business model defined including added value proposition for each partner and scaling up model- Identification initial partners and broader stakeholders- Initial budget agreed- Initial resources required identified and allocated to partners
Datasets	<ul style="list-style-type: none">- Data Plan established
Architecture	<ul style="list-style-type: none">- Framework defined- Requirements defined



Governance

Goal

The goal of this phase is to identify specific data needs related to a challenge for a pilot upon which the collaboration can be built and to define clearly its scope .

Furthermore a data sharing model will be defined, allowing the scaling of the pilot throughout future stages. Also a preliminary design of the business model, identifying the concrete added value for each initial partner and for future participants will be developed and the budget for each phase of the cooperation outlined.

Process

A series of meetings and workshops is needed with partners to define these goals in the preliminary stage. Identifying the exact categories of data that are required to address the challenge and apply the principle of data minimisation (rather than trying to get as much data as possible) can lead to lengthy and unnecessary discussions with data owners and thus delays in accessing the relevant data. Once the data needs have been identified, relevant partners who will bring specific resources (e.g. datasets, skills, management, legal support, etc) need to be contacted according to the needs of the pilot.

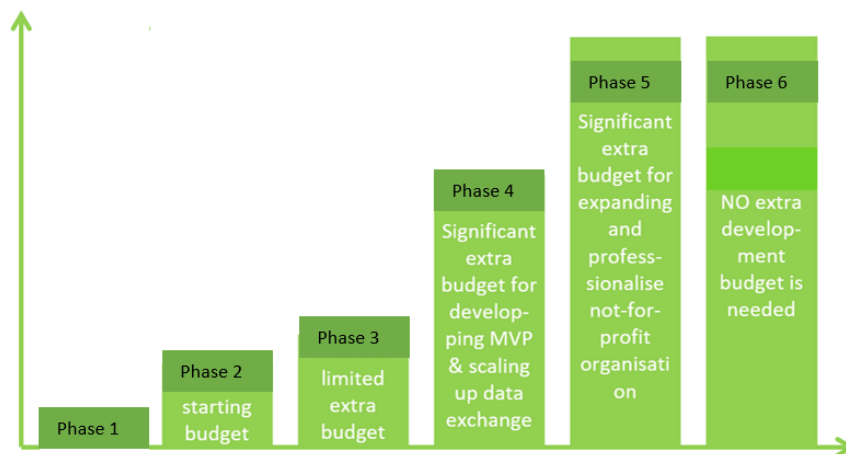


Figure 5. Budgeting per phase



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The definition of the budget needed for each phase of the cooperation and anticipation of financing resources and revenue streams (in the later phases) is also part of this preliminary stage (see Fig. 5). Starting a data cooperation is cost intensive (legal, operational, infrastructure costs, etc), time and resource consuming, and also high risk. Initial budget should be kept minimal to the viability of the proof of concept (i.e. initial pilot) before significant investment in technology, infrastructure and coordination of partners (e.g. network) from phase 3. Once operational, the revenue streams can be diversified (see D2.2. Sustaining the cooperation over time³⁰).

Suggested Actions

It is recommended to work on the ‘Why’ and ‘Organisational’ frames of the Data Cooperation Canvas provided by the DS4SSCC. This step requires a tight work with all the teams involved in the data space creation, as all the dimensions need to be synchronised and unified in a common canvas: data, technical architecture, motivation, business case and technical matters.

A further step that can be executed in parallel would be the analysis of the current governance situation at the city or community. Depending on the type of scenario existing in the city different evolution steps and implementation rules will be required.

Datasets

Goals

In this stage a data plan will be defined to scope out what data is needed to reach the goals of the project and how it will be exchanged among stakeholders. The development of the data plan follows a principle of data minimisation to avoid unnecessary complications. These considerations still happen on a rather high level but are necessary groundwork for a smooth introduction of next phases.

Process

A series of meetings, workshops and coordination calls is needed, including especially stakeholders from dataset owners, providers and technological partners to define a data plan that covers as much relevant information and details as

³⁰ <https://www.ds4sscc.eu/multi-stakeholder-governance-scheme>



needed. Such meetings and workshops will support the formation of an initial informal group of partner organisations that will lead dataset related topics of the project in further phases to come.

Different data scientific approaches to reach defined goals are discussed, including an in-depth discussion about necessary datasets for each of them. Each dataset will be initially reviewed towards its availability, accessibility, data privacy, security and interchangeability, leading to an agreement of a final dataset that will be used for the project in the next phases. Along this process data minimisation is key to streamline the process: the less data is involved in the project, the less complicated and smoother its implementation will take place (Minimal Required Data Points). Datasets in use should meet principles of findability, accessibility, interoperability, and reusability (refer to the FAIR document for more information)³¹.

Suggested Actions

It is recommended to refine the data-related part of the Data Cooperation Canvas provided by the DS4SSCC along with data plan development. This step requires a tight work with all the partners involved in the data space creation, as all the dimensions need to be synchronised and unified in a common canvas: data, governance, motivation, business case and technical matters.

Furthermore the data plan should be refined towards the demonstration of data exchange and interoperability for Proof of Concept (PoC) in the next stage. Focus should lie on the FAIR principles of the dataset towards findability, accessibility, interoperability, and reusability.

Architecture

Goal

The goal of this phase in regards to the architectural dimension is to establish the framework and requirements under which the architecture has to be defined for further phases.

Process

³¹ The FAIR Guiding Principles for scientific data management and stewardship: <https://www.nature.com/articles/sdata201618>



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A series of interviews and meetings with the data space stakeholders, including the use case city/community and the ecosystem around, have to be planned in order to gather the ambition, the context and the specific requirements to be considered in the architecture.

Suggested Actions

It is recommended to work on the technical dimension of the DS4SSCC Data Cooperation Canvas. This step requires close work with all the stakeholders involved, as all the dimensions need to be synchronised and unified in a common canvas: data, governance, motivation, business case and technical matters.

A second step that can be executed in parallel would be the analysis of the current technical infrastructure at the city or community. Depending on the type of scenario existing in the city (such as, smart city platform, some digitised vertical services, digital twin of the city, etc.) different evolution steps and implementation rules will be required.

Additionally, this preliminary phase is ideal to set up the technical deployment plan according to the data space scope defined in the canvas and the current technical infrastructure analysis conducted. The established technical deployment plan allows for a smooth step-by-step implementation in each of upcoming phases, avoiding unnecessary complications along the line.

4.1.2 Phase 2: Development Phase

Using a use case, this phase allows partners to define the foundational principles for the data cooperation which will be scaled up if the proof of concept is validated. The data sharing and governance models are specified and an independent body for data exchange purposes is strategically positioned (see Fig 4 green centre box). The largest investments at this phase relate to setting up the network of committed pilot partners and supporting partners as well as to setting up a non profit organisation, the further development of the MVP and necessary formal and legal procedures.

In this maturity phase, following KPIs should be achieved:

Field of Development	KPI
Governance	- Minimum pilot network defined



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	<ul style="list-style-type: none"> - Legal agreements arranged
<p>Datasets</p>	<ul style="list-style-type: none"> - Number of data points exchanged as a percentage of goal - All (city) partners are able to access the data
<p>Architecture</p>	<ul style="list-style-type: none"> - MVP architecture depicted

Governance

Goal

The goal of this phase is to set up a minimum sized network of committed partners on a limited number of pilots to prove the concept of the data collaboration and to set up legal agreements between them, specifically for data sharing purposes within the project.

Process

This phase includes the activation of networks to identify interested parties that will result in a final selection of a core team including all relevant roles and expertise (governance, technical, datasets). Partners will set up the legal framework, agreements are signed as contracts and are legally binding, defining a solid legal base for next steps. Legal appointments are in place and the budget for this stage marginally extends the budget of phase 1.

