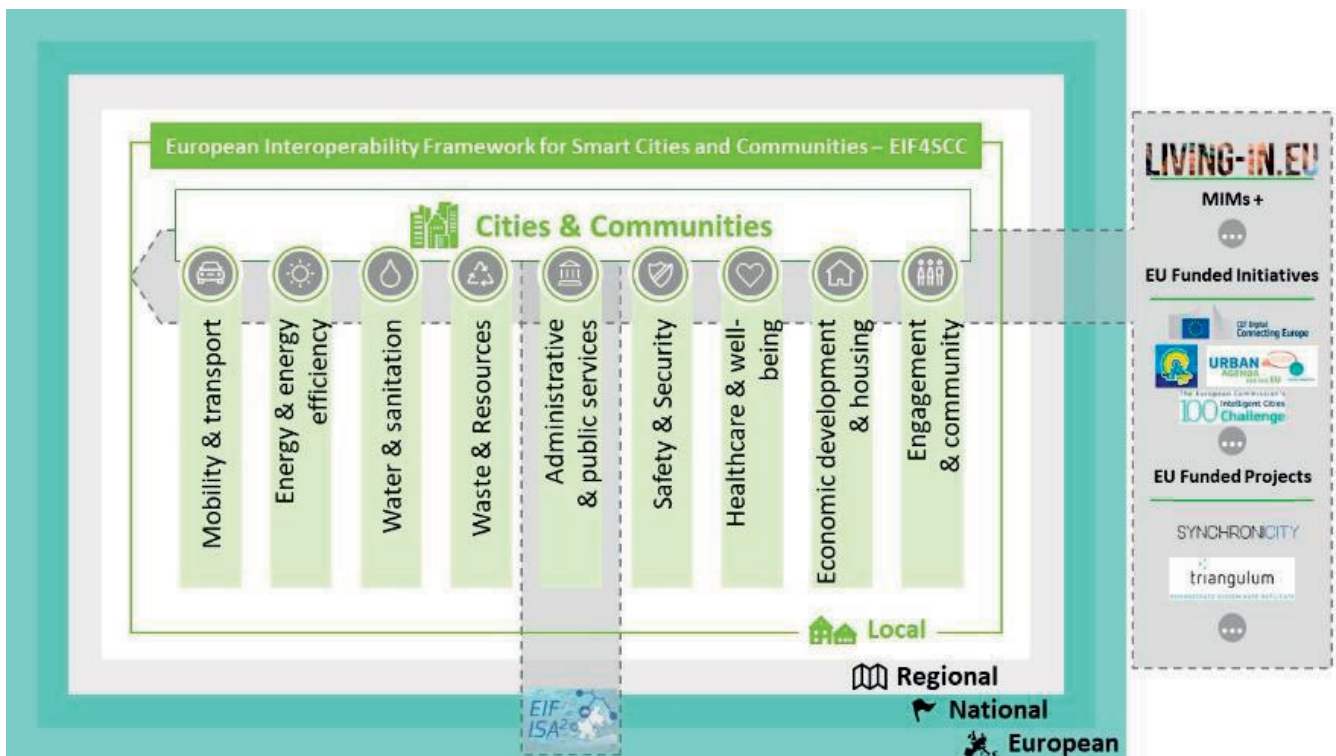




European
Commission

Proposal for a European Interoperability Framework for Smart Cities and Communities (EIF4SCC)



Disclaimer

This deliverable was prepared for the DG DIGIT - ISA² programme, and DG CNECT-C3 and Living-in.EU movement, by Deloitte under the ISA² Action 2016.33: European Interoperability Framework Implementation: EIF and Smart Cities, towards a Smart Cities and Communities Interoperability Framework.

The views expressed in this deliverable are purely those of the authors and may not, in any circumstances, be interpreted as stating an official position of the European Commission.

The European Commission does not guarantee the accuracy of the information included in this report, nor does it accept any responsibility for any use thereof.

Reference herein to any specific products, specifications, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favouring by the European Commission.

All care has been taken by the author to ensure that s/he has obtained, where necessary, permission to use any parts of manuscripts including illustrations, maps, and graphs, on which intellectual property rights already exist from the titular holder(s) of such rights or from her/his or their legal representative.

Luxembourg: Publications Office of the European Union, 2021

© European Union, 2021



The reuse policy of European Commission documents is implemented based on Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39).

Except otherwise noted, the reuse of this document is authorised under a Creative Commons Attribution 4.0 International (CC-BY 4.0) licence (<https://creativecommons.org/licenses/by/4.0/>). This means that reuse is allowed provided appropriate credit is given and any changes are indicated.

For any use or reproduction of elements that are not owned by the European Union, permission may need to be sought directly from the respective rightholders.

Print	ISBN 978-92-76-38667-4	doi:10.2799/545570	NO-08-21-160-EN-C
PDF	ISBN 978-92-76-38666-7	doi:10.2799/816559	NO-08-21-160-EN-N

**Proposal for a European Interoperability
Framework for Smart Cities and
Communities (EIF4SCC)**

European Commission

Directorate General Informatics

Directorate D – Digital Services

DIGIT D2 – Interoperability

Directorate Communication Networks, Content and Technology

Directorate C - Digital Excellence & Science Infrastructure

CNECT C3 – Technologies for Smart Communities

ISA2 Action 2016.33: European Interoperability Framework Implementation: EIF and Smart Cities, towards a Smart Cities and Communities Interoperability Framework

Date: 25th May 2021

This study was carried out for the European Commission by:

Deloitte.

KU LEUVEN

Property	
European Commission Project officers	<p>Serge NOVARETTI, DG CNECT C3 Unit</p> <p>Andrea HALMOS, DG CNECT C3 Unit</p> <p>Victoria KALOGIROU, DG DIGIT D2 Unit</p> <p>Noirin NI EARCAIN, DG CNECT C3 Unit</p> <p>Georges LOBO, DG DIGIT D2 Unit</p>
Project Team	<p>Maxim CHANTILLON, KU Leuven</p> <p>César CASIANO FLORES, KU Leuven</p> <p>Joep CROMPVOETS, KU Leuven</p> <p>Mira SALLAMO, Deloitte</p> <p>Miguel EIRAS ANTUNES, Deloitte</p> <p>Maria Garcia BARRON, Deloitte</p> <p>Jean BARROCA, Deloitte</p> <p>Pedro VICENTE, Deloitte</p> <p>Ana VAZ RAPOSO, Deloitte</p> <p>Gulam SIDIQUE, Deloitte</p>
Reviewers*	<p>Serge NOVARETTI, DG CNECT C3 Unit</p> <p>Victoria KALOGIROU, DG DIGIT D2 Unit</p> <p>Noirin NI EARCAIN, DG CNECT C3 Unit</p> <p>Andrea HALMOS, DG CNECT C3 Unit</p> <p>Georges LOBO, DG DIGIT D2 Unit</p> <p>Zsofia SZIRANYI, DG DIGIT D2 Unit</p> <p>Isa Katharina VON KALBEN, DG DIGIT D2 Unit</p> <p>Miguel ALVAREZ RODRIGUEZ, DG DIGIT D2 Unit</p> <p>Ruben NARZUL, DG DIGIT D2 Unit</p> <p>Asta GRICIENE, DG DIGIT D2 Unit</p> <p>Natalia Aristimuno PEREZ, DG DIGIT D2 Unit</p> <p>Cristina COSMA, DG DIGIT D2 Unit</p> <p>João Rodrigues FRADE, DG DIGIT D3 Unit</p> <p>Caroline CORNEAU, DG DIGIT D3 Unit</p> <p>Kelly LILJEMO, DG DIGIT D3 Unit</p> <p>Alexander KOTSEV, Joint Research Center</p> <p>Michael LUTZ, Joint Research Center</p> <p>Lorena HERNANDEZ, Joint Research Center</p> <p>Peter ULRICH, Joint Research Center</p> <p>Sven SCHADE, Joint Research Center</p>

	<p>Francesco PIGNATELLI, Joint Research Center</p> <p>Marco MINGHINI, Joint Research Center</p>
Co-creators**	<p>Barbara CABRERA, City of Madrid</p> <p>David CUNHA, City of Lisbon</p> <p>Felix MARTIN, City of Madrid</p> <p>Iliia CHRISTANTONI, City of Athens</p> <p>Kadri JUSHKIN, Ministry of Finance - Estonia</p> <p>Kaimo Käärman-Liive, Association of Estonian Cities and Municipalities' ICT Competence Centre</p> <p>Olli VOUTILAINEN, Ministry of Economic Affairs and Employment - Finland</p> <p>Roel RATERINK, City of Amsterdam</p> <p>Ramon Ferri TORMO, City of Valencia</p>
Contact	CNECT-C3@ec.europa.eu
Keywords	EIF4SCC, EIF, ISA ² Programme, Living.in-EU, Smart Cities and Communities, Interoperability

*Full acknowledgment of all contributors from stakeholder consultation in the Study on the development of a Proposal for a European Interoperability Framework for Smart Cities and Communities (EIF4SCC).

** Selected city-experts from European cities and Member States – more detail in the Study on the development of a Proposal for a European Interoperability Framework for Smart Cities and Communities (EIF4SCC).

TABLE OF CONTENTS

1. OVERVIEW	6
2. INTRODUCTION.....	7
3. DEFINITIONS OF THE EIF4SCC CONCEPTS	9
4. TAILORED PRINCIPLES FOR THE EIF4SCC	10
5. TAILORED LAYERS AND COMPONENTS FOR THE EIF4SCC.....	19
6. TAILORED CONCEPTUAL MODEL FOR THE EIF4SCC.....	30
7. CONCLUSION.....	35
LIST OF ACRONYMS.....	37

LIST OF FIGURES

Figure 1 – EIF4SCC alignment with other EU initiatives & projects	6
Figure 2 - EIF4SCC development steps.....	7
Figure 3 - EIF4SCC in a nutshell	7
Figure 4 - EIF4SCC Framework for SCC.....	9
Figure 5 - EIF4SCC Concepts.....	9
Figure 6 - EIF4SCC Principles	10
Figure 7 - EIF4SCC Elements.....	19
Figure 8 - The elements of the EIF4SCC interoperability model	19
Figure 9 - EIF4SCC Conceptual Model.....	30
Figure 10 - Conceptual model for Integrated SCC Services	30
Figure 11 - Common SCC Council.....	31
Figure 12 - Common SCC Platform.....	33
Figure 13 - EIF4SCC Conceptual Model.....	35

1. OVERVIEW

Cities and communities are confronted with complex challenges, such as climate change, housing quality, health and social issues, energy efficiency and urban mobility. More and more cities and communities are making use of the possibilities offered by digital solutions and technological advancements to tackle those growing challenges. Cities and communities are therefore transforming themselves into Smart Cities and Communities (SCC) taking full benefit of digital technologies and becoming more green, resilient and sustainable for the well-being of people.

