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EVALUATION

**of DIRECTIVE 2007/2/EC establishing an Infrastructure for Spatial Information in the
European Community (INSPIRE)**

{SWD(2022) 196 final}

Table of contents

1.	INTRODUCTION	5
1.1.	Purpose and scope	5
2.	BACKGROUND TO THE INTERVENTION	8
2.1.	Description of the intervention and its objectives	8
2.2.	Baseline and points of comparison.....	14
3.	IMPLEMENTATION / STATE OF PLAY	15
3.1.	Description of the current situation.....	15
3.2.	How has the implementation and application of INSPIRE evolved from 2014 to 2020 and how it has affected different stakeholders?.....	15
3.3.	To what extent have the recommendations from the 2016 INSPIRE REFIT evaluation been implemented?	19
3.3.1.	Follow-Up on 2016 REFIT evaluation recommendations by the Commission	20
3.3.2.	Follow-Up on 2016 REFIT evaluation recommendations by Member States	21
3.4.	Compliance promotion and assurance.....	22
4.	METHOD.....	23
4.1.	Short description of methodology	23
4.2.	Limitations and robustness of findings	24
4.3.	Comparison of implementation results across the reporting years	24
4.4.	Measuring impacts of the INSPIRE Directive	24
4.5.	Quantification of costs and benefits	24
4.6.	Representativeness of consultation results	25
4.7.	Difficulty in distinguishing INSPIRE from other spatial data.....	25
5.	ANALYSIS AND ANSWERS TO THE EVALUATION QUESTIONS	25
5.1.	Relevance	26
5.1.1.	To what extent does INSPIRE still match current needs and do they continue to require action at EU level?.....	26
5.1.2.	Is INSPIRE still relevant to the issues (obstacles) it addresses?	27
5.1.3.	To what extent is INSPIRE future-proof?	28
5.1.4.	Are the Articles 7 and 8 of the Public Access to Environmental Information Directive still relevant in view of the current state of the INSPIRE infrastructures?	29
5.2.	Effectiveness	30
5.2.1.	What progress has been made over time towards achieving the objectives and targets set out in INSPIRE in various Member States?	30
5.2.2.	Is the progress made in line with the initial expectations and the INSPIRE implementation roadmap?.....	32
5.2.3.	Is the geographical coverage of implementation consistent with the Directive's objectives?	33
5.2.4.	To what extent does the implementation of the INSPIRE Directive in the Member States build further on the obligations of Public Access to Environmental Information Directive (specifically the provisions under Articles 7 and 8 under the Public Access to Environmental Information Directive)?	34
5.2.5.	Which main factors have contributed to – respectively stood in the way of achieving these objectives?	35
5.2.6.	To what extent is INSPIRE used for reporting under the environmental acquis? 37	

5.2.7.	What are the qualitative and quantitative effects of INSPIRE on the policymaking users in the field of environment in Member States?	38
5.2.8.	What are the qualitative and quantitative effects of INSPIRE on users active in economic sectors influencing environment?	40
5.2.9.	What are the effects of INSPIRE on small businesses using spatial data?.....	42
5.3.	Efficiency	43
5.3.1.	To what extent, and how has the intervention lead to improvements in the quality or efficiency of work of concerned stakeholders?.....	43
5.3.2.	Can any specific provisions in INSPIRE be identified that make cost-efficient implementation more difficult?.....	45
5.3.3.	Can the INSPIRE Directive and implementing rules be made more cost-efficient? What is the simplification potential?.....	47
5.3.4.	Are results achieved so far commensurate with the resources put forward and in line with the ones expected from the ex-ante evaluation of INSPIRE?	48
5.3.5.	How proportionate were the costs of the intervention for different stakeholder groups (enterprises including SMEs, citizens ...)?.....	50
5.3.6.	Have the resources needed to implement INSPIRE been available?	52
5.3.7.	How has the use of INSPIRE for environmental reporting affected the reporting burden?	52
5.3.8.	How would further streamlining of the provisions in Articles 7 and 8 of the Public Access to Environmental Information Directive with the active dissemination provisions of the INSPIRE Directive impact the administrative burden on the Member States.....	53
5.4.	Coherence.....	55
5.4.1.	To what extent is INSPIRE coherent internally?.....	55
5.4.2.	To what extent is INSPIRE coherent with environmental legislation with geospatial reporting obligations?.....	55
5.4.3.	To what extent is INSPIRE coherent with other relevant areas of EU policy with geospatial reporting obligations (transport, agriculture, maritime, space, health, disaster management, research)?.....	56
5.4.4.	To what extent is INSPIRE coherent with the Public Access to Environmental Information Directive and the objectives of the Common European Green Deal data space?	57
5.4.5.	To what extent is INSPIRE coherent with Directive (EU) 2019/1024 on open data and the re-use of public sector information and what are the implications of Directive 2019/1024/EU?	58
5.5.	EU Added Value	60
5.5.1.	What is the EU-added value of INSPIRE in comparison to what could be achieved at Member States national and/or regional level activities?	60
5.5.2.	To what extent do the issues addressed by INSPIRE continue to require action at EU level?.....	64
6.	CONCLUSIONS.....	65
6.1.	Conclusions in details	65
6.2.	Relevance	66
6.3.	Effectiveness	67
6.4.	Efficiency	68
6.5.	Coherence.....	71
6.6.	EU added value.....	73
6.7.	Lessons Learned	74

Glossary

<i>Term or acronym</i>	<i>Meaning or definition</i>
AAQD	Ambient Air Quality Directive
BRG	Better Regulation guidelines
CAP	Common Agricultural Policy
CKAN	Comprehensive Knowledge Archive Network
EAP	Environment Action Programme
EEA	European Environmental Agency
EFTA/EEA	European Free Trade Association/ European Economic Area
EGNOS	European Geostationary Navigation Overlay Service
EIA	Environmental Impact Assessment
EIS	Environmental Information Systems
EMODnet	European Marine Observation and Data Network
E-PRTR	European Pollutant Release and Transfer Register
GIS	Geographic Information System
GML	Geography Markup Language. The Geography Markup Language (GML) is the XML grammar defined by the Open Geospatial Consortium (OGC) to express geographical features. GML serves as a modeling language for geographic systems as well as an open interchange format for geographic transactions on the Internet.
GSAA	Geo-Spatial Aid Application
HELCOM	The Baltic Marine Environment Protection Commission (Helsinki Commission - HELCOM) is an intergovernmental organization governing the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention).
HILUCS	Land Use Classification System
IACS	European Union countries are responsible for the administration and control of payments to farmers in their country under a principle known as 'shared management'. The main building block of the management of payments system is the integrated administration and control system (IACS).
IED	Industrial Emissions Directive
INSPIRE Directive	Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)
ISO	International Organisation for Standardisation
IR	Implementing Rules
ITS	Intelligent Transport Systems
JRC	Joint Research Centre
LPIS	Land Parcel Identification System
MIG	Maintenance and Implementation Group

MSFD	Marine Strategy Framework Directive
MSP	Maritime Spatial Planning
NCP	National Contact Point for the INSPIRE Directive
NSDI	National Spatial Data Infrastructure
OAI-PMH	Open Archives Initiative Protocol for Metadata Harvesting
OGC	Open Geospatial Consortium
OGC-CSW	Open Geospatial Consortium - Catalogue Service for the Web
POP	Persistent Organic Pollutant
PSI	Reuse of Public Sector Information Directive
REFIT	Regulatory Fitness and Performance Programme
SDI	Spatial Data Infrastructure
SEANSE	Strategic Environmental Assessment North Sea Energy
SEA	Strategic Environmental Assessment
SEIS	Shared Environmental Information System
TEN-T	Trans-European Transport Network
UWWT	Urban Waste Water Treatment Directive
WFD	Water Framework Directive
WMS	A Web Map Service (WMS) is a standard protocol developed by the Open Geospatial Consortium for serving georeferenced map images over the Internet.
WMTS	A Web Map Tile Service (WMTS) is a standard protocol for serving pre-rendered or run-time computed georeferenced map tiles over the Internet. The specification was developed and first published by the Open Geospatial Consortium.

1. INTRODUCTION

The present evaluation presents the results of the Commission's evaluation of Directive 2007/2/EC on Infrastructure for Spatial Information in the European Community (hereinafter INSPIRE). It was included in the Commission Work Programme 2021 as part of the 'GreenData4All' initiative. The evaluation findings will be used in follow-up actions under the European Strategy for Data (COM (2020) 66 final) and as a digital enabler for the European Green Deal initiative (COM (2019) 640 final) including initiatives announced in the Commission Work programme for 2022.

1.1. Purpose and scope

The Commission is obliged to evaluate the INSPIRE Directive every five years (starting at the latest in 2022) pursuant to Article 23 of Regulation 2019/1010¹ on the alignment of reporting obligations in the field of legislation related to the environment that amended the INSPIRE Directive.

The evaluation has analysed the underlying mechanisms that have either contributed to or hindered the attainment of the initially defined objectives of the INSPIRE Directive (i.e. 'the intervention'). The evaluation also builds on the mid-term evaluation published in 2016² and on studies prepared in 2019, in particular, the study on the promotion of good practices for national environmental information systems and tools for data harvesting at EU level, the 2019 Communication on Environmental Implementation Review and the study on Article 17 of the INSPIRE Directive on data-sharing. Furthermore, the evaluation gathered views from users to assess whether the appropriate data is available in a user-friendly format and in sufficient quantity to meet their needs.

The INSPIRE Directive obliges Member States to share existing geospatial data³ to support European Union (EU) environmental policies and policies or activities which may have impact on the environment. INSPIRE should build on existing infrastructures for spatial information⁴ already established and operated by the Member States. Within this infrastructure, existing information systems of different authorities are connected in order to share, find and use spatial data more easily while relying on common high quality data standards. As a result, data should be comparable and useable in a cross-border and cross-sector context allowing e.g. to avoid damage to the environment and human health. This approach to sharing of governmental data was extended through the EU's 2015 Digital Single Market strategy⁵. Building on similar principles, the EU's 2016 eGovernment Action Plan⁶ identified the establishment of a European Spatial Data Infrastructure through the implementation of INSPIRE as an important action that would

¹ Regulation (EU) 2019/1010 of the European Parliament and of the Council of 5 June 2019 on the alignment of reporting obligations in the field of legislation related to the environment

² Commission Report (COM(2016)478/2) and Staff Working Document on the midterm evaluation of the INSPIRE Directive (SWD(2016)273))

³ See Textbox 1 - What are spatial data?

⁴ See Textbox 2 - What is a spatial data infrastructure?

⁵ <https://ec.europa.eu/digital-single-market>

⁶ <https://ec.europa.eu/digital-single-market/en/news/infographic-egovernment-action-plan-2016-2020-glance>

help modernise public administrations, connect services across borders and engage citizens through digital interactions with governments across the EU.

Directive 2003/4/EC on public access to environmental information (Public Access to Environmental Information Directive) implements parts of the Aarhus Convention⁷ relating to environmental information that authorities must make available to the public. The provisions in the Public Access to Environmental Information Directive date almost 20 years back. The rapid development in digital technologies and emergence of new data sources such as citizen science⁸ and environmental sensors justify an evaluation of the data sharing and data access provisions embodied in Articles 7 and 8 of the Public Access to Environmental Information Directive. These provisions are therefore part of this evaluation's scope.

These two legal instruments are the backbone of the environmental information management covering the whole of EU environmental policy. The instruments require Member States to provide public access to environmental information in an easily understandable, user-friendly manner. The framework facilitates public access to spatial information, with a view to involving members of the public further in decision-making.

Recently, the EU has embarked on a green and digital transition. The two dimensions are closely interrelated, and the Commission has taken the lead to drive these transitions and to focus investments on recovery and resilience in these areas. The 2019 European Green Deal⁹ recognises the potential of digitalisation to achieve environment and climate aims and the necessity to explore sustainable digital technologies as essential enablers of the changes needed for a just green transition.

In February 2020, the Commission adopted its new digital strategy titled 'Shaping Europe's Digital Future'¹⁰ along with its first two pillars: the European Strategy for Data¹¹ and a White Paper on Artificial Intelligence¹². The European Strategy for Data sets a vision for mutually supporting transitions to a healthy planet and a new digital world. The Strategy also recognises the necessity of data for the public good. Among other uses, the European Strategy for Data indicates that data can serve to address societal challenges, combat environmental emergencies and tackle environmental degradation and climate change. The European Strategy for Data specifically supports the Green Deal through the development of a common European Green Deal data space. The main legislative pillar for bringing data from public administrations into this Green Deal data space is the INSPIRE Directive together with the Directive on public access to environmental information. Both Directives respond to the need for better information and data that are more accessible to support policy development and better implementation. It is therefore important that they deliver as intended and keep pace with

⁷ Council Decision 2005/370/EC - <https://eur-lex.europa.eu/eli/dec/2005/370/oj>

⁸ Citizen science is scientific research conducted, in whole or in part, by amateur (or nonprofessional) scientists whose outcomes often provide advancements in scientific research, as well as an increase in the public's understanding of science.

⁹ https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

¹⁰ COM(2020) 64 final, Shaping Europe's digital future - <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0064>

¹¹ COM(2020) 66 final, A European strategy for data - <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0066>

¹² COM(2020) 65 final, White Paper On Artificial Intelligence - A European approach to excellence and trust - <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:65:FIN>

emerging technological developments. The European Strategy for Data has recognised the importance of this existing data sharing framework and has announced a ‘GreenData4All’ initiative that includes, as a starting point, the assessment of the interaction between INSPIRE Directive 2007/2/EC and Public Access to Environmental Information Directive. The overall objective of the ‘GreenData4all’ is to:

- modernise both the INSPIRE and the Public Access to Environmental Information Directives to align them with the contemporary state of technology;
- promote active dissemination and sharing of public- and private-held public data in support of the environmental acquis and the Green Deal objectives; and
- define and implement interoperable building blocks for sharing public data in the Green Deal data space and in alignment with the respective activities of the Destination Earth initiative, as a main contributing action in the context of the Green Deal Data Space.

This evaluation covers the implementation and application of the INSPIRE Directive and its implementing rules in all EU Member States and the EEA/EFTA countries¹³ and has followed better regulation guidelines¹⁴. External consultants have in addition supported the assessment of the information collected¹⁵. The general public, representatives of public administrations and industry stakeholders have participated in this process.

For the effectiveness criterion, the present evaluation looks into how the INSPIRE Directive delivered on its objectives, in particular how it has contributed to different use-cases, such as sharing of data between Member State authorities, public access to spatially enabled environmental information (active dissemination) and regulatory reporting.

Under the efficiency criterion, the evaluation looks into cost-efficiency of the intervention and identified potential unnecessary administrative burden of the Directive and its Implementing Rules.

For assessment of coherence, the following policy areas, policy initiatives and legislative acts have been considered:

- the Public Access to Environmental Information Directive (in particular Articles 7 and 8 of the latter), how these provisions complement the INSPIRE Directive in terms of actively disseminating environmental information to the public;
- The European Green Deal;
- The European Strategy for Data;
- Directive 2019/1024/EC on open data (the ‘Open Data Directive’) and the re-use of public sector information, including the implementing act on High Value Datasets that is under preparation;

¹³ Iceland, Liechtenstein, Norway, Switzerland.

¹⁴ Better Regulation Guidelines Toolbox Tool #47: Evaluation Criteria and questions.

¹⁵ COWI A/S, Milieu, Technopolis Group, (2021) ‘Support to the evaluation of the implementation of the Directive 2007/2/EC on Infrastructure for Spatial Information in the European Community (INSPIRE)’

- EU environment legislation;
- EU laws that contain a reference to Inspire.

Under the relevance criterion, the evaluation also considered if the INSPIRE Directive and articles 7 and 8 of the Public Access to Environmental Information Directive are still sound in light of the current state of technology.

2. BACKGROUND TO THE INTERVENTION

2.1. Description of the intervention and its objectives

Developing and implementing EU environment policy requires a solid scientific knowledge and evidence base on environmental pressures, state and impacts for a large number of areas, not only in air, water or nature but also in all economic sectors which have an impact on the environment.

Since 2002, the EU Sustainable Development Strategies^{16,17} and the Environmental Action Programmes¹⁸ addressed these issues and identified the need for better information to support the integrated¹⁹ knowledge-base for environmental policies. The Commission came forward with a proposal for the INSPIRE Directive in 2004²⁰ focussing mainly on 'spatial data', i.e. information related to a location or area on Earth²¹. This issue has been also underlined in the European Green Deal.

Textbox 1 - What are spatial data?

What are spatial data and why do we need to share them across borders?

Spatial data are everywhere and we use them on a daily basis. Spatial data are data that are linked to a specific location, e.g. an address, the location of a building, a road, a river, an industrial or commercial facility, a monitoring station or a cadastral parcel. For thousands of years, we used maps or an atlas for this purpose. With digitalisation, it has become much easier to manage and use spatial data. Nowadays, we take it for granted to navigate using satellite navigation or to check the location of anything on the Internet using our electronic devices. The modern world needs increasingly up-to-date spatial data and the use of spatial data is constantly on the rise. We want to know where things are and what is happening there (e.g. the weather forecast or bathing water quality at our holiday destination).

¹⁶ Commission Communication "[A sustainable Europe for a better world: A European strategy for Sustainable Development](#)" (COM(2001) 264)

¹⁷ [2009 Review of the EU Sustainable Development Strategy COM \(2009\) 400](#)

¹⁸ Decision No 1600/2002/EC (6th EAP), DECISION No 1386/2013/EU (7th EAP), COM(2020) 652 final (proposal 8th EAP)

¹⁹ Integrated across policy and economic sectors

²⁰ COM(2004)516

²¹ INSPIRE Directive Article 3(2), definition of 'spatial data': 'any data with a direct or indirect reference to a specific location or geographical area'. For example: spatial data can be a polygon with coordinates defining the borders of a protected site, the exact location of a point of emission into the environment, the borders of an industrial site, facility, building or an administrative unit. But it can also be data collected on species occurring within and referenced to such a protected site or the measurements taken by a sensor at the point of emission, it can be administrative data related to an industrial facility or statistical data related to the geographical area of the administrative unit such as for example, population density or a value describing the air quality at such a location during a certain period.

Consider the example of the volcano eruption in Iceland in 2010. Immediately, data on air pollution and visibility were needed across Europe. This was urgent for services such as air traffic control but also for understanding the impacts the eruption was having on air quality and hence the health of citizens. The easier and quicker such data could be shared across borders, the better decisions could be taken.

The data infrastructure set by the INSPIRE Directive specifically serves these kind of situations and purposes. It applies in many other environmental issues which have a cross-border effect, be it flooding, pollution or the tracing of migratory birds²².