Sites of use case deployment are investigated by the city or community against suitability towards MVP (minimal viable product) testing purposes. The data cooperation is used for selecting functional sharing and governance models for the data exchange by applying the Data Cooperation Canvas. The strategic position and organisational set up for the non profit organisation that is managing the data cooperation / exchange is determined. All details of the cooperation inform further technological development of the use case.



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Suggested Actions

The city or community should find a simple but representative use case and testbed with high impact to validate the architecture and carry out a first MVP implementation.

Datasets

Goal

In this stage a final key dataset for Proof of Concept (PoC) has been defined and the demonstration of data exchange and interoperability of the PoC for one selected use case takes place.

Process

Based on the data plan and initial dataset related progress from the previous preliminary stage, meetings and workshops will allow the identification of a final key dataset for PoC, as minor corrections might take place along the PoC development.

Ownership of the dataset will be defined among stakeholders and access will be provided to partners via metered application programming interfaces (APIs). This involves as well the initiation of legal clearances (such as NDAs) among partners and stakeholders.

This stage also ensures the execution of CRUD³² for further development on datasets and their storage. CRUD is the acronym for CREATE, READ, UPDATE and DELETE. These terms describe the four essential operations that are inherent to relational databases and the applications used to manage them, which include Oracle Database, Microsoft SQL Server, MySQL, and others.

Finally, this stage includes the active attracting of companies for potential partnerships in further steps in the project by activating networks of partners.

Suggested Actions

It is recommended that the technical and data part of the Data Cooperation Canvas be reviewed and updated. Furthermore, the exchange between partners and cities or communities in the next phases should be prepared.

³² Managing the Database Environment: <https://dl.acm.org/doi/10.5555/538746>



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Architecture

Goal

At this phase the architectural goal should be to depict the architecture for a MVP describing the details of the technological layer of the data space and how it would work.

Process

More detailed technical working sessions are required to inspect and expand the current architecture and to define the MVP. A core technical team needs to be set up to work in the architecture and MVP implementation.

Suggested Actions

The architecture team of the data space holder (this can be the city itself or the technical providers nominated by the city) should work in the evolved architecture following the guidelines and recipes provided by the DS4SSCC Deliverable 'Architecture Model'.

The MVP implementation may require the connection to the Universal Trust Data Registry through the Authorization Policies Store and the development or configuration of the Data Space Connector components (see D3.2³³ for more details). It can also require the upgrade of some of the existing components of the city's technological framework in the current architecture. For this implementation, choices about standards and technologies need to be made.

4.1.3 Phase 3: Proving Concept

This phase allows initial partners to test the concept and the added value of the data cooperation identified in the previous stages. If the concept is proven to work and requires only minimal realistic adjustments within scope, then the cooperation can be scaled up with more participants and more use cases. There has been formal agreement for data sharing between partners, API's for data sharing are established and all DS4SSCC components (governance, technological and datasets) are in place.

³³ <https://www.ds4sscc.eu/architecture-model>



In this maturity phase, following KPIs should be achieved:

Field of Development	KPI
Governance	<ul style="list-style-type: none">- Necessary components are working- Possible adjustments are fully implemented
Datasets	<ul style="list-style-type: none">- Data exchange is up and running for defined use case
Architecture	<ul style="list-style-type: none">- MVP validation outcome approved

Governance

Goal

In this phase, the concept developed in prior phases will be turned into action. All technical and data related components necessary for the pilot are initially in place and working. Possible necessary minor adjustments are implemented by all partners.

Process

Regular work meetings between partners are set up ensuring a steady progress on the pilots development, including the establishment of monitoring and evaluation mechanisms. All components of the data exchange, such as governance, technology and standards are applied by all partners. Every pilot and support partner is actively participating in their role in this stage and first exchange of data takes place. Minor adjustments are undertaken by relevant partners and implemented by all partners.

Suggested Actions

It is recommended to activate partners' networks and various public relation channels to add new members to the team. To further extend specifically towards business partners, the data cooperation canvas and defined standards should be



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first reviewed and updated towards a larger partner management. Standards and principles for onboarding will be defined, such as products, pricing, or procedures.

Datasets

Goal

In this stage data exchange for defined use cases or domains between different cities and different private party prosumers will be enabled.

Process

Data owners provide in this stage metadata and detailed information about the data quality attributes and service-level agreement (SLA) levels which will be provided, document the access type (APIs) and contact details. This involves the review of provided information and the discussion and negotiation with partners until common agreement is found.

In terms of interoperability the semantic state of the art (as for instance, LOV³⁴, Smart Data Models³⁵, etc.) is being analysed and assessed if the semantics of the data are correctly understood and agreed on by all involved parties. The most common ontologies for the data domain are being applied (links to other relevant ontologies should be established and provided) and assessed if provided data models and ontologies are able to sufficiently be mapped to the (internal) target system. Furthermore, partners need to decide on an applicable or feasible level of verbosity or granularity.

Wherever necessary, required MIM2 PPI's (Pivotal Points of Interoperability, for instance, GeoJSON³⁶) should be identified as well as interoperability mechanisms (such as wrappers, mappers, convertors).

Suggested Actions

It is recommended in this phase, to review developed data exchange properties and its capabilities towards a fully functional data infrastructure. This action allows the onboarding of new unknown parties for the next step.

³⁴ LOV: <https://lov.linkeddata.es/dataset/lov/>

³⁵ Smart Data Models: <https://smartdatamodels.org/>

³⁶ GeoJSON: <https://geojson.org/>



Architecture

Goal

In this phase, the developed MVP from the previous phase needs to be validated in the selected use case as well as, a decision about the engagement of the data space is taken.

Process

Based on the assessment, the city or community may decide to go ahead with setting up or engaging to the data space, or carrying out further development and adjustments before moving to the deployment phase. Both the technical and managerial teams at the city need to be involved in this process.

Suggested Actions

The deployment and configuration of the MVP to the selected use case requirements are needed. It includes the injection of related datasets, the configuration of required APIs, the creation of the access credentials and registration in the Universal Trust Data Registry.

Once all necessary components are deployed and configured, the use case is tested by the technicians and initial users (depending on the testing procedure in the city or community) during a certain period of time for establishment purposes.

The gathered results from the validation will be used in the following phase to refine and expand the MVP towards the real deployment. During the validation, some of the choices made in regards to standards and technologies may change as a consequence of the validation assessment.

4.1.4 Phase 4: Organising Playing Field

The proven concept is further developed to a product for data exchange and all potential business partners are connected to the network, after DS4SSCC components and standards have been well established and tested via the pilot. Onboarding for additional partners (businesses, etc) has been established. Significant investments in this phase are spent on MVP development and organisation.



In this maturity phase, following KPIs should be achieved:

Field of Development	KPI
Governance	<ul style="list-style-type: none">- Data cooperation canvas reviewed and updated- Onboarding standards defined
Datasets	<ul style="list-style-type: none">- Number of organisation, cities and use cases running- Have a fully functional data infrastructure that is able to onboard new unknown parties
Architecture	<ul style="list-style-type: none">- MVP successfully tested for full deployment

4.4.1 Governance

Goal

This phase focuses on the transition from MVP to a fully operational data exchange and the pilot's scale up in terms of team members and businesses.

Process


The pilot partners, and additional partners define onboarding standards. After a positive review of relevant businesses they are invited to the network (in case of great quantities of applications the onboarding procedures should be self-servicing). Whether the onboarding process should be free-of-charge or not, highly depends on the success of data cooperation (as for instance, if businesses are willing to pay for the service) and the cost-effectiveness of the onboarding process.

