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Commission

# JRC CONFERENCE AND WORKSHOP REPORT

## ELISE Workshop at DigitALL conference:

### *Enabling the interoperability of digital government from a location perspective*

*Proceedings of the ELISE  
workshop at the DigitALL  
Public Conference  
20-22 April 2021*

# ELISE

Enabling digital government through geospatial & location intelligence

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We gratefully thank the representatives from the Member States who provided different perspectives on user-driven approaches regarding location interoperability in the final round table discussion and presented concrete reuse of methodologies and tools applying location data interoperability principles in different sectors as part of the workshop.

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## Abstract

This document is a report of a workshop held by the European Location Interoperability Solutions for e-Government (**ELISE**) action of the Interoperability solutions for public administrations, businesses and citizens (**ISA<sup>2</sup>**) programme<sup>1</sup>, at the **DigitALL Public conference**<sup>2</sup>, the online closing event of the Connecting Europe Facility (**CEF**) Digital and the ISA<sup>2</sup> programmes.

Together with the Member States, these programmes have helped build cross-border public services for citizens, provided free interoperable solutions to companies and connected various organisations in different sectors. The conference celebrated achievements in the two programmes while looking ahead towards Europe's digital future and the beginning of the new Digital Europe Programme (DEP).

During the workshop, speakers and panellists from the European Commission and public administrations in the Member States, industry and international organisations showcased through user stories examples of good practices developed through ELISE support.

After an introduction on ELISE by **Francesco Pignatelli**, ELISE Action Leader at the EU Commission Joint Research Centre (JRC), in the first session of the workshop, **Ray Boguslawski** - external consultant for the Joint Research Centre and three guest speakers, **Miguel Alvarez Rodriguez** - Programme Manager at the European Commission DG Informatics (DG DIGIT), **Andrea Halmos** - Policy Officer at the European Commission DG Communications Networks, Content and Technology (DG CNECT), and **Tomaž Petek** - Director General at the Surveying and Mapping Authority in Slovenia, provided their perspectives on the value and role of a **Location Interoperability Framework** (the EULF Blueprint) and its relationship with the European Interoperability Framework (EIF).

In the second session, **Lorena Hernández Quirós** from the Joint Research Centre and three guest speakers, **Joeri Robbrecht** - Policy Analyst at the European Commission DG Environment (DG ENV), **Ine De Visser** - Standards Advisor at Geonovum, and **Gobe Hobona** - Director of Product Management, Standards at the Open Geospatial Consortium (OGC), provided their perspectives on the **reuse of tools for interoperable location data and reporting**. They highlighted, in particular, the role of the two ELISE flagship solutions, Re3gistry and INSPIRE Reference Validator.

In the third session, **Giacomo Martirano** - external consultant for the Joint Research Centre and three guest speakers, **Gabriele Ciasullo** - "Database and Open Data" Service Responsible at the Italian Agency for Digital Identity (AgID), Italy, **Gema Hernández Moral** - Project manager and researcher at CARTIF, Spain, and **Volker Coors** - Scientific Director at Institute of Applied Research, Germany, provided their perspectives on the **reuse of location data interoperability principles and methodologies in different sectors**. The latter was demonstrated through various pilots and applications carried out under the ELISE action.

In the fourth session, **Simon Vrečar** - external consultant for the Joint Research Centre and three guest speakers, **Morten Borrabaek** - Mapping Authority, Norway, **Eva Pauknerová** - CUZK, Czechia, and **Ricardo Vitorino** - Ubiwhere, Portugal, provided different perspectives on **user-driven approaches regarding location interoperability**. The highlights were on how knowledge transfer can help achieve interoperability benefits.

Finally, the workshop concluded with a panel session where attendees gave their views on the **future importance of location interoperability** and how initiatives can provide the necessary support.

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<sup>1</sup> [https://ec.europa.eu/isa2/home\\_en](https://ec.europa.eu/isa2/home_en)

<sup>2</sup> <https://digitalpublic.eu/>

## Foreword

This report is published in the context of the *European Location Interoperability Solutions for e-Government (ELISE) action* of the [ISA<sup>2</sup> programme](#). ELISE consists of a package of legal/policy, organisational, semantic and technical interoperability solutions to facilitate efficient and effective electronic cross-border and/or cross-sector interaction between European public administrations and between them and citizens and businesses related to location information and services.

ELISE supports Better Regulation and Digital Single Market Strategy goals, including specific actions of the e-Government Action Plan and the European Interoperability Framework, which are reinforced by the Tallinn Declaration and by the Communication on "Building the data economy and on Artificial Intelligence for Europe".

Moreover, its focus is aligned with that of ISA<sup>2</sup> and involves **European public administrations, businesses and citizens** and the need to ensure that **best-practice interoperable solutions** are deployed across the European Union (EU).

Since the adoption of the ISA<sup>2</sup> programme in 2016, ELISE has supported a location-enabled digital government. Public administrations actively use the value and benefits of the spatial dimension in their processes.

The '**location-enabled digital government**' concept incorporates three essential elements:

- **Digital transformation:** the process of using digital technologies to create new (or modify existing) public services processes, new culture and citizen experiences
- **Location:** Public administrations increasingly rely on location data and technologies to design and deliver services around crucial events in citizens and businesses' lives. With "Location Intelligence", they can solve spatial questions and derive meaningful insights on significant socioeconomic and environmental challenges.
- **Interoperability:** Location interoperability is the ability of organisations, systems and devices to use and exchange location data with a coherent and consistent approach. This aspect of ELISE builds on the principles, layers and recommendations of the European Interoperability Framework (EIF).

ELISE's outputs and good practices are gathered in [Joinup](#), a collaborative platform created by the European Commission that contains thousands of news, events, discussions, and interoperability solutions ready to be accessed and used. Moreover, the platform offers a meeting place and a collaborative working environment to develop interoperability solutions.

Through its outputs and good practices, ELISE can provide firm inputs to future activities through the proposed European Location Intelligence and Technology Enablers (**ELITE**) action in the frame of the **Digital Europe Programme**. The proposed action will further improve and enhance European Interoperability by using location data and intelligence.