Interoperability is crucial to overcome the above-mentioned challenges in cities and communities. Lack of interoperability leads to fragmented service delivery at local level as well as a lack of communication among different platforms, technologies and stakeholders, resulting in suboptimal services to the public.

Acknowledging the importance of interoperability for the well-being of inhabitants, businesses, visitors and city/community administrators in the European Union, Deloitte and KU Leuven were appointed by the European Commission to develop a proposal for a European Interoperability Framework for Smart Cities and Communities (EIF4SCC).

The aim of the EIF4SCC is to **provide European Union local administration leaders with definitions, principles, recommendations, practical use cases, and a common model to facilitate service delivery to the public across domains, cities, regions and borders.**

This framework has been developed by building on and finding complementarities with previous and ongoing initiatives, such as, for instance the [Living-in.EU](#) movement, the [2017 European Interoperability Framework \(EIF\)](#), the [Minimal Interoperability Mechanisms \(MIMs Plus\)](#) and the outcomes of EU funded initiatives (e.g. [Connecting Europe Facility \(CEF\) Digital Building Blocks](#), [Smart Cities Marketplace](#), [Intelligent Cities Challenge](#), [Digital Transition Partnership under the Urban Agenda](#)) and EU funded projects ([Synchronicity](#), [Triangulum](#), etc.) as illustrated in Figure 1.

Figure 1 – EIF4SCC alignment with other EU initiatives & projects

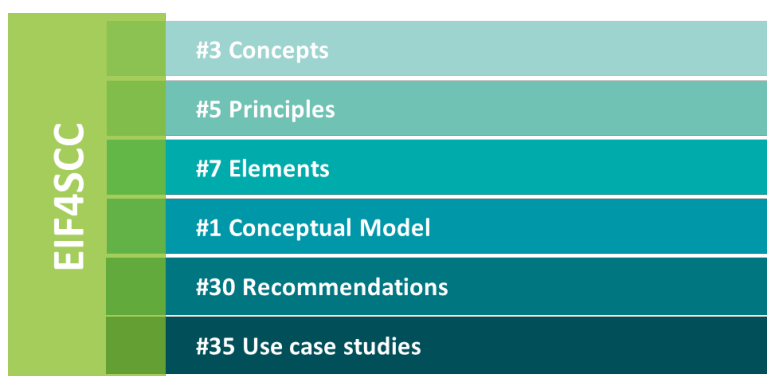


The study framework followed the steps below:

Figure 2 - EIF4SCC development steps



Figure 3 - EIF4SCC in a nutshell



2. INTRODUCTION

Cities and communities have a fundamental role in the European Union. They are the place where most European citizens live and work¹. Cities and communities include inhabitants, visitors, administrators, businesses and organisations. Furthermore, they are places where digital solutions and technology can support the creation of value that unlocks social, economic and environmental benefits for their citizens and business. Cities and communities are confronted with complex challenges, and therefore are using digital solutions and technological advancements to tackle these growing and often interlinked challenges. Co-creation with citizens is also key to turning European cities and communities into smart, resilient, sustainable and inclusive places where people enjoy living, working and visiting.

Current complex challenges and their solutions raise the need for improved interoperability. Lack of interoperability leads to a missing integration of services provided at local level and beyond or a lack of communication among different (data) platforms and/or technologies. The lack of interoperability is also a major obstacle to foster the progress of innovation in cities and communities. It can delay the contribution to meet the targets stated under the Europe’s digital future and the EU Green Deal. Progressing interoperability will help to fully address the challenges faced by cities and communities via digital solutions and technological advancements, the different actors need a common understanding of their way of working, their activities and services. This includes reflecting on the applicable legal frameworks but also on the standards that are applied in the technical development of services, just to mention an example. In addition, interoperability avoids vendor or technology lock in and helps create an open and fair market where SMEs can develop. Cities and Communities benefit from a variety of standard-based solutions that are interoperable and more affordable, reducing time to implement and to deliver services to the public.

¹ Eurostat, 2016, Urban Europe Statistics on cities, towns and suburbs.

Acknowledging the relevance and benefits of interoperability for the wellbeing of the inhabitants in cities and communities in the European Union, the European Commission aims to develop an European Interoperability Framework for Smart Cities and Communities (EIF4SCC).

The purpose of the EIF4SCC is to:

- **inspire cities and communities** across the EU in their efforts to transition to SCC, in particular in the delivery of digital services within their local context, together with the other Smart City and Community actors;
- **provide guidance to EU local administration leaders** with principles, recommendations and a common model that enables interoperability across domains, cities, regions and borders, to improve service delivery for citizens and businesses;
- **contribute to shaping Europe's digital future** by fostering cross-border and cross-sectoral interoperability, supporting as such Europe's digital transformation in the local context.

The EIF4SCC deliberately focuses on EU local administration leaders as it aims to provide a generic framework of what interoperability entails, and how it can contribute to the development of a Smart(er) City/Community. This will pave the way for services for citizens and business to be offered not only in a single SCC, but also across cities, regions and across borders.

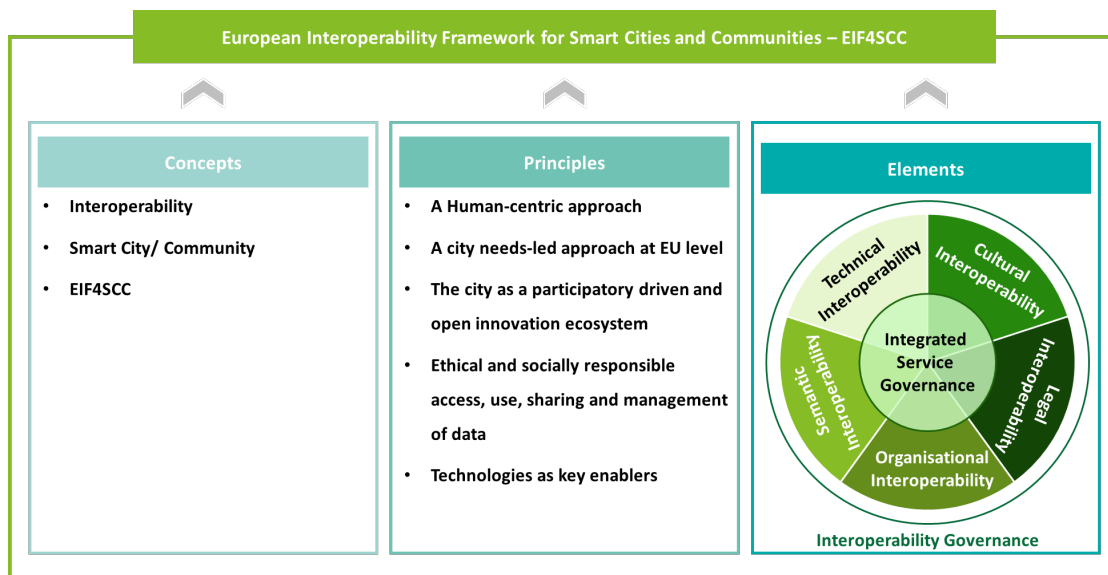
The EIF4SCC includes three interconnected definitions, five principles, and seven elements, composed by five components, one cross-cutting layer which occur against the foundational layer of the Interoperability Governance. To ensure that EU local administration leaders can easily apply the EIF4SCC to their city or community, a conceptual model for integrated service governance was developed. This conceptual model presents the governance support required for the coordination of activities. All these EIF4SCC components are explained in detail in the following sections.

Figure 4 presents the EIF4SCC and its elements. The EIF4SCC is punctuated with recommendations and use cases that can inspire EU local administration leaders in their work on interoperability.

The content and structure of the EIF4SCC is presented below:

- Chapter 3 presents the definitions of the concepts set out in the EIF4SCC;
- Chapter 4 presents a set of principles (five) intended to establish a general approach when developing SCC services based on interoperability;
- Chapter 5 presents the elements (seven) of the EIF4SCC, and in particular the five components, one cross-cutting layer which occur against the background of the Interoperability Governance;
- Chapter 6 outlines a conceptual model for Integrated SCC Services. The conceptual model is in line with the interoperability principles and proposes the idea of “interoperability by design”;
- Chapter 7 concludes the document by providing an overview and tying together the major elements of the EIF4SCC;
- A set of 30 recommendations and 35 use cases, as actionable items to be implemented in SCC, are discussed across the different chapters.

Figure 4 - EIF4SCC Framework for SCC



3. DEFINITIONS OF THE EIF4SCC CONCEPTS

This section presents how the concepts of Interoperability, Smart Cities and Communities and the EIF4SCC should be understood. A definition is provided for each concept. When referring to the EIF4SCC, these three definitions always need to be presented together, as they relate to and reinforce each other. One cannot understand the EIF4SCC, when the concepts of Interoperability and SCC are not understood.

Figure 5 - EIF4SCC Concepts



Interoperability in the context of a SCC, and as such in and between the different domains of a SCC, is:

The ability of organisations and individuals to interact towards the delivery of services in cities and communities, through the exchange of data, information and knowledge, enabled by aligned processes and digital technologies, taking into account security and privacy issues.

Smart City/Community² is:

A sustainable and inclusive city/community aiming at the well-being of their inhabitants, businesses, visitors, organisations and city/community administrators by offering digitally-enabled services.

² This framework refers consequently to Cities and Communities, as the document targets local administration leaders from EU capital cities up to the local villages and urban areas around the EU. Cities and communities mean geographically defined communities of people, having legal status, legal representative and self-governance, legally recognised by its Member State.

EIF4SCC is:

An approach to support the development of interoperable services in a smart city/community across domains and across cities and borders. It defines basic interoperability guidelines in the form of common principles, elements, models and recommendations with use cases.