While the concept has been validated in phase 3, this stage opens up investment opportunities from third parties, especially for technology organisations, such as private companies.

Suggested Actions

While the cooperation will take a legal step towards a professional organisation, such as a nonprofit, legal and formal preparations should be initialised. Furthermore,



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as in the next phase further use cases will be added to the data cooperation, networks should be activated and interested stakeholders contacted. The Data Cooperation Canvas can be a useful tool to help communication towards external partners.

Datasets

Goal

In this phase a technical governance structure is in place, including API's and a secured, metered, access control, allowing the transition from MVP to fully operational data exchange stage.

Process

Together with technical and governance partners of the project, access control will be defined in this phase. In a series of work meetings and workshops a documentation of access control will be set up and defined on how it will be implemented and executed. Access control should be billable, the use of smart contracts can be considered.

Suggested Actions

It is recommended to start to develop performance measurements (KPIs) that can be measured and evaluated, the focus of the next phase.

Architecture

Goal

In this phase, the developed and tested MVP needs to be extended towards the actual and full deployment of the data space. All technical pieces of the architecture need to be put in place in real conditions towards working with any potential use case.

Process

This phase is essentially incremental and needs to be split in smaller and evolutive phases until reaching the complete deployment. It is suggested to create an agile development process with periodic sprints and releases in order to afford the different stages. Creating a Product Backlog with the full deployment features and



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establishing priorities in line with the city/community strategy. Assign a properly sized development team to the process which may take several years.

Suggested Actions

Based on the assessment results of the MVP validation, review the standards and technologies choices to make the final decision.

Starting from the MVP, extend the functionality incrementally by stages until having all the full technical infrastructure for the data space in operation. In each iteration, test and validate the release in an operational environment before going into production.

4.1.5 Phase 5: Increasing Impact & Preparing Implementation

In this phase, additional use cases are being developed to raise attractiveness and awareness of the data space. Investments are mostly spent on the development and technical applications of such use cases towards improvement of their performance. Also in this stage, the preparation for complete implementation (phase 6) has started.

In this maturity phase, following KPIs should be achieved:

Field of Development	KPI
Governance	<ul style="list-style-type: none"> - Additional use cases added - Decision/governance mechanisms are scaled up (e.g. user representation, citizen participation) - Diversity of partners (across sector and multi-level) - Less data mature partners can join (e.g. smaller cities with less data capabilities) - Connect with other data spaces / have other data spaces as participants
Datasets	<ul style="list-style-type: none"> - Agreement on performance measures - Service-level Agreement (SLA)



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Architecture	- Architecture successfully tested with more use cases
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Governance

Goal

In this phase the non profit organisation/consortium is formalised and more use cases are being developed by the data cooperation to maximise the solution's benefits.

Process

The organisation or consortium takes a formal and legal step towards a professional non profit organisation. This involves a number of work meetings and workshops and close cooperation between legal entities of involved partners.


The first phases detected and selected interested and relevant potential partners with interesting use cases, and now this phase adds these use cases to the data cooperation.

The involvement of other communities as partners is important to implement solutions in other environments, under different circumstances and to prove its validity independently from a location, which will attract in return new business partners.

Suggested Actions

As a non profit organisation, a rigid business case is crucial. Most important investments should have been done, the startup organisation from phase 1 and 2 should have grown in professionalism to mature level. To prepare towards fully and complete implementation in the next step, define formal products and services, their business and pricing model and terms and conditions (offering). Furthermore a professional service or support desk and SLA should be installed, standard procedures for onboarding and leaving should be defined and representation of all users in the governance of the non profit should be professionalised.



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Datasets

Goal

The goal of this stage is to ensure and maintain data quality for the project, enabling new communities to make use of the needed data.

Process

To ensure the data exchange's quality and usefulness, performance measurements have to be developed primarily by data-related and technical partners in close collaboration with partners. These measurements are the means for the monitoring and evaluation throughout the following years to come.

Suggested Actions

It is useful to develop a high-level planning towards the fully-fledged data space to achieve complete implementation. This includes specifically future dataset support and maintenance (SLA details).

Architecture

Goal

In this phase the architecture will be challenged by more complex and realistic use cases that will in turn also help to finetune the technical infrastructure of the data space.

Process

In this phase the architecture will not change significantly as it has been prepared and developed in the previous stage. The main process will be the incorporation progressively of the new use cases. Basically, a process of configuration and maintenance will be indicated.

Suggested Actions

The number of use cases for data sharing and value creation in the ecosystem should be added incrementally as well. If needed, the technical solution has to be adjusted and tested for each of the use cases.

Some technical developments can be required as a consequence of the intensive testing, correction of issues or lacking functionality discovered during the testing process.



4.1.6 Phase 6: Complete Implementation

The final phase describes the transformation of the solution into a fully-fledged and operational innovational (non profit) organisation. This includes that new cities and communities and private corporations will be added to the network. Furthermore, at this stage all maintenance processes are operational and an inspiring innovation agenda for the next few years is available including budgets. Finally, all financial management is aligned and controlled by the management.

In this maturity phase, following KPIs should be achieved:

Field of Development	KPI
Governance	- Transition to nonprofit organisation complete
Datasets	- Service-level Agreement (SLA) fully established
Architecture	- Architecture fully working as operational system

Governance

Goal

In this phase, the organisation is completely defined as a fully operational (nonprofit) organisation.

Process

This phase includes the further extension of the network by adding new cities and communities and private companies as partners. This includes public relations and networking activities from relevant partners. Furthermore, legal and organisational steps are taken towards a nonprofit organisation and all maintenance processes are operational and fully working. For further development and growth, an inspiring innovation agenda for 2-4 years is available including budgets.



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Datasets

Goal

This stage includes the steady maintenance of datasets in use, to ensure the project's quality at any scale.

Process

In this final phase, Service-level Agreement (SLA) is fully functioning. Responsible partners fulfil their role ensuring the data quality and availability on a large scale.

Architecture

Goal

The technical deployment of the data space must work as a full operational system used by public administration employees, citizens, city providers, policy makers, etc.

Process

In this stage, the governance schema of the data space, the technical solution maintenance and evolution can be transferred to a commercial operator supporting the community, ensuring the future sustainability of the data space components.

4.2 Intercommunal, Regional and National Level

The context of a data space on a regional and national level implies an intercommunal cooperation. In other words, it is an opportunity for smaller communities to work together and thereby gain access to more data, more expertise, and hence, improved data scientific modelling. However, this in turn also presents the complexity of having different legal and regulatory measures, as well as a wider group of stakeholders. Still, intercommunal, regional and national level implementations are closely connected to local implementation of a data space, as described in chapter 2 (2.2.2., 2.2.3., 2.2.4.) and share similar actions as on local level. As such, those intending to implement a data space on a intercommunal, regional and national level should follow the instructions provided in subchapter 4.1, and adapt it to their use case, their specifications, and map its respective complexities.



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Refer to DS4SSSCC Deliverable 2.2 ‘Multi-stakeholder data governance scheme’³⁷, DS4SSSCC Deliverable 3.2 ‘Architecture’³⁸, and DS4SSSCC Deliverable 4.1 ‘Blueprint and Priority datasets’³⁹ to understand how to adjust your use case.

4.3 European Level

The concept of smart cities and communities⁴⁰ has gained immense traction due to its potential to transform urban living through technological innovation and sustainable practices. The European Commission, a key driving force behind this movement, has been actively promoting and supporting the development of smart cities and communities across the continent. By fostering collaboration, innovation, and sustainable growth, the European Commission is shaping a future where urban areas are intelligent, connected, and environmentally conscious⁴¹.