In order to use such spatial data across administrative levels or borders, they need to be standardised and easy to use, view, search or download. The main challenge is when data are used across borders, standardisation is often missing. In the past, we could find different terms, definitions, attributes or scale levels and all of this in different languages. Drawing from this experience, INSPIRE ensures that spatial data can be accessed and compared across borders and also to use them for electronic services.

Environment knows no borders!

Air pollution knows no borders

68% of air pollution* is imported from outside Belgium

84% of air pollution* emitted in Belgium is exported

floods

Importance of cross-border collaboration

About 20% of the EU citizens (89,2 million) live within 50 km from a border

70% of all fresh water bodies in Europe are part of a trans-boundary river basin

Spatial data is a catalyst for reusing and aggregating information from different sources and different domains

EU-SPOL

MARE

CoVID-19 Covid Current Risk

A wide range of environmental, geographical, social and economic spatial data exists and is being collected. Such location-based information is relevant for environmental policies, covering many thematic areas (water, air, biodiversity, waste, emissions, impact assessments, natural and technological hazards, public access to environmental information, etc.). Also in the context of policies having an impact on the environment (such as transport, agriculture, energy, land-use planning, regional development, etc.) spatial data is systematically collected. This is valuable in the context of environmental policy development and implementation. The INSPIRE Directive was designed to address the spatial data needs of thematic environmental policies by removing the four main categories of obstacles to the availability of such data:

²² For further illustration, see <https://www.youtube.com/watch?v=xew6qI-6wNk>

1. A wide variety of organisational, cultural, institutional, financial and legal obstacles²³ hampered the sharing and re-use of spatial data by public authorities and public stakeholders;
2. Spatial data were difficult to find on the Internet and poorly documented;
3. Many public authorities did not have online services in place allowing consultation and use of their spatial data;
4. Spatial data was often organised in incompatible formats making it difficult to combine different spatial data sets in the absence of a common vocabulary.

The INSPIRE Directive does not require the collection of new data, or establish requirements on the scale or the quality of spatial data. The Directive promotes the sharing of existing spatial data relevant to environmental policies through the spatial data infrastructures that are operated by the Member States.

The intervention logic for the INSPIRE Directive is described in Annex 4, part B. It sets out the different measures of the Directive and how they were expected to interact. The intervention logic used in the evaluation in 2016 has been revised to provide a solid foundation illustrating the causal chains and the underlying assumptions that guide the current evaluation of the INSPIRE Directive and its implementation. The intervention logic is relevant at two levels: (a) to establish an overall understanding of the whole intervention ('big picture view' of the implementation of the INSPIRE Directive) and the interlinkages between the different provisions; (b) to establish an in-depth understanding of the causal pathways and assumptions for each type of activity.

The **general objective**²⁴ of the INSPIRE Directive remains the establishment of an EU-wide infrastructure for spatial information based on compatible Member States infrastructures and that is useable in a trans-boundary context within the EU for the purposes of EU environmental policies and policies or activities which may have an impact on the environment.

Textbox 2 - What is a spatial data infrastructure?

What is a European spatial data infrastructure (as promoted by the INSPIRE Directive)?

A European Spatial Data Infrastructure (ESDI) is about making it easier to *find, use* and *share* the available data from administrations and governments, in particular across border and throughout the whole of the European Union. The idea is to develop an approach which follows a number of common principles:

- Data should be collected only once and kept where it can be maintained most effectively.
- It should be possible to combine seamless spatial information from different sources across Europe and share it with many users and applications.
- It should be possible for information collected at one level/scale to be shared with all

²³ Gaps in spatial data availability; Duplication of data collection efforts, even within organisations; Non-harmonised spatial data which made it difficult to combine and to integrate data in applications; Lack of documentation, which made it difficult for potential users to assess whether the data were "fit for use"; Data were difficult to find and not easy to access, with often many and complex procedures and agreements to be established before access is given or before data are obtained; Data are often expensive;

²⁴ INSPIRE Directive preamble (5) and Article 1

levels/scales (from local to regional, to national to the EU level).

- Geographic information needed for good governance at all levels should be readily and transparently available.
- Available geographic information should be easy to find and it should be clear how it can be used to meet a particular need, and under which conditions it can be acquired and used.

INSPIRE has translated these principles into legislation. Building on already existing national Spatial Data Infrastructures in the Member States, it sets the foundation for the creation of a European Spatial Data Infrastructure for the European Union. It establishes requirements for the governance of the organisational (coordination amongst public administrations, identification of spatial data) and technical components (quality of data, metadata, interoperable services supporting view, search and download) of the Spatial Data Infrastructure. These requirements enable the sharing of environmental spatial information among public sector organisations and better facilitate public access to spatial information across Europe.

The development of such a European spatial data infrastructure should create, amongst other benefits, the reduction of administrative burdens and the creation of new business opportunities. Businesses are now using such administrative data to provide better services to the public (such as combining predictions on weather and air quality or integrating real-time traffic information in business processes such as providing information about road construction sites through satellite navigations)²⁵. The insurance sector is increasingly using geographical data to improve profitability by improving their understanding of risks at locations and verifying the content of claims. Moreover, real estate companies are increasingly factoring in environmental information, e.g. when determining house prices (e.g. whether they are situated in a flood risk area)²⁶ and utility network operators are leveraging spatial data to avoid excavation damage²⁷.

Therefore, INSPIRE sets a coherent legal framework for:

- Sharing spatial data across the EU;
- Coordination structures on spatial information at Member States and EU level;
- Identification of spatial data needed²⁸;
- Documentation of identified spatial data through metadata²⁹;
- Ensuring that the documented spatial data is accessible online through data services allowing its discovery, view and download and, where needed transformation;
- Organising the documented spatial data in interoperable data models with a common vocabulary and online accessible through the IT services;
- Allow data access and reuse over administrative and national borders through data sharing.

²⁵ E.g. <https://www.plumelabs.com/> or <https://www.simacan.com> or ...

²⁶ E.g. <http://www.directionsmag.com/entry/dutch-kadaster-tackles-european-inspire-initiatives-for-spatial-data-infras/122509> ;

²⁷ E.g. <https://joinup.ec.europa.eu/node/150019/>

²⁸ According to the thematic scope defined in the Annexes I, II and III of the Directive and detailed in [INSPIRE - "Data Specifications" –D2.3: Definition of Annex Themes and Scope](#), 2008

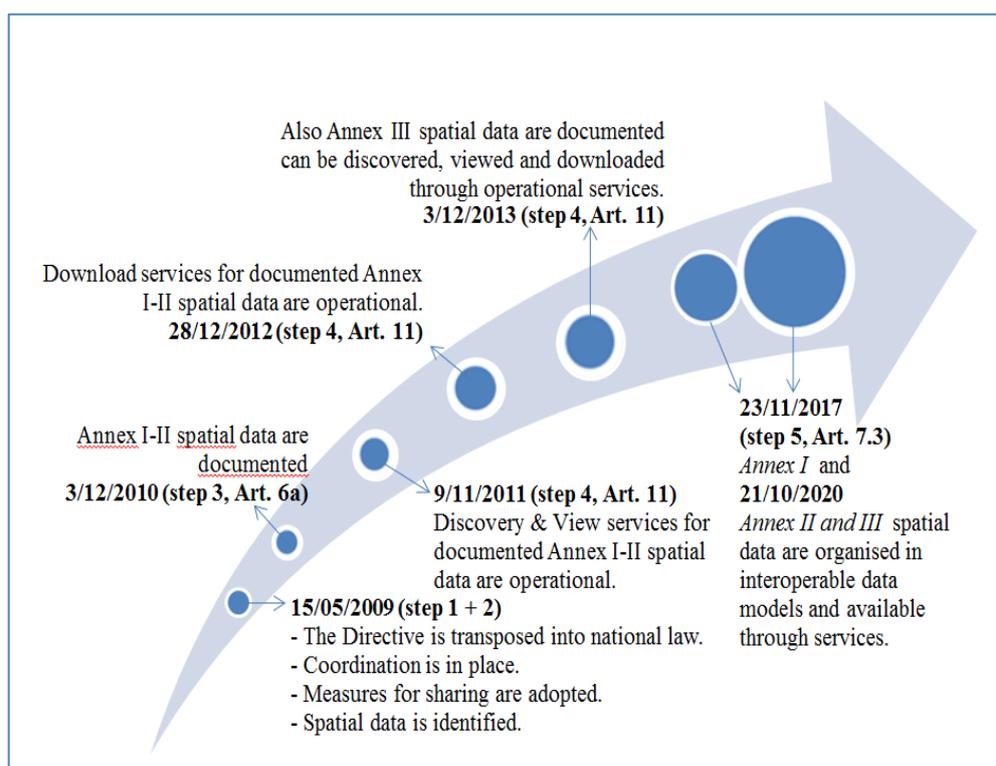
²⁹ Metadata provides structured information allowing the spatial data to be discovered online, to know its origins, the conditions for use and to evaluate its fitness for purpose.

This framework is implemented through 14 'actions' as explained below. These actions are the specific provisions of the INSPIRE Directive imposing obligations mainly on Member States but also on EU institutions. Those actions should be implemented according to an agreed timetable, in several 'steps' as laid down in the INSPIRE Directive and its implementing rules³⁰. Overall, the actions can be grouped into five distinctive steps (see also Figure 1, a more detailed overview is provided in Annex 4, Part A):

- Step 1 concerns transposition, the establishment of coordination structures and a data policy.
- Steps 2-5 relate to a sequential set of actions all related to 'spatial data'. They have to be identified (step 2) and documented (step 3). Thereafter, online services (step 4) have to be established and finally the spatial data should be transformed (step 5) in accordance with agreed data models in order to facilitate the re-use of the data.

At the time of this evaluation, most of the obligations under the five steps had to be completed³¹.

Figure 1: INSPIRE Implementation major milestones and outputs



Who will benefit from the Directive's implementation?

³⁰ The Commission is empowered to adopt Common Implementing Rules (IR) in a number of specific areas (Metadata, Data Specifications, Network Services, Data and Service Sharing and Monitoring and Reporting).

³¹ Only the deadline to make invocable spatial data services conformant with Annexes VI and (where practicable) VII of Commission Regulation (EU) No 1089/2010 as regards interoperability of spatial data services was still in the future (deadline 10/12/2021)

Two different sorts of benefits are identified: (a) benefits in terms of cost savings i.e. efficiency gains, enabling existing needs to be met more cheaply (these benefits accrue to both data producers and data users); and (b) benefits in terms of the ability of users to access and to use data in new and innovative ways increasing productive potential or improving the efficiency and effectiveness of policy responses.

The INSPIRE Directive will ensure overall coherence and ease of use of the spatial data underpinning the information made available to citizens. The resulting better information to the public will lead to increased confidence in the accuracy and relevance of public sector information, leading to more engagement in the democratic process of environmental protection and, eventually, in other areas of government action. The INSPIRE Directive will also enable public sector information to be exploited by the private sector, thereby stimulating the creation of added value services useful to the public. INSPIRE will furthermore allow the private sector to publish their data along with the public sector data, provide to public and private organisations a wider choice of data to underpin their activities.

National authorities and data providers will be beneficiaries in terms of gains in efficiency and in terms of the potential for improvements in policy performance. They will however also have to attribute the necessary resources for the implementation of the INSPIRE Directive. Whether authorities or providers are net contributors or beneficiaries will depend on a number of factors, e.g. the extent to which the organisation is both user and producer, the degree of standardisation already achieved etc.

Citizens, private sector data users, research institutes are mainly beneficiaries of the INSPIRE Directive. The benefits for these organisations arise from having (potential) access to existing data. Private sector data users and research institutes will reduce their search costs and reduce costs of data collection.

The European Commission, international bodies and academic institutions are possible beneficiaries since INSPIRE will reduce the costs of analysing pan-European information for policy making and policy implementation purposes.

2.2. Baseline and points of comparison

The state-of-play summary report³² of December 2007 was used to establish a baseline for the status of national spatial data infrastructures as it reflects the situation at the time of entry into force of the Directive.

In 2014, the Commission presented a report on the implementation of INSPIRE to the European Parliament and to the Council³³ assessing whether the INSPIRE Directive was still fit-for-purpose at the half way mark of its implementation. The midterm evaluation, that looked at the progress made between 2007 and 2014 including the transposition of the Directive into national law. It showed that many of the barriers identified in the original Impact Assessment³⁴ were still relevant. Despite the progress made by some Member States, the implementation gaps in most Member States were significant and underlined the differences in speed and quality of implementation. The findings in relation to the different implementation steps were summed up as follows:

- All Member States had coordination structures in place, but their effectiveness was variable;
- National data policies for sharing data were highly variable and heterogeneous;
- Progress was made as regards the spatial datasets identified and reported. However, for many Member States, the numbers remained low (less than 150) and with limited thematic coverage;
- Implementation of the documentation obligations was advanced, yet only 12 Member States had documented 80 to 100 % of their reported spatial data in line with the INSPIRE Directive by 2014;
- Member States made progress on the online discovery services available for their identified and documented datasets. These services give users access to the documentation. The overall availability of digital services for viewing and downloading spatial data for further use was less advanced;
- The interoperability of the spatial datasets had not advanced much mainly because the main implementation deadlines were still in the future (2017, 2020).

The 2014 evaluation marks an interim implementation milestone. The end date for the period covered by the evaluation is January 2021. This evaluation assesses the further implementation progress between 2014 and 2021 building on the evidence gathered for the midterm evaluation and provides an understanding on how the situation during this period has changed, also compared to the situation prevalent at the time of the adoption of the Directive in 2007. Such consideration allows to evaluate progress against the initial objectives set for the intervention and to conclude whether and to what extent it has still been relevant over the last seven years (2014-2021).

³² <https://inspire.ec.europa.eu/reports/stateofplay2007/INSPIRE-SoP-2007v4.pdf>

³³ The finalisation was delayed due to extensive analysis that was carried out also as a result of inclusion of the INSPIRE Directive in the REFIT programme.

³⁴ INSPIRE (2003), Report on the feedback of the Internet consultation on a forthcoming EU initiative establishing a framework for the creation of an Infrastructure for Spatial Information in Europe. Available at: https://inspire.ec.europa.eu/reports/analysis_consultation_01092003.pdf

The baseline for quantitative and qualitative indicators to measure and compare progress is based on the monitoring and reporting provisions in the INSPIRE Directive that require Member States to monitor and report on the implementation status on an annual basis. Until 2018, Commission Decision 2009/442/EC³⁵ regulated monitoring and reporting. In 2019, this Decision was repealed and replaced by Commission Implementing Decision (EU) 2019/1372³⁶, which introduced the automated calculation of 19 new indicators through the direct use of the INSPIRE Geoportal and the INSPIRE Reference Validator³⁷ to process the metadata harvested from Member States discovery services.³⁸ These indicators are grouped into five categories: availability of spatial data and services, conformity of metadata, conformity of spatial data sets, accessibility of spatial data sets through view and download services, and conformity of network services. Most indicators are calculated as a percentage, thus providing a direct measure of performance and allowing country-by-country comparisons. The scoring methodology for monitoring indicators used for this evaluation is mimicking the JRC Summary Report on Status of implementation of the INSPIRE Directive in EU (the 2016 country fiches)³⁹.

3. IMPLEMENTATION / STATE OF PLAY

3.1. Description of the current situation

This section describes the implementation status of the INSPIRE Directive in each of the 27 Member States⁴⁰ and the 4 EEA/EFTA countries at the beginning of 2021, including a reflection to which extent the 2016 INSPIRE midterm evaluation recommendations have been followed up and implemented.

The simplified intervention logic described in Figure 1 is the basis for the evaluation. A detailed intervention logic is provided in Annex 1, Part B. Before assessing these elements, the status of implementation in relation to the actions which were already required by end 2020 is described on the basis of country summary reports, yearly monitoring data, country fiches⁴¹ and data and services available in the EU geoportal⁴².

3.2. How has the implementation and application of INSPIRE evolved from 2014 to 2020 and how it has affected different stakeholders?

All Member States have installed a coordination structure and governance for their INSPIRE implementation. Since 2014 we see a continuous positive trend in ensuring an effective coordination of the implementation of the INSPIRE Directive in the Member

³⁵ OJ L 148, 11.6.2009, p. 18–26

³⁶ OJ L 220, 23.8.2019, p. 1–5

³⁷ <https://inspire.ec.europa.eu/validator>

³⁸ For a detailed description of all indicators and their calculation see: Minghini, M., Cetl, V., Ziemba, L.W., Tomas, R., Francioli, D., Artasensi, D., Epure, E. and Vinci, F., Establishing a new baseline for monitoring the status of EU Spatial Data Infrastructure, EUR 30513 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-27384-4, doi:10.2760/296219, JRC122351.

³⁹ Cetl V., V. Nunes de Lima, R. Tomas, M. Lutz, J. D'Eugenio, A. Nagy, J. Robbrecht (2017), Summary Report on Status of implementation of the INSPIRE Directive in EU. EUR 28930 EN. Luxembourg: Publications Office of the European Union.

⁴⁰ See Annex 6 for a more detailed view on the implementation maturity across Member States.

⁴¹ Country summary reports, yearly monitoring data, country fiches are publicly available at <https://inspire.ec.europa.eu/INSPIRE-in-your-Country>

⁴² <https://inspire-geoportal.ec.europa.eu/>

States. This is mainly demonstrated by a more comprehensive and complete representation of public administrations responsible for maintaining and publishing spatial data in scope of the INSPIRE Directive (national mapping agencies, cadastres, environmental administrations, statistical administrations, ...). The coordination structure reflects the administrative culture and the constitutional setup of the Member State (federated vs centralized, involvement of local authorities). In some cases, the INSPIRE Directive implementation was initially setup purely from a national mapping and cadastral agencies (NMCA) perspective, resulting in a strong focus on Annex I and II data sets following the implementation roadmap timeline and showing gaps on the availability of Annex III data sets and the coordination with the environmental domain. Awareness has been raised and most Member States have started to remediate this deficiency.

The documentation of spatial data sets and services through metadata has proven to raise the awareness about the availability of spatial data in the public administration and as such has improved spatial data sharing and use. Usage of discovery services is limited mostly to professional users thus making spatial data and services not discoverable for wider user community. In Member States where the service offering is limited or of low quality, usage of the infrastructure tends to be limited. In some Member States, the Open Data Directive is higher on the political agenda and more importance is given to making data available as open data. This does not necessarily conflict with the ambitions of the INSPIRE Directive. On the contrary, in information-mature Member States where Open Data and INSPIRE ambitions are implemented in a complementary way the use of spatial data and the INSPIRE infrastructure is prevalent. In Member States where the only driver for the implementation of the INSPIRE Directive is its legal obligation and where no use cases are being developed or where INSPIRE implementation is done in isolation, the use of the infrastructure is limited.