4. TAILORED PRINCIPLES FOR THE EIF4SCC

Besides the three definitions set out above, the EIF4SCC is also underpinned by five principles. They are as such the main building blocks defining the direction of the interoperability framework.

These five principles are presented in the next section and are the fundamental behavioural aspects defining the direction of the interoperability in SCC. They are the result of tailoring the Living-in.eu and the 2017 European Interoperability Framework principles to the context of SCC.

Figure 6 - EIF4SCC Principles

#5 Principles	A human-centric approach #3 recommendations #3 use case
	A city needs-led approach at EU level #1 recommendation #2 use case
	The city as a participatory-driven and open innovation ecosystem #2 recommendations #2 use case
	Ethical and socially responsible access, use, sharing and management of data and technology #3 recommendations #3 use case
	Technologies as key enablers, not as the objective #3 recommendations #4 use case

- **A human-centric approach**, whereby well-being, inclusivity, accessibility and multiculturalism/multilingualism play a key role. From the service delivery perspective, this approach should also include administrative simplification for the benefit of individuals and organisations. Therefore, this embraces the once only principle³, aiming to reuse data and documents that people have already provided, in a transparent and secure way.

³ The once only principle means that individual users/businesses should not be required to supply the same information more than once. For instance, if information has already been submitted to one public administration, individual users/businesses should not be required to submit that information again to another public administration.

EU eGovernment Action Plan 2016-2020, COM(2016) 179

<https://digital-strategy.ec.europa.eu/en/policies/egovernment-action-plan#:~:text=The%20eGovernment%20Action%20Plan%20enables,to%20operate%20efficiently%20across%20borders>

Berlin Declaration on Digital Society and Value-Based Digital Government, 2020

https://ec.europa.eu/isa2/sites/default/files/cdr_20201207_eu2020_berlin_declaration_on_digital_society_and_value-based_digital_government.pdf

Recommendation #1

Ensure that inhabitants and visitors play an active role by connecting, engaging and enabling them in policy-making, co-creation and testing of solutions for SCC.

Use case

Nantes, France

The city of Nantes, winner of the European Capital of Innovation Award 2019, has been actively providing its inhabitants with the tools to be more involved in decision-making. Nantes believes in the intelligence and strength of collective action, and their objective is to improve public policies and urban processes through citizen-driven innovation. Nantes' participative culture seeks to create a tailored and innovative city built by and for its inhabitants and citizens, considering their needs, uses and solutions.

One initiative in this field is the involvement of citizens in major urban renewal projects – the “Ile de Nantes” and “Loire au Coeur” – where 25 citizens, randomly selected, formed an independent panel connected to the tender process. The teams responding to the tender were able to develop solutions that included the citizens' sensitive, pragmatic and non-expert viewpoints, supplying officials with additional reasoned and unbiased perspectives.

More information: [European Commission Website](#)

Recommendation #2

As far as possible under the legislation in force, ask cities/communities service users once-only and relevant-only information, ensuring a fully transparent process on how data is used.

Use case

Madrid, Spain

Spain is a highly decentralized country, so there are multiple interoperability mechanisms between administrations. All public administrations in Spain are connected to a central data exchange node ([PID - Platform for data intermediation](#)), which, inter alia, reduces the administrative burden of data-sharing.

Madrid is an active contributor to this platform. Moreover, with the user's permission, every time that they access a municipal procedure, their information is accessed through the city's registry avoiding the need for the user to authenticate themselves every single time.

In addition, the City Council makes available information related to Madrid's own records to other organisations that want to consult it.

Madrid is the leader in the number of types of data that can be consulted and offered to the rest of the administrations on this platform, with more than 300.000 consultations and more than 40 different types of sources consulted from other administrations.

Moreover, this platform has been awarded a UN prize and a special mention by the ISA² programme.

More information: [PID - Platform for data intermediation](#)

Recommendation #3

Ensure that accessibility (including for people with disabilities, the elderly and other disadvantaged groups) is taken into consideration during the procurement, design, development, implementation and monitoring phase of service provision, including by following e-accessibility specifications at regional, national, European or international level.

Use case

Warsaw, Poland

Warsaw was the winner of the 2020 Access City Award, an EU initiative that recognises efforts cities are making to become more accessible. By involving people with disabilities in its endeavour to make the city more accessible, Warsaw was able to make a substantial improvement to the city's ease of access in a short space of time.

To be equal for all its citizens and inhabitants, the City of Warsaw has improved its website and has made it accessibility-friendly, with more than 300 employees trained on web accessibility. The city also has an ongoing application, geared at making the city more accessible with investments continuing to improve their digital communication in the future – supporting those with learning difficulties and hearing impairments.

More information: [European Commission Website](#)

- **A city needs-led approach at EU level**, sharing experiences relating to interoperability is a key strategy to overcome interoperability challenges and to inspire individuals or organisations within and across cities/communities. Therefore, identifying commonalities across different city/community contexts can help provide efficient and tailored support.

Recommendation #4

Endorse and join existing forums, networks and working groups, at local, regional, national and European level⁴ to boost cooperation, collaboration, join forces, discuss and share experiences and best practices and build upon the knowledge and experience already available.

Use case

Across cities and communities, Living-in.EU movement

Several public administrations at local, regional, national or European level are members of the Living-in. EU movement - a collaborative platform for cities and communities to accelerate their digital transformation the 'European way' (citizen-centric approach, ethically and socially responsible data usage, co-creation with and engagement of citizens, open and interoperable standards).

The aim of Living-in.EU is to work in a collaborative way among its members to scale up the use of data technology to tackle a range of interconnected challenges, including urban

Living-in.EU

⁴ Examples of existing forums, networks and working groups include: Living-in.EU, Intelligent Cities Challenge, Open and Agile Smart Cities, EUROCITIES, The European Network of Living Labs (ENoLL), Smart Cities Marketplace, European Regions Research and Innovation Network (ERRIN), Local Governments for Sustainability (ICLEI), etc.

mobility, energy efficiency, and digital public services, while ensuring environmental sustainability in line with the European Green Deal. Cities/communities, regions and Member States leaders are invited to join the community by signing the 'Join, Boost, Sustain' declaration, which non-governmental organisations, businesses and non-EU cities can also subscribe to as supporters.

Iconic Projects: The Living-in.EU movement is working on a number of 'iconic projects', areas of focus for collaboration and knowledge-sharing by Declaration signatories, for example Local Data Platforms, Local Digital Twins, Citizen Card and Digital Neighbourhood Instrument.

More information: [Living-in.EU website](#)

Le Havre, France

Le Havre is part of the Intelligent Cities Challenge (ICC), a European Commission initiative that supports 136 cities in using cutting-edge technologies to lead the intelligent, green and socially responsible recovery. Le Havre's main goal in participating in the ICC was to develop a roadmap for the digital transformation of the city, based on the needs and wishes of its citizens. It aims to raise awareness of the city's inhabitants on how advanced technology can be used to improve their daily lives. For Le Havre, the ICC is a forum and facilitator to rally the city's digital local ecosystem around a common cause.

Le Havre wishes to develop a community of champions of digital transformation and to shape a strong vision for the future in the next 10-15 years. The city expects the ICC to be a catalyst of this process, bringing unique skills and expertise while fostering the city's connections across Europe. Ultimately, the city hopes that the ICC will be an inspiration to bring digital solutions closer to the people.

More information: [ICC Website](#)

- **The city as a participatory-driven and open innovation ecosystem** should promote an open and collaborative approach that takes into consideration the opinion of individuals and organisations, and thereby builds on participatory approaches, such as co-creation and co-production.

Recommendation #5

Ensure collaboration and communication between inhabitants, business, visitors, organisations and city/community administrators, in your city/community, so that different needs (e.g. assisted living, social care, health, education, culture and environment), challenges and requirements are addressed in a collaborative way by involving stakeholders with all the necessary competencies and/or skills in the co-creation and co-production of services.

Use case

Porto, Portugal

Santa Casa da Misericórdia do Porto (SCMP) is a charity and social assistance institution. The SCMP supports the most vulnerable, being one of the main players in the region in the

areas of Health, Social Services, Education, Culture and Environment and is continually looking for new answers to the problems that society is facing.

The organisation, in collaboration with businesses, is developing innovative, efficient and tailor-made solutions that meet the needs of the elderly. These needs are identified based on the experience of SCMP with the elderly people.

For example, during the Covid-19 pandemic, the institution launched the “Remote Visiting” initiative that allows the elderly to communicate with their family/ friends, returning this way to the routine of visits, which is essential for the well-being of old people.

More information: [Santa Casa da Misericórdia do Porto Website](#)

Recommendation #6

Foster an open innovation ecosystem (such as local living labs, digital innovation hubs) to ensure that the local community is actively involved in creating new and scaling up solutions.

Use case

Graz, Austria

The city of Graz has a long-term “Smart City Strategy” that includes mobility measures prioritising public transport, e-mobility investments and city logistics.

The city conducted a living lab experiment that engaged local stakeholders to ‘smartly’ redesign Griesplatz, a square in the centre of Graz. Griesplatz is an important hub for both mobility and services : private vehicles, public transport, pedestrian and cyclist zones, local goods supply, housing and services and institutions of all sorts..

This experiment consisted of five phases: 1) identifying key stakeholders; 2) gathering inputs from stakeholders; 3) organising a design competition; 4) Incorporating the results of the competition in the final architectural (re)design of Griesplatz and; 5) evaluation of the impact of the living lab.

It is expected that the living Lab experiment will increase the chances of a successful smart renovation of the square, reduce the risk of a socio-technical ‘misfit’ (i.e.: technical solutions that do not respond to the demands and concerns of stakeholders), as well as the risk of excluding certain social groups (especially non-smart groups, by approaching them ‘on street’ and inviting them in the participative activities), while at the same time increasing the legitimacy of the final design.

More information: [University of Graz Website](#)

- **Ethical and socially responsible access, use, sharing and management of data and technology**, that considers transparency, security and privacy. The protection of the individuals’ privacy, the preservation of their information and its security must be guaranteed as well as the right of the individual to be forgotten.

Recommendation #7

Make sources of information (base registries, open data portals, etc.) available to inhabitants, business, visitors, organisations and city/community administrators ensuring security, trust and privacy in accordance with the relevant legislation and contribute to the EU data space for climate neutral and smart communities.