The European Commission envisions smart cities and communities as those that utilise technology to improve citizens' quality of life while minimising their environmental footprint. This includes integrating information and communication technologies (ICT) into various aspects of urban living, such as transportation, energy consumption, waste management, and citizen engagement. The primary goals are to enhance efficiency, sustainability, and the overall well-being of residents.

However, European initiatives with the aim to support the development of this vision have been established on a local level for a city, a community or a region. Limited by administrative, data-related and technological constraints, projects follow local governance structures, data-related limitations for accessibility and usage and highly individually developed technological establishments, making it difficult to establish an innovative solution due to the course of a project on a large European scale, in different cities and in different European countries.

³⁷ <https://www.ds4sscc.eu/multi-stakeholder-governance-scheme>

³⁸ <https://www.ds4sscc.eu/architecture-model>

³⁹ <https://www.ds4sscc.eu/data-space-blueprint-and-priority-data-sets>

⁴⁰ Smart Cities - European Commission:

https://commission.europa.eu/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en

⁴¹ European Digital Strategy:

https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age_en



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The here presented actions developed as part of the DS4SSCC Blueprint offer a solid base for the deployment phase as a follow up initiative by extending the action plan to its implementation: DS4SSCC Deployment aims to connect such local use cases and projects to the European data space to raise their impact by removing boundaries due to governance, data-related and technological limitations.

4.3.1 DS4SSCC Deployment

The DS4SSCC Deployment action continues the work of the DS4SSCC preparatory action by facilitating and monitoring the deployment of European data spaces for smart communities. This process will make use of the blueprint and the present action plan provided by the preparatory phase. In doing so, the consortium led by DTU (Technical University of Denmark) will select 9-12 pilot sites to deploy the data spaces. Applicants are expected to showcase their cross-domain use case, their cross-border (public-body) partner (and additional partners), their planning (including co-financing plans). The expected release date for this call is January 2024. The selected use-cases will receive 50% co-financing under the Digital Europe Programme. During the span of the project (October 2023 - October 2026), the DS4SSCC deployment action will validate and elaborate the results of the preparatory action and continue fostering the DS4SSCC Stakeholder Forum.


4.3.2 Supporting Initiatives and Key Agencies

The development of the DS4SSCC blueprint and here presented action plan, offers a common ground and stable framework for European projects, initiatives and use cases to be built on and hence, to be implemented outside their specific testbeds and cities as well, maximising their benefit and impact on future urban development. Projects and partner initiatives that benefit from DS4SSCC include the following for instance:

- **Lighthouse cities** - Lighthouse cities⁴² serve as living laboratories where innovative technological methodologies and use cases towards a social and sustainable urban development (as for instance, integrated urban planning, open data and data analytics, citizen engagement and co-creation, circular economy, smart infrastructure and connectivity, public-private partnerships and policy and regulation adaptation) are tested, refined, and scaled up. The

⁴² Lighthouse cities: <https://smart-cities-marketplace.ec.europa.eu/projects-and-sites>



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DS4SSCC action plan plays a pivotal role to bring innovations out of testbeds and into different cities as well. On the one hand, methodologies can be tested in terms of performance at different settings, on the other, cities can benefit from their outcome.

DS4SSCC formulates the base, allowing such very local initiatives to be implemented on a large scale supporting urban sustainability on European level.

- **Living-in.EU** - The Living-in.EU Movement⁴³ is jointly promoted by Eurocities⁴⁴, ERRIN⁴⁵, CEMR⁴⁶, OASC, ENoLL⁴⁷, the European Commission⁴⁸, and the European Committee of the Regions⁴⁹ to help cities and communities in their digital transformation. The movement offers specialised subgroups in the topics of finance, legal, monitoring and measuring, capacity building and technology for those communities that signed the movement's declaration⁵⁰. The movement also welcomes the industry, academia, and civil society to support communities in their development⁵¹. Given its ambition to be an enabler of digital transformation for cities and communities, the DS4SSCC is closely linked to the community of the Living-in.EU movement. As such, members of the Living-in.EU movement were invited to the DS4SSCC stakeholder forum, to ensure the representation of European cities and communities in the development of a European data space that responds to their needs. The DS4SSCC links to the movement as means to raise awareness and to raise a community of stakeholders engaged in the digital transformation of localities, cities, regions, and communities. Specifically, it adopts the European Minimal Interoperability Mechanisms (MIMs Plus) developed under the coordination of OASC together with the Living-in.EU Technical Subgroup members. The link to the technical subgroup was formed as means to support the development and deployment of interoperable data spaces across Europe. Also, the DS4SSCC was developed in parallel with

⁴³ Living in EU: <https://living-in.eu/>

⁴⁴ Eurocities: <https://living-in.eu/partners/eurocities>

⁴⁵ ERRIN: <https://living-in.eu/partners/errin>

⁴⁶ CEMR: <https://living-in.eu/partners/council-european-municipalities-and-regions-cemr>

⁴⁷ ENoLL: <https://living-in.eu/partners/european-network-living-labs>

⁴⁸ EC: <https://living-in.eu/partners/european-commission>

⁴⁹ European Committee of the Regions: <https://living-in.eu/partners/european-committee-regions>

⁵⁰ Living in EU declaration: <https://living-in.eu/declaration>

⁵¹ Living in EU supporters: <https://living-in.eu/supporters>



the LORDIMAS⁵² tool (under the coordination of the monitoring and measuring subgroup), a living tool created to help cities understand their digital maturity, compare themselves to their peers, and receive automated policy recommendations.

- **Data Space Support Centre (DSSC)** - The Data Space Support Centre⁵³ (DSSC) supports initiatives and companies that want to create sovereign data spaces by exploring their needs, defining common requirements, and establishing best practices at all levels. The DSSC contributes to the creation of common European data spaces, that were outlined in the European Data Strategy in February 2020, that collectively create a data sovereign, interoperable and trustworthy data sharing environment, to enable data reuse within and across sectors, fully respecting EU values, and supporting the European economy and society.

As part of the European common interoperable data space, DS4SSCC blueprint is deeply rooted in DSSC principles, and use cases and technical solutions built under the umbrella of DS4SSCC will ensure the involvement of a federated data spaces environment. The DS4SSCC preparatory action ensured it develops in parallel with the efforts of the DSSC by a dedicated relationship manager of the DSSC.

- **Open and Agile Smart Cities and Communities (OASC)** - OASC⁵⁴ is an international network of cities/communities that was founded to support their digital transformation by (among other activities) promoting interoperability. To do so, the Minimal Interoperability Mechanisms (MIMs) were introduced as a means to enable a minimal but sufficient interoperability across digital services and thereby avoid vendor lock-in, to reduce innovation costs and improve efficiency, thanks to open standards and APIs (application programming interfaces). A 'MIM' identifies an aspect of digital services that require interoperability and define relevant specifications.


Given DS4SSCC's ambition to create a blueprint to be adopted by communities, OASC's role was to ensure interoperability by introducing the MIMs Plus. As such, it is imperative that the development and deployment of

⁵² LORDIMAS: www.lordimas.espon.eu

⁵³ Data Spaces Support Center: <https://dssc.eu/>

⁵⁴ OASC Open & Agile Smart Cities: <https://oascities.org/>



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the data space remains in dialogue with the OASC community to ensure their interoperability also globally.

- **European Innovation Board (EDIB)** - The European Innovation Board⁵⁵ (EDIB) will facilitate the sharing of best practices among Member State authorities, relevant European agencies, and other expert bodies. It is going to focus on the realms of data intermediation, data altruism, and the prioritisation of cross-sectoral interoperability standards.