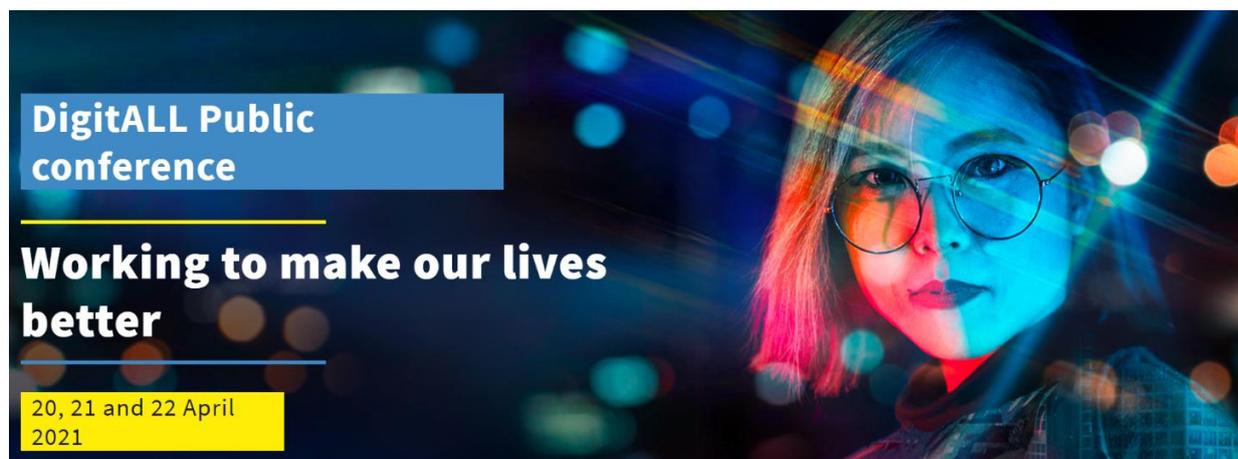


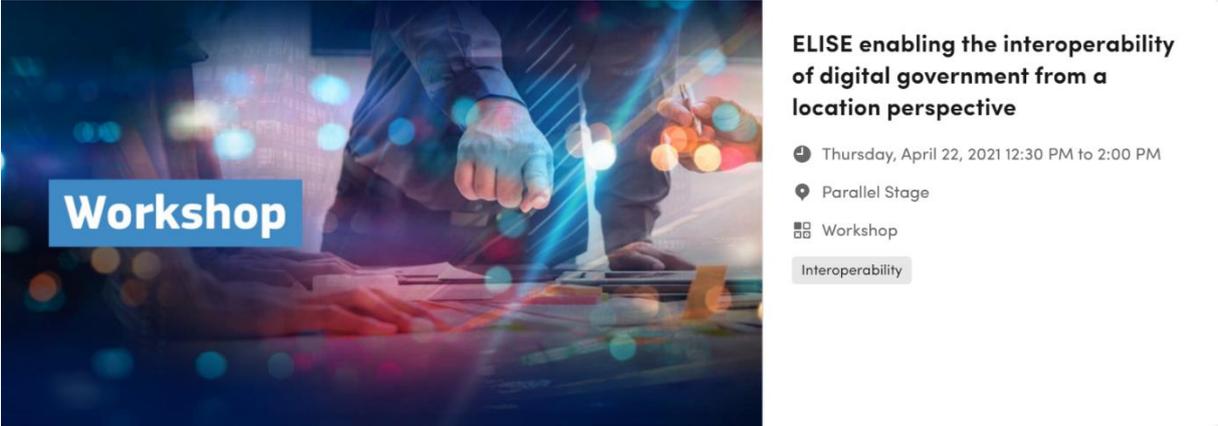
Figure 1 – DigitALL Public Conference

The digitisation of European public administrations and interoperability is one of the policy areas covered by the first Digital Europe Programme (DIGITAL) work programme (2021-2022), under the "European Digital Government EcoSystem" (EDGES) chapter.

The [DigitALL Public Conference](#) from 20-22 April 2021 marked the closure of the ISA<sup>2</sup> and associated Connecting Europe Facility (CEF) programmes and paved the way for the [Digital Europe Programme](#). During this three-day event, the attendees had the unique opportunity to hear and engage in discussions on Innovation and GovTech, Interoperability, Open Source, Smart Cities, Trust and Security, among others. The conference gathered more than 30 speakers in over 30 parallel sessions, attended by more than 1,500 participants.

Within the DigitALL Public Conference, ELISE organised the "[ELISE enabling the interoperability of digital government from a location perspective](#)" workshop on 22 April. In the workshop, speakers and panellists from the Commission and public administrations in the Member States, industry and international organisations showcased through user stories some examples of good practices developed through ELISE support. The recording and slides of the workshop are available at this [link](#).

This document describes and highlights the key messages shared during the ELISE workshop.



**Figure 2** – “ELISE enabling the interoperability of digital government from a location perspective” Workshop

# 1 Introduction

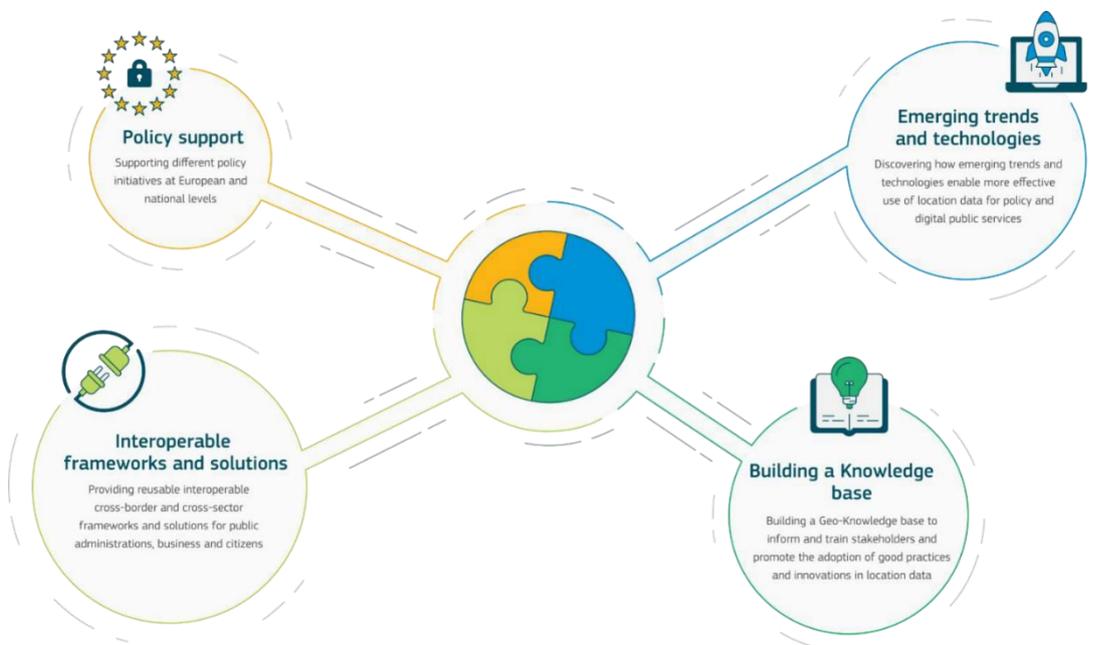
The workshop opened with the **ELISE** Action Leader, **Francesco Pignatelli** – Programme Manager at the Digital Economy Unit (B6) of the Joint Research Centre of the European Commission. In his opening remarks, he noted the virtual nature of the workshop – just another example of adapting to the new realities of life and work in a pandemic society. Aptly so, Unit B6 has the mandate to analyse the impact of digital transformation in the European society and economy. In this context, the importance of a robust public sector ready for the digital era has become even more crucial.