There is a growing demand for uniform European information products within the INSPIRE infrastructure that can support and facilitate EU-level use cases. It is expected that these products will also gradually enhance the use of the infrastructure. Following the midterm evaluation recommendations, the Commission has selected monitoring and reporting under the environmental acquis as a priority use case for the development of a first set of pan-European information products. Based on the evaluation of reporting obligations under the environmental legislation a priority list of eReporting data sets⁴³ related to environmental reporting obligations was prepared by the Commission in collaboration with the Commission expert group working on the maintenance and implementation of INSPIRE (MIG). This list of datasets is a rolling list that will be further extended in view of tangible information needs to adequately evaluate the effects on the environment of EU environmental legislation and its effectiveness, efficiency and coherence with other pieces of EU legislation.

Data policies that ensure effective data sharing without obstacles remain a point of attention in at least five Member States. Member States strongly advocate the benefits of the Directive but quantification of direct costs and benefits remains difficult.

⁴³ <https://github.com/INSPIRE-MIF/need-driven-data-prioritisation/tree/main/documents>

The monitoring data and country fiches over the years show that, overall, there has been a partial implementation of the INSPIRE Directive across Europe. Fewer data sets were available in 2020 than in the previous years. In some cases, this is a result of the data cleaning processes at national level, aggregating local and regional datasets and deleting irrelevant data sets for users and/or duplicates of data sets. Another reason for removing data sets may also be that Member States consider this data cleaning process as an opportunity to improve their overall monitoring indicators by removing those data sets that do not pass compliance testing.

The INSPIRE monitoring indicators⁴⁴ show that the status of the implementation is heterogeneous, with at least twelve countries lagging behind. It is important to consider that the new reporting and monitoring method introduced by Commission Decision (EU) 2019/1372 caused considerable breaks in the trend, lowering the values of INSPIRE indicators in the reference years 2019 and 2020. The new automated approach based on the processing of all metadata harvested from countries' discovery services entails a stricter and more reliable validation method than previous self-declared country assessments. Measured against the INSPIRE roadmap, the monitoring results in 2020 for the 27 EU Member States and 4 EFTA/ EEA countries are in general below expectations.

A snapshot⁴⁵ of the current implementation status for 27 Member States and the four EFTA/ EEA countries combined is provided in the table below. The overview is based on the regulatory reporting and monitoring obligations stipulated in Article 21 of the INSPIRE Directive and the INSPIRE monitoring indicators introduced by the Commission Decision in 2019⁴⁶.

<i>Envisaged outputs according the intervention logic</i>	
<i>Coordination structures on spatial information at Member States</i>	<i>Average performance</i>
<i>Measures of data sharing are that allow data access and reuse over administrative and national borders.Measures of data sharing are that allow data access and reuse over</i>	
Effective coordination	😊
Data sharing arrangements and usage of the infrastructure	😊
<i>Identification of spatial data needed</i>	<i>Total amount</i>
DSi1.1: The number of spatial data sets for which metadata exist	83,805
DSi1.2: The number of spatial data services for which metadata exist	95,381
DSi1.3: The number of spatial data sets for which the metadata contains one or more keywords from a register provided by the Commission indicating that the spatial data set is used for reporting under the environmental legislation	2,068

⁴⁴ Minghini, M., Cetl, V., Ziemba, L.W., Tomas, R., Francioli, D., Artasensi, D., Epure, E. and Vinci, F., Establishing a new baseline for monitoring the status of EU Spatial Data Infrastructure, EUR 30513 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-27384-4, doi:10.2760/296219, JRC122351.

⁴⁵ The snapshot uses the data gathered for all countries in the monitoring process in December 2020.

⁴⁶ Commission Implementing Decision (EU) 2019/1372 of 19 August 2019 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards monitoring and reporting (notified under document C(2019) 6026)

DSi1.4: The number of spatial data sets for which the metadata contains a keyword from a register provided by the Commission indicating that the spatial data set covers regional territory	12,917
DSi1.5: The number of spatial data sets for which the metadata contains a keyword from a register provided by the Commission indicating that the spatial data set covers the national territory	4,456
<i>Documentation of identified spatial data through metadata</i>	<i>Average performance</i>
MDi1.1: Percentage of metadata for spatial data sets conformant with Commission Regulation (EC) No 1205/2008 as regards metadata	59%
MDi1.2: Percentage of metadata for spatial data services conformant with Commission Regulation (EC) No 1205/2008 as regards metadata	55%
<i>Organise the documented spatial data in interoperable data models with a common vocabulary and online accessible</i>	<i>Average performance</i>
DSi2: Percentage of spatial data sets that are in conformity with Commission Regulation (EU) No 1089/2010 as regards interoperability of spatial data sets	50%
DSi2.1: Percentage of spatial data sets, corresponding to the themes listed in Annex I, that are in conformity with Commission Regulation (EU) No 1089/2010 as regards interoperability of spatial data sets	65%
DSi2.2: Percentage of spatial data sets, corresponding to the themes listed in Annex II, that are in conformity with Commission Regulation (EU) No 1089/2010 as regards interoperability of spatial data sets	52%
DSi2.3: Percentage of spatial data sets, corresponding to the themes listed in Annex III, that are in conformity with Commission Regulation (EU) No 1089/2010 as regards interoperability of spatial data sets	50%
NSi2: The percentage of spatial data sets that are accessible through view and download services	42%
NSi2.1: The percentage of spatial data sets that are accessible through view services	50%
NSi2.2: The percentage of spatial data sets that are accessible through download services	50%
<i>Ensure that the documented spatial data is accessible online through data services allowing its discovery, view and download and, where needed transformation.</i>	<i>Average performance</i>
NSi4: The percentage of the network services that are in conformity with Commission Regulation (EC) No 976/2009 as regards the network services	63%
NSi4.1: The percentage of the discovery services that are in conformity with Commission Regulation (EC) No 976/2009 as regards the network services	65%
NSi4.2: The percentage of the view services that are in conformity with Commission Regulation (EC) No 976/2009 as regards the network services	65%

NSi4.3: The percentage of the download services that are in conformity with Commission Regulation (EC) No 976/2009 as regards the network services	62%
NSi4.4: The percentage of the transformation services that are in conformity with Commission Regulation (EC) No 976/2009 as regards the network services	25%

A direct comparison of the country monitoring indicators across different years is not possible due to the legislative and technical changes in 2019 that included a partial redefinition of the monitoring indicators and promoted automated calculation of the monitoring indicators to minimise the reporting burden on the countries. It is important to note that the scoring must be therefore interpreted in the way that progress trends cannot be established based solely on these summarized results and without detailed understanding of the national contexts.

3.3. To what extent have the recommendations from the 2016 INSPIRE REFIT evaluation been implemented?

The midterm evaluation refers to the situation of implementation in 2013-14. It found that INSPIRE was largely fit-for-purpose, but that further efforts are needed at EU and Member State level to close the remaining implementation gaps and to harvest the full benefits of the Directive. Moreover, specific issues needing attention concern the data policy provisions in the Directive (Article 17) and requirements and use of some of the technical specifications in the implementing rules (including the streamlining of reporting). Consequently, the Commission had issued a number of recommendations and actions, which are now being implemented in close collaboration with the Member States as part of an updated Maintenance and Implementation Work Programme 2016-2020⁴⁷.

The Member States increased the overall availability of environmental priority data sets according to one of the recommendations in the midterm evaluation. In terms of coordination between the national INSPIRE implementation and eGovernment, open data and other relevant processes at national level, there are limited linkages in terms of logistical work and cooperation. Nevertheless, it is mostly considered that these initiatives are coherent with the INSPIRE Directive, and that in some cases, the national data policies benefit from its implementation by facilitating an environment of free and open data.

The gathered evidence further shows that most of the recommendations addressed to the European Commission have been implemented through several initiatives and actions summarized in the MIG Work Programme 2016-2020. Initiatives include the evaluation study on data sharing between public authorities and public access and use provisions; proposal for a regulation streamlining reporting obligations in the field of environmental policy; new monitoring and reporting decision; list of common datasets related to environmental reporting obligations; technical cooperation and coordination.

⁴⁷ <https://wikis.ec.europa.eu/x/HZn-AQ>

3.3.1. Follow-Up on 2016 REFIT evaluation recommendations by the Commission

First recommendation: Evaluate the shortcomings of the national data policies in relation to Article 17 of the Directive in more detail.

The Commission assessed the maturity of data sharing between public authorities in 2019 and found that implementation was on-going and that further harmonisation of data policies and licenses for data reuse in the Member States was necessary. Other remaining obstacles limiting data sharing were the availability of the data, broken links and missing services to provide access to the data. This can be improved by further promoting the use of INSPIRE data in practice and demonstrating their benefit.

The environmental e-Reporting use case and the list of priority data for e-reporting are considered good practices to stimulate implementation. Benefits can also be expected from further aligning Article 17 on data sharing of the INSPIRE Directive with the reviewed Directive on Open Data and on the re-use of public sector information. Moreover, the selected data categories in the foreseen implementing act on High Value Datasets⁴⁸ have a clear overlap with the data scope of the INSPIRE Directive and could benefit from reusing already available spatial data in the INSPIRE infrastructure.

Second recommendation: Review, and possibly revise, the INSPIRE rules, in particular on spatial data harmonisation, to take into account the implementing risks and complexities with a view to reducing them (simplifying requirements).

Experience from the midterm evaluation and the Fitness Check on reporting and monitoring have shown the need to simplify and streamline monitoring and reporting, support better comparison of the progress in the implementation across Member States and allow for national and EU-wide overviews while reducing administrative monitoring and reporting burden. Monitoring and reporting have been aligned and streamlined by simplifying the legal provisions and amending the related Implementing Decision to make it more meaningful and effective.

The Regulation on alignment of reporting obligations in the field of environment policy⁴⁹ entered into force on 26 June 2019. The proposal for a review of the reporting Decision⁵⁰ was adopted by the INSPIRE Committee on 27 November 2018 and published on 19 August 2019. Reporting under the new regime took effect from 15 December 2019 and the JRC has developed a reporting tool, which makes the whole monitoring and reporting process much more effective and efficient.

Furthermore, the Commission has gathered evidence in 2017-2018 on possible issues/improvements to the INSPIRE framework. The findings have been discussed with Member States' experts, which will be reflected in the review of the interoperability regulation⁵¹. This will make the application of the data specifications easier and less

⁴⁸ <https://op.europa.eu/en/publication-detail/-/publication/6aa0e08c-d0d9-11ea-adf7-01aa75ed71a1>

⁴⁹ <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex:32019R1010>

⁵⁰ http://ec.europa.eu/transparency/regcomitology/index.cfm?do=search.documentdetail&Dos_ID=16928&ds_id=59505&version=1&page=1

⁵¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02010R1089-20131230>

burdensome without losing the benefits of standardisation and interoperability. The intention is to adopt the revised Regulation in 2022.

Third recommendation: Assist the Member States in applying and implementing the INSPIRE Directive (simplification of use), e.g. by the use of common tools, and promote priority setting together with the Member States.

The Commission has selected monitoring and reporting under the environmental acquis as a priority use case for the development of a first set of pan-European information products. Based on the evaluation of reporting obligations under the environmental legislation, a preliminary list of common datasets related to environmental reporting obligations was prepared⁵² and the number of environmental priority datasets in the INSPIRE catalogue made accessible by Member States is gradually increasing⁵³.

Fourth recommendation: Work closely with Member States to explore opportunities arising from the use of existing EU-level funding programmes to help capacity building and close the INSPIRE implementation gaps (e.g. through the Interoperability Solutions Administrations).

The Commission has informed the Member States about funding opportunities.

3.3.2. Follow-Up on 2016 REFIT evaluation recommendations by Member States

Member States should step up their efforts in implementing (e.g. on their coordination activities) and critically reviewing the effectiveness of their data policies. This applies in particular to those Member States lagging most behind if they are to meet future implementation deadlines. In addition, Member States, in consultation with the Commission, are recommended to:

- give priority to environmental spatial datasets, in particular those linked to monitoring and reporting, and those identified in relevant global processes;
- improve coordination between the national INSPIRE implementation and eGovernment, open data and other relevant processes at national level.

The (quantified and qualified) progress made by the Member States vis-à-vis the follow-up actions identified in the midterm evaluation is documented in country fiches⁵⁴ and a comparative EU overview fiche⁵⁵.

Moreover, the reengineered INSPIRE Geoportal⁵⁶, that was released in September 2018, provides an online dashboard that allows for assessing the actual state of implementation in the Member States.

⁵² <https://wikis.ec.europa.eu/x/65j-AQ>

⁵³ see latest situation at: http://inspire-geoportal.ec.europa.eu/pdv_home.html

⁵⁴ <https://inspire.ec.europa.eu/portfolio/inspire-your-country>

⁵⁵ <https://inspire.ec.europa.eu/documents/summary-report-status-implementation-inspire-directive-eu>

⁵⁶ <http://inspire-geoportal.ec.europa.eu/>

The actions put forward in the Maintenance and Implementation Work Programme for 2017-2020 and continued under the new Maintenance and Implementation Work Programme (WP) for 2021-2024 are continuously monitored and several of them have been completed.⁵⁷ The new programme has three main areas of work: 1) digital ecosystem for the environment and sustainability, 2) Towards a common implementation landing zone, 3) GreenData4All.

3.4. Compliance promotion and assurance

EU pilot letters were sent to five Member States who failed to connect their discovery services to the INSPIRE Geoportal and bilateral technical implementation meetings (20) or written exchanges (2) with the Member States were held during the period September 2015 - April 2016. As a follow-up, Member States were invited to draw up an action plan for improving the implementation of the INSPIRE Directive in conjunction with the next national tri-annual report, which was due on 15 May 2016. The bilateral meetings proved very effective and were appreciated by the Commission services and the Member States. Most Member States critically reviewed their INSPIRE implementation and provided an action plan in 2016 for the period 2016-2020 to remedy existing implementation issues and further improve the overall conformity of the implementation. This resulted in a further increase of transparency of environmental information, also improving the implementation of the Public Access to Environmental Information Directive, in terms of improving public access to environmental information and the quality of the data. The action plans showed a common understanding and awareness of remaining implementation challenges and demonstrated the goodwill of Member States to address these. In addition, the Commission launched a two-yearly review of implementation of EU law with the Environmental Implementation Review (EIR)⁵⁸. The EIR country reports on Member States implementation status included in section V on "Effective governance and knowledge" the evaluation of the INSPIRE evidence-base available to the Commission also building on the bilateral meetings and the INSPIRE country reports. The EIR reports also assessed the status of Member States' data policies and related practices on sharing information, as supported by both the INSPIRE and the Public Access to Environmental Information Directive.

In order to establish a pragmatic way of dealing with INSPIRE implementation, it was agreed with the Member States to give higher importance to selected environmental reporting data to ensure better usability, comparability and access. An initial priority list of data sets was prepared to serve environmental reporting needs covering a number of areas such as water, waste, air, nature, etc.

In the period December 2017 - January 2018, the five bad application EU Pilots' procedures were closed and Member States were requested to prioritise the publication and accessibility of priority data sets for reporting.

Those Member States which did not engage in this exercise were found in breach of the INSPIRE Directive and after several reminders, a first wave of infringements (against

⁵⁷ Maintenance and Implementation Work Programme for the INSPIRE Directive for the period from 2021-2024: "Towards a Common European Green Deal data space for environment and sustainability", endorsed at the 12th MIG meeting on 26-27 November 2020. Available at: <https://webgate.ec.europa.eu/fpfis/wikis/display/InspireMIG/INSPIRE+work+programme+2021-24>

⁵⁸ http://ec.europa.eu/environment/eir/country-reports/index2_en.htm

Bulgaria, Latvia, Lithuania, Poland) was initiated with a letter of formal notice on 8 March 2019.

4. METHOD

4.1. Short description of methodology

The evaluation was carried out in line with the Better Regulation Guidelines⁵⁹ and the assessment was guided by a set of 30 evaluation questions (see Annex 3)⁶⁰, which have been operationalised in an evaluation questions matrix. This formed the basis for the data collection activities and analytical work. The evaluation questions were structured around the current implementation status of the INSPIRE Directive and the five evaluation criteria.

Country forms were prepared based on the desk review of country summary reports, yearly monitoring data and other relevant materials. Country forms, developed for 27 Member States and 4 EEA/EFTA countries, were shared with the respective National Contact Points (NCPs) before being finalised.

The development of country forms to assess the current implementation status was tightly intertwined with a broader review and analysis of relevant available information and evidence in a desk study. In this desk study, quantitative and qualitative data from reports, scientific articles, evaluations and other data sources on the implementation of the INSPIRE Directive were collected and reviewed. Furthermore, as part of the stakeholder consultations several data collection activities were conducted to complete the evidence, including scoping interviews and Focus Group interviews with various Member States authorities and stakeholders. On 19 April 2021, the public consultation was launched for the duration of 12 weeks and four targeted surveys were launched at the end of April targeting the environmental, agricultural, marine and spatial data sectors.

Each of the five evaluation criteria was analysed in relation to specific elements of INSPIRE Directive following the causal pathways in the updated intervention logic (see Annex 4, Part B). The evaluation matrix linked the evaluation questions to indicators/success criteria and used information sources. The evaluation framework was critical in guiding the data collection and the subsequent use of data for the analysis. It ensured that all aspects of the evaluation questions were answered in a systematic and traceable manner.

The main analytical method used for most questions was content analysis, based on the aggregation and analysis of information collected with the literature review, desk study, targeted questionnaires, interviews, public consultation and validation workshop. Data were analysed according to the principles of triangulation of evidence⁶¹ from different perspectives (stakeholder categories) and different sources. Finally, focus was placed on assessing the reliability of information used.

⁵⁹ Better Regulation Guidelines Toolbox Tool #47: Evaluation Criteria and questions.

⁶⁰ The methodology is also described in detail in sections 3 and 4 of the supporting study.

⁶¹ Triangulation is a method used to increase the credibility and validity of research findings.

4.2. Limitations and robustness of findings

Although the analysis encompassed a wide range of data, information and views of stakeholders and Member States, some methodological limitations remained. For each evaluation criterion it was assessed what the key limitations are and what a proposed mitigation measure could be, e.g. using alternative sources or types of data. The main limitations and gaps identified during this evaluation are described in the following paragraphs.