Therefore, their activities, insights, and suggestions will be valuable for activities related to data spaces for smart and sustainable cities and communities.

- **European Digital Infrastructure Consortia (EDICs)** - The European Digital Infrastructure Consortium (EDIC) is a recently introduced legal framework included in the Digital Decade Policy Programme 2030⁵⁶ to support Member States in setting up and implementing multi-country projects. EDICs require at least three member states to team up and can be used for establishing new infrastructure or operating already existing infrastructure. “EDICs will remain open to the participation of all Member States on fair and reasonable terms throughout their duration”⁵⁷.

As such, they will provide a fundamental cornerstone of European digital cooperation, offering a multi-country - and, eventually, likely EU-wide - framework for city and community data infrastructure. In particular the ‘Local Digital Twin and Citiverse EDIC’, aimed at facilitating large scale deployment of digital transformation through Local Digital Twins at city and community level, will be of high relevance for the actions and strategies outlined in this document. However, as the EDIC(s) are being set up at the publication date of this report, details on how to incorporate the EDIC into the action plan are not yet available.

⁵⁵ <https://digital-strategy.ec.europa.eu/en/policies/data-governance-act-explained>

⁵⁶ https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europe-s-digital-decade-digital-targets-2030_en

⁵⁷ <https://digital-strategy.ec.europa.eu/en/policies/edic>



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5. Capacity Building

The DS4SSCC initiative places a strong emphasis on Capacity Building activities⁵⁸ to foster mutual learning and knowledge-sharing within European data ecosystems. This report provides an overview of these activities, their scope, and structure.

Background: The European Union is transitioning towards smarter and more connected communities, making it crucial to promote mutual learning and capacity building among local data ecosystems. DS4SSCC aims to achieve this by leveraging insights from various EU initiatives like Living-in.EU, DT4REGIONS⁵⁹, LEAD⁶⁰, and DUET⁶¹ to promote AI-enabled data services and digital transformation.

Scope: DS4SSCC's Capacity Building activities revolve around creating an interactive training program tailored to data space ecosystems. It offers online short-term training opportunities for public managers and practitioners while serving as a knowledge hub for EU initiatives. The process involves three key steps:

6. **Collection of Capacity Building needs and main interests:** Collaborative assessment involving stakeholder communities and partners to understand specific needs and interests.
7. **Co-design of learning contents and materials:** Collaborative development with external initiatives and project partners to customise content for data space communities.
8. **Engagement of participants and promotion:** Organising webinars, workshops, and open debates to facilitate mutual learning and skills development, with a focus on cross-sector and cross-community data services.

Structure: DS4SSCC's Capacity Building activities consist of two main components:

- **The Training Programme⁶²:** Offers short video lessons and supporting materials accessible through the DS4SSCC Training Hub. It targets public managers, practitioners, and stakeholders, addressing the specific needs of data space communities.

⁵⁸ DS4SSCC Capacity Building deliverable: <https://www.ds4sscc.eu/capacity-building-programme>

⁵⁹ DT4REGIONS: <https://dt4regions.eu/>

⁶⁰ LEAD Project: <https://www.leadproject.eu/>

⁶¹ DUET Project: <https://www.digitalurbantwins.com/>

⁶² DS4SSCC Training Programme: <https://www.ds4sscc.eu/training-programme>



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- **Mutual Learning Initiatives:** Facilitate collaboration and knowledge exchange among stakeholders. This includes Stakeholder Forum meetings, webinars, workshops, and open debates, with all resources hosted on the DS4SSCC Training Hub. These initiatives complement the Training Programme by promoting active participation and community engagement.

Training Hub: The DS4SSCC Training Hub is an online platform centralising access to various training resources and materials. It acts as a repository for video lessons, presentations, reports, and supporting materials related to capacity building activities. The Training Hub is easily accessible through the DS4SSCC project's website, serving as a convenient resource for enhancing knowledge and skills in data spaces for smart and sustainable cities and communities.



6. Recommended Actions for Standardisation

6.1. The Importance of Standardisation

A key aspect of the Roadmap for implementing a European data space for smart and sustainable cities and communities is the need to develop an Action Plan for Standardisation.

This project has developed a set of Building Blocks, linked to the MIMs Plus, that can be implemented within a city or community to enable the development of an effective data space. These are needed to support sharing and re-use of data between many different organisations within a city, and also to enable that data to be shared and re-used in appropriate ways between cities, cities and regions, and right across the EU.

However, to enable those Building Blocks to play an effective role and to be used by the many thousands of cities and communities across Europe, it is vital that they are brought within formal standardisation processes. This will provide the Building Blocks with a more formal status as well as a long-term home to ensure ongoing maintenance and protection from being incorporated into any proprietary standard.

Having this formal status and reliable long-term future will provide city service providers and communities at every level of scale with the confidence to implement those Building Blocks. Just as importantly, it will encourage solution providers to invest in building products and services around them and thus build a scalable market.

6.2. The Type of Standards needed

Conventional standards aim to define a detailed set of requirements that will be adopted by all members of an ecosystem in their entirety and will enable as close as possible to plug-and-play interoperability.

The challenge with data spaces in general and particularly data spaces for smart and sustainable cities and communities is that the aim is to support data sharing between many different types of organisations with different requirements for the way that they handle data, different legacy approaches and who may be following different families of standards or even proprietary approaches used by an integrator with whom they may be in a long-term contract. The standards and technical solutions each of them uses may work perfectly well for their own organisational



purposes, indeed they may even be required for some aspects of what that organisation needs to deliver. It is therefore impossible to expect all of those organisations to change their approach to data sharing completely and all adopt the same detailed set of standards.

The aim of a data space is not to enable all organisations within the ecosystems to share all the data they are collecting with all the other organisations within that ecosystem, but rather to enable the discovery and appropriate sharing and reuse of those data sets that are useful to one or more other agencies. This enables a pragmatic approach, where only those data sets that need to be shared need to be transformed to allow them to be linked to, and add further insight to, data held by other agencies. The task is therefore to put in place a minimal but sufficient set of requirements that will facilitate data integration within a data space, as and when needed.

This is the role of Minimal Interoperability Mechanisms as an intermediate form of standard that is now taking its place within the formal standardisation world through the development of the Y.MIM standard being developed by ITU Study Group 20. Y.MIM describes a methodology to identify a minimal but sufficient set of requirements about different aspects of data sharing that will support as easy as possible integration between data sets that need to be shared within a data space.

6.3. Minimal Interoperability

A MIM specifies a set of requirements that will provide a minimal but sufficient set of capabilities needed to achieve a certain city or community objective. The MIM documentation describes technical solutions that address those requirements that are already commonly used in cities and communities. It also provides guidance on methods to achieve the interoperability needed between those different technical solutions and on conformance and compliance testing. It may also provide informative content as to procurement and other relevant issues.

There are a number of MIMs under development that each address different aspects of data sharing, such as data models, context information management and security. It is likely that more will be identified in the future as data spaces grow in use and maturity. The MIMs are brought together within Living-in.EU as a growing set of tools - MIMs Plus - that support the development of Interoperable Europe.



The value of a MIM is that it enables the different ways of handling data used by different organisations to be broken down into their essential components so that commonalities can be identified and integration facilitated. The different MIMs also lay down minimal requirements for the different aspects of data sharing. Ensuring that all participants in a data space implement the MIMs therefore ensures that there is a fully rounded and effective data sharing environment.

Achieving minimal interoperability between technical solutions to different aspects of data sharing is important because the achievement of complete interoperability is often complicated and difficult and may require a high level of expertise and time to implement. The development of methods to enable an intermediate level of interoperability between different technical solutions will make it easier for organisations to become part of the data sharing ecosystem.