Use case

Prague, Czech Republic

Golemio Prague Capital City's data platform to promote the re-usability of data to find more smart solutions. The platform serves as a single information point where data about the city can be found and analysed. The website allows people to find datasets that they can analyse and process to gain additional insights.

Golemio provides data on different aspects of Prague, such as the pollution levels, modes of transportation, street lights, Wi-Fi locations and USB charging points.

Open data is collected from the municipality of the Capital City of Prague and is used to provide information and map visualisations about different aspects of the city.

Experts are encouraged to re-use data on the platform to create websites, applications or prediction models for the city.

More information: [Official Portal for European Data](#)

Recommendation #8

Ensure that digital rights are respected during the design, development, implementation and monitoring phase of the services provision (including GDPR issues).

Use case

Bordeaux, France

The city of Bordeaux signed the Declaration of the Cities Coalition for Digital Rights aiming to protect and uphold human rights on the internet at the local and global level, showing its willingness to take play a greater part in digital policy.

With the signature of this declaration, Bordeaux aims to implement several actions, such as: i) Pursuing a public data policy involving citizens and the business ecosystem; ii) Ensuring transparency in the use of collected data; iii) Including support and information provision for citizens with the launch of each new digital service.

More information: [Cities for Digital Rights Website](#)

Recommendation #9

Ensure transparency on data sharing collaborations between and within government, citizens, businesses and organisations.

Use case

Across cities, Nordic Smart Governance (NSG)

The NSG aims to simplify the life of small and medium-sized businesses (SMEs) in the Nordic region. For that it is adapting its use of business data and making this available for public and private stakeholders in real-time.

This aims to increase innovation and growth in the region and the boost SMEs productivity by reducing their administrative burden.

This collaboration uses real-time access to business transactions from businesses' enterprise resource planning (ERP) system, establishing machine-readable interfaces to real-time data from businesses' supporting systems and assessing how data can be gathered from the source.

The programme will create value for businesses, public authorities and society by sharing data across the region in an automatic, intelligent and secure manner.

More information: [Nordic Smart Governance Website](#)

- Technologies as key enablers, not as the objective.** Technology should only be considered as an enabler when appropriate. Technological neutrality and data portability should be taken into account when developing services. Open standards and open technical specifications should be employed in the development of interoperable digital platforms. This will require an appropriate assessment of technologies effectiveness and efficiency. Hence, the use of technologies must consider the development of digital skills and capacities of the service providers and the users.

Open standards and open technical specifications avoid vendor or technology lock in and enable interoperability while fostering the smart city ecosystem and the related digital solutions market. The level of openness of a specification/standard is decisive for the reuse of software components implementing that specification. This also applies when such components are used to introduce new services. If the openness principle is applied in full:

 - all stakeholders have the opportunity to contribute to the development of the specification and a public review is part of the decision-making process;
 - the specification is available for everyone;
 - intellectual property rights to the specification are licensed on Fair, Reasonable and Non-Discriminatory (FRAND) terms, in a way that allows implementation in both proprietary and open source software, and preferably on a royalty-free basis.

Recommendation #10

Use open standards and open technical specifications when developing local data platform and services, include multiple access and assistance channels to ensure that users can choose the option that best addresses their needs and/or preferences.

Use case

Cascais, Portugal

The City of Cascais implemented a large portfolio of technology-based services ranging from energy-efficient buildings to remote parking payments. The city's ecosystem of players

continues to evolve and new initiatives are implemented continuously. However, a lack of a unified vision across domains was an obstacle to real progress on the ground.

The plan entailed redefining the city's operational model by integrating data and processes from each vertical domain, ensuring improved quality of citizen services as well as delivering savings based on greater effectiveness and efficiency.

In order to do this, the city deployed the city's operating system - to: i) Centralize different technical verticals in a multidisciplinary room; ii) Ensure coordination with internal/external entities; iii) Enable predictive management through event correlation and data analytics; iv) Facilitate decision-making and urban planning.

The solution picks the right combination of frameworks, widely known standards and specifications, languages and software products, allowing multiple access points (Emails, App, Web, Integrated with IVR, APIs, etc.).

More information: [Municipality of Cascais Website](#)

Recommendation #11

Implement seamless solutions at the service of inhabitants, businesses, visitors, organisations and city/community administrators, leveraging advanced technologies (such as IoT, blockchain, AI, etc.).

Use case

Milan, Italy

The city of Milan ranks third amongst large European cities in its atmospheric concentrations of particulate matter. Milan has also one of the highest European rates of car ownership – one that is also among the highest in the world. It is relevant for Milan to reduce traffic congestion and CO2 emissions by improving control and visualisation of transportation grid status across multiple transport systems, increasing the efficiency and safety of the transport system.

To do this, the Municipality of Milan is leveraging IoT solutions to tackle air pollution and associated health risks due to mobility:

- 43 electronic gates equipped with Automatic Number Plate Recognition technology are already in use to support the congestion charging scheme (Area C) to prevent polluting vehicles from entering the city centre.
- A Low Emission Zone (LEZ), that discourages heavily polluting vehicles from entering the whole city (not only in the centre) has been gradually introduced. Currently, systems are set to control and manage the heaviest vehicles and those used for the transport of dangerous goods.

The effects of these measures are monitored with the help of IoT sensors such as air pollution sensors, weather sensors and traffic loops.

More information: [Synchornicity Website](#)

Athens, Greece

DAEM SA, an IT Company based in the City of Athens, has developed for the Municipality an eServices platform targeting the online citizens' requests process. The platform is a user-friendly innovative solution in Greece, currently adopted and implemented in other Greek cities, under the supervision, consultation and maintenance of the City of Athens.

The eServices access complies with the national requirements on interoperability and access control covering a wide range of municipal requests and documents certification, issued by many administrative procedures. In parallel, eServices consists of a usable tool for public service employees to get real-time notification on citizen's requests, by reducing the processing time and avoid on-site appointments. Finally, the overall administrative dashboard includes features to be used by statistical analysis and reports that support decision making processes.

The Athens eServices is also connected with other agencies, city-systems and with more than 90 features such the GIS applications of the city and the central city registry, including open-source tools ensuring the scalability and interoperability of the platform.

More information: [Digital Services of the Municipality of Athens Website](#)

Recommendation #12

Set-up or consolidate interoperable local data platform(s) that integrate and reuse data in cities and communities by stakeholders, and promotes open standards and open technical specifications, APIs⁵ and data models to provide a holistic view of the information. This aims to support in decision-making process and to foster innovation and citizen engagement.

Use case

Amsterdam, Netherlands

The Amsterdam Data Exchange (AMdEX) is an innovation fieldlab in which several stakeholders collaborate to develop and test trusted, fair and scalable solutions to support the need of datamarkets in which its users can decide with whom to interact and under which conditions.

AmdEX aims to provide broad access to data from/for researchers, companies and private individuals. Inspired by the Open Science Cloud of the European Commission, the project is intended to connect with similar projects across Europe.

In the AmdEX fieldlab the following use cases will be tested:

- Aircraft maintenance data market
- Smart mobility data market
- Materials data market
- Research data market

More information: [AmdEX Website](#)

⁵ Directive 91/250 (or 2009/24/EC)

5. TAILORED LAYERS AND COMPONENTS FOR THE EIF4SCC

Figure 7 - EIF4SCC Elements

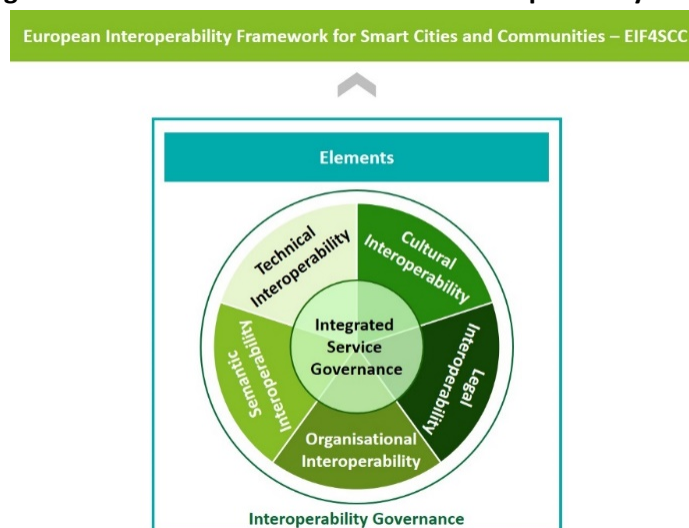
#7 Elements	Interoperability Governance #1 recommendations #1 use case
	Integrated Service Governance #4 recommendations #4 use case
	Cultural interoperability #2 recommendations #2 use case
	Legal interoperability #2 recommendations #2 use case
	Organisational interoperability #1 recommendation #1 use case
	Semantic interoperability #1 recommendation #2 use case
	Technical interoperability #6 recommendations # 8 use case

The desk research, workshops with city experts and interviews with Interoperability and SCC experts demonstrated that while the interoperability layers in the 2017 European Interoperability Framework are highly relevant for the EIF4SCC, it was considered necessary to tailor the approach to take into account the context at local level and the wider thematic scope and broader range of actors, both public and private, engaged in the smart city and community ecosystem. Among the most important differences in the EIF4SCC is the replacement of the layers in the EIF to elements of a collaborative model. According to the experts interviewed, it is important to have an approach that is less hierarchical and more collaborative than the 'layers' contained in the 2017 EIF. Figure 8 presents the elements of the EIF4SCC interoperability model. It is built on five components, one cross-cutting layer, all built on the foundation of Interoperability Governance. The following interoperability components have been identified:

- 1) Cultural interoperability,
- 2) Legal interoperability,
- 3) Organisational interoperability,
- 4) Semantic interoperability and,
- 5) Technical interoperability.

The cross-cutting layer refers to Integrated Service Governance. These five components and cross-cutting layer occur against the background of the Interoperability Governance.

Figure 8 - The elements of the EIF4SCC interoperability model



This EIF4SCC interoperability model retains some characteristics of the 2017 European Interoperability Framework. This ensures a common European approach to interoperability. In addition to the revised layered design, the main changes in the EIF4SCC are the addition of Cultural Interoperability and the modification of Integrated Public Service Governance, which is re-labelled as Integrated Service Governance.

Background:

- **Interoperability governance** is key to a **holistic approach** to interoperability, referring to decisions on interoperability frameworks, institutional arrangements, organisational structures, roles and responsibilities, policies, agreements and other aspects of ensuring and monitoring interoperability at local, national and EU levels.

