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European Union Location Framework Blueprint

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ELISE

Enabling digital government through geospatial & location intelligence

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Abstract

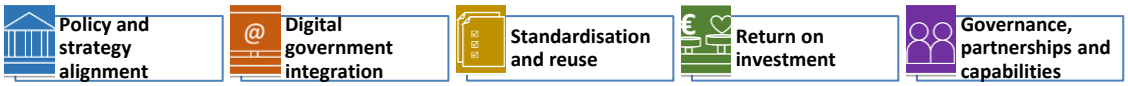
Location data is fundamental to digital public services and the wider economy, delivering value in combination with other data, and supporting innovation through 'location intelligence'. In this context, there is a need for interoperability supporting these services across Europe, and an important role for both government-authorised core location data and sector-specific location data.

The European Union Location Framework (EULF) project, which was part of the Interoperability Solutions for Public Administrations (ISA) programme took action to tackle these challenges. The EULF vision is to create and promote a coherent European framework of guidance and actions to foster cross-sector and cross-border interoperability and use of location information in digital public services, building on national SDIs and INSPIRE1, and resulting in more effective services, savings in time and money, and contributions to increased growth.

The EULF Blueprint is a guidance framework for a wide audience to implement the EULF vision. It is based on an extensive EU survey and consultation with stakeholders and therefore embodies a wide range of views and experience. The EULF Blueprint has been updated periodically to keep pace with developments. This updated version (v5) has been produced by the European Location Interoperability Solutions for e-Government (ELISE) project, which is part of the ISA[2] programme. An online version of the EULF Blueprint content is also available on Joinup. The principles and good practices will be increasingly relevant as the EU progresses to the next stages of its digital and data strategies.

The document is aimed at six types of readers: Policy Maker; Digital Public Service Owner, Manager or Implementer; Information and Communications Technology (ICT) Manager, Architect or Developer; Data Manager or Data Scientist; Public Sector Location Data Provider; and Private Sector Product or Service Provider. There are 5 focus areas identified in the EULF Vision, presented in **Figure 1** below.

Figure 1: Five focus areas of the EULF Blueprint



The EULF Blueprint is organised as follows: for each focus area, the 'current state' assessment and 'vision' are outlined. The key points for progressing from the current state to the vision are then expanded into a series of 19 recommendations, each describing the rationale and expected benefits (why?), a checklist of associated actions (how?), potential problem areas in implementing the recommendation (challenges), a variety of best practices across Europe where this has been done successfully, links to Location Interoperability Framework Observatory (LIFO) monitoring information for the recommendation, cross-references to related recommendations in the European Interoperability Framework[2] (EIF) and the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) Integrated Geospatial Information Framework (IGIF), and additional resources from ELISE and elsewhere related to the recommendation.

The annexes complement this actionable framework with descriptions of selected best practices, a series of benefits illustrations for different applications, cross reference tables linking the main building blocks of the EULF Blueprint with the EIF and the IGIF, and guidance for the reader through a role-based discovery of the relevant recommendations.

A series of separate guidance documents complements the Blueprint framework, providing more detailed guidelines, methodologies and good practices for particular topics. The recommendations refer to these guidance documents. While the EULF Blueprint is targeted at decision makers and managers at EU and national levels, the guidance documents and tools are especially relevant for practitioners.

[1] Directive 2007/2/EC establishing an Infrastructure for Spatial Information in the European Community (INSPIRE): http://inspire.ec.europa.eu/inspire-directive/2

[2] The European Interoperability Framework (EIF) is part of the Communication (COM(2017)134) from the European Commission adopted on 23/03/17. The framework gives specific guidance on how to set up interoperable digital public services. Allied to the EIF, the European Union Location Framework (EULF) Blueprint is a guidance framework on location interoperability for policy and digital public services.

Change history

The EU Location Framework Blueprint has evolved through a series of versions, which have taken on board new EU policy priorities, advances in the use of location data for policy and digital public services, and opportunities afforded by new technologies (see **Table 1**).

Table 1: EU Location Framework Blueprint Change History

Version	Date	Main changes
1.0	2017	- Initial publication
2.0	2018	- A new introduction was included to emphasise the strategic importance of location data and its role in digital government transformation. - The recommendations, checklists and reference materials were refreshed to include additional content and improve readability. - A new recommendation was added on data quality, Additional content was provided on new technical themes, including MESH architectures and APIs. A number of new best practice use cases were added. - Some of the recommendations were reworded. The supporting text was simplified and the checklists were made more 'actionable'. - Initial online version published.
3.0	2019	- The main findings were incorporated from an ELISE study on the impact of the General Data Protection Regulation (GDPR), which came into effect in May 2018. - There were a number of updates to reflect new developments, e.g. an updated Gartner Hype Cycle, additional considerations on the use of APIs, and some new reference materials. - A number of changes were made to improve readability, including creating more structured "how to" checklists for each recommendation. The actions are grouped under sub-headings, which were used to define priority questions for the Location Interoperability Framework Observatory (LIFO) assessment of location interoperability in Member States. - The revision mirrors the layout of the online guidance, enabling readers to move easily between the two formats.
4.0	2020	- Inclusion of a foreword positioning the EULF Blueprint as the ISA^2 Programme draws to a close. - Rework of the introduction, with a new Gartner hype cycle of digital government technologies – 2019 and assumptions on some of the main definitions - Addition of a cross-references between the European Interoperability Framework (EIF) and EULF Blueprint recommendations. Review and update of links and further reading to ensure they remain applicable. - Updates to the 'current state' and 'future vision' for each focus area, taking into account the findings of the ELISE studies and the LIFO 2019 survey. - Refocusing some of the recommendations to reflect developments in European digital and data policy and give greater emphasis on data ecosystems, digital platforms, location intelligence and technology-enabled innovation - Addition of a cross-reference table between EULF best practices and EULF Blueprint recommendations. Inclusion of several new best practices drawn from ELISE studies and the LIFO 2019 survey. - Cross-references to the recently published ELISE study: The Role of Spatial Data Infrastructures in the Digital Government Transformation of Public Administrations - An updated glossary, including new entries for spatial data infrastructures, data ecosystems, digital twins, European data spaces, high value datasets, and location intelligence.
5.0	2021	- Cross-references to the UN-GGIM Integrated Geospatial Information Framework (IGIF), so that users planning their activities can combine the resources of both frameworks.

Version	Date	Main changes
		- Extending the cross-references to the EIF in the EULF Blueprint recommendations to include the EIF pillars in addition to the existing links to the EIF recommendations. - Tables of relevant ELISE resources for each of the EULF Blueprint recommendations. These include studies, guidance, surveys / benchmarking, videos, webinars, workshops, presentations, training resources, solutions / tools, and pilots / testbeds. - Links from the EULF Blueprint focus areas and recommendations to the corresponding LIFO reports and interactive dashboard capabilities. - Updates to the three recommendations in the Return on Investment focus area, including additional guidance on policy assessments and business cases, approaches to monitoring and communication, relevant benefits case studies, and industry views on how to derive benefits from the Open Data Directive and European Data Strategy. - A new *Benefits Illustrations* annex summarising benefits of location data and associated interoperability measures for different applications. - Further guidance and examples on the use of location data and location intelligence in local and community situations, including relevant interoperability standards, integration of technologies, and examples in innovation for local communities. - Additional further reading for each of the EULF Blueprint recommendations. - Improved navigation and usability for the EULF Blueprint online version.

From Version 2 onwards the Blueprint content has also been made available on the Commission's Joinup website. New releases of the document are mirrored in the online version. After the completion of the ISA^2 programme in 2021, it is envisaged that the EULF Blueprint will have a continued role as a domain interoperability framework complementing the EIF.

Executive summary

Blueprint for digital government transformation in Europe through a user driven Spatial Data Infrastructure (SDI)[3]

The European Union Location Framework (EULF) Blueprint is a **guidance framework for using location information in policy and digital public services**. It has been developed in the ISA² Programme and the predecessor ISA Programme and is fully aligned with the European Interoperability Framework (EIF), through its attention to all aspects of '**location interoperability'**. The Blueprint contains recommendations and implementation guidance on **how to use location information effectively and innovatively in policy and digital public services** (**demand-side guidance**) and **how to create a user-driven SDI** that will support the needs of those developing these policies and services (**supply-side guidance**).

Location information continues to play an important role in European policy and digital public services. European politicians have sought to enhance the regulatory environment around the collection, sharing and use of data through general polices such as Public Sector Information (PSI), open data, the General Data Protection Regulation (GDPR), the EU data strategy and associated legislation, and thematic policies associated with, for example, earth observation - Copernicus, environment - Environmental Information Directive (EID), Infrastructure for Spatial Information in the European Community (INSPIRE), transport – Intelligent Transport Systems (ITS), and energy – Energy Efficiency Directive (EED), Energy Performance of Buildings Directive (EPBD). Location data is integral to the wider data policy landscape, contributing to important policy developments in areas such as climate change and energy sustainability, health, transportation, regional and urban development, migration and cohesion policy.

In some areas, we are seeing step changes in policy, fuelled by new access to data. Location information is a basic building block in many digital public services but this requires integration with multiple data sources. There is a general recognition of the importance of 'high value datasets' of which location data is part, and the need to integrate these datasets. European ICT and data interoperability initiatives such as ISA² and INSPIRE aim to support, for example, the goals of the European Digital Single Market and globally the UN Sustainable Development Goals. Interoperability measures have supported policy evidence through capture of location-based statistics and widespread use of spatial analyses.

Implementing digital public services benefits from interoperability in relation to the different principles and levels of the European interoperability framework (EIF). Geospatial or location interoperability has been a major feature of both the ISA² Programme and the predecessor ISA Programme. There was a strong basis for this with the adoption and implementation of INSPIRE over the last thirteen years. INSPIRE has driven forward the implementation of harmonised pan-European geospatial data for European environmental policy.

INSPIRE, as a European SDI, is defined as 'metadata, spatial data sets and spatial data services, network services and technologies, agreements on sharing, access and use, and coordination and monitoring mechanisms, processes and procedures, established, operated or made available in accordance with the Directive[4]'. Both this definition and the INSPIRE principles are **supply** focused. INSPIRE has, of course, listened to users and responded with data validation, discovery and access improvements.

Complementing the INSPIRE programme, the EULF, ARE³NA and ELISE actions in ISA and ISA² have developed location interoperability frameworks and solutions supporting cross-sector and cross-border digital public services and focusing on the **use** of harmonised authoritative location data based on INSPIRE and other sources of standardisation.

The guiding framework for these efforts has been this **EULF Blueprint**, a distillation of good practices in the field of location interoperability, which has been regularly updated to reflect ongoing developments in digital government transformation and in the ICT and geospatial industries supporting this transformation. The Blueprint complements the EIF as a domain-specific framework of goals, recommendations, supporting actions and reference materials, applying the principles of the EIF. The EULF Blueprint cross-references the relevant parts of the EIF. Similarly, the Blueprint is part of the EIF Toolbox and users reviewing EIF solutions can examine relevant geospatial materials related to their investigations.

[3] In general terms, an SDI may be defined as 'a framework of policies, institutional arrangements, technologies, data, and people that enable the effective sharing and use of geographic information' (Bernard et al, 2005)

[4] Directive 2007/2/EC Article 3

This 'location interoperability[5] framework' (LIF) spelt out in the Blueprint addresses **five key focus areas** identified by ISA[2] stakeholders and the wider geospatial community: policy and strategy alignment, digital government integration, standardisation and reuse, return on investment and governance, partnerships and capabilities. Recommendations and associated guidance support the vision of innovative digital public services enabled by interoperable location information and location intelligence capabilities, with a more detailed set of goals (target vision) expressed for each of these five focus areas.

This European guidance framework complements resources available on the policy aspects and technical implementation of INSPIRE as well as providing a geospatial perspective in relation to broader data and digital policies. The geospatial community globally is highly active in promoting standards-based interoperability, through the work of the UN-GGIM[6], OGC[7], ISO/TC 211, the World Geospatial Industry Council (WGIC), and the Geospatial World Forum (GWF). JRC also helped develop the survey framework for a global study on Geospatial Information and Privacy carried out by WGIC, based on the ELISE guidelines for public administrations on location privacy.

This new version of the Blueprint not only extends the links with the EIF it also introduces for the first time a comprehensive cross-reference to the UN-GGIM Integrated Geospatial Information Framework (IGIF). This means that public administrations in Europe, and globally, planning their geospatial activities can use the Blueprint as the route to both sets of guidance.

However, the EULF Blueprint is uniquely positioned as it addresses the use of location information in the context of policy and digital public services and the application of location interoperability good practice to support digital innovation needs of all public administrations. It focuses on user centricity both from the perspective of consumers of location information (e.g. policy analysts and developers of digital public service solutions) and providers of location information for policy and digital public service (e.g. mapping and cadastral agencies, operational public sector bodies, external companies and end-users of digital public services). In this context, an organisation may be a consumer of location information, a provider of location information or both.

The Blueprint goes beyond delivering a data framework, it is written in the context of policy and digital public services and their technology-driven transformation. With this in mind, topics addressed include collaborative business models for public service delivery, enabling modern data ecosystems, user-centric design of location-enabled digital public services, support to SMEs, use of authoritative core reference datasets, open data and licensing simplification, and location data interoperability and privacy measures.

Table 2 below outlines the good practices for providers and users of location data in each focus area, which, together, constitute the 'Blueprint for digital government transformation in Europe through a user-driven SDI'. Details are given on these good practices in the document.

The EULF Blueprint is available both as this **document** and as a structured methodology **online** in Joinup. The document version is intended to be used as a reference rather than read in its entirety. Similarly, the online version enables users to find the appropriate parts of the framework for their needs and to link with relevant detailed guidance, training materials and external resources as required. Complementing the EULF Blueprint, related ELISE resources comprise:

- **detailed guidance** on specific topics in the Blueprint. This includes guidelines for public procurement of geospatial solutions, design of location-enabled digital public services, architectures and standards for SDIs and digital government, and guidelines for public administrations on location privacy;
- **studies** on topics such as Assessment of economic opportunities and barriers related to geospatial data in the context of the digital single market; Digital platforms for public services, and Digital government transformation; and
- **training** resources including a Geospatial Primer and webinars on topics such as the Role of SDIs for digital government transformation, Location intelligence to support sustainable development goals, and Governance models, ecosystems and benefits of APIs for public sector organisations.

[5] Location interoperability is the ability of organisations, systems and devices to exchange and make use of location data with a coherent and consistent approach

[6] see UN-GGIM Integrated Geospatial Information Framework (IGIF) and The Global Statistical Geospatial Framework

[7] see OGC standards, best practices and white papers

Table 2: Blueprint for digital government transformation in Europe through a user-driven SDI – Good practices for providers and users of location data

Focus Area	Provider good practices	User good practices
Policy and strategy alignment	• Aligned digital, innovation, and location policies • Interconnected approach to data policy and data governance, incorporating location data in wider data policy implementation, e.g. open data, PSI, GDPR • European data policy alignment • Structured approach to e-reporting	• Cross-sector policy alignment on use of location data • Use location-based evidence to inform policy • Protect personal data, incorporating 'location privacy' measures • Standards based procurement of location data and services
Digital government integration	• Make data easily discoverable and accessible • Publish open core location data and other open location data where possible • Use simple standardised (machine readable) licensing schemes • Build and adapt the SDI according to user needs and priorities (data ecosystems, key services, public and external organisations; analytical support capabilities) • Integration within wider data frameworks, e.g. national, thematic, international	• Optimise use of location data in digital public services • Use authoritative SDI datasets and common access mechanisms • Collaborative agile development • Feedback to providers on data quality • Collaborative business models for location-enabled digital public services • Reusable models for specific data ecosystems based on authoritative open location data (e.g. smart cities) • Use of new technologies to deliver innovation, e.g. digital twins, digital platforms, AI, location intelligence • Integrated location-based statistics
Standardisation and reuse	• Standardised framework for heterogeneous and agile use • Simple cross-sector interoperability models – core datasets, basic multi-purpose models, persistent identifiers, integration with other public sector core data and different thematic / international standards (e.g. road transport, BIM) • Simple modern data access, e.g. metadata, web access, APIs, micro services, event stream processing • Include dynamic (e.g. IoT) and satellite data in the SDI with necessary localised processing and standard access mechanisms • Include relevant external data in the SDI in a structured way (e.g. community-sourced, business data) • Affordable data quality regime, balancing needs and based on agreed standards and service levels	• Use recognised architectural principles and standards in building digital public services • Reuse data, standard access mechanisms (e.g. APIs) and other ICT assets (e.g. software components from sources such as GitHub) • Feedback to providers of tools and services (e.g. APIs) to improve quality.
Return on investment	• Funding agreements for pan-government and open data access • Efficiencies in location data collection and supply • Integration with alternative sources of supply, e.g. private sector / citizens • Providing access to location datasets and expertise for evaluation purposes	• Benchmarking and improvement • ROI case studies • Support location data innovation in relevant communities (e.g. smart cities, energy, health, construction) • Promote innovation in and with the private sector using public sector location data
Governance, partnerships and capabilities	• Cross-sector governance of core data, including location data • Inclusive transparent governance models, involving users • Data supply and data ecosystem partnerships • Geospatial competency framework • Awareness raising and skills programmes	• Partnerships in acquisition and use of data in digital public services • Share learning on digital government innovation

Monitoring the adoption of good practices from the EULF Blueprint is being carried out through a Location Interoperability Framework Observatory (LIFO), which corresponds in concept to the type of monitoring carried out for the EIF using the National Interoperability Framework Observatory (NIFO). The LIFO survey is based on indicators for each of the recommendations in the EULF Blueprint. Analysis of results is produced in the form of Country Factsheets and an overall State of Play Report. There is also a set of LIFO Interactive Dashboards to query results online. This new version of the Blueprint cross-references relevant LIFO monitoring information, enabling readers to examine the state of play on the adoption of the Blueprint good practices in Europe.

Member States are also required to provide monitoring data for the implementation of INSPIRE, with much of the evidence now captured via the INSPIRE Geoportal. Whereas INSPIRE monitoring is mandatory and concentrates on reporting progress on obligations regarding provision of data, metadata and services to access the data, the complementary LIFO monitoring is voluntary and focuses on the use of harmonised authoritative location data in digital public services and wider measures across the different levels of the EIF. INSPIRE monitoring also provides secondary indicators for the LIFO.

New policy context

As the ISA^2 programme draws to a close in 2021, we are seeing through related developments an even greater recognition of the importance of the data economy for public administrations, businesses and citizens and the need for a harmonised pan-European approach. The Directive on Open Data and PSI ('Open Data Directive'), which entered into force in July 2021, requires certain high value datasets of benefit to the economy and society to be made available free of charge, in machine readable formats and accessible through Application Programming Interfaces (APIs). These high value 'open' datasets include important location datasets such as addresses, geographical names, cadastral, agricultural, earth observation, transport and weather data. An Implementing Act on High Value Datasets (Q3/2021) defines specific rules supporting the commitments in the Open Data Directive.

The EU's digital strategy 'Europe Fit for the Digital Age' (02/2020) contains key elements on digital and data transformation. Key targets were set for Europe's Digital Decade to 2030 (03/2021) through a Digital Compass with four dimensions: skills, infrastructures, businesses and government. A monitoring system based on the Digital Economy and Society Index (DESI) will measure progress towards each of the 2030 targets. On cross-border interoperability, the EU Single Digital Gateway regulation (10/2018) applies from 12/2020, with further legal obligations on availability of information from municipal authorities (12/2022) and use of the 'once-only' system (12/2023).

Another key element of the EU's digital strategy, the European data strategy (02/2020) envisages setting up a series of demand-driven common European data spaces supported by a federated cloud infrastructure in thematic policy areas such as health, mobility and environment, with a "High Impact Project" planned from 2021-27. To support this, the Data Governance Act (11/2020) aims to foster the availability of data by increasing trust in data intermediaries and by strengthening data-sharing mechanisms for data voluntarily made available by public administrations, businesses, individuals and researchers,

Implementation of the environmental 'Green Deal' data space, will include a review of INSPIRE in 2021-22 and an initiative called *Destination Earth* to set up a digital twin of the earth. Links with industry are central to the strategy, including re-use of public sector data, integration of business data in the data spaces, re-use of data about individuals while maintaining rights to privacy, and co-funding of the cloud infrastructure. Core location datasets such as addresses, geographical names, administrative units and transport networks will have an important role to play in all thematic data spaces. Other core reference datasets such as businesses will also have a significant cross-cutting role. An integrated governance approach will be needed to address cross-cutting requirements. Other related developments in data legislation are the Digital Markets Act (12/2020), which regulates powers regarding user data held by online platforms, and the Data Act (Q4/2020), which aims to create a fair data economy by ensuring access to and use of data for legitimate purposes, including B2B and B2G situations.

Artificial Intelligence (AI) is a fast-evolving family of technologies that can support socially and environmentally beneficial outcomes and provide key competitive advantages to companies and the European economy. The European regulatory framework for trustworthy AI is laying down harmonised rules on artificial intelligence (Artificial Intelligence Act, 04/2021). Such action is especially needed in high-impact sectors, including climate change, environment, health, finance, mobility, home affairs and agriculture. Access to high quality data is an essential factor in building high performance, robust and trustworthy AI systems. In this respect, the High Value Datasets (including geospatial datasets) and the access provisions of the Open Data Directive are an important part of the jigsaw.

In July 2020, the Multiannual Financial Framework (MFF) for 2021-2027 was adopted to fund the Next Generation EU. As part of the new MFF, the Digital Europe Programme (DIGITAL) will focus on building the strategic digital capacities of the EU and on facilitating the wide deployment of digital technologies. With an overall budget of €8.2 billion, it will shape and support the digital transformation of Europe's society and economy through investments in supercomputing, artificial intelligence, cybersecurity and digital skills. Interoperability and the EIF have set a strong base for digital transformation and are seen as having continued importance in Europe's future digital strategy.

In the Berlin Declaration on Digital Society, signed in December 2020, Member States committed to building a reinforced and interoperable digital government transformation policy and to supporting digital transformation of public administrations. During 2020/21, an assessment has been made on future interoperability policy and the evolution of the EIF. Going forward, we can expect steps to make the EIF more actionable and to create streamlined governance around interoperability. Finally, the COVID crisis over the last two years has demonstrated the importance of interoperable healthcare and other public processes, the value of location-based analysis for decision-making, and has accelerated trends in remote working and services and use of public spaces.

The principles and guidance in the EULF Blueprint are very tightly aligned to the aims of the European data strategy and the Open Data Directive and will be of value as the Commission and Member States implement these two initiatives. The EULF Blueprint will also have continued relevance through its alliance with the EIF as the EU seeks to derive synergies and value from the European data strategy, the Open Data Directive and the Digital Europe Programme.

September 2021

Introduction

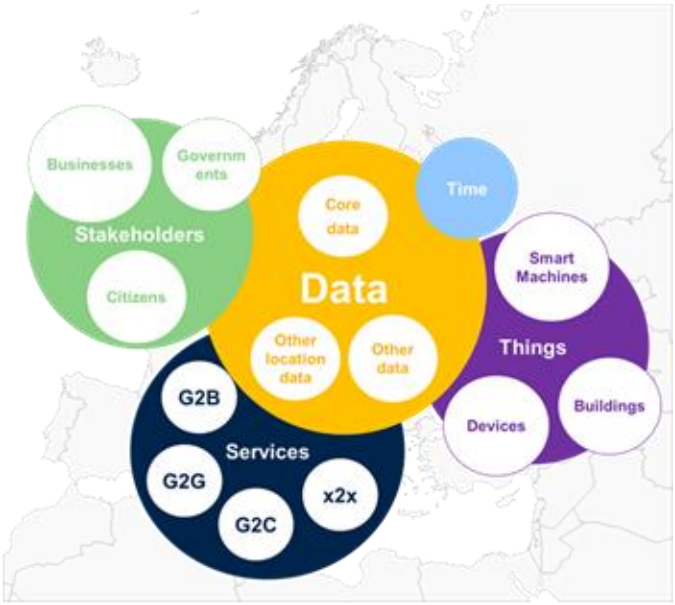
An ambitious context for location data in EU digital public services

Location data provides a foundation for delivering added value in combination with other data connected with services[8], stakeholders or objects from the Internet of Things (devices, machines, buildings etc.).

Location data is used in many fields, including environment, agriculture, regional and local planning, transport, energy, health, and tourism and culture.

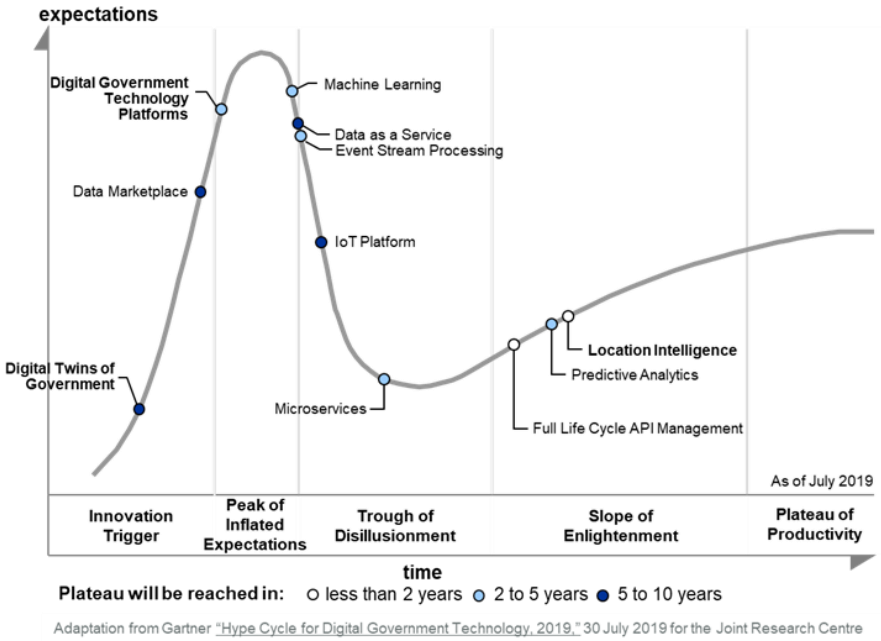
To enable this added value, interoperability of location data is fundamental to more effective data ecosystems, services, products and communication with stakeholders, and is a condition for effective use and analysis of location data to deliver efficiency gains.

Figure 2: Relevance of Location Data in combination with other data domains



'Location Intelligence', which combines analytics, geospatial information and location-based services, has many use cases in government. Examples are Internet of Things applications that integrate government data (such as demographic data, geological maps or planning/zoning information) into their real-time solutions, including those supporting smart cities. According to Gartner, use of Location Intelligence for Digital Government is evolving, with a timeline to maturity foreseen in less than 2 years (see **Figure 3**). Location Intelligence and underlying data ecosystems are key components in 'digital platforms', which enable collaborative provision of digital public services, integration of multiple services, and links with external parties (see Digital Government Technology Platforms, Digital Twins of Government and Data Marketplaces as emerging trends in the diagram). These digital platforms are fuelled by maturing technologies in the areas of data and artificial intelligence.

Figure 3: Gartner Hype Cycle for Digital Government 2019: Technologies relevant to EULF Blueprint



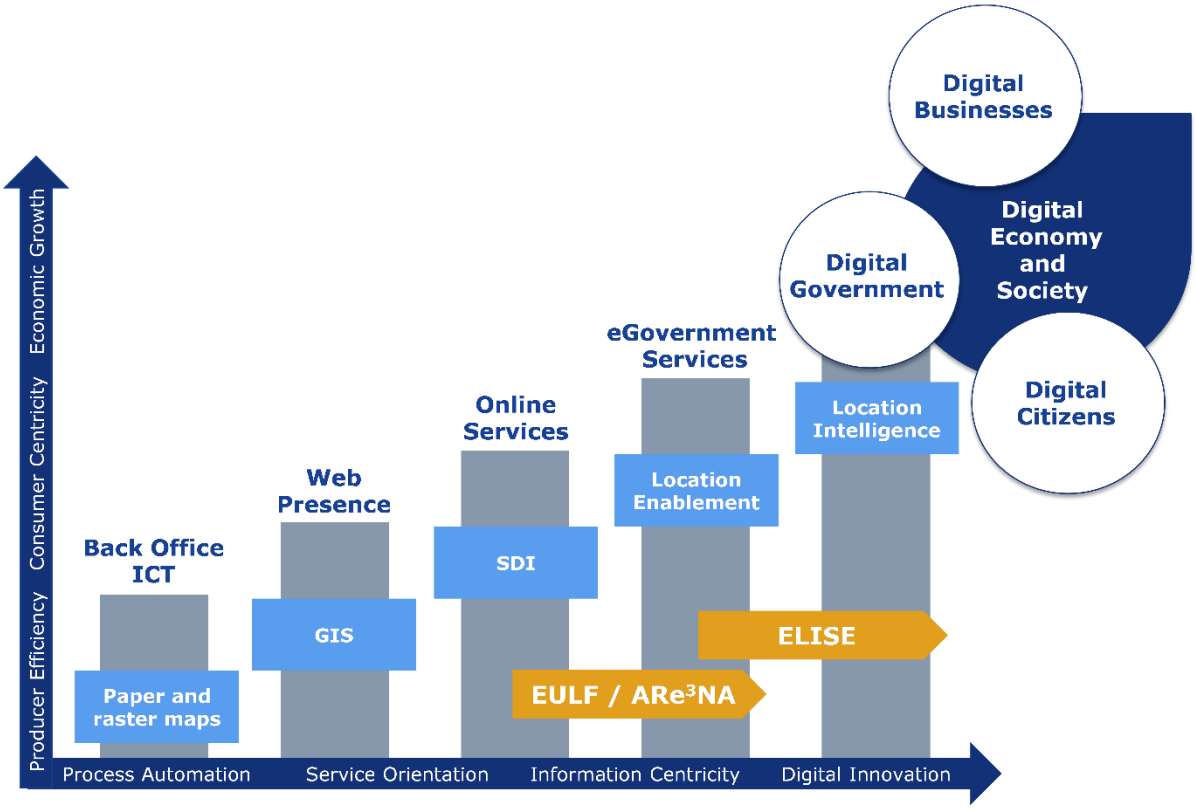
Source: Gartner Research

[8] Government to Government (G2G), Government to Business (G2B) and Government to Citizen (G2C) services

Public administrations increasingly recognise the value of location information to understand policy impacts, interact with citizens and businesses, and manage resources and emergencies. Consequently, location data, location interoperability and location intelligence play a key role in the digital transformation of government, business and society.

Figure 4 below shows the evolution of digital government and use of location information. There is a common trend towards higher information centricity and digital innovation. The most mature models involve comprehensive digital government strategies, promoting innovation and growth through the use of data, and in particular, the use of location intelligence in applications across all aspects of public life.

Figure 4: Evolution of digital government and use of location information



This context - growing in ambition - is further challenged by the need for cross-sector and cross-border interoperability supporting these services across Europe, the importance of government-validated core location data in the legal context of digital public services, and the need to integrate other potential location which will emerge from different sources.

An evolving EU data policy landscape

The current INSPIRE work programme concludes in 2020 and a new work programme is being discussed with Member States. Plans are being developed for INSPIRE support to environmental policy from 2020-24. It is expected that there will be a revision of the INSPIRE Directive in 2022 in order to support the European Green Deal policy. The proposed name is GreenData4All.

The Open Data Directive came into force on 17 July 2021. This requires Member States to publish existing high value datasets as open data, using APIs for data access. The Implementing Act on High Value Datasets (Q3/2021) defines specific rules supporting the commitments in the Directive. Important spatial datasets related to INSPIRE Annex 1 themes are included, e.g. addresses, geographic names, cadastral parcels and transport networks. This has implications and opportunities for SDI support to government, businesses and citizens.

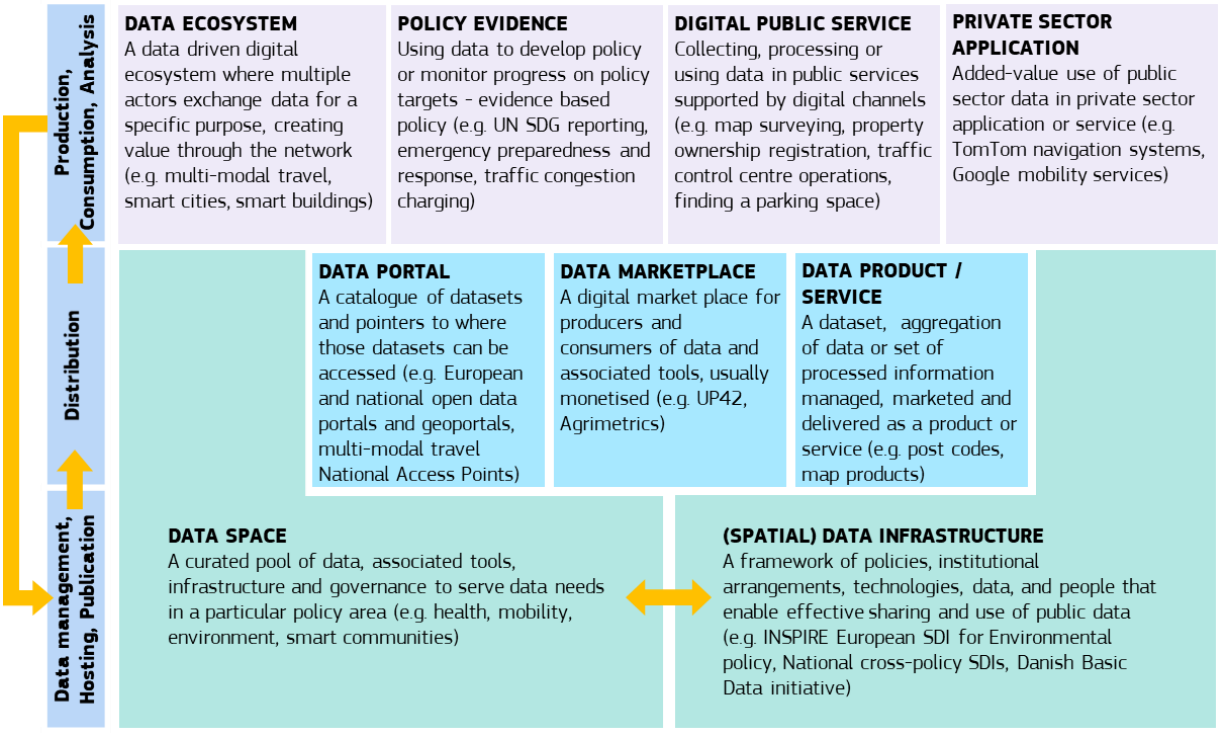
Further to this, the European data strategy envisages implementing a series of European 'data spaces' in particular sectors using a federated cloud infrastructure to enable growth through new data-driven products and services (in the private sector) and support European policy and cross-border digital public services. These 'data spaces' are in a way a curated European data infrastructure, in which INSPIRE will have an important role to play in the environmental ("Green Deal") and agriculture data spaces and spatial data will be relevant

in all data spaces. Other data spaces will have spatial elements overlapping with INSPIRE (e.g. transport networks) or involving different or more detailed spatial data themes (e.g. transport, health, energy). Spatial reference data (e.g. address, administrative areas, cadastral parcels) will be important in different data spaces.

As the data-driven economy evolves, the need for effective collaboration models will increase. National SDIs will need to become more user-driven and transparent in terms of their governance, priority setting and support for different actors and use cases. They will have to evolve to support both national and European requirements. Effective data ecosystems support will be needed, bringing together different actors exchanging data around a common purpose. These ecosystems may involve many different elements loosely connected by standards and rules of operation (e.g. road transport, energy efficiency) or more closely connected ecosystems supported by digital collaboration platforms (digital platforms), such as those relating to smart cities. Digital platforms will also be relevant in supporting particular digital public services and in the evolution of data distribution mechanisms, such as data portals and data marketplaces.

Together with the opportunities, there are also uncertainties in how these policy initiatives will evolve and what is meant by some of the new concepts and terminologies. Assumptions used in the Blueprint are shown in **Figure 5** below.

Figure 5 Terms applied in collecting, publishing, distributing and using public data



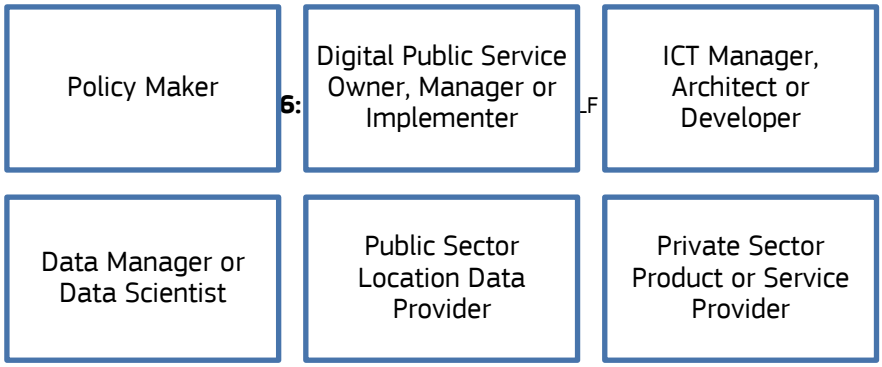
A guidance framework for a wide audience to implement the EULF vision

The EULF vision is that "more effective services, savings in time and money, and increased growth and employment will result from adopting a coherent European framework of guidance and actions to foster cross-sector and cross-border interoperability and use of location information in digital public services, building on national SDIs and INSPIRE".

The EULF Blueprint is the main guidance document targeting the achievement of this vison. It addresses a wide audience, with elements relevant to the specific target groups shown in

Figure 6 below[9].

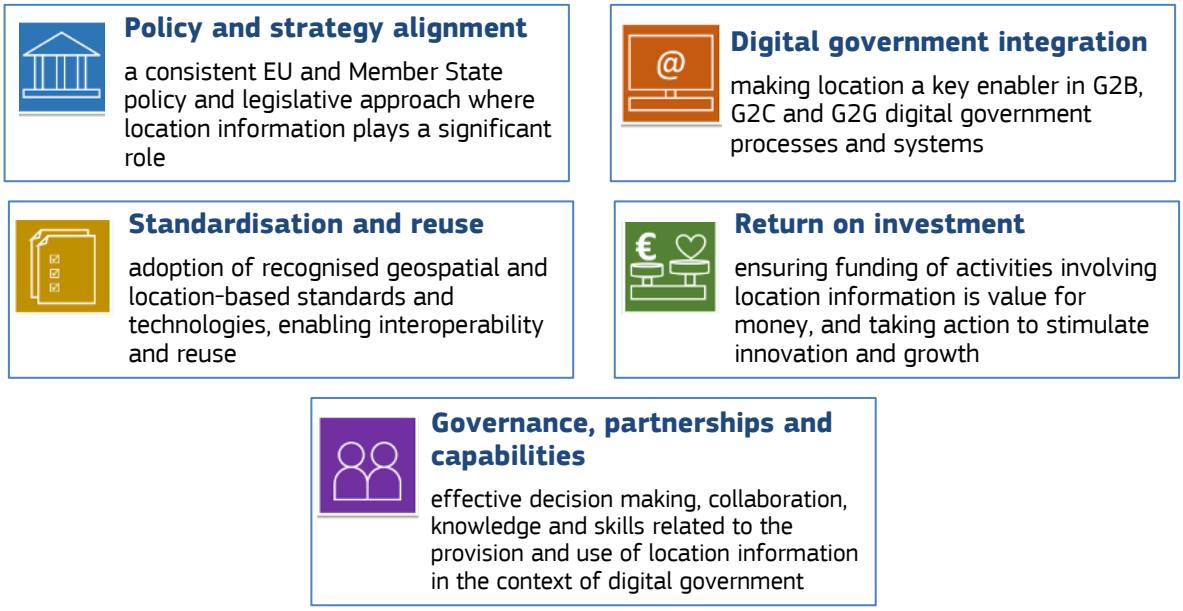
[9] Annex III gives a role-based reading of the recommendations.



6: LF

There are 5 focus areas identified in the EULF Vision and presented in **Figure 7** below.

Figure 7: Five focus areas of the EULF



The EU location guidance framework in the Blueprint is organised as follows: for each focus area, a general 'current state' assessment and 'vision' are outlined; the key points for achieving the vision are then expanded into a series of recommendations.

Focus area	
Current State *Location aspects within existing policy …* **Vision** *An aligned and coordinated policy …* **LIFO Monitoring** *LIFO monitoring information about focus area*	**Recommendation 1** **Recommendation 2**

The 'current state' and 'vision' originated from surveys and analysis carried out in the EULF project up to 2016. The situation evolves over time as new directions emerge and progress is observed across Europe. The Blueprint is updated periodically to reflect these developments. Starting in 2019, the status of location interoperability in Europe has been evaluated through a series of metrics, based on the Blueprint, through the Location Interoperability Framework Observatory (LIFO). Outcomes of LIFO, including the collection of good practices, have contributed to this version and will help update future versions of the Blueprint.

A series of more detailed guidance documents complement the Blueprint framework, providing detailed practical guidance, methodologies and good practices on specific topics, introduced in outline in the Blueprint. The recommendations in the Blueprint refer to these guidance documents. While the EU Location Framework Blueprint may provide a sufficient level of information for decision makers and managers at EU and national levels, the associated detailed guidance documents and tools may provide additional relevant answers for practitioners. Detailed guidance documents available include Guidelines for public procurement of geospatial technologies, Guidelines for public administrations on location privacy, Design of Location Enabled e-Government Services, and Architectures and Standards for SDIs and e-Government.

19 recommendations

The EULF Blueprint defines a series of recommendations in the five focus areas. Each recommendation has the rationale for following the recommendation (why?), a checklist of associated actions (how?), potential problem areas to address in implementing the recommendation (challenges), references to best practices in the topic area, a pointer to where LIFO monitoring information about the adoption of the recommendation can be found, links to relevant pillars and recommendations in the European Interoperability Framework (EIF) and guidance in the United Nations Global Geospatial Information Management (UN-GGIM) Integrated Geospatial Information Framework (IGIF), related ELISE resources such as studies, detailed guidance and webinars, and further reading from contextual documentation to concrete toolboxes. **Figure 8** shows the structure of a recommendation.

Figure 8: Structure of a recommendation

Recommendation 1: Connect location information …
Why: Core location information …
How: ICT strategies …
Challenges: Lack of understanding by policy makers…
Best Practices: #1: A generic GIS . . .
LIFO Monitoring: LIFO monitoring information about Recommendation . . .
Related Frameworks: EIF Related EIF pillars and recommendations
Related Frameworks: UN-GGIM IGIF Related IGIF strategic pathways, elements and actions
ELISE Resources: The Role of Spatial Data Infrastructures . . .
Further Reading: EU Better Regulation Toolbox

There are 5 recommendations for policy and strategy alignment, 4 for digital government integration, 4 for standardisation and reuse, 3 for return on investment and 3 for governance, partnerships and capabilities.

5 annexes

Figure 9: Blueprint annexes

Illustrations of best practices are provided to give additional context and while these are listed under each recommendation, they are described in Annex I. Illustrations of benefits in different applications are described in Annex II.

Cross-reference tables indicating the links between the EULF Blueprint and related frameworks are provided in Annex III and Annex IV. These comprise links between the EULF Blueprint and EIF recommendations and between the EULF Blueprint recommendations and the strategic pathways, elements and actions of the UN-GGIM IGIF.

The reader is guided through the relevant recommendations related to the specific roles in Annex V Role-based methodologies.

Policy and Strategy Alignment

Current State

There is a growing alignment in the location aspects within existing policy and strategic frameworks across the EU. However there is still a need to address the alignment in a a consistent and coherent manner. Lack of alignment and incoherence can result in less effective policies, and in duplication of effort and unnecessary costs. Even though there tends to be a shift in location strategies from provider-focus to user-focus, this area still needs further attention. Data of suitable quality is becoming more readily accessible. There are some good examples of simple, consistent licensing and access to open data but there is limited alignment across Member States. Developments in European data policy, e.g. Open Data Directive, GDPR, and European Data Strategy have given greater emphasis to the data-driven economy balanced with the need for trust.

Vision

A coordinated and aligned policy and strategic approach nationally and across Europe for the use of location information that enables improved and more effective policy making, better integrated and more effective cross-sector and cross-border digital public services, better engagement with businesses and citizens, reduced costs and increased social and economic benefit. Public sector location policies are user-driven and promote availability, accessibility and interoperability. There are simple and consistent approaches to licensing, progressive open data policies that balance the needs of data users and suppliers, and well-managed authentic registers involving location and other datasets. Through all this, location information plays a prominent role in the data-driven economy.

LIFO Monitoring

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of recommendations in the Policy and Strategy Alignment focus area in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Focus Areas.

Recommendation 1: Connect location information strategies and digital government strategies in all legal and policy instruments

Why:

- Core location information (e.g. address data) is relevant to most digital public services and broader location-based information is important in many digital public services (e.g. land registration) and in public sector information provided to citizens and businesses (e.g. location of schools and hospitals).
- Optimising the use of location information helps to deliver innovative, authoritative and comprehensive digital public services.
- Silo thinking in policy development can lead to duplication and inefficiency, poor value for money, confusion for stakeholders, and overall reduction in policy effectiveness. The potential impacts are felt by businesses and citizens as well as across the public sector.
- A connected strategic approach will help align implementation actions for mutual benefit, contributing to achievement of goals around growth and better services.
- A cost efficient and effective public sector is a driver for growth in the data-driven economy.
- Many digital strategies come to a close in 2020. The new decade is an opportunity to rethink with more innovative, user focused, better aligned strategies.
- The COVID-19 pandemic and other disaster phenomena demonstrate the importance of understanding the data in helping to solve global problems.

How:

Location and digital strategy alignment

- Ensure that digital government and ICT strategies include a key role for location information and technologies, to deliver better digital public services through an interoperable ICT and data framework and strategic actions to optimise and communicate the value of location information.
- Embed digital public service requirements in location information strategies, including the framework for meeting information needs through interoperable authoritative location data, how needs in different sectors and key services will be addressed, and supporting links between the public sector and society. These strategies should consider the broad requirements of digital public services and not just the restricted context for which location information might be collected in the first place.

Strategic engagement

- Location stakeholders should be involved in the development of digital government and ICT strategies.
- Stakeholders connected with digital public service provision should be involved in the development of location strategies.
- There is a clear and agreed allocation of tasks and responsibilities between the different parties involved in digital public service, ICT and location information policies.

Consistent thematic polices

- Different thematic policies should apply a consistent approach to the provision and use of location-related information, for example in their references to standards, use of codes, and reuse of authoritative data. The following aspects of policy alignment should be considered:
  - Alignment across different policies in the same thematic area;
  - Alignment with European (e.g. INSPIRE) and national location policies;
  - Alignment with European (e.g. Open Data Directive, European Data Strategy, GDPR) and national data policies (see Recommendation 2 below);
  - Alignment of thematic digital public service and ICT solutions with European (e.g. ISA[2], DIGITAL) and national digital and ICT policies;
  - Cross-sector alignment of data infrastructure frameworks.

Useful tools

- A useful tool for assessing alignment (and other factors) in the development of EU policy is the digital economy and society and ICT issues tool in the Better Regulation 'Toolbox', which contains a digital check to identify the digital aspects and ICT needs of new initiatives.
- ICT assessments may also be undertaken as part of the EU policy monitoring and evaluation phase. These take the form of 'evaluations' of particular policies (e.g. INSPIRE) and 'fitness checks' of particular policy domains (e.g. Environment).
- The EU Better Regulation 'Toolbox' provides a series of relevant best practice 'policy' tools, including those mentioned above.
- The EIF Toolbox provides online guidance on the European Interoperability Framework (EIF).
- The National Interoperability Framework Observatory (NIFO) monitors alignment with the recommendations in the EIF.
- The EULF Blueprint (this document) is available as a structured online resource.
- The Location Interoperability Framework Observatory (LIFO) monitors alignment with the recommendations in the EULF Blueprint.

Challenges:

- Lack of understanding by policy makers of the potential role of location information and how the information should be managed. For example, the EULF Marine pilot and the EULF Energy Efficiency of Buildings feasibility study highlighted requests from different directives related to the same location information without defining a common strategy for data sharing and management.
- Complexity in consultation and coordination involving all relevant stakeholders.
- Keeping pace with the changing political and policy landscape.
- Developing strategies that give an optimum balance to the digital public service and information needs of different stakeholders.
- Location information and digital strategies involve the private sector to an increasing extent. This presents challenges as well as opportunities that need to be handled consistently, e.g. the conditions for use of private sector data alongside public sector data.

Best Practices:

#1: A digital platform for location data in Flanders

#6: Digital Exchange platform for spatial plans

#18: Territorial Information System of Navarre: SITNA

#43: The impact of open geodata – follow up study

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 1 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Interoperability Layer 1: Interoperability Governance	Recommendation 20: Ensure holistic governance of interoperability activities across administrative levels and sectors.
Interoperability Layer 3: Legal Interoperability	Recommendation 27: Ensure that legislation is screened by means of 'interoperability checks', to identify any barriers to interoperability. When drafting legislation to establish a European public service, seek to make it consistent with relevant legislation, perform a 'digital check' and consider data protection requirements.
Interoperability Layer 5: Semantic Interoperability	Recommendation 31: Put in place an information management strategy at the highest possible level to avoid fragmentation and duplication. Management of metadata, master data and reference data should be prioritised.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 1: Governance and Institutions

Documentation	Elements
Implementation Guide Appendices	Governance Model Leadership Value Proposition Institutional Arrangements

Actions	Tools
1. Forming the Leadership	
Governing Board	APP1.1: Steering Committee Charter
2. Establishing Accountability	
Governance Model	National Institutional Arrangements: Instruments, Principles and Guidelines National Institutional Arrangements: Compendium of Good Practices Foundational Guide to National Institutional Arrangements Instruments for Geospatial Information Management (Asia-Pacific)
3. Setting Direction	
Strategic Alignment Study	APP1.2: Strategic Alignment Template
Geospatial Information Management Strategy	APP1.3: Guidance for Mission, Vision and Goals Statements Future trends in geospatial information management: the five to ten year vision (third edition) Global Statistical Geospatial Framework Framework for Effective Land Administration Strategic Framework on Geospatial Information and Services for Disasters COVID-19: Ready to Respond - The role of the Geospatial Community in Responding to COVID-19
4. Creating a Plan of Action	
Change Strategy	
Country-level Action Plan	APP1.4: Country-level Action Plan Template
6. Deriving Value	
Value Proposition	FIG1.6: Value Proposition Canvas

Strategic Pathway 2: Policy and Legal

Documentation	Elements
Implementation Guide Appendices	Legislation Norms, Policies and Guides Governance and Accountability

Actions	Tools
1. Providing Leadership	
Review Group	
2. Assessing Needs	
Review and Assessment	APP2.2: Review and Assessment – Considerations APP2.3: Review and Assessment – Questions
Gaps and Opportunities	APP2.4: Legal and Policy Framework Use Case APP2.6: Gap Analysis Matrix
3. Addressing Opportunities	
Design and Develop	APP2.7: Policy and Legal Instruments - Advantages and Disadvantages APP2.8: Assessing Fitness for Purpose for a Policy Guidance and recommended actions aligned with Strategic Pathway 2: Policy and Legal
4. Future Proofing	
Future Proofing	
6. Delivering Compliance	
Impact Assessment	
Compliance Strategy	

Strategic Pathway 5: Innovation

Documentation	Elements
Implementation Guide Appendices	Technological Advances

Actions	Tools
1. Geospatial Landscape	
Technology Maturity Index	APP5.1: IGIF Technology Maturity Index
Strategic Alignment	APP5.2: Capability Framework Matrix

ELISE Resources:

Type	Resource	Date
Study	Assessment of economic opportunities and barriers related to geospatial data in the context of the Digital Single Market	2018
Study	Digital Government Benchmark: Study on Digital Government Transformation	2018
Study	The Role of spatial data infrastructures in the digital government transformation of public administrations: See institutional setting section which gathers indicators related to the governance, strategy and (national) legal framework underpinning the relationship between SDI and Digital Government Transformation	2019
Study	Exploring Digital Government Transformation in the EU: Analysis of the state of the art and review of literature	2019
Study	Assessing the impacts of digital government transformation in the EU - Conceptual framework and empirical case studies	2020
Study	Exploring Digital Government Transformation in the EU: Final Report	2020
Guidance	EULF References v2	2016
Survey / Benchmarking	Location Interoperability Framework Observatory (LIFO)	2019

Webinar	The Role of Geospatial for Digital Government Transformation	2019
Webinar	The Role of Spatial Data Infrastructures for Digital Government Transformation	2019
Webinar	Exploring Digital Government Transformation in the EU - DIGIGOV	2020
Webinar	Evolution of the access to spatial data for environmental purposes – Study presentation	2021
Webinar	The EULF Blueprint – Its role and how to use it	2021
Webinar	ELISE - Support to policy initiatives	2021
Presentation	INSPIRE Conference: EU Location Framework Blueprint - Paving the road to digital government Presentation Video	2017
Training	INSPIRE training platform: Introduction to INSPIRE	2014
Training	INSPIRE training platform: INSPIRE advanced	2018
Training	INSPIRE training platform: From INSPIRE to e-Government	2020

Further Reading:

- Directive 2007/2/EC establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)
- UK Location Strategy
- UK Government Transformation Strategy
- UK Digital Strategy
- GIDEON: Key geo-information facility for the Netherlands
- Finnish National Spatial Data Strategy 2016
- The Swedish National Geodata Strategy - Well developed collaboration for open and usable geodata via services, 2016-2020
- A Stronger and More Secure Digital Denmark, Digital Strategy 2016-20 – an example of a merged strategy where location is integrated in a wider public sector strategy
- The Danish Basic Data Programme – A holistic programme transforming the Danish public sector, covering strategy, policy, standard web services, common data models, data quality improvements, and delivery through a digital platform
- The impact of the open geographical data – follow up study, Agency for Data Supply and Efficiency, Denmark, 2017
- Better regulation: guidelines and toolbox
- European Interoperability Framework (EIF) toolbox
- National Interoperability Framework Observatory (NIFO)
- Towards a Spatial Knowledge Infrastructure, White Paper, Australia and New Zealand Cooperative Research Centre for Spatial Information (CRCSI), 2017
- The Power of Where: A Geospatial Knowledge Infrastructure to Enhance the World Economy, Society and Environment, White Paper, Geospatial World, 2021
- Sustainable Development Goals Connectivity Dilemma - Land and Geospatial Information for Urban and Rural Resilience, Rajabifard, A (Ed.), CRC Press, Taylor and Francis Group, 2019
- Geospatial Technology and Information for Development, World Bank, 2019
- Everything happens somewhere - National geospatial strategy towards 2025, Norway, 2018
- One digital public sector – Digital strategy for the public sector 2019-2025, Norway 2019

- A Europe fit for the digital age, the EU's digital strategy, EU priorities, 2019-24
- A European Green Deal, the EU's climate strategy, EU priorities 2019-24
- Unlocking the power of location - the UK's Geospatial Strategy 2020 to 2025
- Manual of Digital Earth, Springer, 2020
- National interoperability initiatives, NIFO – an overview of initiatives, such as the political communications, guidelines, and legislation, related to interoperability in 36 European countries namely, the EU's 27 Member States, the EFTA countries, Montenegro, the Republic of North Macedonia, Turkey, Ukraine, and the United Kingdom
- Green Deal and Data Strategy, Connect University, 2021

Recommendation 2: Make location information policy integral to, and aligned with, wider data policy at all levels of government

Why:

- Location information is key public data and much public policy has a location context.
- Location information has particular requirements that need to be considered in formulating wider data policy.
- It is important to avoid contradictions between location information policy and broader data policy.
- Authentic location data is costly to maintain and this needs to be recognised in wider data policy decision making.
- A connected strategic approach will help align implementation actions for mutual benefit.
- Interoperability of data policies paves the way for integrated digital public services offered cost effectively, aiming to solve overarching societal problems and create value for a broader range of users.
- Public-private partnerships and crowdsourcing of data can support sustainability and reliability goals and ensure real needs are met.
- Effective data policies are seen as important at a European level and enhancements are introduced from time to time to ensure policies reflect latest requirements (e.g. Open Data Directive, European Data Strategy, GDPR). It is essential that location data stakeholders and policies recognise and align with these wider data policy developments.