As a result, JRC Unit B6 has carried out research and supported the development of tools and solutions to track and guide the digital transformation of Europe. Since the adoption of the ISA<sup>2</sup> programme in 2016, and in close collaboration with DG DIGIT, ELISE has supported the development of a location-enabled digital government in which public administrations actively use the value and benefits of the spatial dimension of their processes.

The ELISE action builds on the principles of the **INSPIRE Directive**, which establishes an infrastructure for environmental spatial information in Europe while continuing the work from two ISA actions: **European Union Location Framework (EULF)**, which developed and promoted a best practice policy and guidance framework, underpinned by INSPIRE, with pilots in different countries and thematic domains, and **A Reusable INSPIRE Reference Platform (ARE<sup>3</sup>NA)**, which facilitated INSPIRE implementation in the Member States through the development of a structured implementation approach and body of reusable interoperability solutions.

ELISE continued this work by fostering the adoption of best practice location interoperability solutions across the EU, supporting the digital transformation of public services. In particular, ELISE aimed to break down barriers and promote a coherent and consistent approach to the sharing and reuse of location data across sectors and borders in the context of the digital transformation of public services by:

- Supporting different policy initiatives at European and national levels;
- Providing reusable interoperable cross-border and cross-sector frameworks and solutions for public administrations, business and citizens;
- Discovering how emerging trends and technologies are impacting the location domain and vice versa;
- Building a Geo-knowledge base.



**Figure 3** – ELISE objectives in four destinations

These objectives are achieved by delivering four types of outputs, as presented in Figure 4:

- carrying out studies to assess enablers and barriers of location interoperability, examining the role of location information in the digital transformation of government and the data economy, assessing the implications of relevant policies (e.g. the EU's digital strategy, PSI, GDPR), investigating disruptive technological developments for publishing, finding and using location data, addressing topics such as Application Programming Interfaces (APIs), Blockchain, and Artificial Intelligence (AI), and assessing the future role of Spatial Data Infrastructures (SDIs);
- developing pilots and applications to test principles in practice, offer lessons and resources for others to build upon, provide the basis for a widespread rollout, and show the benefits of location interoperability. These pilots support either pan-European reference data solutions (e.g., gazetteer services) or sector-specific applications (e.g., Energy Efficiency of Buildings and Intelligent Transport Systems);
- creating a framework of guidelines, recommendations and reusable tools to enable location interoperability, building on EULF and ARE<sup>3</sup>NA, and expanding into new business models and technologies for data exchange, transformative solutions with location intelligence capabilities, and ethical handling of data;
- providing landscape analysis and assessment of good practices through a Location Information Framework Observatory (LIFO), knowledge transfer and capacity building activities, and stakeholder support to help improve and implement location interoperability and digital government transformation.



**Figure 4** – ELISE outputs

By following this approach, ELISE has accomplished numerous achievements during its five years of activity, among which are:

- Complementing the European Interoperability Framework (EIF) and National Interoperability Framework Observatory (NIFO) with an extensive location interoperability framework and state of play assessments;
- Helping to put the INSPIRE Directive into practice with tools for data providers and a strong focus on use cases;
- Building an extensive community of European and international stakeholders;
- Raising awareness on new approaches to location-enabled digital transformation;
- Helping to assess the role of SDIs in the context of evolving business models, e.g. data ecosystems, digital platforms;
- Assessing new policies (e.g. GDPR, European Data Strategy) and technologies (e.g. Artificial Intelligence, Blockchain, APIs...);
- Promoting and facilitating better links on location data between public and private actors;
- Providing guidance on improving spatial awareness and analytical skills for the best use of data.

The workshop offered participants a journey with stops at the different destinations of ELISE and an opportunity to rate these destinations to benefit future travellers.

## 2 Location Interoperability Framework

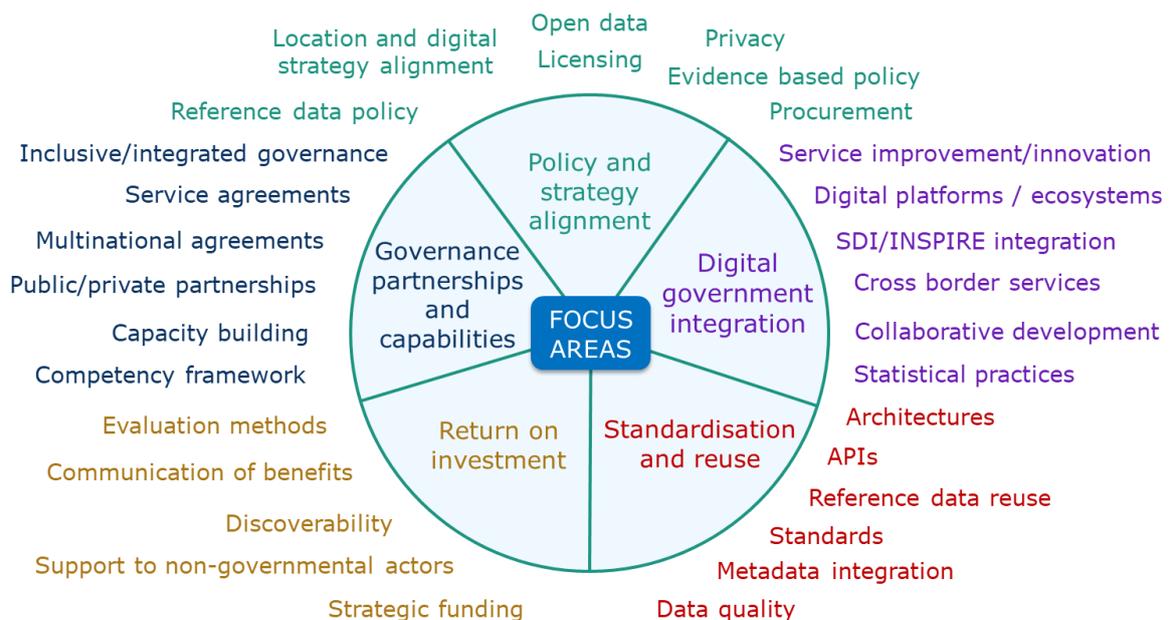
In the first session of the workshop, **Ray Boguslawski**, external consultant at the Joint Research Centre and three guest speakers, **Miguel Alvarez Rodriguez** - Programme Manager at the European Commission DG DIGIT, **Andrea Halmos** - Policy Officer at the European Commission DG CNECT and **Tomaž Petek** - Director General at the Surveying and Mapping Authority in Slovenia, provided their perspectives on the role and value of a **Location Interoperability Framework**.

### 2.1 The EULF Blueprint

Ray Boguslawski introduced the **EULF Blueprint**<sup>3</sup>. The 'location interoperability framework' developed and promoted by ELISE, which has recommendations and guidance for exchanging and using **location information** in government policy and digital public services allied closely to the interoperability principles and scope of the EIF.

The EULF Blueprint is divided into **five focus areas**. A 'current state' assessment and 'future state' vision are outlined, and key points for achieving the vision are described through **19 recommendations**.