4.3. Comparison of implementation results across the reporting years

There is a significant shift in the trend observed, between the year 2018 and 2019, due to the change of the INSPIRE monitoring and reporting process following the adoption of a new reporting Decision⁶² in 2019. Since 2019, the process has been managed by the JRC and is fully automated using the INSPIRE Geoportal and the INSPIRE Reference Validator software tools to process the metadata harvested from the Member States' discovery services. The new automated approach based on the processing of all metadata harvested from countries' discovery services entails a stricter and more reliable validation method than previous self-declared country assessments. As a result of this change in data, the implementation results cannot be directly compared across the reporting years. In order to mitigate this limitation, the Member States and the four EFTA/EEA countries were given the opportunity to provide additional explanations in the country forms regarding their internal challenges and other reasons for the drop in their performance over the years. These explanations have been taken into consideration in the assessment of the implementation progress.

4.4. Measuring impacts of the INSPIRE Directive

It is difficult to measure the impacts, as users of spatial information data in different applications based on INSPIRE are not always aware where the data comes from. Users often do not know whether data they use/would like to use result from the implementation of INSPIRE or from something else (e.g. national legislation). One such example is the application making publicly accessible real time air quality data. Because of this challenge, it is sometimes difficult to trace a real driver for many important initiatives such e-Government and national open data strategies. For this reason, this evaluation aims to provide a transparent overview of where data comes from and how it is interpreted by different stakeholders. In addition, the evaluation conclusions are carefully drawn, acknowledging the limitations of results of different collection tools.

4.5. Quantification of costs and benefits

In the efficiency analysis, the main data gaps relate to assessment of costs and benefits in quantitative terms. Due to the limited data in this regard (from the country fiches), there are challenges related to the cost and benefit assessment as well as with the comparability of data across the Member States. As there are also several objectives, such as data sharing between administrations and making information available to the public, it is not possible to precisely define the quantitative benefits of making information available to

⁶² Commission Implementing Decision (EU) 2019/1372 of 19 August 2019 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards monitoring and reporting (notified under document C(2019) 6026) - https://eur-lex.europa.eu/eli/dec_impl/2019/1372/oj

the public. This is for several reasons, for example, it is difficult to quantify what is the value of information actively disseminated to the public, in terms of facilitating informed decision-making, how this might impact the health of citizens, etc.

In addition, national data providers often do not have a separate budget line for the implementation of the INSPIRE Directive. Further, available estimates and estimates provided by stakeholders are not comparable, e.g. they may include different cost items, they may not rest on the same methodologies and often, INSPIRE costs have not been clearly separated from other costs. For example, costs of developing national SDIs are often included in the estimates. In order to mitigate this, available studies on cost and benefits have been collected and used as well as dedicated cost-benefit analysis. In addition, qualitative data has been collected through the interviews, targeted surveys and public consultation.

4.6. Representativeness of consultation results

Reaching a representative number of respondents in each targeted survey and each stakeholder group and a balance between Member States proved difficult. In particular, the targeted surveys of the marine and agriculture communities experienced low response rates, and results from the targeted survey of the environmental community did not provide a very comprehensive picture across the EU on how INSPIRE is used for environmental reporting (see also Annex 4 of the supporting Study). The Focus Group interviews with Member States generally provided a satisfactory range of stakeholders involved in the implementation of the INSPIRE Directive at national level. However, in several Focus Groups, environmental stakeholders (institutions responsible for sectoral environmental policies and therefore sectoral environmental datasets) were not represented, also because these organisations play a limited role in the governance structure in some Member States. As a result, some information was gathered on the relations between INSPIRE and environmental reporting, on the use of INSPIRE for environmental policy-making and the coherence of INSPIRE with the implementation of the Public Access to Environmental Information Directive. The Focus Groups was also given the opportunity to provide written answers.

4.7. Difficulty in distinguishing INSPIRE from other spatial data

During Focus Group interviews, it became apparent that some stakeholders make the distinction between INSPIRE datasets and the data included in the overall national SDI. Some Member States have developed two different spatial data infrastructures: one for national use and one for the implementation of the INSPIRE Directive. As a result, it is difficult to assess the effects of the INSPIRE Directive, especially when it comes to costs and benefits. Therefore, this evaluation considers the statements provided during the Focus Group in a transparent and objective manner allowing for clear conclusions whether they concern INSPIRE datasets only or a wider set of national spatial data.

5. ANALYSIS AND ANSWERS TO THE EVALUATION QUESTIONS

This chapter replies to the evaluation questions and sets out the supporting arguments to underpin the findings based on information and assessment carried out in the context of the supporting study (in particular, chapters 5 and 6).

5.1. Relevance

5.1.1. To what extent does INSPIRE still match current needs and do they continue to require action at EU level?

From a policy perspective, the relevance of the INSPIRE Directive's objectives in view of the twin challenge of a green and digital transformation has even increased. The INSPIRE Directive together with the Public Access to Environmental Information Directive has been identified as the main pillar for bringing data from public administrations into the Green Deal data space. This ambition has been articulated in the Commission Communication 'A European strategy for data'⁶³ under the 'GreenData4All' initiative.

The European Strategy for Data indicates, amongst other uses, that data can serve to address societal challenges, combat environmental emergencies and tackle environmental degradation and climate change. To do so, the European Strategy for Data specifically supports the Green Deal ambitions through the development of a common European Green Deal data space⁶⁴.

The evaluation demonstrates that the national and public authorities have a need for spatial data for the different phases of their policymaking (design of policy, monitoring of policy, reporting and assessment of results and effects) and put great emphasis to sharing this spatial data with the public. This spatial data need remains the main challenge and justifies EU action. The INSPIRE Directive addresses these needs. For other actors (companies, NGOs, researchers, citizens), limited information has been gathered on their actual information needs.

Table 1 gives an indication of the availability of spatial data using the existing national portals for spatial data in the Member States as a proxy. Twenty-one Member States have more than one geoportal. Most of these portals are in national languages and do not indicate whether these are making use of INSPIRE conformant datasets. For most of these geoportals there is limited data gathered of concrete use (either number and type of users and frequency of use or use-case). Member States that offer data, services and targeted end-user applications through their geoportal(s) and do gather metrics on the usage show positive effects of making spatial (not necessarily INSPIRE) data available e.g. for Luxembourg it is explicitly mentioned that '*independently of the special geoportal dedicated to INSPIRE, the national geoportal of Luxembourg has been a great success and is widely used by the general public. It counts more than 50,000 visitors per day, through its different viewers, web services and APIs*'. Indeed, the INSPIRE portal is an independent subsection of the Luxembourgish SDI and only offers a subset of the rich spatial data offering in the national geoportal.

⁶³ COM(2020) 66 final, "A Common European Green Deal data space, to use the major potential of data in support of the Green Deal priority actions on climate change, circular economy, zero-pollution, biodiversity, deforestation and compliance assurance. The "GreenData4All" and 'Destination Earth' (digital twin of the Earth) initiatives will cover concrete actions."

⁶⁴ Common European data spaces will ensure that more data becomes available for use in the economy and society, while keeping the companies and individuals who generate the data in control. The European Green Deal data space aims to provide more accessible and exploitable environmental data in support of the European Green Deal priority actions.

Table 1 Examples of spatial data portals provided by Member States

Member State	Number of examples of geoportals	Member State	Number of examples of geoportals
Latvia	10	Slovakia	5
Sweden	9	Italy	4
Croatia	8	Netherlands	4
Cyprus	8	Slovenia	4
Finland	7	Spain	4
Belgium	7	France	3
Greece	7	Hungary	3
Austria	6	Ireland	2
Bulgaria	6	Portugal	1
Denmark	6	Estonia	1
Czechia	5	Lithuania	1
Germany	5	Luxembourg	1
Romania	5	Malta	1

Source: Current status country forms for 27 Member States.

Furthermore, several examples are provided in the current status country forms of Member States where INSPIRE has been instrumental in developing access and use of the spatial data e.g. Latvia, Belgium and Portugal.

5.1.2. Is INSPIRE still relevant to the issues (obstacles) it addresses?

The main finding indicates that many of the obstacles considered when the Directive entered into force persist and that further action is required at the EU level to address these obstacles. There has also been evolution of technology and information requirements which point to a need for improvement of the INSPIRE Directive.

The 2004 Impact Assessment⁶⁵ identified several obstacles justifying an EU action:

- difficulties of access to information (insufficient metadata at all levels);
- different projections and scales, making existing information difficult to integrate;
- unclear status of the information as to its currency;
- prohibitive cost of geographical data;
- lack of interoperability between data sets, and among web-enabled services;
- lack of harmonisation in the codes used to represent the objects described;
- varying data quality from one country to another within the same layer of geographical information;
- lack of long-term solutions (instead: supply of snapshots, absence of information on changes), resulting in information that became quickly outdated and hence the need for duplication of data collection efforts.

⁶⁵ https://eur-lex.europa.eu/procedure/EN/2004_175

Under the state of implementation section above (See 3.1, 3.2) and the analysis of effectiveness (See 5.2.1, 5.2.2) the evaluation showed that the Directive has not permitted to fully overcome all of these obstacles which therefore remain (at least partially) valid. The midterm evaluation also identified this and reiterated the relevance of the Directive to address the still persisting obstacles by issuing recommendations. These recommendations have not been fully implemented by the Member States (See 3.2.2).

The relevance was also confirmed by the public consultation⁶⁶ as respondents overall consider that action is required at the EU level to address obstacles and needs related to sharing and disseminating spatial data as addressed by the INSPIRE Directive. So in short, there remains wide support to overcome the obstacles to data access, however the Directive needs to take into account evolution in technology and information management to be more fit for purpose to deliver on its objectives.

5.1.3. To what extent is INSPIRE future-proof?

The evaluation identified some of the technical specifications for the INSPIRE framework as a barrier to current and future implementation as well as use. The legal framework is considered too prescriptive and rigid to respond to fast evolving technology and information needs with the necessary agility.

The implementing rules (on metadata, network services and interoperability) and associated technical guidelines have been developed to support the development of interoperable data sets and services under the scope of the INSPIRE framework, which have been considered by stakeholders as useful and essential for high quality data management.

However, one of the main barriers to implementation identified by Member States (see 5.2.5) relates to the complexity of implementing INSPIRE in the light of various technical issues. The technical over-specification of the Directive was identified as a burden for its full implementation. It impacts on the resources and competences needed for implementation in Member States and limits the relevance of the Directive for potential users (outside of EU authorities and data providers) that would need more flexibility in the use, and in particular in the standards and formats.

Moreover, in the conceptualisation of INSPIRE, it was assumed in multiple cases that requirements which were during the scoping stage not supported by software tools and libraries would be implemented once proposed and endorsed by INSPIRE. Unfortunately, this rarely happened. Typical examples in this respect are lack of support for complex GML attributes in desktop GIS clients and extended capabilities of INSPIRE OGC network services. In both cases, those requirements have been to a large extent difficult to implement, but also not very well supported by clients and servers. That is why, it would be important to align technical requirements as much as possible to functionalities that are already supported (out-of-the-box) by existing tools.⁶⁷

⁶⁶ 77% of respondents indicated that an action is required at the EU level

⁶⁷ Kotsev A., Minghini M., Cetl V., Penninga F., Robbrecht J., Lutz M., INSPIRE – A Public Sector Contribution to the European Green Deal Data Space. A vision for the technological evolution of Europe's Spatial Data Infrastructures for 2030, EUR 30832 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-41564-0, doi:10.2760/8563, JRC126319.

In that sense, even though the ambition of accessibility and interoperability of environmental spatial data remain and continue to be relevant for the Member States, the technical provisions of the Directive do not seem to be future-proof, which could benefit from further simplification and streamlining.

5.1.4. Are the Articles 7 and 8 of the Public Access to Environmental Information Directive still relevant in view of the current state of the INSPIRE infrastructures?

The evaluation found that the objectives of both Directives are highly relevant in the context of the European Green Deal. They respond to the need for better information and data that are more accessible to the public and public authorities to support policy development and better implementation.

The evaluation did not find major inconsistencies between the INSPIRE Directive and the Public Access to Environmental Information Directive. There is some difference in data scope of Articles 7 and 8 of the Public Access to Environmental Information Directive and the scope of the INSPIRE Directive. The INSPIRE Directive has been designed to be consistent with the EU legal framework on data sharing and dissemination – Public Access to Environmental Information Directive and the Open Data Directive (see also 5.4.4).

The objective of the INSPIRE Directive is to set up a European infrastructure for spatial data, promote sharing of public spatial data between public administrations and with the public, and improve availability and accessibility of spatial data relevant to environmental policies and activities. The INSPIRE Directive already governs active dissemination in particular in its Articles 13 and 14. Despite differences in scope to some extent, these requirements are overlapping with the active dissemination provisions in Articles 7 and 8 of the Public Access to Environmental Information Directive.

The active dissemination provisions in the Public Access to Environmental Information Directive date almost twenty years back and as a result lack some key technical terms, crucial for making available high quality data sets. There is also no reference to the INSPIRE Directive as the common instrument to implement the requirement on public authorities to actively disseminate environmental information to the public in a coherent way across Europe. This lack of synergy between the two Directives results in different approaches to make environmental data available impacting the effectiveness of both instruments.

Table 2 Summary of the findings on relevance

Although the objectives behind the INSPIRE Directive are still very relevant and further action is required at the EU level to address the identified obstacles, the legal framework can be improved in terms of effectiveness.

To remain relevant and support the Green Deal ambitions by bringing environmental data into the Green Deal data space, the INSPIRE Directive and relevant provisions of the Public Access to Environmental Information Directive need to better consider evolving technology and information requirements.

5.2. Effectiveness

5.2.1. What progress has been made over time towards achieving the objectives and targets set out in INSPIRE in various Member States?

There has been progress towards achieving the objectives set out in the INSPIRE Directive, even though a full implementation has not been yet achieved.

Most progress was made on national coordination and removing obstacles for data sharing (with some Member States however lagging behind). Implementation difficulties persist as regards the following aspects:

- While overall, the quality of the documentation (metadata) of the identified spatial data is acceptable, there is room for further improvement to reach higher levels of conformity with the full metadata specification.
- Access to the spatial data for viewing and downloading is lagging behind with around half of the documented data sets were not yet accessible.
- Cross-border and pan-European usage of available spatial data is still difficult and time-consuming due to the heterogeneity of data offerings across countries and lack of data harmonisation.

In 2017, the JRC report on the implementation of the INSPIRE Directive indicated that *‘the state of implementation still shows different levels of maturity across Member States’*.⁶⁸ The current status shows a similar picture (see Section 3).

Although the change in the monitoring system introduced in 2019 makes full comparison of progress for each Member State over the years impossible, the following conclusions can be drawn from the latest monitoring cycle for reference year 2020:

- No Member State has yet achieved full implementation according to the implementation roadmap.
- On average, in 2020, 42% of datasets were available through both view and download services (NSi2), 50% were viewable (NSi2.1) and 50% were downloadable (NSi2.2). This means that around half of available data sets were not yet accessible across the EU Member States and EEA/EFTA countries.
- The analysis also shows low conformity of metadata. Average values of 59% and 55% of conformant metadata for spatial data sets and spatial data services, respectively, are low and suggest that data providers have not extensively used the INSPIRE Reference Validator before the monitoring and reporting process.
- Conformity of spatial data sets is also heterogeneous and low on average, with some countries providing few interoperable data sets. Overall, 50% of all listed data sets are in conformity with Commission Regulation (EU) No 1089/2010 as regards interoperability of spatial data sets. The interpretation of the results must, however, take into consideration that these indicators will in many cases never reach 100%, since majority of countries provide their national data sets (as-is

⁶⁸ Cetl V., V. Nunes de Lima, R. Tomas, M. Lutz, J. D'Eugenio, A. Nagy, J. Robbrecht (2017), Summary Report on Status of implementation of the INSPIRE Directive in EU.

data) in addition to the INSPIRE harmonised data sets because both data sets serve different purposes.

- The conformity of network services has quite improved since 2019, and at least in half of the countries it is relatively high. On the other hand, several countries still offer only a few interoperable network services. The overall average percentage of conformant network services (NSi4) amounted to 63%.

Table 3 summarises the number of Member States falling under different implementation groups, in 2016 and 2020, for each implementation category: conformity of metadata; conformity of spatial datasets; accessibility of spatial datasets through view and download services; and conformity of network services. Depending on the performance results, the countries have been divided into four implementation groups, from Group I (top implementation) to Group IV (lowest level of implementation). Although this overview does not allow for strict conclusions⁶⁹, it gives a rough indication of the implementation progress. In all categories, except the conformity of metadata, the number of countries in the highest performance implementation group (i.e. Group I) increased in 2020 compared to the 2016 data, suggesting a positive progress towards achieving the objectives of the INSPIRE Directive.

Table 3 Number of Member States falling under the four implementation groups based on their INSPIRE performance indicators' results in four implementation categories

	Conformity of metadata		Conformity of spatial data sets		Accessibility of spatial datasets through view and download services		Conformity of network services	
	2016	2020	2016	2020	2016	2020	2016	2020
Group I: 80-100%	20	11	0	6	4	6	8	15
Group II: 55-79%	5	5	2	11	7	8	4	3
Group III: 30-54%	1	6	7	4	8	6	6	3
Group IV: 0-29%	1	5	18	6	8	7	9	6

Source: Country forms.

When considering the self-declared results based on qualitative indicators measuring the progress in terms of coordination structures, data sharing arrangements and usage of the infrastructure, there has been certain progress recorded for some Member States (Table 4). More countries recorded an improvement in terms of data sharing arrangements and usage of the infrastructure than effective coordination structures. No concrete progress in

⁶⁹ As data cannot be directly compared across the years due to the changes in the reporting and monitoring system introduced in 2019 and the official performance indicators do not necessary give a full picture of the quality of implementation

establishing effective governance structures, data sharing arrangements and usage of the infrastructure were recorded in a handful of Member States.

The analysis indicates an overall positive trend; however, several Member States still need to step up their implementation efforts. It is important to consider that this qualitative analysis is based on Member State's self-assessments and is not supported by strict criteria or validation methods.

Table 4 Synthesis of the implementation status in 2020 across the Member States regarding coordination structures, data sharing arrangements and usage of the infrastructure compared to the reference year 2016

Number of Member States	Effective coordination	Data sharing arrangements and usage of the infrastructure
Improvement of the implementation status	3	8
No improvement of the implementation status	6	5
Fair level of implementation: Implementation of this provision is well advanced or (nearly) completed. Outstanding issues are minor and can be addressed easily.	18	14
Total ⁷⁰	27	27

Source: Country forms.

5.2.2. Is the progress made in line with the initial expectations and the INSPIRE implementation roadmap?

The implementation of the INSPIRE Directive still shows implementation gaps. As of 2021, most of the implementation deadlines according to the INSPIRE implementation roadmap are in the past. The level of implementation is uneven across the European Union, with many Member States lagging behind. There are still challenges related to governance structures and coordination of implementation. The results also stems from different institutional and political set ups (federal vs. centralised State, larger vs. smaller Member States, etc.). Overall, the progress made so far as regards the provision of INSPIRE-compliant metadata, data and data services is not in line with the initial expectations and the INSPIRE implementation roadmap.