How:

Policy reach

- When developing the approach to ensure consistency and alignment between location policy and wider data policy, include key topics such as data sharing, open data, authentic data, data licensing (including reuse), intellectual property rights (IPR), privacy, data protection and the ethical and professional handling of data.
- Ensure that location information is a prominent feature of policies and actions in areas where it can make an important contribution, e.g. open data, authentic data, data licensing and re-use, and data aspects of digital government and digital transformation strategies.

Data governance

- There is a common data governance approach for all public sector data, determining how data are collected, managed, used and made available by public authorities.
- A data-driven culture is created within government, which includes data literacy and recognises the importance of location data, location data infrastructures, and location-enabled data

ecosystems.

- Access to and reuse of privately held - location - data is covered under the data policy of government.

Stakeholder engagement

- Location information stakeholders are involved in the development of broader data policy and those responsible for broader data policy engage with and take account of the interests of location information stakeholders.
- The role of public-private partnerships and crowdsourced data is determined and applied consistently across all data policy (including location data policy).
- Data policies and clear governance facilitate value creation for stakeholders in collaborative environments such as data ecosystems and digital platforms.
- There is a clear and agreed allocation of tasks and responsibilities between the different parties involved in general data policy and location information policy.

European alignment

- Ensure that European data policies and location data policies, as well as the goals of the EU's Digital Strategy, 'A Europe Fit for the Digital Age', are reflected in national policies. Take steps so that national location information makes a significant contribution to European data infrastructures and data ecosystems, including INSPIRE, Open Data, Earth Observation, European public sector location data products (e.g. EuroGeographics EuroRegional Map and EuroGlobal Map), and thematic data ecosystems, such as those in transport, weather and health.
- The European Data Strategy adds further impetus to European collaboration on data, through the implementation of open high value datasets under the Open Data Directive and European data spaces. Location information from different Member States will play an important integration role within and across the European data spaces.
- **Table 3** outlines some of the main European data policies and their implications for national location information policies and data providers.

Table 3: European data policy and implications for national location information policy

European data policy	National location information policy implications
The Aarhus Convention and Environmental Information Directive	The Aarhus Convention, signed in 1998, guarantees public rights of access to information, public participation in decision-making, and access to justice on environmental matters. Directive 2003/4/EC aims to ensure that environmental information is systematically available and distributed to the public. In 2020, the EC adopted a proposal amending Aarhus Regulation No. 1367/2006 to allow for better public scrutiny of EU acts affecting the environment
INSPIRE Directive (2007/EC)	National legislative transposition and implementation programme National governance and organisation of data sharing Standardised EU data infrastructure and access to a wide range of authoritative location data Opportunity for reference data harmonisation across Europe Harmonised location data for environmental policy European INSPIRE Geoportal
Reuse of Public Sector Information (PSI) and Open Data	Reuse of public sector information for economic benefit, data accessibility, simplified licensing (Directive 2003/98/EC) European open data portal Amended by Directive 2019/1024 on open data and reuse of public sector information ("Open Data Directive"). Harmonising conditions for re-use and

	removing barriers to re-use. Provisions on non-discrimination, charging, exclusive arrangements, transparency and licensing, and tools to facilitate discovery and reuse. Entered into force 07/2021 Commitment to opening up access to high value government datasets for SMEs and innovation.
General Data Protection Regulation (2016/679)	Applicable from 05/2018 Increased trust, recognises location data privacy
Regulation on free flow of non-personal data (2018/1807)	Free movement of non-personal data across borders and sectors Public authorities retain access to data for regulatory control purposes, even when it is located in another EU country or when it is stored or processed in the cloud. Easier switching between cloud service providers and consistency on cybersecurity.
European Data Strategy (02/2020)	Use of location data in European data spaces – Integrating role within and across all data spaces, thematic role in many data spaces (e.g. Green Deal, Mobility) Contribution to high value datasets (programme of implementation) Support to SMEs in developing products and services Integration of data from businesses and citizens Participation in federated cloud infrastructure
Data Governance Act (11/2020)	Fosters data reuse by increasing trust in data intermediaries and strengthening data-sharing mechanisms to ensure data interoperability across sectors (through technical and legal means and with organisational support). Applies to data made available voluntarily by public administrations, businesses, individuals and researchers.
Digital Markets Act (12/2020)	Identifies data access and portability remedies for business and individual data held by online platforms (aimed at controlling the market power of major providers)
Implementing Act on High Value Datasets under the Open Data Directive (Q3/2021)	Specific rules on free access, machine readable formats, APIs and, where relevant, bulk downloads. There are six thematic categories: geospatial, earth observation and environment, meteorological, statistics, companies and mobility
Data Act (Q4/2021)	Better access to and control over data for a fair data economy. Encouraging B2B and B2G data sharing. Addresses issues in terms of economic incentives to share data, trust, imbalances in negotiating power, fear of misappropriation of data, and lack of legal clarity, e.g. establishing fairness in use of co-generated, Internet of Things (IoT) data.

- As well as contributing to European initiatives on data sharing, public administrations in Member States should also aim to draw on the benefits of such initiatives in their own national policies and actions.
- European policy makers should also ensure their policies are aligned in terms of the data obligations for national administrations. The 'European package' of data related policies is growing significantly and clear communications, responsive consultations and effective plans are needed to ensure that national administrations are able to contribute positively.

Challenges:

- Lack of understanding of the specifics of location information by general data policy makers.
- Data policy fails to take into account the cost of collecting and making available location data of sufficient quality.
- Location policy continues to be seen as "special" and fails to align with wider data policy where it

is feasible to do so.

- The European policy agenda and particular actions impacting Member States may not align well with national priorities for action. European policies may be in contradiction with existing national legislation, e.g. on open high value datasets. Alternatively, national solutions may already be in place but in a different format. Or the timing of European initiatives may be too early and not such a priority in the national agenda.
- European data policy is stepping more extensively into 'implementation' with requirements on open data and data spaces on top of the obligations under GDPR. This will be a challenge for national administrations who have already seen the efforts needed with INSPIRE. Where there are established national data programmes, their business cases may be diluted by the changes needed to support new European policies.
- Finally, the European policy agenda may not appear to be well aligned or priorities may be unclear. The European Commission needs to address any potential contradictions or uncertainties as it progresses implementation of policies on multiple overlapping fronts.

Best Practices:

#3: 'LoG-IN' to the local economic knowledge base

#6: Digital Exchange platform for spatial plans

#16: Managing the granting of licenses for selling tobacco

#21: Integrated transport solutions: TRAVELINE

#23: INSPIRE-compliant marine environment e-reporting

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 2 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 2: Openness	Recommendation 2: Publish the data you own as open data unless certain restrictions apply.
Underlying Principle 3: Transparency	Recommendation 5: Ensure internal visibility and provide external interfaces for European public services.
Interoperability Layer 1: Interoperability Governance	Recommendation 20: Ensure holistic governance of interoperability activities across administrative levels and sectors.
Basic Component 4: Open data	Recommendation 43: Communicate clearly the right to access and reuse open data. The legal regimes for facilitating access and reuse, such as licences, should be standardised as much as possible.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 2: Policy and Legal

Documentation	Elements
Implementation Guide Appendices	Legislation Norms, Policies and Guides Data Protection, Licensing and

	Sharing Governance and Accountability

Actions	Tools
1. Providing Leadership	
Review Group	APP2.1: Common Legal Terms
2.. Assessing Needs	
Review and Assessment	APP2.2: Review and Assessment – Considerations APP2.3: Review and Assessment – Questions
Gaps and Opportunities	APP2.4: Legal and Policy Framework Use Case APP2.6: Gap Analysis Matrix
3. Addressing Opportunities	
Design and Develop	APP2.7: Policy and Legal Instruments - Advantages and Disadvantages APP2.8: Assessing Fitness for Purpose for a Policy Guidance and recommended actions aligned with Strategic Pathway 2: Policy and Legal
Data Sharing and Dissemination	
Licensing Geospatial Information	Compendium on Licensing of Geospatial Information
4. Future Proofing	
Future Proofing	
5. Addressing Coherence	
Intellectual Property Rights	APP2.9: Managing Intellectual Property Rights
Privacy and Data Protection	
Liability Concerns	
Sensitive Information	App2.10: Addressing Sensitive Information
6. Delivering Compliance	
Impact Assessment	
Compliance Strategy	

ELISE Resources:

Type	Resource	Date
Study	Study of the terms of use applied in the INSPIRE resources and their usability barriers	2018
Webinar	Location enabled public services	2020
Presentation	INSPIRE Conference: Good practices for licences - overcoming usage barriers for INSPIRE data Presentation Video	2018
Presentation	INSPIRE Conference: Adding Location Interoperability to Better Regulation's Assessment of ICT Implications of New Legislation Presentation Video	2018
Training	INSPIRE training platform: INSPIRE data and service sharing	2018

Further Reading:

- UK Government Licensing framework for Public Sector Information
- UK Government Service Design Manual – Open Data
- UK National Information Infrastructure

- Denmark: Good Basic Data For Everyone – A Driver for Growth
- Planning for Socio Economic Impact – Open data as a policy instrument in the Netherlands and elsewhere
- INSPIRE Empowers Re-use of Public Sector Information
- Open Data Institute: Publisher's Guide to Open Data Licensing
- Open Data Institute: Reuser's Guide to Open Data Licensing
- Open Knowledge Foundation: The state of open licensing in 2017
- A Europe fit for the digital age, the EU's digital strategy, EU priorities, 2019-24
- Open Data Directive, 2019
- A Corporate Information Management Framework for the European Public Sector, Nov 2016
- Compendium on Licensing of Geospatial Information
- European data strategy: Making the EU a role model for a society empowered by data
- Data is Different: Why the World Needs a New Approach to Governing Cross-border Data Flows, Centre for International Governance Innovation, 2018
- Guidance on the 'Regulation on access to spatial data sets and services of the Member States by Community institutions and bodies under harmonised conditions', INSPIRE DT Data and Service Sharing, 2013
- Public Service Data Strategy 2019 -2023, Government of Ireland
- Data Governance Framework, The Data Governance Institute
- FAIR data principles, Australian National Data Service
- Open Government Data Report - Enhancing Policy Maturity for Sustainable Impact, OECD, 2018
- Data Governance Act, Impact Assessment Report, 2020
- Proposal for a Regulation laying down harmonised rules on Artificial Intelligence, European Commission, 2021
- Green Deal and Data Strategy, Connect University, 2021
- State of Open Data: Histories and Horizons

Recommendation 3: Ensure all measures are in place, consistent with legal requirements, to protect personal privacy when processing location data

Why:

- Compliance with data protection and privacy law is mandatory. Failure to comply will attract significant financial penalties, particularly under General Data Protection Regulation (GDPR). There is a risk that without adequate provisions to protect personal data, there will be a breach of national or European data protection and privacy laws.
- The protection of personal data is a fundamental right. Users of public services expect their rights to be protected and public administrations have an obligation to put in place the necessary protections.
- Failure to protect personal data will erode citizen trust and confidence in the services.
- Without clear and appropriate data protection procedures, there is a risk in not being able to deal adequately with crisis situations such as systematic unlawful use of personal data or major data leakages.
- A governance framework focusing on privacy allows organisations to better implement privacy

related principles and respect personal data protection in all processes. Furthermore, according to the General Data Protection Regulation (GDPR), every public administration has to appoint a Data Protection Officer (DPO). Having a DPO and, where appropriate, a supporting team allows for supervision and transparency of (location) data processing, implementation of the data protection strategy, and creation of trust towards data subjects.

How:

Data protection policy approach

- Set up a governance structure and data management programme for location data protection which includes:
  - Developing a data protection strategy in-line with the organisation's strategy;
  - Creating and implementing data protection policies, standards and guidelines. Policy documents should be created around rights of access requests, data retention cookies, privacy and consent protocols where required;
  - Implementing processes and systems to automate the task of governance compliance;
  - Defining metrics to measure the effectiveness of the data protection programme.
- Appoint a responsible and certified[10] person for data protection – Data Protection Officer (DPO) – to supervise the management of personal location data and provide transparency within the organisation and towards data subjects.
- Connect the DPO with the Chief Information Security Officer (CISO) to secure adequately the processing of personal location data: There are security control frameworks such as ISO 27018 for data protection but also more general frameworks such as the ISO 2700x family, ISF Standard of Good Practices, NIST or SANS publications that can help.

Data management approach

- Ensure lawful processing of personal location data and that the processing of personal location data is fair and transparent – individual 'data subjects' should know why their location data is being collected, how it will be used, how this will benefit them, if it will be shared and with whom, and how long it will be retained; data subjects should not be deceived or misled.
- Use clear and unambiguous language about what data is being collected, why it is being collected how it will help the user.
- Be open about collecting the data including if it is required under legislation.
- Assess the risks for data subjects when data is exposed and their location data processed. Also, perform periodic privacy risk assessments to guarantee an accurate level of data protection towards the data subjects.
- Minimise the data collected to ensure that only the minimum amount of data is collected that the task requires, and that the data is retained only as long as is needed.
- Prepare for data subjects' rights of access, rectification, erasure, to be forgotten, data portability, restriction of processing and notification of data breaches (in the latter case to both data subjects and supervisory authorities)
- Unless required by legislation, ensure anonymisation of personal data before publication (see Annex II of the EULF Guidelines for publication administrations on location privacy).
- Have Data Protection Impact Assessments (DPIAs) defined and in place for both future and legacy processes including significant updates/changes to legacy systems.

[10] The EC expressed preference for certificate evidence through Article 42 and 43 of the General Data Protection Regulation. Accredited certifications include e.g. the Certified Information Privacy Professional Europe (CIPP/E) of International Association for Privacy Professionals' International Association for Privacy Professionals (IAPP)or the Certification Programme for Data Protection Officers and Other Data Protection Professionals from the European Institute of Public Administration (EIPA)

Location data awareness in data protection community

- Ensure DPOs are aware of the scenarios for use of location data within the organisation and the potential data privacy risks
- Check the website of your national Data Regulator
- Review general EU resources on data protection under GDPR
- Review the EULF Guidelines for public administrations on location privacy
- Link to the ELISE community on location data and GDPR
- Link into local and European wide bodies that specialise in location data. For example, EUROGI is European wide professional body that brings together industry and individuals involved in location data

Trust measures

- Create trust with data subjects. Be transparent and open with regard to data collection, processing, security, and privacy measures applied:
  - Keep all notices and terms in simple, clear and unambiguous language;
  - Publish a privacy notice that describes how the organisation collects, uses, retains and discloses what personal data is collected, how the data is used, what technical security measures are in place to protect personal data, with whom the data is shared, how a data subject can access or rectify personal data, and contact information of the DPO;
  - Make explicit statements on actions taken regarding data minimisation to protect privacy, for example recording 'approximate location' rather than 'precise location';
  - Require informed consent from customers and users on the use of their personal data. PLEASE NOTE CONSENT MAY NOT ALWAYS BE NEEDED IF PERSONAL DATA IS REQUIRED TO BE COLLECTED FOR EXAMPLE UNDER LEGISLATION. However, this should be stated clearly, concisely, and in plain and simple language to the data subject;
  - Supplementing the above, include repeat consent requests rather than rely on a first response, which may have been made hastily or may not be relevant of time;
  - Have a contact point for data subjects where they can direct their enquiries.

Challenges:

- To have a complete 'protection without sharing' approach can result in lost opportunities. As in the commercial world, the release of personal data can benefit users of public services. In the same way that users of internet retail sites may feel they benefit from targeted marketing (others may not of course), there can be similar advantages for users of public services, e.g. to take advantage of energy subsidies they may not otherwise know about. This is why transparency, and clear and simple communication are so important. If the data subjects understand and can see the benefit to them, they are more likely to share their location or any other personal data.
- Introducing personal data protection presents extra considerations and efforts for all organisations and projects. The benefit of strengthened consistent GDPR regulation, which increases trust for consumers, promoted by the EC, is seen by some organisations as a burden, without recognising instead seen as a burden.
- The drive towards more 'open government data' and more data-sharing between administrations raises more situations where privacy risks need to be considered.
- Organisation culture can be difficult to change and managing personal data across an organisation under GDPR may require a series of changes that will need to be implemented across organisations.
- A key tool to protect the data subject, where data is to be shared, is the anonymisation of the data. There are a number of ways of doing this, however, ongoing reviews are needed as new and other data sets become available. The newly available data may invalidate or compromise

the anonymisation method used resulting in a requirement re-anonymise.

Best Practices:

#17: Location-enabled census data in Poland

Please see also Guidelines for public administrations on location privacy for further case studies of Transport for London (Oyster) and EUCARIS (European CAR and driving licence Information System)

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 3 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 3: Transparency	Recommendation 5: Ensure internal visibility and provide external interfaces for European public services.
Underlying Principle 8: Security and privacy	Recommendation 15: Define a common security and privacy framework and establish processes for public services to ensure secure and trustworthy data exchange between public administrations and in interactions with citizens and businesses.
Basic Component 3: Base registries	Recommendation 37: Make authoritative sources of information available to others while implementing access and control mechanisms to ensure security and privacy in accordance with the relevant legislation.
Basic Component 3: Base registries	Recommendation 38: Develop interfaces with base registries and authoritative sources of information, publish the semantic and technical means and documentation needed for others to connect and reuse available information.
Basic Component 7: Security and privacy	Recommendation 46: Consider the specific security and privacy requirements and identify measures for the provision of each public service according to risk management plans.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 2: Policy and Legal

Documentation	Elements
Implementation Guide Appendices	Data Protection, Licensing and Sharing

Actions	Tools
1. Addressing Coherence	
Privacy and Data Protection	

ELISE Resources:

Type	Resource	Date
Guidance	EULF guidelines for public administrations on location privacy v2	2020
Webinar	Guidance on location data privacy	2020
Workshop	INSPIRE Conference: General Data Protection Regulation (GDPR): Trusting the use of your personal location data	2018

Further Reading:

- European Commission, Data Protection
- Your Europe European Union: Data protection under GDPR
- Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016, General Data Protection Regulation
- European Data Protection Board
- EDPB, National bodies responsible for data protection
- European Union Agency for Fundamental Rights, Handbook on European data protection law (2018)EU Agency for Network Information and Security (ENISA): Privacy, Accountability and Trust – Challenges and Opportunities
- EU Agency for Network Information and Security (ENISA): Privacy and Data Protection by Design – from policy to engineering
- EU Agency for Network Information and Security (ENISA): Privacy by Design in Big Data
- UK Information Commissioner's Office : Privacy by Design Guidelines
- The Location Forum: Location Data Privacy – Guidelines, Assessment & Recommendations
- ISO/IEC 27018:2014
- ISO/IEC 27001 - Information security management
- NIST Privacy Framework: A Tool for Improving Privacy through Enterprise Risk Management
- European Automobile Manufacturers Association: Principles of data protection in relation to connected vehicles and services, September 2015
- Information Commissioner's Office (ICO) (November 2012), Anonymisation: managing data protection risk code of practice
- Elliot, Mackey, O'Hara and Tudor, UKAN (2016), The Anonymisation Decision-Making Framework
- Companies that fail to see privacy as a business priority risk crossing the creepy line, KPMG (2016)
- Location data, privacy and consent, the Benchmark Initiative, 2019
- Building Ethics into Privacy Frameworks for Big Data and AI, UN Global Pulse and International Association of Privacy Professionals (2018)
- The Ethical Framework: Ethics by Design, the Benchmark Initiative, 2020
- Geospatial Information and Privacy: Policy Perspectives and Imperatives for the Geospatial Industry, World Geospatial Industry Council (2020)

Recommendation 4: Make effective use of location-based analysis and location intelligence for evidence-based policy making

Why:

- Geographic differences, e.g. in relation to property and jobs, should be taken into account in policy formulation and assessing policy instruments. This will help in establishing an overall approach balancing geographic variations or in developing "differential" policy that specifically targets regional differences (e.g. regional development policy).
- Location analytics and map visualisations are valuable instruments to analyse large and localised data sets quickly and in a way that helps recognise hidden patterns, relationships and correlations between phenomena happening in the same place. These patterns may not be readily apparent using generic socioeconomic and statistical analysis.
- Visualisation tools available for location information are an extremely attractive and understandable alternative to lists and tables of figures. They enable policy makers to explain the impact of their interventions to the general public.
- Effective use of location information contributes to more open, transparent and inclusive policy making processes.

How:

Analytical geo-reference data

- Use data for standard geographical areas (e.g. administrative and statistical units, post code areas, statistical grids, national parks) to support statistical and policy analysis.
- Take account of the opportunities with INSPIRE for EU-wide analytical comparisons based on harmonised location-related data.
- Ensure reference data semantics and standards are consistently applied, to support accurate and comprehensive assessments and help in clear decision making.

Location based statistics and visualisation for policy

- Use location-based data and statistics as evidence to inform policymaking and monitor or evaluate policy outcomes. This location-based data may come from a variety of sources, such as sensors and mobile devices, or from mapping data/services (for example, geocoding).
- Take account of national / regional / local variations or variations by other geographic characteristics (e.g. urban/rural contexts, risk exposure to atmospheric pollution, noise and flooding in different locations, how a new road through an area can affect communities) to establish a balanced approach in policy formulation.
- Use spatio-temporal analysis to highlight changes in policy indicators over time.
- Use relevant location-based evidence in ex-ante impact assessments, ongoing reporting of policy implementation, and ex-post policy evaluations of EU and national legislation.
- Target scientific research funding towards key policy topics, giving due weight to the value of location-based research.
- Use geographical visualisation techniques (e.g. maps, heat maps, visualisations over time) to "communicate the message" and make the policy analysis easy to understand, including evaluating existing data, assessing policy options, and communicating the impact of policies to the general public.
- Have the flexibility to use different techniques in different situations, depending on the audience, to make the communication as impactful as possible.

Analytical sources and techniques

- Consider both 'hard' and 'soft' evidence in informing policy. 'Hard' evidence may come from databases and surveys. 'Soft' evidence could come, for example, from interviews, focus groups,

social media (e.g. location-based information from mobile phones) and behavioural analysis.

- Combine the technologies for location-based analysis and business intelligence and analytics platforms to support extensive analysis and insight for policy makers, using location-based data as fully as possible.
- Make use of location intelligence algorithms (such as network path analysis, matrix routing, etc.) for spatial analysis and optimised resource allocation based on topological, geometrical and/or geographical properties.
- A 'location intelligence' approach makes use of (1) descriptive analytics that uses data to describe, summarise and visualise information, as well as mining and aggregating current and historic data to gain insight; (2) predictive analytics that uses machine learning with data to make predictions and uses statistical and probabilistic techniques to predict future trends and outcomes; and (3) prescriptive analytics that recommends courses of actions to achieve an outcome by making decisions.
- Identify the type of location intelligence that will enable a public service use case to contribute to public value, including the type of decision making and the impact of that decision (see **Figure 10**: Location intelligence contribution to public value in Smart Spaces**Figure 10**).

Figure 10: Location intelligence contribution to public value in Smart Spaces

Dimension 1: Location intelligence contribution to public value in Smart Spaces			
Example Use Case	**Location intelligence type**	**Type of decision making and impact**	
Please provide use case name and short description Enter text here	*Please select one or several items from the list below* (1) **descriptive analytics** that uses data to describe, summarise and visualise information, as well as mining and aggregating current and historic data to gain insight (2) **predictive analytics** that uses machine learning with data to make predictions and uses statistical and probabilistic techniques to predict future trends and outcomes; and (3) **prescriptive analytics** that recommends courses of actions to achieve an outcome by making decisions.	**Type of decision making:** *Please select one or several items from the list below* - End user - Strategic **Impact:** *Please select one or several items from the list below* - Short term - Medium term - Long term	
Public Value of the use case *Please select for each value low, medium, high or none*			
Economic and financial value (incl. efficiency)	**Citizen value and user attractiveness** (incl. Social, environmental sustainability)	**Administrative value and effectiveness** (incl. innovation and quality)	**Democratic value and trust** (incl. transparency)
- None - Low - Medium - High	- None - Low - Medium - High	- None - Low - Medium - High	- None - Low - Medium - High

Source: ELISE Smart Space Benchmark Framework (Dimension 1)

Challenges:

- Policy processes are complex with multiple factors involved and often gaps or inconsistencies in data and information (particularly in ex-ante stages). A holistic understanding is needed, taking account of relevant risk factors. There may be trade-offs to take into account in affected policy areas. These issues are particularly important in relation to environmental policy and related policy areas, e.g. transport, industry, energy, health, industrial and residential development.
- Simplistic extrapolations based on geography and demographics can hide key underlying variables and patterns that result in misjudged decisions.
- Lack of spatial literacy (e.g. the difficulty in reading a map without being guided) and designing communications for specialists rather than the general target audience may hinder the immediacy of the message that policy makers want to pass on.
- Maps can be used to hide the real connections or make un-related connections. To avoid this, it is particularly important that the underlying analysis is sound.

Best Practices:

#1: A digital platform for location data in Flanders

#3: 'LoG-IN' to the local economic knowledge base

#4: Rotterdam Digital City

#5: Radiological Emergency Response in Germany

#7: National landslide warning system in Italy

#8: 'One solution for all emergency services' in Poland

#9: Digital Accessibility Map for better informed firemen

#13: KLIC to prevent damage caused by excavation works

#14: Air quality monitoring and reporting in Belgium

#15: Information System of Contaminated Sites in Slovakia

#18: Territorial Information System of Navarre: SITNA

#20: Digital system for building permits in Italy

#23: INSPIRE-compliant marine environment e-reporting

#33: Urban platform, Guimarães

#40: Rubber Boot Index

#47: IDE-OTALEX

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 4 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Interoperability Layer 5: Semantic Interoperability	Recommendation 30: Perceive data and information as a public asset that should be appropriately generated, collected, managed, shared, protected and preserved.
Basic Component 3: Base registries	Recommendation 37: Make authoritative sources of information available to others while implementing access and control mechanisms to ensure security and privacy in accordance with the relevant legislation.
Basic Component 3: Base registries	Recommendation 38: Develop interfaces with base registries and authoritative sources of information, publish the semantic and technical means and documentation needed for others to connect and reuse available information.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 4: Data

Documentation	Elements
Implementation Guide Appendices	Data Themes Data Curation and Delivery

Actions	Tools
1. Getting Organised	
Data Framework	APP4.1: Data Theme Description Template

	The Global Fundamental Geospatial Data Themes
6. Integrating Data	
Geospatial and Statistical Integration	APP4.12: Guidance for Geospatial and Statistical Integration Global Statistical Geospatial Framework
Geocoding and Aggregation	

Strategic Pathway 5: Innovation

Documentation	Elements
Implementation Guide Appendices	Technological Advances Bridging the Geospatial Digital Divide

Actions	Tools
2. Identifying Innovation Needs	
Monitoring Trends	APP5.3: Geospatial Drivers and Trends
3. Transformation Roadmap	
Modern Data Creation Methods	APP5.7: Modern Data Creation Methods
6. Innovation Ecosystem	
Bridging the Digital Divide	APP5.12: Open SDG Data Hubs

ELISE Resources:

Type	Resource	Date
Webinar	Location Intelligence and Partnerships to support the Sustainable Development Goals	2020
Webinar	Location Intelligence for Cities and Regions: preparing the ground for smart places of the future	2020
Pilot / Testbed	EULF Marine Pilot, creating a Marine SDI framework for Marine Strategy Framework Directive e-reporting	

Further Reading:

- EU Environmental status of marine waters
- Making the most of our evidence: a strategy for Defra and its network
- Sustainable Development Goals in the Netherlands - Building blocks for environmental policy for 2030
- GIS and Evidence-based Policy Making, ed. Stephen Wise, Max Craglia
- Do Place Based Policies Matter, Federal Bank of San Francisco
- Place Based Policies, Oxford University School for Business Taxation
- The Case for Evidence Based Policy, Policy Horizons Canada
- What is wrong with evidence-based policy, and how can it be improved, Saltelli & Giampietro (2017)
- United Kingdom Crime Statistics
- EULF Marine Pilot, creating a Marine SDI framework for Marine Strategy Framework Directive e-reporting

- Italian National Landslide Warning System
- Unlocking Value with Location Intelligence, Boston Consulting Group, 2021

Recommendation 5: Use a standards-based approach in the procurement of location data and related services in line with broader ICT standards-based procurement

Why:

- It is important to have a transparent and uniform procurement approach to ensure fully effective competition following procurement best practices.
- Suppliers should be given a clear steer on what is needed from them and how they will be evaluated. This will result in more relevant proposals and reduce the risk of delivery failure / change requests.
- Legal requirements (e.g. INSPIRE, ITS) need to be followed.
- Such an approach avoids additional burdens or unnecessary expenditure in re-inventing the wheel or re-working solutions.
- Electronic procurement makes for more effective procurement processes.

How:

Procurement process

- Apply the procurement rules specified in the EU Directives on Public Procurement
  - Directive 2014/23/EU on the award of concession contracts
  - Directive 2014/24/EU on public procurement
  - Directive 2014/25 EU on procurement by entities operating in the water, energy, transport and postal service sectors.
- Use electronic procurement processes and tools for more effective management of the procurement process, including pan-European e-procurement tools, such as e-PRIOR, the European Single Procurement Document (ESPD) Service and e-CERTIS.
- Ensure location assets being procured are interoperable and reusable and that ownership of these assets is clear.
- Ensure procurement includes relevant geospatial skills as well as data or software solutions.
- Include these location-specific requirements in the selection/evaluation criteria.
- Apply procurement methods that allow piloting of new technologies and promote the involvement of, and collaboration, between multiple parties.

Standards-based references

- Make appropriate references to INSPIRE and other relevant standards (e.g. thematic standards) in procurement documents.
- If the standards landscape for a particular application is complex or not entirely clear, ask bidders for their understanding and proposals on relevant standards (responses can be validated by relevant experts).
- When referring to INSPIRE:
  - Refer to the INSPIRE Directive, its Implementing Rules and Guidelines in a precise way;
  - Refer to INSPIRE as a method for data specification development or apply some of the technical specifications of INSPIRE, even if certain activities covered by the Call for Tender do not – strictly speaking – relate to INSPIRE;

- For geoportals or data portals accessing location data, reference may be made to the use of INSPIRE data and services but not to any INSPIRE requirements for geoportals (they do not exist). To say "the geoportal should be compliant with the INSPIRE Directive" does not make sense;
- Clarify the terminology used in the procurement documents and how it relates to the terminology used in INSPIRE;
- Refer whenever possible to existing architecture documents describing the National/sub-National SDI, INSPIRE or digital public service architecture in which the requested components fit;
- Allow room for flexibility by not only referring to standards and specifications that are already adopted, but also to ongoing work.

- When including conformity requirements:
  - Be clear about which outputs/products of the procurement should/must be conformant/compliant with which specification/standard;
  - Require testing of the outputs/products on conformity/compliancy as part of the procurement.
- When referring to international standards:
  - Be as complete and precise as possible when referring to International standards;
  - If necessary, refer to a series of standards that go together, rather than to individual standards.
- When mentioning required skills and tasks to be executed:
  - Be as complete and precise as possible about the personnel required to perform the contract, both in terms of numbers and skills (qualification requirements) and about the goods, services, works to be provided;
  - Make use of common vocabularies of skills, knowledge, actors and tasks, such as the vocabularies on the INSPIRE in Practice platform.
- If necessary, employ INSPIRE/standards specialists in the procurement or follow-on implementation to ensure appropriate standards-based approaches are followed.
- Check the European Catalogue of ICT Standards for Public Procurement.
- See the initiative Living in EU which supports various interoperability initiatives, such as the Minimal Interoperability Mechanisms (MIMs) – for example, the final draft of the MIMs Plus Technical Specification v4.0 includes an updated list of the Open & Agile Smart Cities (OASC) MIMs, approved by the OASC Council of Cities on 16 June 2021, and with input from JRC aligning OASC MIM7 (Geospatial information management) with the INSPIRE Directive.

Challenges:

- Lack of understanding of what is relevant to specify in procurement documents on location standards / INSPIRE.
- Supplier evidence may be lacking in early stages of INSPIRE implementation or adoption of particular standards more generally.
- Specifying that particular standards should be followed does not guarantee that they will be followed or that solutions will be functionally or even technically proficient. Parallel functional requirements are needed in procurement. Oversight of solution delivery is needed during implementation to ensure what is promised is what is delivered.

Best Practices:

#4: Rotterdam Digital City

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 5 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 4: Data

Documentation	Elements
Implementation Guide Appendices	Custodianship, Acquisition and Management

Actions	Tools
3. Capturing and Acquiring Data	
Data Acquisition Programme	

Strategic Pathway 6: Standards

Documentation	Elements
Implementation Guide Appendices	Standards Governance and Policy Compliance Testing and Certification

Actions	Tools
1. Direction Setting	
Standards Governance Framework	APP6.1: National Governance Model Examples
3. Planning for Change	
Institutional Arrangements	APP6.4: Roles and Responsibilities for National Standards Governance
6. Achieving Outcomes	
Compliance	

ELISE Resources:

Type	Resource	Date
Guidance	EULF Guidelines for public procurement of geospatial technologies	2016

Further Reading:

- EC Communication on Against lock-in: building open ICT systems by making better use of standards in public
- Guide for the procurement of standards-based ICT — Elements of Good Practice
- Study on best practices for ICT procurement based on standards in order to promote efficiency and reduce lock-in – Survey results' analysis

- Study on best practices for ICT procurement based on standards in order to promote efficiency and reduce lock-in - Final Report
- European Catalogue of ICT Standards for Public Procurement
- EC Single Market Scoreboard – Public Procurement
- World Bank Procurement Framework and Regulations for Projects
- United Nations Food and Agriculture Organisation (FAO) procurement framework
- Living in the EU
- Open & Agile Smart Cities (OASC) and OASC Minimum Interoperability Mechanisms (MIMs) Plus Technical Specifications, Version 4

Digital Government Integration

Current State

Location information is key to effective public services and is being applied more effectively as public administrations introduce data-driven online services, spurred on by policy developments, e.g. climate, mobility, growth and EU policies such as Cohesion Policy, Smart Specialisation, Europe Fit for the Digital Age and the European Data Strategy. Digital innovation and collaborative developments are progressing in different policy areas but much more can be achieved to benefit users and partners. This will require more user-driven SDI support for digital public services, data ecosystems and digital platforms across the policy landscape, and capable of meeting both national and European demands for location data .

Vision

Location information is well integrated in digital public services and processes, supporting new business models, more effective collaboration and location-based decision making, and helping to transform public service delivery across government (G2G, G2B and G2C). SDIs are fulfilling an important role in digital transformation both nationally and in Europe. Following the once-only principle, users do not have to supply the same information multiple times. There is visibility of common coordinating and support structures, expert groups and technologies, a strong user voice in the design, evaluation and improvement of location-based services, and good evidence of digital public service innovation and take-up of services.

LIFO Monitoring

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of recommendations in the Policy and Strategy Alignment focus area in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Focus Areas.

Recommendation 6: Identify where digital public services can be simplified or transformed using location information and location intelligence, and implement improvement actions that create value for users

Why:

- As everything happens in a place or space, location information underpins many digital public services. However, this is not always understood or recognised, and location information is not always used in the most effective and efficient ways.
- Administrative burdens can be reduced and better services delivered with optimal use of location information, accessed via digital channels whenever appropriate.
- Location intelligence provides new means to gather insight, driving innovation in digital public services.
- Such action will help realise the value of location information in digital public services.
- Data, in all forms, is becoming a fundamental resource, with digital public services relying on and creating large amounts of data. Location data and interoperability concerns need to be assessed for their full contribution in these contexts and not be seen as a separate effort or after-thought.
- Users of digital public services have increasing expectations on the nature and integration of the online experience, based on their exposure to private sector applications.

How:

Key events inventory

- A focus on 'key events' which are in some way related to 'location' can help in deciding priorities for optimisation of relevant digital public services.
- Look for events that trigger a series of cascading actions and location data exchange across a network of people, businesses and organisations, and things to achieve a singular objective (e.g. moving house).
- Create an inventory of key digital government processes and services that play a role in such events and determine in which location information plays a significant role.
- Document use cases for such events in a common structured manner as this will increase the possibility of re-use and interoperability, with the associated economic advantages and user benefits. Consider using the following classification:
    - Policy area
    - Location
    - Application
    - Level – regional/national
    - Interfaces – G2C, G2G, G2B
    - Business area
    - Indoor/outdoor
    - Static/Dynamic data

  This approach will support organisational interoperability by setting a common description across Member States, a first step towards reuse of practices and then solutions. Use cases can then be documented according to the different possible scenarios related to the roles of different actors: G2G, G2B, G2C and the intermediary role for government to provide the rule engine for the different producers and consumers of data.

Digital public service optimisation

- Analyse opportunities for improving digital public services and processes in their use or potential use of location information, through internal analysis (e.g. using BPMN), external analysis (e.g. customer insight techniques) or external comparison (e.g. benchmarking, examining best practices in other Member States or other administrations in the same Member State). This can be best achieved by applying the following event-based approach:
    - Step 1: Identify key events in your environment in which location data plays a critical role. Key events are ideally real-life cases which are very recognisable and impact multiple stakeholders e.g. precision emergency response to incidents (e.g. terror attack, boat capsizes, oil spill, flooding, search and rescue, etc.) or natural disaster (e.g. tornado, tsunami, etc.) or human-related incidents (e.g. job losses, human and drug trafficking, etc.) or events impacting the local community (e.g. litter, graffiti, maintenance of street furniture, traffic flows, schools and crèche services);
    - Step 2: Analyse the bilateral data exchanges amongst the different stakeholders involved in the processes of the key event. (Techniques such as BPMN, Use Case Diagrams and Data Modelling can support this step);
    - Step 3: Rethink the processes and data exchanges, considering their role in any broader data ecosystem and exploring different options for multidirectional exchange of data;
    - Step 4: Analyse what new (location-) intelligence techniques could add value either using existing data sources or connecting with new data sources. Techniques could be for example: site location optimisation (e.g. police force deployment, automated public lighting), location impact simulation (e.g. oil spill), and geographic concentration (e.g. terrorism threats);

- Step 5: Look for new ways of collaboration with all stakeholders who might benefit from the processes and data exchanges being assessed. Stakeholders, in this context, could be those engaged in the data ecosystem, potential partners in a digital collaboration platform ('digital platform'), contributors to a digital public service or users of a digital public service. Evaluate the impact on their business and operating model, and the benefits to end-users, as input to define the new digital public services. Consider, for example, how various external parties can be integrated in the processes involved in digital public service delivery or how they may benefit from the outputs of the digital public service. This could be integration of external companies in the service delivery model with associated sharing of location data (e.g. supply of energy saving solutions to citizens and businesses signing up to energy saving initiatives), involving citizens or businesses in volunteering activities in a local borough (e.g. to clean up parks), or engaging citizens in problem reporting (e.g. 'Fix My Street' type reporting linked to scheduling systems for priority-based problem resolution).

Data ecosystem optimisation

- Some individual digital public services are part of a broader data-driven digital ecosystem (or 'data ecosystem' for short), which needs to be considered at the macro level in order to determine the role of government (the public task), the effectiveness of the ecosystem for different participants and users, and actions to improve effectiveness in particular areas. The focus of the Blueprint is on data ecosystems where location data plays an important role.
- Data ecosystems involve different actors exchanging data around a common purpose. Typically, this means different public sector and non-public sector actors (e.g. businesses, NGOs, citizens, academia). Public administrations may be a participant in the data ecosystem (e.g. road transport) or orchestrate the ecosystem (e.g. smart city management, climate action programmes, pandemic management).
- Triggers for examining ecosystem effectiveness include a policy initiative (e.g. climate policy, open government policy), an unforeseen event (e.g. pandemic), a failure in the ecosystem (e.g. traffic accident levels, crime levels), demands from or expectations of participants and users (e.g. parking availability), developments in use of technology (e.g. IoT, digital twins), or government funding actions to stimulate growth (e.g. infrastructure projects), prioritise investment or deliver savings for the taxpayer.
- Good practices for public administrations involved in data ecosystems depend on the nature of the ecosystem and their role. Some examples are described below:
    - Coordinating agreements on data models and data exchange standards necessary for the functioning of the ecosystem (e.g. travel information standards, data exchange standards for managing underground works, integration of geospatial and BIM standards in smart cities);
    - Making public data available openly determining with ecosystem partners how best to meet their needs. One aim in this is to enable private sector companies to develop products and services for the ecosystem and the broader market (e.g. Transport for London open data and unified API for developers);
    - Coordinating or participating in data sharing communities associated with the ecosystem (e.g. Intelligent Transport Systems community, UK Transport Data Initiative);
    - Developing platforms for exchanging data between multiple actors as well as delivering services and information (e.g. multi-purpose urban platforms for policy and operational management in cities);
    - Integrating dynamic and static location data in smart city applications, using IoT devices and cameras, localised processing, and integration of streamed data;
    - Coordinating or participating in ecosystems to support policy goals (e.g. Sonderborg Project Zero, Covenant of Mayors for Climate and Energy). These initiatives may include action plans, projects for different actors in support of collective goals, funding incentives, localised data collection and reporting (e.g. through a city dashboard), scenario analysis of optimal solutions (e.g. best sites for solar energy, traffic congestion measures), and localised multi-dimensional reporting against targets aggregated across different levels of government;

- Using evidence in decision making to ensure effective operation of the ecosystem (e.g. assessing impact of altering speed limits on traffic flow and safety);
- Analysing value chains and impact on different actors in the ecosystem when assessing potential changes or improvements in digital public services and use of location data that are part of the ecosystem;
- Consider opportunities for connecting with new data sources and actors, including developments at a European level with the emerging common European data spaces;
- Prioritised and interconnected projects undertaken in collaboration with different actors in the ecosystem, with associated governance arrangements to manage dependencies and ensure value delivered for multiple stakeholders;
- Funding models relevant to the functioning and sustainability of the ecosystem or core data to support multiple ecosystems (e.g. KLIP underground works in BE, Basic Data Programme in DK).

Digital platforms

- A digital platform is a business-driven framework that allows a community of partners, providers and consumers to share, extend or enhance digital processes and capabilities for the benefit of all stakeholders involved through a common digital technology system.
- A digital platform is a new way of organising, thinking and collaborating around digital government. To adopt such an approach involves a new business model, new funding structures and possibility alterations to legislation.
- Digital platforms may be used for standalone digital public services, digital public services that are part of a broader data ecosystem or a collection of digital public services, which may be provided by a single public administration (e.g. services related to city governance and operations) or multiple administrations (e.g. a national government digital platform).
- Public administrations may have different roles in the digital platforms in the same way as they have in data ecosystems mentioned above. In fact, a digital platform may be used to support the whole ecosystem or form part of the overall ecosystem.
- The most logical starting point for public administrations that seek to explore platform business models is to start with orchestration business models, as these provide a natural role for public administrations to coordinate interaction between distant groups in society. Using a digital platform approach shifts government (and others) to facilitating the integration of business processes between different actors within an ecosystem.
- The approach for public administrations implementing digital platforms may include:
  - Establish your own (government-led) digital platforms, engage in platform "co-creation" with other public or private sector stakeholders, or devise appropriate strategies on how to operate with privately owned digital platforms, as provider, consumer or ecosystem partner;
  - Evaluate with stakeholders the data exchange and analytical requirements and the appropriate technologies for addressing these requirements (e.g. IoT and location intelligence components, a 'digital twin' approach with associated scenario modelling);
  - Invest in creating and designing ecosystem partnerships to channel value to digital platforms or to ensure the digital platform delivers value to the broader data ecosystem. Foster ecosystems around government platforms or support the creation of ecosystems around private platforms;
  - For public administrations providing data as part of the 'user-driven SDI', this may involve designing the platform to target specific needs (use cases) and collaborating with the relevant stakeholders, e.g. around priorities, finance, formats, service levels.

- Public administrations should consider opportunities linked to technology innovation and approaches to investigate these opportunities, such as establishing a 'technology watch' or collaboration with universities. An example of technology innovation is the use of location intelligence for predictive policing and public safety to better position resources to improve response time.
- Technology watches should focus on the variety of technologies that influence the evolution of Digital Government, as depicted in the Hype Cycle for Digital Government in **Figure 3**. The analysis should cover both the potential for innovation and their benefits but also the time to maturity of the technology, which has an impact on the risk of investing in this technology. An example is presented in **Figure 11** below which lists the technology trends that will impact location intelligence, according to Gartner. These trends are classified both in terms of their number of years to mainstream adoption and in terms of benefit.

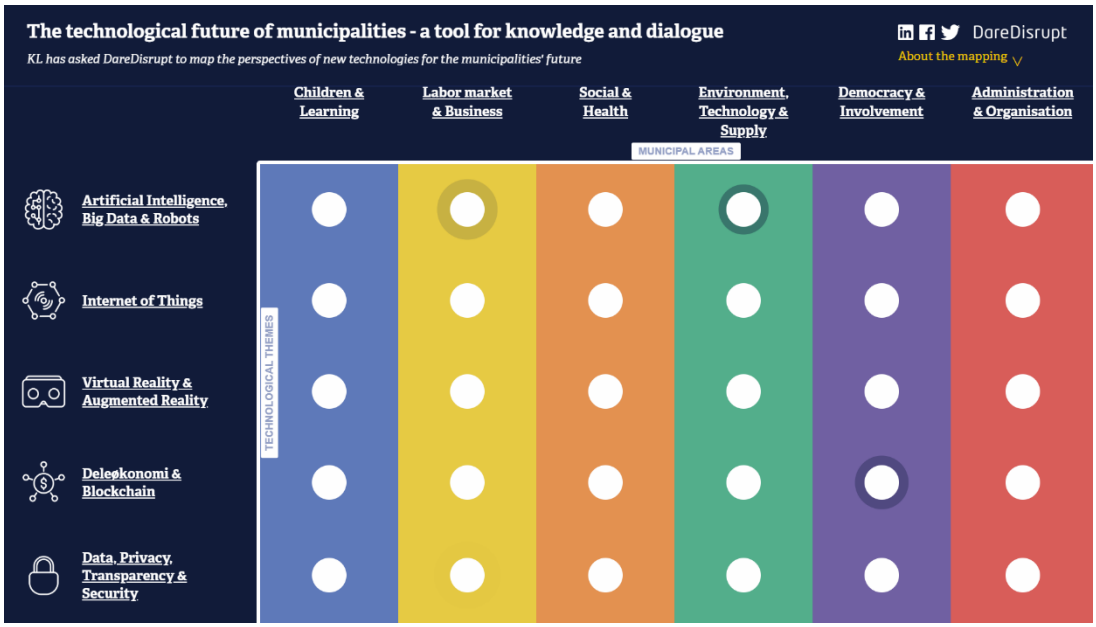
Figure 11: Technology trends that shape location intelligence

Benefit	**Years to mainstream adoption**		
	Less than 2 years	2 to 5 years	5 to 10 years
Transformational	▪ Cloud Services for Government	▪ IoT Event Stream Processing ▪ Deep Learning Networks ▪ Machine Learning ▪ Digital Government Platforms ▪ Edge AI	▪ GeoAI ▪ Data Marketplace ▪ Immersive Analytics ▪ IoT-Enabled Applications ▪ Smart Monitoring for Public Infrastructures ▪ Digital twin ▪ Blockchain
High	▪ Multichannel Communications Tools ▪ Geocoding Services ▪ Web-Mapping Tools ▪ Smart Lighting ▪ Indoor Location	▪ Social Analytics ▪ Video/Image Analytics ▪ Open Data and APIs ▪ Predictive Analytics ▪ Building Information Modelling ▪ Commercial Drones ▪ 3D/4D Maps	▪ Real-Time Analytics ▪ Smart Transportation ▪ Explainable AI ▪ IoT Platforms
Moderate		▪ Privacy by Design	▪ Advanced Anomaly Detecti

Source: Gartner Research

- New technologies should be considered in relation to existing and potential needs of public administrations in order to be able to answer the question 'why should we be interested in particular technologies?' See **Figure 12** below, which is the home page for a technology awareness tool created by KL (Local Government) Denmark).

Figure 12: Potential use of new technologies in local government



Source: KL, Denmark

Improvement programmes

- Establish improvement programmes in priority areas where public location information can be used more effectively in digital public services and processes, data ecosystems and digital platforms.
- Ensure users, partners and operational staff involved in service delivery are consulted on priorities and design of improvements.
- Determine the most cost-effective business models, from step-changes in the approach (e.g. the introduction of a collaborative 'digital platform' supporting new business models to replace previous bi-lateral arrangements) to more incremental improvements (e.g. revising a single part of the process, relationships with a single actor).
- Look for quick wins to demonstrate progress.
- Establish and publicise 'model implementations' in repeatable areas to encourage wider take-up of good practice (e.g. smart city architectures, applications and components (e.g. my nearest bus stop, reporting a problem, finding a parking space).
- Look elsewhere nationally and in other MS to identify good practices that can be re-used.
- Introduce methods of continuous assessment involving all stakeholders, to help in planning and delivery of incremental improvements, identify new factors that need to be considered, and ensure interoperability is maintained over time as location-enabled services and solutions evolve.

Challenges:

- Better use of location information is only one aspect of public service improvement.
- The significance and benefits of well-managed or applied location information may not be understood or be clear.
- The benefits of investment in other areas may be more cost effective or felt to be more cost effective because they are more clearly understood and defined.
- Individual digital public services may be collectors, providers or users of location information. The same information may be relevant in many other digital public services and wider contexts. This is particularly the case for core location data, e.g. addresses, buildings information, transport

information. However, the wider context may not be taken into account in planning individual investments.

- Digital platforms imply new collaboration and funding models and, possibly new legal instruments, together with changes in governance of data (e.g. ownership, sharing), leading to reuse, for example, of non-open data and definitions of new licensing models.
- Innovating with new technologies involves having enough time and resources to test scenarios and carry out evaluations. In this way, risks are mitigated and relevant opportunities identified.
- The value of location intelligence and the techniques that might be applicable may not always be understood or appreciated.
- Lack of available skilled resources may inhibit large scale adoption of new technologies.
- Smart spaces, smart city platforms and digital twins involve collecting, processing and analysing large amounts of data, including combining dynamic, static and modelled data from multiple sources. There are challenges in data integration and ensuring interoperability in these complex data-driven applications.

Best Practices:

1: A digital platform for location data in Flanders

4: Rotterdam Digital City

#14: Air quality monitoring and reporting in Belgium

#18: Territorial Information System of Navarre: SITNA

#21: Integrated transport solutions: TRAVELINE

#22: Standardised road safety data exchange

#23: INSPIRE-compliant marine environment e-reporting

#30: Location intelligence for ground works – KLIP platform

#31: Digital Twins of Helsinki

#32: City of Madrid - Asistencia COVID19

#33: Urban platform, Guimarães

#37: Integrated Rescue System

#40: Rubber Boot Index

#41: Public private partnership for development and release of hydrological elevation model

#45: Common Services BUILD

#46: Citizen Map

#47: IDE-OTALEX

#49: Rennes Urban Data Interface (RUDI)

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 6 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 6: User centricity	Recommendation 13: As far as possible under the legislation in force, ask users of European public services once-only and relevant-only information.
Underlying Principle 10: Administrative simplification	Recommendation 17: Simplify processes and use digital channels whenever appropriate for the delivery of European public services, to respond promptly and with high quality to users' requests and reduce the administrative burden on public administrations, businesses and citizens.
Interoperability Layer 4: Organisational Interoperability	Recommendation 28: Document your business processes using commonly accepted modelling techniques and agree on how these processes should be aligned to deliver a European public service.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 5: Innovation

Documentation	Elements
Implementation Guide Appendices	Technological Advances Innovation and Creativity Process Improvement Bridging the Geospatial Digital Divide

Actions	Tools
2. Identifying Innovation Needs	
Monitoring Trends	APP5.3: Geospatial Drivers and Trends
Technology Needs Assessment	APP5.4: ICT Data Inventory APP5.5: PEST and SWOT Analyses
3. Transformation Roadmap	
Modern Data Creation Methods	APP5.7: Modern Data Creation Methods
Enabling Infrastructure	APP5.8: Data Integration Approaches APP5.9: Data Storage Processes
4. Culture of Innovation	
Geospatial Digital Transformation Strategy	APP1.3: Guidance for Mission, Vision and Goals Statements Future trends in geospatial information management: the five to ten year vision (third edition) Framework for Effective Land Administration Strategic Framework on Geospatial Information and Services for Disasters COVID-19: Ready to Respond - The role of the Geospatial Community in Responding to COVID-19
5. Operationalising Innovation	
National Innovation System	
Innovation Programmes	APP5.10: Pillars of an Innovation Programme
Innovation Hubs	

Process Improvement	APP5.11: Critical Path Analysis
6. Innovation Ecosystem	
Bridging the Digital Divide	APP5.12: Open SDG Data Hubs
Integrated System of Systems	

ELISE Resources:

Type	Resource	Date
Study	Digital Government Benchmark: Study on Digital Government Transformation	2018
Study	Digital Platform for Public Services	2018
Study	Blockchain for Digital Government	2019
Study	Establishment of Sustainable Data Ecosystems	2021
Guidance	EULF References v2 - see examples of use cases	2016
Guidance	Design of location-enabled e-government services	2020
Guidance	Improving use of location information in e-government processes: methodology and use case	2020
Webinar	ELISE webinar series - for more information on new technologies in the public sector, such as location intelligence, digital twins and GeoAI	
Webinar	The role of Organisational Interoperability in the context of Geospatial and Digital Government Transformation	2020
Webinar	Digital Twins - Are they ready to embrace the benefits of Location Information?	2020
Webinar	Geospatial Data and Artificial Intelligence – a deep dive into GeoAI	2020
Webinar	Location Intelligence for Cities and Regions: preparing the ground for smart places of the future	2020
Webinar	Location Intelligence Technology trends and case studies in digital government	2020
Webinar	Monitoring and understanding emerging geospatial technologies	2020
Webinar	Location enabled public services	2020
Webinar	Geospatially enabled modelling, simulation and prediction	2021
Webinar	Blockchain and proof of location supporting digital government	2021
Webinar	Immersive realities and location for better public services	2021
Webinar	Digital platform for the smart management of infrastructures - the public lighting case	2021
Webinar	3D city models to predict energy heat demand	2021
Webinar	Data driven methodology for electricity characterisation of districts	2021
Workshop	Energy and Location: Spatial data for modelling building stock energy needs	2015
Workshop	Energy and Location: Methodologies for energy performance assessment based on location data	2016
Workshop	INSPIRE Conference: New directions in digital government using INSPIRE	2017
Workshop	INSPIRE Conference: INSPIREd Energy	2017
Workshop	INSPIRE Conference: Digital transformation and the future of SDIs	2018
Workshop	INSPIRE Online Conference: Co-innovation with public-private	2020

	sector data ecosystems Presentations and Video Event Report	
Workshop	INSPIRE Online Conference: The Role of Smart Cities in Meeting the Objectives of the Green Deal - Geospatial data for smart city applications	2020
Workshop	INSPIRE Online Conference: Energy and Location	2020
Workshop	18th European Week of Regions and Cities: Participatory Lab on 'Location Intelligence4Cities and Regions'	2020
Pilot / Testbed	EULF Transportation Pilot - A model implementation in the ITS domain involving sharing of safety-related road data in Norway and Sweden that can be followed by other countries	2014 - 2017
Pilot / Testbed	Energy and Location Applications - Pilot activities involving various cities and regions to demonstrate how an integrated data approach can support planning, implementation, monitoring and reporting for multiple policies and initiatives, considering energy performance of buildings, energy consumption of buildings and energy production at a local level	2015 - 2021
Pilot / Testbed	EU Gazetteer - Feasibility study, survey and evaluation study for an EU gazetteer common service	2016 - 2020

Further Reading:

- United Nations E-Government Survey
- OECD Digital Government
- Digital Government Benchmark - Study on Digital Government Transformation
- EU Cohesion Policy 2014-20
- EU Cohesion Policy 2021-27
- EU Smart Specialisation Platform
- Declaration on joining forces to boost sustainable digital transformation in cities and communities in the EU
- E-Government: Using technology to improve public services and democratic participation, European Parliamentary Research Service, 2015
- ISA2 Innovative Public Services: Bringing new technologies into the public sector
- Transport Data Initiative
- Transport for London – Open Data and APIs
- Intelligent Transport Systems, European Commission
- Intelligent Transport
- FixMyStreet
- GIS and BIM integration leads to smart communities, ESRI
- Project Zero, Sonderborg
- Covenant of Mayors for Climate and Energy
- European data strategy, 2019
- The technological future of municipalities - a tool for knowledge and dialogue, KL (Local Government) Denmark
- Principles for Spatially Enabled Digital Twins of the Built and Natural Environment in Australia

- Digital twins for the built environment, Atkins
- Digital Urban European Twins (DUET)
- Ordnance Survey Case Studies
- Geospatial Singapore
- Geospatial AI/ML Applications and Policies: A Global Perspective, World Geospatial Industry Council Policy Report, 2021
- SmartCitiesWorld City Profile - Barcelona
- Helsinki's 3D city models and Kalasatama Digital Twins Project, Final Report
- Fin Est Digital Twin Cities – 3D city model demonstration

Recommendation 7: Use spatial data infrastructures (SDIs) in digital public services and data ecosystems across sectors, levels of government and borders, integrated with broader public data infrastructures and external data sources

Why:

- 'Location' is a key integrating factor for a lot of public sector data used in digital public services and data ecosystems across sectors, different levels of government and borders. To manage this integration effectively and efficiently requires well organised and widely used SDIs with interoperable authoritative location data integrated with broader public data infrastructures.
- National SDIs are faced with increased demands in terms of volume and complexity. The range of uses of location data in government is increasing both nationally and in the EU. This requires a well-organised SDI approach addressing all upstream and downstream aspects of data. Some of the factors impacting SDIs in this context are:
    - Public administrations are increasing involved in collaboration with the private sector through partnerships and ecosystems, where their data plays a role in a bigger picture;
    - The drive to open public data is shifting from 'any data' to 'high value data' and on to 'interoperable high value data';
    - Data innovation in cities is developing rapidly with integration needed both across city platforms and with higher levels of government;
    - Dynamic location data is increasing in importance in applications served by the SDI.
- INSPIRE is built on Member State SDIs. In some cases, INSPIRE has been the driver for a national SDI, in other cases INSPIRE is a use-case for reference data and thematic data in the national SDI where integration is required. The impact of INSPIRE has been to create a level playing field on location data interoperability relating to environmental policy in Europe. The principles applied in national SDIs and INSPIRE and the body of interoperable authoritative reference data can be applied more widely in different sectors and in cross-border applications.
- The Open Data Directive requires Member States to publish existing high value datasets as open data, using APIs for data access. Location datasets from the INSPIRE Annex 1 themes are likely to be included, e.g. addresses, geographic names, cadastral parcels and transport networks. This has implications and opportunities for SDI support to data ecosystems and opening up the SDI to businesses.
- Further to this, the European data strategy envisages implementing a series of European 'data spaces' in particular sectors using a federated cloud infrastructure to enable growth through new data-driven products and services (in the private sector) and support European policy and cross-border digital public services. Location data will be important in all these data spaces. To derive maximum value from the use of the data, it will be important to have an integrated user-driven governance and design approach for the data spaces. National data and SDI strategies will need to evolve to encompass and derive value from the new EU measures.