Each recommendation comprises a rationale for its inclusion, a series of action checklists, challenges to be overcome, illustrative best practices and links to related EIF recommendations. ELISE monitors the level of adoption of the EULF Blueprint good practices through the **Location Interoperability Framework Observatory**<sup>4</sup>, which provides a tool to monitor, assess, and report on through a series of indicators the state of play of location data in Member States' digital government programmes.



**Figure 5** – Topics covered in EULF Blueprint guidance and LIFO indicators

After describing the structure and rationale behind the EULF Blueprint, Ray Boguslawski concluded by highlighting some important aspects related to the use of the framework. In particular, he pointed out that:

- **As a location data framework, the EULF Blueprint combines several elements that make it unique (e.g., user-driven, based on interoperability principles, used for benchmarking...)**
- It is a comprehensive framework where all topics are equally relevant in principle, although some of them may be more of a priority to deal with for a particular country at a certain maturity level than the others
- The guidance can be used to help answer both strategic and tactical questions

<sup>3</sup> <https://joinup.ec.europa.eu/collection/elise-european-location-interoperability-solutions-e-government/solution/eulf-blueprint/about>

<sup>4</sup> <https://joinup.ec.europa.eu/collection/elise-european-location-interoperability-solutions-e-government/solution/eulf-blueprint/about-interoperability-framework-observatory-lifo>

- It provides a gateway to other information on relevant topics
- It complements the European Interoperability Framework, with which it is fully cross-referenced<sup>5</sup>, as a domain interoperability framework
- There is no "one size fits all" in using location data in different situations. The guidance is designed as a 'toolbox' to be used selectively rather than read throughout.

## 2.2 The European Interoperability Framework

Miguel Alvarez Rodriguez introduced the **European Interoperability Framework**<sup>6</sup>, an overarching framework created under the ISA<sup>2</sup> programme in close cooperation between the Member States and the Commission. The EIF lays out the basic conditions for achieving interoperability, acting as the common denominator for relevant initiatives at all levels, including European, national, regional and local, embracing public administrations, citizens and businesses.

Miguel pointed out that the objective of the EIF is to **inspire European public administrations in their efforts to design and deliver seamless European public services**. To the extent possible, they aim to be digital-by-default, cross-border by-default and open-by-default, fostering cross-border and cross-sectoral interoperability. The EIF is composed of **12 principles, 4 layers, a conceptual model and 47 recommendations**. In addition, Miguel stressed that the INSPIRE Directive had been a source of inspiration for implementing the new version of the EIF by complementing it from a location data perspective.

Like LIFO, the **National Interoperability Framework Observatory (NIFO)** is used to **monitor the implementation** of the revised version of the EIF and help **foster the capacity building policy and modernisation of public administrations**. By doing so, the NIFO aims at becoming an online community of practice and the prime source of information regarding digital public administration and interoperability matters within Europe. NIFO takes stock of the state of play in broader domains related to digitalisation and general interoperability, while LIFO focuses on location interoperability.

The NIFO **EIF monitoring mechanism** aims to provide each participating country with a way to identify areas of improvement in its alignment with the EIF, measuring the degree of implementation of each recommendation. For that, the mechanism exploits both **primary** and **secondary** indicators. The former is gathered from a survey filled in by national contact points. The latter is compiled from existing data sources, such as LIFO, the Open Data Portal, the Digital Economy and Society (DESI) index, the eGovernment Benchmark Report, Eurostat data.... LIFO has adopted the same approach.

Miguel finally described the **EIF Toolbox**, a set of tools designed to guide **national public administrations** and equip them with the tools necessary to implement the EIF. He highlighted that the main purpose of the EIF Toolbox is to provide a comprehensive approach to interoperability and allow its users to access information and reusable solutions when tackling specific aspects of interoperability or designing a new digital service. The EIF Toolbox includes some ELISE solutions, namely the EULF Blueprint, the Re<sup>3</sup>gistry and the INSPIRE Reference Validator (see below).

## 2.3 Using the EULF Blueprint in Slovenia

Tomaž Petek provided a **national-level** perspective on the value of a Location Interoperability Framework and shared the experience of Slovenia in using the EULF Blueprint. He showed how the General Surveying and Mapping Authority leveraged all EULF Blueprint's **recommendations** and **best practices** to assess Slovenia's current situation regarding location interoperability and compare it with their **future goals**. For example, the 2025 Strategy of the Surveying and Mapping authority goes towards implementing the recommendations of the **"Policy and Strategy Alignment"** focus area and, under the **"Standardisation and reuse"** focus area, Slovenia's national standardisation bodies are preparing a national standard for metadata. There are other strategic and operational documents in the pipeline following the principles and implementation guidance of the EULF Blueprint.

<sup>5</sup> <https://joinup.ec.europa.eu/collection/elise-european-location-interoperability-solutions-e-government/solution/eulf-blueprint/eif-relationships>

<sup>6</sup> [https://ec.europa.eu/isa2/eif\\_en](https://ec.europa.eu/isa2/eif_en)

Regarding the LIFO, Tomaž Petek pointed out that Slovenia has exploited it as a tool to monitor and assess the State of Play of location interoperability. It has been possible to highlight some weakness in the "**Return on investment**" focus area, leading to better consideration of the country's open data policy.

Tomaž also explained how Slovenia sees ELISE activities fitting within the broader national and global context. Various initiatives consider geospatial information management a driving force for the digital transformation of society. He mentioned initiatives such as the "**Future trends in geospatial information management**"<sup>7</sup> report prepared on behalf of the United Nations group of expert for global geospatial data management. The report highlights some future trends in **geospatial information management** in the next 5 to 10 years time horizon. It also remarks that the "**Integrated Geospatial Information Framework**"<sup>8</sup> and the "**Geospatial knowledge infrastructure to enhance the world economy, society and environment**"<sup>9</sup> display a very strong link with the EULF Blueprint and its focus areas.

## 2.4 Smart and Sustainable City Ecosystem

From the perspective of **local administrations**, Andrea Halmos from DG CNECT shared the experience of the European Commission in enabling cities and communities to better benefit from the availability of location data, with location intelligence being at the heart of this transformation. DG CNECT's policies and supporting actions follow a similar path to the EULF Blueprint's guidance in the "**Policy and strategy alignment**" focus area, facilitating access to and use of common location data. Moreover, commonalities can also be observed in the "**Digital Government Integration**" focus area through the creation of "**European data spaces**", specifically regarding data space for Climate Neutral and Smart Communities. These data spaces may constitute part of a Smart and Sustainable City Ecosystem data layer as designed in the "Living-in.eu" initiative, representing the European way to the digital transformation in smart cities.

Furthermore, DG CNECT is also helping cities and communities establish interoperable data platforms, which will be enablers to manage cross-sectoral data sets and support developing the right skills that would allow them to benefit from solutions as **digital twins** and **interoperability frameworks** and **standards**.

Significant work has been done by different European projects on **smart cities**, dealing in particular with the so-called **minimal interoperability mechanisms**. The latter is open and reusable means to define a minimum level of interoperability for enabling better data exchange. Such mechanisms will benefit significantly from the exploitation of common location data.