Recommendation #13

Define and implement a holistic governance of interoperability services across domains and stakeholders at the local level, complying with national and European interoperability requirements to ensure interoperability across cities/communities, regions and borders.

Use case

Slovenia

The Slovenian National Interoperability Framework (NIO) represents the central metadata framework for the coordinated development of public sector eServices. The Slovenian NIO portal repositories can be used as catalogues, containing information on collections and structures of data, their use, administrators, or persons, responsible for data, etc.

Moreover, the Slovenian NIO represents the national concept of public administration functioning, directed towards sustainable development and management of electronic business.

More information: [Slovenian NIO Website](#) | [EC Joinup Page](#)

Cross-cutting layer:

- **Integrated service governance.** The 2017 EIF refers to the public nature of services and states that European public service provision often requires different public administrations to work together to meet end-users' needs and provide **public services in an integrated way**. In the EIF4SCC the concept *public* is removed. The cross-cutting layer becomes broader, acknowledging the role of non-public administration actors in the service provision in the context of SCC. As a substantial amount of data and information in a SCC context is out of the hands of public administrations, the Integrated service governance has to take a broader view and not look beyond the public administration itself. Therefore, Integrated service governance refers to the governance context and encompasses all components: cultural, legal, organisational, semantic and technical interoperability. Ensuring interoperability when agreeing the cultural context, preparing legal instruments, organising collaboration processes, data and information exchange, services and components that support SCC services is a continuous task, as interoperability is regularly disrupted by changes to the environment. Integrated service governance results in an integrated service pathway and shared workflows.

Recommendation #14

Reuse and share solutions, data, tools and services by cooperating with different stakeholders in the design, development, implementation and monitoring phase of service provision at local, regional, national and European levels.

Use case

Helsinki, Turku and Tampere, Finland

The cities of Helsinki, Turku and Tampere are working together to implement the 6Aika Carbon Neutral Tourism project. This project aims to implement a new operating model using data and digital tools to promote carbon neutrality and improved energy efficiency within the tourism industry in cooperation with the cities of Helsinki, Turku and Tampere and various tourism operators.

The project is defining applicable indicators and develop and correlate relevant data sources such as air traffic data, road traffic data, hotel booking nights and business data. These data are being combined into a shared database and transformed into usable and readily available information supported by smart solutions to reduce emissions generated by the tourism industry.

The data can then be used to determine for example the correct level of hotel investments, identify sustainable destination markets, guide tourist flows sustainably and efficiently, discover hidden seasons, and balance year-round tourism. Businesses can also make concrete changes to their services, at the local level.

By consolidating all the data in one place and leveraging Artificial Intelligence or machine learning, the entire industry can make more sustainable choices based on accurate information. Energy efficiency can also be improved by providing businesses with specific evidence-based development targets to reduce consumption.

The smart solutions, together with the industry tourism operators and public stakeholders, will build the digital tools required and develop and pilot a CO2-TIS (Carbon Neutral Tourism Intelligence System) operating model.

More information: [6Aika Website](#)

Recommendation #15

Establish and maintain an integrated governance structure with relevant stakeholders to ensure interoperability in the delivery of the integrated services, in coordination with the holistic interoperability governance guidance.

Use case

Madrid, Spain

Madrid has launched a digital transformation office, which inter alia, aims to promote and coordinate interoperability with other administrations and with other actors working with the national government, city departments and other city stakeholders.

As part of this office, Madrid City Council has ensured internal coordination in the national action for the use of common interoperability solutions (European Interoperability Framework via ENI - Esquema nacional de interoperabilidad), data exchange (PID y SIR) as

well as citizen identification mechanisms (Cl@ve, aligned with the European eIDAS framework).

More information: [Madrid City Council Government Agreement 2019-2023](#)

Recommendation #16

Establish, publish and maintain API design framework(s) to facilitate the automation of data sharing and data access for cities and communities to enable the development of (new) services and solutions.

Use case

Region of Lombardy, Milan

The Region of Lombardy has been publishing open data and open geoservices for more than 10 years. One of its strategic goals is to use an API-driven approach to open the overall Regional Information System and spread “public value” to inhabitants, businesses, visitors, organisations and city/ community administrators, and encourage public-private partnerships to share APIs and co-design and implement new digital public services.

The Region of Lombardy and ARIA s.p.a, the regional in-house organisation responsible for digital innovation and public procurement, are collaborating with the European Commission's Joint Research Centre (JRC) in a pilot project to validate the JRC API framework proposal “Government API Best Practices and Guidelines: Proposals for an Evidence-Based, EU-wide API framework” and has been using the “Government API Framework Maturity Instruments” proposed by the JRC to assess their API Programme and gain a better understanding of where and what they need to improve.

More information: [Region of Lombardy Website](#)

Recommendation #17

Support and/or promote best practices among stakeholders, at an early stage of any (new) service design, development and implementation phase.

Use case

Hungary

Based on the experiences of previous low-impact local government digitalisation projects, isolated back-office solutions and a lack of interoperability at local public administrative level, the Hungarian Government has decided that local government IT developments must be continued in a more centralised way. To promote unified technical quality standards and ensuring optimal use of investment and operational resources, a centralised application service providing (ASP) model has been chosen to promote local government digitalisation in Hungary. The application service provider (ASP) model is largely used worldwide in many business sectors and public administrations as a cost-effective solution and allows the software to be accessed remotely via a simple web browser.

More information: [European Commission Website](#)

ISA²

Components:

- **Cultural interoperability** refers to the approach taken by individuals and organisations to take into consideration their social and cultural differences and, if applicable, organisational cultural differences. Interoperability can be impacted by cultural differences, as individuals and organisations can respond differently to the same interoperability challenge. These cultural differences can, for example, be reflected in political challenges and leadership styles. Different actors within a smart city can have varying views on how leadership, in the context of interoperability, is exercised. This requires a debate among the actors involved about how to exercise leadership in their interoperability context.

Recommendation #18

Ensure that diverse stakeholders (inhabitants, businesses, visitors, organisations and cities/communities administrators) are involved in a multidisciplinary process of definition and/or design of interoperable services so that societal and cultural differences (organisational, economic, ethnic, religious beliefs, gender, language) are accounted for.

Use case

Leuven, Belgium

The Leuven 2030 roadmap was developed in a co-creation and co-design process between research institutes, companies, local government and citizens. People from different nationalities, religions, political views, gender and socio-economic background were included when defining all these actions to achieve carbon neutrality in the city of Leuven.

Leuven 2030 represents all actors in the society. The close cooperation between knowledge institutions, companies, local government, and citizens is known as the quadruple helix, a unique model. As a result of the success and effectiveness of this concept, Leuven was awarded the Green Leaf Award 2018 and the European Capital of Innovation Award 2020.

More information: [Leuven 2030 Website](#)

Recommendation #19

Monitor and audit software codes and ensure transparent and accountable use of AI algorithms, to avoid biases (economic, ethnic, religious beliefs, gender, etc.) that can discriminate people.

Use case

Helsinki, Finland

The city of Helsinki uses the AI Register as a foundation to tackle the problem of harmful effects of algorithms, incomplete datasets and biased developers and as a window into the artificial intelligence systems to make fairer decisions with a positive impact on its stakeholders.

Through the AI register, inhabitants, business, visitors, organisations and city/community administrators can access a quick overview of the city's artificial intelligence systems and examine the information in greater depth based on their own interests.

The city uses AI as part of their city services and these include: housing and environment, social services and health care, and culture and leisure.

More information: [City of Helsinki Website](#)

- **Legal interoperability** is about ensuring that individuals and organisations, be they public or non-public organisations, operating under different legal and regulatory frameworks, procurement rules, policies and strategies, can work together. Policies, regulations and legislation should enable the establishment of services within a SCC and between different SCCs, rather than being an obstacle. There is a need for clear agreements about how to deal with differences in policies, regulations and legislation across SCCs, including the option of putting in place new policies, regulations and legislation. The sharing of data is for example strongly influenced by legal interoperability, as this requires the development and use of data licences.

Recommendation #20

Put in place a solid and trusted legal framework to enable and facilitate data sharing across stakeholders and across domains at local, regional, national and European level.

Use case

Netherlands

The Privacy by Design Foundation creates and maintains free and open-source software in which the privacy of the user is paramount. The most important application of the foundation is the identity platform IRMA, an acronym of I Reveal my Attributes.

IRMA is a unique privacy-friendly identity platform for both authentication and signing, empowering the citizens to disclose some of their attributes online (“over 18”) while at the same time hides other (like their name, or phone number), and being able to authenticate themselves to, for example, login on a website, protecting this way their privacy.

More information: [IRMA Website](#)

Recommendation #21

Communicate the right to access and reuse of solutions, data, tools and services. The legal permission for facilitating access and reuse, such as Creative Commons Licenses, should be standardised as much as possible.

Use case

Lisbon, Portugal:

“Lisboa Aberta” is a free data sharing portal produced by the Lisbon City Council and the partner entities of the Lisboa Aberta program, with the aim of enhancing citizen participation, encouraging the reuse and sharing of data, stimulating entrepreneurship and innovation. The catalogue allows the user to navigate through data from: public administration and justice, environment, culture, sports, economy and innovation, education, urban management, amongst others.

The use of the data is free of charge and the rights related to users' accessibility are licensed under the Creative Commons CC Zero Attribution 1.0 license.

More information: [Lisboa Aberta Website](#)

- **Organisational interoperability** refers to the way in which organisations align their processes, responsibilities and expectations to achieve commonly agreed goals. Organisational interoperability means documenting, integrating or aligning processes and exchanging relevant information. Organisational interoperability also aims to meet the requirements of users by making services available, easily identifiable, accessible and user-focused. Furthermore, active involvement of the user community can be part of the organisational interoperability component.

Recommendation #22

Put in place an organisational structure to establish and maintain clear roles and responsibilities of processes to deliver services at local level.

Use case

Berlin, Germany:

In 2016 the city of Berlin issued its Berlin law on e-government (E-Government Gesetz Berlin) that was a real game changer for digital services in the city. Before 2016 city IT services were developed mostly independently by over 100 different entities on municipal and central level. This led to several hundred different solutions of very different levels of maturity and with no safeguards for interoperability.