- SDIs will need to evolve and potentially transform significantly to support new and hybrid requirements and become better integrated in the different data ecosystems operating across Europe. To do this, national SDIs and the European SDI (INSPIRE), which have tended to be provider-driven, will need to become more user-driven.
- Developers or those in charge of digital public services have to decide on the range of data they will require or produce (both location data and other data), how they should access any source data, whether they should share any data they produce and how this sharing should be done. Data involved may be a mix of public sector data and external data. The applications may be confined to a particular sector or topic or involve multiple sectors or topics (e.g. smart cities applications). Integration can be a challenge particularly as different sectors have their own standards (including differing location data standards). There may be a combination of more static and more dynamic (e.g. IoT) data to consider. Doing all this in an organised way can be a complex task. Having a well-defined and well-organised national data infrastructure and SDI is beneficial but developers need to make use of the infrastructure and contribute towards its evolution. Private sector companies can support the process but they will also need to apply harmonised and reusable concepts to ensure long term value from what is produced.

How:

- The overall approach involves a set of actions to position the SDI for the future and ensure it fulfils given needs. The approach is divided into checklists for four distinct elements, any one of which may be relevant depending on the status of SDI development in the country and the background and interest of the reader:
  1) National data infrastructure assessment – ensuring the national data infrastructure meets evolving user and integration needs and incorporates location data effectively;
  2) Transition to a user-driven SDI – specific actions across the public sector to create a multi-purpose SDI supporting different user needs and priorities;
  3) Publishing SDI data – Actions for data providers to ensure they support both immediate and potential user needs, recognising the multi-purpose nature of the SDI;
  4) Building digital public services using the SDI – Actions for developers and those responsible for digital public services to ensure they get the most out of the SDI.
- Note that some of the checklists contain references to European data policies, where precise implementation requirements are not yet known. This should be borne in mind when reading the guidance and the current implantation status of these policies taken into account in planning any actions.

1. National data infrastructure assessment

- Review the current status and operation of the national public sector data infrastructure and how location data is integrated into the infrastructure. Consult relevant organisational, national and EU experts in this review. The review should consider:
  - How well the national data infrastructure its location elements fit with national and European strategic priorities and what needs to change;
  - The scope and purpose of the national data infrastructure;
  - The scope and intent of all relevant legislation relating to data sharing and data protection;
  - The standards applied within the national data infrastructure, how well do these standards serve current information needs, and where are the problem areas or gaps;
  - Where is innovation through data sharing taking place or needed (e.g. in cities, intelligent transport, energy, health);
  - The extent to which data ecosystems involving different sectors or levels of government (local, national, EU) are considered in the national data infrastructure and how integration of the different data ecosystems is managed;
  - The implications of different European legislation on the national data infrastructure and how requirements can be met in the most efficient way (e.g. Open Data Directive, European

data strategy, ITS, Energy directives, European statistical system);

- The specific requirements of the Open Data Directive and the European data strategy for the national data infrastructure and within particular sectors, including free of charge access to high value datasets, implementation of common sector data spaces using a federated cloud infrastructure, mechanisms for integrating and sharing data (e.g. APIs, context brokers), establishing a user-driven infrastructure, and linking more closely with the private sector (including integrating private sector data into the national data infrastructure);
- How location data, through the SDI, is organised to support information needs and as a basis for integration in particular sectors, data ecosystems and applications;
- The implications of IoT data integration and edge computing for the national data infrastructure and the SDI (IoT devices very often provide location-related data);
- The mechanisms for ensuring location interoperability, including requirements on standards, the role played by the INSPIRE data specifications and technical services, implementation of APIs and context broker mechanisms, and master data management processes (including those associated with any new cloud infrastructure).

- Update the national data infrastructure strategy explaining the transformation to a model that supports:
  - current and evolving user needs of all types;
  - effective integration of location data requirements, with the role of the SDI and INSPIRE factored into the thinking and documentation of the new national data framework;
  - the increased volumes and types of data (e.g. rapid IoT expansion);
  - the diverse uses of data at different levels of government (local, national, sector, EU);
  - how innovation in the use of data will be built into the data framework;
  - how new models of data sharing (e.g. data ecosystems, European data spaces, API access to open high value datasets) will be addressed;
  - how different operational delivery models will be implemented, e.g. digital platform models and more tightly integrated third party contributions from businesses and citizens (input to priority setting, service design, feedback on data, and data contributions).

2. Transition to a user-driven SDI

- The provider-centric model of SDIs has not generated the level of uptake and benefits envisaged. The future user-driven SDI will need to reflect and balance the needs of a wide variety of actors and support multiple purposes. A user-driven SDI is one where user needs and priorities drive decisions and funding in relation to the SDI, different user interests are represented in the governance process and addressed in a balanced way, there is wide consultation with different providers, users and data integrators, joint decisions on scoping and data release, co-design and co-creation of technological solutions, transparent communication, and feedback from consumers to providers on data quality and value. Automated means of managing quality through AI techniques should also be considered. Furthermore, the user-driven nature of the SDI is measured and reported on periodically and the impact of changes on user satisfaction communicated to all stakeholders. In summary, the operation of the SDI is based on user-value.
- If there is an extensive contribution from the location community to the national data infrastructure strategy, the focus will be on aligning with the new model. However, specific details regarding the SDI may need to be spelt out in an annex to the national data infrastructure strategy or in a separate location data strategy or framework. Whatever the approach, sufficient consideration will be needed to conceptualise, plan and guide in a practical way the transformation to a user-driven, multi-purpose and versatile SDI.
- The transition to a user-driven SDI should be considered as 'transformational' rather than 'evolutionary', so the implementation will cover a number of years and will require building value incrementally, taking on board learning and accommodating fresh requirements. Elements to consider in the planning are outlined below:

2.1 National SDI framework

- Ensure the national SDI strategic framework gives attention to the following:
    - Governance of the SDI, including user participation, transparency in decision making, and monitoring and funding based on user value;
    - Interoperability specifications for metadata, discovery, access to data, and licensing;
    - Support for multiple use cases through reference data and thematic data. This will include models for different sectors and levels of government – local, regional, national, multinational and trans-national – with a focus on reference data interoperability across the different domains and publication schemes, responsibilities and any specific interoperability specifications for different sectors, data ecosystems and applications;
    - The approach to European integration (see below) – this will include references to the role of INSPIRE;
    - The catalogue of standards and any updates required for the multi-purpose user-driven SDI framework;
    - Methods of publishing APIs for access to different data sources;
    - Methods of integrating more dynamic data and supporting life-cycle requirements (e.g. temporal data requirements);
    - Methods for integrating external data (e.g. from businesses and citizens) into the national SDI and for linking with major external location data sharing services (e.g. OpenStreetMap, Google);
    - Methods of supporting location intelligence, including uses of AI;
    - Infrastructure deployment, including use of cloud infrastructure;
    - Sponsorship and support for innovation in use of location data;
    - Skills and awareness raising for the multi-purpose SDI (this should cover providers and consumers of data in the SDI).

2.2 Data ecosystems

- 'Data ecosystems' (or 'data-driven digital ecosystems') are communities in different sector and geographical contexts deriving value from data exchange for specific purposes (e.g. Sustainable Development Goals monitoring, traffic management, crime and security, disease control, weather services). Location data is important in many data ecosystems but the standards and access mechanisms in different ecosystems are not always compatible. National SDIs should be capable of supporting different data ecosystems effectively now and into the future.
- Establish and share learning for effective data ecosystems in which the public sector has an interest as a data provider or user of external data and where the public sector role is one of ownership, orchestration, participation, regulation or different combinations. Consider the main different data ecosystem scenarios, e.g. city management, sector data ecosystems, policy reporting.
- Identify the role of location data in effective data ecosystems and determine the degree of harmonisation possible for different scenarios
- Based on the existing data framework assessment above and the understanding of effective location-enabled data ecosystems, plan a programme of transformation on multi-national, national, and sub-national data ecosystems to maximise value in the data economy.
- Address national and international priorities for transformation in data ecosystems and in the role played by location data, e.g. in relation to sharing core reference data or broader thematic data integral to the data ecosystem (e.g. mobility, energy ecosystems).
- Data ecosystems combine static and dynamic data, operate at different levels of granularity, and have different temporal requirements. Methods need to be found for better integration of spatial data to support overlapping scope (e.g. the links between mobility, climate, health and security) and different models and requirements (e.g. smart cities, intelligent transport, indoor

SDIs, augmented tourism, grid-based statistics).

- Analytical methods used in data ecosystems, include modelling techniques (e.g. 3D and 4D modelling), predictive analytics (e.g. GeoAI) and other techniques for combining observed and predicted data (e.g. for predicting energy performance of building stock or noise levels in a locality). These analytics become part of the ecosystem and drive further requirements in terms of observed data from the ecosystem. This mode of operation is very different from the typical SDI publication model, although the community approaches offered by initiatives like OpenStreetMap give possible approaches for future data ecosystem models.
- An important focus for SDIs will need to be on the standards and methods for integration. These methods will need to converge more with prevalent ICT access methods (e.g. through APIs) rather than more traditional web services (the basis of INSPIRE). For example, the CEF Context Broker should be considered as a method for integration in different data ecosystems. The CEF Context Broker is a standard-based API allowing users to collect, integrate and contextualise near real-time data. It is often used by cities to track real-time actions and to make real-time decisions (see Best Practice 33).
- Promote sharing of good practice in data ecosystems and platforms for city modelling and operations. Encourage reuse of models and solutions in different cities, supported by innovation funding to encourage growth and social benefit. Learn from good practices in smart cities and digital twins in Europe.
- Organise the communities of practice to promote collaboration and serve respective needs through these data ecosystems, with location data specialists occupying a key role in these communities of practice.

2.3 European integration

- The plan for transition to an all-purpose user-driven SDI needs to address evolving European policy requirements, including the Open Data Directive, the European data strategy, the European Green Deal and the evolution of INSPIRE.
- The current INSPIRE programme concludes in 2020. As part of the Green Deal policy, there will be an assessment of the INSPIRE and Environmental Information directives, with the aim to modernise the regime in line with technological and innovation opportunities, making it easier for EU public authorities, businesses and citizens to support the transition to a greener and carbon-neutral economy, and reducing administrative burden.
- The European data strategy outlines plans for common interoperable European data spaces in strategic sectors. A first step will be to put in place an enabling legislative framework for governance of the European data spaces (Q4/2020). This should support decisions on what data can be used in which situations, facilitate cross-border data use, and prioritise interoperability requirements and standards within and across sectors, while taking into account the need for sectoral authorities to specify sectoral requirements.
- The European data strategy aims to be demand driven. A key focus will be on high value datasets which are intended to be shared free of charge through APIs. Some of the high value datasets will be spatial datasets. The Open Data Directive, which comes into force on 17 July 2021, has been introduced to drive forward this requirement.
- Also relevant is the 'Destination Earth' initiative which will develop a high precision digital model of the Earth to visualise, monitor and forecast natural and human activity in support of sustainable development and Europe's efforts for a better environment as set out in the Green Deal. The digital twin of the Earth will be constructed progressively, starting in 2021, as part of the work programme for the Green Deal data space.
- All of these policies will have important implications for national SDIs. Plans should be developed to incorporate national high value datasets in the European infrastructure, including any changes needed in relation to national core data initiatives as well as licensing and funding models. The publication schemes for the European data spaces and future INSPIRE data sharing will also need to be addressed. Member States manage their SDI master data to support national, European and global needs. INSPIRE publication often involves transforming national master data to INSPIRE models and providing access through INSPIRE services. The European data

spaces may require different 'distribution paths' for SDI and other sector data. The European Commission needs to work closely with Member States to ensure the opportunities from data reuse are managed as efficiently as possible, through a well-integrated data governance approach.

- Piloting of solutions will play an important role in the development of European data spaces. National stakeholders should make an effective contribution to ensure mechanisms are established that align well with national data infrastructures. The pace of evolution of the European data spaces will need to be factored into the national data infrastructure schedule, including the plans regarding spatial data.
- A key purpose of the European data spaces is to support development of private sector data-driven products and services and promote growth. National administrations should ensure that their data is openly available through portals and other channels and that industry is engaged effectively in governance and can benefit where possible.
- National administrations involved in developing or contributing to the 'user-driven SDI' will need to plan how they will deal efficiently with the different and overlapping data requirements of different European directives as well as their national needs. For example, national public transport access nodes (e.g. bus stops, rail stations) may be available to national operators through APIs, form part of the INSPIRE transport network data accessed via web services, need to be accessible via the National Access Points (NAPs) required under the ITS directive, and will no doubt form part of the European transport data space (this may even be one of the high value datasets).

3. Publishing SDI data

- Data providers for the national SDI have a number of important considerations to take into account as their administrations continue to improve and transform their digital public services using data more extensively, and European policies evolve to place an even stronger emphasis on the roles of 'digital' and 'data' in the economy and society.
- Digital government transformation is at different stages in European Member States and some are following different paths depending on, for example, the national economy, social norms, the policy agenda, and the state of maturity in digital government. Nevertheless, there are common themes in terms of 'digital explosion', 'digital by default', 'technology enabled innovation', 'digital enabled growth', 'data-driven economy', 'social, economic and environmental interconnectivity', 'collaborative government', 'digital trust' as well as 'digital divide', 'digital skills gaps' and 'inequality'.
- SDI data providers have played an important role in national digital and data strategies and have evolved from specialists in collection and provision of location data to active participants in digital government transformation, linked more closely with broader digital and data policy and implementation both within government and with external stakeholders. As 'digital' and 'data' become more pervasive, the integral role of SDI data providers will become more important. The use cases for location data will grow exponentially and effective integration with other types of data will be vital.
- SDI data providers should ensure they understand the needs of the communities and customers they serve and that they are responsive to those needs in terms of the data and services they provide. This can be done, for example, through participation in national or ecosystem governance, developing their own customer communities, or engaging as specialists in pilots or customer projects.
- The communities served for reference data providers (e.g. NMCAs) is much broader than the communities for thematic data providers. In either case, their products and services should be user driven. With many more use cases, reference data providers will increasingly need to balance their offerings. Thematic data providers will have more demands in terms of depth of data and service.
- Publishers of location data will increasingly be dealing with different types of data, such as satellite imagery and sensor data. Data management and publication schemes will need to be implemented to reflect the large volumes of data involved, the dynamic nature of some of these data feeds and the need to assemble data in an organised way for analysis and decision making.

Event stream processing techniques should be developed and applied. Data should be organised to align with persistent identifiers of related (reference) datasets (including INSPIRE datasets). Retention schemes should also be managed carefully according to the permanence or transience requirements for use of the data.

- The introduction of new technologies and ways of using location data (e.g. IoT, digital twins, GeoAI) will create opportunities both for existing and new providers of data and services.
- The interconnected nature of demand, expectations on quality and service levels, together with the drive to open data will need revisions to funding streams to maintain quality and, in many cases, continued provision of legislated data and services.
- Much of what is happening nationally is mirrored at a European level. Policies relevant to national SDI data providers include the Open Data Directive, the European data strategy, the European Green Deal (within which the future role of INSPIRE will be assessed), Join, Boost, Sustain: the European way of digital transformation in cities and communities, and the Intelligent Transport Systems (ITS) directive.
- As environmental policy evolves, publishers of INSPIRE datasets should respond to any changes required in the datasets or the European publication requirements. Where the INSPIRE data is transformed from other national sources, they may also need to respond to any changes in the source datasets. All relevant changes will need to be reflected in the metadata, data management schemes, licensing and services to access the data.
- INSPIRE does not require publication of open data though national policy may have introduced such a requirement. The Open Data Directive will require publishers of existing high value datasets across Europe to make their data available free of charge for reuse. Geospatial data has been identified as one of the priority themes, though the initial choice of datasets is still to be made.
- Publishers of important location datasets should contribute to national and European policy preparations, in terms of deciding which datasets, defining the national funding model, introducing any licensing changes, and preparing operationally for open access to the data. As with the initial phase of INSPIRE, there are no requirements to change the data. However, publishers should participate in open data communities to be aware of needs, put in place mechanisms for user feedback, and be responsive to this feedback in improving the data or services. Demands may come both nationally and internationally for the data or improvements to the data.
- The drive towards more open data is likely to be extended both nationally and through ongoing European policy developments. All location data publishers should be aware of these developments and either be well prepared for them or take their own steps to make their data openly available.
- The Open Data Directive requires high value datasets to be published using APIs, in line with standard approaches being adopted in the ICT and web communities. Location data publishers should adopt standard API approaches, such as OGC API-Features and OGC SensorThings API. For INSPIRE data publishers, the API4INSPIRE wiki on GitHub will be a good resource to follow developments. Publishers should also be alert to any broader European or national API approaches, with more general requirements on publication and sharing of APIs.
- The European data strategy will establish common European thematic data spaces (e.g. environment, health, mobility, energy). There will be requirements for location data across all the data spaces both in terms of reference data and thematic content. Location data publishers can expect to have an important role in supplying data to support the needs of the data spaces and in enabling interoperability of data and efficiency in data management. An organising framework will be needed across the data spaces and, in this respect, the experience of Member States in organising their SDIs to support cross-sector digital strategies and in managing contributions to INSPIRE will be relevant. Location data publishers should contribute to consultations and working groups in defining the approach.
- Suppliers of core reference location data are likely to have requirements in all the data spaces, alongside potential obligations on open data supply. Suppliers of thematic location data in different policy areas will need to establish how best to address thematic needs, working where

necessary with peers in different policy areas on best practice approaches. Relevant funding and hosting models will need to be established. On the latter, the European data strategy aims to establish a federated cloud infrastructure. Location data publishers will need to plan how to make use of these capabilities.

- Publishers of core reference and environmental location data should be ready to respond to new requirements emerging as part of the Green Deal and GreenData4All policies, the Destination Earth initiative and the plan outlined in the European Data Strategy to establish a Green Deal data space. Both INSPIRE and the European Environmental Regulations will be reviewed in the context of these developments. Data publishers should contribute to any consultations and plan their responses accordingly.

- Environmental e-reporting requirements will include indicators for the European Green Deal policy and indicators for UN SDG reporting. Synergies in data will need to be managed. Broader requirements for data sharing will need to be met in relation to the GreenData4All, Open Data Directive and European data space requirements, including addressing demands for data and integration of data from external parties and new sources of supply (e.g. city environmental dashboards).

- Location data publishers will also be required to participate in a more heterogeneous data supply approach envisaged under the European data strategy. This may involve integration of external data with their data (e.g. OpenStreetMap, other community generated data, business data) and participation in data marketplaces through digital platforms.

- A key aspect of the European data strategy is the focus on priorities and demand. This may involve a shift in obligations with some changes to INSPIRE requirements. The INSPIRE principles relating to data supply will still be relevant but will need to be supplemented with a strong focus on user needs across a significant array of policies, digital public services, external organisations and data ecosystems. Thematic needs in different policy areas will still have to be met. There will however be increased cross-sector demand (e.g. smart cities data ecosystems) and cross-border demand (e.g. pandemics and other emergencies, digital single market developments). Location data publishers should establish outreach, engagement, funding and supply mechanisms to meet the increase in and variety of demands in an agile, balanced and cost-effective way.

4. Building digital public services using the SDI

    - Those in charge of digital public services will want to build their solutions to support needs for innovation and improvement and deliver long term value. Where location data plays a role in digital public services, reusing and contributing to the SDI will be a key part of the value proposition.

    - Having access to a clearly defined and organised public sector data framework can help in deciding the approach to data management, acquisition and sharing for re-use. For spatial data, the SDI framework will be an important reference and source for data. Ideally the SDI framework will be well-aligned with the national data framework as most if not all digital public services with spatial data content, combine both spatial and other data.

    - Those developing digital public services should reference and apply the data frameworks (national and SDI) and reuse data, through standardised access mechanisms (e.g. INSPIRE services, APIs). Where data is collected and needs to be shared more widely than the particular digital public service, this should be done applying the same standardised approach (e.g. use of persistent identifiers, metadata publication, availability of APIs to access the data).

    - The particular digital public service being developed may be part of a broader data ecosystem (e.g. 'road maintenance' and 'traffic control centre operations' are part of the operation of the 'road transport network' and associated 'navigation services'). Developers of digital public services will need to work with those in the broader data ecosystem, to define the most applicable data management approach, including standards for exchange of both spatial and other data.

    - Public administrations may have their own guidance for such activities or may rely on national guidance. In either case, those in charge should both reuse the available guidance and contribute to making the guidance more comprehensive and robust if they are developing digital public

services which are at the boundaries of the data and technologies typically used.

- Peer communities may help in deciding the approaches to building digital public services. These may be at a sector level (e.g. the Transport Data Initiative in the UK) or for particular categories of applications (e.g. smart cities). Those in charge of digital public services may benefit from working with peers to develop reusable models (e.g. smart city models) that apply the national data and SDI frameworks for common purposes (e.g. in different cities) in cost-effective ways.

Challenges:

- The difference between spatial data infrastructures, data ecosystems and now data spaces is not widely understood. The definitions in Annex I and the explanations given in this recommendation should hopefully make this clearer. See also, the International Data Spaces initiative under Further Reading.
- The European data strategy is effectively promoting the concept of a European data infrastructure and within that, a European SDI. INSPIRE has delivered harmonised spatial data (reference data and thematic data) for environmental policy. The challenge is in defining the European SDI approach that combines the deep needs of environmental policy (e.g. GreenData4All) and support within the Green Deal data space with the broader needs of the different policy areas addressed in the other data spaces. This is complicated by the use of different standards for spatially related data in different sectors (e.g. in terms of data models, metadata and access methods). These standards are sometimes as embedded and long-serving as those supporting environmental policy (through INSPIRE). The likelihood is one of harmonising where possible and desirable different sector approaches. In this respect, the steps taken by INSPIRE on reference data (Annex 1) provide a worthwhile basis for broader integration and support. INSPIRE has already made improvements on data access and priorities, and these will need to be carried forward to further improvements using more mainstream ICT access methods (e.g. APIs), integration of more dynamic data (e.g. IoT), and support for analytical and modelling capabilities.
- Some of the challenges and learning from INSPIRE may be relevant for both the Commission and Member States in establishing a broader European approach, e.g.:
    - Policies may reference INSPIRE but are unclear in exactly what correspondence is expected;
    - Different interpretations of the INSPIRE specifications can create challenges in cross-border harmonisation;
    - INSPIRE does not require the publication of new data but user demand may point towards the need for new data;
    - INSPIRE extensions have been attempted to accommodate broader needs but the process is more complicated than expected;
    - Data may be mandated in the INSPIRE roadmap but not seen as a priority by users of the data.
- The Open Data Directive requires publication of high value datasets which are free of charge at point of use and available through APIs. Some of the high value datasets will be spatial datasets. INSPIRE does not mandate open data although INSPIRE principles are well-served by open interoperable spatial data. As part of the culture change towards opening up public sector, some Member States have already enabled open access to some of their spatial datasets. However, the approach is not universal or uniformly applied (e.g. different licensing schemes may apply). A more uniform approach will be needed when the Open Data Directive comes into force.
- Data ecosystems evolve for different purposes. Methods for ecosystem operation are developed for these purposes. Adoption of common standards and methods for (spatial data) integration across ecosystems will be considered but are not a priority in establishing the ecosystems. To achieve a high degree of harmonisation across multiple data ecosystems with overlapping data scope is challenging and may not be feasible due to the level of investment in legacy standards which are already fit-for-purpose in particular scenarios.
- Integration of different types of location data in data ecosystems and SDIs (e.g. IoT data, imagery, time series data) and the use of analytical models with requirements to store scenarios

or use results alongside observed data, present new technical and data management challenges compared with the more static data typically shared through SDIs. There will also be challenges in determining the boundaries between (specific) data ecosystems and (shared) SDIs.

- SDIs typically involve authoritative location datasets such as those supporting national core data initiatives and INSPIRE. There is often regulation around this authoritative data. Different methods of generating and sharing authoritative data as part of the SDI will need to be considered in the future, including collecting IoT data and integrating third party data in the SDI. There is a challenge in maintaining authority and trust in highly dynamic data environments.
- Numerous data-related innovations are being implemented in urban and regional contexts (e.g. smart cities, digital twins, measures on climate action). Some of the best pockets of innovation are in cities but the challenge is to scale up the extent of innovation across all cities and to higher levels of government. How to scale and spread data-driven innovation is not widely or fully understood (see also Recommendation 16).
- The governance of data in this increasingly complex setting is challenging. Data infrastructure integration is required at national, European and global levels and in different thematic sectors. Integration at all levels is highly complex. Strong governance is planned in relation to the EU data strategy but this will have to be set alongside national, sector and data ecosystem governance involving the same data. The challenge for the Commission will be to maintain momentum and build up critical mass in the European data spaces while minimising the burden on Member States and ensuring a fair reflection of the needs of all parties in decision making.

Best Practices:

#2: IDOS - Cross-border journey planner for citizens

#4: Rotterdam Digital City

#6: Digital Exchange platform for spatial plans

#8: 'One solution for all emergency services' in Poland

#11: Register of Territorial Identification, Addresses and Real Estates (RÚIAN)

#12: Enterprise locations in the Euregio Meuse-Rhine

#13: KLIC to prevent damage caused by excavation works

#14: Air quality monitoring and reporting in Belgium

#15: Information System of Contaminated Sites in Slovakia

#16: Managing the granting of licenses for selling tobacco

#17: Location-enabled census data in Poland

#18: Territorial Information System of Navarre: SITNA

#19: Democratisation of soil data in the UK

#22: Standardised road safety data exchange

#23: INSPIRE-compliant marine environment e-reporting

#30: Location intelligence for ground works – KLIP platform

#31: Digital Twins of Helsinki

#33: Urban platform, Guimarães

#34: Extending INSPIRE data specifications beyond environmental policy

#37: Integrated Rescue System

#38: Cross-border management of Lake Constance area

#44: Geoplatforme: a collaborative initiative for management of geodata

#47: IDE-OTALEX

#48: Interactive tool for geospatial presentation of statistical data (STAGE)

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 7 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 5: Technological neutrality and data portability	Recommendation 9: Ensure data portability, namely that data is easily transferable between systems and applications supporting the implementation and evolution of European public services without unjustified restrictions, if legally possible.
Interoperability Layer 1: Interoperability Governance	Recommendation 20: Ensure holistic governance of interoperability activities across administrative levels and sectors.
Interoperability Layer 5: Semantic Interoperability	Recommendation 31: Put in place an information management strategy at the highest possible level to avoid fragmentation and duplication. Management of metadata, master data and reference data should be prioritised.
Basic Component 5: Catalogues	Recommendation 44: Put in place catalogues of public services, public data, and interoperability solutions and use common models for describing them.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 1: Governance and Institutions

Documentation	Elements
Implementation Guide Appendices	Leadership

Actions	Tools
3. Setting Direction	
Strategic Alignment Study	APP1.2: Strategic Alignment Template
Geospatial Information Management Strategy	APP1.3: Guidance for Mission, Vision and Goals Statements Future trends in geospatial information management: the five to ten year vision (third edition) Global Statistical Geospatial Framework Framework for Effective Land Administration Strategic Framework on Geospatial Information and Services for Disasters COVID-19: Ready to Respond - The role of the Geospatial Community in Responding to COVID-19
4. Creating an Plan of Action	
Change Strategy	
Country-level Action Plan	APP1.4: Country-level Action Plan Template

Strategic Pathway 2: Policy and Legal

Documentation	Elements
Implementation Guide Appendices	Legislation Norms, Policies and Guides Data Protection, Licensing and Sharing

Actions	Tools
2. Assessing Needs	
Review and Assessment	APP2.2: Review and Assessment – Considerations APP2.3: Review and Assessment – Questions
Gaps and Opportunities	APP2.4: Legal and Policy Framework Use Case APP2.6: Gap Analysis Matrix
3. Addressing Opportunities	
Design and Develop	APP2.7: Policy and Legal Instruments - Advantages and Disadvantages APP2.8: Assessing Fitness for Purpose for a Policy Guidance and recommended actions aligned with Strategic Pathway 2: Policy and Legal
Data Sharing and Dissemination	
Licensing Geospatial Information	Compendium on Licensing of Geospatial Information
4. Future Proofing	
Future Proofing	

Strategic Pathway 4: Data

Documentation	Elements
Implementation Guide Appendices	Data Themes Custodianship, Acquisition and Management Data Supply Chains Data Curation and Delivery

Actions	Tools
1. Getting Organised	
Data Framework	APP4.1: Data Theme Description Template The Global Fundamental Geospatial Data Themes
Data Inventory	APP4.2: Data Inventory Questionnaire
Dataset Profile	APP4.3: Dataset Profile Template
2. Planning for the Future	
Data Gap Analysis	APP4.4: Gap Analysis Matrix
Data Theme Roadmap	APP4.5: Data Theme Roadmap Template
4. Managing Data Sustainably	
Data Management Plan	APP4.8: Data Management Plan Elements
Maintained Metadata	APP4.9: Metadata Creation Checklist
6. Integrating Data	
Data Supply Chains	
Data Interoperability	

Strategic Pathway 5: Innovation

Documentation	Elements
Implementation Guide Appendices	Innovation and Creativity Bridging the Geospatial Digital Divide

Actions	Tools
3. Transformation Roadmap	
Modern Data Creation Methods	APP5.7: Modern Data Creation Methods
Enabling Infrastructure	APP5.8: Data Integration Approaches APP5.9: Data Storage Processes
4. Culture of Innovation	
Geospatial Digital Transformation Strategy	APP1.3: Guidance for Mission, Vision and Goals Statements Future trends in geospatial information management: the five to ten year vision (third edition) Framework for Effective Land Administration Strategic Framework on Geospatial Information and Services for Disasters COVID-19: Ready to Respond - The role of the Geospatial Community in Responding to COVID-19
6. Innovation Ecosystem	
Bridging the Digital Divide	APP5.12: Open SDG Data Hubs
Integrated System of Systems	

ELISE Resources:

Type	Resource	Date
Study	Assessment of economic opportunities and barriers related to geospatial data in the context of the Digital Single Market	2018
Study	The Role of spatial data infrastructures in the digital government transformation of public administrations: See technical infrastructure section which includes details on the breadth of the SDI infrastructure, the magnitude of interoperability efforts, innovative ways for linking to SDIs and the usage of the SDIs	2019
Study	Establishment of Sustainable Data Ecosystems	2021
Webinar	The Role of Geospatial for Digital Government Transformation	2019
Webinar	Geospatial Technology and Public Participation	2019
Webinar	The Role of Spatial Data Infrastructures for Digital Government Transformation	2019
Webinar	Digital Twins - Are they ready to embrace the benefits of Location Information?	2019
Webinar	Geodata marketplaces supporting location intelligence	2021
Webinar	Evolution of the access to spatial data for environmental purposes – Study presentation	2021
Workshop	INSPIRE Conference: INSPIRE on Tools - Geoportal, Registry, Validator	2018
Workshop	INSPIRE Conference: Digital transformation and the future of SDIs	2018
Workshop	INSPIRE Online Conference: Co-innovation with public-private	2020

	sector data ecosystems Presentations and Video Event Report	
Workshop	INSPIRE Online Conference: Data ecosystems for geospatial data	2020
Workshop	GO-PEG Workshop: "A step towards High Value Datasets"	2020
Workshop	Data Ecosystems for Geospatial Data	2020
Training	INSPIRE training platform: Introduction to INSPIRE	2014
Training	INSPIRE training platform: INSPIRE advanced	2018
Training	INSPIRE training platform: INSPIRE data and service sharing	2018
Training	INSPIRE training platform: From INSPIRE to e-Government	2020
Pilot / Testbed	EULF Marine Pilot, creating a Marine SDI framework for Marine Strategy Framework Directive e-reporting	

Further Reading:

- INSPIRE Knowledge Base
- INSPIRE Geoportal
- INSPIRE in Practice
- INSPIRE Community Forum
- GIM International, INSPIRE Boosts Spatial Data Sharing
- UN-GGIM Integrated Geospatial Information Framework (IGIF)
- What is a data ecosystem? Oliveira and Lóscio, 2018
- Mapping data ecosystems, Open Data Institute
- Open Government Data Ecosystems: Linking Transparency for Innovation with Transparency for Participation and Accountability, Reggi and Dawes (2016)
- Communication "Towards a common European data space" (COM(2018) 232 final)
- Open Data Directive, 2019
- European data strategy, 2020
- Data ecosystems for sustainable development, UN Development Programme, 2016
- Global Partnership for Sustainable Development Data
- Join, Boost, Sustain: the European way of digital transformation in cities and communities
- The Transport Data Revolution, UK Catapult Transport Systems, 2015
- Leveraging big data for managing transport operations
- Transport Data Initiative
- A taxonomy of definitions for the health data ecosystem
- A strategy for a modern digitalised energy system, UK Catapult Energy Data Taskforce, 2019
- From Spatial Data Infrastructures to Data Spaces — A Technological Perspective on the Evolution of European SDIs
- Comparing INSPIRE and OpenStreetMap Data: How to make the most out of the two worlds
- CEF Context Broker
- International Data Spaces Association Reference Architecture Model, including links between data spaces and data driven business ecosystems (or 'data ecosystems' as used above). See also International Data Spaces Association: The Role of IDS in Implementing the European Data Strategy and International Data Spaces, Fraunhofer.

- The Rise of the Data Economy: Driving Value through Internet of Things Data Monetization, IBM, 2016
- Volunteered Geographic Information and the Future of Geospatial Data, C.E.C. Campelo, M. Bertlotto and P. Corcoran, IGI Global, 2017
- The value of Integrated Geospatial and Building Information Modelling (BIM) solutions to advance the United Nations Sustainable Development Goals (Agenda 2030) with specific focus on resilient infrastructure, UN-GGIM, WFEO, and WGIC, 2020
- Towards a Spatial Knowledge Infrastructure, White Paper, Australia and New Zealand Cooperative Research Centre for Spatial Information (CRCSI), 2017
- The Power of Where: A Geospatial Knowledge Infrastructure to Enhance the World Economy, Society and Environment, White Paper, Geospatial World, 2021
- Enhancing the UK's Geospatial Ecosystem, Geospatial Commission, UK, 2020
- National Underground Assets Project Update, Geospatial Commission, UK, 2020
- GAIA-X – A federated data infrastructure for Europe

Recommendation 8: Adopt an open and collaborative methodology to design and improve location-enabled digital public services

Why:

- Having an open and collaborative methodology and communicating it openly to all parties involved increases stakeholders' buy-in and participation since it starts from the needs and requirements of the users.
- Public services are about 'serving' the public (i.e. businesses and citizens) who pay taxes to help in paying for these services. Businesses and citizens should therefore have a say in what the services look like.
- There is an expectation from taxpayers that different parts of government will share information they provide and act in a coordinated and efficient way.
- Asking for feedback at an early stage of development together with frequent releases ensures quick user feedback, incremental improvement, and reduces the risk of building a service that does not meet users' requirements.
- Working groups with experts from public administrations, academia, and the industry can help to build consensus and tackle difficult challenges when developing digital public services.
- Use of business process standards can help formalise the process and analyse the (location) data flows of services and collaboration opportunities, possibly using service chaining and orchestration to facilitate collaboration and implementation of services.
- Evaluating and monitoring digital public services help public administrations improve future releases of the service.
- Allowing or ensuring feedback to the public sector on the improvement of data by the private sector can provide a source of added value of data.

How:

Collaborative service development

- Use the three phases for collaborative development of digital public services - design, implement, evaluate and monitor – defined in the European Commission publications: 'Collaborative *Production in e-Government*' and *'Analysis of the value of new generation of e-Government services'*.

(1) Follow these collaborative service design principles:

- Stakeholder engagement by organising workshops, surveys, interviews, focus groups and other forms of collaboration.
- Ask early feedback by sharing ideas, concepts, source code and any other relevant artefacts as soon as possible so that engaged parties can provide feedback.
- Release early and frequently to reduce risk in service design. This enhances mutual learning and usually improves quality.
- Adopt user-centric design principles, based on needs and views of users, for example:
  - Create a service that is simple and intuitive enough that users succeed first time;
  - Give users a single point of contact for the service, rather than passing them around different parts of government;
  - Ask users of digital public services once only for location-related information. For example, users should not be required to resubmit their address data for each service when it has already been registered with government;
  - Requested location information should be relevant and proportionate to the needs of the service and the associated legislation;
  - Location-based digital public services should use the preferred electronic channels of citizens, e.g. mobile channels. They should be optimised for mobile use;
  - Public administrations should respect the legitimate 'location privacy' of citizens and businesses (see recommendation 3) and should not compromise their security through unchecked sharing of location-related information. The approach should aim to increase businesses' and citizens' confidence in the way public administrations are handling their location information;
- Create and communicate the process for collaboration so that stakeholders know how and to what extent their input will be taken into account. As an example, the UK Government Digital Service Manual contains guidance and resources to understand the needs of the consumer of digital public services. The Manual is tailored to different profiles like designers, developers, researchers, analysts, architects, etc. Make use of Working Groups. For example, ISA developed a 'Process and methodology for developing core vocabularies' which includes among others the use of collaborative tools that are publicly available.
- Adopt governance models and business models for developing added value data which allow or even entice public and private sectors to collaborate.

(2) Ensure that implementation and operation of the service maintains the user and collaborative focus of the design phase:

- Put in place a sustainable multidisciplinary team to design, build and operate the service, led by a service delivery manager.
- Deliver the service by ensuring that collaborators can reuse the service or data in their processes. Service chaining (choreography) and orchestration are key to manage the process flow:
  - Standards such as the Universal Description, Discovery and Integration (UDDI) can facilitate service chaining and orchestration of services. UDDI is a protocol that includes a registry by which organisations can list themselves on-line and allow for third parties to register and locate web service applications;
  - Electronic Business using eXtensible Markup Language (ebXML) includes XML-based standards sponsored by UN/CEFACT and OASIS and allows reuse of (electronic) business and location information by all collaborators.
- Test the end-to-end service with all participants and parts of government in an environment identical to the live service, including all common types of browsers and devices. If possible, involve users who have contributed in the design phase. If required, conduct usability testing with other potential users outside the input group to validate the design.
- Ensure contingency plans are in place for initial service introduction (e.g. peaks in certain

processes) and potential service disruption.

(3) Openly measure and evaluate the performance of digital public services:

- Analytics can reveal how digital public services are actually being used and how users respond to variations in service design. Similarly, key performance indicators like usage statistics or service delivery costs can help make better decisions on improving services. For example, Gov.uk Performance makes this information publicly available to promote transparency and accountability.
- Carry out ongoing user research and usability testing to continuously seek feedback from users to improve the service.

External delivery

The above model assumes that public authorities take responsibility for service delivery as well as the ICT associated with the service. The ICT may be produced in-house or with the help of private sector companies. However, it must first be determined whether public authorities should deliver the service, i.e. that the service is part of the public task. There, there are other models that may be adopted, for example:

- The private sector may be well-placed to offer a particular service or a sufficiently similar service without the need for significant intervention from the public sector (i.e. it is in their commercial interest to offer such as service and their commercial interest coincide with the public interest).
- Public authorities may collect data through a particular process or service and decide to make the data openly available for external parties to develop their own products and services. In this case, the external parties (e.g. private sector companies) should be engaged openly to inform them and to assess their potential interest in using the data. Actions to tailor the data to external needs may be part of the eventual public sector process. This option is also a contributor to growth objectives (see Recommendation 15).
- Public authorities may scale back their role in existing service delivery when they can rely on alternative models. For example, the UK Department for Transport operated a national multi-modal journey planning service for several years. The data was subsequently made available as open data so that developers could build their own services. Finally, a public / private partnership called Traveline was developed that operates the service, including publication of open data, on a not-for-profit basis without public funding (see Best Practice 21).
- Governments may encourage 'civic hacking' to develop new ideas, technologies or methodologies to help solve civic problems and improve the lives of citizens (this is a form of participatory government, often involving the use of public data, that has had some successes).

Challenges:

- If public administrations do not use open methodologies for collaborative digital public service design, they risk developing digital public services that do not meet stakeholders' requirements, especially if stakeholders are not included early in the design process.
- Difficulty in obtaining the 'voice of the customer' when it comes to public services. Introducing an open collaborative approach gives voice to those wanting to participate and not necessarily those whose needs may be met by a collaborative approach to digital public services.
- The wishes of citizens and businesses may conflict with government policy needs, which are often about control, rules, taxes etc.
- There is a risk in overcomplicating the data collection and reporting process under the guise of 'policy compliance'.
- Legacy systems often make repeat requests for data and possibly use different standards and formats, and channels that are difficult to integrate.
- There may be gaps in skills (digital divide) that limit participation and use of digital services. This possibility needs to be managed in the process.

- Required changes may not be affordable.
- The time required to develop a service may be so long that, when the service is ready to use, it is obsolete. A faster way to develop services should be adopted.
- If government relies on the private sector to deliver 'services', there is a risk that the public interest may not be (fully) supported.

Best Practices:

1: A digital platform for location data in Flanders

#15: Information System of Contaminated Sites in Slovakia

#17: Location-enabled census data in Poland

#19: Democratisation of soil data in the UK

#21: Integrated transport solutions: TRAVELINE

#22: Standardised road safety data exchange

#33: Urban platform, Guimarães

#39: List of applications reusing open data

#41: Public private partnership for the development and release of the hydrological elevation model

#44: Geoplatforme: a collaborative initiative for management of geodata

#45: Common Services BUILD

#49: Rennes Urban Data Interface (RUDI)

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 8 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 4: Reusability	Recommendation 6: Reuse and share solutions and cooperate in the development of joint solutions when implementing European public service.
Underlying Principle 6: User centricity	Recommendation 11: Provide a single point of contact in order to hide internal administrative complexity and facilitate users' access to European public services.
Underlying Principle 6: User centricity	Recommendation 12: Put in place mechanisms to involve users in analysis, design, assessment and further development of European public services.
Underlying Principle 6: User centricity	Recommendation 13: As far as possible under the legislation in force, ask users of European public services once-only and relevant-only information.
Basic Component 6: External information sources and services	Recommendation 45: Where useful and feasible to do so, use external information sources and services while developing European public services.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 7: Partnerships

Documentation	Elements
Implementation Guide Appendices	Private Sector and Academia Collaboration Community Participation

Actions	Tools
1. Understanding Partnerships	
Need for Partnering	
Types of Partnering	APP7.1: Types of Partnership
2. Evaluating Opportunities	
Partnering Opportunities	
Selection Criteria	
3. Identifying Potential Partners	
Potential Partners	APP9.1: Categories of Stakeholders APP9.2: Identifying and Classifying Stakeholders
Preliminary Screening	APP7.2: Evaluation of Potential Partners
4. Selecting Partners	
Options and Operational Implications	
5. Formalising Partnership	
Establishing Agreements	

Strategic Pathway 9: Communication and Engagement

Documentation	Elements
Implementation Guide Appendices	Stakeholder and User Engagement Monitoring and Evaluation

Actions	Tools
1. Providing Leadership	
Engagement Strategy	
2. Understanding Opportunities	
Stakeholder Identification	APP9.1: Categories of Stakeholders APP9.2: Identifying and Classifying Stakeholders
Stakeholder Analysis	APP9.3: Stakeholder Analysis Matrix
5. Monitoring Progress	
Review and Evaluate	APP9.8: Review and Evaluation - Methods for Benchmarking
Stakeholder Surveys	

ELISE Resources:

Type	Resource	Date
Guidance	Design of location-enabled e-government services	2020
Guidance	Improving use of location information in e-government processes: methodology and use case	2020

Webinar	Using serious games in the geospatial domain to stimulate digital transformation of government	2019
Webinar	Location enabled public services	2020

Further Reading:

- Study on "Analysis of the value of new generation of eGovernment services" - Final Report
- UK Government Digital Service Manual
- Rethinking e-Government Services – User Centred Approaches, OECD
- Electronic Business using eXtensible Markup Language
- Taxonomy of Open Government Services
- Universal Description, Discovery and Integration
- UK Performance Dashboard
- 'Civic hacking' in Open Government Data: The Book
- Co-creation of Public Services: What and How
- Digital government: Co-creating innovative public services for citizens and businesses
- Example of citizens' participation to shape European eGovernment services
- Embracing Innovation in Government, OECD, 2017
- Geopunt - The user speaks, INSPIRE Conference 2018
- Barcelona City Council Collection, Joinup
- Decidim digital platform for citizen participation
- Decentralised Citizens Owned Data Ecosystem (Decode) Project

Recommendation 9: Adopt an integrated location-based approach in the collection and analysis of statistics on different topics and at different levels of government

Why:

- Much statistical data has a geospatial component.
- The techniques and mechanisms used nationally and in different policy areas for location-based data collection and analysis are not sufficiently well integrated to support pan European or cross-domain analysis and comparisons.
- The challenge in integrating location-based statistical data may hinder the timeliness and extent of analysis that can be undertaken, inhibiting the potential value of the policy evidence base.
- Geospatial information combined with statistics underpins evidence-based policy making and political decisions at all levels in government and helps deliver better services based on informed decisions.
- Periodic monitoring of geographically related indicators over time is a typical requirement for many EU Directives, e.g. the Air Quality Directive, the Water Framework Directive, the Marine Strategy Framework Directive.
- With a common geospatial framework policy makers in public administrations will be able to combine different methods of location-based data collection to inform their policy decisions, including census data, transaction data, social media information etc.

How:

Reference framework

- Member States create and maintain an accurate and up-to-date knowledge base of where their citizens and businesses are located. This will make the collection of census and other statistical data as straightforward as possible.
- Member States have a common geospatial reference framework for statistics to enable timely, accurate and efficient production of location-based statistics. This should be based on geocoded registers of administrative units, addresses, buildings and dwellings and use consistent and persistent identifiers to reference relevant information. The geospatial reference framework for statistics can benefit from INSPIRE which provides a valuable framework for standardising and modelling the SDI, enabling the widest possible collation of harmonised data.
- The geospatial reference framework for statistics forms the basis for the collection of census data, including supporting dynamic census data collection.
- To support the production of statistics and census information, it is important to understand the origin, production process and other aspects of the quality of geospatial data. INSPIRE metadata should be used as the basis for this documentation.

Dynamic data capture

- Member States have mechanisms to enable frequent ('dynamic') collection of statistical information taking account of this 'location' knowledge.
- Opportunities are taken to streamline and improve statistical data collection, taking into account new sources of information, such as sensors, social media, web analytics etc.

Statistical analysis

- Public authorities apply analytical techniques (customer analytics, location intelligence) to help improve public services. For example, Transport for London uses 'big data' analysis of vehicles, vehicle location, traffic information and payment cards to reveal patterns or trends and enable action to be taken.
- The spatio-temporal dimension of statistics is captured in a format that enables it to be used readily in a GIS for geostatistical analysis, with consistent geo-reference data and other consistent coding to enable it to be analysed at different geographic / administrative levels.
- Include relevant private sector data in the statistical information infrastructure.
- Ensure the location intelligence infrastructure is continuously kept relevant to growing and evolving needs.

Challenges:

- Too much data and not enough information – there is so much data that can be collected and analysed, with risk of hiding or missing the message.
- Drawing conclusions based on location may be too simplistic to determine appropriate interventions.
- Establishing a common basis for analysis and comparison in multiple geographies and domains is very challenging.

Best Practices:

#17: Location-enabled census data in Poland

#24: GeoSTAT projects

#33: Urban platform, Guimarães

#48: Interactive tool for geospatial presentation of statistical data (STAGE)

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 9 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 6: User centricity	Recommendation 11: Provide a single point of contact in order to hide internal administrative complexity and facilitate users' access to European public services.
Basic Component 3: Base registries	Recommendation 37: Make authoritative sources of information available to others while implementing access and control mechanisms to ensure security and privacy in accordance with the relevant legislation
Basic Component 3: Base registries	Recommendation 38: Develop interfaces with base registries and authoritative sources of information, publish the semantic and technical means and documentation needed for others to connect and reuse available information.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 4: Data

Documentation	Elements
Implementation Guide Appendices	Data Themes Data Curation and Delivery

Actions	Tools
1. Getting Organised	
Data Framework	APP4.1: Data Theme Description Template The Global Fundamental Geospatial Data Themes
6. Integrating Data	
Geospatial and Statistical Integration	APP4.12: Guidance for Geospatial and Statistical Integration Global Statistical Geospatial Framework
Geocoding and Aggregation	

Strategic Pathway 5: Innovation

Documentation	Elements
Implementation Guide Appendices	Bridging the Geospatial Digital Divide

Actions	Tools
3. Transformation Roadmap	
Modern Data Creation Methods	APP5.7: Modern Data Creation Methods
6. Innovation Ecosystem	
Bridging the Digital Divide	APP5.12: Open SDG Data Hubs

ELISE Resources:

Type	Resource	Date

Further Reading:

- Global Statistical Geospatial Framework, UN Department of Social and Economic Affairs Statistics Division, UN-GGIM and UN Statistical Commission
- New Frontiers for Official Statistics, Eurostat
- Geospatial Information for Sustainable Development
- Geospatial analysis at Eurostat
- Sweden: How Geospatial Statistics Can Measure Climate Change
- Sweden: Benefits from data sharing - increased use of geospatial information in the statistical production process
- INSPIRE data specification for statistical units
- Transport for London Big Data for a Better Customer Experience
- Statistical geography in Australia

Standardisation and Reuse

Current State

Several standardisation bodies work on standards in the geospatial field. Also, various cross-cutting and thematic standards exist at an international level. These standards are important but can be interpreted and implemented in different ways resulting in incompatibilities in managing and integrating location information. Compliance with existing legislation (notably INSPIRE) helps, but does not guarantee, the creation of harmonised pan-European or cross-border products, including core reference data sets. Significant efforts have been made towards the standardisation of spatial data modelling, sharing and exchange and these are recognised as a point of strength of location interoperability practices in Europe. However, the challenge from the geospatial domain use of standards that are not applied in other domains still remains. The adoption of a common location architecture approach fitting within a national, EU or international ICT architectural framework supports the standardisation and reuse of location information in a broader context. Current governance and funding models leave gaps in relation to the interoperability arrangements required for the creation and sharing of EU-wide core reference data. The Open Data Directive commitment to share open high value datasets is a worthwhile development. Public administrations also struggle with the deployment of emerging and innovative technologies, and the integration with existing geospatial technologies.

Vision

Core reference location data has been defined and a funding model has been agreed for its ongoing maintenance and availability. Data quality is maintained with effective feedback from users. Geospatial and location-based standards and technologies are used consistently and in simplified ways, enabling interoperability and reuse, and integrating broader ICT standards and technologies, including solutions promoted by the ISA^2 Programme, as well as emerging technologies. There is a strong focus on commonly accepted APIs such as the latest OGC web services and those being developed for INSPIRE. These standards are applied in all areas related to the publication and use of location information in digital public services, including metadata, discovery, view, exchange, visualisation etc. There are well developed and widely deployed architectural approaches for integrating dynamic and static location data.

LIFO Monitoring

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of recommendations in the Policy and Strategy Alignment focus area in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Focus Areas.

Recommendation 10: Adopt a common architecture to develop digital government solutions, facilitating the integration of geospatial requirements

Why:

- Adopting a common interoperability framework and reference architecture ensures that interoperability is addressed, especially when there is the intention to reuse existing solutions.
- The framework needs to consider interoperability in a holistic way, taking into account all relevant aspects, i.e. legal, organisational, semantic and technical, as defined by the European Interoperability Framework (EIF) and the associated European Interoperability Reference Architecture (EIRA).
- The framework also needs to be capable of supporting new innovative business models and cloud-based approaches for the delivery of digital public services.
- The framework needs to incorporate architectural techniques relevant to different situations, to provide flexibility, modularity, scalability, improved information flow and encourage re-usability of services, e.g. Service Oriented Architecture (SOA) for more static data, event-driven

architectures for more dynamic data, edge processing for real-time analytics.