Andrea also referred to the EULF Blueprint's "**Governance, partnerships and capabilities**" focus area, mentioning the importance of **partnerships**. She highlighted that DG CNECT is working with cities and communities that have teamed together based on common values and principles and relying on open and reusable frameworks. Such frameworks allow for better integration of new applications and services.

Finally, she mentioned that DG CNECT is developing a **European interoperability framework for smart cities and communities (EIF4SCC)**, translating the EIF to the specific needs and context of local communities and showcasing best practices to illustrate its principles and guidance. The EIF4SCC addresses all interoperability layers and principles in the EIF and adds a new dimension of cultural interoperability. In this framework and supporting architectures and solutions, location data plays a fundamental enabling role.

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<sup>7</sup> [https://qgim.un.org/meetings/GGIM-committee/10th-Session/documents/Future\\_Trends\\_Report\\_THIRD\\_EDITION\\_digital\\_accessible.pdf](https://qgim.un.org/meetings/GGIM-committee/10th-Session/documents/Future_Trends_Report_THIRD_EDITION_digital_accessible.pdf)

<sup>8</sup> <https://qgim.un.org/IGIF/>

<sup>9</sup> <https://geospatialmedia.net/pdf/GKI-White-Paper.pdf>

### 3 Reusable tools for interoperable location data and reporting

In the second session of the workshop, **Lorena Hernández** from the Joint Research Centre and three guest speakers, **Joeri Robbrecht** - Policy Analyst at the European Commission DG ENV, **Ine De Visser** - Standards Advisor at Geonovum, and **Gobe Hobona** - Director of Product Management, Standards at the Open Geospatial Consortium, provided their perspectives on the **reuse of tools for interoperable location data and reporting**.

#### 3.1 The development of interoperable and reusable tools

ELISE has funded the development of different interoperability tools, including the two flagship solutions, the [Re<sup>3</sup>gistry](#) and the [INSPIRE Reference validator](#).

The Re<sup>3</sup>gistry is a tool that enables effective **management** and **sharing of reference codes**, exploiting the value of **persistent URIs** to ensure that concepts are correctly referenced in every domain. The INSPIRE Reference Validator is a tool that enables **automatic validation of digital assets** based on predefined rules that are entirely customisable. ELISE has designed and developed such tools in a **context-neutral** way to be reused in any domain. They are used in practice in **public administrations** and the **private sector**. Both tools will continue to be developed and maintained under the **Digital Europe Programme**.

The Re<sup>3</sup>gistry and the INSPIRE reference validator share some common features. Both tools are **open source**, have been licensed under the [EUPL 1.2 version](#) and have a **built-in API** compliant with the open API initiative. Both tools have been recently moved to **GitHub** to foster collaboration with developers and rely on a community for gathering valuable feedback on the elements that need to be improved. Furthermore, both tools have been recognised in the **European Interoperability Framework Toolbox**.

#### 3.2 The Dutch validation approach

Ine De Visser showed how the Netherlands has benefited from the INSPIRE reference validator. First of all, she outlined that the Netherlands **does not develop standards without validation tools**. These are necessary to ensure that the interpretation of the standard is carried out coherently. In this regard, the Netherlands has been developing its validators since 2009, moving to ESDIN (European Spatial Data Infrastructure Network) Test Framework (**ETF**) in 2012 and consequently developing the **INSPIRE test rules for metadata, ATOM, Web Feature Service (WFS) and Web Map Service (WMS)**, which are based on the national interpretation of the INSPIRE technical guidelines.

However, although the Netherlands has its own INSPIRE test rules for searching metadata, it has promoted and supported the **development of a European Reference validator**, as all European countries share common data validation requirements. From a user perspective, the Netherlands has seen the advantage of reaching a shared understanding and joint interpretation of the technical specifications to achieve improved location data interoperability at the European level. From a management perspective, they did so to **save time** and **resources** and to have the possibility of **sharing knowledge**. As Ine pointed out, it could be too expensive for a single Member State to develop such tools independently.

In terms of **reusability**, Ine confirmed that the Validator could be used not only for the INSPIRE infrastructure or INSPIRE data sets but also for other domains and additional tests against national data requirements. She, therefore, encouraged Member States to look at common tools such as the INSPIRE reference validator rather than building in-house validation tools.

#### 3.3 Good practices and efficiency involving the INSPIRE reference validator

Joeri Robbrecht framed the use of the INSPIRE reference validator in the policy context of INSPIRE monitoring. When it entered force in 2007, the INSPIRE Directive aimed to **establish a pan European spatial data infrastructure to support policymaking** by facilitating public access to environmental spatial information and promoting common data sharing methods among public sector organisations in Europe.

In May 2015, the Commission launched a package on **Better Regulation** to review EU legislation and check that it was still fit for purpose. In this context, DG ENV launched a **Fitness Check** on the environmental monitoring and reporting systems, including those mandated by the INSPIRE Directive. It was found that INSPIRE

was still fit for purpose, even though a key recommendation was to **simplify the monitoring and reporting process**, with the view to **minimise the administrative burden** on the Member States and the Commission.

The INSPIRE monitoring and reporting system originally included more than **40 indicators** to measure the availability and accessibility of environmental spatial data and the compliance of the metadata services and data structures within the provisions of the INSPIRE Directive annually. This data was **manually** or sometimes **semi-manually recorded** and documented in an Excel file. Every **three years**, Member States provided the Commission with a lengthy monitoring report in their national languages. The production of this report and its translation and processing by the Commission was very resource-intensive. Its textual nature was not always a source of evidence that allowed DG ENV to easily compare Member States' performance.

Therefore, in 2019, DG ENV and the Member States agreed on a fully automated monitoring procedure. The new system was simplified to a significant degree, with 19 instead of over 40 indicators. These indicators are automatically calculated based on the metadata description of the data sets and the data services harvested from the direct use of the INSPIRE Geoportal and the INSPIRE Reference Validator. The triennial reporting was replaced as well by a yearly updated **online country fiche**.

In this regard, the **INSPIRE reference validator** developed under the ELISE action has become a central component. It is used by data providers, solution providers and national procurement coordinators to check whether data sets, network services and metadata meet the requirements defined in the technical guidance and legislation. It enables everyone to measure the compliance of more than **250 000 data sets** or services harvested from **35 data catalogues** in **32 countries**, including Member States and EEA countries.

Joeri wrapped up the main benefits of the INSPIRE reference validator, namely:

- Ground-truth: Monitoring is now based on harvested real-time data.
- Comparability and transparency: Compliance is automatically validated against common business rules; business rules are based on legal provisions and documented.
- Reuse: The reference validator supports standalone deployment, enabling reuse at the national and regional levels and other policy domains.
- Interoperability: The reference validator supports validation rules through common service interfaces (ETS for OGC API – Features under development) and common data models.
- Time- and resource-save: the reference validator has rationalised a lengthy and resource-intensive process.

The INSPIRE Reference Validator is open-source software available on GitHub (<https://github.com/INSPIRE-MIF/helpdesk-validator>)

It can be reused as a corporate component for streamlining reporting and compliance assessment, e.g. by promoting data services and automated validation.