With the 2016- law, Berlin introduced a central IT governance led by a Minister of State with clear tasks and mandates. The new central entity provides a central ICT architecture with cross-cutting building blocks that have to be (re)used for all ICT solutions in the cities. The solutions for the different portfolios (social, environment etc.) are to be developed by the different ministries respecting the common architectural model. Organisational interoperability got a real boost as the law foresees that before providing a digital solution the service has to prove that the underlying business processes were optimised. A cooperation mechanism on business process management between implementing municipality and central city ensures that the same concepts are reused in the description of business processes. First use cases show that this also has a positive impact on the drafting of new digital-ready policies.

More information: [City of Berlin Website](#)

- **Semantic interoperability** ensures that the precise format and meaning of exchanged data and information is preserved and understood throughout exchanges between individuals and organisations. Semantic interoperability covers both semantic and syntactic aspects: The semantic aspect refers to the meaning of data elements and the relationship between them. It includes data models, controlled vocabularies and common code lists to describe data exchanges and ensures that data elements are understood in the same way by all communicating parties. The syntactic aspect refers to describing the exact format of the information to be exchanged in terms of grammar and format.

Recommendation #23

Work towards a commonly agreed description and understanding of the solutions, data, tools and services (format, meaning of data, relationship between parties), across stakeholders and across domains at local, regional, national and European level.

Use case

Flanders region, Belgium

Flanders is running a project that ensures an automated update of data in databases – Local Decisions as Linked Open Data LBLD.

The project launched in 2015 aims to publish local decisions as Linked Open Data so that this information can be exchanged automatically between local and higher authorities, making it easier to re-use information reducing the administrative burden, simplifying decision-making processes, transparency and providing better and more efficient services to its inhabitants, business, visitors, organisations and city/community administrators.

As the data is published online, this project ensures that data from local decisions can also be re-used by non-state actors, creating an open government that is transparent and open to the outside world.

More information: [Flanders Region Website](#)

Trentino region, Italy

The Consortium of Trentino Municipalities and the Autonomous province of Trento have developed a socio-technical platform to manage web sites and digital services. The platform allows for the municipalities of Trentino to exchange their public data through the use of APIs, automatically documented; no agreement is required between the parties and there are no implementation costs.

The APIs generate real time and updated datasets, published as Open Data, which can be used by mobile Apps and chatbots.

Moreover, the homogeneity of the data structure (designed according to ISA² standards) makes data aggregation and monitoring feasible: data are collected and displayed as tables, graphs and maps on a monitoring dashboard, automatically.

To ensure a common understanding of data and information across the several municipalities' public authorities, that were previously working independently, a catalogue of public services, an Open Data catalogue (collection of APIs) and a one-stop-shop of digital forms have been prepared, open sources and very accessible costs.

More information: [Comunweb Website](#) / [Developers Italia Website](#)

- **Technical interoperability** refers to the inclusion of interface specifications, interconnection services, data integration services, data presentation and exchange, and secure communication protocols. Furthermore, when applying standards they should be available in an open format. Open technical specifications should be tailored to the specific context in which they will be used. For example, from a technical interoperability point of view, the Minimal Interoperability Mechanisms (MIMs Plus) and the CEF Building Blocks, based on commonly agreed open standards and open technical specifications, ensure achieving

interoperability of data, systems, and services between cities and suppliers around the world, and can guide those working on interoperability in a SCC ecosystem.

Recommendation #24

Create more horizontal services towards local data platforms, to overcome silos within different domains, by encouraging collaboration and engagement among inhabitants, business, visitors, organisations and city/community administrators.

Use case

Copenhagen, Denmark

Copenhagen's City Data Exchange (CDE) aims to break down application silos by integrating and sharing city data through a collaborative effort involving 50 companies. The economies of scale resulting from this strategy lower the costs of data management for all participants.

The city decided to invest in the creation of a marketplace for the exchange of public, and private sector data. The initial investment was meant as a seed towards a self-sustained marketplace. This was an innovative approach to test the readiness of the market to deliver new data-sharing solutions.

More information: [Smart Cities World Website](#) | [Atis Smart Cities Data Sharing Framework](#)

Recommendation #25

Develop and provide seamless services where inhabitants, businesses, visitors and organisations are able to identify and authenticate using eID schemes.

Use case

Netherlands

The eIDAS 2018 Municipalities Project is one of the early implementations of the mutual recognition principle of European eIDs to access public services introduced by the eIDAS regulation.

It enables citizens of EU Member States and EEA countries to electronically prove their identity with their nationally issued eID when seeking access to around 300 services in 81 municipalities across the Netherlands.

This project not only allows an easier access of the end-user to public services but it also significantly reduces the administrative burden - there is no need to maintain multiple databases and spend resources on collating and cross verifying information across borders and jurisdictions.

The solution is currently available for Austrian, German and Belgian eID holders, and should progressively be extended to other countries connecting to the eIDAS network.

More information: [CEF Digital Website](#)

Recommendation #26

Use commonly agreed open standards and open technical specifications for achieving interoperability of data, systems, and services, to support cities/ communities and suppliers during the design, development and implementation phase of new services or reengineer existing ones (to avoid “reinventing the wheel”).

Use case

Japan

The Japanese government has launched the “Super City Initiative” to deliver the benefits of digital transformation to their inhabitants, business, visitors, organisations and city/community administrators.

The aim of this initiative is to launch Japanese cities into a new age of urban planning and to offer better and more efficient services. The Super City initiative pays particular attention to and considers European benchmarks like the General Data Protection Regulation, the once only principle and the minimal interoperability mechanisms (MIMs Plus) as these are needed to achieve digital transformation of their cities.

More information: [OASC Website](#)

Recommendation #27

Use and raise awareness of the benefits of open standards and open technical specifications amongst SCC service providers, during the design, development and implementation phase.

Use case

Tartu, Estonia

The city of Tartu is developing a 3D city information model that brings together as many meaningful city information datasets that currently exist separately, in different formats and in different databases.

The value of this exercise is to demonstrate the level of effort needed to integrate data from different databases and in different formats to such a 3D city information model based on open standards, facilitating interoperability and data exchange among different products or services.

More information: [Espresso Project Website](#)

Lisbon, Portugal:

During the public procurement process, to set up the Intelligent Platform of Lisbon, the use of a set of standards to be followed based on Fiware, an open source middleware platform, was mandatory.

The Intelligent Platform of Lisbon is a technological solution that provides capacity for monitoring, analysis and management of the entire local ecosystem, based on the use of open technologies.

More information: [Smart Portugal Website](#)

Recommendation #28

Ensure a local level playing field for open source software and demonstrate active and fair consideration to increase the quality and interoperability solution and become more cost-efficient.

Use case

Barcelona, Spain:

The city has a set of Ethical Digital Standards: A Policy Toolkit, which is an open source Policy Toolkit for cities to develop digital policies that put citizens at the centre and drive governments to become more open, transparent, and collaborative.

The Barcelona City Council Open Digitisation Plan defines a process of profound, progressive change in the way the city will develop and offer its services to its citizens. It aims for radical improvement in digital public services, based on their Ethical Digital Standards, including in particular the use of free software, open standards, data sovereignty, developing digital services in an agile manner, and ensuring privacy, ethics and security by design.

More information: [City of Barcelona Website](#)

Recommendation #29

Develop apps/ digital services ensuring that these are open by default (even if not using open standards and open technical specifications, the apps/ digital services should allow integration with others through APIs, to boost the digital transformation at local level).

Use case

Espoo, Finland:

The city of Espoo offers the REST, an open interface on the espoo.fi website in which users can search for news, events, projects, electronic services, announcements and basic content documents. The interface covers all three language versions of the espoo.fi website (Finnish, Swedish, and English). The search can be limited by content type.

More information: [City of Espoo Website](#)

Finland:

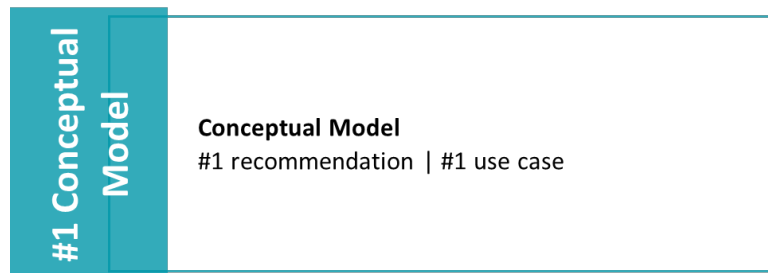
Finland is adapting the API framework suggested by the European Commission. The framework structures actions to be taken by organizations to better profit of their API infrastructure. The framework offers twelve 'proposals' arranged around four organisational pillars, namely, policy support, platforms and ecosystems, people, and processes. The twelve proposals, inspired by the European Interoperability Framework (EIF) of the European Commission, were created following an extensive and deep systematic review that assessed available documents on current government API strategies, guidelines, related policies and action plans in digital government and other areas, and private industry best practice guidelines.

The main goal of API policies is to create a shared set of principles for API development in public administrations in Finland. Further goals include promotion of a customer-driven approach, cooperation, reusability, interoperability, information security and data protection and quality API development. Common principles will promote the coherent use of data and functions, primarily through APIs.