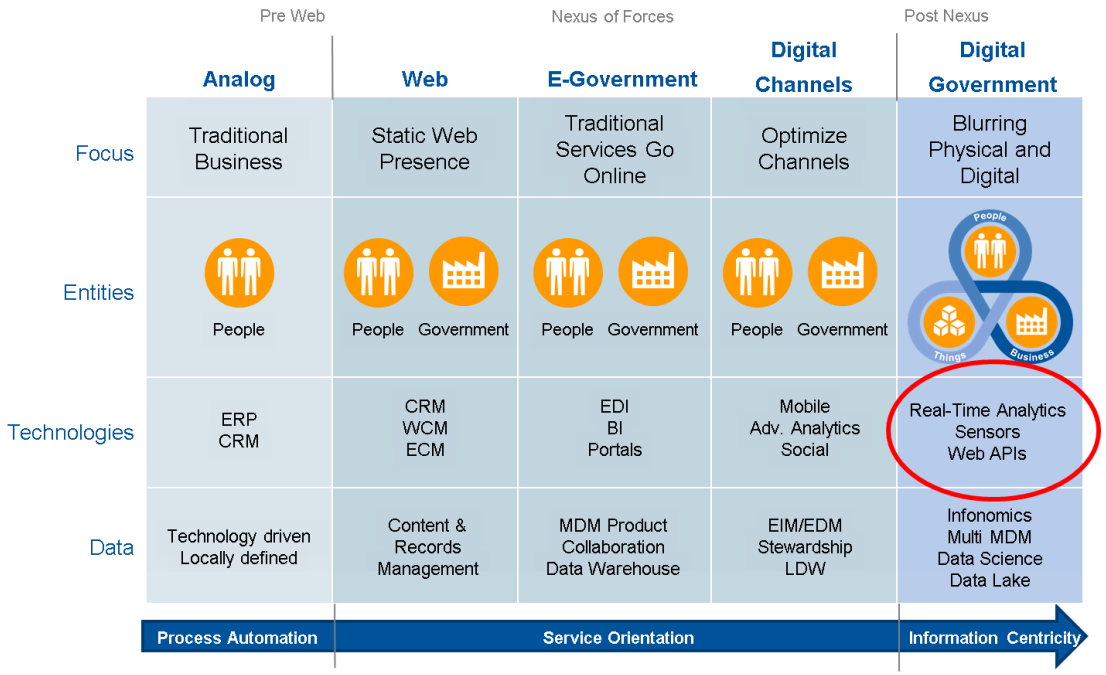
- The EIRA implements the four interoperability layers of the EIF and provides further scoping, common terminology and re-usable architecture building blocks to develop service-oriented architectures and services. By using a common terminology, it will be easier for public administrations to integrate location information when developing digital public services. Common terminologies permit minimum level of coordination by providing a set of well-defined architecture building blocks.
- The lack of a common architecture and common terminology on location information can lead to divergent and difficult-to-integrate location information systems.
- INSPIRE provides a common SOA-based architectural approach for cross-sector and cross-border digital government solutions involving location information. The broad-based INSPIRE architecture may need to be complemented by more granular micro services oriented architectural solutions to suit domain-specific needs and enable new business models for digital public services.
- The "EULF Architecture and Standards for SDIs and e-Government" report complements the EIF and the EIRA and provides additional information on how they relate to each other and how SDIs and INSPIRE fit into the overall architectural framework.

How:

Common architectural approach

- Embed location data architectural approach in broader cross-government ICT and data architecture approach.
- Use an approach based on Service Oriented Architecture (SOA) for web services such as those specified within INSPIRE. SOA enables a system of building blocks and ensures re-usability, modularity and flexibility of the service.
- Evaluate and Use relevant emerging technologies. Align with emerging technologies in digital government where they provide new opportunities for innovation, as shown in **Figure 13**. Use of these technologies may require refinements in the architectural approach.

Figure 13: Evolving towards digital government



Source: Gartner Research

- Consider deploying a Meshed App and Service Architecture (MASA) approach. This is a relatively new application architecture structure with constituent parts (apps, mini services, micro services and mediated Application Programme Interfaces (APIs)) which delivers increased agility and enables application innovations to support Internet of Things (IoT) integration, automated decision making, third-party interoperability and omni-channel business models. A mediated API is a design pattern in which an API is virtualised, managed, protected and enriched by a mediation layer. This layer can enforce policy and inject capabilities into the API interaction for increased agility, usability, performance, security and control. A mediated API allows a service to expose an "inner API" that directly reflects its domain model, and one or more "outer APIs" tailored to support specific client requirements. IoT integration and event stream processing to capture and use the data will become increasingly important in location-based applications, reflecting the transition from largely static SDI models to increasingly dynamic models, e.g. smart cities, smart grids, intelligent transport systems.

- Organisations adopting SOA, MASA and these transformative architecture patterns can take advantage of transformative business innovations, through the API economy and the promotion of an API marketplace. An API marketplace is an aggregator site in which API providers can publish APIs that provide access to their services, data or applications. Customers use an API marketplace to discover, access, test and purchase access to APIs to use in their own applications. API marketplaces differ from standard API developer portals by aggregating multiple API providers and by providing subscriptions, billing and user management. Essentially, what app stores are for mobile apps, API marketplaces are for APIs.

- Public administrations should consider creating open APIs for core services, to support reuse and evolution as well as business model and application development vendor flexibility.

- Public administrations should consider adopting 'Government as a Platform' (GaaP) approaches to share components, service designs, platforms, data and hosting across public authorities, enabling location data and services to be reused as effectively and widely as possible.

- Use a recognised common modelling language such as Archimate, an open and independent modelling language for enterprise architecture that is supported by different tool vendors.

European alignment

- Although the architecture for digital public services will be based on national standards and frameworks, reference should be made to European frameworks to explore potential synergies and areas for improvement.

- Design the architecture of the digital public service by taking into account the four interoperability layers defined by the European Interoperability Framework (EIF): legal, organisational, semantic, and technical. The EIF also provides underlying architectural principles to consider when designing the service oriented architecture (SOA). These principles should be applied when defining the architecture of the location-enabled digital public service.

- Use the European Interoperability Reference Architecture (EIRA), a content meta-model and reference architecture focused on interoperability between public administrations. The EIRA expands on the interoperability levels of the EIF. It provides architecture building blocks for each layer together with a common terminology. Furthermore, it uses a SOA-based approach in-line with the EIF.

- Consult the EULF Architecture and Standards for SDIs and e-Government document. This document uses the Reference Model for Open and Distributed Processing (RM-ODP) to describe architecture and standards for Spatial Data Infrastructure (SDI) and digital government. It provides information on how digital public services relate to assets from SDIs and INSPIRE.

Note:

- The recommendations above provide examples of architecture approaches and methodologies. Other relevant architecture frameworks and methodologies can be used in combination with the EIF and EIRA such as: The Open Group Architecture Framework (TOGAF), Dynamic Enterprise Architecture (DYA), Generalised Enterprise Reference Architecture and Methodology (GERAM), Nolan-Norton or Zachman's framework.

Challenges:

- The application may be (largely) standalone and considerations of wider architectural conformity may be an overhead.
- Different public administrations may have different architectural standards making cross-administration interoperability difficult, particularly in a cross-border context.
- Integration may be required with legacy systems that were not built using today's architectural principles.
- The EIRA and EIC are not yet fully proven and embedded in EU-wide architectural planning for digital government systems.
- Strategic choices may be needed between traditional SOA-based architectural approaches and new architectural styles (e.g. MASA).
- More amenable people and administrations might share their solutions but these might not be the best solutions.

Best Practices:

#5: Radiological Emergency Response in Germany

#6: Digital Exchange platform for spatial plans

#11: Register of Territorial Identification, Addresses and Real Estates (RÚIAN)

#15: Information System of Contaminated Sites in Slovakia

#18: Territorial Information System of Navarre: SITNA

#23: INSPIRE-compliant marine environment e-reporting

#25: National Geoportal of the Grand-Duchy of Luxembourg (GeoAPI)

#26: NASA Earthdata Developer Portal

#33: Urban platform, Guimarães

#49: Rennes Urban Data Interface (RUDI)

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 10 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 6: User centricity	Recommendation 11: Provide a single point of contact in order to hide internal administrative complexity and facilitate users' access to European public services.
Interoperability Layer 6: Technical Interoperability	Recommendation 33: Use open specifications, where available, to ensure technical interoperability when establishing European public services.
Conceptual Model	Recommendation 34: Use the conceptual model for European public services to design new services or reengineer existing ones and reuse, whenever possible, existing service and data components.
Conceptual Model	Recommendation 35: Decide on a common scheme for interconnecting loosely coupled service components and put in place and maintain the necessary infrastructure for establishing

	and maintaining European public services.
Basic Component 2: Shared information sources and services	Recommendation 36: Develop a shared infrastructure of reusable services and information sources that can be used by all public administrations.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 4: Data

Documentation	Elements
Implementation Guide Appendices	Data Curation and Delivery

Actions	Tools
5. Maintaining Accurate Positioning	
Maintained Geodetic Infrastructure	APP4.11: Guidance for Improving Geodetic Infrastructure
6. Integrating Data	
Data Interoperability	

Strategic Pathway 5: Innovation

Documentation	Elements
Implementation Guide Appendices	Technological Advances Innovation and Creativity Bridging the Geospatial Digital Divide

Actions	Tools
2. Identifying Innovation Needs	
Monitoring Trends	APP5.3: Geospatial Drivers and Trends
Technology Needs Assessment	APP5.4: ICT Data Inventory APP5.5: PEST and SWOT Analyses
3. Transformation Roadmap	
Modernising Data Assets	APP5.6: Modernising Data Assets
Modern Data Creation Methods	APP5.7: Modern Data Creation Methods
Enabling Infrastructure	APP5.8: Data Integration Approaches APP5.9: Data Storage Processes
4. Culture of Innovation	
Geospatial Digital Transformation Strategy	Future trends in geospatial information management: the five to ten year vision (third edition) Framework for Effective Land Administration Strategic Framework on Geospatial Information and Services for Disasters
6. Innovation Ecosystem	
Bridging the Digital Divide	APP5.12: Open SDG Data Hubs
Integrated System of Systems	

ELISE Resources:

Type	Resource	Date
Study	Digital Government Benchmark: Study on Digital Government Transformation	2018
Study	Digital Government Benchmark: API Study	2018
Study	Blockchain for Digital Government	2019
Study	Exploring Digital Government Transformation in the EU: Analysis of the state of the art and review of literature	2019
Study	Assessing the impacts of digital government transformation in the EU - Conceptual framework and empirical case studies	2020
Study	Exploring Digital Government Transformation in the EU: Final Report	2020
Study	API4INSPIRE	
Guidance	Architectures and Standards for Spatial Data Infrastructures (SDIs) and Digital Government	2020
Webinar	Governance models, ecosystems and benefits of APIs for public sector organisations	2019
Webinar	Geospatial Data and Artificial Intelligence – a deep dive into GeoAI	2020
Webinar	Exploring Digital Government Transformation in the EU - DIGIGOV	2020
Webinar	Monitoring and understanding emerging geospatial technologies	2020
Webinar	Geospatially enabled modelling, simulation and prediction	2021
Webinar	Blockchain and proof of location supporting digital government	2021
Webinar	Immersive realities and location for better public services	2021
Webinar	ELISE - Emerging trends and technologies	2021
Workshop	INSPIRE Conference: INSPIRE on Tools - Geoportal, Registry, Validator	2018
Workshop	NSPIRE Online Conference: INSPIRE/api	2020
Workshop	INSPIRE Online Conference: INSPIRE Reference Validator - Status and next steps	2020
Workshop	INSPIRE Online Conference: INSPIRE Geoportal Workshop - Use of the INSPIRE Reference Validator in 2019 Monitoring: Process and lessons learned	2020
Workshop	SensorThings API brings Dynamic Data to INSPIRE	2020
Workshop	Smart Data Loader and Templating for GeoServer	2021
Presentation	INSPIRE Conference: INSPIRE Reference Validator Presentation Video	2017
Presentation	INSPIRE Conference: Re3gistry Version 2 - Manage and share reference codes in a simple way Presentation Video	2017
Training	INSPIRE training platform: Introduction to linked data	2015
Training	INSPIRE training platform: INSPIRE network services (advanced)	2018
Training	INSPIRE training platform: Monitoring and understanding emerging geospatial technologies	2020
Training	INSPIRE training platform: From INSPIRE to e-Government	2020
Training	INSPIRE training platform: INSPIRE network services (update)	2020

Further Reading:

- The New European Interoperability Framework
- European Interoperability Reference Architecture
- INSPIRE Network Services Architecture
- INSPIRE Data Specifications: Generic Conceptual Model
- Governments should open APIs to core services
- APIs4DGov: Assessing government API strategies across the EU
- APIs4DGov: Publicly available API cases
- APIs4DGov: API standards and technical specifications
- Archimate modelling language; and Architool
- Top 10 Emerging Technologies of 2020, World Economic Forum
- Oskari A framework for building multipurpose web mapping applications using distributed SDIs such as INSPIRE. See also Oskari solution on Joinup.

Recommendation 11: Reuse existing authentic data, data services and relevant technical solutions where possible.

Why:

- Carrying out a re-usability check reduces the risk of isolated ICT development.
- Online catalogues provide lists of re-usable solutions and standards. These catalogues provide access to solutions that have undergone a reusability assessment and are mature enough to be reused.
- Engaging with communities of interest and re-using solutions from other public administrations can help public administrations share best practices and receive guidance when developing ICT solutions.
- Authentic data registers and common data services can help maximise the potential for reuse of data since they offer common, trusted sources of information.
- Using existing single sources of authentic data, data services and relevant technical solutions reduces development, maintenance and operating costs of new solutions (in terms of integrating data sources). This helps to focus on more value-adding tasks instead of 'reinventing the wheel'.
- Using single sources of authentic data improves data quality, assuming these sources are managed properly.
- Using single sources of authentic data increases the potential for interoperability between administrations and for providing a more efficient service to users.
- Persistent identifiers ensure that data resources are more visible and connectable. Furthermore, they promote semantic interoperability.

How:

Check for reusable solutions

- Before developing new ICT systems or digital public services, check whether there are existing solutions that could be reused.
- Use an online catalogue of re-usable technical solutions to find relevant solutions. The European Commission maintains a catalogue of re-usable technical solutions on https://joinup.ec.europa.eu. This includes solutions that facilitate geolocation integration and implementation of the INSPIRE Directive. The solutions are centred around communities of interest such as:

- The Community of Interoperable Solution Repositories (CISR): a community that brings together digital government professionals to disseminate good practices on sharing and re-using ICT solutions. The CISR community can provide an entry point into the Joinup catalogue of solutions.
- The ARE3NA community holds a list of interoperability solutions in the geospatial and digital government domain in line with the EIF interoperability layers and the tasks associated with the publication and re-use of INSPIRE data and services.

- Reusable solutions in Joinup are mapped to the European Interoperability Reference Architecture (EIRA) using the European Interoperability Cartography (EIC) tool. This mechanism should be used for both finding and sharing solutions. In this way, users can benefit from solutions developed by others as well as contribute to their improvement.

Authentic registers

- Use authentic data registers and data services to ensure that the location information part of the digital public service is trusted and authentic and avoid duplication of data and related management processes ("collect once, use many times"). Authentic data registers and data services are essential building blocks that can include important location datasets and data for various domains. Some examples of data registers providing access to trusted data are:
  - The INSPIRE registry
  - Stelsel van basisregistraties (System of basic registration)
  - European Pollutant Release and Transfer Register (E-PRTR)

Persistent identifiers

- Use persistent unique identifiers when reusing location data solutions. Using common unique identifiers for the same data (spatial and non-spatial) allows unambiguous references to the same resources over time. They provide a long-lasting globally unique reference to a digital resource, applicable to all uses and potential uses of the data. The European Commission Joint Research Centre (JRC) has developed guidance on governance of persistent identifiers to be used in Spatial Data Infrastructures.
- Persistent unique identifiers can also be used to connect data that were not previously connected and support analysis relating to the connections between the data, e.g. between health and location. These data juxtaposition techniques have their history in studies such as John Snow's analysis of cholera deaths in London, pointing to drinking water from a particular pump, through to more formalised relational modelling techniques in use from the 1970s, and more recently linked data and associated technologies that support increasingly open-ended applications.

Data as a Service

- Make use of Data as a Service (DaaS) as design approach or a style of information architecture geared toward transformation of raw data into meaningful data assets for agile/timely data provisioning, and the delivery of these data assets on demand via consistent, prebuilt access, with the aid of standard processing and connectivity protocols. Data as a Service provides ways to share, collect and compose data from a variety of sources in varying formats. DaaS is intended to facilitate repeatable delivery of an established data product and DaaS is generally designed to provide output for targeted context.

Challenges:

- Sharing of solutions and associated documentation involves some effort and cost. The rewards of a "sharing culture" are not always appreciated.
- Required data quality may come at a price that is not affordable.
- The existing single authentic data source may not be fit for purpose in relation to a particular new requirement – i.e. it may be too complex, too simplistic, have data gaps etc.
- There may be many legacy systems operating off different isolated data that make the

transition to single data sources difficult to justify and manage in a reasonable timeframe.

- Location data is usually combined with other data in digital public services, both multi-purpose data (e.g. citizen data) and thematic data (e.g. energy usage). To get the fullest benefit of a cross-government authentic data strategy requires a clear business case, very strong backing and an intensive delivery programme. Denmark, for example, has been successful with its Basic Data Programme. Such a programme would be more challenging in countries with much larger populations and areas. Governmental structures may also be part of the challenge.

Best Practices:

#2: IDOS - Cross-border journey planner for citizens

#3: 'LoG-IN' to the local economic knowledge base

#6: Digital Exchange platform for spatial plans

#11: Register of Territorial Identification, Addresses and Real Estates (RÚIAN)

#14: Air quality monitoring and reporting in Belgium

#16: Managing the granting of licenses for selling tobacco

#17: Location-enabled census data in Poland

#18: Territorial Information System of Navarre: SITNA

#19: Democratisation of soil data in the UK

#20: Digital system for building permits in Italy

#21: Integrated transport solutions: TRAVELINE

#22: Standardised road safety data exchange

#33: Urban platform, Guimarães

#37: Integrated Rescue System

#44: Geoplatforme: a collaborative initiative for management of geodata

#48: Interactive tool for geospatial presentation of statistical data (STAGE)

#49: Rennes Urban Data Interface (RUDI)

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 11 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 4: Reusability	Recommendation 6: Reuse and share solutions and cooperate in the development of joint solutions when implementing European public service.
Underlying Principle 4: Reusability	Recommendation 7: Reuse and share information and data when implementing European public services, unless certain privacy or confidentiality restrictions apply.
Underlying Principle 6: User centricity	Recommendation 11: Provide a single point of contact in order to hide internal administrative complexity and facilitate users' access to European public services.
Basic Component 2: Internal information sources and services	Recommendation 36: Develop a shared infrastructure of reusable services and information sources that can be used by all public administrations.

Basic Component 3: Base registries	Recommendation 37: Make authoritative sources of information available to others while implementing access and control mechanisms to ensure security and privacy in accordance with the relevant legislation
Basic Component 3: Base registries	Recommendation 38: Develop interfaces with base registries and authoritative sources of information, publish the semantic and technical means and documentation needed for others to connect and reuse available information.
Basic Component 5: Catalogues	Recommendation 44: Put in place catalogues of public services, public data, and interoperability solutions and use common models for describing them.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 4: Data

Documentation	Elements
Implementation Guide Appendices	Data Themes Data Supply Chains Data Curation and Delivery

Actions	Tools
1. Getting Organised	
Data Framework	APP4.1: Data Theme Description Template The Global Fundamental Geospatial Data Themes
Data Inventory	APP4.2: Data Inventory Questionnaire
Dataset Profile	APP4.3: Dataset Profile Template
2. Planning For the Future	
Data Gap Analysis	APP4.4: Gap Analysis Matrix
Data Theme Roadmap	APP4.5: Data Theme Roadmap Template
4. Managing Data Sustainably	
Maintained Metadata	APP4.9: Metadata Creation Checklist
Data Release	APP4.10: Data Release Guidelines
Data Storage and Retrieval Systems	
6. Integrating Data	
Data Supply Chains	
Data Interoperability	

Strategic Pathway 5: Innovation

Documentation	Elements
Implementation Guide Appendices	Innovation and Creativity Bridging the Geospatial Digital Divide

Actions	Tools
3. Transformation Roadmap	
Modernising Data Assets	APP5.6: Modernising Data Assets

Modern Data Creation Methods	APP5.7: Modern Data Creation Methods
Enabling Infrastructure	APP5.8: Data Integration Approaches APP5.9: Data Storage Processes
4. Culture of Innovation	
Geospatial Digital Transformation Strategy	Future trends in geospatial information management: the five to ten year vision (third edition) Framework for Effective Land Administration Strategic Framework on Geospatial Information and Services for Disasters COVID-19: Ready to Respond - The role of the Geospatial Community in Responding to COVID-19
6. Innovation Ecosystem	
Bridging the Digital Divide	APP5.12: Open SDG Data Hubs
Integrated System of Systems	

ELISE Resources:

Type	Resource	Date
Study	Establishment of Sustainable Data Ecosystems	2021
Webinar	Spatial Data on the Web Part 1 - How to make geospatial data more accessible for e-government applications	2018
Webinar	Spatial Data on the Web Part 2 - GeoNetwork´s User feedback form: How to make geospatial data more accessible for e-government applications	2018
Webinar	Persistent Identifiers (PIDs) as the glue for linking information infrastructures	2019
Webinar	Using synonyms to improve discovery of geospatial data	2020
Webinar	Evolution of the access to spatial data for environmental purposes – Study presentation	2021
Workshop	INSPIRE Online Conference: INSPIRE Reference Validator - Status and next steps	2020
Workshop	INSPIRE Online Conference: INSPIRE Geoportal Workshop - Use of the INSPIRE Reference Validator in 2019 Monitoring: Process and lessons learned	2020
Workshop	INSPIRE Online Conference: Data ecosystems for geospatial data	2020
Workshop	Smart Data Loader and Templating for GeoServer	2021
Presentation	INSPIRE Conference: INSPIRE Reference Validator Presentation Video	2017
Presentation	INSPIRE Conference: Re3gistry Version 2 - Manage and share reference codes in a simple way Presentation Video	2017
Presentation	INSPIRE Conference: Spatial Data on the Web - Tools and guidance for data providers Presentation Video	2017
Presentation	INSPIRE Conference: INSPIRE in RDF - Increasing semantic interoperability for European geospatial data Presentation Video	2017
Training	INSPIRE training platform: Principles for data and metadata harmonisation according to INSPIRE	2020
Solution / Tool	INSPIRE Reference Validator - Reusable open-source tool, based on the ETF open-source testing framework, which allows data providers, solution providers and national coordinators to	

	check whether metadata, data sets and network services meet the requirements defined in the INSPIRE Implementing Rules and the related Technical Guidelines.	
Solution / Tool	Re3gistry - Reusable open-source software for managing and sharing reference codes through the use of persistent URIs	

Further Reading:

- European Interoperability Reference Architecture – Catalogue of Solutions
- European Interoperability Cartography
- CISR Community
- ARE3NA community
- Governance of Persistent Identifiers to be used in Spatial Data Infrastructures
- A Beginner's Guide to Persistent Identifiers
- Relational data modelling
- Linked data
- EC Sharing and Reuse of IT Solutions
- European legislation on reuse of public sector information
- Authentic Registers in the Netherlands, European Land Registry Association, 2011
- Oskari A framework for building multipurpose web mapping applications using distributed SDIs such as INSPIRE. See also Oskari solution on Joinup.

Recommendation 12: Apply relevant standards to develop a comprehensive approach for spatial data modelling, sharing, and exchange to facilitate integration in digital public services

Why:

- Active participation in GI and digital government communities improves alignment of specifications and helps administrations maintain awareness on technological innovation.
- Open standards facilitate interoperability and data exchange. They help reduce ICT vendor lock-in and promote fair competition.
- Standards are used to shape ICT solutions. If existing standards are not applied, ad hoc design decisions may be taken that are relevant to the solution in question but less applicable in the wider context. These ad hoc design decisions may result in long term interoperability issues when integrating with other ecosystems in the future and thus higher costs.
- The EU INSPIRE Directive sets out binding implementing rules and technical guidelines in a number of specific areas (metadata, data specifications, network services, data and service sharing, and monitoring and reporting). They ensure that spatial data infrastructures of the Member States are cross-border compatible.
- Catalogues of ICT open standards are centralised online catalogues that contain commonly agreed standards for different domains. They help public administrations identifying standards that, for example, could be included in public procurement.

How:

Standards community involvement

- Engage actively in national and international standardisation activities relevant to your Geospatial Information (GI), ICT and digital government communities.
- Open & Agile Smart Cities (OASC), representing more than 150 sub-national governments, leads the development of the Minimum Interoperability Mechanisms (MIMs) Plus, through the Living-in.EU Technical Sub Group. MIMs Plus are based on the principle of minimal interoperability and the ten OASC MIMs. MIMs Plus is an ongoing effort to develop a common list of minimal technical specifications to achieve basic interoperability of data, systems, and platforms for cities and communities in Europe. MIMs Plus supports the evolution of critical digital infrastructure in the twin green-digital transformation, such as in data spaces, platforms and local digital twins. Implementation can be different, as long as crucial interoperability points in any given technical architecture use the same interoperability mechanisms.

Open standards

- Use open standards – where possible – to reduce the risk of ICT vendor lock-in. There are catalogues of recommended open standards both at national and international level that help identifying existing solutions. Examples include: the Open Geospatial Consortium (OGC) catalogue service, the Dutch Government Open Standards Catalogue and the German Standards and Architectures for e-Government Applications (SAGA). To know more about interoperability initiatives in Member States, the European Commission developed the National Interoperability Framework Observatory (NIFO) factsheets.

INSPIRE and related standards

- Apply the INSPIRE implementing rules and technical guidelines to put in place an EU-wide, cross-sectoral interoperability framework for location information facilitating its integration in digital government processes and services. The SDI service interfaces applied by INSPIRE - e.g. Web Mapping Service (WMS), Web Feature Service (WFS), and Web Coverage Service (WCS) - are well known and supported by client applications.
- Expand the application of INSPIRE with other geo-standards elaborated at international level – e.g. the World Wide Web Consortium (W3C), the Open Geospatial Consortium (OGC), the Organisation for the Advancement of Structured Information Standards (OASIS) - and European level – e.g. Copernicus, European Interoperability Framework (EIF), European Committee for Standardisation, Technical Committee 'Geographic Information' (CEN TC/287). This allows linking of the use of geo-standards with relevant general ICT and digital government standards. Examples of geospatially relevant standards that are not covered by INSPIRE are: sensor observation services, quality services and notification, alert and feedback services. INSPIRE has, however, provided technical guidance for implementing download services using the OGC Sensor Observation Service. Note that, as an evolution of the current INSPIRE standards and to go towards the use of evolving architectures and technologies (e.g. MASA, see Recommendation 10), the OGC has recently published two Representational State Transfer (REST) based standards, namely the 'OGC API - Features'[11] and the SensorThings API[12], which provide standardised APIs for ensuring modern access to spatial and observation data. Both standards have huge potential for modernising SDIs and are already considered as possible INSPIRE Download Services[13] [14]. Finally, the frequently used OpenAPI specification[15] supports documentation of APIs in a vendor independent, portable and open manner, and fully integrates a testing client within the API documentation. Public administrations should consider the appropriate path for evolution towards APIs balanced with co-existence of traditional access methods.
- Adopt a standards-based approach for Internet of Things (IoT) data, communications and devices – as this will rapidly increase the availability of sensors and tools to share and process big (geospatial) data that becomes relevant for digital government applications. The SensorThings API standard mentioned above facilitates this activity.
- Use a standards-based approach in the application of the Linked Data paradigm and its technical specifications, which can enable the integration of geo-spatial and non-geospatial information

[11] https://www.ogc.org/standards/ogcapi-features
[12] https://www.ogc.org/standards/ogcapi-features
[13] https://github.com/INSPIRE-MIF/gp-ogc-api-features/blob/master/spec/oapif-inspire-download.md
[14] https://www.mdpi.com/2076-3263/8/6/221
[15] https://swagger.io/specification/

using Uniform Resource Identifiers (URIs) and Resource Description Framework (RDF) specifications. The application of Linked Data principles and technology supports INSPIRE implementation and can be seen as a complementary approach for exposing INSPIRE assets providing some flexibility. For example, the European Commission has already developed Core Vocabularies in the context of the ISA programme. They are data specifications created in an open process with expert groups and endorsed by ISA Member State representatives. In addition to Core Vocabularies there are also metadata schemas such as Asset Description Metadata Schema Application Profile (ADMS-AP), Data Catalogue vocabulary Application Profile for data portals (DCAT-AP) and Data Catalogue vocabulary Application Profile extension for describing geospatial datasets, dataset series, and services (GeoDCAT-AP) that help to connect related data that was not previously linked.

- Integrate the standards-based approach for different thematic sectors to support multi-sector applications. Different sectors have established sometimes different de facto and de jure standards involving location data, e.g. multi-modal transport, construction, energy. An integrated approach is particularly important where the same data (e.g. address, road) is used in different sectors or where applications from different sectors converge (e.g. smart cities).
- Use Business Process Model and Notation (BPMN) to design and describe business processes and Business Process Execution Language (BPEL) to execute the described processes using services. These techniques can be useful to define where spatial data input is needed, processed, and generated in digital government processes.

Needs-based approach

- In all of the above considerations regarding standards, ensure the implementation applies the standards in the simplest possible way to reduce complexity and cost, whilst maintaining the aims of interoperability and re-usability.

Challenges:

- The standards world moves slowly and is continually evolving. This means that sometimes it lags behind or is not yet ready in the context of a particular new application. Standards evolve with the evolution in technology. Legacy systems are built on legacy technologies and standards. This sometimes means that it is difficult to justify and make “one more major upgrade” or to integrate new and legacy systems.
- Standards are often a “middle ground” agreed by specialists over a number of years. Hence, they might not always be a perfect fit for a particular new application.
- System and data integration require common standards such as those promoted by INSPIRE. With so many public authorities and countries involved, there is an immense implementation challenge to achieve harmonisation. However, the steps are being taken to make this happen in a coordinated way, underpinned by the legislation.
- The return on investment for linked data depends on a degree of harmonisation which is difficult to achieve, with a multiplicity of data, different data and quality standards, and in many cases, a lack of legislative and policy support.

Best Practices:

#1: A digital platform for location data in Flanders

#2: IDOS - Cross-border journey planner for citizens

#3: ‘LoG-IN’ to the local economic knowledge base

#4: Rotterdam Digital City

#5: Radiological Emergency Response in Germany

#9: Digital Accessibility Map for better informed firemen

#11: Register of Territorial Identification, Addresses and Real Estates (RÚIAN)

#12: Enterprise locations in the Euregio Meuse-Rhine

#13: KLIC to prevent damage caused by excavation works

#15: Information System of Contaminated Sites in Slovakia

#16: Managing the granting of licenses for selling tobacco

#18: Territorial Information System of Navarre: SITNA

#19: Democratisation of soil data in the UK

#22: Standardised road safety data exchange

#23: INSPIRE-compliant marine environment e-reporting

#30: Location intelligence for ground works – KLIP platform

#31: Digital Twins of Helsinki

#33: Urban platform, Guimarães

#35: Use of GeoDCAT-AP specification for integration of catalogues in spatial data and open data portals

#45: Common Services BUILD

#48: Interactive tool for geospatial presentation of statistical data (STAGE)

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 12 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 2: Openness	Recommendation 4: Give preference to open specifications, taking due account of the coverage of functional needs, maturity and market support and innovation.
Underlying Principle 5: Technological neutrality	Recommendation 8: Do not impose any technological solutions on citizens, businesses and other administrations that are technology-specific or disproportionate to their real needs.
Interoperability Layer 1: Interoperability Governance	Recommendation 21: Put in place processes to select relevant standards and specifications, evaluate them, monitor their implementation, check compliance and test their interoperability.
Interoperability Layer 1: Interoperability Governance	Recommendation 22: Use a structured, transparent, objective and common approach to assessing and selecting standards and specifications. Take into account relevant EU recommendations and seek to make the approach consistent across borders.
Interoperability Layer 1: Interoperability Governance	Recommendation 23: Consult relevant catalogues of standards, specifications and guidelines at national and EU level, in accordance with your NIF and relevant DIFs, when procuring and developing ICT solutions.
Interoperability Layer 1: Interoperability Governance	Recommendation 24: Actively participate in standardisation work relevant to your needs to ensure your requirements are met.
Interoperability Layer 4: Organisational Interoperability	Recommendation 28: Document your business processes using commonly accepted modelling techniques and agree on how these processes should be aligned to deliver a European public service.
Interoperability Layer 5: Semantic Interoperability	Recommendation 32: Support the establishment of sector-specific and cross-sectoral communities that aim to create open information specifications and encourage relevant communities to

	share their results on national and European platforms.
Interoperability Layer 6: Technical Interoperability	Recommendation 33: Use open specifications, where available, to ensure technical interoperability when establishing European public services.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 6: Standards

Documentation	Elements
implementation Guide Appendices	Standards Governance and Policy Technology and Data Interoperability Compliance Testing and Certification Community of Practice

Actions	Tools
1. Direction Setting	
Standards Governance Framework	APP6.1: National Governance Model Examples
Standards Awareness	A Guide to the Role of Standards in Geospatial Information Management A Guide to the Role of Standards in Geospatial Information Management: Companion Document on Standards Recommendations by Tier
Strategic Goals	
2. Understanding National Needs	
Baseline Study	APP6.2: Standards Baseline Survey
Standards Inventory	
Needs Assessment and Gap Analysis	APP6.3: Needs Assessment and Gap Analysis
3. Planning for Change	
Action Plan	
Institutional Arrangements	APP6.4: Roles and Responsibilities for National Standards Governance
4. Taking Action	
Implementation	
Communication and Engagement	APP6.5: Standards Training, Tools and Related Resources A Guide to the Role of Standards in Geospatial Information Management A Guide to the Role of Standards in Geospatial Information Management: Companion Document on Standards Recommendations by Tier
Risk Assessment	
5. Ongoing Management	
Standards Review Programme	
Community of Practice	APP6.6: User Community Case Studies and Statements of Benefits

Capacity Building	
6. Achieving Outcomes	
Compliance	
Success Indicators	APP6.7: Community Best Practice Examples

ELISE Resources:

Type	Resource	Date
Study	INSPIRE-MMTIS, overlap in standards related to the Delegated Regulation (EU) 2017/1926 - INSPIRE support to EU multimodal travel information services	2019
Guidance	Guidelines for public procurement of geospatial technologies	2016
Webinar	Spatial Data on the Web Part 1 - How to make geospatial data more accessible for e-government applications	2018
Webinar	Spatial Data on the Web Part 2 - GeoNetwork´s User feedback form: How to make geospatial data more accessible for e-government applications	2018
Webinar	ISO/TC211 "Standards in Action" seminar: European INSPIRE Directive and Location Interoperability	2020
Workshop	INSPIRE Conference: INSPIRE on Tools - Geoportal, Registry, Validator	2018
Workshop	INSPIRE Online Conference: INSPIRE Reference Validator - Status and next steps	2020
Workshop	INSPIRE Online Conference: INSPIRE Geoportal Workshop - Use of the INSPIRE Reference Validator in 2019 Monitoring: Process and lessons learned	2020
Presentation	INSPIRE Conference: INSPIRE Reference Validator Presentation Video	2017
Presentation	INSPIRE Conference: Spatial Data on the Web - Tools and guidance for data providers Presentation Video	2017
Presentation	INSPIRE Conference: INSPIRE in RDF - Increasing semantic interoperability for European geospatial data Presentation Video	2017
Presentation	INSPIRE Conference: The role of INSPIRE in the provision of EU-wide multi-modal transport information services (MMTIS) Presentation Video	2018
Training	INSPIRE training platform: Introduction to INSPIRE	2014
Training	INSPIRE training platform: Data harmonisation	2014
Training	INSPIRE training platform: Metadata and catalogue services	2014
Training	INSPIRE training platform: Introduction to linked data	2015
Training	INSPIRE training platform: INSPIRE advanced	2018
Training	INSPIRE training platform: INSPIRE data specifications	2018
Training	INSPIRE training platform: Procedures for data and metadata harmonisation	2018
Training	INSPIRE training platform: Examples of data transformation	2018
Training	INSPIRE training platform: Metadata and data validation for INSPIRE	2018
Training	INSPIRE training platform: INSPIRE network services (advanced)	2018
Training	INSPIRE training platform: Principles for data and metadata harmonisation according to INSPIRE	2020
Training	INSPIRE training platform: INSPIRE network services (update)	2020

Further Reading:

- INSPIRE
- NIFO factsheets
- Core Location Vocabulary
- ADMS-AP
- DCAT-AP
- GeoDCAT-AP
- White paper Geo-standards
- France: e-Government interoperability standards, including geospatial standards
- ISA² Programme
- Open geospatial data, software and standards
- From Spatial Data Infrastructures to Data Spaces – A technological Perspective on the Evolution of European SDIs
- Living in the EU
- Open & Agile Smart Cities (OASC) and OASC Minimum Interoperability Mechanisms (MIMs) Plus Technical Specifications, Version 4

Recommendation 13: Manage location data quality by linking it to policy and organisational objectives, assigning accountability to business and operational users and applying a "fit for purpose" approach

Why:

- Research indicates that poor data quality is costing organisations an average of €8.4 million per annum and this is likely to worsen as information environments become increasingly complex.
- Improved data quality is a primary source of value for many IT-enabled business initiatives. Data quality has the potential to improve labour productivity by as much as 20% but, on the other hand, research shows that 40% of the anticipated value of all business initiatives is never achieved (source: Measuring the Business value of Data Quality, Gartner 2011). Poor data quality in both the planning and execution phases of these initiatives is a primary cause. Poor data quality also affects operational efficiency, risk mitigation and agility by compromising the decisions made in each of these areas.
- INSPIRE is creating a data infrastructure where we can anticipate reuse of the data. Public administrations are publishing open data. The same data is reused in many circumstances and, unlike other resources, the value of this data increases rather than decreases with use. Consequently, there is a need for a balanced approach to managing data quality and metadata across different EU Member States to support effective reuse.
- Managing data quality with a common approach/framework will enable a seamless exchange of data between different public service providers reusing this data. This can be done when administrations share their data through a common service for example.
- Managing data quality with a common approach will also enable the exchange of data between data providers. These can define "fitness for purpose" quality levels which include frequency of updates, produce data of a specific level of quality/detail with the adequate level of resources and define appropriate licensing. Data providers can also contribute to and enhance each other's data, thus sharing resources.
- As more business processes become digitalised, data quality becomes the limiting factor for

overall process quality.

How:

Fit for purpose data quality design approach

- Determine what is meant by and what is needed in terms of data quality. The dimensions of data quality include timeliness, accuracy, completeness, integrity, consistency, compliance to specifications / standards / legislation, well-described etc.
- Achieving perfect data quality on all data quality dimensions (typically ranging from three to six but sometimes up to several hundred) is impossible to achieve at reasonable cost for most organisations. Instead, it becomes essential to define clearly what is meant by "fit for purpose" data quality. By initiating an ex-post evaluation of existing data quality issues against data quality best-practice guidance, an organisation can define what “good enough” data quality means and develop and apply a framework for analysis. This framework will enable common data quality language, better communication of issues, and less confusion and better positioning of governance.
- Establish a clear line of sight between the impact of data and data quality improvement. This can be best achieved by:
    - Identifying the application systems and external services that produce data to support business activities and policy making;
    - Measuring conformance of data to quality parameters set out in the data policy on an agreed frequency;
    - Assessing the current business value in terms of the existing data quality level and engaging with relevant stakeholders to assess the value of improving specific data quality items.
- Use data profiling techniques early and often to assess data quality and present profiling results in a way that appropriate issues can be acted upon, identifying outliers, anomalies, cross-referencing errors, gaps etc. A useful approach is to design and implement data quality dashboards for critical information such as authentic data and to embed this as a business-as-usual IT process.
- Establish a data quality standard which incorporates multilingualism to ensure consistency and appropriateness in the way key enterprise data is applied and reported across the National and European Data Infrastructures

Common metadata approach

- Data quality standards are linked to data standards; ensure completeness and adequacy of the metadata, this will support reusability.
- Implement an agreed metadata standard across the public sector, which is based on or is consistent with the INSPIRE approach.
- When using common metadata standards, agree among the different stakeholders on the meaning of each metadata field, this ensures semantic interoperability of data.
- Combining authoritative and non-authoritative data.
- Combine authoritative and non-authoritative data for enhancing public services but define a framework or use cases where this is allowed, so as not to create legal uncertainty or infringement in public service delivery.
- Identify authoritative data and non-authoritative data using the quality framework, standardise the referencing of this authoritative/non-authoritative data for example with a specific metadata field in a common standard.
- Allow the combined publication of authoritative data and non-authoritative data on common platforms so as to favour marketplaces driving innovation in public services.

Data quality governance

- Make data quality a recurring agenda item at the information governance steering group

meetings to ensure the data quality improvement roadmap is aligned with the information governance vision and strategy.

- Establish data quality responsibilities as part of the information steward role.
- Establish a cross-unit or cross-organisation special interest group for data quality, led by the Information Management team or equivalent body.
- Establish a data quality review as a release management "stage gate" review process.
- Communicate the benefits of better data quality regularly to departments by benchmarking improvements with other similar organisations or creating a regular data quality bulletin and highlighting what could be achieved with better data quality management.
- Leverage external/industry peer groups by inviting them to present at special interest group meetings.
- Encourage feedback from users to report problems and help improve data quality. This process can be incorporated in licensing agreements.
- Use artificial intelligence (AI) and machine learning techniques to make suggestions for improving data quality.
- Involve citizens and the private sector actively in enhancing public data quality (completeness, correctness, predications, metadata completion, ...), potentially leveraging technology to support these processes, such as digital platforms

Challenges:

- Chief data officers (CDOs) and information management leaders continue to struggle with getting data quality onto their digital business agendas. This is often due to an overemphasis on enabling technology rather than a focus on organisational culture, people and processes.
- Few organisations attempt to use a consistent, common language for understanding business data quality. Instead, they maintain divergent and often conflicting definitions of the same logical data.
- Information leaders struggle to make data quality improvements beyond the level of a project and do not embed them at the programme level as part of their digital business information culture.
- Required data quality may come at a price that is not affordable.
- Drawing together data from multiple sources for analysis increases the possibility that effort will be needed to transform data to a form where it can be used.

Best Practices:

#27: Quality Assurance Framework of the European Statistical System (ESS)

#28: INSPIRE – Data Quality and Data Specifications

#29: ISO Standard for Geographic Information – Data Quality (ISO-19157:2015)

#30: Location intelligence for ground works – KLIP platform

#31: Digital Twins of Helsinki

#44: Geoplatforme: a collaborative initiative for management of geodata

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 13 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 9: Multilingualism	Recommendation 16: Use information systems and technical architectures that cater for multilingualism when Establishing a European public service. Decide on the level of multilingualism support based on the needs of the expected users.
Interoperability Layer 5: Semantic Interoperability	Recommendation 31: Put in place an information management strategy at the highest possible level to avoid fragmentation and duplication. Management of metadata, master data and reference data should be prioritised.
Basic Component 3: Base registries	Recommendation 37: Make authoritative sources of information available to others while implementing access and control mechanisms to ensure security and privacy in accordance with the relevant legislation.
Basic Component 3: Base registries	Recommendation 38: Develop interfaces with base registries and authoritative sources of information, publish the semantic and technical means and documentation needed for others to connect and reuse available information.
Basic Component 3: Base registries	Recommendation 40: Create and follow data quality assurance plans for base registries and related master data.
Basic Component 4: Open data	Recommendation 42: Publish open data in machine-readable, non-proprietary formats. Ensure that open data is accompanied by high quality, machine-readable metadata in non-proprietary formats, including a description of their content, the way data is collected and its level of quality and the licence terms under which it is made available. The use of common vocabularies for expressing metadata is recommended.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 4: Data

Documentation	Elements
Implementation Guide Appendices	Data Themes Custodianship, Acquisition and Management Data Supply Chains Data Curation and Delivery

Actions	Tools
1. Getting Organised	
Data Framework	APP4.1: Data Theme Description Template The Global Fundamental Geospatial Data Themes
Data Inventory	APP4.2: Data Inventory Questionnaire
Dataset Profile	APP4.3: Dataset Profile Template
2. Planning For the Future	
Data Gap Analysis	APP4.4: Gap Analysis Matrix
Data Theme Roadmap	APP4.5: Data Theme Roadmap Template
3. Capturing and Acquiring Data	

Data Acquisition Programme	
4. Managing Data Sustainably	
Data Governance	APP4.7: Data Governance Roles and Responsibilities
Data Management Plan	APP4.8: Data Management Plan Elements
Maintained Metadata	APP4.9: Metadata Creation Checklist
5. Maintaining Accurate Positioning	
Maintained Geodetic Infrastructure	APP4.11: Guidance for Improving Geodetic Infrastructure
6. Integrating Data	
Data Supply Chains	
Data Interoperability	

ELISE Resources:

Type	Resource	Date
Training	INSPIRE training platform: Data harmonisation	2014
Training	INSPIRE training platform: Metadata and catalogue services	2014
Training	INSPIRE training platform: Geospatial data quality	2017
Training	INSPIRE training platform: INSPIRE data specifications	2018
Training	INSPIRE training platform: Procedures for data and metadata harmonisation	2018
Training	INSPIRE training platform: Examples of data transformation	2018
Training	INSPIRE training platform: Metadata and data validation for INSPIRE	2018
Training	INSPIRE training platform: Principles for data and metadata harmonisation according to INSPIRE	2020

Further Reading:

- INSPIRE Knowledge Base – Data Quality Training
- Statistics Canada – Data Quality Toolkit
- Measuring the Business Value of Data Quality, Gartner 2011

Return on Investment

Current State

Infrastructure investments, such as SDIs or INSPIRE, are difficult to justify. There is growing evidence of measuring the extent of data reuse and business cases are increasingly developed before making investments. Nevertheless, less attention is given to examining the impact of access to interoperable authoritative public sector location data, considering its role in user satisfaction of digital public services, contribution to efficiencies and contribution to the wider value chain. There are many benefits studies but less concrete evidence that can be used in communications and to raise awareness. Funding models are not always clear, particularly where many parties contribute to and derive benefit from the infrastructure. There is growing awareness of the importance of a systematic approach to communicate the benefits of location data and location-enabled digital public services. This communication could be made even stronger if followed up by evidence-based case studies.

Vision

There is a strategic approach to national and European funding, procurement, and delivery of location information and location-based services to minimise costs and maximise benefits for government, businesses and citizens, building on the national SDI and its integration in broader national and European infrastructures, and supporting global initiatives such as the delivery of UN sustainable development goals (SDGs). The approach considers societal return of investments, e.g. in freeing data. The funding and sourcing model for collection and distribution of location data takes into account user needs from different sectors and the strategic importance of continued supply of data at a suitable quality. There are compelling impact assessments and business cases, a rigorous approach to targeting and tracking benefits, and good evidence that benefits are being achieved. Governments invest in the creation and design of ecosystems around data and data platforms in which value is created for the different providers, consumers and partners in the ecosystem. New ways of collaborative funding and return mechanisms are used in data ecosystems and digital platforms.

LIFO Monitoring

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of recommendations in the Policy and Strategy Alignment focus area in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Focus Areas.

Recommendation 14: Apply a systematic approach to assessing and monitoring the benefits and performance of location-based services

Why:

- Public sector data is a valuable asset on which added value products and services can be built.
- Understanding the extent, use and value of location enabled digital public services enables the value of the investment to be determined and helps target further investments and promote wider reuse.
- Comparisons with other MS can help in identifying opportunities for re-use and collaboration.
- Core location datasets such as addresses and geographical names are used in multiple cases. Interoperability of these and other datasets makes re-use easier in different sectors and geographies. However, justification of 'infrastructure' or 'enabling' policies and implementation projects involving core location datasets or interoperability measures is complex. However, learning is possible from successful cases where this has been done.
- Initial cost benefit assumptions used to justify a policy or implementation project are subject to change over time, with new factors often emerging which require consideration. Rigorous

downstream evaluation of cost benefit assumptions is not always done. This is vital where the policy and technology landscape is changing rapidly.

- Infrastructure investments support both intended and unintended uses. Estimates on the frequency and extent of use may prove to be inaccurate. Datasets and delivery mechanisms are built to meet planned needs and estimates of usage. Continuous monitoring is therefore needed to help in planning relevant operational measures.
- Directives such as INSPIRE and the Open Data Directive determine the need for specific actions relating to location data that may or may not otherwise have been taken or may have been taken at a later time. They present important policy drivers. However, they do not remove the need for national impact assessments and implementation business cases. Instead, because of the mandatory nature of these policies, they amplify the need to ensure there is a strong focus on implementation efficiency and cost minimisation and a parallel focus on ensuring widest possible use of the data to drive through benefits.

How:

- Key to any proposed policy or implementation project is the identification of target benefits, Identification of target benefits effectively defines the purpose of a policy or project. Quantification of the target benefits supports the rationale for making the investment. Demonstration of proven benefits can also be useful in securing investment for further development or investment by other parties in similar initiatives of their own.
- Return on investment (ROI) assessments are needed both to justify an initiative and to verify that the initiative has delivered the expected outcome in terms of costs and benefits. Such initiatives may include either 'policies' or 'implementation projects', both of which typically involve ROI assessments to determine the comparative merits of different options in terms of scope and approach. As well as looking at ROI, these assessments also consider the feasibility of different options, including the availability of funding related to the initiative. Governments or organisations also have to consider the relative priorities of different policies or projects as part of a portfolio approach.

What types of benefit to target?

- ***Productivity benefits***: There are many types of direct benefit relating to the sharing and use of location data. One of the simplest to communicate and understand is improved productivity, when tasks are made more efficient by removing manual processes or simplifying a digital process., for example simplifying the data collection and analytical processes in understanding Environmental Impact Assessments or Strategic Environmental Assessments (a staple of the INSPIRE investment case) or transport modelling using more accurate location data to reduce journey times for commuters, delivery drivers, shoppers, health care visits etc.
- Another type of direct productivity benefit is reducing the cost of citizens or businesses interacting with the government (often called 'reducing the administrative burden'). Integrating the national registers that hold land and property ownership, company registrations and addresses enable changes to be reported once and then synchronised across the different 'basic' registers. If these basic registers are used throughout all downstream processes and systems, benefits are thereby maximised. The principle behind this approach is known as the 'Once Only Principle'.
- Productivity benefits may or may not result in economic benefit (e.g. cost saving, increased time available to generate more income). Reducing journey times for parcel deliveries may have a direct economic benefit in terms of lower staff and vehicles costs. Reducing journey times in healthcare situations may do the same for home healthcare visits. There may also be indirect benefits related to health outcomes and costs to the health system. Reducing the administrative burden for citizens will not usually have an economic benefit but may have a social benefit (e.g. Increased time available to perform tasks that are more enjoyable) or a democratic benefit (e.g. increasing trust in government).
- ***Economic or financial benefits****:* These include cost savings, increased revenues, increased profitability (a combination of the two) and impact on GDP. Benefits may either be direct

(measurable and attributable) or indirect (e.g. having a measurable impact on data accessibility or a calculable impact on GDP). The role of location data is an important factor when communicating benefits. Where location data is the product or service (e.g. a mapping product) any economic benefit can be more readily traced to the availability of the product or service. In many situations, the use of location data is only part of the policy, project or service that is being communicated. The contribution of location data, therefore, needs to be explained if the focus of the communication is on the impact of location data (or the impact of interoperability measures associated with the location data).

- ***Social or environmental benefits***: The challenges of climate change place demands on data and information, not least spatial data and location information, as everything happens somewhere. Utilisation of new technologies, efficient data collection and easy access to value-creating data is a foundation for the work of climate adaptation. The INSPIRE spatial data infrastructure for Europe is concerned with supporting better environmental outcomes. INSPIRE came about because there is so much location-related data about the environment and there were significant barriers in availability and use of that data. Environmental benefits are therefore important in identifying and communicating location data benefits.

- By providing society with easily accessible environmental data that can be combined cross sector and cross countries, data-driven decisions on and investments in climate adaptation can be made. This includes the ability to carry out the analysis as efficiently and effectively as possible, through interoperability of data and availability of relevant technologies (e.g. sensors) and tools (e.g. data management, analytical tools). Arguments of this type can be important when central funding is needed from finance ministries to cover the cost of a national or other wide-ranging initiative.

- Social value is often related to environmental factors, such as living in proximity to green spaces and availability of tree cover in urban locations. Extending tree coverage can have social impacts in terms of improved wellbeing but environmental impacts in terms of helping to deal with air pollution. Social value can also have measures of a cultural or community nature, including access to community services, safety and security etc. Safety and security is an area where location-related crime statistics are often compared against causal factors. Impacts may come not only from the investment in policing but also other factors such as street lighting, surveillance cameras etc. There are some useful ideas on social value investment that may be important in communications (see Social Value International Standards and Guidance). Social value may also have close connections with democratic value.

- ***Innovation and effectiveness****:* Digital public service investment may result in new innovative services in areas not previously possible without the assistance of technology and associated location-related data. Such services may range from more personalised services in areas such as transportation (e.g. bike sharing), volunteering (selection, organisation and outcomes) and environmental services (e.g. waste) to services involving public participation (such as 'fix-my-street' type reporting of problems). The latter services also fit in the democratic benefits category. Effectiveness is not always associated with innovation. An effective service meets user expectations, gives them what they need, and has a user interface that handles information well for both transactional and information related activity. Digital public services do not always arrive 'right for time'. Communication of new and improved capabilities promotes take-up and can also invite feedback to help plan further improvements. There are also links between effectiveness and other measures of benefit. For example, increasing the level of investment in local policing is not necessarily effective in reducing crime – the investment has to be targeting at the right measures.

- ***Democratic benefits***: Democratic benefits may relate to increased participation, transparency and trust. Often different elements may be related. Local administrations may share details of planning applications and invite feedback electronically. These are examples of transparency and participation. Trust is also a factor when actions are taken (or not taken) reflecting the feedback of the local community. Reporting problems gives citizens an 'agent' role as well as their 'user' role in the community and improves trust, when actions are taken swiftly to resolve problems. Participation can take broader forms to help prioritise local policy, which is often related to targeting of available investment. Listening to the views of citizens can go a long way to maintaining trust. Fairness is also a factor to consider in that government should not be seen to

favour one sector of society or location above another in undertaking its public service task. Location-related statistics often feature in the 'evidence' for policy affecting different locations and their communities, including the outcomes of particular policy measures.

- ***Conclusion***: There are many different types of benefit resulting from effective sharing and re-use of location data, as many as there are generally for investments in digital public services. Many of the types of benefit have overlaps, e.g. productivity improvements may deliver economic benefits, increased participation may help in delivering social and environmental benefits, and measures aimed at improving the environment may also have economic benefits. Because all policy changes or implementation projects will have cost implications, it is essential that any economic or financial benefits are identified in addition to the on-economic or financial benefits. This enables both an economic or financial justification and a non-economic justification (where applicable) to be carried out. The economic or financial justification may be in terms of net benefits (justifying the extra investment), cost savings (delivering more for less) or more efficient government (getting more out of a given investment). Where targeted stakeholders may be required to make commitments, they will also want to know the funding model related to those commitments.

Using a business case or impact assessment for decision making

- Business cases or impact assessments are usually needed to help decision makers understand the rationale for taking action, the most appropriate action to take, and the impacts that can be anticipated in terms of costs and benefits. A business case or impact assessment will typically include the elements outlined below.

Definition and scope

- A statement of the problem; the stakeholders involved, reasons for taking action (e.g. policy or strategic drivers), potential solution or solutions to be assessed.

Assessment framework

- The assessment framework contains the cost elements and types of benefit to be assessed. Cost elements include people, technology, data, and physical resources. Types of benefit include economic and financial benefits (cost savings, increased revenues, GDP enhancement), efficiency gains (increased productivity, burden reduction), social and environmental benefits (e.g. improved health, improved air quality, reduced carbon emissions), and democratic value (e.g. increased trust and participation). Benefits may be further subdivided into 'intermediate benefits' and 'outcome benefits' or 'end benefits'.

- As an example, public administrations may publish their datasets on a national (open data) portal (output), create standard metadata to describe the datasets (output) and enable easier discovery of relevant datasets (intermediate benefit) and through use of these datasets enable private companies to create value added products (intermediate benefits) and increase profitability (outcome benefits) or enable more informative or easier to use digital public services (outcome benefits).

- The assessment framework will often be constructed in the form of a time-related model, with multiple data points and underlying assumptions. Such a model can be used to assess different option scenarios varying, for example, scope, time, resource assumptions, and take-up assumptions. Simpler models are used for project cost benefit assessments. More complex models are required for infrastructure investments or crosscutting policies or projects with multiple stakeholders and various network effects.

Quantitative assessment

- This involves quantification of costs and benefits with appropriate risk-based adjustments (sensitivity analysis).