It is fully reusable for compliance/interoperability testing of future High-Value Datasets and data services under the Common European data spaces.

### **3.4 The impact on location interoperability without the INSPIRE reference validator**

The session ended by addressing the following question:

"If the INSPIRE reference validator was not available, what would have been the impact on interoperability?"

**Gobe Hobona** mentioned that, in such a case, the **cost** and **time** taken to implement in-house validation tools would have been much higher. The unavailability of the Validator would have led to a different interpretation of the standards on the developer's side. In contrast, on the consumers' side, differences in implementation would have resulted in barriers to their adoption.

**Joeri Robbrecht** complemented the intervention stating that without the reference validator that **converts** the **legal provisions** of the INSPIRE monitoring into **tangible testing**, it would be challenging for the Member States. In particular, in reaching their location interoperability level, the reference validator provides a **bridge** between the **policymakers** and the **technical implementers**.

## 4 Reuse of location data interoperability principles and methodologies in different sectors

In the third session of the workshop, **Giacomo Martirano**, an external consultant from the Joint Research Centre and three guest speakers, **Gabriele Ciasullo** - "Database and Open Data" Service Responsible at AgID - Italy, **Gema Hernández Moral** - Project manager and researcher at CARTIF - Spain, and **Volker Coors** - Scientific Director at Institute of Applied Research - Germany, provided their perspectives on the reuse of location data interoperability principles and methodologies in different sectors.

### 4.1 ELISE's cross-border pilots and applications to test location data interoperability principles

Giacomo Martirano pointed out how ELISE has developed **cross-border pilots** and **applications** to test **location data interoperability principles** in several sectors:

- In the [marine sector](#), supporting Member States in the management of Marine Strategy Framework Directive (MSFD) related spatial information;
- In the [transport sector](#), developing and sharing best practices for the implementation of the Intelligent Transport Systems (ITS) Directive;
- In the [energy efficiency sector](#), supporting public administrations, businesses and citizens engaged in activities related to different energy policies;
- In the [cultural heritage sector](#), exploiting a pan-European gazetteer service.

For the transport sector, he mentioned that location data interoperability principles and methodologies had been applied in the exchange of road safety data between national road authorities in Sweden and Norway and private sector map providers. In this regard, road authorities upgraded **from quarterly to daily updates to map providers**, with significantly **reduced data error rates** from 25% to 7%. The transportation pilot has been rolled out in 14 countries across Europe under the CEF - Transport instrument, an excellent example of integrating this programme and ISA<sup>2</sup>.

Regarding the energy efficiency sector, he stated that the core applications developed in the ELISE pilot were aimed to **leverage location data at the building level** as an enabling factor to scale-up methodologies to assess energy consumption and performance from local to district/city level and beyond. In the pilot's applications, the directives on the energy performance of buildings have been considered, and policy instruments such as the [Covenant of Mayors](#), which is a voluntary initiative to support the achievement of energy targets in different timeframes. Moreover, Giacomo stressed the importance of **focussing on buildings**, as they are responsible for 40% of final energy consumption, with over 75% of building stock older than 25 years. Finally, he pointed out that the energy efficiency pilot has been executed by co-designing and co-executing several use cases in the frame of **non-monetary collaboration agreements** with all the partners.

### 4.2 A digital platform for public lighting

Gabriele Ciasullo showcased the **digital platform for the public lighting** (PELL-IP) project carried out in Italy. PELL-IP is a national project launched by ENEA (the Italian National Agency for New Technology, Energy and Sustainable Economy Development) for the **energy efficiency of the public sector**. In particular, the project aims at energy efficiency and a new operational management method consistent with the principle of interoperability of geospatial information, with the strategic objective of encouraging **urban and territorial innovation**.

In this context, AgID supported ENEA to define **a data model** in line with the INSPIRE implementation rules and the national rules relating to geo-topographic databases, resulting in a concrete interoperable solution. Currently, together with ENEA, AgID is working to **apply the same methodology and principles** to define a **data model** on school buildings and hospitals, with particular attention to information on the seismic vulnerability.

The PELL-IP project has been included as a use case in the energy pilot of the ELISE action. AgID has carried out a small survey in other countries regarding similar actions and potential reuse of this solution at the European level from this association. Gabriele concluded by stating that a more extensive survey and the

consequent analysis could effectively consider the Italian experience as a good practice for adoption in other countries.

### 4.3 Assessing energy heat demand of buildings

Gema Hernández Moral presented the work developed by [CARTIF](#) to assess the energy heat demand of buildings. For this purpose, the SimStadt tool has been used, performing simulations in four test areas at the district/city level in three Member States. A comparison of the accuracy of the results with the accuracy of the input data used was carried out to foster the reusability of the methodology in other cities/regions.

Furthermore, there has been a focus at the **regional level**. For this purpose, an overview of specific competencies of actors at the regional and national level has been provided to understand the typology of needs concerning location data. An **analysis of relevant available public data** at European and national levels has also been conducted to create a regional energy strategy. The case represented by the Regional Energy Efficiency Strategy of Castilla y León in Spain has been analysed to delve deeper into this analysis. The case has shown the complexity of elaborating a regional strategy when energy can derive from sources often located outside of the region itself.

Finally, the work carried out by CARTIF analysed the **harmonisation of Energy Performance Certificates (EPC) of Buildings**. In this regard, a data model has been developed to overcome the lack of comparability of EPCs across regions/countries. This data model has been applied in two specific local areas of two Member States (Italy and Spain). A **web application has also been prototyped** to make EPC harmonised data accessible to non-GIS experts. Finally, Gema highlighted how the entire methodology developed is easily **reusable** in other regions/countries.

### 4.4 ELISE's support in the Recovery and Resilience Facility

The final part of the session addressed the following question:

"RENOVATE Energy efficiency of buildings" is a flagship area for the Recovery and Resilience Facility investments and reforms. To what extent can the applications developed by ELISE in the energy efficiency sector support the implementation of the Recovery and Resilience National Plans?

From **Volker Coors'** perspective, geospatial data can provide precious information to address problems in various fields, such as **the renovation of buildings**. In this regard, a potent tool is represented by **3D-city models** available all over Europe. It can provide, for instance, the volume of the buildings (precious information for the heating of buildings). These tools also help enable a new way to communicate with citizens, as they mainly renovate the buildings. Further to this, the 3D-city models allow an evaluation of the impact of refurbishment and calculation of the impact of different refurbishment strategies, also helping to make information on buildings more available and transparent.

## 5 Following a user-driven approach

In the fourth session of the workshop, **Simon Vrečar** from the Joint Research Centre and three guest speakers, **Morten Borrabaek** - Mapping Authority, Norway, **Eva Pauknerova** - CUZK, Czechia, and **Ricardo Vitorino** - Ubiwhere, Portugal, provided different perspectives on user-driven approaches regarding location interoperability.