More information: [European Commission Website](#)

6. TAILORED CONCEPTUAL MODEL FOR THE EIF4SCC

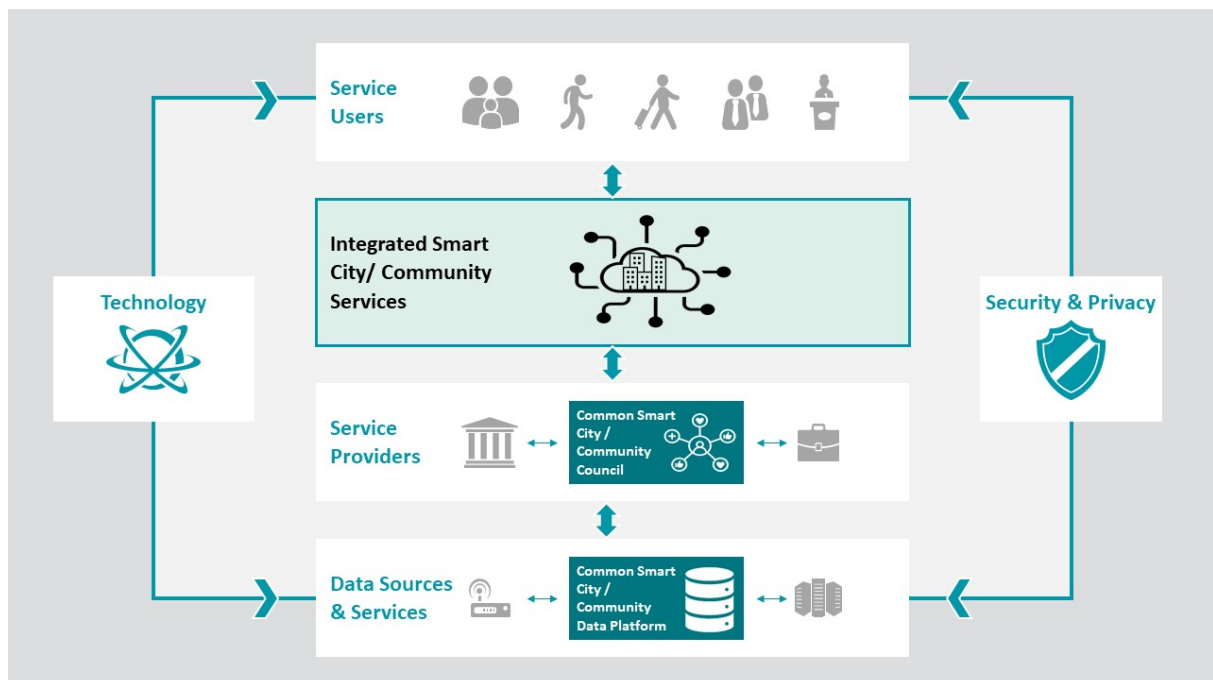
Figure 9 - EIF4SCC Conceptual Model



The SCC conceptual model aims to support the understanding of local administration leaders for the planning, development, operation and maintenance of integrated SCC services. The conceptual model is developed from a generalised SCC ecosystem perspective. As a result, it serves as a generalised model and may need to be adapted according to the specific context of local administrations. The conceptual model is in line with the 2017 European Interoperability Framework and proposes the idea of “interoperability by design”, meaning that the integrated SCC services should be designed in accordance with the proposed model and with interoperability and reusability requirements in mind.

The conceptual model for the Integrated SCC Services, is presented in Figure 10.

Figure 10 - Conceptual model for Integrated SCC Services



The model includes six essential elements and its related interactions. The elements are 1) Service Users, 2) Integrated SCC Services, 3) Service Providers, 4) Data Sources & Services, 5) Technology and 6) Security & Privacy. These six elements are explained below.

Service Users



1. **Service Users**, such as inhabitants, visitors, businesses, organisations and city/community administrators make use of the services offered by the

Service Providers. Service Users can take an active role by providing their input through co-creation and coproduction processes in the Integrated SCC Services. Service Users can also provide their input via technology, which might lead to improved services offered to them. This dynamic implies a continuous exchange of data, guarantying security and privacy.

2. **Integrated Smart City/Community Services** are services offered to Service Users by Service Providers. Integrated SCC Services may be offered by the public sector or though collaboration between the public and non-public sector. Examples range from the development of services that are cloud-based and provide a user-friendly interface for Service Users to the development of a Local Digital Twin. A Digital Twin is a digital copy of the city or community that allows policy decisions to be tested in a digital environment. These services can make use of building blocks that are available for reuse. Examples of such building blocks are the ISA² solutions and the Connecting Europe Facility (CEF) Building Blocks, which offer basic capabilities and can be used in any European project to facilitate the delivery of digital public services across borders. Examples of ISA² and CEF Building Blocks include the [Core Vocabularies](#), [eSignature](#) and [eInvoicing](#).

Integrated Smart City/Community Services



3. **Service providers**, such as local public administrations, businesses and societal actors can provide a great variety of services to **Service Users**. Those services range from the registration of the birth of a child, to the waste collection at your home or the management of the streetlights during the night. The interaction between Service Providers and Service Users in the SCC can occur within a Common SCC Council. The aim of the Council is to facilitate the delivery of services in the SCC.

Service Providers



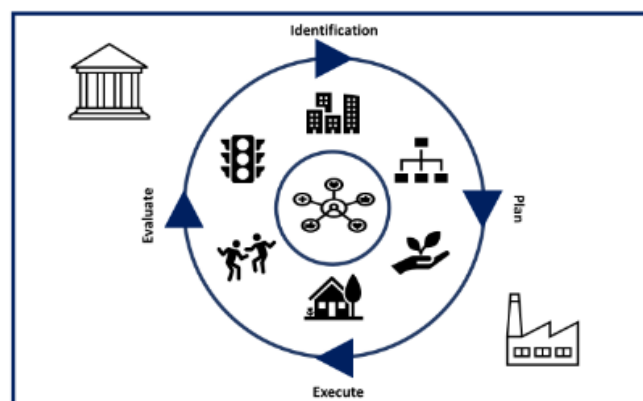
3. **Service providers**, such as local public administrations, businesses and societal actors can provide a great variety of services to **Service Users**. Those services range from the

registration of the birth of a child, to the waste collection at your home or the management of the streetlights during the night. The interaction between Service Providers and Service Users in the SCC can occur within a Common SCC Council. The aim of the Council is to facilitate the delivery of services in the SCC.



The Council provides an interaction stage for Service Providers and Service Users. This Council can take a leading role in identifying service needs, in planning how to handle service needs, in executing the plans regarding services and in evaluating the achievement of the objectives.

Figure 11 - Common SCC Council



Considering that the Common SCC Council is an interaction ground in the relation between the Service Users and Service Providers, it is important to reflect on the organisation of the Council. The different actors of a SCC should decide on how they want to organise the Council so that it can function according to their needs and context. This interaction can lead to co-creation and coproduction processes. Figure 5 offers a detailed view of the Common SCC Council. The Council can be developed taking into account different possible service domains as well as the interactions between those domains – think of Smart Economy (e.g. entrepreneurship, economic growth and value creation), Smart Governance (e.g. public participation, public-private partnerships, transparent governance), Smart Environment (e.g. waste management, sustainable energy use, water resilience), Smart Living (e.g. housing quality, urban safety, educational quality, cultural facilities), Smart People (e.g. skills & talented human capital, a caring community) and Smart Mobility (e.g. public transport systems, efficient road accessibility).



4. Data Sources & Services consists of two aspects. The first aspect is focused on the **data sources** available in a SCC. Data can be gathered by both Service

Providers and Service Users, through Smart Sensors, Internet of Things, Software Applications, etc.

Data can be classified as open, shared or closed, depending on privacy and security considerations.

- **Open data** is available for reuse by third parties with minimal restrictions. In the EU, the concept of open data denotes the specific relationship of public administrations opening their data with a minimum set of restrictions towards third parties (whereby limited financial compensations can still apply)⁶.
- **Shared data** is an intermediate category. This is data that is not shared as open data, but it is available for third parties while respecting certain conditions. Those conditions are more restrictive than those governing open data.
- Finally, **closed data** has a restricted use and cannot be shared with third parties.

The sharing and opening of data can apply to all actors in the smart city or community. Public administration actors can share data with non-public administration actors and *vice versa*. Data should be structured in data catalogues that support service providers to find reusable data sources. Data from public administration can be recognised in the format of a base registry. A base registry is a trusted and authoritative source of information which can and should be digitally reused by others, where one actor is responsible and accountable for the collection, use, updating and preservation of information. From the perspective of non-public administration, it could also be relevant to reflect on the possibilities offered by the development of base registries. This requires the necessary legal framework and agreements with the public administration actors. Base registries can facilitate the application of the once only principle, the reuse of data and documents that service users have already supplied, in a transparent and secure way.

In line with data, services can be classified as open, shared or closed.

- When services are available in an open format, they can be reused by third parties with a minimal set of restrictions.
- Shared services are also reusable, but the reuse will be restricted to certain conditions – e.g. time limitations, allowed number of users, restrictions on which type of actors can reuse it.
- Closed services are not available for reuse by third parties.

⁶ An overview of the applicable legislative framework concerning open data can be found at this [page](#).

The European Commission, as well as national and regional public administrations, have developed building blocks. These are services that are available to both public administration and non-public administration actors for reuse. Building blocks can be available in an open or in a shared format. These building blocks allow the Service Providers to offer Integrated SCC Services to the Service Users in a standardised way. The reusable building blocks lead to a higher efficiency for the Service Providers, and to a possible increase in the user-friendliness for the Service Users.

Data and services can be shared among the different SCC actors in a **Common SCC Data Platform**, also known as a Local Data Platform. This Platform, established by Service Providers, facilitates management and sharing of city/community data and services. This can be done in line with the governance approaches of the Common SCC Council. The difference between the Common SCC Council and this Data Platform lies in the fact that the Common SCC Council is focused on the overall organisation of the SCC and the services offered in it. In contrast, the Data Platform focuses on the exchange of data and services. Both are as such complementary to each other.



Figure 12 - Common SCC Platform

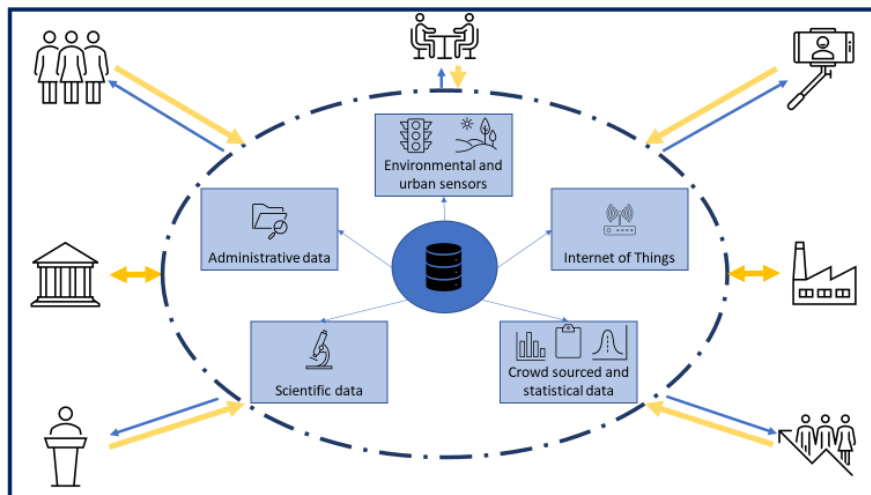


Figure 6 provides a detailed view of this Common SCC Data Platform. The main beneficiaries of this Data Platform are Service Providers, who feed in and use data from the Data Platform to develop and offer services. The dotted line in Figure 6 indicates that the data reused from the Data Platform can be offered under specific reusability conditions. Together with the Service Providers, Service Users play a key role in the Data Platform. Via their overall behaviour within the SCC and the use of services offered to them by the Service Providers, the Service Users provide data to the Data Platform. The privacy and security of data is of crucial importance and can be improved via the Platform. Since the Service Providers tend to provide more data to the Data Platform when compared to the data they use, the yellow arrow is wider than the blue arrow. Different types of data can be available in the Data Platform – including administrative data, scientific data, crowd-sourced and statistical data, data collected via Internet of Things or data collected via environmental and urban sensors.