- Financial cases will typically use discounted cash flow techniques to determine the net present value of an investment based on future projections. This technique is important in assessing different investment options with varying payback periods. Sensitivity analysis will usually make adjustments to increase cost estimates and reduce benefits estimates, often making assumptions about the differences across stakeholders and implementations.

- Macro-level socio-economic models may be constructed for complex policy or project scenarios (i.e. those involving multiple stakeholders, locations, baseline scenarios and possible outcomes). Socio economic analysis or 'value chain analysis' typically involves 'input-output' models to construct a representation of the stakeholders and processes involved in the scope of the policy or project. Such models provide a simplified representation of often complex network effects. Analysis may focus on part of the overall picture (e.g. a single dataset, core processes, processes with proven issues, sector use that is relatively easy to analyse, an individual geography). Assumptions are then made to extrapolate the analysis to the wider landscape, a technique sometimes referred to as 'benefits transfer'. Related benefits should also be flagged, for example the link between improvements in air quality, health impacts and cost of healthcare.

Strategic or qualitative assessment

- Quantitative assessments may also be complemented by strategic or qualitative assessments that have a variable role between mandating the need for an investment (e.g. to fulfil a legislative commitment, respond to a disaster event) or provide additional backing to the overall case (including the likelihood of support for or resistance towards a particular option).

Interoperability and location data considerations

- While the business case and decision-making approach is common regardless of the nature of the policy or project, there are certain factors that may be relevant to highlight where interoperability and location data elements are important parts of the picture.

- Interoperability elements: It may be important in the business case to highlight the interoperability elements relevant to the problem (interoperability barriers) or the proposed solution (interoperability measures). This analysis can be used to demonstrate the 'interoperability benefits' of the proposed project. This can be done by indicating the relevant aspects of the EIF applying to the project, such as the interoperability layers or principles, or in the case of a project with a significant location data component, the relevant aspects of the EULF Blueprint, such as the focus areas or recommendations.

- Policy drivers: A project investment may be linked to policies that are either direct or indirect drivers for the project. A 'direct' policy driver may be the policy requiring or even mandating the project. Without the direct policy link the project would not be needed or feasible. For example, a project to implement INSPIRE-compliant datasets and services might be necessary because of the legislative requirement under INSPIRE. Similarly, a project to fund and make available high value open location datasets via standard APIs may be needed as a result of the Open Data Directive. In these cases, the INSPIRE and Open Data Directives are direct policy drivers for the respective projects. On the other hand, an indirect policy driver is one which is supportive to the achievement of the project aims but is not a sufficient reason for undertaking the project. If the indirect policy driver were not there, the project could still go ahead and would have to be justified by other means. For example, a project to assess the collective energy efficiency of building stock in a particular district may be required as a result of the Energy Efficiency Directive or Energy Performance of Buildings Directive (direct policy drivers) but would benefit from the availability of INSPIRE datasets and standards to locate the position and extent of the buildings within the defined district (INSPIRE is an indirect policy driver).

- It should be noted that, although interoperability elements may be highly significant in digital public service problem analysis and implementation solutions, it is unlikely that the European Interoperability Framework in its current form or equivalent National Interoperability Policies will be direct policy drivers for many digital public service investments. Interoperability is more often seen as enabler rather than a reason on its own for a project. More likely direct policy drivers will come from the thematic policies that involve interoperability elements to enhance exchange of data and connectedness of systems to implement the policies (for example, transportation, health, environment, energy policies).

- Synergies regarding interoperability measures between European interoperability policy and European thematic policies and between National interoperability policies and National thematic policies are important to promote in order to lower barriers and maximise the integration opportunities and benefits coming from interoperability. In a basic sense, interoperability policy aims to simplify integration. There are many mutually-reinforcing policy options through which this can be achieved (see **Table 4**).

Table 4: Policy options to lower barriers and realise benefits associated with interoperability

Policy options	Lower economic barriers	Realise benefits
Lead on developing interoperability vision and foster alignment on roadmap Examples: EIF, EULF Blueprint, INSPIRE	An interoperability policy aims to simplify integration. Impact: Reduce costs of integration, operation, installation, maintenance and upgrade (for systems using the data; the cost of implementing and maintaining the policy also have to be taken into account) Cross-policy alignment to minimise burdens	An interoperability policy can indirectly stimulate reuse, lower exit / shifting costs / lock-in Impact: More innovation opportunities, more price points, more features, more choices in products – more competition. Encourage and facilitate stakeholder participation in the development of a roadmap of activities that lead toward the realisation of the interoperability vision.
Support consensus building Examples: Minimal Interoperability Mechanisms (MIMs), INSPIRE	Common interfaces support reuse and reduce costs of data access	Capture interoperability requirements of interfaces. Encourage and facilitate stakeholder participation (in defining interface requirements, a roadmap of activities, etc.) Establish effective governance when moving from project to maintenance – who's doing what, who decides, and who's paying?
Promote open standards, open data and use of open source software Examples: DG CNCT open data policies, ODD high value datasets, INSPIRE cross-border harmonisation, MIM data models for smart cities, Open APIs…	Open high value public datasets accessible through open APIs reduces costs and provides access to high quality interoperable data	Open standards for data and use of open-source software are extremely important and can be enforced through policy and public procurement actions. Open public data supports innovation and competition and provides transparency
Provide funding Example: cost of infrastructure and maintenance	Address funding gaps and any uncertainties related to hidden costs	Implement services not otherwise possible
Encourage public / private partnerships Example: DIAS	Address funding gaps and any uncertainties related to hidden costs	Implement digital public services not otherwise possible Private sector possibilities in other administrations

Economic modelling of the impact of location data: Location data may be a major focus or even the entire focus of an assessment. In this context, Alan Smart of ACIL Allen Consulting and Andrew Coote of ConsultingWhere have carried out several studies estimating the economic impact of location data, from national and regional studies, to studies of individual organisations (e.g. mapping agencies), particular high value datasets (e.g. addresses) and important use cases (e.g. land administration).. A useful description of techniques from these and other studies can be found in their presentation to the World Bank, Land and Poverty Conference 2017 entitled "Economic and Financial Modelling of the Impact of Geospatial Information – Techniques and Results for Land Administrations in Developing Nations". A summary of the different techniques and uses is given in

- **Table 5**.

Table 5: Techniques used in economic and financial modelling of the impact of geospatial information

Technique	Description	Usage
Welfare analysis	A model that captures the economic value of a good or service, applying concepts of consumer surplus (willingness to pay) and producer surplus (difference between revenues and costs).	Generally appropriate for valuation of specific geospatial data products or the economic effects of different pricing policies. Pollock, UK (2008) estimated a net benefit of £156m in moving from average cost pricing to marginal cost pricing for geospatial data. This involved using multipliers, which can be challenging to apply coherently. Welfare analysis is best suited to evaluating a single product or service rather than a whole package of datasets.
Gross revenue estimates	Estimate gross revenue for the geospatial sector	Oxera (2013) in a report for Google estimated that global revenues from geo services were between USD150bn and USD279bn. This technique is not a true indicator of economic value as it ignores input costs associated with generating the revenue.
Value added analysis	Total revenues of an organisation less cost of inputs. Gross value added makes up the bulk of GDP.	Gross Value Added (GVA) is a more realistic indicator of the economic contribution than measures of total revenue. The Oxera report estimated that GVA of geo services was USD113bn compared with GVA of all sectors in the global economy of USD70tn, suggesting geo services account for 0.2% of global GDP.
Value added along supply chains	Extends the estimate of value added to examine the contribution of geospatial systems to the supply chain.	Used by Oxera in 1999 to estimate the economic contribution of Ordnance Survey in the UK. The result was a total Gross Value Added (GVA) of between £79bn and £136bn with breakdowns by sector. Allen Consulting did a similar analysis in Australia in 2010, estimating GVA at around AUSD12.5bn.
Value chain analysis	This approach analyses business processes for different parties in the supply chain to identify opportunities for adding value and increasing competitiveness.	Value chain analysis can be useful to illustrate linkages between the geospatial data supply chain and related industries and reveal productivity and employment impacts not captured in more static analysis. These network effects can lead to further value creation as outlined in Longhorn and Blackmore (2008)
Economic impact assessment	Estimates the additional value created by an investment or policy.	Geospatial information economic impact assessments attempt to estimate part or all of the total extra value. To do this, the analysis must establish two scenarios: - a reference case for the services to be assessed - a counterfactual for the situation without the services (typically representing the next best option)
Cost Benefit Analysis	Benefits represent the additional value produced when compared to the counterfactual. A similar approach is taken to costs. Justification is when the change in benefits exceeds the change in costs over time (with discounting back to present value).	Used for assessing investment decisions or policy change. Benefits can be either tangible (direct or indirect) or intangible (unpriced) benefits. In some cases, the stated preference of consumers (willingness to pay) or their revealed preference (estimated trade-offs in terms of concessions in exchange for a benefit) are taken into account. Cost benefit analysis is a partial analysis that does not take into account changes elsewhere in the economy. Multipliers have been used but are difficult to estimate.
Computable General	A CGE model is a representation of all	CGE modelling is a more rigorous method of estimating the economy wide benefits when significant resource shifts

Equilibrium Modelling	markets in an economy. The models recognise that changes in one entity or sector can have repercussions elsewhere. The technique draws on different economic outcomes for a reference case compared with a counterfactual.	are likely. The technique can be used to show the national and if necessary regional economic impacts of an investment or policy change. It has been applied in studies in Australia, New Zealand, Great Britain, England, Wales and Canada. The strength of CGE analysis is its ability to incorporate technological change and to manage the consequent resource shifts in the economy, while overcoming the lack of resource constraints in multiplier analysis. CGE modelling is nevertheless heavily dependent on data, requiring extensive surveys and case studies to provide credible and verifiable results.

Source: Smart, A and Coote, A, 2017 {Adaptation)

- UN-GGIM IGIF Strategic Pathway 3: Financial Implementation Guide. Appendix 3.7 gives an example of a socio-economic impact assessment approach. The guidance outlines a process with the following steps:

  1) Agree on scope and priorities;
  2) Develop the engagement plan:
  3) Gather the socio-economic evidence;
  4) Analyse the information gathered; and
  5) Justify the benefits.

  A series of case studies are also presented to illustrate the approach.

  Appendix 3.8, meanwhile, describes the components of a business case and includes a case study on the Danish Basic Data Programme.

Portfolio based decisions

- Policy or investment decisions are rarely taken in isolation. Any national government has a range of policies to consider in its portfolio, taking into existing policy commitments, the manifesto of the party in power and the legislative programme agreed in government. Maintenance and implementation of policies has funding considerations that require budgetary support from the Treasury and ultimately the taxpayer. Public sector and private sector organisations have a mixture of ongoing costs and revenues as well as discretionary investments and any associated benefits, including revenue impacts, to consider.
- Decisions on individual policies, projects or purchases are taken in the context of the overall portfolio as part of a budget cycle (typically one year but may be longer). The Executive Board of an organisation will assess the commitments for the budget cycle on a collective (portfolio) basis. The budget portfolio for a period will involve existing commitments and discretionary investments or funding reductions. Discretionary projects or purchases will be evaluated typically on the basis of strategic and financial considerations. In this respect, proposed projects with a positive business case may not be approved because other projects have a higher strategic priority, a higher financial return or are simply more affordable.
- As ICT related projects typically have multi-year budget implications, it is often worthwhile to break them down into multiple stages to smooth out the discretionary investment need and allow for further investment decisions based on positive outcomes (see benefit realisation).

Benefit realisation

- The 'baseline' estimates of costs and benefits used in making an investment decision should be evaluated periodically to confirm the validity of the investment, inform any changes needed in the implementation programme, update the funding requirements, and aid communications. The approach to monitoring costs and benefits should be included in the original business case. Funding commitments and future decision points should also be highlighted. This is particularly important with a complex policy or project having a multi-year investment programme.

- Cost benefit monitoring is easiest where the costs and benefits are confined to an individual organisation. However digital public services often involve multiple delivery agencies and usually have very large external stakeholder communities, in terms of citizens and businesses. Infrastructure investments such as those associated with data sharing, which rely on multiple uses and in some cases network effects, are also more challenging to justify and monitor than policies or projects with a direct end-purpose.
- For infrastructure investments, surveying the views of key stakeholders before and at different points in the implementation cycle can provide useful metrics. An example taken from the INSPIRE evaluation is shown in **Table 6**. As mentioned earlier, it is important to distinguish between 'intermediate benefits' (e.g. number of dataset downloads resulting from improved discoverability and accessibility) and 'outcome benefits' (e.g. use of data to create or improve products and service). Most of the benefits in the table are 'intermediate benefits'. The traceability of outcome benefits is also important. For example, did the use of a location dataset which delivers outcome benefits come from discovering and downloading the dataset on a data portal or finding out about the dataset from personal contacts or news items? Traceability of end user benefits can be problematic when providing and distributing free and open data. New business models can address this issue, for example digital platforms or other community-oriented SDI approaches where the relationship between the provider and the user can become closer.

Table 6: Benefits deriving from INSPIRE identified by Member States

Type of benefit	Benefit identified by stakeholders	No. (%) MS
Direct benefits		
Benefits from production / processing of geospatial data	Improved quality and reliability of data	4 (13%)
	Harmonisation and interoperability	11 (35%)
	Improved cooperation among stakeholders	7 (23%)
Benefits from products (public/private) based on geospatial data	Reduction of time / costs (efficiency)	10 (32%)
	Sharing and reuse of data	9 (29%)
	Economic profit and new business opportunities	4 (13%)
	Innovation, technologies and technical knowledge	11 (35%)
	Better overview, discoverability, availability, accessibility of data	18 (58%)
	Harmonisation and interoperability	11 (35%)
	Improved quality and reliability of data	7 (23%)
Indirect benefits		
Transparency and improved policy making	Contribution to policy making in various areas	4 (13%)
	Increased openness to share data by data providers	3 (10%)
Benefits at national and EU level	Socio-economic benefits	5 (16%)
	National infrastructure and data strategy development	6 (19%)
	EU-wide collaboration	4 (13%)

Source: INSPIRE evaluation country forms, 2021

- 'Sampling' will be important for both estimates and monitoring. The cost model will need to cover all supply organisations and components and take into consideration the cost drivers and any variations in assumptions (e.g. cross programme costs, organisational costs, size of 'customer' base). Benefits 'sampling' will need to consider 'public value' both in terms of supply-side impacts (e.g. savings in costs and effort in delivery agencies) and external impacts (e.g. burden reduction, growth, environmental outcomes). The benefits sample may focus on the most significant benefits and a sample community that is statistically representative to give an appropriately accurate picture of outcomes. As in the original business case, risk-based adjustments may still be needed in monitoring outturns but at a lower level.

Stakeholder surveys and workshops

- Stakeholder surveys may be undertaken at various stages in the assessment of the policy or

project to determine their views on such things as:

- barriers (the nature of the problem, the effects on different stakeholders, the underlying causes of the problem) and enablers or measures (potential solutions to solve the problem);
- development and validation of the 'value chain model' where different actors are involved and determination of processes where improved digitalisation and use of data may have the greatest social or economic impact;
- costs and benefits associated with the problem and potential solutions, quantified as far as is possible
- views on the potential impact and ranking of different solution options and associated benefits;
- risk adjustments on both the level of costs and benefits to address for example, difficulties in identifying current costs across all elements and potential variances in future estimates of costs and benefits, taking into account the feasibility of delivery and extent of take-up;
- ex-post validation and updating of cost and benefit assumptions used in ex-ante assessment models, possibly done on a periodic basis as part of a long term implementation programme.

- Where possible, different types of stakeholders should be consulted (e.g. providers of data, users of data) to obtain a consolidated picture. Different techniques may be used to make risk adjustments. These include removal of outliers and risk adjustment of costs (typically upwards) and benefits (typically downwards). Evidence should also be sought from stakeholders to back their views.
- Workshops can be run to evaluate options and create consensus. The Delphi method[16] can be useful in orchestrating the evaluation process. This approach originated in assessing warfare scenarios but can also be applied in an investment context.

Performance benchmarking and improvement

- In the same way that individual investment decisions need to be considered in the context of the overall portfolio, investment in continuation and improvement of a digital public service needs to be considered through monitoring at a portfolio level. In this context, a possible approach to performance benchmarking and improvement is defined below.

Agreed list of services for benchmarking

- Define a list of 'basic services' to identify what can be expected to be implemented and measure / benchmark location-enabled digital government development against this list. Use a 'basic services' list which addresses all basic digital public services, with a balanced contribution of those involving location information.
- Align the list of digital public services with those used by other countries to support both national and international performance benchmarking.

Regular performance monitoring

- Apply a regular monitoring approach that looks at both "upstream" and "downstream" aspects of location-enabled digital public services, considering:
  - The available components (technological and non-technological) for enabling the availability and access to location data and services;
  - The e-services and processes that have integrated location data and web services;
  - The use (take-up) of these location-enabled e-services by public administrations, businesses and citizens;
  - The financial and non-financial benefits of using location data and services.
- Use the indicators that are included in the INSPIRE monitoring and reporting obligations, e.g.:

[16] The Delphi method is a process for arriving at a group opinion or decision by a panel of experts, based on a series of question rounds and sharing of results after each successive round of questions.

- Existence, accessibility and conformance of data, metadata and network services;
- Use and benefits of data and network services.

Impact-based improvement

- In identifying and monitoring the benefits of location information, it is important to focus on the benefits of the use and especially the integration of location data and services in (digital government) processes of public administrations, as this is where the benefits are most visible and tangible. The identification of the benefits of integrating location information in processes can be done at different levels. Benefits can be measured: 1) of one single location-enabled service that is provided in the process (in comparison with a traditional service) to support a G2C, G2B and/or G2G interactions, 2) of the entire location-enabled processes (in comparison with the traditional processes), or 3) of several processes within a policy action or policy domain. Moreover, it is important to look, not only at the benefits for government, but also to take into account the benefits for citizens, businesses and other parties and even broader socio-economic benefits.
- Use the regular monitoring of "upstream" (i.e. production and dissemination) and "downstream" (i.e. use) aspects of location data and services to obtain a good understanding of return on investment across the public sector.
- Use the information to fund improvements in particular location data or services and to prioritise investment across the governmental portfolio.
- For projects applying agile methods or divided into specific implementation stages, use an 'agile financing' approach to release funds progressively taking into account the needs of each project iteration or planned implementation stage, and the success in delivery and take-up as well as the learning from completed iterations or project stages.
- Use a common maturity assessment method across EU Member States and benchmark the performance measurement with other MS to understand the relative degree of maturity and identify where good models may be found for future service improvements.

Challenges:

- Different types of benefits are not always spelt out clearly and dealt with appropriately in business cases and impact assessments. It is important to distinguish between 'outputs' and 'outcomes', between benefits associated with intermediate stages in the value chain ('intermediate benefits') and benefits where value is actually realised ('outcome benefits' or 'end benefits'). The assessment of productivity gains or burden reductions also needs to consider whether the time savings have a material impact in terms actual cost savings or substantial service improvement that frees up valuable time for individual users.
- It can be difficult to attribute benefits when multiple drivers are involved. For data sharing initiatives, 'benefits' may be attributed in many ways, for example to the appointment of a digital champion that promoted the initiative, to the government digital strategy (where this initiative may have been one of 10 key elements of the strategy), to the governments open data policy which has the aim of opening up public sector data for the widest possible use, or to the government's interoperability policy, which aims to promote good practices in interoperability of digital public services. The justifications for each of these initiatives could all use the same 'evidence'. Furthermore, EU policies and initiatives operate in the same field of 'good practice'. Attribution of 'benefits' could therefore also be applied to a European level digital strategy, data strategy, open data strategy, interoperability strategy and any associated legislative or policy interventions (including funding). Finally, the role and impact of any policy, local, national or EU, sits in a landscape where practitioners are applying good practices out of common sense, experience and demands from stakeholders (either other public employees, partners of government or the citizens and businesses they serve). The value of any policy has to be considered therefore in the context of these external and related factors. To attribute benefits to any one 'policy driver' is 'very challenging', if not impossible.
- The narrower the policy or action, the easier its potential benefits can be predicted and measured and the broader the policy or action, the more difficult it is to predict or measure the

benefits or impact. The easiest to construct justifications and business cases are those at a project level in single administrations. In the circumstances, where broad-ranging policies sit within a highly complex landscape of external factors and varying degrees of history and maturity in dealing with a topic in different administrations (nationally) or different Member States (at an EU level), these are more difficult to justify or construct a business case and correspondingly, to define and assess the quantifiable benefits of different policy options.

- The EIF is an example of a very broad ranging framework. The scope of 'interoperability' in the framework includes legal, organisational, semantic, technical and governance elements, with 47 recommendations across the whole framework. These are most of the aspects of an overall digital strategy, expressed from the reference point of interoperability. In fact, the national interoperability initiatives (policies and strategies) across Europe are a mixture of digital strategies, dedicated broad-ranging interoperability initiatives and more-specific interoperability initiatives that focus, typically, on more technical or data-related matters. Both the breadth of the EIF and its overlap with digital strategies makes the identification and attribution of benefits difficult to assess and provides a corresponding challenge in determining the appropriate type of policy intervention.
- Interoperability policy and infrastructure projects suffer similar challenges in terms of defining and attributing benefits. Both are enablers in the delivery of benefits and may have intermediate results that can be attributed, for example more organisations adopting relevant standards, more cases of external organisations using public datasets. However, outcome benefits such as cost savings, environmental improvements, increasing revenues come from the use of standards or data for specific purposes. In simple terms, interoperability policies or infrastructure projects do not deliver benefits but are enablers to the delivery of benefits in different circumstances.
- Use of cost benefit analysis for investments of policies has its own set of challenges, particularly when the range of affected stakeholders and processes is significant and the investment or policy applies across a range of sectors and geographies. Optimism bias should be avoided. This can be done with appropriate sensitivity analysis. An important challenge is in defining the counterfactual to compare the proposed change against. Policy impact assessments typically require a baseline scenario which looks at what happens if we "do nothing". However, a common error is to assume that without the change, nothing happens but this is rarely the case. To be credible, a cost benefit analysis must have a credible counterfactual.
- A further challenge is in analysing all the costs and benefits when the range of stakeholders in terms of types and maturity, the number of cost elements, and the types of benefit are substantial. Sensitivity analysis will be important to address the different levels of uncertainty. It may also be useful to consider focusing only on major benefits (this may be sufficient to justify the investment), restricting the analysis of benefits to productivity effects (which are inherently understandable) rather than modelling broader economic effects, or creating estimates for different classes of implementation in the assessment model (e.g. by size of administration).
- Each of the assessment techniques has benefits and limitations. It is important to choose the appropriate technique for the required purpose. The summary of the different techniques in Figure 14 provides some pointers in this respect. It is also important to recognise the limitations of any technique and to factor in those limitations to the risk analysis for the investment or policy change. Below are some potential limitations to note:
    - A socio-economic model is always a model and any repeat assessment after implementation is refining the assumptions in the model rather than providing 'evidence' of results;
    - Views from surveys are also 'views' and not hard evidence;
    - Monitoring number of downloads or website visits does not demonstrate that what has been accessed has been used to create value (i.e. saved time, money or contributed to a product or service);
    - Very small time savings on frequent tasks or moderately large savings on infrequently carried out tasks may appear to be significant where very large numbers of people are involved. However, the time savings for each person may not be sufficient to spend on productivity activity which will contribute to GDP.

- Monitoring and benchmarking in the context of digital public services tends to focus on the main upstream activities of the value chain (readiness and availability), while the downstream elements (use and impact) are neglected because of the difficulty of finding this information.
- Indicators can sometimes be difficult to measure, with information provided too vague, general or abstract. Involve professional investment analysts to validate indicators.
- Impacts of new services or service improvements can be difficult to predict. This is why ongoing monitoring and targeting of improvements is needed. An iterative approach to service delivery and improvement (see recommendation 8) can also be beneficial.
- Financing a reliable policy assessment, investment case or monitoring approach can be challenging. The more complex the assessment and the more stakeholders involved the more costly is the process. Similarly, it can be costly to maintain frequent automated monitoring or carry out surveys to provide extensive business analysis / intelligence.

Best Practices:

1: A digital platform for location data in Flanders

#43: The Impact of open geodata – follow up study

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 14 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 12: Assessment of effectiveness and efficiency	Recommendation 19: Evaluate the effectiveness and efficiency of different interoperability solutions and technological options considering user needs, proportionality and balance between costs and benefits.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 1: Governance and Institutions

Documentation	Elements
Implementation Guide Appendices	Leadership Value Proposition

Actions	Tools
1. Setting Direction	
Strategic Alignment Study	APP1.2: Strategic Alignment Template
Geospatial Information Management Strategy	APP1.3: Guidance for Mission, Vision and Goals Statements Future trends in geospatial information management: the five to ten year vision (third edition) Global Statistical Geospatial Framework Framework for Effective Land Administration Strategic Framework on Geospatial Information and Services for Disasters COVID-19: Ready to Respond - The role of the Geospatial

	Community in Responding to COVID-19
4. Creating a Plan of Action	
Change Strategy	
Country-level Action Plan	APP1.4: Country-level Action Plan Template
5. Tracking Success	
Monitoring and Evaluation	APP1.5: Monitoring and Evaluation Template
Success Indicators	APP1.6: Success Indicators
6. Deriving Value	
Value Proposition	FIG1.6: Value Proposition Canvas

Strategic Pathway 2: Policy and Legal

Documentation	Elements
Implementation Guide Appendices	Governance and Accountability

Actions	Tools
4. Future Proofing	
Future Proofing	
6. Delivering Compliance	
Impact Assessment	

Strategic Pathway 3: Financial

Documentation	Elements
Implementation Guide Appendices	Business Model Investment Benefits Realisation

Actions	Tools
2. Situational Assessment	
Current Business Model	APP3.4: Example of a Business Model Canvas
3. Financial Plan	
Desired Business Model	APP3.5: Developing a Business Model - Some Considerations
4. Case for Investment	
Socio-Economic Impact Assessment	APP3.7: Socio-Economic Impact Assessment Approach
Business Case	APP3.8: Components of a Business Case
6. Deriving Value	
Benefits Realisation	
Communicate Benefits	

ELISE Resources:

Type	Resource	Date
Study	Digital Platform for Public Services	2018
Study	The Role of spatial data infrastructures in the digital government transformation of public administrations: See impact section which gathers indicators concerning the breadth	2019

	of usage of the SDI and the benefits derived, as well as the cross-border perspective.	
Webinar	The Role of Geospatial for Digital Government Transformation	2019
Webinar	The Role of Spatial Data Infrastructures for Digital Government Transformation	2029
Webinar	Evolution of the access to spatial data for environmental purposes – Study presentation	2021

Further Reading:

- NASA: Geospatial Interoperability Return on Investment Study, Booz Allen Hamilton, 2005
- The Value of Danish Address Data, 2010
- The Value of Geospatial Information to Local Public Service Delivery in England and Wales, 2010
- The Value of Geospatial Information in Local Public Service Delivery, Schmidt, G, Local Government Association, Westminster Briefing, 2010
- Review of Recent Studies on PSI Re-use and Related Developments, Vickery 2011
- Assessing Social Benefits in Sweden, INSPIRE Conference, 2011
- Beyond Interoperability, OGC, INSPIRE Conference, 2011
- INSPIRE in Danish e-Government, 2012
- Estimating Benefits of Spatial Data Infrastructures: A Case Study on e-Cadastres, 2012
- Finnish INSPIRE benefits study, 2012
- What is the Economic Impact of Geo Services? - a report prepared by Oxera for Google, 2013
- Valuing Geospatial Information: a review, Alan Smart, Andy Coote, INSPIRE Conference, 2013
- OECD Working Paper on "Open Government Data: Towards Empirical Analysis of Open Government Data Initiatives", 2013
- Spatial Data Infrastructure (SDI) Manual for the Americas, provided by the Permanent Committee for Geospatial Data Infrastructure of the Americas (PCIDEA, now UN-GGIM Americas), 2013
- Management of On-demand Transport Services in Urban Contexts, Barcelona Case Study, 2015
- Cost Benefit Analysis of Address and Street Data for Local Authorities and Emergency Services in England and Wales, 2016 – Identifies a 4:1 return on investment
- The Business Impact of GIS - Case Studies from Utah, Kloos W, Utah Department of Natural Resources, ESRI, 2016
- Cost benefit analysis of increased production and improved availability of marine geospatial data, Menon Economics, 2016
- Making the case for data standards - Final business case for local waste services, Local Digital Coalition, UK, 2016
- Economic and Financial Modelling of the Impact of Geospatial Information - Techniques and Results for land administration in developing Nations, Smart, A and Coote, A, Office International du Cadastre et du Régime Foncier (OICRF), Land and Poverty Conference, 2017
- The impact of the open geographical data – follow up study, Agency for Data Supply and Efficiency, Denmark, 2017
- **The impact of open geodata in Denmark - follow up study after 5 years, INSPIRE**

Conference 2017 Presentation Video

- The Economic Impact of Geospatial Services, AlphaBeta, 2017
- Towards a Spatial Knowledge Infrastructure, Australia and New Zealand Cooperative Research Centre for Spatial Information (CRCSI) White Paper, 2017
- The Economic Impact to the UK of a GNSS Disruption, London School of Economics, 2017
- The economic benefits of Open Data, data.europa.eu, 2017
- Interoperability in the digital economy, MAGKS Joint Discussion Paper Series in Economics, Kerber, Wolfgang; Schweitzer, Heike Philipps, University of Marburg, School of Business and Economics, 2017
- Assessing the Economic Value of 3D Geo-information, EuroSDR, 2017
- Impacts of Open Data in Luxembourg and the Greater Region – 2018
- Economic value of spatially enabled services in Finland, Spatineo, 2018
- Measurement activities related to open data, Lämmerhirt, D, State of Open Data, International Development Research Centre, Canada, 2018
- An Initial Analysis of the Potential Geospatial Economic Opportunity, UK Geospatial Commission, 2018
- Google Analytics information about the Flemish geoportal "Geopunt": the pro's and con's, INSPIRE Conference 2018
- Economic benefit of a unified national geodata approach in the community building process, Lantmäteriet, Sweden 2019Economic and social benefits of data access and sharing, OECD iLibrary, 2019
- Cross port benefits of geospatial technology, Port Strategy, 2019
- eGovernment Benchmark 2019
- The value of Integrated Geospatial and Building Information Modelling (BIM) solutions to advance the United Nations Sustainable Development Goals (Agenda 2030) with specific focus on resilient infrastructure, UN-GGIM, WFEO, and WGIC, 2020
- Geospatial Data Market Study, Report for the UK Geospatial Commission, Frontier Economics, 2020
- Measuring and Mapping Data Reuse: Findings from an Interactive Workshop on Data Citation and Metrics for Data Reuse, Federer, L, Harvard Data Science Initiative, 2020
- The Value of Surface-based Meteorological Observation Data, World Bank, 2021
- Unlocking Value with Location Intelligence, Boston Consulting Group, 2021
- The Netherlands Geospatial Economy Report, Geospatial Media and Communications, Ministry of the Interior and Kingdom Relations of the Netherlands and Geonovum, 2021
- INSPIRE Knowledge Base: Monitoring and Reporting
- United Nations e-Government Surveys
- Open Data Institute: Benchmarking open data automatically
- GeoSamen - showcasing what the geosector has to offer, Netherlands
- TomTom Traffic Index
- Vaisala blog: Day to Day Benefits of Weather Detection
- Delphi method, RAND Corporation

Recommendation 15: Communicate the benefits of integrating and using location information in digital public services

Why:

- Clear metrics provide powerful messages.
- Communicating the benefits of strategic 'infrastructure' investments such as those related to data sharing and associated interoperability measures can be challenging and requires a different type of analysis to more straightforward 'project' investments.
- Communication of benefits supports investment and demonstrates to taxpayers that public administrations are spending their money to good effect.
- A business case investment approach based on evidence complements the evidence-based policy approach.
- Demonstration of benefits and how they are achieved in particular use cases helps in promoting wider reuse and delivery of benefits by others.
- User stories and examples of benefits are simpler to understand and more meaningful to most people than detailing the process followed, parties involved or technology used.
- Data sharing initiatives, particularly those involving high value datasets, have the potential for very large-scale reuse and benefits. To maximise benefits needs reaching out to the widest possible number of stakeholders. Effective communication is vital to achieve this aim.

How:

Purpose of communication

- Communication of benefits is done for a range of different purposes:
  - To help create a 'vision' of what a policy or implementation project hopes to achieve. This will help secure interest and eventually support for the policy or implementation project. Different benefits may have different degrees of importance for different stakeholders. It is important to 'target' the benefits that will be important to these stakeholders (to obtain political backing, to help secure investment), to deliver the widest possible benefit (largest number of stakeholders), to deliver the largest benefit (areas of most significant impact);
  - To secure commitment to a policy or project that will involve investment from multiple stakeholders (a national data programme may involve financial and time commitments from large numbers of stakeholders) or to secure financial backing within an organisation for its own proposed project or purchase. For these purposes, an 'investment case' will be needed that estimates net benefits (i.e. taking both benefits and costs into account). The investment also needs to be affordable (there is no point in having a good business case for a project for which funds are not available) and funding sources need to be clearly spelt out (this is particularly important where policies or projects involve distributed costs);
  - To secure further investment by demonstrating success of a policy or project (this may be the case for a phased investment, where an intermediate milestone needs to be reached before further funding is made available) or by highlighting variations in certain investment parameters (typically in costs) where a re-justification of the investment is needed;
  - To raise awareness of the initiative and its benefits to a wider stakeholder community. This may be done to encourage the adoption of the outputs of a project within an organisation (e.g. raising awareness with policy makers of an available location data service or location intelligence capability), to encourage target end-users to adopt a new location enabled digital public service (to broaden take-up and therefore delivery of benefits), or to raise awareness with stakeholders in other public or private sector organisations (to encourage participation, reuse of solutions, and extend the benefits);
  - To promote an available location data product or service, illustrate how it may be used and the benefits for users, with the aim of increasing take-up and thereby either increase

revenue or support the need for continued or additional funding for the location data product or service. There may also be a skills transfer impact of the communication, which will help raise the capacity needed to deliver benefits across the stakeholder community.

Evidence collection

- Use 'strategic' investment approaches, such as socio-economic analysis to assess overall market impacts, including impact on GDP of widespread re-use of high-quality interoperable location datasets. Key metrics such as impact on GDP present simple and powerful messages to support policies and investments. Evidence collected in one country can also encourage other countries to adopt similar approaches and help support cross border use cases.
- Apply localised result analysis, such as the impact on air quality, noise, congestion. Local evidence can be collated to form a broader geographical picture. Alternatively, different local scenarios drawn from measured evidence can be modelled to provide a broader geographical assessment.
- Indicators expressed in widely used terms can help in supporting investments and communication. Examples are local contributions to Sustainable Development Goals, expressed in terms of standardised indicators, INSPIRE monitoring results, European Open Data Maturity measurement, Digital Economy and Society Index (DESI), Covenant of Mayors Sustainable Energy and Climate Action Plans.
- Prepare 'project' business cases taking into account the potential benefits of an integrated approach to the use of location information in digital public services, using this information to inform investment decisions for particular services.
- In all impact assessments / business cases, it is essential to state the assumptions underlying both costs and benefits. If these are stated, future outcomes can be compared against them and adjustments made where relevant.
- Collect evidence on how the integration of location data and services can help public administrations improve their processes and achieve benefits. Measure benefits of particular investments to validate projected outcomes and make the case for further / continued funding.

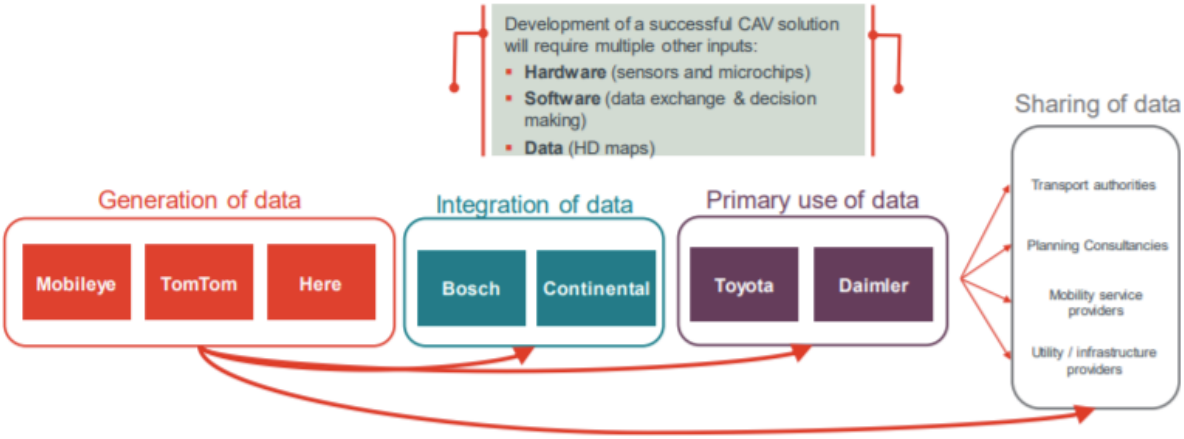
Communication methods

- The different types of benefit associated with the use of location data and intelligence capabilities are described in Recommendation 12 under '*What types of benefit to target*?' The types of benefit include productivity benefits, economic or financial benefits, social or environmental benefits, innovation and effectiveness, and democratic benefits.
- The types of benefit and information selected for communication will vary according to the purpose of the communication and the audience. Ensure the communication addresses the understanding and motivations of the target audience, for example, whether they are policy or technically focused.
- It can be valuable in communication to provide both the overall picture in terms of benefits and one or more illustrations or 'user stories' to bring the communication to life. Use real life case studies and user stories to highlight benefits in a way that is understandable to the audience. These can help show how the approach and benefits achieved in one administration may also be applicable in other administrations or how benefits derived by users of a new digital public service may also be obtained if other users take advantage of the service.
- Include relevant quantitative and qualitative metrics in the communication to support the 'case study' or 'user story', for example the average time saved for each user, the cost saving for the administration, the improvement in environmental factors, or the improvement in user satisfaction in the introduction of the new service. Explanations of the before (ex-ante) and after (ex-post) scenarios can also be helpful in explaining how barriers have been removed and opportunities realised. Where possible the economic or financial impact should be included to convey the 'value for money' of a particular investment. A useful metric to present, in this respect, is the payback period for any investment.
- Ensure a 'balanced assessment' is given to counter any scepticism in the audience. This may include giving details of different scenarios to highlight best, worst and typical cases, providing

details of net benefits (i.e. outline the costs as well as the benefits) or saying something about the assumptions used or the process undertaken in making any assessments. Socio-economic assessments that demonstrate large GDP impacts can provide impressive 'results' for communication but it can be helpful to say something about the way the numbers have been derived, including the risk-adjustments that have been made.

- In all cases of communication, the outcomes achieved should be highlighted. This should be accompanied by an appropriate degree of communication about how those outcomes were achieved, including the contribution of location data and interoperability measures. Where the audience is quite technical or the communication is to share knowledge on how something is done to achieve the benefits, a well-structured and detailed technical presentation will be relevant.
- Sometimes, the 'user story' involves describing a relatively complex network to show how benefits are derived through the interactions of different actors in a digital ecosystem or how a digital or data infrastructure can help remove barriers and enable new capabilities and benefits. A visual representation of the 'value chain' can be helpful in the communication, together with an explanation of the role of different actors and the impact on them of the changes being communicated. An example is shown in **Figure 14**, which is taken from a Fronter Economics geospatial data market study undertaken for the UK Geospatial Commission in 2020.

Figure 14: Autonomous vehicle geospatial value chain



Source: Frontier, 2020

- Another example, this time from Denmark, is highlighted in Annex II, Benefits Illustration 12. This shows the value chain in using free geodata to assess flood risk for the purposes of urban planning, disaster management, insurance underwriting etc. See SCALGO Live Flood Risk and the associated value chain in the following presentation: The Impact of Open Geodata – follow up study after 5 years.
- Communicate benefits using relevant techniques appropriate to the purpose of the communication and the target audience. This may be factsheets, web-based documentation, videos, digital government 'communication' events involving public sector or external stakeholders etc.

Benefits illustrations

- There are many examples of the benefits of location data and associated interoperability measures in different sectors and situations. See Annex II: EULF Benefits Illustrations for some typical applications, each with a general summary of the types of benefit and one or more specific case studies to act as illustration. Benefits are described for the following applications:

Table 7: EULF benefits illustrations (see Annex II)

No	Application Type	Case Studies
1	European data programmes	EU

2	National data programmes	DK
3	Geospatial strategic reviews	UK, AU, LT, NE
4	Integration of data from external sources	PT, INT
5	Address data	UK, DK
6	Planning and construction	SE
7	Routing applications	UK, NO. SE
8	Public transport	UK
9	Catchment area and transport planning	ES
10	Asset maintenance	BE, NE, UK
11	Agriculture and fisheries	AU, EU
12	Environment	DK, INT
13	Healthcare	KR, CZ, DE, FR, INT
14	Fix My Street applications	PT, INT
15	Meteorological services	INT, FI

INT = International

Location interoperability benefits template

- The template in **Table 8** can be used to summarise information relevant to the role of location data, interoperability measures and policy drivers, contributing to the benefits of an investment or policy change. This captures the main themes in the foregoing analysis.

Table 8: Location interoperability benefits template

Location interoperability benefits template	
Name	Name of policy, project or service
Description	Description of policy, project or service
Stakeholders	Type / Role Include different public administrations and external stakeholders
Scope and role of location data	Main location data produced or used as well as the geographical extent Role of location data. Role types include: • Location data is the service, e.g. location data download, average temperature records, map search by geographical name • Location data personalises, e.g. personalised advertising, my local weather • Location data adds intelligence, e.g. navigation system re-routing to avoid traffic congestion, forecasting earthquake events
Interoperability measures	List of interoperability measures incorporated in the policy or project implementation: For each measure include: • Brief description of solution / enabler • Barrier (s) addressed • EULF Blueprint focus area / recommendation • EIF layer
Policy drivers	Policy name / relationship type / relationship description Policy relationship types are: • Direct – This may be the policy requiring or even mandating the project. Without the direct policy link the project would not be needed or feasible. • Indirect – A policy that is supportive to the achievement of the project aims but not a sufficient reason for undertaking the project. If the indirect policy driver were not there, the project could still go ahead and would have to be justified by other means.
Costs	Type / Stakeholders / Value / Method of measurement Cost types include: • Development costs

	• Fixed costs (e.g. equipment and other physical resources) • Operational and maintenance costs (IT, data, user support)
Benefits	Type / Stakeholders / Value / Method of measurement. Benefit types include: • Productivity - time savings both within the public sector and burden reduction for external stakeholders (which may or may not equate to financial benefit) • Economic and financial (cost saving, revenue increase, GDP impact) • Social and environmental • Innovation and effectiveness (e.g. service quality and capabilities) • Democratic value (e.g. increased participation, transparency and trust).
Start date	Date of initial implementation

'Location interoperability' is the ability of organisations, systems and devices to exchange and make use of location data with a coherent and consistent approach.

- **Table 9Error! Reference source not found.** below gives an example of the use of the location interoperability benefits template in an important policy development in Denmark, 'Good Basic Data for All', and the associated implementation programme, the Basic Data Programme'.

Table 9: Location interoperability benefits template – Basic Data Programme, Denmark

Location interoperability benefits template	
Name	Basic Data Programme
Description	'Good basic data for all' was part of the Danish digitisation strategy 2011-2015. The vision was that basic data about individuals, businesses, real properties, buildings, addresses and more would be updated efficiently in one place and openly available to everyone, including the private sector. In this way, basic data would be a driver for efficiency and growth. The first free and open Basic Data was released in 2013 and the first standardised (interoperable) Basic Data was available through a 'Common Data Distributor' platform in 2017. The programme was completed in 2019.
Stakeholders	The Basic Data Programme stems from the agreement on 'Good basic data for all' between the government and KL (Association for Local governments in Denmark) in 2012. In 2013, the Danish Regions joined the agreement, making it binding for all of the public sector in Denmark. The programme was run by the Danish Digitisation Agency, within the Ministry of Finance. It operated at 3 levels: 1) The Basic Data Programme Board, providing overall coordination; 2) Steering groups, forums and secretariats covering topics such as architecture, standards and communication; 3) Eight sub-programmes for to improve quality and make data interoperable, structured by data/policy domains. Basic Data is distributed via a Basic Data Platform, which is the centre of a broad ecosystem of users, solution developers, and data and technology providers. There is a User Forum targeting broader use of Basic Data involving NGOs, citizens and SMEs. The Basic Data Board was closed down in 2020 and operation of the Basic Data Platform and further development of Basic Data in Denmark transferred from the Danish Digitisation Agency to the Agency for Data Supply and Efficiency (NMCA)
Scope and role of location data	The main Basic Location Data are Addresses, Roads, Cadastral parcels (real property), Administrative Units, Place names, Elevation and topological maps. Coverage is for the whole of Denmark. There are many uses. Some examples can be found here: https://sdfe.dk/data-skaber-vaerdi/maanedens-anvender-cases-og-temaer. Key roles / uses of the basic location data are: • Visualisation and administrative foundation • Integration between Basic Data registers and with non-basic data, e.g. to see that a person owns a specific house, located on a specific road, at a specific address in a specific administrative area • Spatial analysis and business intelligence, e.g. demographic, financial, taxation,

	health and several private solutions • Location based services/apps mainly provided by the private sector
Interoperability measures	The Basic Data Programme encompasses all 12 principles and 6 layers of the EIF and incorporates recommendations in all five focus areas of the EULF Blueprint. There is a Joint Public Digital Architecture based on the EIF, EIRA2 and other international frameworks and standards, including TOGAF and Archimate. See also, this white paper on the Common Public Sector Digital Architecture. A Common Public Sector Catalogue of Concept and Data Models is also available. From a legal interoperability perspective, the programme is fully aligned with the Common Public Sector Digitisation Strategies and the different laws enacted to secure the Basic Data Programme and its interoperability between registers. Examples of legislative changes were the revisions to the laws on properties and addresses. The programme is also aligned with the Danish INSPIRE legislation and the Danish Act on processing of personal data (addressing GDPR).
Policy drivers	*Direct policy drivers: Growth and efficiency, Open Data policy* The programme was mainly spurred by government foreseeing major economic challenges up to 2020: 1) Denmark's competitive position weakened and productivity growth insufficient 2) Demographic profile – ageing population 3) Tight public sector budget constraints The implementation and further development of the Basic Data Programme has been part of the rolling public sector digitisation strategies from 2011 onwards. The agreement on Good Basic Data for All (2012) clearly states the purpose to support growth and efficiency. Furthermore, the agreement text for the Basic Data Programme describes how "open access to basic data in the private sector is a potential source of innovation, growth and new jobs" and "public data can be used for completely new types of digital products and solutions. *Indirect policy drivers: INSPIRE legislation* INSPIRE was an indirect policy driver as most of the Basic Location Data was already covered by the Danish INSPIRE law and hence should be made available in a standardised manner meaning that there was a data and service foundation already as well as a legislative foundation for parts of the programme. The Basic Data Programme could have been done without INSPIRE but INSPIRE was an inspiration for the concept and a tested example of the approach to standardisation and interoperability.
Costs	The first agreement in 2012 covered the estimated cost in the business case of EUR 125m up to 2016. In 2017, further funding of EUR 7.2m was agreed and granted via the Finance Act 2018. To establish and run the Basic Data Platform, a 4+4 year contract was awarded to KMD. This ran out in 2019 and the Agency for Data Supply and Efficiency now operates the platform. A second tender will be launched in 2021. It has been necessary to adjust the cost schedule several times during the programme. Delays led to increased costs of DKK 120.5m. By the time implementation was completed in 2019, total programme costs were DKK 616.7m. During the Basic Data Programme, data owners in different administrations were compensated for making their Basic Data 'free at point of use' via adjustments to their allocations or block grants. Continued funding of Basic Data after 2019 is negotiated yearly as part of the National Finance Act.
Benefits	The following programme benefits have been identified for different stakeholders: *Citizens:* • Better public services in the form of speedier case processing and fewer errors • Less reporting to public authorities, for example to correct errors • Time savings through prefilling online forms with up-to-date basic data. *Businesses:* • Less red tape – less reporting and registration • Faster digitisation, fewer errors and more efficient and effective procedures

- Cheaper procurement of public-sector data
- Improved collaboration with the public sector through access to common data
- Opportunity to develop new and improved data-related products and services and for new businesses to emerge

Public authorities:

- Efficient and effective maintenance of basic data and fewer redundant registers
- Operational savings in IT systems and update of data locally
- Cheaper IT system development with access to basic data from a single source
- Fewer manual workflows, fewer errors and shorter case-processing times
- Improved control e.g. of payments, so that social welfare fraud can be reduced.

Cost benefit analysis

The Basic Data Programme was expected to reach EUR 100m annual savings for society by 2020, approximately 25% accruing to the public sector and 75% to the private sector. It was estimated that potential benefits of the programme would stabilise from 2017. Afterwards, benefits would exceed costs for all public entities. Moreover, better access to higher quality data could lead to economic growth in different sectors including real estate, telecommunications, and transport.

Socio-economic analysis

A baseline analysis was carried out estimating the socio-economic value of geodata in 2012 (pre-open geodata). The analysis was repeated in 2016 (post open geodata). In both cases, information was collected through a survey of both public sector and private sector organisations. The follow-up study, published in 2017, reported an increase in the number of users of the online service from 800 to 60.000 and an increase in the number of site visits per annum from 800m to 3.3bn. Results from the analysis indicated that the socio-economic value of geodata more than doubled from an estimated 1.6 billion DKK in 2012 to 3.5 billion DKK in 2016.

DKK in millions	2012	2016
Production effect of the open geodata	**1.402**	**2,542**
Private enterprises	116	446
Government agencies	321	373
Municipalities	965	1,376
Regions		151
Independent institutions, etc.		196
Efficiency effect of the open geodata	**190**	**999**
Private enterprises	40	726
Utility companies	100	229
Government agencies	50	22
Municipalities		18
Regions		2
Independent institutions, etc.		2
Total socio-economic value of the open geodata	**1.592**	**3,541**

Source: *The questionnaire survey has been performed among private enterprises, utility companies and public authorities and pre-measurement (2012)*

The method used for estimating the socio-economic value of geodata considered:

- *Increased innovation* that can contribute to new solutions and higher productivity
- *Greater competition* that can reduce prices and thereby increase real income and / or competitiveness
- *Welfare economic effects* such as the time savings for citizens and businesses from the use of solutions or services involving geodata

Socio-economic value was considered as the combination of production effects + efficiency effects. For different stakeholder groups, this was calculated as follows:

Public sector	production effect = value of production / staff requirements
	efficiency effect = cost savings in internal processes
Private sector	production effect = size / value of the market

	efficiency effect = cost savings in internal processes The Agency for Data Supply and Efficiency has recently published two analysis dealing with the value creation of open location data in the private sector and the value creation of open address data (in Danish)
Start date	January 2012

Challenges:

- Data infrastructure investments and the associated interoperability measures can be difficult to justify, although they can be seen as a necessary ongoing maintenance cost. Benefits do not come from the availability of the data, or the ease of finding and combining the data with other data but from the use of the data to create value.
- Monitoring and benchmarking in the context of digital public services often focuses on the main upstream activities of the value chain (readiness and availability), while the downstream elements (use and impact) are neglected because of the difficulty of finding this information.
- Indicators can sometimes be difficult to measure, with information provided too vague, general or abstract. Involve professional investment analysts to validate indicators.
- Impacts of new services or service improvements can be difficult to predict. This is why ongoing monitoring and targeting of improvements is needed. An iterative approach to service delivery and improvement (see recommendation 8) can also be beneficial.
- It can be difficult to understand and therefore communicate the large-scale benefits of strategic data sharing to those not directly involved in the collection, processing and use of the data. Furthermore, data providers do not always have a strong grasp of the different uses of their data and developers looking for suitable data will look for the easiest ways of obtaining the data they need and may neglect strategic solutions for more tactical approaches. It is important that data providers consider the wide range of uses of their data and developers put effort into ensuring strategic data sources are able to meet their needs. Good communication amongst the immediate ecosystem partners comes before communication of results from their efforts.