A detailed overview of the INSPIRE implementation milestones is provided in the INSPIRE roadmap (see Annex 4, Part A). The major implementations steps of the INSPIRE Directive implementation are the following:⁷¹

- (I) set up coordination structures and adopt and implement legal measures to remove procedural obstacles to the sharing of spatial data;

⁷⁰ As the coordination structures and data sharing arrangements were not assessed for the EEA/ EFTA countries in 2016, the progress assessment for the relevant countries (NO, LI, CH, IS) is not taken into account.

⁷¹ European Commission (2016), Report from the Commission to the Council and the European Parliament on the implementation of Directive 2007/2/EC of March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) pursuant to article 23 (COM/2016/0478 final/2).

- (2) identify their spatial data relevant to environmental policies and policies and actions with an environmental impact according to themes listed in the annexes of the Directive;
- (3) document the spatial data so that they can be accessed on the internet together with information on aspects such as their source, geographical coverage, quality and conditions of use, in line with the metadata specifications;
- (4) implement interoperable online services allowing the discovery, visualisation and download of spatial data;
- (5) gradually organise and publish the spatial data according to common data models for greater interoperability and improved productivity.

The implementation progress as regards the steps 2, 3, 4 and 5 is covered in the overview of the current situation (See chapter 3) and identifies four implementation groups of countries based on the INSPIRE indicator results in 2020, from the least to the best performing.

When it comes to the availability of spatial data sets and services, the progress cannot be measured as no quantitative objectives have been set for this indicator. The evaluation demonstrated that Member States do not have the same number of data sets and services at national or regional level (see 5.2.3). Furthermore, several Member States reduced the number of spatial data sets in the recent years, for example, by combining several local and regional data sets into national ones. Thus, the total number of data sets and services available cannot be considered as an evidence on implementation maturity.

The progress can however be more effectively measured for other INSPIRE indicators, expressed in percentages. The main finding when comparing the current state of play and the initial implementation roadmap is that implementation for all Member States is still lagging behind the initial implementation schedule. Most of the actions in the roadmap should have been achieved by the end of 2020, however, the monitoring data shows that this is not the case (see 5.2.1). The barriers to the full implementation are described in more detail under 5.2.5.

5.2.3. Is the geographical coverage of implementation consistent with the Directive's objectives?

The evaluation showed that conclusions in terms of the geographical coverage of the implementation of the INSPIRE Directive are difficult to draw as the datasets could not be verified individually in the framework of this evaluation. When considering the interoperability requirements stemming from the INSPIRE Directive, the current geographical coverage is not deemed optimal as there are significant discrepancies in the number of datasets across Member States, their geographical scope (national, regional, local) and their content.

When looking at the number of metadata records, downloadable datasets and viewable datasets available on the INSPIRE Geoportal at national level and regional level, and their geographical distribution (Table 5) it can be observed that Member States offer a varying amount of INSPIRE-relevant datasets. For instance, while Germany, Italy (and France in the past) have offered several thousands of datasets, other Member States have only made less than 100 datasets available. France reduced drastically the number of

datasets available in the recent years. Since 2016, France has rationalised its offering with a focus on making datasets available that have a national coverage and were listed as environmental data priorities. In 2016, France offered 29,700 spatial datasets for which metadata existed and has reduced the number to 214 data sets in 2020.

Table 5 INSPIRE Geoportal data set statistics: number of data sets available

Number of Member States	Meta data records	Downloadable data Sets	Viewable Data Sets
Number of datasets available			
below 100	5	15	17
between 100 and 299	14	7	5
between 300 and 699	6	4	4
above 10,000	2	1	1
TOTAL	27	27	27

Source: Based on the data from INSPIRE Geoportal, July 2020

There are more than twice as many regional metadata records available on the INSPIRE Geoportal than national metadata records (Table 6). Under the assumption made that regional data are more heterogeneous than the national data, it is unlikely that the current geographical coverage allows yet for a good pan-European interoperability as there is too much heterogeneity in the number and content of spatial datasets made available by different Member States.

Table 6 INSPIRE Geoportal data set statistics: regional and national coverage

Data sets	National spatial scope coverage	Regional spatial scope coverage
Total number of metadata records	5,459	13,747
Downloadable datasets	2,131	1,948
Viewable datasets	2,308	2,828

Source: Based on the data from INSPIRE Geoportal, July 2020

It is important to note when considering the above observations that INSPIRE does not set the requirement to collect new data, nor sets specific requirements on the scale or the quality of the spatial data provided. This means that INSPIRE was intended to operate with a legacy of heterogeneous datasets that have been produced for the purpose of different national and regional contexts. Full interoperability can therefore not be expected based on the current framework.

5.2.4. To what extent does the implementation of the INSPIRE Directive in the Member States build further on the obligations of Public Access to Environmental Information Directive (specifically the provisions under Articles 7 and 8 under the Public Access to Environmental Information Directive)?

The evaluation could not identify with precision to what extent the implementation of the INSPIRE Directive in the Member States is effectively building on the obligations under the Public Access to Environmental Information Directive (specifically the provisions under Articles 7 on the dissemination of environmental information and 8 on the quality of environmental

information). The two Directives have overlapping scopes to a certain extent, stemming from the requirements of the Aarhus Convention, Article 5 (see 5.4.4) and are often implemented in parallel, especially because of the common requirements of active dissemination.

In many countries, different public organisations are legally responsible for providing the environmental information, for providing (geo)data and for implementing INSPIRE. This might result in several separate portals to provide the environmental information, the legal base, the national implementation of that legislation and spatial data under INSPIRE. These portals are not always interlinked⁷² which may result in additional administrative burden and could show a lack of coordination between the different actors managing the two instruments.

5.2.5. Which main factors have contributed to – respectively stood in the way of achieving these objectives?

The evaluation found no new barriers to the implementation and the use of INSPIRE compared to the ones identified in previous evaluations. The table below lists the common types of obstacles already identified by Member States in the midterm evaluation.⁷³ From the most identified barriers to the least identified barriers were: 1) technical barriers, 2) licencing and sharing barriers, 3) knowledge barriers, 4) legal barriers, 5) financial and organisational barriers to the same extent.

The technical requirements of the INSPIRE Directive result in different levels of complexity and some specifications no longer correspond to the current technical standards and user needs. One example is the default use of the GML⁷⁴ format that is considered cumbersome and not fit for purpose. Technical complexity and over-specification have a negative impact on resources needed to implement the spatial data infrastructure and its possible use and is considered a barrier to its full deployment.

However, in other areas lack of specifications have also given rise to problems. The INSPIRE Directive leaves it up to the Member States to decide on the licensing conditions for data access. This has resulted in heterogeneous licensing schemes, terminology and reuse conditions throughout the Member States, which makes it difficult for users to assess to what extent data can be reused for cross-border and pan-European use cases.

Several Member States provide INSPIRE datasets and services as a standalone activity that is only marginally linked to the national infrastructure, often supplying access to only a subset of the rich spatial data available in national catalogues⁷⁵. This is to

⁷² European Commission (2019), Promotion of good practices for national environmental information systems and tools for data harvesting at EU level. Final Report, drafted by Wageningen University and Research (The Netherlands), Umweltbundesamt GmbH (UBA) (Austria), Epsilon (Greece), COWI (Belgium).

⁷³ EEA & JRC (2014), Mid-term evaluation report on INSPIRE implementation, EEA Technical report No 17/2014, ISSN 1725-2237., P.7.

⁷⁴ The Geography Markup Language (GML) is the XML grammar defined by the Open Geospatial Consortium (OGC) to express geographical features. GML serves as a modeling language for geographic systems as well as an open interchange format for geographic transactions on the Internet.

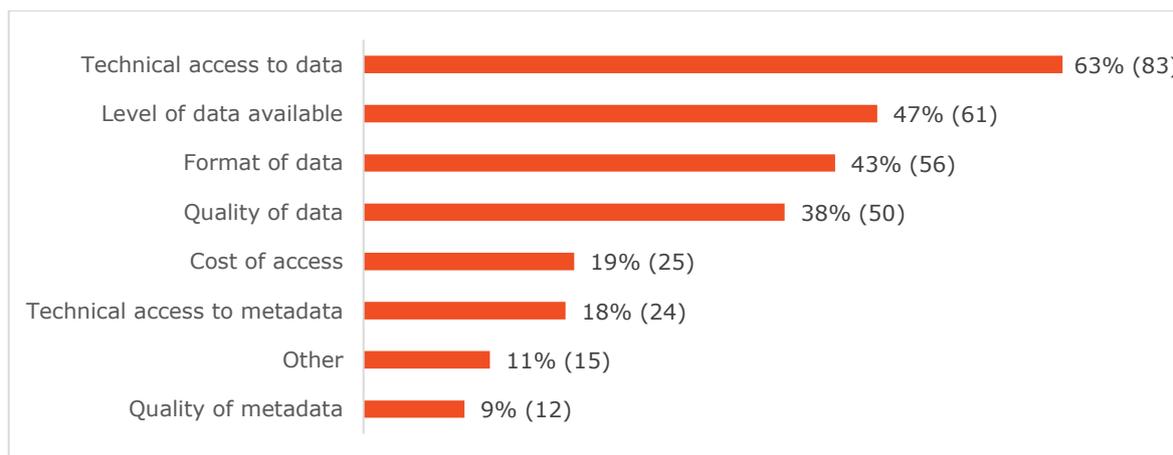
⁷⁵ European Commission (2019), Promotion of good practices for national environmental information systems and tools for data harvesting at EU level. Final Report, drafted by Wageningen University and

minimise the burden of setting up network services and making the data interoperable according to INSPIRE rules that are not always supported by off the shelf software solutions, or not aligned with requirements adopted at the national level.

Cross-border implementation is also hampered by the different ways Member States describe the same data. Differences in description and quality are a challenge to creating a uniform picture across Member States resulting in a patchwork of data available in the INSPIRE infrastructure making it difficult to achieve pan-European coverage for specific themes. This can be remediated through extra efforts by the community involved to specify and agree more precisely the common data models. This has been done, for instance, by the marine community whereby over 100 institutions have agreed common standards for distributing geospatial data according to INSPIRE-based FAIR (findable, accessible, interoperable, reusable) principles through the EMODnet⁷⁶ initiative. Some discretion in application of data specifications should be allowed to support these community initiatives.

The evaluation further showed (Figure 2) that the main barriers to the use of spatial data from the point of view of the users are firstly the technical access to data (63%), then the level of data (47%), the format (43%) and the quality of data (38%) available. Cost of access (19%), technical access to metadata (18%) and quality of metadata (9%) are less considered as barriers.

Figure 2 Barriers to the use of spatial data from the point of view of the users (N=131)



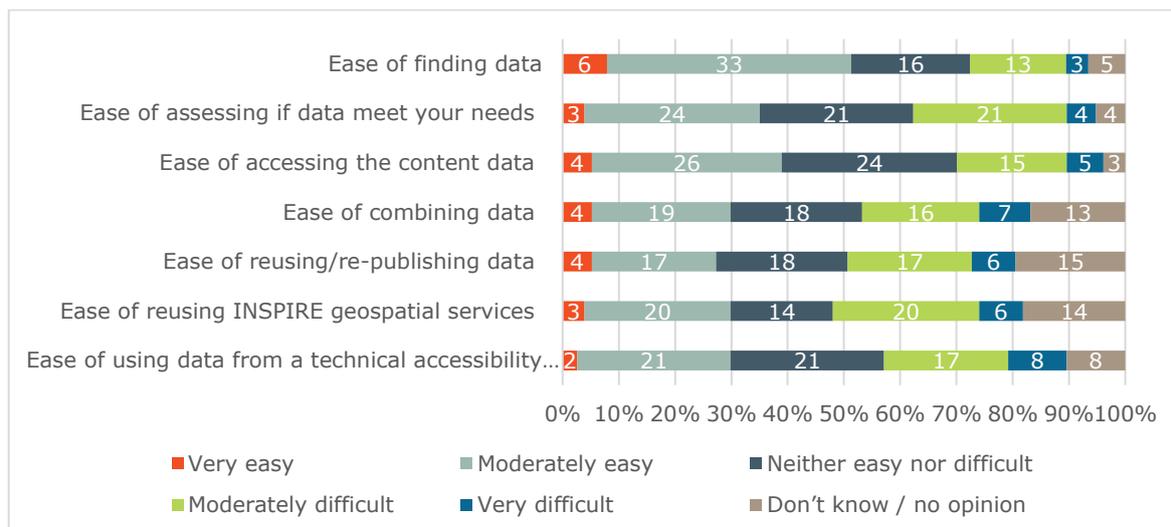
Source: All respondents, Targeted surveys (combined) April-May 2021, Question 15.

According to the public consultation (Figure 3) finding data is experienced as easy by more than half of the respondents, while access and reuse of data and services is still experienced difficult by two-third of respondents.

Research (The Netherlands), Umweltbundesamt GmbH (UBA) (Austria), Epsilon (Greece), COWI (Belgium).

⁷⁶ <https://emodnet.ec.europa.eu/en>

Figure 3 Ease to find data, assess relevance, access data, combine data, re-use or republish data, reuse services or use data from a technical point of view (N=76-77)



Source: All respondents, public consultation May-July 2021, Questions 11-17.

5.2.6. To what extent is INSPIRE used for reporting under the environmental acquis?

The evaluation shows that even though challenges remained for Member States, in particular considering the harmonisation process, there has been progress in the use of INSPIRE for reporting under the environmental acquis.

INSPIRE was indeed designed to optimise data transfer and processing through the harmonisation requirements, as Member States rely on many different networks of thematic and regional data providers for environmental reporting. The midterm evaluation provided an example from the MDI-DE⁷⁷ (Marine Dateninfrastruktur Deutschland) project, as example of an infrastructure dedicated to that purpose⁷⁸.

The JRC has undertaken several pilot initiatives together with Member States to foster the streamlining of regulatory reporting requirement and INSPIRE provisions e.g. Air Quality e-Reporting where real-time air quality data is made available by the Member States.⁷⁹ The different projects experienced difficulties linked to the disciplinary nature of the endeavour. In many cases, the communities responsible for reporting under the environmental acquis do not have the technical expertise required to implement INSPIRE provisions, and the INSPIRE experts lack knowledge of the thematic domain. The key factors identified for successful projects were a ‘*balanced set of experts with good*

⁷⁷ MDI-DE aims to provide data and information coming from coastal engineering, coastal protection, marine environmental protection and marine nature protection via a joint internet portal. Metadata and web-services support the search for data and their use. The database helps German administration to fulfill reporting for EU directives like MSFD and INSPIRE.

⁷⁸ ‘The distributed service-oriented architecture and implementation of INSPIRE services and data models allows serving information on several environmental policies (such as Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy’, EEA & JRC (2014).

⁷⁹ Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe.

*domain knowledge and where either the complexity of the topic was feasible to address or where the data work had a long tradition’.*⁸⁰

In more operational terms, the 2019 report on environmental information systems (EIS) indicated that in the question ‘*Is there a link between the EIS and the national INSPIRE portal, is the monitoring data found via the EIS and provided through INSPIRE?*’⁸¹ Only in 15% of the evaluated Member States and regions declared that the link between the EIS and INSPIRE was properly provided. In 38% of the cases, reference to INSPIRE was made within the EIS, but no links were found, in 47% of the evaluated Member States and regions there is no reference and no links between the EIS and INSPIRE were found. This suggests a lack of connection between the environmental information platforms and INSPIRE and an incomplete integration resulting in different incompatible platforms and approaches for sharing environmental data.

Overall, Member States are satisfied with ongoing efforts in aligning INSPIRE and reporting requirements in EU environmental legislation and they are positive about the added value of INSPIRE for reporting when it will be fully implemented. Directives such as the Air Quality Directive, Water Framework Directive, the Industrial Emissions Directive and Bathing Water Directive are examples where the alignment process has already been achieved and has led to better reuse of spatial data for policy implementation⁸², and decreased implementation burden⁸³.

National environment authorities, which are in many cases responsible for the reporting, find that spatial data made available by INSPIRE is used in the reporting under the environmental acquis especially the priority datasets identified for INSPIRE reporting. However, there are still some challenges experienced, as data cannot always be fully used by reporting authorities because it does not meet the reporting requirements (not recent enough, different content).

5.2.7. What are the qualitative and quantitative effects of INSPIRE on the policymaking users in the field of environment in Member States?

A general remark is that the evaluation gathered some examples and relevant information about use of INSPIRE and the evidence-base is considered as not robust enough. It is therefore difficult to conclude firmly on this important aspect of the Directive and the presented results are likely under-estimating the actual use as a result. Positive side effects like better organisation of the governance in particular between regional and national levels may also be under-estimated.

The above also apply to policymaking users as the information contained in the current status form is not specific and mostly quantitative (e.g. examples and numbers of geoportals in use in the Member State). The main finding is that outside some examples of use by policy makers, which are also data providers, it was difficult to quantify the use and effect on policy making in

⁸⁰ EEA & JRC (2014), Mid-term evaluation report on INSPIRE implementation, EEA Technical report No 17/2014, ISSN 1725-2237., P.7

⁸¹ European Commission (2019), Promotion of good practices for national environmental information systems and tools for data harvesting at EU level. Final Report, drafted by Wageningen University and Research (The Netherlands), Umweltbundesamt GmbH (UBA) (Austria), Epsilon (Greece), COWI (Belgium).

⁸² e.g. European Air Quality Index - <https://www.eea.europa.eu/themes/air/air-quality-index>

⁸³ e.g. EU registry on industrial sites that improves the coherence of the E-PRTR, IED and LCP data sets, and reduces the reporting burden on operators and competent authorities

general, while in some specific areas there was a good uptake of the INSPIRE Directive.

Interviews with Member States revealed a mixed picture when it comes to measuring the effect of the Directive on policy making in the field of environment. Spatial data is considered an important source of information for the implementation of environmental policy, but Member States are not always able to provide precise information about the use or users of data. The reason behind is that it is not specifically monitored or because users are also the data providers for their own needs (mainly at local, regional, national level) and do not need to use the datasets in INSPIRE formats. It was also raised that the INSPIRE Directive is not yet fully implemented and as such, the effects cannot be observed yet.