### 5.1 ELISE Knowledge Transfer

Simon Vrečar pointed out that the [Knowledge Transfer activity](#) has a central role in achieving the overall aims of ELISE by reaching the highest possible number of users. Knowledge transfer is a complex process of disseminating knowledge from one individual, team or organisation to another. Simon stressed that it is pivotal to establish mutually beneficial collaborative communities and stakeholders to create an interactive environment, enabling co-creation and open innovation while turning ELISE outputs into actionable knowledge for the community.

Moreover, Simon highlighted the following guiding principles of Knowledge Transfer:

- Interoperability
- Usability
- Openness
- Guidance and advice
- Capacity building and skill
- Networking and participation
- Collaboration and partnerships
- Innovation and experimentation
- Accessibility
- Transparency

During these past five years, he also pointed out, ELISE had organised more than **50 public events** with over **3000 participants**. During these events, different pools of experts and stakeholders from government, business and civil society sectors have shared knowledge and experience.



**Figure 6** – ELISE knowledge transfer supporting the stakeholder community

## 5.2 Modernising the SDI

Morten Borrabaek stated that, in the digital transformation process, Member States are experiencing a **shift** from the **traditional SDI** towards **location enablement** and **location intelligence** to feed the **digital economy**. Moreover, he added that if this transformation is exploited correctly and efficiently, it can transform decision-making processes, the way governments operate, and their services to citizens.

He believes that **geospatial literacy is the key enabler for this shift to occur**. In this regard, the SDI community must understand the needs of public administrations while public administrations need to know how to exploit the value of geospatial data in their applications. All the three components of a geospatial **body of knowledge** are essential to understand the **needs, challenges** and **technologies** related to geospatial information and services in the context of the digital transformation process:

- Knowledge: the understanding or information about a subject, which is gained through experience or by study;
- Skills: the ability to use methods, tools, etc.;
- Competency: the ability to apply the knowledge.

In this context, ELISE has delivered different studies, webinars, and articles, highlighting the role of geospatial information and solutions in the digital transformation of government, which form a relevant part of the 'geospatial body of knowledge'.

## 5.3 The European Union Location Framework

Eva Pauknerová carried out a deeper analysis on the **European Union Location Framework** (represented in the EULF Blueprint), analysing its evolution from the perspective of **knowledge exchange**. She remarked that the INSPIRE Directive is an example of interoperability implementation in Europe, but this could create another silo as it primarily targets environmental policies. At the same time, location information is relevant to many other domains.

Eva recalled that relatively early in implementing the INSPIRE Directive, the Working Group on Geospatial Solutions, built under the ISA-ISA<sup>2</sup> programme, was turning attention to the fact that **location data** and **geospatial information** were significant in all parts of governmental services and agendas. Therefore, it is needed to create a bridge between **SDIs** and **INSPIRE** and the **digital transformation process of governments**. In this context, the European Union Location Framework was created by incorporating the main principles to monitor and evaluate location interoperability in various domains.

She also mentioned that stakeholders had debated a lot on interpreting and using such a framework. In this regard, the **Location Interoperability Framework Observatory (LIFO)** was developed and launched through a collaborative process as a pilot in 2017. LIFO was then deployed in 2019 and 2020 to monitor the adoption of good practices in the framework and understand the latest play in Europe while collecting concrete examples to illustrate these good practices.

## 5.4 The relationship between user-driven approaches and knowledge transfer

Ricardo Vitorino, whose expertise focuses on software development for telecom and smart cities, mentioned that while working on developing solutions related to those domains, he always gives prime consideration to the needs and views of **end-users**. The latter involves understanding their current challenges or pain points and assessing what **approach** and **standards** work best for their context, thus basically doing matchmaking between their requirements and needs with the market offers.

He believes that opening up the discussion between the end-users and those doing research and development is the best way to achieve the benefits of interoperability and overcome the political barriers present in the process.

## 6 Panel session

In the final section of the workshop organised as a panel session, all speakers shared their thoughts on

What they see as important in the future in terms of location interoperability and how future initiatives can support their activities?

Miguel Alvarez Rodriguez believes that ELISE is going in the right direction: **Interoperability needs frameworks and tools and specific guidelines**. He also encouraged the ELISE community to continue building on the experience gained so far, added that it is essential to **raise awareness** on this topic. DG DIGIT can help on this as it is dealing with the same challenges in the broader interoperability domain.

Andrea Halmos focused on the importance of the **use cases** to assess the concrete implementation and the demand for location information. She highlighted the importance of the examples showcased during the workshop for **smart cities** and **communities** to gather **common conclusions** and **interoperability solutions**. Moreover, Andrea pointed out the importance of using **location data** with **different local ecosystem actors** (such as the private sector or the citizens), bringing together different stakeholders such as in the INSPIRE community. She also affirmed that the upcoming **Digital Europe Programme** would place funding opportunities to procure interoperable platforms for cities, creating a data space for smart communities using location intelligence. An **EU toolbox for local digital twins** will also be created, comprising reusable tools and interoperable reference architectures and mechanisms.

Gabriele Ciasullo highlighted the need to effectively disseminate the recommendations defined in the EULF Blueprint, especially regarding **digital government integration**. Gabriele affirmed that these recommendations represent the tip of the iceberg to support location interoperability, and therefore the starting point for future initiatives in the Member States. He also underlined that LIFO should continue following this same path.

Morten Borrabaek pointed out that, in the process of shaping Europe's digital future, digital transformation should put "people first" by **continuing to build a professional GIS community** and open **new opportunities for businesses**. He added that the combination of spatial data and other data from public administration and business and their exchange with technical tools and infrastructures is a priority task. These facts will impact technologies and the underlying standards, as the spatial components will probably be more integrated with mainstream ICT. It is expected similar actions will be continued in the Digital Europe Programme.

Joeri Robbrecht pointed out that many initiatives are ongoing regarding interoperability, from the Data Governance Act through reviewing the European Interoperability Framework and INSPIRE as an interoperability framework for spatial data. He believes it is crucial to ensure there are **synergies** among all these initiatives, both in terms of **legislative initiatives** and **funding opportunities**, especially given the upcoming Digital Europe Programme. Moreover, he added that it is essential to develop a **common understanding** of what is feasible for the Commission, the Member States and all actors in producing and sharing data. To achieve these goals, it is important to have a **minimum legal framework** that identifies the **usable building blocks** and **minimum interoperability mechanisms** on the technical, semantic and legal levels in a common framework supported by private and public sectors.

Eva Pauknerová welcomed the incorporation and support of the **INSPIRE reference validator** together with other **supporting tools** in the Digital Europe Programme. She also understood from the pilot projects promoted by ELISE that more efforts should be made in the future for the sustainable financing of pan-European services by reformulating funding concepts. The pilot projects also indicated ways to go beyond single national cases.

Ricardo Vitorino pointed out that, while there is still a focus on **digitising solutions** and **public governments** through the cloud, it would also be beneficial to consider the **distribution of computing units, sensors** and the **mobile network** throughout the urban environments. These technologies will analyse the data in a specific urban setting, leveraging the efficiency of novel networks and equipment. So, while working on interoperability and allowing for this distributed equipment to run, Ricardo stressed the importance of using this infrastructure for data exchange and **more efficient use of interoperable solutions**.