Best Practices:

#13: KLIC to prevent damage caused by excavation works

#14: Air quality monitoring and reporting

#20: Digital platform for building permits

#22: Standardised road safety data exchange

#30: Location intelligence for groundworks, KLIP platform

#33: Urban platform, Guimarães

#42: Geodata use case portal

#43: The impact of open geodata – follow up study

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 15 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 12:	Recommendation 19: Evaluate the effectiveness and efficiency of

Assessment of effectiveness and efficiency	different interoperability solutions and technological options considering user needs, proportionality and balance between costs and benefits.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 1: Governance and Institutions

Documentation	Elements
Implementation Guide Appendices	Leadership Value Proposition

Actions	Tools
1. Setting Direction	
Strategic Alignment Study	APP1.2: Strategic Alignment Template
Geospatial Information Management Strategy	APP1.3: Guidance for Mission, Vision and Goals Statements Future trends in geospatial information management: the five to ten year vision (third edition) Global Statistical Geospatial Framework Framework for Effective Land Administration Strategic Framework on Geospatial Information and Services for Disasters COVID-19: Ready to Respond - The role of the Geospatial Community in Responding to COVID-19
4. Creating a Plan of Action	
Change Strategy	
Country-level Action Plan	APP1.4: Country-level Action Plan Template
5. Tracking Success	
Monitoring and Evaluation	APP1.5: Monitoring and Evaluation Template
Success Indicators	APP1.6: Success Indicators
6. Deriving Value	
Value Proposition	FIG1.6: Value Proposition Canvas

Strategic Pathway 2: Policy and Legal

Documentation	Elements
Implementation Guide Appendices	Governance and Accountability

Actions	Tools
4. Future Proofing	
Future Proofing	
6. Delivering Compliance	
Impact Assessment	

Strategic Pathway 3: Financial

Documentation	Elements
Implementation Guide	Business Model

Appendices	Investment Benefits Realisation

Actions	Tools
2. Situational Assessment	
Current Business Model	APP3.4: Example of a Business Model Canvas
3. Financial Plan	
Desired Business Model	APP3.5: Developing a Business Model - Some Considerations
4. Case for Investment	
Socio-Economic Impact Assessment	APP3.7: Socio-Economic Impact Assessment Approach
Business Case	APP3.8: Components of a Business Case
6. Deriving Value	
Benefits Realisation	
Communicate Benefits	

ELISE Resources:

Type	Resource	Date
Study	Assessment of economic opportunities and barriers related to geospatial data in the context of the Digital Single Market	2018
Study	Digital Platform for Public Services	2018
Study	The Role of spatial data infrastructures in the digital government transformation of public administrations: See impact section which gathers indicators concerning the breadth of usage of the SDI and the benefits derived, as well as the cross-border perspective.	2019
Video	Inspiring experiences and lessons learned from the INSPIRE Community: What are the benefits of INSPIRE implementation so far?	2021
Webinar	The Role of Geospatial for Digital Government Transformation	2019
Webinar	The Role of Spatial Data Infrastructures for Digital Government Transformation	2019
Webinar	Location enabled public services	2020
Pilot / Testbed	EULF Transportation Pilot - A model implementation in the ITS domain involving sharing of safety-related road data in Norway and Sweden that can be followed by other countries	2014 - 2017

Further Reading:

- NASA: Geospatial Interoperability Return on Investment Study, Booz Allen Hamilton, 2005
- The economic benefits of precision agriculture: case studies from Australian grain farms, GRDC and CSIRO Sustainable Ecosystems, 2007
- The Value of Danish Address Data, 2010
- The Value of Geospatial Information to Local Public Service Delivery in England and Wales, 2010
- The Value of Geospatial Information in Local Public Service Delivery, Schmidt, G, Local Government Association, Westminster Briefing, 2010
- Review of Recent Studies on PSI Re-use and Related Developments, Vickery 2011
- Assessing Social Benefits in Sweden, INSPIRE Conference, 2011

- Beyond Interoperability, OGC, INSPIRE Conference, 2011
- INSPIRE in Danish e-Government, 2012
- Estimating Benefits of Spatial Data Infrastructures: A Case Study on e-Cadastres, 2012
- Finnish INSPIRE benefits study, 2012
- What is the Economic Impact of Geo Services? - a report prepared by Oxera for Google, 2013
- Valuing Geospatial Information: a review, Alan Smart, Andy Coote, INSPIRE Conference, 2013
- OECD Working Paper on "Open Government Data: Towards Empirical Analysis of Open Government Data Initiatives", 2013
- Spatial Data Infrastructure (SDI) Manual for the Americas, provided by the Permanent Committee for Geospatial Data Infrastructure of the Americas (PCIDEA, now UN-GGIM Americas), 2013
- Precision Agriculture – An Opportunity for EU Framers – Potential Support with the CAP 2014-2020, European Parliament, DG for Internal Policies and Joint Research Centre, 2014
- Management of On-demand Transport Services in Urban Contexts, Barcelona Case Study, 2015
- Cost Benefit Analysis of Address and Street Data for Local Authorities and Emergency Services in England and Wales, 2016 – Identifies a 4:1 return on investment
- The Business Impact of GIS - Case Studies from Utah, Kloos W, Utah Department of Natural Resources, ESRI, 2016
- Cost benefit analysis of increased production and improved availability of marine geospatial data, Menon Economics, 2016
- Making the case for data standards - Final business case for local waste services, Local Digital Coalition, UK, 2016
- Economic and Financial Modelling of the Impact of Geospatial Information - Techniques and Results for land administration in developing Nations, Smart, A and Coote, A, Office International du Cadastre et du Régime Foncier (OICRF), Land and Poverty Conference, 2017
- The impact of the open geographical data – follow up study, Agency for Data Supply and Efficiency, Denmark, 2017
- **The impact of open geodata in Denmark - follow up study after 5 years, INSPIRE Conference 2017** Presentation Video
- The Economic Impact of Geospatial Services, AlphaBeta, 2017
- Towards a Spatial Knowledge Infrastructure, Australia and New Zealand Cooperative Research Centre for Spatial Information (CRCSI) White Paper, 2017
- The Economic Impact to the UK of a GNSS Disruption, London School of Economics, 2017
- The economic benefits of Open Data, data.europa.eu, 2017
- Interoperability in the digital economy, MAGKS Joint Discussion Paper Series in Economics, Kerber, Wolfgang; Schweitzer, Heike Philipps, University of Marburg, School of Business and Economics, 2017
- Assessing the Economic Value of 3D Geo-information, EuroSDR, 2017
- Assessing the value of Transport for London's open data and digital partnerships, 2017
- The Economic Value of Spatial Information in New South Wales for 2017 and 2022
- Impacts of Open Data in Luxembourg and the Greater Region – 2018
- Economic value of spatially enabled services in Finland, Spatineo, 2018
- Measurement activities related to open data, Lämmerhirt, D, State of Open Data, International

Development Research Centre, Canada, 2018

- An Initial Analysis of the Potential Geospatial Economic Opportunity, UK Geospatial Commission, 2018
- Google Analytics information about the Flemish geoportal "Geopunt": the pro's and con's, INSPIRE Conference 2018
- Large scale precision agriculture – Farming Tools for External Nutrients Inputs and Water Management (FATIMA) project, INSPIRE Conference, 2018
- Economic benefit of a unified national geodata approach in the community building process, Lantmäteriet, Sweden 2019
- Economic and social benefits of data access and sharing, OECD iLibrary, 2019
- Cross port benefits of geospatial technology, Port Strategy, 2019
- National Underground Asset Register pilot, UK, 2019
- eGovernment Benchmark 2019
- The value of Integrated Geospatial and Building Information Modelling (BIM) solutions to advance the United Nations Sustainable Development Goals (Agenda 2030) with specific focus on resilient infrastructure, UN-GGIM, WFEO, and WGIC, 2020
- Geospatial Data Market Study, Report for the UK Geospatial Commission, Frontier Economics, 2020
- Measuring and Mapping Data Reuse: Findings from an Interactive Workshop on Data Citation and Metrics for Data Reuse, Federer, L, Harvard Data Science Initiative, 2020
- Impact Assessment study on the list of High Value Datasets to be made available by the Member States under the Open Data Directive, 2020
- Lithuania INSPIRE 2020 country fiche
- Commission Recommendation (EU) 2020/518 on a common Union toolbox for the use of technology and data to combat and exit from the COVID-19 crisis
- Guidelines 04/2020 on the use of location data and contact tracing tools in the context of the COVID-19 outbreak
- John Hopkins COVID-19 Dashboard
- The Value of Surface-based Meteorological Observation Data, World Bank, 2021
- Unlocking Value with Location Intelligence, Boston Consulting Group, 2021
- The Netherlands Geospatial Economy Report, Geospatial Media and Communications, Ministry of the Interior and Kingdom Relations of the Netherlands and Geonovum, 2021
- The Value of Surface-based Meteorological Observation Data, 2021
- INSPIRE Knowledge Base: Monitoring and Reporting
- United Nations e-Government Surveys
- Open Data Institute: Benchmarking open data automatically
- GeoSamen - showcasing what the geosector has to offer, Netherlands
- Ordnance Survey Case Studies, UK
- GeoPlace Case Studies, UK
- TomTom Traffic Index
- Vaisala blog: Day to Day Benefits of Weather Detection
- Social Value International

- Fin Est Digital Twin Cities, Helsinki and Tallinn
- 4 Key Benefits of Agtech for Farmer Co-ops, Foodie Project
- Sonderborg, Project Zero
- Covenant of Mayors
- UN Sustainable Development Goals
- Sites running on the FixMyStreet platform
- Vaisala blog: Day to Day Benefits of Weather Detection
- SCALGO Live Flood Risk

Recommendation 16: Facilitate the use of public administrations' location data by non-governmental actors to stimulate innovation in products and services and enable job creation and growth

Why:

- These actions help improve the sharing and reuse of location data to help build the data economy.
- Public sector data is a valuable asset on which added value products and services can be built.
- Governments are increasingly open to sharing their data but there are still too many restrictions in discovering the right data and accessing this data easily.
- There are inconsistent models in data licensing across European public administrations.
- There are proven studies in the contribution of government open data to growth, with geographic datasets being cited as some of the more important data.

How:

Core reference data

- Take a strategic approach to funding public sector location reference data (i.e. data that acts as a spatial reference to other data) alongside the funding of other important public sector authentic datasets, e.g. citizens, businesses, property ownership, including consideration of innovative funding models, to promote the widest possible benefit from such investment.

Data policy enablers

- Actively promote the availability of location data and web services to companies, research institutions, citizens and other interested parties.
- Make the process of searching, finding and accessing these data and web services as easy as possible, through for example:
  - Creating data portals merging location data and non-location data, so data needs can be satisfied in one search;
  - Creating an API marketplace as a facilitator for reuse of location data by non-governmental actors;
  - Using standardised metadata for describing location and non-location data;
  - Consider broad potential uses of the data beyond the primary users, when describing the data resource and specifying metadata;
  - Complementing general search facilities with "specialist" search, e.g. thematic portals, extended metadata, to cater for more specialist needs;
  - Simplified and consistent data licensing using standard government-wide terms and

conditions for re-use of data and services, both spatial and non-spatial, based on generally used approaches, e.g. Creative Commons;

- Clearly defined licensing for access to data that has been derived from third party sources (often a sticking point in access to thematic location data which is linked to authentic reference location data);
- 'Open data by default' or 'maximised access to open data' if not the default, with access to public sector data free at point of use and without any reuse restrictions or conditions;
- Free 'evaluation licences' for public sector data that is ultimately chargeable;
- 'Freemium' licensing models to distinguish between free and non-free access to datasets, giving free access to, for example, lower resolution datasets, and chargeable access to higher resolution datasets.

Support to innovation and growth

- Public administrations should actively support private, non-profit and academic actors in the development of new products and e-services through, for example:
  - Establishing 'innovation labs' or 'innovation hubs' to foster new business developments using public sector data;
  - Promoting open data policy in government and brokering access to this data through hackathons, open challenges to government;
  - Incorporating non-government actors in the governance framework for public sector data, so that their demands and views are heard;
  - Setting up testbeds, as a means to provide different types of user access to services, tools and applications that still are under development. Testbeds make it possible to experiment with new technologies and to test and validate these new technologies in a 'safe and controlled' environment. An important benefit of testbeds to private companies is that they make it possible to take into account these new technologies in developing their own products and services;
  - Setting up pilot projects, in which different stakeholders (public organisations, companies, researchers, etc.) collaborate in exploring, developing, testing and implementing new technological developments. The goal of such projects is to share existing knowledge, ideas and experiences on new technological developments, to stimulate people to further experiment with these new developments and to determine an integrated approach;
  - Providing companies and other non-governmental actors the opportunity to add their data and services to the public sector (spatial) data infrastructure, where they are compliant and relevant, providing a wider audience for their products and services;
  - Establishing digital 'geospatial' platforms through which a community of data providers, consumers and partners is actively engaged in the sharing, enhancing and using of location data and value is created for all partners in the ecosystem;
  - Investing in data sharing initiatives through public-private partnerships, which provide incentives for both public and private organisations;
  - Taking into account the needs and requirements of businesses, research institutions and other (potential) users in the further development and implementation of INSPIRE/SDI. This means also non-governmental actors and organisations are invited to participate in user requirements analyses and in defining and describing use cases;
  - Demonstrating best practice examples of how private companies, citizens, academic institutions and other users make use of INSPIRE/SDI data and services to provide new or improved products and services. This can be linked to an award competition focusing on the best practices;
  - Providing training in the skills needed to exploit public sector location data, use it in developing digital government solutions, and in creating new commercial products and services.

- Public administrations should take specific action to facilitate companies from other countries wishing to establish operations or do business in their country, for example by:
    - Non-restrictive tender qualifications;
    - Working with other countries on shared information sources for new businesses (see EULF Best Practice 12);
    - Reducing red tape in registration of new businesses;
    - An inclusive approach on promotion of innovation;
    - Supporting the appointment of multi-national consortia on government funded projects to obtain the right skills;
    - Supporting multiple languages where appropriate in relevant documentation and services.

Involve external stakeholders in decision making

- The external stakeholders themselves are best placed to determine their needs and priorities in terms of collaboration with and support from public administrations. Their views should be consulted to determine relevant actions, particularly when public administrations are involved in collaboration with external parties rather straightforward customer-supplier relationships. This involvement can be through ad hoc surveys, consultations and studies or through more systematic involvement in governance mechanisms. As an example, a recent study carried out by Geospatial Media for the ELISE action examined the opportunities and challenges of collaboration for geospatial services. This included a series a series of structured interviews with 14 geospatial industry organisations to obtain their views on the impact for them of the Open Data Directive and the European Data Strategy. The main findings are summarised in **Figure 15**.

Figure 15: Geospatial industry views on the Open Data Directive and European Data Strategy

Expectations	• Access to data not previously available for free to private companies • Fewest restrictions in use of the data • Usable formats with relevant documentation (e.g. concepts, fields, values) • Trusted regulatory framework for integration of public and private data • Open services for integration of data into information products • Mandatory use of open location data for specified purposes • Measurement of return on investment and concrete examples to develop behavioural change and raise awareness
Contribution	• Enhancing the open data ecosystem through identification of new data sources and development of new products • Collaboration through innovative business models • Platform services for sharing open data through open catalogues • Expertise in standardising data formats • Alignment of solutions to meet government needs • Bringing out solutions based on public datasets and making them accessible to broader communities • Expertise in analytics involving diverse data to improve decision making and reduce inefficiencies
Benefits	• Data harmonisation will enable new services and value-added products and applications, leading to increased efficiency and economic development • New insights involving situational and causal analysis possible to solve business and societal challenges through increased collaboration and quality and consistency of data • More robust, accurate and responsive AI models through Increased access to diverse data • Cost savings through reuse of public data • Increased revenue through services or solutions transforming raw data into actionable insights

Challenges	• Heterogeneity of data in terms of format, structure, granularity and frequency of update hinders re-use. • Security risks associated with decentralised data management • Slow, inefficient and bureaucratic operations of many public sector entities • Need for more streamlined data acquisition processes • Lack of involvement of private sector in governance of integrated data sharing initiatives • Trusted legal and regulatory framework required to deal with liabilities in data aggregation, data ownership conflicts, monetisation and reuse across sectors and borders, ensure fair competition for all players, and limit the use of regional specifications when there are recognised international standards • Erosion of private sector 'data as a service' profit margins
Mitigations	• Showcase value of data to encourage sharing, through innovative uses cases, hackathons and data exchange spaces for public and private entities • Provide legal guidance and tools to contributors and enablers to help with data sharing, e.g. contact guidance document for use when drafting contracts involving AI and data • Ensure private sector revenues are protected in co-innovation models, e.g. subsidies, incentives • Direct incentives to public entities for sharing data, including necessary funding models • Tax and procurement incentives for companies complying with standard requirements • Data sharing frameworks aimed at promoting trust and protecting small players • Rigorous assurance of data quality and ethical oversight across data sharing community, including feedback from data users • External review board to address legal ambiguities and ethical issues • Fit for purpose governance, technical infrastructure and processes for data distribution • Encourage shared data ownership through data trusts, community co-ops etc. • Investment in digital skills with collective engagement of all stakeholders

Source: Geospatial Media, 2021 (adaptation)

Challenges:

- Businesses or citizens may not be aware of the possibilities that access to government location data may offer or have the capabilities to exploit the improved availability of this data. In accessing data, potential users may firstly have difficulties in finding the appropriate catalogue. Secondly, when they do find the catalogue, it may be difficult for them to find the right dataset for their needs, even though it appears in the catalogue. This is because data publishers may fail to provide good search parameters for their data or the catalogues may not have good quality search algorithms.
- Access to 'high value' location datasets, capable of supporting the broadest opportunities, may be more limited than access to other datasets.
- Access to public location data may be subject to 'unavoidable' restrictions, e.g. existing commercial arrangements with suppliers, personal privacy concerns associated with the data.
- Although the benefits of high value open government data may be recognised, the cost of making such data available free of charge whilst maintaining data quality may be restrictive.
- Providing open access to high value government data may compromise the commercial position of certain players in the market.
- Free data still needs to be funded. If funding levels drop due to reduction or removal of income from licensing of data or data services, then quality may be compromised as a result.
- Different countries may have significant investments in different data standards, making harmonisation difficult to justify, even with the impetus of INSPIRE
- Sharing technology and data does not necessarily create business value and growth. There needs to be relevant business and commercial acumen and innovation to build the new data businesses of the future.
- The broadest capabilities come from existing players in the market who can afford to pay for

their data.

- Product cycles are increasingly short and governments are too slow moving to match this pace of change.
- Governments may want to develop data services that are more appropriately placed in the private sector.
- The wider business environment, including wider government policy, may inhibit business growth, regardless of actions taken to provide access to data. This includes, for example, the tax regime, availability of capital, employment policy, policies on establishment of businesses from other countries etc.

Best Practices:

#1: A digital platform for location data in Flanders

#2: IDOS – Cross-border journey planner for citizens

#3: 'LoG-IN' to the local economic knowledge base

#4: Rotterdam Digital City

#7: National landslide warning system in Italy

#8: 'One solution for all emergency services' in Poland

#10: Risk assessment in the Insurance business in Germany

#11: Register of Territorial Identification, Addresses and Real Estates (RÚIAN)

#12: Enterprise locations in the Euregio Meuse-Rhine

#13: KLIC to prevent damage caused by excavation works

#16: Managing the granting of licenses for selling tobacco

#18: Territorial Information System of Navarre: SITNA

#19: Democratisation of soil data in the UK

#21: Integrated transport solutions: TRAVELINE

#22: Standardised road safety data exchange

#30: Location intelligence for groundworks, KLIP platform

#44: Geoplatforme: a collaborative initiative for the management of geodata

#49: Rennes Urban Data Interface (RUDI)

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 16 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 2: Openness	Recommendation 2: Publish the data you own as open data unless certain restrictions apply.
Underlying Principle 6: User	Recommendation 11: Provide a single point of contact in order to hide internal administrative complexity and facilitate users'

centricity	access to European public services.
Basic Component 3: Base registries	Recommendation 37: Make authoritative sources of information available to others while implementing access and control mechanisms to ensure security and privacy in accordance with the relevant legislation.
Basic Component 3: Base registries	Recommendation 38: Develop interfaces with base registries and authoritative sources of information, publish the semantic and technical means and documentation needed for others to connect and reuse available information.
Basic Component 4: Open data	Recommendation 41: Establish procedures and processes to integrate the opening of data in your common business processes, working routines, and in the development of new information systems.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 2: Policy and Legal

Documentation	Elements
Implementation Guide Appendices	Data Protection, Licensing and Sharing

Actions	Tools
1. Addressing Opportunities	
Design and Develop	APP2.7: Policy and Legal Instruments - Advantages and Disadvantages APP2.8: Assessing Fitness for Purpose for a Policy Guidance and recommended actions aligned with Strategic Pathway 2: Policy and Legal
Data Sharing and Dissemination	
Licensing Geospatial Information	Compendium on Licensing of Geospatial Information

Strategic Pathway 5: Innovation

Documentation	Elements
Implementation Guide Appendices	Innovation and Creativity Process Improvement Bridging the Geospatial Digital Divide

Actions	Tools
5. Operationalising Innovation	
National Innovation System	
Innovation Programmes	APP5.10: Pillars of an Innovation Programme
Innovation Hubs	
6. Innovation Ecosystem	
Bridging the Digital Divide	APP5.12: Open SDG Data Hubs

ELISE Resources:

Type	Resource	Date
Study	Assessment of economic opportunities and barriers related to geospatial data in the context of the Digital Single Market	2018
Study	Digital Platform for Public Services	2018
Study	Establishment of Sustainable Data Ecosystems	2021
Study	Study on opportunities and Challenges for Collaboration in Geospatial Services	2021
Webinar	Location enabled public services	2020
Webinar	Data driven methodology for electricity characterisation of districts	2021
Workshop	INSPIRE Online Conference: Co-innovation with public-private sector data ecosystems	2020

Further Reading:

- European Commission plan to digitise European Industry, 2016
- Denmark Basic Data Programme: Good Basic Data for Everyone – a driver for growth and efficiency
- Matched funding models: e.g. Innovate UK, EU PCP and PPI funding
- UK: Government Service Design Manual – Open Data
- Socio-economic benefits of Danish open address data
- GeoAlliance Canada: How can a clear identity for the geomatics sector lead to economic growth?
- Australian Government National Innovation and Science Agenda
- Innovation Hubs: Geovation Hub (UK), GeoHive (Ireland), GeoWorks (Singapore)
- Embracing Innovation in Government, OECD, 2017
- Assessing the value of Transport for London's open data and digital partnerships, Deloitte, 2017
- HM Land Registry Looks to the Future, Trigg, A, Geomatics World, Nov/Dec 2018, P19
- Reusing Open Data - A study on companies transforming public data into economic and societal value, European Data Portal, 2020

Governance, Partnerships and Capabilities

Current State

Good practices in strategic 'location' governance exist in some Member States, linked with wider governance of digital service delivery, open government and digital government transformation. However, there are still many cases where different interests are not resolved coherently, key stakeholders are left outside the decision process (including citizens and the private sector), and network vs central approaches are not well balanced (e.g. in collecting and combining data in a particular domain). Often the partnering model for the exchange of location information is not well defined or understood, and the benefits to stakeholders are not well articulated. Collaboration may exist for specific purposes but wider considerations are not always addressed. It is difficult to develop services that cross organisational boundaries, particularly where costs incurred by one organisation have a downstream benefit to others. Geospatial experts have knowledge and skills related to standard approaches within their domain. They need to broaden and adapt these skills for more mainstream deployments. There is increasing awareness of the opportunities and approaches to using location information outside the geospatial community but skills need to be enhanced to deliver increasingly innovative solutions, e.g. digital twins, location intelligence, and in integrating data from multiple sources (e.g. geospatially-enabled IoT, integrating static and dynamic data) and for different purposes (e.g. geospatial / BIM integration).

Vision

There is high level support for a strategic approach to the funding and availability of location information at Member State and EU level, based on recognised data sharing frameworks (e.g. INSPIRE) and other tools to achieve interoperability. Effective governance, partnerships, work programmes, responsibilities and capabilities are in place, taking into account the needs and expectations of stakeholders (e.g. citizens, businesses, and partners) and involving them in governance and decision making. The data-driven nature of digital government and the role of location information are recognised in the governance framework. Digital government and location information governance operates with a high degree of transparency. Ecosystems are growing and becoming a new way of collaborating, funding and harvesting benefits. Effective partnership models exist for collaborations in data ecosystems and digital platforms including, where appropriate, partnerships from emerging technical domains. Governments recognise the importance of 'location' understanding and skills, and invest in awareness raising, training and resourcing. Service design takes account of user capabilities. Specialists form communities to share knowledge and develop new ideas related to location information. As a result, there is a sufficient level of understanding and skills to develop, deploy and use location information effectively for improving and transforming decision-making and digital public services and extending the scale and boundaries of data-driven innovation in society.

LIFO Monitoring

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of recommendations in the Policy and Strategy Alignment focus area in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Focus Areas.

Recommendation 17: Introduce integrated governance of location information processes at all levels of government, bringing together different governmental and non-governmental actors around a common goal

Why:

- The use and integration of location information in public sector processes requires the participation and cooperation of many different actors: not only governments at different levels and/or in different areas, but also private companies, non-profit and academic organisations and citizens can contribute to the integration of location information in certain processes, with the aim of providing more effective, transparent and participative digital public services integrated

with the wider community.

- Finding a common goal is all about creating a situation in which all parties could benefit. Having a common goal also improves the long-term stability and sustainability of the cooperation.
- Governance needs to be aligned to the types of decisions taken, e.g. strategic, programme, financial, technical.

How:

Stakeholder participation

- Recognise the potential contribution of different types of actors, and optimally make use of the competences, knowledge and experiences of different partners.
- The involvement of many different partners requires an approach to create and maintain effective partnerships between these partners.
- Governance needs to take account of the voice of users of the outputs of the location activities, e.g. businesses, citizens, academic bodies, research institutions. This can be done through a number of means, including communications events, consultations, and including "users" in the formal governance arrangements through the establishment of a User Group, Business Forum etc.
- Encourage online participation in decision making on place-based matters, for example in city planning decisions. Barcelona provides a good case study and involves the use of the Decidim open-source participation platform.

Goal orientation

- The key to success is to bring together and unify different parties around a common goal or problem to be solved. In some cases, the basis for cooperation might be a legal obligation or a political decision. Also, the need to provide better or even new services to citizens and other actors might be a good incentive to collaborate.
- Integrating the use of location information effectively in digital public services is a long-term continuous process that needs constant attention and occasional renewal.
- INSPIRE and open data policies have been used as drivers for integration. However, the legislative and political obligations of these policies should not be seen as goals in their own right but rather as an opportunity to gain political and financial support to improve service delivery or decision making.
- Once consensus has been established amongst the different actors, a more project management-oriented approach can be followed, determining well-defined goals that will be realised through an agreed sequence of activities. An important instrument within such a project management approach is the instalment of a small but efficient project task force with representatives from the different parties. In many of the EULF Best Practices such a task force or coordination group was established.

Fit-for-purpose governance and decision making

- Over time, public administrations should adopt a flexible approach for governing the relationships and dependencies between different actors, drawing on a combination of different governance mechanisms as appropriate. Initially, more network-oriented forms of governance may be appropriate. When private actors are involved, more market-oriented forms of governance will be appropriate to manage the relationships with them. More hierarchal forms of governance, with agreed roles and responsibilities of different actors may be needed to formalise and guarantee over the long term the commonly agreed principles and decisions.
- The type of governance often depends on how money is approved and flows and whether the governance is operating at the policy level, the programme level or both. If the governance body is managing a budget, decisions will naturally be focused on where and how that money is spent and whether investments are delivering what was intended. Strategic or policy decision making will operate at a different level but should also take account of the implementation feasibility and impact of decisions that have been taken.

- Specialist governance groups may need to be established for particular aspects of the 'location infrastructure', either as location-specific groups or as part of wider ICT-related governance. Examples include groups on data standards, data specifications and metadata, groups to manage persistent identifiers, linked data governance etc.
- Establish an independent chair and independent quality assurance for key location governance bodies to ensure interests are balanced and the group performs effectively.
- An example of integrated governance of data management is the development of an API programme reaching across both location data and digital public service data communities. In this case, merging governance of digital public service data and geospatial data is needed. This can be complemented with the use of common platforms catering for both ecosystems (i.e.: merging INSPIRE portals with Open Data Portals). Multichannel citizen engagement, cross-agency digital government and emerging IoT requirements are driving new demands for government data (including geospatial data) and services. A proactive API programme can support these demands and promote innovative delivery of government services. Such a programme includes:
    - Reframing the perspective on APIs among IT leadership. Move APIs from the technical domain to the realm of strategic digital government enabler as part of the development of a digital government platform;
    - Implementing a proactive API programme focused on progressively unlocking both the services and data available within current and legacy applications for integrating with internal and external systems;
    - Promoting APIs as a vital digital government asset. Identify opportunities to deliver innovative solutions that utilise internal and external APIs.
- Align initiatives related to Smart Spaces from central and local governments as well as delivery partners in the private sector to take a place-based approach to smart cities and connected infrastructure and services and realise the value of Smart Spaces and interconnected systems.

Challenges:

- Securing the necessary time from key relevant stakeholders in the collective governance, balanced with their other responsibilities.
- Covering all interests in the governance arrangements, including balancing 'demand' and 'supply interests.
- Building governance arrangements based on distributed infrastructures involving many stakeholders entails challenges in overall management and guaranteeing everyone's commitments.
- Maintaining flexibility in the governance arrangements to cope with the changing status of the work programme.
- Keeping the governance fresh and alive when new ideas and political priorities come to the fore.
- Balancing the long-term strategic focus and the short-term tactical focus.

Best Practices:

#9: Digital Accessibility Map for better informed firemen

#13: KLIC to prevent damage caused by excavation works

#14: Providing citizens better access to information on air quality issues in their region

#15: Providing citizens better access to information on contaminated sites

#18: Territorial Information System of Navarre: SITNA

#20: Digital system for building permits in Italy

#21: Integrated transport solutions: TRAVELINE

#22: Standardised road safety data exchange

#23: INSPIRE-compliant marine environment e-reporting

#49: Rennes Urban Data Interface (RUDI)

LIFO Monitoring:

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Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 6: User centricity	Recommendation 12: Put in place mechanisms to involve users in analysis, design, assessment and further development of European public services.
Interoperability Layer 1: Interoperability Governance	Recommendation 20: Ensure holistic governance of interoperability activities across administrative levels and sectors.
Interoperability Layer 2: Integrated Public Service Governance	Recommendation 25: Ensure interoperability and coordination over time when operating and delivering integrated public services by putting in place the necessary governance structure.
Basic Component 6: External Information Sources and Services	Recommendation 45: Where useful and feasible to do so, use external information sources and services while developing European public services.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 1: Governance and Institutions

Documentation	Elements
Implementation Guide Appendices	Governance Model Leadership Value Proposition Institutional Arrangements

Actions	Tools
1. Forming the Leadership	
Governing Board	APP1.1: Steering Committee Charter
Geospatial Co-ordination Unit(s)	
Specialist Working Groups	
2. Establishing Accountability	
Governance Model	National Institutional Arrangements: Instruments, Principles and Guidelines National Institutional Arrangements: Compendium of Good Practices Foundational Guide to National Institutional Arrangements Instruments for Geospatial Information Management (Asia-Pacific)
3. Setting Direction	
Strategic Alignment Study	APP1.2: Strategic Alignment Template
Geospatial Information	APP1.3: Guidance for Mission, Vision and Goals Statements

Management Strategy	Future trends in geospatial information management: the five to ten year vision (third edition)
4. Creating a Plan of Action	
Change Strategy	
Country-level Action Plan	APP1.4: Country-level Action Plan Template
5. Tracking Success	
Monitoring and Evaluation	APP1.5: Monitoring and Evaluation Template
Success Indicators	APP1.6: Success Indicators Example
6. Deriving Value	
Value Proposition	FIG1.6: Value Proposition Canvas

ELISE Resources:

Type	Resource	Date
Study	The Role of spatial data infrastructures in the digital government transformation of public administrations: Analysis of governance in different countries	2019
Webinar	The Role of Geospatial for Digital Government Transformation	2019
Webinar	The Role of Spatial Data Infrastructures for Digital Government Transformation	2019

Further Reading:

- Digital Government Factsheets, 2018, institutional arrangements for digital government
- e-Government Factsheets 10 Years Anniversary Report, 2018, governance examples
- European Data Portal – Open Data Maturity in Europe, national coordination arrangements
- INSPIRE Knowledge Base – INSPIRE in your Country, coordination and governance arrangements
- UK Geospatial Commission
- The UK Location Programme's approach to benefit realisation and the role of the Location User Group
- Open data governance and open governance – interplay or disconnect?, Open Knowledge Foundation
- The Smart Places Strategy of New South Wales, Australia
- Decidim digital platform for citizen participation

Recommendation 18: Partner effectively to ensure the successful development and exploitation of Spatial Data Infrastructures

Why:

- The use and integration of location information in public sector processes requires the participation and cooperation of many different actors: not only public authorities at different levels and/or in different areas, but also private companies, non-profit and academic organisations can contribute to the integration of location information in certain processes, with the aim of providing better services to citizens and other parties.
- Agreements need to be formalised in an appropriate way and by relevant people for any

partnership to be successful. Harmonisation of agreements across European borders facilitates collaboration and brings about cost and time savings.

- Even if one party is the central driving force for a location strategy or programme, successful outcomes often depend on multiple parties working together and such an arrangement will stand a better chance of success if these multiple parties have a say in what happens.
- Data integrators, data stewards and data marketplaces are playing an increasingly important role in bringing all actors together. These developments drive the need for effective partnering.

How:

Partnering and 'community' approach

- The ground rules of cooperation need to be debated and agreed by the different participants and formalised in an appropriate way, signed by persons of responsibility in the cooperating organisations.
- Building and maintaining a spatial data infrastructure requires concerted action and cooperation from a large number of organisations (maybe hundreds of public administrations) over a lengthy period of time (the INSPIRE implementation timetable spans 10 years – 2010 to 2020 – and the intended use of the infrastructure doesn't stop there). Such an activity requires a "community" approach, both at a national level (to engage all the relevant organisations around a common purpose tailored to national needs) and EU-wide (to contribute to specifications, share experiences, collaborate on tools etc.). Such communities may also be relevant at a thematic level (e.g. the marine and transport sectors have active communities) and in relation to particular technologies, e.g. open source software development communities working on tools for data portals, metadata management etc. Working in such communities can encourage a coordinated approach for the installation of data capturing devices, generating synergies in hardware for sensors capturing various types of data (one pole for collecting various data sets such as air, light, temperature etc.).
- Partnerships can be long term arrangements. The success of the partnership needs to be evaluated from time to time. Changes need to be introduced into the nature of the partnership, the membership, the priorities for action as needs change and to keep the partnership relevant and performing effectively.
- Partnerships can be set up to lobby government on particular (location) data issues, e.g. in order to get open access to public sector data, to lobby for data to be made available in particular ways.
- Governments should invest in the design and creation of ecosystems around data where multiple stakeholders are able to capture value.

Partnership agreements

- Partnership agreements should be established as early as possible in cross government strategic data programmes, joint initiatives to develop location interoperability solutions, or where different public authorities are involved in the provision of location enabled digital public services. These may include considerations on:
  - Purpose
  - Scope
  - Outputs
  - Service Levels
  - Intellectual property rights
  - Data protection
  - Responsibilities
  - Funding
  - Personnel

- Timetable
- Governance

- Examples of different types of partnership agreements include:
  - Multilateral Collaboration Agreement
  - Bilateral Collaboration Agreement
  - Memorandum of Understanding
  - Implementing Agreement
  - Data Sharing Agreement
- The following types of agreement involve more binding elements that can contribute to the partnership:
  - Legal Partnership Agreements
  - Framework Contracts
  - Service Contracts
  - Pre-commercial procurement for R&D services
  - Service Level Agreements

Public private partnerships

- Develop public private partnerships to bring the best of both worlds in the implementation of digital public service location interoperability solutions and in the delivery of location enabled digital public services. These can be at a strategic level or in relation to specific projects or services. At a strategic level, partnerships may be established with industry bodies (e.g. groups representing the geospatial, surveying and land management, or insurance sectors) or with key industry players. For specific projects or services, the 'partnerships' may be associated with (long term) framework contracts to support public authorities in delivering ICT or digital public services.
- Consider digital platforms to support the public-private partnerships and other collaboration modes with multiple stakeholders.
- Consider not only publishing data through governmental platforms (e.g. public data portals) but also sharing data through data marketplaces and exploiting data available through those marketplaces. Through these mechanisms the nature and level of demand can be ascertained and data services can be more demand focused.
- Where government integrates data from different sources and then shares that data according to agreed rules, the stewardship role that is being fulfilled should take account of the needs of both data providers and users in the data sharing community.

Multi-national partnerships

- Develop multi-national partnerships to progress common research interests or promote cross-border opportunities involving location data and services.

Challenges:

- In establishing public private partnerships, public authorities have to be wary of giving unfair competitive advantage to particular industry players.
- Participants may be too focused on their own interests rather than the common good. In this case governments should act as regulators in the interest of the citizens.
- Lead times for getting agreements can be significant, particularly if many parties are involved. This can create inertia and potentially limit or counterbalance the goodwill engendered in initial discussions amongst the parties.
- Partnerships may reduce their effectiveness over time unless close attention is given to the operation of the partnership and whether it is effective in achieving the commonly agreed goals.

- Successful communities need constant fuelling in order to maintain interest and momentum. There is a risk that without this, they will not succeed.
- Sufficient funding and resource may not be available to maintain the partnership / community. There is a related risk of dependence on particular sponsors or other individuals who may move on to other things.

Best Practices:

#1: A digital platform for location data in Flanders

#2: IDOS – Cross-border journey planner for citizens

#4: Rotterdam Digital City

#6: Digital Exchange platform for spatial plans

#9: Digital Accessibility Map for better informed firemen

#10: Risk assessment in the Insurance business in Germany

#12: Enterprise locations in the Euregio Meuse-Rhine

#13: KLIC to prevent damage caused by excavation works

#14: Air quality monitoring and reporting in Belgium

#18: Territorial Information System of Navarre: SITNA

#20: Digital system for building permits in Italy

#21: Integrated transport solutions: TRAVELINE

#22: Standardised road safety data exchange

#23: INSPIRE-compliant marine environment e-reporting

#30: Location intelligence for ground works – KLIP platform

#31: Digital Twins of Helsinki

#33: Urban platform, Guimarães

#37: Integrated Rescue System

#38: Cross-border management of Lake Constance area

#41: Public private partnership for development and release of the hydrological model

#44: Geoplatforme: a collaborative initiative for the management of geodata

#45: Common Services BUILD

#47: IDE-OTALEX

#49: Rennes Urban Data Interface (RUDI)

LIFO Monitoring:

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Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 6: User centricity	Recommendation 12: Put in place mechanisms to involve users in analysis, design, assessment and further development of European public services.

Interoperability Layer 2: Integrated Public Service Governance	Recommendation 26: Establish interoperability agreements in all layers, complemented by operational agreements and change management procedures.
Interoperability Layer 4: Organisational Interoperability	Recommendation 29: Clarify and formalise your organisational relationships for establishing and operating European public services.
Interoperability Layer 5: Semantic Interoperability	Recommendation 32: Support the establishment of sector-specific and cross-sectoral communities that aim to create open information specifications and encourage relevant communities to share their results on national and European platforms.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 7: Partnerships

Documentation	Elements
Implementation Guide Appendices	Cross-sector and Interdisciplinary Cooperation Private Sector and Academia Collaboration International Collaboration Community Participation

Actions	Tools
1. Understanding Partnerships	
Need for Partnering	
Types of Partnership	APP7.1: Types of Partnership
2. Evaluating Opportunities	
Partnership Opportunities	
Selection Criteria	
3. Identifying Potential Partners	
Potential Partners	APP9.1: Categories of Stakeholders APP9.2: Identifying and Classifying Stakeholders
Preliminary Screening	APP7.2: Evaluation of Potential Partners
Initial Engagement	
4. Selecting Partners	
Options and Operational Implications	
Financial Analysis	
5. Formalising Partnership	
Establishing Agreements	
Communication Plan	APP9.5: Stakeholder Communication Plan
Governance Structure	
6. Managing Partnership	
Reporting and Accountability	
Reviewing and Evaluation	APP7.3: Review and Evaluation APP7.4 Success Indicators
Concluding a Partnership	

ELISE Resources:

Type	Resource	Date
Study	Digital Platform for Public Services	2018
Webinar	The role of Organisational Interoperability in the context of Geospatial and Digital Government Transformation	2020
Webinar	Location enabled public services	2020

Further Reading:

- Designing Comprehensive Partnering Agreements, Rotterdam School of Management, Erasmus University
- INSPIRE Community website
- MEDIN Marine Environment Data & Information Network
- Open Knowledge Foundation
- GeoNetwork's Open source Community
- GEO Alliance Canada
- European Commission ESIF funding partnership agreements
- European Commission Joint Research Centre Collaboration Agreements
- European Commission Cloud Service Level Agreement Standardisation Guidelines
- Pre-commercial Procurement: Driving innovation to ensure sustainable high-quality public services in Europe

Recommendation 19: Invest in communications and skills to ensure sufficient awareness and capabilities to drive through improvements in the use of location information in digital public services and support growth opportunities

Why:

- Computers and mobile phones are used widely in all walks of life.
- Basic spatial knowledge and understanding of maps is relevant to many everyday situations but is not always retained or kept up to date from geography learning in schools.
- Location information is relevant in many policy areas but the opportunities afforded and the best way of exploiting these opportunities are not always well known.
- INSPIRE impacts a wide range of people in public authorities across Europe, and requires awareness and skills at different levels and for different purposes.
- ICT and data skills frameworks do not always keep up to date with relevant technologies.
- There are many ways of learning, and different people learn in different ways, e.g. formal education and training, studying publications, work experience, communicating with peers. These different types of learning all need to be factored in to the overall approach.
- Project teams disband and move on to other things, sometimes outside the organisation. It is therefore essential that knowledge and learning is captured and retained for future use.
- Teams brought together from different organisations and countries can bring a broad perspective of knowledge together to solve particular problems.
- Communicating benefits and how they were achieved through worked examples is a powerful

way of raising awareness raising and learning.

How:

Education and spatial literacy

- Promote an understanding of geography and spatial literacy in academic and work environments.
- Include effective use of geospatial information systems in schools and university curricula.
- Include 'spatial' competencies in national ICT and data competency frameworks.
- Recognise relevant geospatial and INSPIRE competencies in the terms of reference for procurements involving geospatial technologies.
- Introduce new and innovative teaching and learning methods in education on geospatial data and related topics, such as active learning, blended and online learning, case-based approaches, and use of educational technology.

Awareness raising

- Provide awareness training for policy makers to help them understand the value of location-based analysis for evidence-based policy making and the approaches and tools that can be adopted.
- Provide INSPIRE awareness raising and training events for policy makers, (geo) data specialists, and ICT implementers involved in the implementation and use of INSPIRE data.
- Introduce 'digital champions' to promote public sector modernisation through the use of digital technology, and ensure these people are aware of and convey the benefits of geospatial information and technologies. Where an organisation is running a major GI improvement programme, a 'GI champion' may be needed to drive through the changes.
- Promote the benefits of an integrated approach to the use of location information in digital public services and the role of INSPIRE, through communications events, use case factsheets, videos etc. (see also recommendation 14).

Developer and analytical skills

- Run hackathons and competitions to promote innovation in the use of geospatial technologies and take up of more openly available geospatial data. The Sharing and Reuse Awards 2017 included several winners from the geospatial sector.
- Reuse existing best practices, tools, and solutions where possible to shortcut implementation, introduce innovation, and reduce the need for specialist skills.
- Employ expert quality assurance to avoid mistakes in first time deployment and use of geospatial technologies and data.
- Re-use existing geospatial and INSPIRE training resources to support new learning for data specialists and ICT implementers.
- Use web-based learning tools to share knowledge and ideas, e.g. wikis, blogs, webinars.
- Participate in geospatial community groups to gain / share knowledge and communicate with peers (e.g. INSPIRE community, EUROGI, UK Association for Geographic Information, Trentino Open Data community).
- Install and use location-based apps on mobile phones to see what end-users experience in their daily lives.
- Read specialist books and journals to develop knowledge and keep it up to date.
- Ensure public sector projects introducing geospatial digital public service solutions document and publish the learning from these projects, and produce relevant training resources to support rollout and take up of solutions.

User skills

- Recognise the potential 'digital divide' and 'spatial divide' amongst users of digital public services. Ensure the services are as simple to use as possible, are developed in collaboration with potential users, and have the necessary instructions, training and support for users (see also recommendation 8).

Skills intelligence

- Collect, analyse, synthesise and disseminate relevant, correct and up-to-date information on the needs for certain skills related to sharing and reusing geospatial data and any mismatches with the existing skills of staff and relevant stakeholders.
- Develop and use skills vocabularies for describing and representing skills and for establishing links with other relevant vocabularies.
- Build upon existing national and international initiatives for collecting skills and labour market data and information that describe skills and related concepts. Key examples are the Cedefop's Skills Panorama web-portal, the European classification of Skills, Competences, Occupations and Qualifications (ESCO) and past and ongoing initiatives to develop a Body of Knowledge for the GIS&T domain.

Challenges:

- Training needs to be relevant to the user and timely for the situation, otherwise knowledge and information is not retained.
- Open Knowledge (i.e. knowledge sharing) like Open Data requires commitment and resourcing.
- Policy makers see geospatial information as a technical topic and not a tool for policy related analysis.
- Projects do not allow sufficient time for training and capturing lessons learnt.
- Competency frameworks are too general to focus on geospatial or other specialist topics.
- INSPIRE is seen as too complicated and technical.
- The number of geography graduates and graduates with geospatial training (i.e. in geography or ICT courses) cannot keep pace with requirements.
- Industry is relied upon for training but this concentrates knowledge on the supply side when knowledge is needed at all levels.
- SMEs require business acumen and a supportive business environment as well as technical knowledge and available data to create and run successful (geo) businesses.

Best Practices:

#3: 'LoG-IN' to the local economic knowledge base

#11: Register of Territorial Identification, Addresses and Real Estates (RÚIAN)

#19: Democratisation of soil data in the UK

#36: Standardised Geographic Information professional profiles

#42: Geodata use case portal

#44: Geoplatforme: a collaborative initiative for the management of geodata

#48: Interactive tool for geospatial presentation of statistical data (STAGE)

LIFO Monitoring:

The Location Information Framework Observatory (LIFO) monitors the implementation of EULF Blueprint recommendations in European countries. Read about the implementation of Recommendation 19 in the LIFO Country Factsheets or the LIFO European State of Play Report. Explore the results for selected countries at LIFO Interactive Dashboards - Recommendations.

Related Frameworks: European Interoperability Framework (EIF)

EIF Pillars	Recommendations
Underlying Principle 4: Reusability	Recommendation 6: Reuse and share solutions and cooperate in the development of joint solutions when implementing European public services.

Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

Strategic Pathway 3: Financial

Documentation	Elements
Implementation Guide Appendices	Benefits Realisation

Actions	Tools
1. Deriving Value	
Benefits Realisation	
Communicate Benefits	

Strategic Pathway 8: Capacity and Education

Documentation	Elements
Implementation Guide Appendices	Awareness Formal Education Professional Training Entrepreneurship

Actions	Tools
1. Setting Direction	
Capacity and Education Working Group	
Target Groups	
2. Assessing Needs	
Inventory of Knowledge, Skills and Resources	APP8.1: Knowledge-Skills-Resource Matrix for Organisations APP8.2: Knowledge-Skills-Resource Matrix for Teams APP8.3: Capacity Scanning Matrix
Assessments and Analyses	APP8.4: Incremental Approach to Needs Assessment and Analysis APP8.5: Gap Analysis Approach to Needs Assessment and Analysis
3. Considering Alternatives	
Capacity Development and Education Strategy	APP8.6: PEST and SWOT analyses for Capacity and Education APP8.7: Typical Components of a Capacity Development and Education Strategy
4. Planning for Action	
Approaches	APP8.8: Types of Capacity Development Approaches
Implementation Plan	
Reviewing Existing	

Programmes	
Outreach Initiatives	
5. Taking Actions	
Community of Practice	
Innovation Hubs and Incubators	
Geospatial Industry Challenges	
Geography in Schools	
Scholarships and Internships	
6. Assessing Value	
Monitor and Evaluate	APP8.9: Recording Success Indicators for Capacity Development

Strategic Pathway 9: Communication and Engagement

Documentation	Elements
Implementation Guide Appendices	Stakeholder and User Engagement Strategic Messaging and Engagement Communication Strategy, Plans and Methods Monitoring and Evaluation

Actions	Tools
1. Providing Leadership	
Engagement Strategy	
Steering Group	
Internal Communication	
2. Understanding Opportunities	
Stakeholder Identification	APP9.1: Categories of Stakeholders APP9.2: Identifying and Classifying Stakeholders
Stakeholder Analysis	APP9.3: Stakeholder Analysis Matrix
3. Setting Direction	
Policy Platform	
Geospatial Brand	
Strategic Messages	
4. Creating Plan of Action	
Communication Strategy	APP9.4: Stakeholder Analysis and Communication
Communication Plan	APP9.5: Stakeholder Communication Plan
Communication Methods	APP9.6: Communication Methods APP9.7: Communication Methods - Advantages and Disadvantages
5. Monitoring Progress	
Review and Evaluate	APP9.8: Review and Evaluation - Methods for Benchmarking
Stakeholder Surveys	
6. Communicating Value	
Benefits Analysis	
Lessons Learnt	

ELISE Resources:

Type	Resource	Date
Study	Location interoperability, innovation and digital transformation: Lessons learned from ELISE Action webinar series	2021
Webinar	ELISE Webinar series - Topics for inclusion in communications and education programmes on the use of interoperable location data for policy and digital public services including, for example, strategic considerations, studies on emerging technologies, innovative use cases, and guidance on practical techniques and technologies	
Webinar	The EULF Blueprint – Its role and how to use it	2021
Webinar	ELISE - Support to policy initiatives	2021
Webinar	ELISE - Interoperable frameworks and solutions	2021
Webinar	ELISE - Emerging trends and technologies	2021
Workshop	INSPIRE Conference: New directions in digital government using INSPIRE	2017
Workshop	INSPIRE Online Conference: Vocabularies for describing and enhancing GI/EO Knowledge and Skills for INSPIRE and Copernicus	2020
Training	ELISE Location Interoperability Workshop Pack	2021
Training	Improving spatial skills - includes INSPIRE training platform self-learning modules	

Further Reading:

- Geospatial Knowledge Base (GKB) Training Platform
- INSPIRE Knowledge Base
- INSPIRE in Practice
- Defra Geography Skills Framework
- European e-Competence Framework
- European Umbrella Organisation for Geographic Information (EUROGI)
- UK Association for Geographic Information (AGI)
- American Geosciences Institute (AGI)
- Open Source Geospatial Foundation (OSGeo)
- UN-GGIM Knowledge Base
- smeSpire Project / Training Platform
- Geovation
- GIM International
- Geospatial World
- Digital champions
- Towards the Data Driven Economy (The Gap in Data and Technology Skills), IDC
- Cedefop's Skills Panorama portal
- The European Classification of Skills, Competences, Qualifications and Occupations (ESCO)
- Understanding capacity-building/ capacity development: A core concept of development policy,

European Parliament Think Tank, 2017

- GIS Lounge - GIS and Map Contests
- Why GIS in Education Matters, Kerski, J, Geospatial World, 2018
- Guide to Campaign Planning: OASIS, UK Government Communications Service
- Building Geospatial Infrastructure, Dangermond, J, Goodchild, M, Taylor & Francis Online, 2019
- Second Geo Inspiration Day, Geonovum, 2021

Conclusion

The EU Location Framework Blueprint outlines 5 focus areas and sets out 19 recommendations in an ambitious context for EU digital public services, whereby location data is sitting at the core of virtually all digital public services. This Blueprint takes into account various maturity levels of public services, e.g.: service orientation, information centricity and digital innovation, and recognises the differences in maturity across Europe.

Different stakeholders are steadily progressing towards deriving value from location data and have already demonstrated multiple examples of implementation of the recommendations. In this context, the Blueprint is anchored in the EU strategic agenda, through its role in the "Interoperability Solutions for Public Administrations, Businesses and Citizens" (ISA^2) Programme and its relevance to new Commission digital and data priorities, including the Digital Europe Programme. It, thus, reflects the current status of location interoperability, while guiding the reader towards location intelligence and the broader adoption of harmonised spatial data in data ecosystems and data spaces, which will support digital innovation in Europe and the digital transformation of government.

The Blueprint is designed to be as inclusive as possible in terms of where it may be applied in public administrations. It also caters for a large target audience, implying that all actors in the public sector have a role to play for achieving digital innovation. This inclusiveness is further demonstrated by the different focus areas that are used in the document to structure the recommendations: policy and strategy alignment, digital government integration, standardisation and reuse, return on investment, and governance, partnerships and capabilities.

While the Blueprint's main benefit is bringing all these actors together and guiding them to follow a common path with, often joint, actionable recommendations to implement, it also needs to be adopted by the actors involved to take ownership of this resource and achieve the highest impact possible. Many of these recommendations have already been implemented in EU Member States, where the best practices provided are an illustration of how the recommendations can be achieved in practice. The Location Interoperability Framework Observatory (LIFO) is being implemented by ELISE across the EU to help monitor regularly and present progress on the implementation of the EULF Blueprint, aiding its maintenance, assessing its impacts and sharing best practices. The LIFO will also help to provide a tool for planning national improvement measures and further European action.

The widespread adoption of this coherent European framework of guidance and actions will foster cross-sector and cross-border interoperability, where location plays either a leading or supporting role. It will enable the use of location data in digital public services, building on national SDIs and INSPIRE, and will result in more innovative and effective services, savings in time and money, and increased growth and employment in the European economy, as well as related social and environmental benefits.

List of abbreviations and definitions

The EULF Blueprint abbreviations and definitions below are part of the ELISE glossary on Joinup.