Furthermore, it was observed that in many Member States more and richer non-harmonised data sets, that better serve the needs of national and regional policy makers, are being made available through the national infrastructure⁸⁴. In addition, when these Member States are providing separate INSPIRE datasets and services, they usually pay less attention to their usability. For example, INSPIRE services may be set up to serve huge amounts of datasets or layers, or the services may not be actively quality-controlled or monitored. This makes them difficult to use in any practical application.⁸⁵

To increase the usefulness of the INSPIRE Directive for policymakers active in sectors or policies that are relevant for the environment (transport, energy marine etc.) further alignment with sectoral requirements would be needed. Pilot projects over the last 5 years⁸⁶ report that alignment is a long process and technical difficulties arise in relation to data quality (for instance, frequency of data collection: annual data versus real-time data for traffic information or spatial accuracy).

However, it is also important to emphasize that the INSPIRE Directive was reported by Member States to be a driver for a better organisation of the governance in particular between regional and national levels. INSPIRE has driven the development of portals and centralised access to the datasets in most Member States.

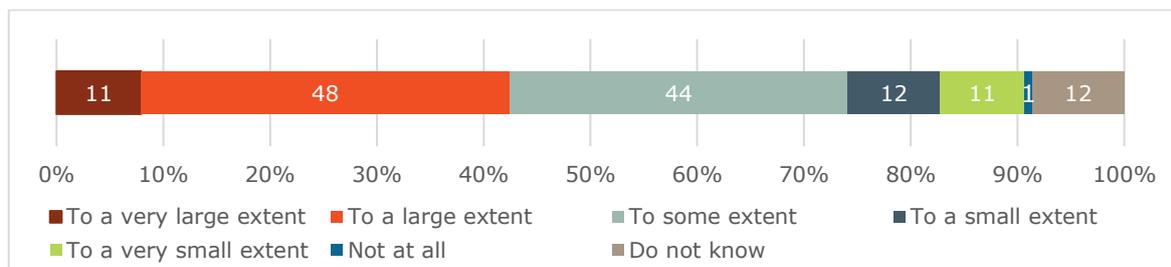
In the surveys for targeted sectors (agriculture, marine, spatial data, environment) 42% of respondents considered that the INSPIRE Directive contributed to a large extent to access, exchange and reuse of geospatial data across public sector organisations. Another third (32%) considered that it contributed to this to some extent (Figure 4).

⁸⁴ European Commission (2019), Promotion of good practices for national environmental information systems and tools for data harvesting at EU level. Final Report, drafted by Wageningen University and Research (The Netherlands), Umweltbundesamt GmbH (UBA) (Austria), Epsilon (Greece), COWI (Belgium).

⁸⁵ Kotsev A., Minghini M., Cetl V., Penninga F., Robbrecht J., Lutz M., INSPIRE – A Public Sector Contribution to the European Green Deal Data Space. A vision for the technological evolution of Europe's Spatial Data Infrastructures for 2030, EUR 30832 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-41564-0, doi:10.2760/8563, JRC126319.

⁸⁶ See: <https://inspire.ec.europa.eu/inspire-pilots/59289>

Figure 4 Contribution of INSPIRE to access, exchange and reuse of geospatial data across public sector organisations (N=139)



Source: All respondents, Targeted surveys (combined) April-May 2021, Question 5

5.2.8. What are the qualitative and quantitative effects of INSPIRE on users active in economic sectors influencing environment?

The main finding on qualitative and quantitative effects of INSPIRE on users active in economic sectors influencing environment is that information on use and users is too scarce to provide a clear view of the effects of INSPIRE for these. Studies and stakeholders involved in the INSPIRE implementation (at European Union and Member States levels) seem to be focused on making data available, without identifying upstream the precise effects on each type of users or monitoring how data are used, by whom and what for.

As far as uses are concerned, reporting and planning purposes rank first. This is coherent with the fact that the first users of spatial data are national / local authorities or agencies.

The availability of data and the way data are, or could be used have often been assessed but there is no precise or comprehensive information on effects of availability of the data on the users in different sectors. The JRC carried out two projects in the past years to assess how geospatial data made available by the Member States, as a result of INSPIRE, can be used to tackle energy efficiency⁸⁷ or mobility issues⁸⁸. The two projects start from a very specific need from a final user to identify information needs for policy implementation. INSPIRE data are seen as a means to achieve high-level objectives but it is not indicated what effects can be identified. It is therefore challenging to establish a direct link between the availability of data as a result of the implementation of INSPIRE and the positive effects on users in economic sectors.

18 Member States and EFTA/EEA countries indicated in their country forms that better overview, discoverability, availability, accessibility of data were among the main direct benefits of INSPIRE (see 5.3.1).

Targeted surveys showed that respondents think that spatial data made available because of INSPIRE are:

⁸⁷ Hans Bloem, Ray Boguslawski, Maria Teresa Borzacchiello, Piergiorgio Cipriano, Albana Kona, Giacomo Martirano, Isabella Maschio, Francesco Pignatelli (2015), Location data for buildings related energy efficiency policies, European Union Location Framework (EULF) Project Feasibility Study, JCRC Technical report.

⁸⁸ Bourée, K., De Vries, B., Duquesne, C., Dodson, C., Jugelt, S., Martirano, G., Minghini, M., Pignatelli, F. (2019), INSPIRE-MMTIS: overlap in standards related to the Delegated Regulation (EU) 2017/1926, EUR 29975 EN, Publications Office of the European Union, Luxembourg.

- Mainly used by public administrations: national governments / ministries (36%) followed by regional and local authorities (29%) and national and regional agencies (36%).⁸⁹
- Used (to a very large, large or some extent) by 25% of the marine/maritime sector, 38% of the transport/mobility sector, 36% of the agricultural sector and by 24% of other sectors / users.⁹⁰

The public consultation⁹¹ indicated that the purposes for using data are (logically) dependent from the type of users. All academic/research institutions use data for research purposes and for 60% of respondents the data is used for reporting purposes. NGOs all indicated that they use data for planning purposes while 80% also use data for research purposes and three out of five for reporting purposes. Overall, reporting purposes and planning purposes are the two first usages of data (59% and 58% of respondents respectively). Research purposes was chosen by almost 50% of respondents to the public consultation.

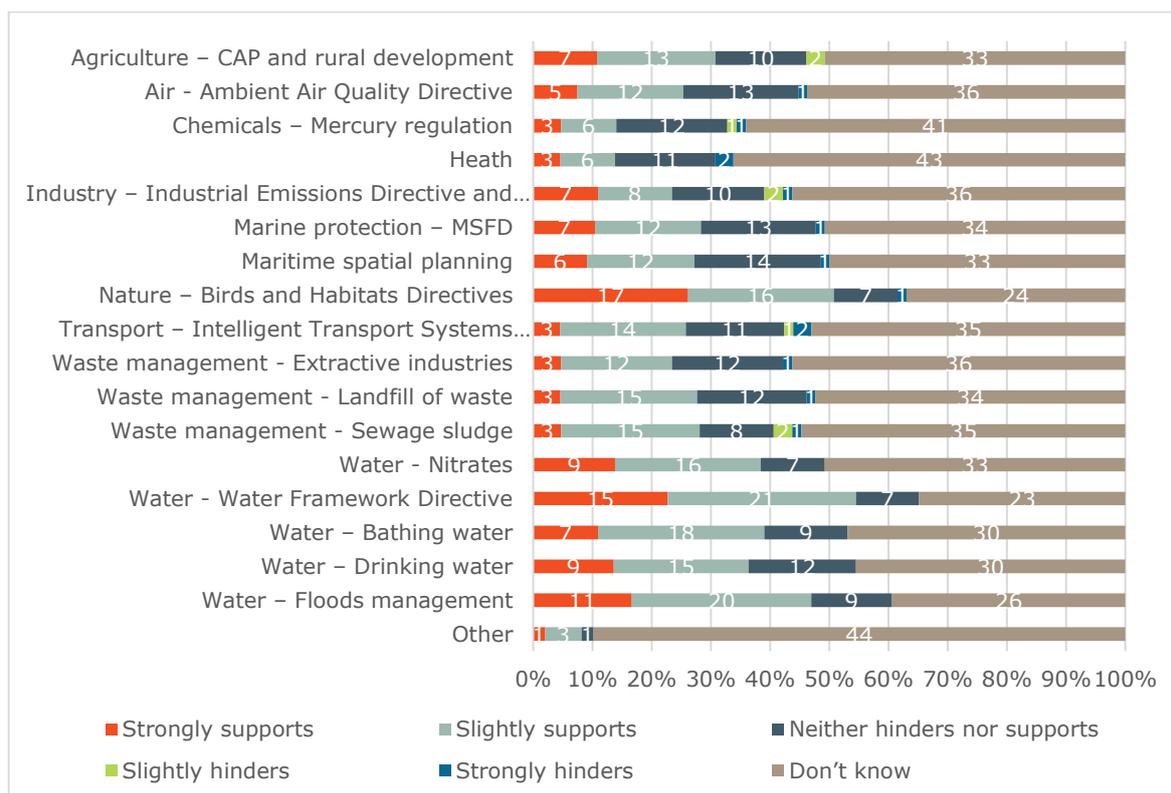
Furthermore, the public consultation also gave an indication at sector level (Figure 5) how INSPIRE can support process of planning and assessing impacts (either slightly or strongly). The better results are related to the implementation of the Water Framework Directive (55% of respondents) and the Nature – Birds and Habitats Directives (51%). One respondent out of four (26%) indicated that INSPIRE supports process of planning and assessing impacts as far as Transport / the Intelligent Transport Systems Directive are concerned. They were slightly more to consider that INSPIRE does provide support for Marine protection / Marine Strategy Framework Directive (28%).

⁸⁹ Source: All respondents (N=134-136), Targeted surveys (combined) April-May 2021, Question 12

⁹⁰ Source: All respondents (N=88-103), Targeted surveys (combined) April-May 2021, Question 13

⁹¹ Source: EU/EEA respondents (N=91), public consultation May-July 2021, Question 3

Figure 5 Support of INSPIRE to the process of planning and assessing impacts in different policy areas – responses from the public authorities - responses from all respondents (N=49-67)



Source: All respondents, public consultation May-July 2021, Question 18.

5.2.9. What are the effects of INSPIRE on small businesses using spatial data?

The knowledge by INSPIRE implementers (Member States) of companies that use spatial data is limited. They do not monitor such users but indicated that the number of SMEs using spatial data is most likely limited. Based on this, the evaluation concluded that the use of INSPIRE data for commercial purposes or by the private sector more generally is rather limited.

The public consultation did not present conclusive evidence but indicated that the use of spatial data made available under INSPIRE for commercial purposes and more generally by companies themselves might be limited. This can be explained by lack of knowledge in the sector about INSPIRE or because the data as such can be acquired by other means.

Table 7 Summary of the findings on effectiveness

Member States have progressed in the implementation of the Directive. Still, no Member State has achieved full implementation yet. Implementation gaps still need to be closed to fully capture effects and impacts.

The current geographical coverage of implementation does not allow to meet the INSPIRE Directive objective in terms of interoperability.

The implementation of the INSPIRE Directive as well as the sharing and reuse of existing spatial data still face barriers already identified in the previous evaluation of the Directive. These barriers are primarily of a technical nature.

The different ways that Member States can describe the same data, limits cross-border application. It requires extra effort to align standards as has been done by the marine community

through EMODnet.

Several Member States provide INSPIRE datasets and services as a standalone activity that is only marginally linked to the national infrastructure, often supplying access to only a subset of the rich spatial data available in national catalogues and limiting the usefulness and effectiveness of the INSPIRE infrastructure.

The use of datasets and services through the INSPIRE framework is developing both in a data-sharing and active dissemination context. However, Member States' additional efforts would be needed to increase the use of the INSPIRE framework – be it for EU level, national or regional purposes. Revising INSPIRE and the Public Access to Information Directive should be considered to improve their effectiveness and as a result the implementation of both instruments.

5.3. Efficiency

5.3.1. To what extent, and how has the intervention lead to improvements in the quality or efficiency of work of concerned stakeholders?

With regard to the improvements of the quality and/or efficiency of the work of involved stakeholders, the main direct benefits of the directive has been: better overview, discoverability, availability, and accessibility of data. The main benefits are followed by Harmonisation and interoperability, and Innovation, technologies, and technical knowledge. These benefits were identified in the analysis of the country forms reports (Table 8).

To the extent that INSPIRE is implemented, the evaluation has found that it provides the following benefits: better overview, discoverability, availability, and accessibility of data. These are followed by: harmonisation and interoperability; innovation, technologies, and technical knowledge. These findings stem from the analysis of the country form reports.

Table 8 INSPIRE benefits listed by Member States and EFTA/EEA countries in the country forms

Direct benefits		Number of countries in the country forms
<i>Type of benefit</i>	<i>Benefit identified by stakeholders:</i>	
Benefits from the production/processing 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%)
	Share 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%)
	Improved quality and reliability of data	7 (23%)
Indirect benefits		Number of countries in the country forms
<i>Type of benefit</i>	<i>Benefit identified by stakeholders:</i>	
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%)

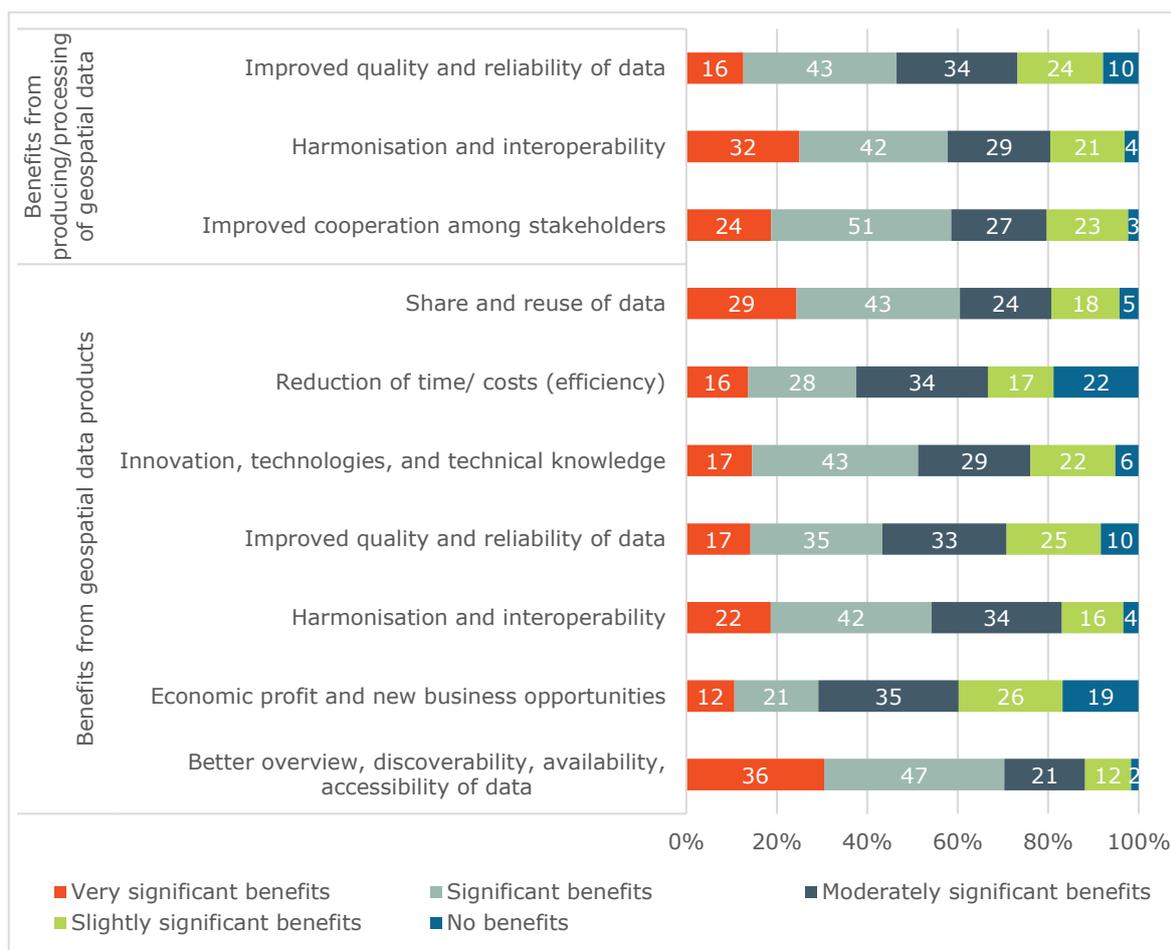
Source: Current status country forms (Total Number N=31).

Interviews with seven Member States confirmed that especially harmonisation and interoperability is a key benefit. In Member States where data is stored in many different formats and some of these formats are not readable using the most common GIS⁹² systems, creating services and formats that can be used by all users is one of the most important benefits.

In targeted surveys with stakeholders from selected communities (environment, marine, agriculture, and spatial data) most of the direct benefit types were judged as significant. The categories “Better overview”, “Harmonisation” and “Share and Reuse of Data” score very significant from more than 20% of the respondents.

⁹² A geographic information system (GIS) provides the ability to capture and analyse spatial and geographic data. GIS applications are computer-based tools that allow the user to create interactive queries (user-created searches), store and edit spatial and non-spatial data, analyse spatial information output, and visually share the results of these operations by presenting them as maps.

Figure 6 Direct benefits of INSPIRE (Total number of respondents N=113-128)



Source: All respondents, Targeted surveys (combined) April-May 2021, Question 23.A.

In terms of indirect benefits “Increased openness to share data by data providers”, “National infrastructure and data strategy development” and “EU-wide collaboration” are identified as most significant.⁹³ This shows that INSPIRE has been instrumental in furthering the development of the national geoportals as well as in promoting increased sharing of data.

The public consultation showed that better comparability and interoperability are identified as main benefits (64%), followed by the use of data across the EU and better availability of spatial data (57%).⁹⁴

5.3.2. Can any specific provisions in INSPIRE be identified that make cost-efficient implementation more difficult?

Some Member States implemented INSPIRE as an integral part of the national SDI, while others as a separate system with separate IT-infrastructure. The specific approach chosen has a major influence on how to appreciate the cost (and perceived value) of INSPIRE. Moreover, the implementation modalities depend largely on organisation in the countries at the different administrative levels.

⁹³ Source: All respondents (N=110-117), Targeted surveys (combined) April-May 2021, Question 23.B

⁹⁴ Source: All respondents (N=70), public consultation May-July 2021, Question 23

With these major precautions in mind, provisions on harmonisation and interoperability of spatial data and the costs (resources) are considered to make implementation more costly and less efficient.

9 countries (Table 9) have reported that the main costs relate to data harmonisation, IT Infrastructure, geodata services and interoperability and staff resources. Some countries provide estimates of actual costs either as totals or as yearly costs.