5. Technology has, together with Security & Privacy, a fundamental role in the set-up of the Integrated SCC Services. Both aspects have a relevant impact on the process of creating Integrated SCC Services offered by the Service Providers to the Service Users. The Technology allows for the collection, storing, sharing, updating and preservation of data, and creates the possibility to build reusable services. It allows the Service Providers to create Integrated SCC Services for the Service Users and gives the

possibility to the Service Users to take an active role in the creation of those services. Examples of technology that is relevant in a SCC context are Artificial Intelligence, Big Data, Blockchain, Cloud computing, High performance computing, Digital Twins, Data Integration platforms, Internet of Things, Mobile applications, etc.

Security & Privacy



6. Security & Privacy are primary concerns in the provision of services, and both the public administration and non-public administration actors need to ensure that a privacy-by-design and security-by-design approach is followed. It should also be ensured that services are not vulnerable to attacks and that the services are compliant with [contractual and] legal requirements and obligations regarding data protection and privacy. Like Technology, Security & Privacy impacts not only the City/Community Data

Sources & Services, but also the relation between the Service Providers and the offering of Integrated SCC Services to the Service Users.

Recommendation #30

Use the conceptual model for European Smart City and Community Services to support the design of new services or update existing ones and reuse, where possible, existing data, service components and digital solutions such as CEF Building Blocks, ISA² solutions.

Use case

Vienna, Austria:

Vienna manages one of the biggest challenges for smart cities, big data, through the VeroCity Platform.

Its data aggregation and analysis capabilities are based on the CEF Context Broker Building Block of the European Commission, which can sort through all kinds of data from different sources from all over the city. The Context Broker enables the platform to provide visual dashboards that cater to the needs of all stakeholders, from inhabitants to city officials and software developers, with real time information.

The platform can ease day-to-day activities, such as urban mobility, environmental monitoring, urban infrastructure, energy efficiency etc. The city's open data and open interfaces, in addition to the web services offered, have contributed to unprecedented innovation as +200 new applications have been developed by third-party software engineers.

More information: [CEF Digital Website](#)

CEF Digital

7. CONCLUSION

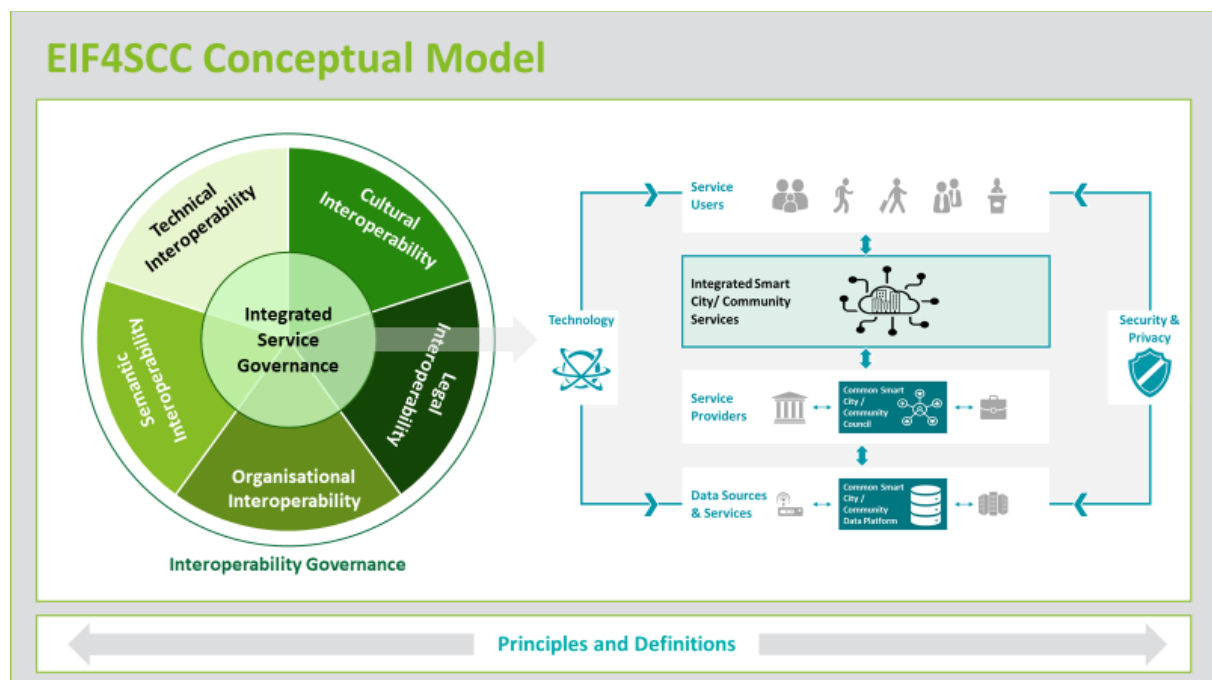
Cities and communities play a fundamental role in the life of European Union citizens. Public administrations in cities and communities are the closest to the inhabitants, businesses and visitors and have a key role in the creation of value for through the delivery of services. The vast growth of digital solutions and technological advances of the previous decades have seen local administrations begin their transition towards becoming a smart city or community and has demonstrated the importance of interoperability.

Interoperability is a prerequisite for electronic communication and the exchange of information between different actors, but as we have seen, it is much broader than technical in nature. Taken in the broader sense as presented in the EIF4CC, interoperability is a necessary condition for achieving and further developing Smart Cities and Communities in Europe.

The EIF4SCC provides European Union local administration leaders with a guide to interoperability. It includes principles, a common interoperability model, recommendations and practical use cases to enable interoperability across domains, cities, regions and borders, leading to improved delivery of services to inhabitants, visitors, businesses and city/community administrators. The EIF4SCC is part of a wider range of initiatives taken by the European Commission to facilitate the development of SCCs as well as the interoperability within and across public administrations, and private actors in the smart city and community context. The EIF4SCC must be seen as a complementing effort of the European Commission to stimulate and contribute to interoperability from a local, regional, national, European and global perspective.

The EIF4SCC is premised on the fact that that interoperability goes beyond ICT matters. The EIF4SCC identifies seven elements of interoperability (five components: cultural, legal, organisational, semantic and technical, one cross-cutting layer, all built on the foundation of Interoperability Governance). Figure 13 illustrates the components of the EIF4SCC.

Figure 13 - EIF4SCC Conceptual Model



These components involve governance factors to ensure coordination of relevant activities across all domains of a SCC. The EIF4SCC conceptual model aims to facilitate this governance support by

providing local administration leaders with a framework and practical use cases that help in the planning, development, operation and maintenance of integrated SCC services.

Besides the EIF4SCC practical guidelines, local administrators are also encouraged to follow and to contribute to other initiatives. One of these is the Living-in.EU community, a commitment in which decision makers can join forces to boost sustainable digital transformation in cities and communities in the EU and together develop sustainable measures. This also includes exchange of knowledge and sharing best practices around interoperability solutions in the cities.

The European Observation Network for Territorial Development and Cohesion (ESPON) is also developing another initiative to assess the digital maturity at local level. The Local and Regional Digital Indicators (LORDI) framework will soon provide evidences of measuring indicators at the local and regional level, that could be used to support cities and regions to develop and steer the relevant policies, including interoperability related issues.

The activities conducted by the European Commission to progress interoperability are a continuous learning path. Therefore, this is a living document that will need to be updated on the basis of the input provided by local administrations, the evolution of ICT and public administrations and the development of new insights on interoperability. Furthermore, it has to be underlined that in light of the EIF, which targets only public administrations, the EU Member State administrations have developed National Interoperability Frameworks. Local administration leaders are encouraged to participate in the overarching National Interoperability Framework of their Member State.

The EIF4SCC as such fits into the multi-level governance context of the EU, where all levels of public administration play a key role in achieving interoperability at local, regional, national, European and global level. Taking an approach which considers interoperability from the beginning, means being better prepared to tackle complex challenges such as climate change, health issues and socio-economic issues. Therefore, it is important to see interoperability as a facilitator of present and future actions or initiatives such as the [European Green Deal](#) or the [Digital Single Market](#).

LIST OF ACRONYMS

AI	Artificial Intelligence
API	Application Programming Interface
CEF	Connecting Europe Facility
EIF	European Interoperability Framework
EIF4SCC	European Interoperability Framework for Smart Cities/Communities
ESPON	European Observation Network for Territorial Development and Cohesion
EU	European Union
EC	European Commission
ICC	Intelligent Cities Challenge
ICT	Information and Communication Technologies
IoT	Internet of Things
ISA ²	Interoperability solutions for public administrations, businesses and citizens
LORDI	Local and Regional Digital Indicators
MIMs Plus	Minimal Interoperability Mechanisms
NIO	National Interoperability Framework
SCC	Smart City/Community

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: https://europa.eu/european-union/contact_en

On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696 or
- by email via: https://europa.eu/european-union/contact_en

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: https://europa.eu/european-union/index_en

EU publications

You can download or order free and priced EU publications at: <https://op.europa.eu/en/publications>. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see https://europa.eu/european-union/contact_en).

EU law and related documents

For access to legal information from the EU, including all EU law since 1952 in all the official language versions, go to EUR-Lex at: <http://eur-lex.europa.eu>

Open data from the EU

The EU Open Data Portal (<http://data.europa.eu/euodp/en>) provides access to datasets from the EU. Data can be downloaded and reused for free, for both commercial and non-commercial purposes.