Abbreviations

ADMS-AP	Asset Description Metadata Schema Application Profile
AGI	American Geosciences Institute
API	Application Programming Interface
ARE³NA	A Reusable INSPIRE Reference Platform
BfS	German Federal Office for Radiation Protection
BPEL	Business Process Execution Language
BPMN	Business Process Model Notation
BI	Business Intelligence
BIM	Building Information Modelling
CEN	Comité Européen de Normalisation - European Committee for Standardisation
CEN/TC 287	CEN Technical Committee 'Geographic Information'
CISR	Community of Interoperable Solution Repositories
CNR	Italian National Research Council
CNR-IRPI	Institute for Geo-Hydrological Protection of the Italian National Research Council
CRM	Customer relationship management
DaaS	Data as a Service
DCAT-AP	Data Catalogue vocabulary (DCAT) Application Profile for data portals
DG	Directorate General
DIKE	MSFD Working Group for Data, Information and Knowledge Exchange
DPO	Data Protection Officer
DURP	Dutch Digital Exchange of Spatial Processes
DYA	Dynamic Enterprise Architecture
ebXML	Electronic Business using eXtensible Markup Language
EC	European Commission
e-CERTIS	A mapping tool used to identify and compare certificates requested in public procurement procedures across the EU
EED	Energy Efficiency Directive
EIC	European Interoperability Cartography
EID	Environmental Information Directive (Directive 2003/4/EC on public access to environmental information)
EIF	European Interoperability Framework
EIRA	European Interoperability Reference Architecture

EIS	European Interoperability Strategy
ELF	European Location Framework
ELISE	European Location Interoperability Solutions for E-government
EMODNet	European Marine Observations and Data Network
e-PRIOR	The European e-Procurement Platform
E-PRTR	European Pollutant Release and Transfer Register
ECM	Enterprise Content Management
EDI	Electronic Data Interchange
EDM	Enterprise Data Management
EIM	Enterprise Information Management
ELISE	European Location Interoperability Solutions for e-Government
EPBD	Energy Performance of Buildings Directive
ERP	Enterprise Resource Planning
ESIF	European Structural and Investment Funds
ESPD	European Single Procedure Document
EU	European Union
EUROGI	European Umbrella Organisation for Geographic Information
EULF	European Union Location Framework
G2B	Government-to-Business
G2C	Government-to-Citizen
G2G	Government-to-Government
GDPR	General Data Protection Regulation
GDV	German Insurance Association
GeGIS	Belgian Generic GIS for e-government
GEO	Group on Earth Observations
GeoDCAT-AP	Data Catalogue vocabulary (DCAT) Application Profile extension for describing geospatial datasets, dataset series, and services
GERAM	Generalised Enterprise Reference Architecture and Methodology
GI	Geographic information or geospatial information
GIS	Geographic information system or geospatial information system
GML	Geography Markup Language
GRM	Geospatial Rights Management
ICT	Information and Communication Technologies
IGIF	United Nations Integrated Geospatial Information Framework
IMIS	German Integrated Measuring and Information System
INSPIRE	Infrastructure for Spatial Information in the European Community

IoT	Internet of Things
IPR	Intellectual Property Rights
IRCE-CELINE	Belgian Interregional Environment Agency
ISA	Interoperability Solutions for European Public Administrations
ISA^2	Interoperability Solutions for Public Administrations, Businesses and Citizens
ISF	Information Security Forum
ISO	International Organisation for Standardisation
ISO/TC 211	International Organisation for Standardisation (ISO) Technical Committee 211 (Geographic Information/Geomatics)
ITS	Intelligent Transport Systems
JRC	Joint Research Centre
MASA	Meshed App and Service Architecture
MDM	Master Data Management
MEDIN	Marine Environment Data and Information Network
MIM	Minimum Interoperability Mechanism
MS	EU Member State
MSFD	Marine Strategy Framework Directive
NIFO	National Interoperability Framework Observatory
NIST	National Institute for Standards and Technology
OASC	Open & Agile Smart Cities
OASIS	Organisation for the Advancement of Structured Information Standards
OECD	Organisation for Economic Cooperation and Development
OGC	Open Geospatial Consortium
OMG	Open Management Group
OSGeo	Open Source Geospatial Foundation
PCP	Pre-Commercial Procurement
PID	Persistent Identifier
PPI	Public Procurement of Innovative Solutions
PSI	Public Sector Information
RDF	Resource Description Framework
REST	Representational State Transfer
RM-ODP	Reference Model for Open and Distributed Processing
RÚIAN	Registry of Territorial Identification, Addresses and Real Estates
SAGA	Standards and Architectures for eGovernment Applications
SANS	Escal Institute of Advanced Technologies
SDG	Sustainable Development Goal

SDI	Spatial Data Infrastructure
SITNA	Territorial Information System of Navarre
SME	Small and Medium-sized Enterprises
SOA	Service Oriented Architecture
sTESTA	Secured Trans European Services for Telematics between Administrations
TOGAF	The Open Group Architecture Framework
UDDI	Universal Description, Discovery and Integration
UK-AGI	UK Association for Geographic Information
UML	Unified Modelling Language
UMM	Universal Map Module
UN/CEFACT	United Nations Centre for Trade Facilitation and Electronic Business
UN-GGIM	United Nations initiative on Global Geospatial Information Management (UN-GGIM)
URI	Uniform Resource Identifier
W3C	World Wide Web Consortium
WCM	Web Content Management
WCS	Web Coverage Service
WFS	Web Feature Service
WMS	Web Map Service
XML	eXtensible Markup Language

Definitions

Asset Description Metadata Schema	The Asset Description Metadata Schema (ADMS) is a specification used to describe reusable solutions, such as data models and specifications, reference data and open source software. The ADMS specification was developed in an International Working Group of more than 60 representatives from public administrations and other experts from 20 EU Member States, following an open and inclusive process of consensus building.
Authentic data	Data that provides an accurate representation of reality with quality parameters that are fit for the intended purposes
Authoritative data	Data from officially regarded sources. A subset of spatial data may be described as 'authoritative data', where it has legal value because it is defined by a competent authority.
Application Programming Interface (API)	A set of functions and procedures that allow the creation of applications which access the features or data of an operating system, application, or other service.
Big data	High volume, high velocity (speed at which data is generated) and high variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making.
Context Broker	A Context Broker enables organisations to manage and share data in real time. An example is the CEF Context Broker, which provides an API that can

	integrate data from multiple systems, creating a holistic view of information. By providing the layer that describes each type of data, the Context Broker makes it possible to create an interface that makes it easy for anyone to view and interpret big data. Using the Context Broker, organisations can monitor their metrics in real time through live updates. Thus, for example, Smart Cities can share information about what is happening in streets (e.g. traffic status, quality of air data, available parking slots, location), The CEF Context Broker enables the publication of context information by entities, referred to as 'Context Producers', that is available to other entities, referred to as 'Context Consumers', that are interested in processing this context information.
Data as a Service (DaaS)	A design approach that contributes to an information architecture by delivering data on demand via consistent, prebuilt access, with the aid of standard processing and connectivity protocols. Originating data remains local to its storage platform and, following various steps to access, format, evaluate and possibly even contextualize it, is presented as output for use in a subsequent process or delivery endpoint.
Data ecosystem	A 'data ecosystem' (or 'data-driven digital ecosystem') is where a number of actors interact with each other and their environment for a specific purpose, generating value from the network by producing, exchanging and consuming data in a collectively governed and operated way. Many data ecosystems involve spatial data. Typically, where spatial data is used, the data ecosystems combine spatial data with other data, include both static and dynamic spatial data, and embrace both 'raw' data and 'interpretations' based on the raw data. See also, the concept of a 'data-driven business ecosystem' in International Data Spaces Association Reference Architecture Model.
DCAT-AP	The DCAT Application profile for data portals in Europe **(**DCAT-AP**)** is a specification based on W3C's Data Catalogue vocabulary (DCAT) for describing public sector datasets in Europe. Its basic use case is to enable a cross-data portal search for data sets and make public sector data better searchable across borders and sectors. This can be achieved by the exchange of descriptions of data sets among data portals.
Digital government	Government designed and operated to take advantage of information in creating, optimising, and transforming, government services.
Digital platform	A business-driven framework that allows a community of partners, providers and consumers to share, extend or enhance digital processes and capabilities for the benefit of all stakeholders involved through a common digital technology system" (Moyer, 2016).
Digital twin	A digital twin of government provides an ecosystem with an interface for government, industry and non-government organisations to work together in delivering a sustainable, intelligent place to live and work through improved societal outcomes. Most digital twins of government today are immature compared with the potential of this technology approach. Jurisdictions that have created these early versions of digital twins of government are often focused on developing a 3D or 4D GIS model of their physical environment. More-advanced features of solutions being leveraged by governments today include real-time event stream processing; spatial, descriptive and causal analytics; and citizen engagement tools. An example of a use case is using a

	digital twin of road and transportation systems to automate traffic management for incidents, weather and emergency response.
European data space	Towards a common European data space - COM (2018) 232 final: "A seamless digital area with the scale that will enable the development of new products and services based on data" A European strategy for data – COM (2020) 66 final: The above 'definition' is not quoted but the following 'description' is provided: "A genuine single market for data, open to data from across the world – where personal as well as non-personal data, including sensitive business data, are secure and businesses also have easy access to an almost infinite amount of high-quality industrial data, boosting growth and creating value, while minimising the human carbon and environmental footprint. It should be a space where EU law can be enforced effectively, and where all data-driven products and services comply with the relevant norms of the EU's single market. Data spaces should foster an ecosystem (of companies, civil society and individuals) creating new products and services based on more accessible data. Public policy can increase demand for data-enabled offerings, both by increasing the public sector's own ability to employ data for decision-making and public services and by updating regulation and sectoral policies to reflect the opportunities provided by data and ensure that they do not maintain disincentives for productive data use." The European strategy for data envisages domain specific data spaces for: • Industry • Green Deal (including evaluating the INSPIRE and Environment Information Directives) • Mobility • Health • Financial • Energy • Agricultural • Public administration • Skills
European Interoperability Cartography	The European Interoperability Cartography (EIC), as defined by the Decision (EU) 2015/2240 is a "repository of interoperability solutions for European public administrations provided by Union institutions and Member States, presented in a common format and complying with specific re-usability and interoperability criteria that can be represented on the EIRA".
European Interoperability Framework	The new European Interoperability Framework (EIF) is part of the Communication (COM(2017)134) from the European Commission adopted on 23 March 2017. The framework gives specific guidance on how to set up interoperable digital public services. It offers public administrations 47 concrete recommendations on how to improve the governance of their interoperability activities, establish cross-organisational relationships, streamline processes supporting end-to-end digital services, and ensure that both existing and new legislation do not compromise interoperability efforts.
European Interoperability	The European Interoperability Reference Architecture (EIRA) is an architecture

Reference Architecture	content metamodel defining the most salient architectural building blocks (ABBs) needed to build interoperable eGovernment systems. The EIRA provides a common terminology that can be used by people working for public administrations in various architecture and system development tasks.
Evidence-based policy making	The development of public policy which is informed by objective evidence, e.g. through data related to the content of the policy
Government as a Platform (GaaP)	Government as a Platform presents a new way of building digital public services using a collaborative development model by a community of partners, providers and citizens to share and enhance digital public processes and capabilities, or to extend them for the benefit of society.
High Value Dataset (HVD)	The Open Data Directive introduces the concept of 'high-value datasets' as datasets holding the potential to (i) generate significant socio-economic or environmental benefits and innovative services, (ii) benefit a high number of users, in particular SMEs, (iii) assist in generating revenues, and (iv) be combined with other datasets. Given this, the Directive requires that such datasets are available free of charge, are provided via Application Programming Interfaces (APIs) and as a bulk download, where relevant, and are machine-readable. The Directive does not include the specific list of high-value datasets—which is expected in the future—but only their thematic categories, one of which is 'Geospatial'. The 'high value dataset' concept is also considered in national data policy and programmes in different European countries, typically incorporating 'core' datasets, including geospatial data.
INSPIRE	Directive 2007/2/EC establishing an infrastructure for spatial information in Europe to support Community environmental policies, and policies or activities which may have an impact on the environment.
Internet of Things (IoT)	A network of dedicated physical objects (things) that contain embedded technology to sense or interact with their internal state or external environment. The IoT comprises an ecosystem that includes things, communications, applications and data analysis.
Interoperability	Interoperability is a key factor in making a digital transformation possible. It allows administrative entities to electronically exchange meaningful information in ways that are understood by all parties. It addresses all layers that impact the delivery of digital public services in the EU, including: legal, organisational, semantic and technical aspects.
Location information	Any piece of information that has a direct or indirect reference to a specific location or geographical area, such as an address, a postcode, a building or a census area. Most information from diverse sources can be linked to a location. This term can be interchanged with spatial, geospatial, place or geographic information.
Location information strategy	A strategic approach for managing and maximising the value of location information.
Location intelligence	The process of deriving meaningful insight from geospatial data relationships — people, places or things — to solve particular challenges such as demographic or environmental analysis, asset tracking, and traffic planning.
Location interoperability	Location interoperability is the ability of organisations, systems and devices to exchange and make use of location data with a coherent and consistent

	approach. In the context of digital government, the following expanded definition may be applicable: "Location interoperability is the ability to exchange and make use of information with direct or indirect reference to a location or geographical area for government policy and digital public services, involving coherent interactions between all elements, legal, processes, people, organisations, data of all types and technology, and supporting relationships between public administrations and between them and businesses and citizens."
Location privacy	The reasonable expectation that an individual cannot be identified without their permission by reference to information regarding their location or objects that may be attributed to them.
Location-enabled services	Services provided by public authorities which depend on effective management or use of location information
Master Data Management	Master data management (MDM) is the effort made by an organisation (or collection of organisations) to create one single master reference source for all critical data, leading to fewer errors and less redundancy in processes.
Meshed Application and Service Architecture (MASA)	A new application architecture structure with constituent parts (apps, mini services, micro services and mediated APIs) which delivers increased agility and enables far-reaching application innovations to support IoT integration, automated decision making, third-party interoperability and omni-channel business models.
Mediated API	A mediated API is a design pattern in which an API is virtualised, managed, protected and enriched by a mediation layer.
Smart City	Making a better life for citizens in cities through digitally-enabled public services. The 'Smart City' concept has evolved into 'Smart Communities' and the two terms may be used interchangeably.
Smart Community	Innovation, partnerships, community building and decision making in a city, community or region enabled through interoperable digital services, technology and data. The concept evolved from 'Smart Cities' and the two terms may be used interchangeably.
Smart Space	A Smart Space is a physical or digital environment in which humans and technology-enabled systems interact in increasingly open, connected, coordinated and intelligent ecosystems. The term 'Smart Space' is closely related to the terms 'Smart City' and 'Smart Community'. Differences lie in the emphasis within Smart Spaces on integrated 'intelligence' capabilities and machine-based decisions. Smart Spaces may also exist at more granular levels (e.g. buildings).
Spatial data	Data with a direct or indirect reference to a specific location or geographical area (cf. the legal definition in the INSPIRE directive, Directive 2007/2/EC). This term can be interchanged with location data, geospatial data or geodata.
Spatial Data Infrastructure	In general terms, an SDI may be defined as 'a framework of policies, institutional arrangements, technologies, data, and people that enable the effective sharing and use of geographic information' (Bernard et al, 2005). INSPIRE as an SDI for European environmental policy is defined as 'metadata, spatial data sets and spatial data services, network services and technologies,

	agreements on sharing, access and use, and coordination and monitoring mechanisms, processes and procedures, established, operated or made available in accordance with the Directive'.
Spatial literacy	The ability to use the properties of space to communicate, reason, and solve problems.
Standard	As defined in European legislation (Article 1, paragraph 6, of Directive 98/34/EC), a standard is a technical specification approved by a recognised standardisation body for repeated or continuous application, with which compliance is not compulsory and which is one of the following: • international standard: a standard adopted by an international standardisation organisation and made available to the public; • European standard: a standard adopted by a European standardisation body and made available to the public; • national standard: a standard adopted by a national standardisation body and made available to the public.
United Nations Global Geospatial Information Management	A Committee of Experts, established by the United Nations Economic and Social Council (ECOSOC) in 2016, as the apex intergovernmental mechanism for making joint decisions and setting directions with regard to the production, availability and use of geospatial information within national, regional and global policy frameworks. Led by United Nations Member States, UN-GGIM aims to address global challenges regarding the use of geospatial information, including in the development agendas, and to serve as a body for global policymaking in the field of geospatial information management.
United Nations Integrated Geospatial Information Framework	The United Nations Integrated Geospatial Information Framework (IGIF) provides a basis and guide for developing, integrating, strengthening and maximising geospatial information management and related resources in all countries. It will assist countries in bridging the geospatial digital divide and securing socio-economic prosperity, leaving no one behind. The IGIF comprises three parts: Part 1 an Overarching Strategic Framework; Part 2 an Implementation Guide; and Part 3 a Country-level Action Plan. The three parts comprise a comprehensive Integrated Geospatial Information Framework that serves a country's needs in addressing economic, social and environmental factors; which depend on location information in a continually changing world. The Implementation Guide communicates to the user what is needed to establish, implement, strengthen, improve, and/or maintain a national geospatial information management system and capability. The IGIF focuses on location information that is integrated with any other meaningful data to solve societal and environmental problems, acting as a catalyst for economic growth and opportunity, and supporting a nation's development priorities and the Sustainable Development Goals.

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Annex I: EULF Best Practices

The EULF best practices are case studies and initiatives in different domains demonstrating the benefits of a consistent use and integration of location data and services in policy and digital public services. The table below lists the best practices and the recommendations they demonstrate. This is followed by a brief overview of each of the best practices. Some of the best practices are described further in factsheets available on the ISA website.

BEST PRACTICES			EULF BLUEPRINT RECOMMENDATIONS																	
			Policy and Strategy Alignment					Digital Government Integration				Standardisation and Reuse				Return on Investment			Governance, Partnerships and Capabilities		
No	Name	Co	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	A digital platform for location data in Flanders	BE	X			X		X		X				X		X		X		X	
2	IDOS – cross border journey planner	CZ							X				X	X				X		X	
3	LoG-IN to the local economic knowledge base	>1		X		X							X	X				X			X
4	Rotterdam Digital City	NL				X	X	X	X					X				X		X	
5	Radiological emergency response	DE				X						X		X							
6	Digital exchange platform for spatial plans	NL	X	X					X			X		X						X	
7	National landslide warning system	IT				X												X			
8	'One solution for all emergency services'	PL				X			X									X			
9	Digital accessibility map for fireman	NL				X								X					X	X	
10	Risk assessment in the insurance business	DE																X		X	
11	Register of Territorial Identification, Addresses and Real Estates (RÚIAN)	CZ							X			X	X	X				X			X
12	Enterprise locations in the Euregio Meuse-Rhine	>1							X					X				X		X	
13	KLIC to prevent damage caused by excavation works	NL				X			X					X			X	X	X	X	
14	Air quality monitoring and reporting	BE				X		X	X				X				X			X	
15	Information system of contaminated sites	SK				X			X	X		X		X							
16	Granting licenses for selling tobacco	ES		X					X				X	X				X			
17	Location-enabled census data	PL			X				X	X	X		X								
18	Territorial Information System of Navarre (SITNA)	ES	X			X		X	X			X	X	X				X	X	X	
19	Democratisation of soil data	UK							X	X			X	X				X			X
20	Digital system for building permits	IT				X							X				X		X	X	
21	Integrated transport solutions (TRAVELINE)	UK		X				X		X			X					X	X	X	
22	Standardised road safety data exchange	>1						X	X	X			X	X			X	X	X	X	
23	INSPIRE-compliant marine environment e-reporting	>1		X		X		X	X			X		X					X	X	
24	GeoSTAT projects	EU									X										
25	National Geoportal of the Grand-Duchy of Luxembourg (GeoAPI)	LU										X									
26	NASA Earthdata Developer Portal	US										X									
27	Quality assurance framework of the European Statistical System	EU													X						
28	INSPIRE data quality and data specifications	EU													X						
29	ISO Standard for Geographic Information – Data Quality (ISO-19157:2015)	MN													X						
30	Location intelligence for ground works – KLIP platform	BE						X	X					X	X		X	X		X	
31	Digital Twins of Helsinki	FI						X	X					X	X					X	
32	City of Madrid - Asistencia COVID19	ES						X													
33	Urban platform, Guimarães	PT				X		X	X	X	X	X	X	X			X			X	
34	Extending INSPIRE data specifications beyond environmental policy	IT							X												

BEST PRACTICES			EULF BLUEPRINT RECOMMENDATIONS																	
			Policy and Strategy Alignment					Digital Government Integration				Standardisation and Reuse				Return on Investment			Governance, Partnerships and Capabilities		
No	Name	Co	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
35	Use of GeoDCAT-AP specification for integration of catalogues in spatial data and open data portals	IT												X							
36	Standardised Geographic Information professional profiles	IT																			X
37	Integrated Rescue System	CZ						X	X				X							X	
38	Cross-border management of Lake Constance area	>1							X											X	
39	List of applications reusing open data	AT								X											
40	Rubber Boot Index	DK				X		X													
41	Public-private partnership for development and release of the hydrological elevation model	DK						X		X										X	
42	Geodata use case portal	DK															X				X
43	The impact of open geodata – follow up study	DK	X													X	X				
44	Géoplateforme, a collaborative initiative for management of geodata	FR							X	X			X		X			X		X	X
45	Common Services BUILD	NO					X	X		X				X						X	
46	Citizen Map	PT						X													
47	IDE-OTALEX	>1				X		X	X											X	
48	Interactive tool for geospatial presentation of statistical data (STAGE)	SI							X		X		X	X							X
49	Rennes Urban Data Interface (RUDI)	FR						X		X		X	X					X	X	X	

MN = Multinational

EULF Best Practice 1 **A digital platform for location data in Flanders**

Country: Belgium

Policy domain: Agriculture & Spatial planning

Process owners: Agency for Information Flanders (AGIV)

Short description: In 2013 the Flemish government launched Geopunt. The aim of the Geopunt project is to bridge the gap between shared location data infrastructure and end users. The platform makes available authentic government, INSPIRE and other data through a partnership between Government, Businesses and Citizens. It bridges the gap with end users by enabling the creation of custom-tailored tools for different types of users with different levels of geo-maturity. In essence there are four components that allow tailoring: The Portal, Plugins, MAP APIs and Webservices API.

Recommendations: Policy and Strategy Alignment (1; 4); Digital Government Integration (6; 8); Standardisation and Reuse (12); Return on Investment (14; 16); Governance, Partnerships and Capabilities (18)

Link:

Map: http://www.geopunt.be/

Presentation: https://ies-svn.jrc.ec.europa.eu/attachments/download/973/APIs_Flanders.pdf

EULF Best Practice 2	**IDOS – Cross-border journey planner for citizens**
Country: Czech Republic	
Policy domain: Transport & mobility	
Process owners: Ministry of Transport, Czech Public Transport Operators, Private sector	
Short description: IDOS is a multimodal public transport planner of the Czech Republic integrating international, national, regional and urban public transport connections including bus, rail and air. Any person can access the service online to obtain information on a planned journey including timetables, links to the reservation systems, and information about the connection (e.g. time, distance, and transfer time).	
Recommendations: Digital Government Integration (7); Standardisation and Reuse (11; 12); Return on Investment (16); Governance, Partnerships and Capabilities (18)	
Link: http://jizdnirady.idnes.cz/	
EULF Factsheet: https://joinup.ec.europa.eu/sites/default/files/document/2019-08/New%20EULF%20Factsheet%20IDOS.pdf	

EULF Best Practice 3	**LoG-IN to the local economic knowledge base**
Country: Belgium, Germany and the United Kingdom	
Policy domain: Local economy, tourism, child care, water management, etc.	
Process owners: Intercommunale Leiedal (BE), Landkreis Rotenburg-Wümme (DE), Norfolk County Council (UK)	
Short description: The LoG-IN project aimed to turn local authorities into key players in the local economy through the development of a Generic Information Infrastructure. This infrastructure allowed them to manage and publish their - location - data and to build their own web applications. One of the first applications that was built with support of this Generic Information Infrastructure was an online overview of all companies in a certain region.	
Recommendations: Policy and Strategy Alignment (2; 4); Standardisation and Reuse (11; 12); Return on Investment (16); Governance, Partnerships and Capabilities (19)	
Link: https://joinup.ec.europa.eu/community/epractice/case/local-governments-3-countries-sharing-one-gis-infrastructure, http://www.smartregions.eu/log-0	

EULF Best Practice 4	**Rotterdam Digital City**
Country: Netherlands	
Policy domain: Multiple	
Process owners: City of Rotterdam	
Short description: The Municipality of Rotterdam is investigating the possibilities for the future city in the	

Digital City (DC) programme. The core of this programme is the development of a digital Open Urban Platform with a 3D Digital Twin of Rotterdam. The 3D Digital Twin of the city is a model of the city in which all fixed physical objects (houses, trees, benches, etc.) are included. This model is supplemented with 'live' data about the use of the city: Is that streetlight on? Is that parking bay occupied? Is that waste container full? Through a series of pilot projects with internal and external parties, the DC programme is gaining new knowledge to simulate the necessary developments. Opportunities are being targeted in the areas of economy, spatial planning, services, participation, safety, and asset management. Prototype proofs of concept were delivered for four applications in 2020:

1. An application to enable time and location independent participation and consultation in the area of spatial planning. In a 3D game setting, parties can consider the structure of an area in relation to potential restrictions, e.g. costs and physical obstacles. The objective is that residents can make proposals and submit them to the municipality. They can also see their designs 'come to life' with augmented reality (AR).
2. A prototype for an automated environmental permit making use of 3D models (BIM and GEO) and data driven rules. Using an automated model-based approach increases the chance of a successful proposal and speeds up the planning process.
3. A 'SAFE 3D' prototype to increase the physical safety for people present in and around buildings. The objective is to arrive at a better safety policy with specific information.
4. An application using 3D building information (BIM) for communication and promotion on building projects. With AR, the proposed final results can be visualised prior to and during the building project. Passers-by can scan a code at the building site and experience the scheduled building on their smartphone.

The objective is to have the platform operational for all users in 2022.

Recommendations: Policy and Strategy Alignment (4; 5); Digital Government Integration (6; 7); Standardisation and Reuse (12); Return on Investment (16); Governance, Partnerships and Capabilities (18)

Link: https://www.rotterdam.nl/wonen-leven/digitaal/

EULF Best Practice 5	**Radiological Emergency Response in Germany**

Country: Germany

Policy domain: Emergency management

Process owners: Federal Office for Radiation Protection (BfS), Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Short description: In Germany, the nuclear accident in Chernobyl 1986 prompted the establishment of the 'Integrated Measuring and Information System (IMIS) for the Monitoring of Environmental Radioactivity', operated by the Federal Office for Radiation Protection. In case of emergency, IMIS provides the information necessary to give recommendations and take appropriate countermeasures based on measurements, forecasts and spatial analysis.

Recommendations: Policy and Strategy Alignment (4); Standardisation and Reuse (10; 12)

Link: http://www.bfs.de/EN/topics/ion/accident-management/measuring-network/imis/imis_node.html

EULF Best Practice 6	**Digital Exchange platform for spatial plans**
Country: The Netherlands	
Policy domain: Spatial planning	
Process owners: Ministry of Infrastructure and Environment, Kadaster, Dutch Provinces and municipalities, Geonovum	
Short description: As part of the initiative 'Digital Exchange of Spatial Processes' (popularly abbreviated as DURP), a digitized environment for spatial planning was created to facilitate the sharing of spatial plans. A portal to make the plans publicly available was established called Ruimtelijkeplannen.nl with the goal to enhance the communication of future plans to professionals and citizens at municipal, provincial, and national levels.	
Recommendations: Policy and Strategy Alignment (1; 2); Digital Government Integration (7); Standardisation and Reuse (10; 12); Governance, Partnerships and Capabilities (18)	
Link: www.ruimtelijkeplannen.nl	
EULF Factsheet: https://joinup.ec.europa.eu/sites/default/files/ckeditor_files/files/New%20EULF%20Factsheet%20DURP.pdf	

EULF Best Practice 7	**National landslide warning system in Italy**
Country: Italy	
Policy domain: Emergency management	
Process owners: CNR Research Institute for Geo-Hydrological Protection (IRPI), Italian Department for Civil Protection	
Short description: The Research Institute for Geo-Hydrological Protection (IRPI) of the Italian National Research Council (CNR) started with the development of a national landslide warning system that is used by the Italian Department for Civil Protection. The system daily provides spatially distributed forecasts for the possible occurrence of rainfall-induced landslides in Italy. The main output consists of critical rainfall levels, which are determined from rainfall measurements and rainfall forecasts.	
Recommendations: Policy and Strategy Alignment (4); Return on Investment (16)	
Link: http://www.protezionecivile.gov.it/jcms/it/allertamento_meteo_idro.wp	

EULF Best Practice 8	**'One solution for all emergency services' in Poland**
Country: Poland	
Policy domain: Emergency management	
Process owners: Head Office of Geodesy and Cartography, (National) Police, Fire brigades, Emergency services	

Short description: The Head Office of Geodesy and Cartography in Poland has developed a geospatial module enhancing the Command Support System of Polish emergency services. This module, the so-called Universal Map Module (UMM), is applicable for all the emergency services and can be integrated in their Command Support Systems in order to deliver "spatial functionality" as a support to their work processes.
Recommendations: Policy and Strategy Alignment (4); Digital Government Integration (7); Governance, Partnerships and Capabilities (16)
Link: http://www.gugik.gov.pl/

EULF Best Practice 9	**Digital Accessibility Map for better informed firemen**
Country: The Netherlands	
Policy domain: Emergency management	
Process owners: Fire brigades, Ministry Infrastructure and Environment, Municipalities, Kadaster	
Short description: In the Netherlands, the Digital Accessibility Map was developed to provide firemen up-to-date navigation description and all relevant information about the emergency location. Linking the digital map with the nation-wide registries for Addresses and Buildings makes this information more reliable and quicker available. Due to the Digital Accessibility Map firemen immediately know everything about each address and building.	
Recommendations: Policy and Strategy Alignment (4); Standardisation and Reuse (12); Governance, Partnerships and Capabilities (17; 18)	
Link: http://www.brandweernederland.nl/	

EULF Best Practice 10	**Risk assessment in the insurance business in Germany**
Country: Germany	
Policy domain: Flood management	
Process owners: German Insurance Association, Insurance companies, Water resource management authorities	
Short description: The German Insurance Association (GDV), an umbrella organisation for private insurers in Germany, has developed a zoning system for floods, backwater and heavy rains, the so-called ZÜRS Geo system. Individual insurance companies can make use of this online risk assessment tool to assess the risk of natural hazards (especially flooding) for any requested area risks and determine a risk-related premium.	
Recommendations: Return on Investment (16); Governance, Partnerships and Capabilities (18)	
Link: http://www.gdv.de/2015/01/kompass-naturgefahren/	
EULF Factsheet: https://joinup.ec.europa.eu/sites/default/files/document/2019-08/New%20EULF%20Factsheet%20ZURS_rev.pdf	

EULF Best Practice 11	**Register of Territorial Identification, Addresses and Real Estates (RÚIAN)**

Country: Czech Republic

Policy domain: Broad set of policy domains

Process owners: Czech Office for Surveying, Mapping and Cadastre (ČÚZK), Czech Statistical Office, Municipalities, National Registries Authority

Short description: As one of the four Base Registers in the Czech Republic, the Base Register of Territorial Identification, Addresses and Real Estates (RÚIAN) provides up-to-date core location data on administrative units, buildings, addresses, streets and public spaces, geographic names and election districts, as open data. In addition, RÚIAN contains information on various characteristics of real estates, buildings and addresses.

The main benefit of the system of basic registers is the creation of a set of reference data, which are binding for the performance of agendas in public administration. For example, RÚIAN location data (on addresses, buildings, cadastral parcels, ...) is central to the functioning of the Integrated Rescue System (IRS) in the Czech Republic (see Best Practice 37).

Recommendations: Digital Government Integration (7); Standardisation and Reuse (10; 11; 12); Return on Investment (16); Governance, Partnerships and Capabilities (19)

Link: http://www.cuzk.cz/Uvod/Produkty-a-sluzby/RUIAN/RUIAN.aspx; https://geoportal.cuzk.cz/(S(pcurr4iig43wzmqv0jbtqgmb))/Default.aspx?lng=EN&mode=TextMeta&text=dSady_RUIAN&side=dSady_RUIAN

EULF Factsheet:

https://joinup.ec.europa.eu/sites/default/files/document/2019-08/New%20EULF%20Factsheet%20RUIAN%20-%20CZ.pdf

EULF Best Practice 12	**Enterprise locations in the Euregio Meuse-Rhine**

Country: Germany, the Netherlands & Belgium

Policy domain: Economic policy

Process owners: AGIT (DE), Province of Limburg (NL), Enterprise Flanders, POM Limburg, SPI (BE)

Short description: The Locator is a multi-functional system, consisting of four different modules. Each module provides information on one specific topic. Users can find information about the available plots on business parks, about existing companies on these business parks, about the availability of commercial real estate, and information about settlement conditions.

Recommendations: Digital Government Integration (7); Standardisation and Reuse (12); Return on Investment (16); Governance, Partnerships and Capabilities (18)

Link: http://www.the-locator.eu/

EULF Factsheet:

https://joinup.ec.europa.eu/sites/default/files/ckeditor_files/files/New%20EULF%20Factsheet%20LOCATOR.pdf

EULF Best Practice 13	**KLIC to prevent damage caused by excavation works**
Country: The Netherlands	
Policy domain: Utility management, road works	
Process owners: Dutch Cadastre, Utility network operators, Excavation community	
Short description: In 2010 The Netherlands introduced the digital information system KLIC to optimize the digital information-exchange between excavators and cable and pipe operators. Before starting excavation works, an excavator needs to submit an application request to KLIC. Network operators deliver the digital information about their cables and pipelines through KLIC to the Cadastre, which provides the information from all network operators to the excavator.	
Recommendations: Policy and Strategy Alignment (4); Digital Government Integration (7); Standardisation and Reuse (12); Return on Investment (15; 16); Governance, Partnerships and Capabilities (17; 18)	
Link: http://www.kadaster.nl/web/Themas/Registraties/KLIC-WION.htm	
EULF Factsheet: https://joinup.ec.europa.eu/sites/default/files/document/2019-08/New%20EULF%20Factsheet%20KLIC.pdf	

EULF Best Practice 14	**Air quality monitoring and reporting in Belgium**
Country: Belgium	
Policy domain: Environment	
Process owners: Belgian Interregional Environment Agency, Flemish Environment Agency, Brussels Environment, Walloon Agency for Air and Climate	
Short description: The Belgian Interregional Environment Agency (IRCEL-CELINE) is responsible for reporting on air quality issues to citizens and policy makers and for transmitting national data concerning air quality to the European level and other international organisations. Several INSPIRE-compliant services are used for reporting and exchanging air quality information through e-Reporting but also for informing the public.	
Recommendations: Policy and Strategy Alignment (4); Digital Government Integration (6; 7); Standardisation and Reuse (11); Return on Investment (15); Governance, Partnerships and Capabilities (18)	
Link: http://wwwdev.irceline.be/en	

EULF Best Practice 15	**Information System of Contaminated Sites in Slovakia**
Country: Slovakia	
Policy domain: Environmental protection	
Process owners: Ministry of Environment, Slovak Environment Agency, Regional Environmental offices, Slovak Environmental Inspectorate	

Short description: In Slovakia, an 'Information System of Contaminated Sites' was developed to support and document all processes related to the management of contaminated sites and to provide access to all official information on different measures in the field of contaminated sites. An essential part of the system is the 'Register of Contaminated Sites', which allows searching all information on Contaminated Sites in Slovakia (spatial and non-spatial).

Recommendations: Policy and Strategy Alignment (4); Digital Government Integration (7; 8); Standardisation and Reuse (10; 12)

Link: http://envirozataze.enviroportal.sk/mapa

EULF Best Practice 16	**Managing the granting of licenses for selling tobacco**

Country: Spain

Policy domain: Economic policy

Process owners: Commissioner of the Tobacco Market, National Geographic Institute

Short description: According to the Spanish law all tobacco points of sale provide themselves of tobacco from one of the three closest official tobacco delivery establishments. For a permit request for a Tobacco Sales Point, the 'AppTobaccoManagement' application determines the spatial location of the 3 tobacconists nearest the sales point. The AppTobaccoManagement is one of the new services that are built upon data and services of CartoCiudad, the seamless cartographic database of Spain.

Recommendations: Policy and Strategy Alignment (2); Digital Government Integration (7); Standardisation and Reuse (11; 12); Return on Investment (16)

Link: http://www.cmtabacos.es/

EULF Factsheet:

https://joinup.ec.europa.eu/sites/default/files/ckeditor_files/files/New%20EULF%20Factsheet%20Tobacco.pdf

EULF Best Practice 17	**Location-enabled census data in Poland**

Country: Poland

Policy domain: Statistics

Process owners: Central Statistical Office of Poland

Short description: In Poland, the Agricultural Census of 2010 and the Housing Census of 2011 were the first censuses that were completely carried out electronically, without use of paper. Enumerators were equipped with hand-held devices with a mobile application for the execution of the census process. The application contained a map module with orthoimagery and a digital map that assisted the enumerator in locating respondents.

Recommendations: Policy and strategy alignment (3); Digital Government Integration (7; 8; 9); Standardisation and Reuse (11);

Link: http://geo.stat.gov.pl/

EULF Factsheet:

https://joinup.ec.europa.eu/sites/default/files/document/2019-08/New%20EULF%20Factsheet%20CENSUS.pdf

EULF Best Practice 18	**Territorial Information System of Navarre (SITNA)**

Country: Spain

Policy domain: Many different policy areas

Process owners: Government of Navarre

Short description: The Government of Navarre started with the implementation of a government-wide Territorial Information System of Navarre (SITNA), in order to coordinate and integrate all information from different departments. On top of SITNA, a broad set of applications have been developed in the past years to support different public sector processes and services: the identification of agrarian parcels within the Common Agricultural Policy aid system, information provision on the air quality and air pollution levels in Navarre, etc.

Recommendations: Policy and Strategy Alignment (1,4); Digital Government Integration (6; 7); Standardisation and reuse (10; 11; 12); Return on Investment (16); Governance, Partnerships and Capabilities (17; 18)

Link: http://sitna.navarra.es/

EULF Best Practice 19	**Democratisation of soil data in the UK**

Country: United Kingdom

Policy domain: Soil protection

Process owners: Natural Environment Research Council, British Geological Survey, Centre for Ecology and Hydrology

Short description: Funded by the Natural Environment Research Council, a smartphone application that brings together soil property data and information from a broad range of research centres and data providers was developed by the British Geological Survey in partnership with the Centre for Ecology and Hydrology. Users of the 'mySoil' application can view soil maps of the UK and EU that provide regional information on soil depth, texture, pH, temperature and organic-matter content, and on vegetation habitats.

Recommendations: Digital Government Integration (7; 8); Standardisation and reuse (11; 12); Return on Investment (16); Governance, Partnerships and Capabilities (19)

Link: http://bgs.ac.uk/mySoil/

EULF Factsheet:

https://joinup.ec.europa.eu/sites/default/files/ckeditor_files/files/New%20EULF%20Factsheet%20UK%20Soil%20data.pdf

EULF Best Practice 20	**Digital system for building permits in Italy**
Country: Italy	
Policy domain: Spatial planning	
Process owners: Piedmont Region, Piedmont provinces, Piedmont municipalities	
Short description: With the aim of streamlining administrative procedures related to building permits, different public authorities in the Piedmont region in Italy started with the development of MUDE Piedmont, a unified digital system for building permits. The aim of MUDE was to standardize the application forms for building permit requests and of the municipal procedures for managing these requests throughout the region.	
Recommendations: Policy and Strategy Alignment (4); Standardisation and Reuse (11); Return on Investment (15); Governance, Partnerships and Capabilities (17; 18)	
Link: http://www.mude.piemonte.it/cms/	

EULF Best Practice 21	**Integrated transport solutions (TRAVELINE)**
Country: United Kingdom	
Policy domain: Transportation	
Process owners: Traveline Information Limited (TIL)	
Short description: TRAVELINE is an all Great Britain multi-modal travel planning service, which uses route timetables and real time departures for journey planning; an Open Data provider. It is structured as a private not for profit company among local authority, government, transport operator and passenger group partners. The purpose of TRAVELINE is to promote public transport passenger growth and enable the delivery of high-quality mobility information across a mix of channels in a way that represents best value to stakeholders. It has no government or public funding.	
Recommendations: Policy and Strategy Alignment (2); Digital Government Integration (6, 8); Standardisation and Reuse (11); Return on Investment (16); Governance, Partnerships and Capabilities (17, 18)	
Link: www.traveline.info	

EULF Best Practice 22	**Standardised road safety data exchange**
Country: Norway, Sweden	
Policy domain: Intelligent Transport Systems	
Process owners: JRC, ERTICO, Norwegian and Swedish Road Authorities, Norwegian and Swedish Road Authorities, TomTom, HERE	
Short description: The EULF Transportation Pilot aimed to improve the flow of up-to-date road safety data between road authorities and private sector map providers in different countries, supporting the aims of the Intelligent Transport Systems Directive and drawing on INSPIRE. It was a collaborative initiative involving the European Commission-Joint Research Centre from its European Union Location Framework (EULF) project,	

ERTICO's Transport Network ITS Spatial Data Deployment Platform (TN-ITS), including national road authorities and commercial map providers, and the European Location Framework (ELF) project, including national mapping agencies.

The project established more timely and accurate data flows in Norway and Sweden applying standardised exchange methods (the TN-ITS protocol) and guidance on linear referencing drawing on methods used in INSPIRE. The work highlighted: (i) the value of timely road safety updates for commercial map providers and users; (ii) the need for public road authorities to make each step in their data processing as timely as possible, to minimise the time taken from making a physical change to disseminating the information about that change; (iii) the need to put in place effective data sharing and collaboration agreements between public and private parties, complementing the tested technical solution (iv) the need to agree on a common location referencing method to facilitate road data exchange (v) the importance of relying on INSPIRE transport network data when national road databases are not available.

Similar exchange mechanisms are now being rolled out in different countries through the CEF Transport funding initiative.

Recommendations: Digital Government Integration (6; 7; 8); Standardisation and Reuse (11; 12); Return on Investment (15; 16); Governance, Partnerships and Capabilities (17; 18)

Link: https://joinup.ec.europa.eu/community/eulf/og_page/eulf-transportation-pilot

EULF Best Practice 23	**INSPIRE-compliant marine environment e-reporting**

Country: Denmark, Netherlands, Germany

Policy domain: Marine environment

Process owners: JRC, EEA, Danish, Dutch and German Marine Agencies

Short description: The aim of the INSPIRE marine pilot is to help improve the understanding of INSPIRE in the management of Marine Strategy Framework Directive (MSFD)-related spatial information, and to provide guidance and tools that facilitate the mentioned obligations. The activity is funded by the ISA programme as part of the EULF Action, by DG ENV, and by JRC. The EEA, NL, DE, and DK are partners in the first phase project and are contributing in-kind. The pilot takes a few datasets needed to underpin the MSFD reporting and works out complete examples of INSPIRE-based data management. In the first phase of the pilot this is done for data holdings in NL, DE, and DK. In the second phase the guidelines, tools and expertise are promoted in other countries participating in MSFD Working Group Data Information and Knowledge Exchange (DIKE).

Recommendations: Policy and Strategy Alignment (2; 4); Digital Government Integration (6; 7); Standardisation and Reuse (10; 12); Governance, Partnerships and Capabilities (17; 18)

Link: https://joinup.ec.europa.eu/community/eulf/og_page/eulf-marine-pilot

EULF Best Practice 24	**GeoSTAT Projects**

Country: Various EU Member States

Policy domain: Cross-Policy Supporting Statistics

Process owners: EUROSTAT and National Statistical Institutions (NSIs)

Short description: The GEOSTAT initiative was taken jointly by Eurostat and the National Statistical

Institutes to establish a data and production infrastructure for geospatial statistics. This infrastructure is to be defined and designed through a series of GEOSTAT projects.

The infrastructure will become an integral part of the European Statistical System's (ESS's) existing statistical data infrastructure. The idea is to incorporate the production of geospatial statistics into the various phases of the Generic Statistical Business Process Model (GSBPM), which provides the framework for the production of official statistics. The European Spatial Data Infrastructure (INSPIRE) will be another key element in geo-enabling statistical production.

GEOSTAT's main goal is to support NSIs in setting up their data, methods, and production systems to achieve a fully geocoded 2021 census. All census output should be aggregated from geocoded point-based information, providing sufficient flexibility to publish statistics for any type of territorial classification, including grids.

Recommendations: Digital Government Integration (9);

Link:http://ec.europa.eu/eurostat/web/gisco/gisco-activities/integrating-statistics-geospatial-information/geostat-initiative

http://www.efgs.info/information-base/case-study/analyses/

EULF Best Practice 25	**National Geoportal of the Grand-Duchy of Luxembourg (GeoAPI)**

Country: Luxembourg

Policy domain: Supporting many different

Process owners: Administration du Cadastre et de la Topographie (ACT)

Short description: geoportal.lu is Luxemburg's national official geoportal, a governmental platform to collect, describe, show and deliver geospatial data and related products. It has been built by Administration du Cadastre et de la Topographie, Luxemburg's national cadastre and mapping authority. The GeoAPI, one of its foundational pillars, is a web delivered service platform delivering both data and functionality, enabling geographical information to be viewed on a map. Just as with the geoportail.lu web service, the GeoAPI enables the integration in external web pages of the geoportal functionality. Although the options for data processing are limited compared with "real" office GIS software, some targeted queries and analyses are possible. A web GIS makes access to geographical information truly independent of platform, installation and location.

Recommendations: Standardisation and Reuse (10);

Link: https://www.geoportail.lu/en/

EULF Best Practice 26	**NASA Earthdata Developer Portal**

Country: United States

Policy domain: Supporting many different

Process owners: NASA

Short description: The newly released Earthdata Developer Portal is for application developers who wish to build applications that search, access, and browse NASA's Earth science data by leveraging the Earth

Observing System Data and Information System (EOSDIS) enterprise tools and services. The Earthdata Developer Portal provides centralized and uniform access to public Application Programming Interfaces (APIs) and other documentation.

Recommendations: Standardisation and Reuse (10);

Link: https://developer.earthdata.nasa.gov/; https://api.nasa.gov/

EULF Best Practice 27	**Quality Assurance Framework of the European Statistical System**

Country: Pan-European

Policy domain: Supporting many different

Process owners: EUROSTAT

Short description: The Quality Assurance Framework of the European Statistical System (ESS QAF) is a supporting document aimed at assisting the implementation of the European Statistics Code of Practice (CoP). It identifies possible activities, methods and tools that can provide guidance and evidence for the implementation of the indicators of the CoP. A first version of the ESS QAF covering principles 4 and 7 to 15 of the CoP was published in August 2011. Following a revision of the CoP adopted by the European Statistical System Committee (ESSC) on 28th September 2011, the ESS QAF was updated and approved by the Working Group Quality of Statistics in November 2012.

The current version (V1.2) emanates from work carried out in 2013-2015 by the ESS Task Force Peer Review who, in order to develop a complete and coherent self-assessment questionnaire, developed a set of methods and procedures to assess compliance for Principles 5 and 6 of the CoP.

Recommendations: Standardisation and Reuse (13);

Link:http://ec.europa.eu/eurostat/documents/64157/4392716/ESS-QAF-V1-2final.pdf/bbf5970c-1adf-46c8-afc3-58ce177a0646; http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-32-11-955

EULF Best Practice 28	**INSPIRE – Data Quality and Data Specifications**

Country: EU and Member States

Policy domain: Environmental

Process owners: European Commission

Short description: This report describes how data quality (DQ) was addressed during the development of the INSPIRE implementing rules and technical guidelines. This development process, which started in 2005 with the drafting of the conceptual framework, continued with the interoperability specification development for Annex I data themes in 2008-2010, and was finished with the definition of specifications for Annex II and III in 2013.

Recommendations: Standardisation and Reuse (13);

Link: http://inspire.ec.europa.eu/documents/data-quality-inspire-balancing-legal-obligations-technical-aspects; http://inspire.ec.europa.eu/Technical-Guidelines/Data-Specifications/2892

EULF Best Practice 29	**ISO Standard for Geographic Information – Data Quality (ISO-19157:2015)**

Country: Multinational

Policy domain: Supporting many different policy domains

Process owners: International Organisation for Standardisation (ISO)

Short description: ISO 19157:2013 establishes the principles for describing the quality of geographic data. It:

- defines components for describing data quality;
- specifies components and content structure of a register for data quality measures;
- describes general procedures for evaluating the quality of geographic data;
- establishes principles for reporting data quality.

ISO 19157:2013 also defines a set of data quality measures for use in evaluating and reporting data quality. It is applicable to data producers providing quality information to describe and assess how well a data set conforms to its product specification and to data users attempting to determine whether or not specific geographic data are of sufficient quality for their particular application.

ISO 19157:2013 does not attempt to define minimum acceptable levels of quality for geographic data.

Recommendations: Standardisation and Reuse (13);

Link: https://www.iso.org/standard/32575.html

EULF Best Practice 30	**Location Intelligence for ground works – KLIP platform**

Country: Belgium

Policy domain: Utilities

Process owners: Informatie Vlaanderen

Short description: KLIP (Kabel en Leidinginformatieportaal) aims to reduce excavation damage by exchanging cable and pipe information in advance of commencing works. The KLIP platform supports information exchange about underground assets (localisation, colour, type,...) in a specific zone. Users who plan works in a specific zone request a map of the underground. KLIP determines which network operators are possibly involved and sends the request to those parties. All network operators have to deliver their data according to the IMKL-model to KLIP. The users get one map with all the relevant data about underground utility assets and plans for works. This map can be viewed online in the KLIP portal in the KLIP app for Android, iOS and Windows. Users can access the IMKL-data as well (to convert the data and import them into their own systems). The IMKL data model is based on the INSPIRE data model for utility and governmental services. The INSPIRE model has been extended to add more information to identify the cables and pipes in the field.

Recommendations: Digital Government Integration (6; 7); Standardisation and Reuse (12; 13); Return on Investment (15; 16); Governance, Partnerships and Capabilities (18)

Link: https://overheid.vlaanderen.be/en/producten-diensten/cable-and-pipeline-information-portal-klip

EULF Best Practice 31	**Digital Twins of Helsinki**

Country: Finland

Policy domain: Urban development

Process owners: City of Helsinki

Short description: Kalasatama is a new seaside district being developed in Helsinki. A smart city project called Fiksu Kalasatama has been experimenting with smart services in collaboration with the residents, businesses, and other stakeholders in the area. The Kalasatama digital twin project got funding from KIRA-digi, the national digitalisation programme of the Finnish government. The aims of the project are to:

- Create digital twins of the Kalasatama urban development
- Share the models as open data.
- Provide a virtual platform for the experiments that are part of the Fiksu Kalasatama project.
- Test new technologies, especially those related to CityGML.
- Advance the use of digital twins in the city's processes and services.

The team created two city models. The first one is a triangular mesh and the other is a CityGML model. CityGML is a global standard established by OGC (Open Geospatial Consortium). It is a semantic, expandable information model that can describe objects—e.g., buildings and building parts—and their relationships in a hierarchical structure. CityGML makes the model "intelligent," rather than just a three-dimensional representation of the reality.

Recommendations: Digital Government Integration (6; 7); Standardisation and Reuse (12; 13); Governance, Partnerships and Capabilities (18)

Link: https://www.hel.fi/static/liitteet-2019/Kaupunginkanslia/Helsinki3D_Kalasatama_Digital_Twins.pdf

EULF Best Practice 32	**City of Madrid - Asistencia COVID19**

Country: Spain

Policy domain: Health

Process owners: City of Madrid, Carto

Short description: AsistenciaCovid19 is a web and mobile application to help reduce the pressure on emergency systems and track the status of symptoms when people are taking care of themselves at home. The project is inspired by the use of technology in China and South Korea, where it has been one of the key success factors in managing the crisis, by tracking the symptoms of its citizens. The Spanish version relieves pressure on the already saturated emergency communication methods (telephone hotlines) by allowing citizens to self-evaluate COVID-19 symptoms and give clear recommendations for action. The application provides a method to understand the pandemic from a spatio-temporal perspective. Since there is a location element to the data being collected, the local authorities are also be able to visualise infections on an interactive map and perform geospatial analysis to determine high risk areas.

Recommendations: Digital Government Integration (6)

Link: https://www.coronamadrid.com/

EULF Best Practice 33	**Urban platform, Guimarães**
Country: Portugal	
Policy domain: Multiple	
Process owners: Guimarães, Ubiwhere	
Short description: The urban platform in Guimarães is a city dashboard with mapping support displaying information in different domains. The platform supports operational activities such as routing to traffic accidents and availability of parking spaces. It also provides information to inform policy, e.g. on energy consumption of street lighting, or reporting on SDG goals in different domains (mobility, environment, tourism, energy, waste). The platform gathers data from different sources, be it from sensors, from platforms or services via APIs, or directly from citizens (e.g. street problems). There is integration with different partner information sources (e.g. Here). Centralisation and harmonisation of data provides opportunities for analysis in real time and in batch, giving insights for informed decisions. For example, it is possible to understand how an event (e.g. concert, sports event) has impacted traffic flows and parking, as well as air quality and noise levels. This allows impact analysis which can be used to take precautionary action in the future.	
Recommendations: Policy and Strategy Alignment (4); Digital Government Integration (6; 7; 8); Standardisation and Reuse (10; 11; 12); Return on Investment (15); Governance, Partnerships and Capabilities (18)	
Link: https://urbanplatform.city	

EULF Best Practice 34	**Extending INSPIRE data specifications beyond environmental policy**
Country: Italy	
Policy domain: Energy, Telecommunications	
Process owners: Agency for Digital Italy and several other public administrations	
Short description: New thematic data models were defined consistent with national and European reference specifications (i.e. the relevant INSPIRE data specifications and the national rules on the geo-topographic database (DBGT), the reference data model including the main base spatial layers and objects being harmonised to INSPIRE). Two examples: i) the data model defined for the information system of the physical infrastructures to allow the access to the information related to the implementation of the EU Directive 2014/61/EU on measures to reduce the cost of deploying high-speed electronic communications networks; ii) the data model defined for the PELL (Public Energy Living Lab) project aimed at implementing a digital platform for public lighting. The PELL project has also contributed learning to the Energy and Location project under the ELISE action of the ISA2 Programme.	
Recommendations: Digital Government Integration (7)	
Link: https://geodati.gov.it/geoportale/datiterritoriali/regole-tecniche	

EULF Best Practice 35	**Use of GeoDCAT-AP specification for integration of catalogues in spatial data and open data portals**
Country: Italy	
Policy domain: Data	
Process owners: Agency for Digital Italy	
Short description: The actions carried out were: i) definition of national guidelines; ii) implementation of these guidelines and the development of the tools needed for their implementation; iii) full engagement of the Italian organisations managing local catalogues by June 2020. The tools developed include the XSLT script extended (to take into account the extensions introduced in the national metadata profiles) and the GeoDCAT-AP_IT API reusing and extending the one developed under the ISA^2 Programme.	
Recommendations: Standardisation and Re-use (12)	
Link: https://geodati.gov.it/geoportale/documenti/12-documenti/277-linee-guida-nazionali-geodcat-ap; https://geodati.gov.it/geodcat-ap_it	

EULF Best Practice 36	**Standardised Geographic Information professional profiles**
Country: Italy	
Policy domain: Geospatial, Jobs	
Process owners: UNI (Italian Standardisation Body)	
Short description: This technical standard defines the requirements related to GI professional activities carried out in different organisational contexts, public and private. These requirements are detailed, starting from identified tasks and professional activities, in terms of knowledge, skills and ability, in accordance with the European Qualifications Framework (EQF) and stated in such a way as to support learning outcomes assessment and endorsement. The technical standard (the first of its type in Europe) is part of the European Framework of Reference and Definition of Competences and Related Competences in accordance with UNI EN 16234-1 (e-Competence Framework) and UNI 11506 (Non- Regulated Professional Activities – Professional profiles in ICT) and follows the methodology for creating third-generation profiles (UNI 11621-1). A short description of the GI professional profiles is included both in the Guidelines on digital skills and in the dedicated register published in the INSPIRE Italia Registry.	
Recommendations: Governance, Partnerships and Capabilities (19)	
Link: http://store.uni.com/catalogo/index.php/uni-11621-5-2018.html	

EULF Best Practice 37	**Integrated Rescue System**
Country: Czech Republic	
Policy domain: Emergency response	

Process owners: Fire Rescue Service of the Czech Republic – FRS CR

Short description: The Integrated Rescue System (IRS) is determined for co-ordination of rescue and clean-up operations in case where a situation requires operation of forces and means of several bodies, e.g. firefighters, police, medical rescue service and other bodies.

The system is supported by RUIAN (Register of Territorial Identification, Addresses and Real Estate) location data (on addresses, buildings, cadastral parcels, ...).

Recommendations: Digital Government Integration (6; 7); Standardisation and Reuse (11); Governance, Partnerships and Capabilities (18)

Link: https://www.hzscr.cz/hasicien/article/about-us-scope-of-activities-integrated-rescue-system.aspx; and https://cs.wikipedia.org/wiki/Integrovan%C3%BD_z%C3%A1chrann%C3%BD_syst%C3%A9m

EULF Best Practice 38 — Cross-border management of Lake Constance area

Country: Austria, Germany and Switzerland

Policy domain: Multiple

Process owners: Federal Office for Metrology and Surveying – BEV (Austria); State Office for Geographic Information and State Development, Baden-Württemberg (Germany); Federal Office for Landestopografie (Switzerland)

Short description: Lake Constance forms the centre of a cross-border natural and economic region, involving Austria, Germany and Switzerland. The surveying administrations of the three countries are responsible for national management and provision of the spatial reference, the landscape models, national maps, aerial photos, elevation and gravity models as well as the property register. In 2002, a permanent working group on Lake Constance geodata was set up to deal with the cross-border issues. This creates analyses, processes pilot projects and makes suggestions for solutions to improve cross-border cooperation and cross-border use of data through coordination of processes, harmonisation of databases, and providing the impetus for new applications.

Recommendations: Digital Government Integration (7); Governance, Partnerships and Capabilities (18)

Link: http://www.bodensee-map.net

EULF Best Practice 39 — List of applications reusing open data

Country: Austria

Policy domain: Multiple

Process owners: Cooperation Open Government Data Austria (Federal Chancellery, the cities of Vienna, Linz, Salzburg and Graz)

Short description: The Austrian open data portal includes a list of applications that use open data made available by the public sector. Almost 500 applications, created by external parties, are listed, reusing open data from more than 30 sources. For each application, the following information is provided: a short description, the records and/or services used, a link to the application, the contact points, and a link to the source code, if available. Many of these applications are based on location data and services.

Recommendations: Digital Government Integration (8)

Link: https://www.data.gv.at/anwendungen/

EULF Best Practice 40	**Rubber Boot Index**

Country: Denmark

Policy domain: Emergency management

Process owners: Danish Agency for Data Supply and Efficiency (SDFE)

Short description: With the Rubber Boot Index, emergency preparedness can use far more detailed data to predict the consequences of increased water levels. It enables better planning and management of critical situations - thus minimizing the risk of damage. For example, emergency services need to know whether to allocate pumps and barriers to affected areas and how to travel to affected areas.

The Rubber Boot Index specifies water depth in 10 cm intervals, illustrated by six colour codes, making it possible to see very quickly where water levels are very deep and what are the routes of access. It was first introduced in 2012 and enhanced in 2017 with links to other geodata when a new edition of the Climate Adaptation Tool "Seawater on Land" came out, on which the Rubber Boot Index was based. The new release of the Index provides a more accurate tool to support better informed contingency measures. It consists of free geographical data from "Seawater on land" combined with data on the height of the Danish road network. This means that through the Rubber Boot Index it is also possible to see where flooding affects roads, which can be very useful in planning evacuations in an affected area.

The tool is offered in two versions: as a web service that can be included in other professional solutions, or as part of SDFE's Map Viewer, which is aimed at citizens who can, for example, visualise the consequences of a given storm surge in their local area.

Recommendations: Policy and Strategy Alignment (4); Digital Government Integration (6)

Link: https://sdfekort.dk/spatialmap

EULF Best Practice 41	**Public-private partnership for development and release of the hydrological elevation model**

Country: Denmark

Policy domain: Flood management

Process owners: Danish Nature Agency (board of the Ministry of the Environment and Food)

Short description: The hydrological elevation model, made available free of charge by the Danish Nature Agency, can be used to calculate where the water flows in the event of a cloudburst and storm surge. Among other things, the model helps municipalities with climate adaptation plans. The development and release of the model is an example of successful partnership between the public and private sector. Forsikring & Pension, the association of Danish insurance companies and pension funds, has contributed DKK 1 million to develop the model, in view of the common interest in helping to limit water damage, thus preventing too high insurance premiums for insurance clients and too high compensations for the insurance companies.

Recommendations: Digital Government Integration (6; 8); Governance, Partnerships and Capabilities (18)

Link: https://naturstyrelsen.dk/nyheder/2013/sep/danmarkshoejdemodel/

EULF Best Practice 42	**Geodata use case portal**

Country: Denmark

Policy domain: Geospatial

Process owners: Geoforum (the Danish Association for Geographic Information)

Short description: Brugstedet.dk is a common communication platform for the Danish geodata domain. The Brugstedet.dk portal serves as a geographical information (GI) communication and marketing platform and is open to anyone with ideas, solutions and ready-made examples of how geographical information can create value for public authorities and private companies. The examples can be used by anyone who wants inspiration and ideas for using geographical information in their business or management.

Behind Brugstedet.dk is an editorial board, which operates the site and its activities on a voluntary basis. In 2015, the editorial team launched the Geodata Prize to support and share good ideas from industry in the field of geodata. The awards are selected by a professional jury of geodata professionals.