Figure 6 illustrates the spectrum of levels of interoperability.

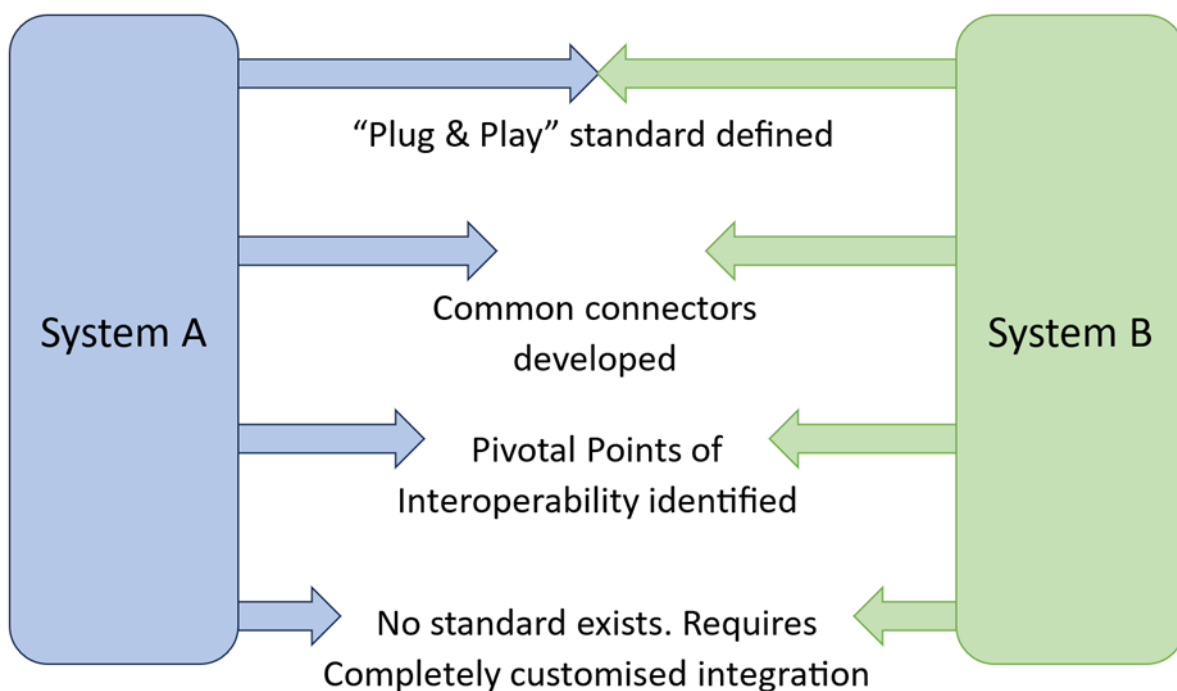


Figure 6. Levels of Interoperability

Figure 6 depicts 4 different levels of interoperability between two systems, ranging from having no standards and thus requiring completely customised integration to achieve interoperability, to "plug and play" interoperability, where integration



between those systems becomes simple and automatic. The challenge with “plug and play” standards is that developing them may take a significant amount of time and resources and may require modifications to the two different systems. MIMs focus on levels of interoperability between these two extremes and two examples are given of how minimal but useful levels of interoperability can be achieved – the identification of Pivotal Points of Interoperability (PPIs) and the development of common connectors. Both can significantly simplify the task of integration between the two systems.

6.4 Standardising the MIMs

There are ten MIMs at various stages of development, with all of them relevant to data spaces for cities and communities. During the deployment phase, many of them will be further enhanced through the experience of implementation in various local data spaces. The development phase may even result in the identification of the need for further MIMs.

The deployment phase would include ensuring that the MIMs are applicable right across all European Member States, effectively making them European Standards. The three recognised European Standards Bodies are CEN, CENELEC,⁶³ and ETSI⁶⁴ and it might be thought best for the developing MIMs to be brought into the work of one or other of these organisations.

However, it is not enough just to have European Standards. As a key part of the global economy and to enable Europe to benefit from good practice from across the world, it is vital that the standards used in Europe also reflect International Standards. It is therefore important that the MIMs are taken within International Standardisation.

The World Trade Organisation recognises three main international standards organisations; ISO, IEC, and ITU. The value of these three bodies is that they do not simply bring the best industry expertise to develop the most appropriate technical solutions, but they also have the role of ensuring that these meet the needs of society as well. This means that issues such as ethics, safety, ease of management, and the role of those standards in supporting trade are taken into account in the standardisation process.

⁶³ <https://www.cencenelec.eu/>

⁶⁴ <https://www.etsi.org/>



In identifying these three International Standards development organisations, it is also important to take into account ISO/IEC JTC1⁶⁵ - the Joint Technical Committee between ISO and IEC that deals with Information Technology related standards.

ISO, IEC, and JTC1 are all based on National Standards Development Organisations and are a way to enable these to collaborate to develop global standards that also meet the needs of the individual nations represented. ITU membership is based on national governments, along with representation from industry and research.

ITU focuses on the development of technical standards relating in some way or other to communications technologies. Specifically, Study Group 20 is active in developing standards related to IoT and smart and sustainable communities.

For standardising the MIMs that are relevant to data spaces, clearly the most relevant international organisations are JTC1 and ITU.

6.5 Developing a Standardisation Action Plan

The first step is already well underway with the work being done within ITU Study Group 20 to standardise the MIM format and methodology through Y.MIM. The next stage will be to bring each individual MIM within European and International Standardisation.

The challenge is that the main International Standards Development Organisations are all based either on national governments or on national standards bodies. This means that the European voice is fragmented. There is also a resourcing issue in that individual European member states find it difficult to resource sending experts to many individual international standards development committees and this has resulted in poor or no participation of European Experts in the development of many key international standards.

Clearly an action plan will be needed to enable each MIM to become a formal standard. This obviously needs to be taken within the developing wider standardisation strategy that is being put together by the Commission, and, in particular, for standardising tools related to Local Digital Twins and the CitiVerse.

The first question is whether to start by standardising each MIM at a European level and then taking this to the International Standardisation bodies. The value of this is that it would enable the development of a standard that is tailored to the European

⁶⁵ <https://www.iso.org/committee/45020.html>



requirements and provide a mature text to be taken to International standardisation, supported by strong consensus of European Member States.

However, there are some problems with this. First of all, it would be strange to first develop a standard on a European level if the intention from the beginning would be to make it an International one. This would result in a significantly longer process and may also make it more difficult to achieve international consensus if the text is seen as too European centred.

The other issue is that at an international level the MIMs in general would most appropriately be standardised by either JTC1 or ITU. The challenge is that while CEN and CENELEC have clear processes in place to take European Standards to ISO and IEC, there is no clear link with JTC1, even though it is a Joint Committee between ISO and IEC. One reason for this is that the European Standards Body that covers the same area as JTC1 is ETSI, and that has no formal relationship with CEN or CENELEC. ETSI also has only weak links with ITU and there is no strong history of ETSI taking its standards into ITU.

(It must be noted that it is possible that some MIMs might appropriately be standardised via ISO - specifically MIM7 on geospatial data handling, as ISO has a specialist committee - TC 211 on Geographic Information/Geomatics.)

Should the decision be made to take the MIMs straight to international standardisation, then the decision would need to be made as to whether this should be via ITU or JTC1. ITU is already standardising the Y.MIM and there is a developing link between ITU and DG CNECT. On the other hand, JTC1 has a strong record of delivering standards on some areas of Information Technology that are outside the core expertise of ITU and some of these may be relevant to some of the MIMs.