Volker Coors highlighted the importance of the **availability of data**, which does not necessarily mean sharing the data. In this regard, he believes that APIs' development has a considerable impact on integrating interoperability processes into tools and software available for businesses and citizens, therefore boosting the **co-creation process**.

Tomaž Petek noted that we are still far away from operational interoperability. We have ensured the legal and technical conditions. Still, future challenges will be oriented towards **continuous knowledge** and **capacity building**, developed within local and national geospatial and non-geospatial domains alike. Skills and partnerships are necessary to implement what is potentially possible. There are still some semantic issues to address, but he is confident that they will be addressed soon.

Gema Hernández Moral stressed the **importance of interoperability** and the **use of standards** to reuse and share data. She believes that users should not be frightened by the complexity of this topic. Tools such as the Validator and tutorials explaining the benefits of using common procedures and standards can be very helpful in this sense.

Gobe Hobona from the Open Geospatial Consortium pointed out that in the future, it will be important to **improve interoperability as a community**, specifically for **location-enabled systems** and reaching users and developers beyond the strict professional geospatial domain. One way to achieve this goal is to adopt **web APIs** and the development, for instance, **OGC API standards**. Gobe also stressed that it would be important to undertake, for example, hackathons and action programmes like ELISE. These activities could help to raise awareness on location interoperability and standards among organisations and developers.

Finally, **Francesco Pignatelli** concluded by reaffirming the importance of **data interoperability**. He stressed that the ELISE Action has enabled close contact with stakeholders across the Member States and has helped enlarge and integrate the geospatial community with wider digital government stakeholders. ELISE will continue for about one year more, but **ELITE** (*European Location Intelligence and Technology Enablers*) is about to 'take the baton' under the Digital Europe Programme. In the meantime, JRC is working with DIGIT on interoperability policies to overcome gaps related to location information.

## 7 Conclusions

The DigitALL Public conference represented the culmination of the CEF and ISA<sup>2</sup> programmes and an opportunity to demonstrate and celebrate the achievements in these flagship programmes, progressing European digital policies and helping the Member States transform their digital public services and connect with other stakeholders across Europe. Within the event, ELISE, the ISA<sup>2</sup>'s geospatial action, took its opportunity to show what it had achieved, with the help of stakeholders in Member States public administrations and representatives from European Commission DGs, business, the private sector and academia.

The challenge was to demonstrate the extent of ELISE and the scale of achievements in the 90 minutes of the workshop. Unlike many ISA<sup>2</sup> actions, which focus on a single major topic, ELISE has addressed an extensive range of objectives and topics in the geospatial domain, from strategy to implementation, from policy to people, from sharing of basic reference data to the collection and reuse of new streams of data from sensors and other devices. Moreover, ELISE contributed to balancing trust and technological innovation and provided a forum for stakeholders across Europe to exchange ideas, collaborate in innovative ways, and develop skills needed to exploit location data for decision making in this new digital age.

The event took the form of a 'quick fire' demonstration of the different strands of ELISE, organised by facilitators from the ELISE team and gave an external perspective on the importance of the topics tackled by ELISE, the value created by activities undertaken by ELISE, and the opportunities offered for collaboration and learning within the scope of ELISE.

ELISE covered studies, frameworks, tools, applications and knowledge sharing describes the areas that ELISE operated but didn't convey the depth of analysis and the extent of outreach undertaken by the action. The time available meant that far more was left out than was included in the event. The focus was, by design, on those activities that have impacted the broadest range of stakeholders. Consequently, many of the studies on technology applied to the future digital transformation of government were not included and will demonstrate their value in the future Digital Decade.

On the 'here and now', ELISE has achieved a successful outcome, based on the feedback from public administrations in Europe, business collaborators and partners in other European Commission DGs. ELISE currently has the only 'domain interoperability framework', complementing the EIF. INSPIRE is seen in ISA<sup>2</sup> as a beacon in the field of large-scale interoperability policy. There is a relevant role of location data in policy and digital public services and a positive contribution from INSPIRE and the geospatial actions in ISA and ISA<sup>2</sup> in progressing this important agenda.

It was interesting to see the perspectives both in national and local public administrations, with an important role for location data in the development of smart cities and communities and introducing a domain interoperability framework, EIF4SCC, in the local context. Local administrations are fundamental 'pockets of innovation' in location-enabled digital public services, supported by digital twins and urban digital platforms. The workshop remarked on the importance of public-private sector collaboration in these contexts and an important future through the Digital Europe Programme.

Location data plays a crucial role in the various sector data spaces envisaged in the European data strategy and supported through the Digital Europe Programme. But location data will need to be integrated successfully with thematic data in many different sectors. ELISE has proven that it can help environment policy evolution with INSPIRE validation tools. It can also help other sectors such as energy efficiency of buildings and intelligent transport systems, applying best practice principles and solutions in different contexts.

However, there are still challenges to overcome. The LIFO monitoring has identified successful interoperability measures in different Member States and helped share best practices. However, progress is not homogeneous. There are still 'interoperability gaps' of many types that need to be addressed to foster the digital government agenda. ELISE has demonstrated it can help fill these gaps, not just with frameworks, technical solutions and tools but, importantly, with actions to share knowledge and develop skills associated with location-enabled digital transformation. Future action through ELITE can support the [Interoperability Academy](#) and Digital Innovation Hubs. However, the success of Europe's digital future can only be made by the people involved in the journey, both providers and users of digital public services. They should be the focus of future activities, evolving from ELISE.

## List of abbreviations and definitions

AgID	Italian Agency for Digital Identity
AI	Artificial Intelligence
API	Application Programming Interface
ARe <sup>3</sup> NA	A Reusable INSPIRE Reference Platform
CEF	Connecting Europe Facility
DESI	Digital Economy and Society Index
DEP	Digital Europe Programme
DG CNECT	Directorate-General Communications Networks, Content and Technology
DG DIGIT	Directorate-General Informatics
DG ENV	Directorate-General Environment
EDGES	European Digital Government EcoSystem
EEA	European Economic Area
EIF	European Interoperability Framework
EIF4SCC	European interoperability framework for smart cities and communities
ELISE	European Location Interoperability Solutions for E-government
ELITE	European Location Intelligence and Technology Enablers
ENEA	Italian National Agency for New Technology, Energy and Sustainable Economy Development
EPC	Energy Performance Certificate
ETF	ESDIN Test Framework
EULF	European Location Framework
GDPR	General Data Protection Regulation
GIS	Geographic Information System
ISA	Interoperability Solutions for Public Administrations, Businesses, and Citizens
JRC	Joint Research Centre
LIFO	Location Interoperability Framework Observatory
NIFO	National Interoperability Framework Observatory
OGC	Open Geospatial Consortium
PELL-IP	Digital Platform for the Public Lighting
SDI	Spatial Data Infrastructure
WFS	Web Feature Service
WMS	Web Map Service

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