Recommendations: Return on Investment (15); Governance, Partnerships and Capabilities (19)

Link: http://brugstedet.dk/

EULF Best Practice 43	**The Impact of Open Geodata – follow up study**

Country: Denmark

Policy domain: Geospatial

Process owners: Danish Agency for Data Supply and Efficiency (SDFE)

Short description: Since basic geographic data (geodata) was released on 1 January 2013, the total value of geodata has increased from DKK 1.6 billion in 2013 to DKK 3.5 billion in 2016. Both measurements considered the value of the free geodata. The value is based on the effect of data on production and efficiency in both the public and private sectors. In addition, the estimated increase in value goes well with the fact that the number of users of SDFE's data has increased 75 times over the same period, and the number of data transfers has quadrupled.

Recommendations: Policy and Strategy Alignment (1); Return on Investment (14; 15)

Link: https://sdfe.dk/media/2916777/de-frie-geodata-eftermaaling.pdf; https://sdfe.dk/media/2917052/20170317-the-impact-of-the-open-geographical-data-management-summary-version-13-pwc-qrvkvdr.pdf

EULF Best Practice 44	**Géoplateforme, a collaborative initiative for management of geodata**

Country: France

Policy domain: Geospatial

Process owners: France's National Geographic Institute (IGN)

Short description: The Géoplatforme is the future public space for geographical information in France. It will consist of a catalogue of data and APIs, of generic user-friendly applications, learning databases and algorithms. It brings together users and / or producers of data and services that can be federated around themes or technical communities. It is based on an innovative mechanism for collaborative data enrichment or updating, offering the possibility of generating savings in resources both at IGN and at partners and improving the quality of data. The project is supported by national and local administrations, as well as by users in the public and private sector.

Recommendations: Digital Government Integration (7; 8); Standardisation and Reuse (11; 13); Return on Investment (16); Governance, Partnerships and Capabilities (18, 19)

Link: http://www.ign.fr/institut/sites/all/files/2018_synthese_geoplateforme_laureate.pdf

EULF Best Practice 45	**Common Services BUILD**

Country: Norway

Policy domain: Construction

Process owners: Directorate for Building Quality

Short description: Common Services BUILD (Fellestjenester BYGG) is a toolkit for service providers in the ICT industry who want to develop commercial application solutions for building applications for both professional and public users. With the help of Common Services BUILD, all digital building applications will come to the municipalities in a common format and appearance regardless of which application system is selected.

Common Services BUILD offers automatic control of a building application before submission to the municipality. In addition, it supports digital dissemination of applications and further dialogue between the applicant and the municipality in connection with the processing of the application.

Recommendations: Policy and Strategy Alignment (5); Digital Government Integration (6; 8); Standardisation and Reuse (12); Governance, Partnerships and Capabilities (18)

Link: https://dibk.no/verktoy-og-veivisere/andre-fagomrader/fellestjenester-bygg/

EULF Best Practice 46	**Citizen Map**

Country: Portugal

Policy domain: Multiple

Process owners: Administrative Modernisation Agency

Short description: Citizen Map is part of the Administrative Modernisation Agency's one-stop shop for digital public services. Citizen Map offers information about all points of assistance of public administration, namely hospitals, police stations, tax offices, registration offices, Citizen Shops and Spaces.

It is possible to find out the distance, the best route, the working hours, documentation required, costs and

legal deadlines for any service in approximately 7000 georeferenced assistance points.

The platform enables online procurement through a mobile app of tickets for all services available in any Citizen Shops. It also offers information about the number of people waiting or the waiting time of the last ticket for services present in such Shops.

All information is available in reusable formats in the national open data portal, dados.gov.

Recommendations: Digital Government Integration (6)

Link: https://www.ama.gov.pt/web/english/citizen-map

EULF Best Practice 47	**IDE-OTALEX**

Country: Portugal / Spain

Policy domain: Territorial cohesion

Process owners: Alentejo and Centro regions (Portugal); Extremadura region (Spain)

Short description: IDE-OTALEX was a project financed by the European programme INTERREG III A aimed at building the cross-border spatial data infrastructure between Portugal (Alentejo and Centro regions) and Spain (Extremadura region).

IDE-OTALEX was implemented to share official geographic information with all users and to contribute to territorial cohesion, one of the three main pillars of the European Cohesion Policy.

The location information available in the infrastructure is the result of extensive work of data harmonisation based on INSPIRE Directive and integration of basic cartography, socio-economic and environmental indicators.

Although the IDE-OTALEX project ran from 2006-13 and is now closed, it contains useful lessons for projects of a similar type (see publication link).

Recommendations: Policy and Strategy Alignment (4); Digital Government Integration (6; 7); Governance, Partnerships and Capabilities (18)

Link: http://www.ideotalex.eu/OtalexC/cargaGeoportal.do; http://www.ideotalex.eu/OtalexC/Publicaciones/OTALEX/LIBRO%20OTALEX_web.pdf

EULF Best Practice 48	**Interactive tool for geospatial presentation of statistical data (STAGE)**

Country: Slovenia

Policy domain: Statistics, Various

Process owners: Statistical Office of Slovenia

Short description: STAGE is an interactive tool for presenting and disseminating geospatial data. It provides users with interactive viewing of statistical content in the form of thematic maps at 10 spatial scales. Based on spatial queries, spatial units can be combined and statistics customised. All data are freely available in geospatial format (vector * .shp file) or in a thematic map and can be used in further spatial statistical analyses. The generated map displays can be accessed as a simple or embedded link. In terms of metadata and network services, STAGE follows the recommendations of the INSPIRE Directive.

Recommendations: Digital Government Integration (7; 9); Standardisation and Reuse (11; 12); Governance, Partnerships and Capabilities (19)

Link: http://gis.stat.si/

EULF Best Practice 49	**Rennes Urban Data Interface (RUDI)**

Country: France

Policy domain: Multiple

Process owners: Rennes Metropole

Short description: The Rennes Urban Data Interface (RUDI) is an open and inclusive metropolitan data ecosystem supported by an ERDF grant of approximately €4m through the Urban Innovative Actions (UIA) Initiative. RUDI is a platform ecosystem built around a web portal to help local stakeholders cooperate around data of public interest in an open and secured environment. The project involves 12 partners, including local authorities, research organisations, NGOs and private sector organisations. There is open governance, with users and citizens involved in the design of services and the data ecosystem, shared technical assets and a federated infrastructure.

Conceived as a "data social network", RUDI is based on the creation of a metadata catalogue and offers features directed towards individuals to enhance their knowledge of, and control over their personal data, and towards the project holders to facilitate management of data rights and the implementation of innovative economic models.

RUDI works with citizens, entrepreneurs and academics on new opportunities to identify data worth sharing and to cooperate around data to produce new services. The project provides connections between various thematic data ecosystems (e.g. mobility, waste management) and enables new data ecosystems in new domains/areas of local interest.

The UIA funded project for RUDI runs from 01/09/19 to 31/0/8/22. The workplan involves establishing the framework and governance, developing a prototype and then moving to a production version of the platform.

Recommendations: Digital Government Integration (6; 8); Standardisation and Reuse (10; 11); Return on Investment (16); Governance, Partnerships and Capabilities (17; 18)

Link: https://www.uia-initiative.eu/en/uia-cities/rennes-metropole

Annex II: EULF Benefits Illustrations

There are many examples of the benefits of location data and associated interoperability measures in different sectors and situations. This annex summarises the benefits for some typical applications. For each application listed below, there are some general points about the types of benefit and one or more specific case studies to act as illustration.

No	Application Type	Case Studies
1	European data programmes	EU
2	National data programmes	DK
3	Geospatial strategic reviews	UK, AU, LT, NE
4	Integration of data from external sources	PT, INT
5	Address data	UK, DK
6	Planning and construction	SE
7	Routing applications	UK, NO. SE
8	Public transport	UK
9	Catchment area and transport planning	ES
10	Asset maintenance	BE, NE, UK
11	Agriculture and fisheries	AU, EU
12	Environment	DK, INT
13	Healthcare	KR, CZ, DE, FR, INT
14	Fix My Street applications	PT, INT
15	Meteorological services	INT, FI

INT = International

The focus in these examples is on the outcome benefits (e.g. cost savings, GDP impacts, environmental outcomes) rather than the intermediate benefits (e.g. improved discoverability and access to data). See recommendations in the Return on Investment focus area for relevant guidance.

EULF Benefits Illustration 1: **European data programmes**

General points: EU policies and associated implementation programmes have been promoting data sharing over a number of years, with a strong focus on open data. Implementation of the Open Data Directive involves publication of a series of High Value Datasets, including important geospatial datasets such as addresses and geographical names. The European Data Strategy involves the implementation of European data spaces in different sectors, including a 'Green Deal' data spaces, that will have a strong geospatial aspect. Geospatial data will be an important integrating factor across the different sector data spaces.

Case studies: The Impact Assessment study on the list of High Value Datasets to be made available by the Member States under the Open Data Directive, 2020 identifies the potential datasets for initial release, the use cases for these datasets and the impacts of different implementation options. Several INSPIRE geospatial datasets are included, namely administrative units, geographic names, addresses, buildings and cadastral parcels.

Example references included a Swedish meta-study which found that 4 different data categories / datasets could bring benefits to Swedish society of approximately SEK 11.1 bn annually. The same study identified annual productivity and commercialisation benefits of SEK 10 – 21 bn in the following sectors: Agricultural Sciences (SEK 1.1 – 2.9 bn, Information and Technology (SEK 2.6 – 6.4 bn), Finance and Insurance (SEK 2.0 – 3.3 bn), Spatial Planning (SEK 3.0 – 6.2 bn), and Public Sector (SEK 1.1 – 1.7 bn).

Across the EU, the different policy interventions could bring direct economic benefits of EUR 1.1 – 2.3 bn and indirect economic benefits of EUR 4.1 – 8.5 bn by 2028. The report shows the cost benefit ratios for each of the countries that were consulted.

EULF Benefits Illustration 2: **National data programmes**

General points: Strategic initiatives with large numbers of stakeholders and datasets and significant opportunities for benefits through network effects. May be specific location data initiatives (e.g. driven by INSPIRE or national location data strategies) or broader data initiatives involving high value datasets or open data, driven by open government, data policy or growth and efficiency drivers. Policy justification may involve cost benefit analysis but will often include socio-economic analysis to account for the broad potential impact of the policy. Cross-programme assessment may be challenging but useful illustrations can be made with particular applications (e.g. environmental assessments in the case of INSPIRE or high value datasets such as addresses or geographical names).

Case studies: One of the best large-scale illustrations of the benefits of interoperable data, combining and integrating public sector high value location data and other data, is the Danish Basic Data Programme. This has some well-presented quantified results, both in terms of intermediate benefits and outcome benefits. It is also a use case for open data. Between baseline measurement in 2012 and further measurement in 2016 there was an Increase in users of the online service from 800 to 60.000 and an increase in site visits per annum from 800m to 3.3bn. Socio-economic value of geodata increased from an estimated 1.6 billion DKK in 2012 to 3.5 billion DKK in 2016.

Similar programmes have been set up in the Netherlands and the Czech Republic.

EULF Benefits Illustration 3: **Geospatial strategic reviews**

General points: These may look at the public value of geospatial activities and seek to align these activities with wider social and economic goals, such as growth, efficiency, environment, public trust etc Studies may consider a specific policy, such as a location strategy or the implementation of INSPIRE, or they may assess the economic or societal impacts of either public sector or industry-wide geospatial activities.

Case studies: A 2010 study, The Value of Geospatial Information to Local Public Service Delivery in England and Wales, concluded that real output of local government increased by over GBP 230m in 2009 as a result of the accumulated productivity benefits of using geospatial applications; GDP for England and Wales was over GBP 320m higher in 2009 using GI; projecting forward to 2015, GDP for England and Wales would be an estimated GBP 560m higher using GI; better policies and actions could improve GDP by GBP 600m by 2014-5..

A study on The Economic Value of Spatial Information in New South Wales for 2017 and 2022 estimated that total net benefits from improvements in productivity attributed to the use of spatial information, services and analytics would increase from AUD 923m in 2017 to AUD 1,395m in 2022. Key sectors included emergency services, insurance and ambulance services (AUD 339.5m to AUD 390.8m) smart buildings and infrastructure (AUD 360 bn to AUD 360 bn) and land and property administration (AUD 4.4m to AUD 248.4m).

A UK Geospatial Commission study in 2018 'An Initial Analysis of the Potential Geospatial Economic Opportunity' examined known public sector and private sector use cases and concluded that government could unlock up to £6-11 bn per year of economic value in the private sector. The analysis focused on productivity impacts, e.g. labour / time savings, fuel savings, e.g. in route optimisation, and material savings, e.g. reduced error rates in construction. The methodology involved 1) identify use cases; 2) estimate potential impact on gross value added (GVA) 3) estimate adoption rate. The main private sector themes were sales and marketing, property and land, infrastructure and construction, mobility and natural resources. The main public sector themes were housing, land and planning, security and emergencies, transport and logistics, environment and citizen engagement and service delivery.

The Lithuania INSPIRE 2020 country fiche outlines the costs and benefits of the Lithuania Spatial Infrastructure (LSI), a large part of which covers the implementation of the INSPIRE Directive. Between 2009 and 2019, LSI

implementation costs amounted to EUR 11.6m. Annual savings of around 20.000 working days were identified which, in terms of average wages, amounts to EUR 1.2m. It was noted that time savings do not necessarily equate to financial savings. Socio-economic benefits were assessed from EUR 0.9m in 2014 to an average of EUR 1.8m in subsequent years.

The Netherlands Geospatial Economy Report, 2021 estimated the geospatial economic impact in the Netherlands to be EUR 35.5 bn annually. The geospatial industry was estimated to have generated EUR 1.05 bn in revenues in 2019. It was concluded that the use of geospatial technologies has a strong multiplier effect and could result in productivity impacts representing 60% of the Netherlands Gross Value Added (GVA). The total business impact of the geospatial industry was valued at EUR 31 bn. Estimated consumer benefits based on a "willingness to pay" approach mounted to EUR 4.5 bn annually. Of this total, the time saved by commuters by using digital maps was estimated at EUR 2.5 bn and fuel savings due to improved navigation was estimated at EUR 1.95 bn. Furthermore, in comparison to 2010, CO2 emissions from vehicular traffic had reduced by 18.5% with the use of digital maps.

EULF Benefits Illustration 4: **Integration of location data from external sources**

General points: Digital public services are increasingly involving collaborations with non-governmental actors and integration of data from external sources. Typical examples are smart city applications, digital twins or in data driven ecosystems where data is combined and data flows exist between governmental and non-governmental actors. Google Maps offers comprehensive mapping globally, has its quality procedures, and offers integration through standard interfaces. OpenStreetmap offers increasingly high-quality mapping information, particularly in urban areas. Developers may be more familiar with either of these products than strategic national mapping products. Even if there is a charge for the external data products, the effort of assembling the necessary data and achieving interoperability may be less with external data sources. All administrations need to consider the total cost of ownership and, sometimes, tactical rather than strategic solutions may offer the best path.

In smart city applications or digital twins of cities, data may be integrated from different sources to support policy or provide services that offer value through innovation. This may include data from externally-owned sensors (e.g. weather monitoring devices), cameras (e.g. security cameras) or other smart devices (e.g. parking space notifications). Buildings data from the construction industry may be integrated in digital twins of the city to help in urban planning and energy efficiency programmes. Data ecosystems exist in the road transport where governmental actors (e.g. road authorities, traffic managers, police services) and non-governmental actors (e.g. vehicle manufacturers, navigation system providers, construction companies and insurance companies) all exchange data to support the safe and efficient operation of the road transport network.

The distributed data management requirements of these applications typically involve the use of microservices and APIs (including Context Brokers). Interoperability is vital but the effort (and cost) involved in managing interoperability is minimised by the use of these technologies. This type of distributed approach also enables new capabilities or fixes to problems to be introduced into the 'system' in relatively straightforward ways (i.e. with incremental business cases).

The benefits of integrating data from external sources can be of many types. Innovation and effectiveness benefits apply with the new business models and service possibilities. Cost savings and total cost of ownership may arise from distributing the 'public task', and social and environmental benefits may be possible through fuel saving and energy saving measures.

Case studies: The Urban Platform in Guimarães (Best Practice #33) exhibits may of the aspects described above. It includes parking and fix-my-street types of applications, capabilities to help transport planners and traffic managers and integration of operational and statistical practices to support monitoring of sustainable development gaols (SDGs). Data is integrated from governmental and non-governmental sources, including the use of externally-sourced mapping to provide the optimum solution for the city area.

Navigation system providers, such as TomTom and Here, are highly integrated into international road transport activities. They support route planning within and across borders (managing the interoperability aspects to support users), provide automation in vehicles (supporting transport policies) and provide operational data to governmental traffic managers to support transport policy (e.g. speed limits and safety restrictions) and help in managing the operation of the road network (e.g. dealing with traffic congestion)..

EULF Benefits Illustration 5:	**Address data**

General points: This is one of the 'high value' location datasets. Any efficiencies that can be introduced in collecting, distributing and using address data and, in particular, processing change of address information will result in 'big number' outcomes through having timely accurate information. Actors typically involved are local administrations, mapping agencies and postal services. Legal, organisational, semantic and technical interoperability measures all feature in management of address data. For the citizen, having to input address data multiple times goes against the 'once-only' principle and there are user efficiencies to be gained from implementing exchange mechanisms to avoid this.

Case studies: A UK study in 2016 commissioned by GeoPlace 'Cost Benefit Analysis of Address and Street Data for Local Authorities and Emergency Services in England and Wales', projected net benefits up to £202 million by 2020 from better use of the address and street data that councils create and maintain. Based on the current rates of adoption, this represented a return on investment after discounting of 4:1.

See also the range of specific GeoPlace case studies for address and street data, with many examples of benefits delivered.

In Denmark, a 2010 study, The value of Danish address data, commissioned by the Danish Enterprise and Construction Authority found that the direct financial benefit to society of opening Danish address data amounted to roughly DKK 471m (€62m) between 2005 and 2009, set against relatively small costs of DKK 15m (€2m) across the same period.

EULF Benefits Illustration 6:	**Planning and construction**

General points: Geospatial data plays an important role in urban planning and construction activities, including developing plans, obtaining building permits, real estate activities, groundworks and construction, utilities, safety and security, building maintenance etc. Integration of geospatial and buildings information modelling (BIM) data is an important interoperability aspect.

Case studies: In 2019, in a report to Lantmäteriet, the National Land Survey of Sweden, estimated the potential annual economic benefit of the use of geodata in the digital urban planning and building process in Sweden to be between SEK 22.3 – 42.4 bn. The goal was to set up a national spatial data platform with detailed plans in harmonised digital formats, linked to a standardised base map with controlled property boundaries.

For public administrations dealing with planning inquiries and investigations, there were estimated cost savings for municipalities of SEK 172m, for regional authorities SEK 34m, for the courts SEK 9m and for the Swedish Transport Administration SEK 34m (total SEK 249m). These savings were derived from a Finnish study where it was estimated that 60% of the time spent on inquiries and investigations could be saved.

Estimated cost savings in working hours for municipalities providing a digital building permit service would be SEK 91 - 190 m.

For public sector property development, state and municipal surveying authorities would, with the help of national basic data and a national platform for access to geodata be able to make cost savings of up to SEK 21 – 43 m for the National Land Survey and SEK 8 – 16 m for municipal land surveys (total SEK 29 – 59 m).

Design costs for urban transformation could be reduced significantly with a common management of geographical data, creating benefits for municipalities, developers and citizens. Based on an assessment for the Kiruna development (Sweco, 2017), the time taken can be reduced by 50%. Nationally, this could result in annual construction savings of SEK 3 bn.

For groundworks and construction, larger savings were estimated. Total savings in labour costs for house construction were estimated at SEK 19 - 38 bn and for infrastructure construction at SEK 0.4 – 0.9 bn when using geographical data, BIM models and a common picture and information (total SEK 19.4 – 38.9 bn).

EULF Benefits Illustration 7:	**Routing applications**

General points: These are relatively straightforward to understand and measure. The applications take many forms but the basic concept is largely the same. Applications often involve collaborations between public sector and private sector organisations. Examples include provision of authoritative public sector road data for navigation services, better routing of waste collection, saving money on vehicles and staff, and directing emergency services to the scene of an emergency.

Case studies: In 2006, Daventry District Council in England undertook a feasibility study to look at the potential to improve the efficiency of waste collections. They compared new routes optimised using a software package called RouteSmart against routes that had historically been produced using local knowledge and experience. The following cash savings were identified: mileage reduction of 12-13% delivering savings of GBP 25,000 p.a.; spare capacity to allow for vehicle washing, securing savings of GBP 17,000 p.a.; employee overtime virtually eliminated, saving approximately GBP 28,000 p.a.; purchasing a smaller waste collection vehicle, saving GBP 25,000. Subsequently, route optimisation enabled the number of weekly collection rounds to be reduced from 18 to 16, yielding manpower savings and avoiding the need to purchase additional vehicles, with cash savings of GBP 153,000 p.a. (see The Value of Geospatial Information to Local Public Service Delivery in England and Wales, 2010).

The EULF project participated in a transportation pilot in Norway and Sweden sharing road safety data on a more regular basis between road authorities and map providers (Tom Tom and Here) and help improve the accuracy of their navigation systems. One of the map providers reported a reduction in errors from 25% to 7%. This was due largely to increasing the frequency of update rather than improvements in data quality or using a standard exchange format. The standard exchange format did however enable these multinational companies to implement common processes in different countries (there is now roll out in CEF with 14 countries). These are not 'end-user benefits, though one could envisage benefits for drivers from having more up-to-date and therefore accurate information in their navigation systems.

EULF Benefits Illustration 8:	**Public transport**

General points: Users of public transport have benefited from many technological improvements in recent years. These have included public transport journey planning using single or multiple modes of transport, extending the journey planning to include walking times from home or between transport nodes, displaying real time information at waiting points, and even moving to on-demand public transport in remote areas. These services typically involve both public and private operators and require a high degree of interoperability in both data and technology. The public sector is often an orchestrator in terms of the coordination and integration of the processes and data. There are good examples of public administrations providing open access to enable developers to create value added services for travellers. Multinational travel information services are coming more to the fore, with Google extending into travel services and specialist providers emerging (e.g. Rome2Rio).

Case studies: In 2017, a Deloitte study, Assessing the value of TFL's open data and digital partnerships, found that Transport for London generates economic benefits and savings of up to £130m each year, by opening up access to geospatial data – such as the locations of rail lines, embarkation points and facilities, and georeferenced data – such as timetables, transit status, and updates about disruptions and scheduled works. The benefits, which included reduced travel time, not needing to produce in-house apps and campaigns, job creation and revenue from new services were set against a relatively small estimated cost of around £1m per year for publishing the data openly, suggesting a significant return on investment.

EULF Benefits Illustration 9::	**Catchment area and transport planning**

General points: Using geospatial and demographic model to model locations for public facilities (anything from hospitals to mobile library locations) and plan transport routes (including new on-demand public transport capabilities). These are typical examples of combining location data with thematic data and using the analysis

for decision making.

Case studies: See Management of On-demand Transport Services in Urban Contexts, Barcelona Case Study, 2015 for analysis of on-demand taxi and car sharing services.

EULF Benefits Illustration 10: **Asset maintenance**

General points: Underground asset maintenance is an important use case, where there is a need to manage access by multiple operators efficiently and safely and minimise disruption to the local community and businesses. Costs and benefits of an integrated (i.e. interoperable) approach to underground asset maintenance are significant. The importance of getting all stakeholders on board and taking a strategic approach to data sharing are paramount.

Case studies: The EULF Blueprint features KLIC (NE) and KLIP (Flanders). KLIP was involved in the ELISE co-innovation workshop at the INSPIRE 2020 Conference. INSPIRE is used for data harmonisation between public and private sectors.

The UK Geospatial Commission initial analysis of geospatial opportunities In 2018 suggested that more accessible and better quality location data in infrastructure and construction could be worth over £4bn per year. Accidental strikes on underground assets were estimated to cost £1.2bn per year. A £2.4m National Underground Asset Register pilot was initiated in 2019 to inform national rollout. Strike avoidance and efficiency savings were identified across the four tested use cases. The benefits of shared digital asset data were proven.

EULF Benefits Illustration 11: **Agriculture and fisheries**

General points: Supporting and protecting food supply is a policy area with a high degree of regulation and subsidy. In agriculture and fisheries, much of the policy attention relates to the geographic extents of farms and fishing areas. Location-related data is highly important therefore in the regulation of these industries and the protection of species involved. Key examples include agricultural subsidies (under the Common Agricultural Policy), associated environmental protection, and protection of species (e.g. animal welfare, disease control, fishing quotas). Some of the processes and use of location data in managing animal disease outbreaks, such as Foot and Mouth Disease, have similarities to the controls put in place to deal with human health pandemics such as COVID-19..

Farming and fishing industries increasingly use more sophisticated technologies to help them manage yields and use their resources as efficiently as possible. Precision agriculture software provides a decision support system for farmers using location intelligence assisted by satellite positioning technology and farm equipment sensors (e.g. combine harvesters). The goal is to optimise returns on inputs whilst preserving resources. The software supports crop management planning and rotation plans for best yields. Precision livestock farming involves use of sensors to track animals, enabling improvements in production and sustainability (e.g. animal welfare, environmental impact)..

Case studies: A 2007 report on the economic benefits of precision agriculture in Australia examined six case studies. The level of capital investment varied from $55,000 to $189,000. Capital investment per hectare varied from $14 to $44/ha. Estimated annual benefits ranged from $14 to $30/ha and the initial capital outlay was recovered within 2-5 years. All farmers we were able to quantify benefits to variable rate fertiliser management, ranging from $1 to $22/ha across the six farms.

The EU funded Foodie Project has highlighted the benefits of using agricultural technology for farming cooperatives.

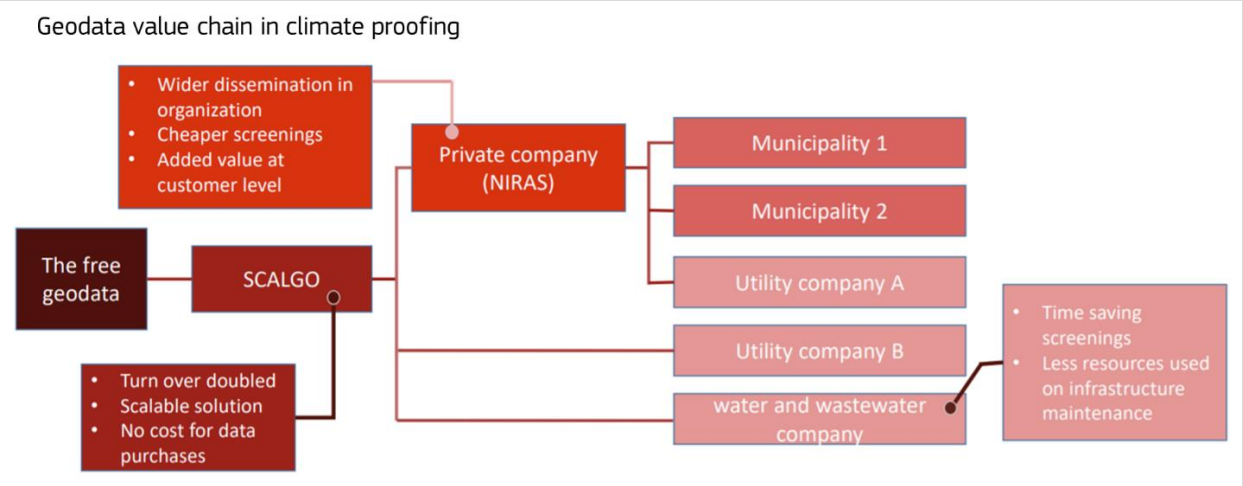
FATIMA, an EU funded project concerning large-scale precision agriculture, aimed to implement new tools for intensive farming that help optimise use of nutrients and water and improve productivity. The project highlighted that use of a variable rate delivery system for nutrients could reduce inputs by 38% without impacting grain yields.

EULF Benefits Illustration 12: **Environment**

General points: Carbon emissions, air quality, noise levels are all measurable or calculatable factors that can be the basis for an interoperability benefits assessment. Measurements can be associated with action plans and the resulting improvements can be published as benefits of the action plans. The whole impact assessment may have multiple factors (e.g. carbon reduction, congestion charges, industry competitiveness). This is a subject where both targeted and macro analysis are relevant.

Case studies: Climate action programmes and their associated monitoring of individual administrations (e.g. Sonderborg, Project Zero) or multiple administrations (e.g. Covenant of Mayors) provide important demonstrations of environmental benefits. At a macro level, reporting against UN Sustainable Development Goals highlights the broader commitment and progress towards sustainability.

SCALGO Live Flood Risk is a national flood risk platform in Denmark, that makes use of free geodata provided through the Danish Basic Data Programme and is used for working with climate adaptation, urban planning, emergency management and administration of watercourses. Users include municipalities, utility companies, consulting engineers (such as NIRAS) and insurance companies. Use of the software demonstrates the value generative role of geodata and interoperability for public and private sector organisations, as well as wider society.



Source: The Impact of Open Geodata – follow up study after 5 years

EULF Benefits Illustration 13: **Healthcare**

General points: Healthcare applications combine policy and operational use of location data, to assess particular healthcare problems and plan and manage actions to address them. Population growth and population aging put increasing pressure on healthcare services, which collectively form a significant proportion of GDP. As we have seen from the COVID-19 pandemic, some of the largest scale and most impactful analysis using location data comes in this sector, together with some of the most innovative and costly solutions (e.g. mobile tracking and contact tracing applications), involving logistical challenges and high risk / impact scenarios. Location intelligence has never meant so much globally as it has during the COVID-19 outbreak.

As with environment problems, diseases do not respect national boundaries and multinational intelligence and solutions are needed. Environment issues are also in various respects related to health issues. This is also the case for social and economic issues. With so much interconnection in different sectors and geographies, the importance of interoperability in data, systems and organisational response (in terms of capability, capacity and logistics) is vital. COVID-19 has also highlighted the importance of data in driving solutions, from quickly understanding the nature of the problem through genome sequencing through, developing vaccines, carrying out clinical trials, and giving regulatory clearance in different locations, developing vaccine supply capacity and

rolling out vaccines globally, modelling scenarios to decide on recovery and residence measures, providing healthcare where needed to deal with cases, and taking action to address the economic, social and long term health impacts related to the pandemic.

Citizens have also come to rely on location-based information to understand the rationale for lockdowns and manage their activities in response to the challenges. Availability of reliable information from government and policies and actions taken based on the data has been an important factor for governments in maintaining the trust of their citizens.

Relevant location data involved in dealing with COVID-19, as well as other disease and disaster scenarios, includes: COVID-19 infections data, map reference information including administrative areas, places frequented by many people, transport networks, mobility information, address data, demographic data, land cover, air pollution, water sources, and health facilities, and health and other emergency services data. Such information needs to be available and shared amongst the many different parties involved in deciding on policy and managing the outbreak. Interoperability of data is key as well as the ability to handle a high frequency of update to enable accurate modelling and decisions to be taken with as much certainty as possible.

In April 2020, the European Commission published "Commission Recommendation (EU) 2020/518 on a common Union toolbox for the use of technology and data to combat and exit from the COVID-19 crisis", in particular concerning mobile applications and the use of anonymised mobility data. Also published were "Guidelines 04/2020 on the use of location data and contact tracing tools in the context of the COVID-19 outbreak".

Case studies: The John Hopkins COVID-19 Dashboard, based on ESRI software, become an important global tool to track and monitor the virus and the UN Statistics Division has made the data available in various formats and provides access through an API and geo-services.

At a national level, countries have implemented data solutions in rapid timeframes. Some countries with experience of SARS, such as South Korea, had approaches and solutions they could build upon. South Korea also enhanced their applications vary rapidly, for example the contact tracing system used to locate people attending a religious event in Daegu which resulted in mass infections. The system analysed data provided by credit card, transport and mobile companies. Many developed countries, however, lacked the necessary preparations and hurriedly built solutions.

The Czech Republic developed a 'smart quarantine' system which involved creating memory maps by processing individuals movements obtained from mobile phone data. Individuals have to give their consent. Thanks to location sharing, the probability of infection can be calculated and informed decisions taken. Take-up reached around 1.5m people by mid-2020 (out of a population of 10.5m). While this is good, there are limitations in the Czech Republic, and other countries with similar applications, where critical mass is needed.

In Germany, policy makers introduced a system to deal with local infection hotspots using NUTS 3 level administrative units. Restrictions were adapted according to the percentage of cases for the relevant populations. Interventions were varied over time as the progress of the outbreak evolved. The benefits of this localised approach were seen in dealing with an outbreak at a meat processing plant in June 2020, where 400 people were infected and appropriate quarantine measures were quickly put in place.

France introduced measures to move out of the containment phase based on department level red, amber and green classifications, taking into account the incidence of new cases, the virus reproduction factor, hospital bed occupancy rates, number of tests performed and rate of positive tests.

To support EU member states, Eurostat has performed spatial analysis to detail risk areas, using population data, combined with a European healthcare services dataset, transport networks and address data.

EULF Benefits Illustration 14: **Fix My Street applications**

General points: FixMyStreet is an independent website, built by the charity mySociety. They enable users to report problems and share the information with local councils. FixMyStreet is primarily for reporting things which are broken or dirty or damaged or dumped, and need fixing, cleaning or clearing, like graffiti, dog fouling, potholes or street lights that don't work. FixMyStreet is an example of participatory democracy, organisational interoperability, location data interoperability and technology reuse. Monitoring extent of problems, time to fix and citizen satisfaction can all be done in relation to the service.

Case studies: Many local administrations now include such facilities within their websites or urban platforms (e.g. the EULF Blueprint Guimarães best practice). See the list of European countries reusing the platform: https://fixmystreet.org/sites/..

EULF Benefits Illustration 15: **Meteorological services**

General points: Weather data sharing and forecasting is a ubiquitous location-based data sharing application which relies on an interoperable ecosystem and common standards for its functioning. All the benefits of having reliable weather forecasts can be attributed in part to the interoperability aspects of the ecosystem.

Case studies: A report published by the World Bank, produced in collaboration with the World Meteorological Organisation and the Met Office (UK), estimates improving the collection and international exchange of surface-based observational data will deliver additional socioeconomic benefits worth more than US $5bn a year - The Value of Surface-based Meteorological Observation Data, 2021.

See also Vaisala blog: Day to Day Benefits of Weather Detection for various examples of the benefits of weather forecasting services.

Annex III: Related Frameworks: European Interoperability Framework (EIF)

			EULF BLUEPRINT RECOMMENDATIONS																	
			Policy and Strategy Alignment					Digital Government Integration				Standardisation and Reuse				Return on Investment			Governance, Partnerships and Capabilities		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
EIF RECOMMENDATIONS	Principles	1																			
		2		X														X			
		3																			
		4												X							
		5		X	X																
		6								X			X								X
		7											X								
		8					X					X		X							
		9							X												
		10																			
		11								X	X		X					X			
		12								X									X	X	
		13						X		X											
		14																			
		15			X																
		16													X						
		17						X													
		18																			
		19														X	X				
	Interoperability Layers	20	X	X					X										X		
		21												X							
		22												X							
		23					X							X							
		24												X							
		25																	X		
		26																		X	
		27	X																		
		28						X						X							
		29																		X	
		30				X															
		31	X						X						X						
		32												X						X	
		33										X		X							
	Conceptual Model for Public Services	34																			
		35										X									
		36										X	X								
		37			X	X					X		X		X			X			
		38			X	X					X		X		X			X			
		39																			
		40													X						
		41																X			
		42													X						
		43		X																	
		44							X				X								
		45								X									X		
		46			X																
		47																			

Annex IV: Related Frameworks: UN-GGIM Integrated Geospatial Information Framework (IGIF)

IGIF Strategic Pathways / Elements

			EULF BLUEPRINT RECOMMENDATIONS																		
			Policy and Strategy Alignment				Digital Government Integration				Standardisation and Reuse				Return on Investment			Governance, Partnerships and Capabilities			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
UN-GGIM IGIF STRATEGIC PATHWAYS / ELEMENTS	Governance and Institutions	Governance Model	X																X		
		Leadership	X						X							X	X		X		
		Value Proposition	X													X	X		X		
		Institutional Arrangements	X																X		
	Policy and Legal	Legislation	X	X					X												
		Policies, Norms and Guides	X	X					X												
		Data Protection, Licensing and Sharing		X	X				X									X			
		Governance and Accountability	X	X												X	X				
	Financial	Business Model														X	X				
		Opportunities																			
		Investment														X	X				
		Benefits Realisation														X	X				X
	Data	Data Themes				X			X		X		X		X						
		Custodianship, Acquisition and Management					X		X						X						
		Data Supply Chains							X				X		X						
		Data Curation and Delivery				X			X		X	X	X		X						
	Innovation	Technological Advances	X			X		X				X									
		Innovation and Creativity						X	X			X	X					X			
		Process Improvement						X										X			
		Bridging the Geospatial Digital Divide				X		X	X		X	X	X					X			
	Standards	Standards Governance and Policy					X							X							
		Technology and Data Interoperability												X							
		Compliance Testing and Certification					X							X							
		Community of Practice												X							
	Partnerships	Cross-sector and Inter-disciplinary Cooperation																		X	
		Private Sector and Academia Collaboration								X										X	
		International Collaboration																		X	
		Community Participation								X										X	
	Capacity and Education	Awareness																			X
		Formal Education																			X
		Professional Training																			X
		Entrepreneurship																			X
	Communication and Engagement	Stakeholder and User Engagement								X											X
		Strategic Messaging and Engagement																			X
		Communication Strategy, Plans and Methods																			X
		Monitoring and Evaluation								X											X

IGIF Strategic Pathways / Actions

			EULF BLUEPRINT RECOMMENDATIONS																		
			Policy and Strategy Alignment				Digital Government Integration				Standardisation and Reuse				Return on Investment			Governance, Partnerships and Capabilities			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
UN-GGIM IGIF STRATEGIC PATHWAYS / ACTIONS	Governance and Institutions	Forming the Leadership	X																X		
		Establishing Accountability	X																X		
		Setting Direction	X						X							X	X		X		
		Creating a Plan of Action	X						X							X	X		X		
		Tracking Success														X	X		X		
		Deriving Value	X													X	X		X		
	Legal and Policy	Providing Leadership	X	X																	
		Assessing Needs	X	X					X												
		Addressing Opportunities	X	X					X									X			
		Future Proofing	X	X					X							X	X				
		Addressing Coherence		X	X																
		Delivering Compliance	X	X												X	X				
	Financial	Setting Direction																			
		Situational Assessment														X	X				
		Financial Plan														X	X				
		Case for Investment														X	X				
		Sources of Funding																			
		Deriving Value														X	X				X
	Data	Getting Organised				X			X				X		X						
		Planning for the Future							X				X		X						
		Capturing and Acquiring Data					X								X						
		Maintaining Data Sustainably							X				X		X						
		Maintaining Accurate Positioning										X			X						
		Integrating Data				X			X			X	X		X						
	Innovation	Geospatial Landscape	X																		
		Identifying Innovation Needs				X		X				X									
		Transformation Roadmap				X		X	X		X	X	X								
		Culture of Innovation						X	X			X	X								
		Operationalising Innovation						X										X			
		Innovation Ecosystem				X		X	X		X	X	X					X			
	Standards	Direction Setting					X							X							
		Understanding National Needs												X							
		Planning for Change					X							X							
		Taking Action												X							
		Ongoing Management												X							
		Achieving Outcomes					X							X							
	Partnerships	Understanding Partnerships								X										X	
		Evaluating Opportunities								X										X	
		Identifying Potential Partners								X										X	
		Selecting Partners								X										X	
		Formalising Partnership								X										X	
		Managing Partnership																		X	
	n d	Setting Direction																			X

			EULF BLUEPRINT RECOMMENDATIONS																		
			Policy and Strategy Alignment				Digital Government Integration				Standardisation and Reuse				Return on Investment			Governance, Partnerships and Capabilities			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		Assessing Needs																			X
		Considering Alternatives																			X
		Planning for Action																			X
		Taking Actions																			X
		Assessing Value																			X
	Communication and Engagement	Providing Leadership								X											X
		Understanding Opportunities								X											X
		Setting Direction																			X
		Creating Plan of Action																			X
		Monitoring Progress								X											X
		Communicating Value																			X

Annex V: Role-based methodologies

This annex shows role-based methodologies for the main intended users of the document, i.e. policy makers, digital public service owners, managers or implementers, ICT managers, architects or developers, data managers or data scientists, public sector location data providers, and private sector product or service providers. These methodologies indicate the relevant recommendations that should be considered in undertaking the typical tasks for each of these roles.

Policy Maker					
RECOMMENDATIONS		TASKS			
		Preparation	Adoption	Implementation	Application
POLICY AND STRATEGY ALIGNMENT					
1.	Connect location information and digital government strategies in all legal and policy instruments	X	X		X
2.	Make location information policy integral to, and aligned with, wider data policy at all levels of government	X	X		X
3.	Ensure all measures are in place, consistent with legal requirements, to protect personal privacy when processing location data.	X	X		X
4.	Make effective use of location-based analysis and location intelligence for evidence-based policy making	X		X	X
5.	Use a standards-based approach in the procurement of location data and related services in line with broader ICT standards-based procurement			X	
DIGITAL GOVERNMENT INTEGRATION					
6.	Identify where digital public services can be simplified or transformed using location information and location intelligence, and implement improvement actions that create value for users	X			X
7.	Use spatial data infrastructures (SDIs) in digital public services and data ecosystems across sectors, levels of government and borders, integrated with broader public data infrastructures and external data sources				
8.	Adopt an open and collaborative methodology to design and improve location-enabled digital public services				
9.	Adopt an integrated location-based approach in the collection and analysis of statistics on different topics and at different levels of government	X			X

STANDARDISATION AND REUSE					
10.	Adopt a common architecture to develop digital government solutions, facilitating the integration of geospatial requirements				
11.	Reuse existing authentic data, data services and relevant technical solutions where possible	X		X	
12.	Apply relevant standards to develop a comprehensive approach for spatial data modelling, sharing, and exchange to facilitate integration in digital public services				
13.	Manage location data quality by linking it to policy and organisational objectives, assigning accountability to business and operational users and applying a "fit for purpose" approach	X	X	X	X
RETURN ON INVESTMENT					
14.	Apply a systematic approach to assessing and monitoring the benefits and performance of location-based services				X
15.	Communicate the benefits of integrating and using location information in digital public services				X
16.	Facilitate the use of public administrations' location data by non-governmental actors to stimulate innovation in products and services and enable job creation and growth	X			
GOVERNANCE, PARTNERSHIPS AND CAPABILITIES					
17.	Introduce integrated governance of location information processes at all levels of government, bringing together different governmental and non-governmental actors around a common goal	X		X	X
18.	Partner effectively to ensure the successful development and exploitation of location data infrastructures				
19.	Invest in communications and skills programmes to ensure sufficient awareness and capabilities to drive through improvements in the use of location information in digital public services and support growth opportunities				X

Digital Public Service Owner, Manager or Implementer						
RECOMMENDATIONS		TASKS				
		Plan	Design	Develop and test	Introduce and operate	Review and improve
POLICY AND STRATEGY ALIGNMENT						
1.	Connect location information and digital government strategies in all legal and policy instruments					
2.	Make location information policy integral to, and aligned with, wider data policy at all levels of government					
3.	Ensure all measures are in place, consistent with legal requirements, to protect personal privacy when processing location data.					
4.	Make effective use of location-based analysis and location intelligence for evidence-based policy making					
5.	Use a standards-based approach in the procurement of location data and related services in line with broader ICT standards-based procurement	X				
DIGITAL GOVERNMENT INTEGRATION						
6.	Identify where digital public services can be simplified or transformed using location information and location intelligence, and implement improvement actions that create value for users	X	X	X	X	X
7.	Use spatial data infrastructures (SDIs) in digital public services and data ecosystems across sectors, levels of government and borders, integrated with broader public data infrastructures and external data sources	X	X	X	X	X
8.	Adopt an open and collaborative methodology to design and improve location-enabled digital public services	X	X	X	x	X
9.	Adopt an integrated location-based approach in the collection and analysis of statistics on different topics and at different levels of government	X	X	X	X	X
STANDARDISATION AND REUSE						
10.	Adopt a common architecture to develop digital government solutions, facilitating the integration of geospatial requirements	X	X			
11.	Reuse existing authentic data, data	X	X	X	X	

	services and relevant technical solutions where possible					
12.	Apply relevant standards to develop a comprehensive approach for spatial data modelling, sharing, and exchange to facilitate integration in digital public services		X	X		
13.	Manage location data quality by linking it to policy and organisational objectives, assigning accountability to business and operational users and applying a "fit for purpose" approach	X	X	X	X	X
RETURN ON INVESTMENT						
14.	Apply a systematic approach to assessing and monitoring the benefits and performance of location-based services					X
15.	Communicate the benefits of integrating and using location information in digital public services					
16.	Facilitate the use of public administrations' location data by non-governmental actors to stimulate innovation in products and services and enable job creation and growth				X	X
GOVERNANCE, PARTNERSHIPS AND CAPABILITIES						
17.	Introduce integrated governance of location information processes at all levels of government, bringing together different governmental and non-governmental actors around a common goal	X				X
18.	Partner effectively to ensure the successful development and exploitation of location data infrastructures	X	X	X	X	X
19.	Invest in communications and skills programmes to ensure sufficient awareness and capabilities to drive through improvements in the use of location information in digital public services and support growth opportunities	X			X	

ICT Manager, Architect or Developer						
RECOMMENDATIONS		TASKS				
		Plan	Design	Develop and test	Release, operate and maintain	Review and improve
POLICY AND STRATEGY ALIGNMENT						
1.	Connect location information and digital government strategies in all legal and policy instruments					
2.	Make location information policy integral to, and aligned with, wider data policy at all levels of government					
3.	Ensure all measures are in place, consistent with legal requirements, to protect personal privacy when processing location data.					
4.	Make effective use of location-based analysis and location intelligence for evidence-based policy making					
5.	Use a standards-based approach in the procurement of location data and related services in line with broader ICT standards-based procurement	X				
DIGITAL GOVERNMENT INTEGRATION						
6.	Identify where digital public services can be simplified or transformed using location information and location intelligence, and implement improvement actions that create value for users		X	X	X	X
7.	Use spatial data infrastructures (SDIs) in digital public services and data ecosystems across sectors, levels of government and borders, integrated with broader public data infrastructures and external data sources	X	X	X	X	X
8.	Adopt an open and collaborative methodology to design and improve location-enabled digital public services	X	X	X	X	X
9.	Adopt an integrated location-based approach in the collection and analysis of statistics on different topics and at different levels of government	X	X	X	X	X
STANDARDISATION AND REUSE						
10.	Adopt a common architecture to develop digital government solutions, facilitating the integration of geospatial requirements	X	X			X

11.	Reuse existing authentic data, data services and relevant technical solutions where possible	X	X	X	X	X
12.	Apply relevant standards to develop a comprehensive approach for spatial data modelling, sharing, and exchange to facilitate integration in digital public services		X	X		
13.	Manage location data quality by linking it to policy and organisational objectives, assigning accountability to business and operational users and applying a "fit for purpose" approach	X	X	X	X	X
RETURN ON INVESTMENT						
14.	Apply a systematic approach to assessing and monitoring the benefits and performance of location-based services					X
15.	Communicate the benefits of integrating and using location information in digital public services					
16.	Facilitate the use of public administrations' location data by non-governmental actors to stimulate innovation in products and services and enable job creation and growth				X	X
GOVERNANCE, PARTNERSHIPS AND CAPABILITIES						
17.	Introduce integrated governance of location information processes at all levels of government, bringing together different governmental and non-governmental actors around a common goal	X				X
18.	Partner effectively to ensure the successful development and exploitation of location data infrastructures	X	X	X	X	X
19.	Invest in communications and skills programmes to ensure sufficient awareness and capabilities to drive through improvements in the use of location information in digital public services and support growth opportunities	X				

Data Manager or Data Scientist								
RECOMMENDATIONS		TASKS						
		Data policy and governance	Data specification and modelling	Data acquisition and quality	Data documentation, organisation and control	Data access, sharing and dissemination	Data warehousing and analytics	Data archiving
POLICY AND STRATEGY ALIGNMENT								
1.	Connect location information and digital government strategies in all legal and policy instruments	X						
2.	Make location information policy integral to, and aligned with, wider data policy at all levels of government	X	X					
3.	Ensure all measures are in place, consistent with legal requirements, to protect personal privacy when processing location data.	X	X	X	X	X	X	X
4.	Make effective use of location-based analysis and location intelligence for evidence-based policy making	X	X			X	X	
5.	Use a standards-based approach in the procurement of location data and related services in line with broader ICT standards-based procurement	X	X	X				
DIGITAL GOVERNMENT INTEGRATION								
6.	Identify where digital public services can be simplified or transformed using location information and location intelligence, and implement improvement actions that create value for users	X				X	X	
7.	Use spatial data infrastructures (SDIs) in digital public services and data ecosystems across sectors, levels of government and borders, integrated with broader public data infrastructures and external data sources	X	X	X		X	X	
8.	Adopt an open and collaborative methodology to design and improve location-enabled digital public services	X	X	X		X		
9.	Adopt an integrated location-based approach in the collection and analysis of statistics on different topics and at different	X	X			X	X	

	levels of government							
STANDARDISATION AND REUSE								
10.	Adopt a common architecture to develop digital government solutions, facilitating the integration of geospatial requirements	X	X		X		X	
11.	Reuse existing authentic data, data services and relevant technical solutions where possible	X		X	X	X	X	
12.	Apply relevant standards to develop a comprehensive approach for spatial data modelling, sharing, and exchange to facilitate integration in digital public services	X	X		X	X	X	
13.	Manage location data quality by linking it to policy and organisational objectives, assigning accountability to business and operational users and applying a "fit for purpose" approach	X	X	X	X	X	X	X
RETURN ON INVESTMENT								
14.	Apply a systematic approach to assessing and monitoring the benefits and performance of location-based services	X						
15.	Communicate the benefits of integrating and using location information in digital public services	X				X		
16.	Facilitate the use of public administrations' location data by non-governmental actors to stimulate innovation in products and services and enable job creation and growth	X				X		
GOVERNANCE, PARTNERSHIPS AND CAPABILITIES								
17.	Introduce integrated governance of location information processes at all levels of government, bringing together different governmental and non-governmental actors around a common goal	X	X	X	X	X	X	
18.	Partner effectively to ensure the successful development and exploitation of location data infrastructures	X						
19.	Invest in communications and skills programmes to ensure	X				X	X	

	sufficient awareness and capabilities to drive through improvements in the use of location information in digital public services and support growth opportunities							

Public Sector Location Data Provider								
RECOMMENDATIONS		TASKS						
		Plan for INSPIRE	Identify spatial data sets	Create and maintain reusable spatial data sets	Provide discovery, view and trans-formation services	Monitor and report on INSPIRE	Support use of spatial datasets
POLICY AND STRATEGY ALIGNMENT								
1.	Connect location information and digital government strategies in all legal and policy instruments	X				X	
2.	Make location information policy integral to, and aligned with, wider data policy at all levels of government	X	X	X		X	X
3.	Ensure all measures are in place, consistent with legal requirements, to protect personal privacy when processing location data.	X		X			
4.	Make effective use of location-based analysis and location intelligence for evidence-based policy making	X	X	X	X		X
5.	Use a standards-based approach in the procurement of location data and related services in line with broader ICT standards-based procurement	X		X	X		X
DIGITAL GOVERNMENT INTEGRATION								
6.	Identify where digital public services can be simplified or transformed using location information and location intelligence, and implement improvement actions that create value for users	X	X				X
7.	Use spatial data infrastructures (SDIs) in digital public services and data ecosystems across sectors, levels of government and borders, integrated with broader public data infrastructures and external data sources	X	X	X	X	X	X
8.	Adopt an open and collaborative methodology to design and	X					X

	improve location-enabled digital public services						
9.	Adopt an integrated location-based approach in the collection and analysis of statistics on different topics and at different levels of government	X	X	X	X		X
STANDARDISATION AND REUSE							
10.	Adopt a common architecture to develop digital government solutions, facilitating the integration of geospatial requirements	X			X	X	
11.	Reuse existing authentic data, data services and relevant technical solutions where possible	X	X	X	X	X	
12.	Apply relevant standards to develop a comprehensive approach for spatial data modelling, sharing, and exchange to facilitate integration in digital public services	X	X	X	X	X	
13.	Manage location data quality by linking it to policy and organisational objectives, assigning accountability to business and operational users and applying a "fit for purpose" approach		X	X	X	X	
RETURN ON INVESTMENT							
14.	Apply a systematic approach to assessing and monitoring the benefits and performance of location-based services	X					X
15.	Communicate the benefits of integrating and using location information in digital public services	X					X
16.	Facilitate the use of public administrations' location data by non-governmental actors to stimulate innovation in products and services and enable job creation and growth	X					X
GOVERNANCE, PARTNERSHIPS AND CAPABILITIES							
17.	Introduce integrated governance of location information processes at all levels of government, bringing together different governmental and non-governmental actors around a common goal	X					X
18.	Partner effectively to ensure the successful development and exploitation of location data infrastructures	X	X				X
19.	Invest in communications and skills programmes to ensure sufficient	X					X

	awareness and capabilities to drive through improvements in the use of location information in digital public services and support growth opportunities						

Private Sector Product or Service Provider							
RECOMMENDATIONS		TASKS					
		Insight and definition	Proto-typing and develop-ment	Testing and evaluation	Marketing and sales	Deploy-ment	Maint-enance and support
POLICY AND STRATEGY ALIGNMENT							
1.	Connect location information and digital government strategies in all legal and policy instruments						
2.	Make location information policy integral to, and aligned with, wider data policy at all levels of government	X	X				
3.	Ensure all measures are in place, consistent with legal requirements, to protect personal privacy when processing location data.						
4.	Make effective use of location-based analysis and location intelligence for evidence-based policy making				X	X	X
5.	Use a standards-based approach in the procurement of location data and related services in line with broader ICT standards-based procurement		X				
DIGITAL GOVERNMENT INTEGRATION							
6.	Identify where digital public services can be simplified or transformed using location information and location intelligence, and implement improvement actions that create value for users				X		
7.	Use spatial data infrastructures (SDIs) in digital public services and data ecosystems across sectors, levels of government and borders, integrated with broader public data infrastructures and external data sources	X	X				X
8.	Adopt an open and collaborative methodology to design and improve location-enabled digital public services	X	X	X	X	X	X
9.	Adopt an integrated location-based	X			X		

	approach in the collection and analysis of statistics on different topics and at different levels of government						
STANDARDISATION AND REUSE							
10.	Adopt a common architecture to develop digital government solutions, facilitating the integration of geospatial requirements	X	X		X		
11.	Reuse existing authentic data, data services and relevant technical solutions where possible	X	X		X		
12.	Apply relevant standards to develop a comprehensive approach for spatial data modelling, sharing, and exchange to facilitate integration in digital public services	X	X		X		
13.	Manage location data quality by linking it to policy and organisational objectives, assigning accountability to business and operational users and applying a "fit for purpose" approach	X	X	X		X	X
RETURN ON INVESTMENT							
14.	Apply a systematic approach to assessing and monitoring the benefits and performance of location-based services						
15.	Communicate the benefits of integrating and using location information in digital public services						
16.	Facilitate the use of public administrations' location data by non-governmental actors to stimulate innovation in products and services and enable job creation and growth	X	X	X	X	X	X
GOVERNANCE, PARTNERSHIPS AND CAPABILITIES							
17.	Introduce integrated governance of location information processes at all levels of government, bringing together different governmental and non-governmental actors around a common goal	X			X		
18.	Effective partnering is key to the successful development and exploitation of location data infrastructures	X			X		
19.	Invest in communications and skills to ensure sufficient awareness and capabilities to drive through improvements in the use of location information in digital	X					

	public services and support growth opportunities						

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