The decision will be easier in that ITU and JTC1 have a strong working relationship and have, for example, developed many joint standards. It therefore might be feasible to work with both to standardise different MIMs. Given that it is also possible that ISO might have a role, it might also be worth investigating the potential for a Joint Working Group between ITU, JTC1 and ISO to cover the standards needed for data spaces.

The recommendation is that discussions are held with DG CNECT at an early stage in the DS4SSCC deployment phase as to how best to set up a Standardisation Action plan for standards related to data spaces so that work on developing the most appropriate channels can start as soon as possible.



7 Conclusions and Next Steps

7.1 Conclusions

This deliverable presented the roadmap for implementing a European data space for smart and sustainable cities and communities, based on completed work as presented in previous deliverables for the DS4SSCC blueprint. Our presented actions, reaching over three main topics - governance, datasets and technical architecture - have been developed over the course of the project and are deeply grounded in its findings. The initiative prepared workshops with stakeholders, surveys, and expert interviews as means to collect data and validate findings. The results defined the DS4SSCC blueprint, action plan for deployment, and capacity building resources.

Defined by the DS4SSCC maturity model, stakeholders of use cases, such as cities and communities, are with this report able to (A) locate their use case within our action plan framework using a set of defined KPIs and (B) to apply a set of actions to reach higher maturity on local and European levels. Together with results of work conducted in other WPs, these results lead to the development of a solid roadmap as outlined in this deliverable, supporting stakeholders setting up a dataspace for smart and sustainable cities and communities.

7.2 Next Steps

As this action plan has been developed based on thoroughly prepared deliverables on the multistakeholder governance scheme⁶⁶, data space technological architecture⁶⁷, and priority datasets⁶⁸ it is important for its further refinement to take these actions to actual implementation. As described above, use cases, involved stakeholder landscapes, testbeds, legal frameworks and environmental conditions differ from case to case and this action plan aims to offer a solid starting point. By real world implementation, the presented action plan will now be applied to real

⁶⁶ <https://www.ds4sscc.eu/multi-stakeholder-governance-scheme>

⁶⁷ <https://www.ds4sscc.eu/architecture-model>

⁶⁸ <https://www.ds4sscc.eu/data-space-blueprint-and-priority-data-sets>



DATA SPACE FOR
SMART AND SUSTAINABLE
CITIES AND COMMUNITIES

 <p>DATA SPACE FOR SMART AND SUSTAINABLE CITIES AND COMMUNITIES</p>	<p style="text-align: right;">D4.2</p> <p>Roadmap for implementing a European data space for smart and sustainable cities and communities</p>
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world use cases due to the course of DS4SSCC Deployment open calls⁶⁹. Use cases from cities and communities will be located within the action plan to reach higher maturity levels especially, but not limited, within the next 3 years of project duration (October, 2023 - October, 2026). This will result in learnings from real-world application, which will be re-applied and fed into this action plan due to the course of the project to ensure its further refinement. Expected contributions are a) nuanced action plans/practices b) list of common bottlenecks c) risk mitigation measures.

Our consortium



⁶⁹

<https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/digital-2022-cloud-ai-03-ds-smart>



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8 Annexes

8.1 Annex 1: Action Plan Cheat Sheet

	1	→	2	→	3	→	4	→	5	→	6
	Preliminary Phase	ACTIONS	Development Phase	ACTIONS	Proving Concept	ACTIONS	Organising Playing Field	ACTIONS	Increasing Impact and Preparing Implementation	ACTIONS	Complete Implementation
Governance	Scope and purpose of data sharing defined	Completing Governance part of Data Cooperation Canvas	Minimum pilot network defined	Define simple and representative use case for MVP testing	Necessary components are working	Expansion of the team by interested parties through activating networks, PR work.	Data cooperation canvas reviews and updated	First legal and formal preparations should be initialised	Additional use cases added	Definition of formal products, pricing and fixed terms	Transition to nonprofit organisation complete
	Data sharing model defined	Analysis of current governance situation	Legal agreements arranged		Possible adjustments fully implemented	Update of governance part in Data Cooperation Canvas, specifically on standards and larger partner management.	Onboarding standards defined	networks should be activated and interested stakeholders contacted to add further use cases to the exchange in the next phase	Decision/governance mechanisms are scaled up (e.g. user representation, citizen participation)	Instalment of professional helpdesk and support	
	Preliminary business model defined including added value proposition for each partner and scaling up model					Define principles of onboarding, standards, product pricing and procedures.			Diversity of partners (across sector and multi-level)	Standard procedures for onboarding and leaving should be finalized	



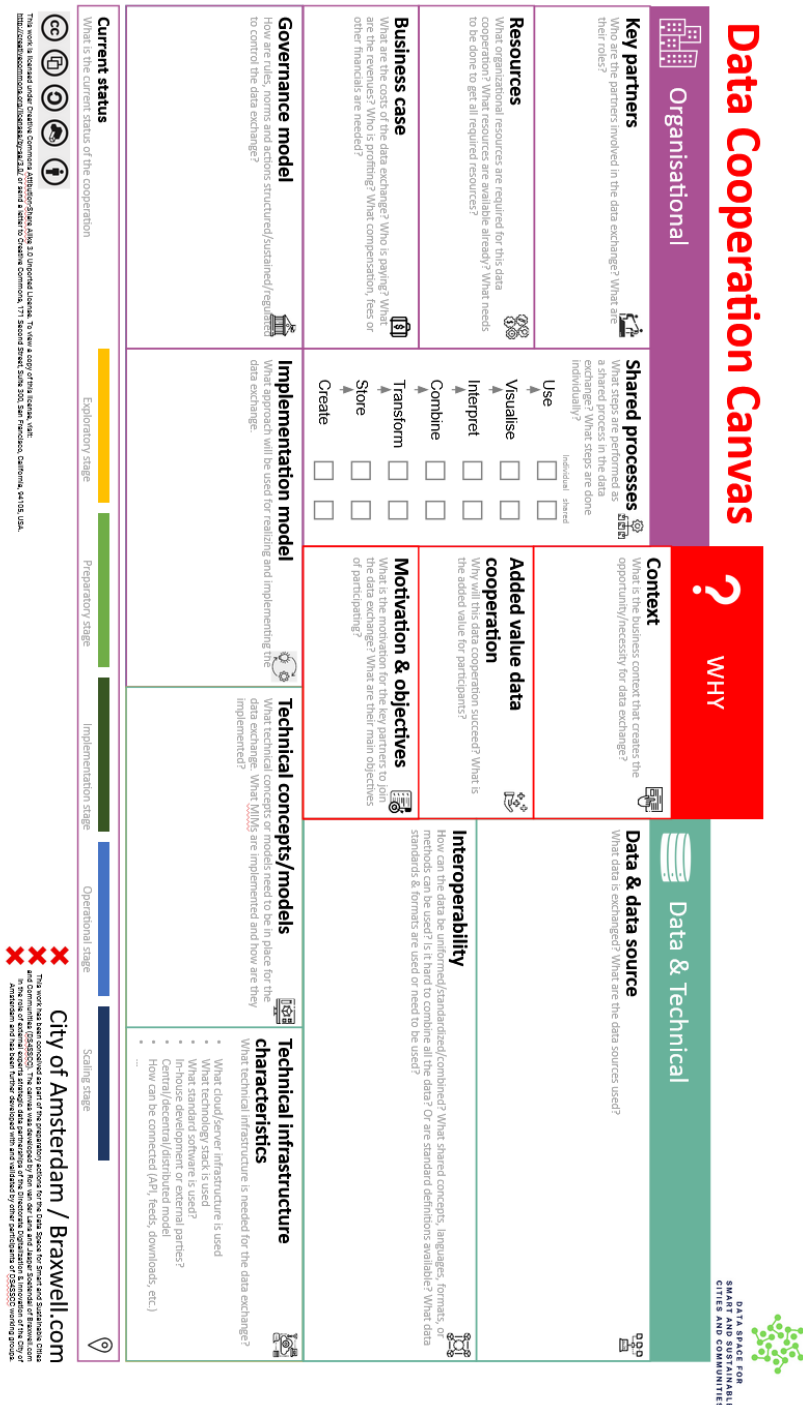
	Identification initial partners and broader stakeholders								Less data mature partners can join (e.g. smaller cities with less data capabilities)	Representation of nonprofit should be professionalised	
	Initial budget agreed								Connect with other data spaces / have other data spaces as participants		
	Initial resources required identified and allocated to partners										
Datasets	Data Plan established	Refinement of data-related parts of Data Cooperation Canvas	Number of data points exchanged as a percentage of goal	Update of data-related parts of Data Cooperation Canvas	Data exchange is up and running for defined use case	Review developed data exchange properties and its capabilities towards a fully functional data infrastructure	Number of organisations, cities and use cases running	Start to develop performance measurements (KPIs) that can be measured and evaluated	Agreement on performance measures	High-level planning towards the fully-fledged roll-out	Service-level Agreement (SLA) fully established
		Further refinement of data plan towards PoC	All (city) partners are able to access the data	Preparation of exchange between partners and cities			Have a fully functional data infrastructure that is able to onboard new unknown parties		Service-level Agreement (SLA)		
Architecture	Framework defined	Completing Technical part of Data Cooperation Canvas	MVP architecture depicted	Work on evolved architecture, following DS4SSCC guidelines	MVP validation outcome approved	Injection of relevant datasets to the MVP	MVP successfully tested for full deployment	Review of standard and technology choices for final selection, based on test results	Architecture successfully tested with more use cases	Increment adding of new use cases for data sharing and value creating in the ecosystem	Architecture fully working as operational system