Table 9 Costs of implementing INSPIRE listed in the country forms

Type of cost	Cost types identified by stakeholders	Number of Member States and EFTA/EEA countries
Costs related to acquiring and processing of geospatial data	Data production and maintenance	5 (16%)
	Data harmonization and interoperability	9 (29%)
	Provision of metadata	7 (23%)
Costs related to storing and distributing geospatial data	IT infrastructure	9 (29%)
	Centralized systems and data centres	2 (6%)
	System maintenance	5 (16%)
	Network security	1 (3%)
	Geodata services and interoperability	9 (29%)
	Staff resources	9 (29%)
	Consultancy/INSPIRE expertise	3 (10%)
Costs related to improving use of geospatial data	Development of other related systems and projects	2 (6%)
	Training of stakeholders/users	-
	Staff resources	-
	Consultancy/INSPIRE expertise	1 (3%)
INSPIRE reporting	Staff resources	-
	Meetings/coordination	2 (6%)
	INSPIRE indicators	1 (3%)

Within countries, costs are perceived differently among stakeholders at the same administrative level but from different institutions (i.e. organisations/institutions at national level). Large providers of data such as cadastre or mapping agencies do not have infrastructure costs. Such institutions experience costs in relation to processing and harmonising of data instead.

Targeted surveys confirm that costs related to harmonisation and interoperability are most significant⁹⁵, and that the bulk of these costs are carried by public administrations (national, regional and local in order of volume of expenditures)⁹⁶.

⁹⁵ Source: All respondents (N=117-118), Targeted surveys (combined) April-May 2021, Question 19.A.

⁹⁶ Source: All respondents (N=113-115), Targeted surveys (combined) April-May 2021, Question 21.A

Also in the public consultation especially harmonisation is identified as a key cost driver for the implementers⁹⁷. Notably the users do not perceive that there are additional costs, and if any these would relate to purchasing additional or new software to access/use the data⁹⁸.

5.3.3. Can the INSPIRE Directive and implementing rules be made more cost-efficient? What is the simplification potential?

The evaluation evidence suggest further costs-efficiency could be accomplished by: 1) simplifying the implementation requirement and 2) better facilitating the use of the infrastructure (data, services). The latter may not necessarily lead to reduced nominal costs, but to a better ratio to outcome.

Already the mid-term evaluation identified technical complexity as the number one obstacle for the INSPIRE implementation according to the respondents in the public consultation. Simplification of the technical specifications came second as the most important obstacle to achieve the INSPIRE objectives⁹⁹.

JRC started in 2018 defining alternative encodings (e.g. GeoJSON and Geopackage) to simplify the complex data models related to the INSPIRE Directive and introduce encodings that are broadly accepted by the geospatial community and the industry. Relaxation of some semantic requirements would help improve the usability of the INSPIRE framework. When considering changes to the current INSPIRE infrastructure, it is important to not only consider the data but also to consider relevant technological developments and the role of new actors, including the private sector and citizen science initiatives.

One other aspect of simplification is the perception by users that the data models and the way data is presented (view) is too complicated for a number of users. Different types of users have different needs regarding data models: while advanced users need quite complex structures to do their job, using data models with this complexity will be a burden for other users with simpler needs. INSPIRE specifies data models for each data theme covered by INSPIRE, covering the combined needs from the most advanced users.

Interviews with Member States show in general that there is a need to simplify the implementation at the technical level. Due to the complexity in the data models data consumption in mainstream GIS software is limited (not all software can be used). Additionally, technical specifications are not easy to understand.

The need of simple models and standard software was also reflected in the targeted surveys, that propose simpler data models for increased use.

⁹⁷ Source: Spatial data providers (N=68), public consultation May-July 2021, Question 21

⁹⁸ Source: Spatial data providers (N=74), public consultation May-July 2021, Question 22

⁹⁹ A similar conclusion was reached at the “What if...?” sessions at the 2017 INSPIRE conference. Simple APIs by providing user-friendly access to datasets for common ICT professionals, would likely have a higher impact on creating value-added services on top of INSPIRE data and services.

Notably, the analysis of the public consultation¹⁰⁰ found that respondents were more concerned with harmonisation and interoperability than with use (downloading and viewing spatial data).

5.3.4. Are results achieved so far commensurate with the resources put forward and in line with the ones expected from the ex-ante evaluation of INSPIRE?

The key findings of this evaluation are that relatively few assessments of costs and benefits have been made of the implementation of INSPIRE. Even in the cases where these have been conducted, it is clear that it is not always possible to separate the cost of implementing INSPIRE from the costs of implementing and maintaining the national SDI.

The impact assessment estimated that the benefits of implementing INSPIRE would be many-fold compared to the investment needed.¹⁰¹ The benefits were estimated in the range of EUR 680-1660 millions against costs of EUR 77-161 millions.

The ex-post costs and benefits to Member States from INSPIRE are difficult to assess as these have not been collected and calculated in a uniform manner, if at all. The impact assessment/ex ante evaluation of 2007/2004 sets out a methodology for Member States to record and calculate the costs and benefits, but only a few Member States have complied with the request to apply the methodology.

All cost-benefit assessments focus mainly on the benefits of implementing SDI in general. Overall, all the reviewed cost-benefit analysis find that when SDI is implemented this has a large positive impact/benefit for both the public (cost savings) and private sector (costs savings and business opportunities). Nevertheless, a number of Member States found that it is too early to really assess the cost-benefits ratio as INSPIRE is not yet fully implemented.

Table 10 presents recent cost-benefits analysis (CBA) conducted by individual Member States. CBA studies for NL, DK, UK were already included in the midterm evaluation. The three more recent studies (ES, SE and LT) show that different approaches have been taken to measure the costs and benefits. In the case of Spain, the value of the web services and data are estimated. In the case of Lithuania, the costs of saved working hours resulting from the sharing of data are assessed. In the last study on Sweden, the benefits and costs of physical planning of digitalisation and geodata has been analysed. The three studies all find that the benefits outweigh the costs.

A study conducted in Finland in 2017¹⁰² (and used as basis for the cost-benefit analysis (utility analysis) conducted by Sweden) shows that harmonised digital physical planning can save up 60% of the time used for inquiries and investigations. The Swedish study¹⁰³ estimates cost savings for the municipalities at EUR 17 million, for regional authorities it is EUR 3,5 million, for the court system the saving amounts to EUR 0.8 million and for

¹⁰⁰ Source: Spatial data providers (N=64), public consultation May-July 2021, Question 25

¹⁰¹ European Commission (2004), Commission Staff Working Document, Proposal for a Directive of the European Parliament and of the Council establishing an infrastructure for spatial information in the Community (INSPIRE). Extended Impact Assessment, SEC(2004) 980.

¹⁰² Ministry of Environment Finland, 2017

¹⁰³ Ekonomisk nytta av ett samlat nationellt tillgängliggörande av geodata i samhällsbyggnadsprocessen. 2019. Lantmäteriet

the Swedish Transport Administration to EUR 3.5 million. The estimated total savings are thus EUR 25 million. The same study estimates that the total savings regarding labour costs for house construction in Sweden can be estimated at EUR 1.8–3.7 billion and corresponding cost savings for infrastructure construction at between EUR 39 million and EUR 88 million when using geodata, Building Information Modeling (BIM) and a common perspective and information. The total savings are thus estimated to be between EUR 1.8 billion and EUR 3.8 billion per year in Sweden.

The example from Lithuania¹⁰⁴ included in Table 10 indicatively shows the benefits and costs of INSPIRE implementation. The costs of INSPIRE is estimated to amount to EUR 3 million whereas the benefits are estimated to EUR 6-7 million.

In the report which assesses the costs and benefit for Spain, although concluding that the benefits outweigh the costs, the main purpose is to set up a methodology to estimate the economic benefits generated by the central SDI-node.

Table 10 Examples of cost-benefits analysis conducted in Member States

MS	Description of study	Description of key findings
ES	<p>The study developed and tested a methodology to estimate the economic benefits generated by the central SDI-node of Spain. Benefits estimation is understood as an approximate calculation - as accurate as possible - in monetary terms of the value of the web services and data in the central SDI-node based on a set of objective considerations and criteria. The central SDI node comprises all the SDI resources published on the web by the same organization, IGN-ES, as coordinator of the Spanish SDI¹⁰⁵.</p> <p>The authors note that this is a model based on estimates and not hard mathematics – but this provides a possibility for an estimate and a comparison between Member States.</p>	<p>The factor that has the biggest impact on the benefits or value is the number of service requests. When these numbers are rising, then the benefits are rising as well.</p> <p>The richer the central-node is, i.e. the more WMTS and WMS there are, the more requests this will generate, and thus also more value. However, it should be noted that this depends on whether the services are ‘used’, this means are embedded in (new) applications.</p>
SE	<p>In 2019, in a report to the Swedish government Lantmäteriet estimated the potential benefits (utility) from national governed access to geodata to be in-between 22.3 and 42.4 billion Swedish kronor in the area of societal development only.¹⁰⁶</p>	<p>Benefits:</p> <ul style="list-style-type: none"> - At local government level EUR 25 million - At central government level EUR 53 million <p>Private public construction companies EUR 2,1 million</p>

¹⁰⁴ Data provided by Lithuania as part of the Focus Group interview.

¹⁰⁵ Vandenbroucke, D. and G. Vancauwenberghe (2021), The benefits and value of the Central SDI-node of Spain, Final Report.

¹⁰⁶ https://www.lantmateriet.se/contentassets/50c7b8feec4744e5a0fa2ffaf0ea07ec/519-2018_2889-bilaga-2-ekonomisk-nytta-rattelse-190514.pdf

LT For the structural fund applications, the Lithuanian authorities did a comprehensive study based on assumptions, experiences and statistics. They calculated the working hours that were saved because of the sharing of data. For example, time was saved for users, who no longer need to drive across Lithuania to obtain some paper documents or data storage. The benefits are expressed in saved working hours rather than in monetary terms. Estimates can be then calculated based on the average wage of the employees whose working hours were reduced. Most of the benefits are linked to saving time or buying new software.

Benefits:

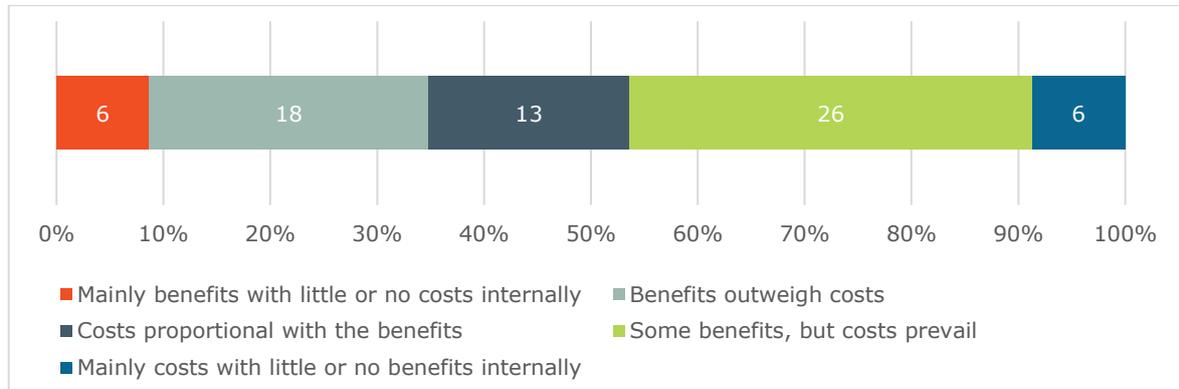
- For INSPIRE Annex 3 – estimated ca 20,000 working days annually / ca EUR 1,2 million (for 2020)
- For INSPIRE Annex 1 and 2 estimated EUR 4 million
- Plus ca. EUR 1 million indirect benefits (better informed decisions, transparency...)
- Total annual EUR 6-7 million

Costs:

- Three EU-funded SDI development projects: EUR 8,9 million (full SDI + administrative services)
- INSPIRE part, explicit: about EUR 2,5 million
- Annual budget 2011–2020 (full SDI); EUR 4 million
INSPIRE part, explicit: ca EUR 0,5 million

It is noticeable that the responses of the public consultation (Figure 7) show that 37% of the respondents overall found that there were some benefits of INSPIRE, but that the costs prevail in terms of sharing and using spatial data. Only 25% of the respondents found that benefits outweigh the costs. This is not particularly surprising, as the majority of respondents belong to public administrations responsible for implementing the INSPIRE Directive and carrying the bulk of the costs (see 5.3.5).

Figure 7 Proportionality of costs and benefits (N=69)



Source: All respondents, public consultation May-July 2021, Question 24.

5.3.5. How proportionate were the costs of the intervention for different stakeholder groups (enterprises including SMEs, citizens ...)?

National authorities and agencies are the stakeholders bearing the highest cost and where less of the (direct) benefits appear. Yet, the consultation showed that also businesses have the perception that costs outweigh benefits. The evaluation shows that the role of INSPIRE is not fully understood and notably that the cost of generating data is attributed to INSPIRE whilst the undeniable need for the data to be available regardless of INSPIRE is not fully reflected. The findings point to a need for more targeted information about INSPIRE and how it can be utilised for

different public and commercial purposes.

The review of the cost-benefits analysis presented under 5.3.4 included a presentation of studies of Sweden and Lithuania that assessed the cost-benefit at different government levels and to the private sector (in the case of Sweden only). In the Swedish study, the assessment of the benefits (cost savings) for the municipal level is the highest among stakeholder levels and groups included (in the example of physical planning). In another example in Sweden concerning the administration of the construction law the municipal level is estimated to have a cost saving of EUR 20 million per year. These examples do not provide information on the costs for the municipal levels as such, but only serve to reflect that the benefits for the municipal level can be significant when implementing an SDI system.

In the JRC Study¹⁰⁷ on access to spatial data for environmental purposes, the study finds that the costs related to acquiring (accessing) spatial data in some Member States are significant.

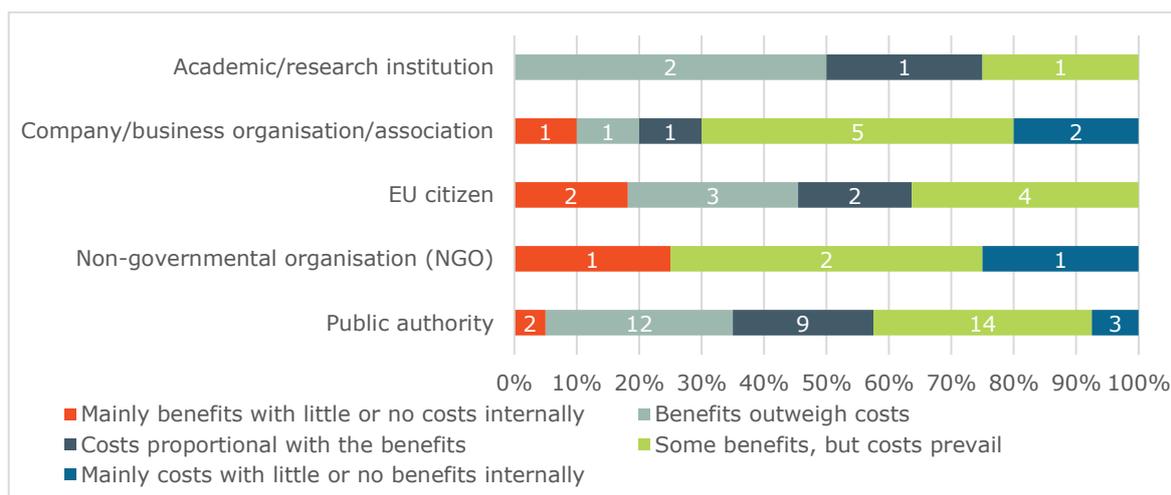
Interviews with Member States confirm that it is at the national level that the highest cost occur. The main costs relate to acquiring and processing of geospatial data i.e. the production of data. In addition, costs relating to harmonisation of data were identified as a cost category for both national and local level institutions. The cost structure depends on the organisation of the Spatial Data Infrastructure (SDI) in the country, the size and the constitutional structure of the country. Federally organised countries will tend to involve more institutional stakeholders and levels of government in SDI implementation, and this requires additional harmonisation and coordination efforts.

Targeted surveys also confirmed that the main costs are perceived at national level and that these organisations may not see all the benefits. The stakeholder group of geological survey, mapping and cadastre and national authorities are those that perceive that cost outweigh benefits.

It is noticeable that the public consultation shows (Figure 8) that in addition to the national level also businesses have the perception that costs outweigh benefits at this stage.

¹⁰⁷ JRC (not yet published), Evolution of the access to spatial data for environmental purposes. JRC Technical Report.

Figure 8 Proportionality of costs as perceived per stakeholder group (N=69)



Source: All respondents, public consultation May-July 2021, Question 24

5.3.6. Have the resources needed to implement INSPIRE been available?

The resource situation varies from country to country and within countries at different administrative levels. Several resource issues were identified that have a negative impact on the available resources: bad prioritisation of the use of resources between the different tasks of INSPIRE (e.g. underestimation of the data harmonisation effort), uneven distribution of resources/funds between national/regional/local levels of administration, lack of available profiles with the required expertise, budget discontinuity, additional costs of outsourcing the implementation and maintenance of the infrastructure.

Mostly, INSPIRE implementation has been funded as part of the general SDI budget allocation with some difference in terms of which costs are carried at different government levels. Often, funding is provided at national level (state budget). Some Member States¹⁰⁸ have also used funding via European Structural Investment Funds (ESIF) or have reported the participation of a number of organisations to projects with EU level funding from other instruments (the research framework programmes¹⁰⁹, LIFE+, ISA¹¹⁰) without further budgetary information. Such projects can help to develop solutions and tools that can be used by all Member States (reusable components), which can improve efficiency across multiple policy sectors. However, these opportunities are not used systematically by Member States.

5.3.7. How has the use of INSPIRE for environmental reporting affected the reporting burden?

The evaluation shows that the reporting burden is estimated to be further reduced in function of the ongoing alignment of INSPIRE provisions with regulatory reporting provisions in other environmental regulations. Environmental authorities use the spatial data made available through INSPIRE to some extent. At the same time, it was noted that this does not necessarily reduce the reporting burden.

¹⁰⁸ BG, LT, RO, PL

¹⁰⁹ For example: SMARTOPENDATA - [Linked Open Data for environment protection in Smart Regions](#), FP7-ENVIRONMENT, Start date: 2013-11-01, End date: 2015-10-31

¹¹⁰ [Interoperability Solutions for European Public Administrations](#)

The Commission identified monitoring and reporting under the environmental acquis as a priority use case for the development of a first set of pan-European information products (see 3.2.1). Based on the evaluation of reporting obligations¹¹¹ under the environmental legislation, it was found, inter alia, that the more advanced and systematic use of information technology including the wider application of the INSPIRE positively influence the efficiency of reporting process. It was also found that relying more on active dissemination would also improve these processes.