Requirements defined	Analysis of current technical architecture in use		Establishment of connection between MVP and Universal Trust Data Registry and Data Space connector components		Configuration of required APIs		Continue testing, validating and extending		Testing of technical solution for each use case, if needed	
	Set up technical deployment plan		Possible upgrade of technical components		Creation of Access credentials and registration at Universal Trust Data Registry				Possible adaptation in the technical architecture, depending on use case	
			Decide on standards and technologies		In depth testing after deployment					
					Test result collection					



8.2 Annex 2: Template of Data Cooperation Canvas






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8.3 Annex 3: Glossary

Concept	Definition
Action Plan of DS4SSCC	An action plan describes a document that lists the action steps needed to achieve project goals and objectives. In particular the DS4SSCC action plan describes phases of maturity defined by KPIs and necessary actions to take to reach a next maturity phase.
Cheat Sheet of DS4SSCC	The here presented action plan cheat sheet (annex 1) offers a quick overview of presented KPIs for each phase along the DS4SSCC maturity model and suggested actions to take to reach higher maturity levels. KPIs and actions are organised by fields of development (governance, datasets, architecture)
Data Cooperation Canvas	The Data Cooperation Canvas describes a common and transversal self-assessment tool, that has been developed in the project to condense at a glance the motivation, the governance and the technical dimensions of a data space. In addition the canvas offers the opportunity to locate a use case in the DS4SSCC maturity level, hence, connecting it to the action plan.
Data minimisation	The principle of “data minimisation” means that a data controller should limit the collection of personal information to what is directly relevant and necessary to accomplish a specific purpose. They should also retain the data only for as long as is necessary to fulfil that purpose.
Data Space	<i>‘A distributed system defined by a governance framework that enables secure and trustworthy data transactions between participants while supporting trust and data</i>



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	<p><i>sovereignty. A data space is implemented by one or more infrastructures and enables one or more use cases.</i>⁷⁰</p>
<p>Data Space for Smart and Sustainable Cities and Communities (DS4SSCC) Preparatory Action</p>	<p>The preparatory action was launched to create the blueprint of a data space that caters to the needs of smart and sustainable cities and communities complimented by an action plan for deployment and capacity building resources.</p>
<p>Data Space for Smart and Sustainable Cities and Communities (DS4SSCC) Deployment Phase</p>	<p>The deployment phase builds on the results (data space blueprint, action plan, capacity building resources) of the DS4SSCC preparatory action to deploy real life data spaces across 9-12 sites of pilots.</p>
<p>DS4SSCC Catalogue of Specifications</p>	<p>The Catalogue of Specifications developed by DS4SSCC partners as one of the project deliverables aims at providing an overview of the identified building blocks (BBs) (technical and non-technical) required to set up and operate the data space for smart and sustainable cities and communities (SSCC). (see D3.1: Catalogue of Specifications)</p>
<p>DS4SSCC Governance Structure</p>	<p>The DS4SSCC Governance group (WP2) has co-develop a data space governance structure to guide the practices and interactions with various stakeholders (e.g., cities, industry, academia, civil society, etc.) in the cities & communities data space. The governance scheme has been integrated with other project deliverables to create a blueprint for a European data space for smart and sustainable cities and communities. (see D2.2: Multi-stakeholder governance scheme)</p>

⁷⁰

<https://dssc.eu/space/Glossary/176553985/DSSC+Glossary+%7C+Version+2.0+%7C+September+2023>



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<p>DS4SSCC Priority Data Sets</p>	<p>With data being a cornerstone of EU's industrial competitiveness, the EC defined a catalogue of high value datasets⁷¹ and the Inspire Geo Data Portal⁷², focusing on high value geo-data. Such specific high-value datasets are available free of charge, machine readable, provided via APIs and provided for bulk download, where relevant and become even more useful when accessible via data spaces, allowing their use for applications on a large European level. (see D4.1: Data Space Blueprint & Priority Data Sets)</p>
<p>DS4SSCC Reference Architecture</p>	<p>The DS4SSCC Reference Architecture defines a reference architecture which explains how to use those BBs in a coherent and consistent manner to develop the functionality which is expected to be provided by a data space. (see D3.2: Architecture Model)</p>
<p>DS4SSCC Stakeholder Forum</p>	<p>DS4SSCC Stakeholder Forum describes the formation of an interest group around DS4SSCC, a community that holds individuals from the quadruple helix from over 26 European Member States (as per 10/2023). Seven meetings were organised throughout the project's course to enable close collaboration with stakeholders. These occasions also served to brief stakeholders about our work-in-progress, to announce any relevant events, and to receive feedback, questions and inputs from participants. During these meetings the stakeholders were engaged in different exercises to either receive input for deliverables or to validate the results. The coordination of the Stakeholder Forum will be taken over by the DS4SSCC deployment phase.</p>

⁷¹ EC High Value Datasets: <https://digital-strategy.ec.europa.eu/en/news/commission-defines-high-value-datasets-be-made-available-re-use>

⁷² INSPIRE Geo Data Portal: <https://inspire-geoportal.ec.europa.eu/>



 <p>DATA SPACE FOR SMART AND SUSTAINABLE CITIES AND COMMUNITIES</p>	<p style="text-align: right;">D4.2</p> <p>Roadmap for implementing a European data space for smart and sustainable cities and communities</p>
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<p>DS4SSCC Training Hub</p>	<p>The DS4SSCC Training Hub is an online platform centralising access to various training resources and materials. It acts as a repository for video lessons, presentations, reports, and supporting materials related to capacity building activities. The Training Hub is easily accessible through the DS4SSCC project's website, serving as a convenient resource for enhancing knowledge and skills in data spaces for smart and sustainable cities and communities.</p>
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