Findings under effectiveness (see 5.2.6) and under coherence (see 5.4.2) point out that although the ongoing alignment of regulatory reporting obligations with INSPIRE obligations, the use of INSPIRE still offer unused potentials. More work in terms of making it technically more efficient will be needed before INSPIRE really can support the reduction of the administrative burden.

Member States were overall positive (see 5.2.6) about the alignment process of INSPIRE with EU reporting requirements in areas such as: air quality directive, water framework directive, the industrial emissions directive and the bathing water directive. These are examples where it has been implemented with success.

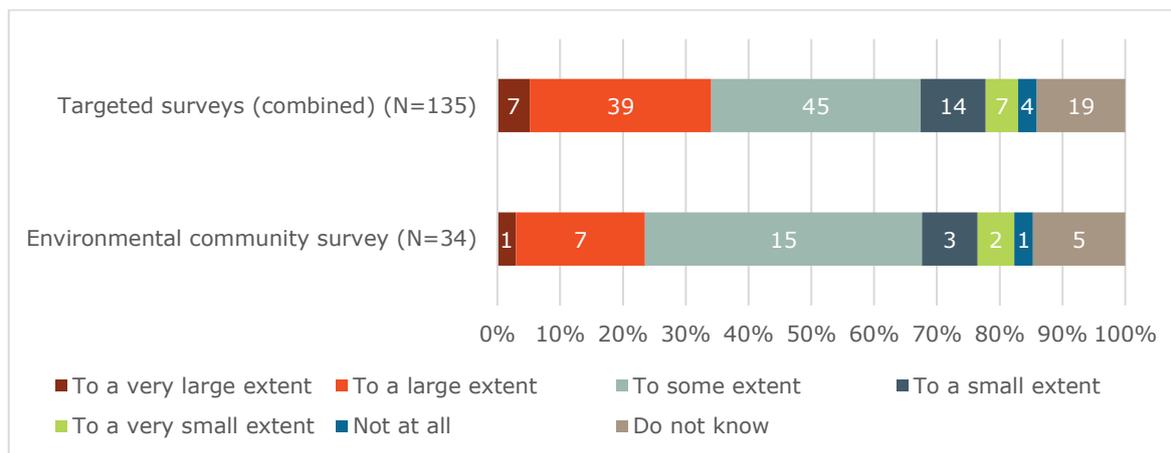
5.3.8. How would further streamlining of the provisions in Articles 7 and 8 of the Public Access to Environmental Information Directive with the active dissemination provisions of the INSPIRE Directive impact the administrative burden on the Member States.

The evaluation found that INSPIRE can further support the implementation of the Public Access to Environmental Information Directive as it provides a technical framework for electronic data sharing.

In terms of the administrative burden, the targeted surveys showed (Figure 9) that stakeholders perceive that INSPIRE supports the implementation of the Public Access to Environmental Information Directive, at least to some extent, by improving the capacity. An improvement in the capacity of public authorities to disseminate environmental information to the public in an easily accessible electronic format should have an effect on the administrative burden.

¹¹¹ https://ec.europa.eu/environment/legal/reporting/pdf/SWD_2017_230.pdf, page 76

Figure 9 Extent to which INSPIRE contributes to the capacity of public authorities to disseminate environmental information to the public in compliance with Directive 2003/4/EC



Source: All respondents, First row: Targeted surveys (combined) April-May 2021; and second row: Targeted survey of the environmental community only April-May 2021, Question 41.

Table 11 Summary of the findings on efficiency

INSPIRE facilitates the work of the stakeholders in the area of spatial data provision through improved discoverability, availability and accessibility to spatial data.

Interoperability (of data and services) is the most important cost factor in the INSPIRE implementation.

There is a simplification potential of the implementation in terms of addressing the requirement for interoperability.

The results achieved so far are commensurate with the resources put forward and are in line with the ones expected from the ex-ante evaluation of INSPIRE in observed cases. However, implementation is not yet complete and hence results cannot be fully assessed yet.

Stakeholders perceive the costs as 'asymmetrical'. Most costs relate to the implementation of the Directive and are largely borne by national governments because the implementation obligation is on their public administrations, but differ significantly in function of how INSPIRE has been implemented notably if it is part of or independent from SDI. A proportion of these costs can therefore not necessarily be attributed to the Directive as such. Users of the spatial data infrastructure do not perceive extraordinary costs.

In most cases, the resources for implementation were available, but some Member States have perceived it as a challenge to secure the resources. In these Member States, costs have been perceived as higher.

The INSPIRE Directive has proven to be a valuable instrument to achieve legal interoperability by streamlining concepts and reporting provisions across different environmental acts (e.g. on environmental emissions).

The INSPIRE Directive can support the implementation of the Public Access to Information Directive by providing a technical framework for electronic data sharing.

While the INSPIRE Directive performs satisfactorily at making geospatial environmental data accessible, simplification, modernisation and future-proofing would mitigate the challenges linked to the costs of implementing the Directive.

5.4. Coherence

5.4.1. To what extent is INSPIRE coherent internally?

The evaluation did not identify any major inconsistencies between INSPIRE Directive, its Implementing Rules and the non-binding Technical Guidance.

The requirements of the INSPIRE Directive are contained in several layers of regulations and guidance, which have different statuses. The general requirements, are contained in the INSPIRE Directive itself, together with the list of spatial data themes, listed in the Annexes to the Directive. These are complemented by a series of Implementing Rules for metadata, network services, and interoperability of spatial data sets and services, which are binding in their entirety, and by non-binding Technical Guidance, which specifies data models and implementation requirements for each spatial data theme, metadata and network services.

No evidence was found that having several layers of regulations and guidance creates any inconsistencies per se. However, a number of the technical elements included in the Implementing Rules are no longer in line with technological developments, such as certain code lists and their values, or coordinate reference systems. Such modifications can currently only be made by amending the Implementing Rules.

If the INSPIRE implementing rules were to be revised through legislative procedure, they would have to be aligned with the provisions of Article 290 and 291 of the Lisbon Treaty regarding Delegated and Implementing Acts, and with the comitology procedures laid down in Regulation (EU) 182/2011. Aligning the comitology procedures referred to in the INSPIRE Directive to the Lisbon treaty might lead to more flexible revision procedures.

5.4.2. To what extent is INSPIRE coherent with environmental legislation with geospatial reporting obligations?

The evaluation did not identify any impediments to the application of INSPIRE contained within relevant EU legislation; in fact many pieces of legislation do make reference to INSPIRE rules. Having a reference to INSPIRE in the various pieces of environmental legislation recalling the obligation to share data according to INSPIRE rules supports compliance with INSPIRE and is considered helpful to increase awareness of the INSPIRE obligations, while also avoiding duplication of obligations and administrative burden.

The midterm evaluation concluded that, despite efforts to increase the coherence between INSPIRE and EU environmental legislation requiring the reporting of spatial data, both in terms of legal coherence and guidance, ‘reporting systems were only partially making use of the INSPIRE rules and specifications’, and that more work was needed to improve coherence of INSPIRE with environmental reporting requirements.

To ensure that in practice environmental reporting and the implementation of INSPIRE become consistent processes, the alignment of reporting data models with INSPIRE data specifications is necessary. Often environmental reporting and provision of INSPIRE data sets are still two distinct processes, resulting in two different datasets produced, because of differences in data specifications, standards or lack of collaboration between competent authorities responsible for environmental reporting and authorities building

and maintaining the national SDI. Abramic et al (2018) mentioned for instance that in the case of MSFD, the metadata created by authorities responsible for implementing the MSFD in Member States were not always included in the national metadata catalogues (but only in Reportnet), limiting the benefits in terms of data discoverability¹¹².

Progress has been made for certain legislation, with new data specifications being based on INSPIRE requirements (IED, Environmental Noise Directive) and alignment efforts are being made or will be made soon for other environmental Directives (e.g. Floods, Nitrates, Drinking water, or Seveso Directives). The progressive alignment of environmental reporting obligations with INSPIRE is a long process, which requires cooperation between the Commission, the EEA and Member States. It is also a complex process as INSPIRE might not always be perfectly suited for catering the requirements of thematic pieces of legislation.

To facilitate the alignment of reporting obligations and INSPIRE, a new reporting platform has been established by the EEA as Reportnet 3.0¹¹³. Reportnet is Eionet's infrastructure used for environmental reporting, which has been operational since 2002.¹¹⁴ One of the functions of Reportnet 3.0 will allow for the intake of INSPIRE datasets. Member States will progressively have the possibility to connect their reporting processes to INSPIRE services through Reportnet 3.0.¹¹⁵

5.4.3. To what extent is INSPIRE coherent with other relevant areas of EU policy with geospatial reporting obligations (transport, agriculture, maritime, space, health, disaster management, research)?

The evaluation found that INSPIRE is coherent with other policy areas and further synergies have been identified and used during the evaluated period. Further potentials could be harvested by even closer cooperation across related policy fields.

The evaluation revealed synergies between INSPIRE and sectoral objectives (See Annex 5). INSPIRE is considered as an opportunity in several sectors to have a centralised entry point to access and share data, and to avoid duplication of data collection and reporting processes (IACS data sharing, Copernicus in situ component, climate adaptation data, TEN-T, development of pan-European geospatial reference data sets by Eurostat). Links with INSPIRE are being developed (legal references, technical guidance) and alignment of various data sharing instruments is ongoing (IACS, EMODnet, Copernicus). The pace of implementation (or varying degrees of implementation) of INSPIRE across the Member States is however slowing down the process and, in some cases, impedes successful interactions (e.g., the Copernicus in situ component).

In some sectors the possible use of the INSPIRE Directive is still largely to be defined (MSP, TEN-T, climate adaptation). Collaboration with sectoral DGs at EU level and through committees could be further developed, where relevant (e.g., representation of INSPIRE groups in sectoral committees, formalising cooperation).

¹¹² Ibid.

¹¹³ Reportnet: <https://reportnet.europa.eu/> (Last accessed on 19.05.21).

¹¹⁴ About Reportnet : <https://www.eionet.europa.eu/reportnet> (Last accessed on 19.05.21).

¹¹⁵ Scoping Interview with EEA.

5.4.4. To what extent is INSPIRE coherent with the Public Access to Environmental Information Directive and the objectives of the Common European Green Deal data space?

Public Access to Environmental Information Directive and INSPIRE were adopted for partially overlapping purposes. The former has the objective of ensuring the right of access to environmental information held by public authorities to end-users. It also aims to ensure the progressive electronic dissemination of environmental information to the public, for transparency purposes, and for enabling public scrutiny and access to justice, as provided by Article 5 of the Aarhus Convention.

The evaluation did not reveal any formal conflicts between the INSPIRE Directive and Public Access to Environmental Information Directive. However, evidence shows that both Directives were often implemented through separate systems that are not necessarily connected. There are also significant potentials for further alignment between the two instruments to achieve better and more up-to-date outcomes, notably in form of better and more useful information available to the public (and business).

The scope of ‘environmental information’ addressed by the Public Access to Environmental Information Directive is significantly broader than the scope of INSPIRE. Environmental information, in the meaning of the Public Access to Environmental Information Directive does concern a wide range of items, listed in Article 2(1) of the Directive, including environmental assessment, policy and planning documents, environmental permits, implementation reports, enforcement measures etc., which should be made publicly accessible. Although some of these documents might be relevant for some spatial datasets (e.g. list of permitted installations, facilities or transport networks), the aim of the Public Access to Environmental Information Directive is also that those documents are made available to the public in their entirety for transparency purposes.

The provisions in the Directive concerning dissemination of environmental information leave a lot of discretion to the MS and would benefit from:

- a reference to metadata (which is an essential element to ensure that the information made available is of sufficient quality in accordance with Article 8 of the directive);
- a definition of what active dissemination entails, e.g. view and download services.

In terms of scope, the Public Access to Environmental Information Directive and the INSPIRE Directive address information or data held by public authorities. Both directives are fully aligned in the way they define ‘public authority’.¹¹⁶

¹¹⁶ ‘public authority’:

- a) Any government or other public administration, including public advisory bodies, at national, regional or local level, or
- b) Any natural or legal person performing public administrative functions under national law, including specific duties, activities or services in relation to the environment, or
- c) Any natural or legal person having public responsibilities or functions, or providing public services relating to the environment under the control of a body or person falling within (a) or (b). (Article 3(9) of the INSPIRE Directive / Article 2(2) of the Public Access to Environmental Information Directive).

The adoption of the INSPIRE Directive introduced an important new mechanism for sharing environmental information that has a spatial dimension through electronic means. Some Member States already use INSPIRE specifications to fulfil its obligations to share environmental information under the Public Access to Environmental Information Directive. In this perspective, the Public Access to Environmental Information Directive and INSPIRE are largely complementary as INSPIRE has the potential to support the implementation of the former.

Recent studies have shown however that both Directives were often implemented through separate systems that are not necessarily connected. A recent study on national environmental information systems (EIS) found that, in many Member States, there are no links between the EIS and the INSPIRE SDI. Only in 15% of the evaluated Member States and regions a link between the EIS and INSPIRE was properly provided. In 38% of the cases, a reference to INSPIRE was made within the EIS, but no links were found, and in 47% of the evaluated Member States and regions there was no reference and no links between the EIS and INSPIRE¹¹⁷. The study also found that the monitoring data provided in the EIS did not have metadata in line with INSPIRE.¹¹⁸ This is clearly pointing to a problem that results in impacting the quality and reliability of the data made available under the Public Access to Environmental Information Directive.

The Public Access to Environmental Information Directive does not mention the INSPIRE Directive as it was adopted before INSPIRE and has not been revised. The language of the Public Access to Environmental Information Directive with regards to data sharing is quite outdated and the obligation to share information through ‘electronic means’ is not further specified with regards to environmental data. This suggests that INSPIRE at present does not actively support the implementation of the Public Access to Environmental Information Directive in the absence of a binding reference to INSPIRE, requiring that data referred to in Article 7(e) should be shared in accordance with INSPIRE.

5.4.5. To what extent is INSPIRE coherent with Directive (EU) 2019/1024 on open data and the re-use of public sector information and what are the implications of Directive 2019/1024/EU?

Although they do overlap in scope, the evaluation showed that technical requirements on data sharing currently laid down in both Directives do not contradict each other. The inconsistencies between INSPIRE and the PSI Directive that were exposed by the study to support the review of the PSI Directive, have been largely resolved by the Open Data Directive.

The 2018 evaluation of the PSI Directive concluded that the ‘question of coherence between the INSPIRE Directive and the charging provisions of the PSI Directive could benefit from some clarification or formal alignment’,¹¹⁹ as some stakeholders called for more guidance on what charges and licenses are permitted for accessing spatial data and

¹¹⁷ European Commission (2019) Promotion of good practices for national environmental information systems and tools for data harvesting at EU level. Final report, p.31.

¹¹⁸ Ibid, p.35.

¹¹⁹ European Commission (2018), Evaluation accompanying the proposal for a Directive of the European Parliament and of the Council on the re-use of public sector information (SWD/2018/145 final), p.40

services.¹²⁰ Similarly, the midterm evaluation found some inconsistencies regarding the data sharing provisions under INSPIRE (Article 17) and the PSI Directive regarding licensing and charging for the data.

Although both Directives allow for some type of charging mechanism for the provision of data, including the notion of recovering a reasonable return on investment, the PSI Directive is more prescriptive than the INSPIRE Directive. It provides that charges must be limited to the marginal costs incurred for the reproduction, provision and dissemination of the data, and in the case of public bodies that are required to generate revenue to cover the costs of their activities, also a reasonable return on investment.¹²¹ On the other hand, the INSPIRE Directive uses a broader terminology, providing that charges applied for sharing data between public bodies should be kept to the minimum required to ensure the necessary quality and supply of spatial data sets and services, together with a reasonable return on investment.¹²²

In addition, the evaluation of the PSI Directive found that metadata interoperability issues could arise, in practice, if the PSI and INSPIRE communities do not sufficiently coordinate with each other, as both communities use their own metadata standards (ISO vs. CKAN standards), which are not interoperable.¹²³ This issue may increase in the future with the practical implementation of the Open Data Directive and further developments to the EU Open Data portal, created to facilitate the discovery of the data made available by the PSI Directive. Although the PSI Directive does not set obligations in terms of standards or format it will nonetheless be crucial to ensure that supporting guidance and recommendations for both directives are compatible in practice.

In terms of the interplay with the INSPIRE Directive, the new Open Data Directive makes several references to INSPIRE to clarify the interactions between the Directives based on the PSI Directive evaluation. Recital 4 states that the provisions of the Open Data Directive should focus on the relationship with other EU legal instruments, including INSPIRE. Recital 34 states that, where possible and appropriate, public sector information should be ‘made available through an open and machine-readable format and together with their metadata at the best level of precision and granularity, in a format that ensures interoperability, for example by processing them in a way consistent with the principles governing the compatibility and usability requirements for spatial information under Directive 2007/2/EC’. Finally, Article 1(7) specifically clarifies that the Open Data Directive ‘governs the re-use of existing documents held by public sector bodies and public undertakings of the Member States, including documents to which Directive 2007/2/EC applies.’

The main changes in the Open Data Directive that might call for a future alignment in the INSPIRE Directive are related to the principles governing charging (Article 6) and to the provisions on high-value datasets (Articles 13 and 14), more specifically the future implementing act currently being developed by the Commission and the requirement to

¹²⁰ European Commission (2018), Evaluation accompanying the proposal for a Directive of the European Parliament and of the Council on the re-use of public sector information (SWD/2018/145 final); and Scoping interview with DG CONNECT - G1 Data Policy and Innovation, 6 April 2021.

¹²¹ PSI Directive 2013/37/EU, Article 6

¹²² INSPIRE Directive 2007/2/EC, Article 17

¹²³ European Commission (2018), Study to support the review of Directive 2003/98/EC on the re-use of public sector information, Final Report.

provide such datasets free of charge. The coherence of the INSPIRE and Open Data Directive cannot be fully assessed at this stage. The national transposition and implementation of the latter is still ongoing and the high-value datasets implementing act is currently being developed.

Close cooperation in future developments of both legal frameworks is needed to guarantee their alignment, complementarity and efficient implementation with minimal burden on stakeholders.

Table 12 Summary of the findings on coherence

INSPIRE is legally coherent with environmental legislation with geospatial reporting obligations and with other relevant areas of EU policy with geospatial reporting obligations. In practice however, data specifications are not yet fully aligned, leading to instances of duplication of reporting processes.

The INSPIRE Directive has been designed to be consistent with the EU legal framework on data sharing and dissemination and can support implementation of the Public Access to Environmental Information Directive and the Open Data Directive. Synergies between the three Directives could however be better exploited, in particular, INSPIRE can be useful in support of improving dissemination of information under other aforementioned two Directives.

Coherence issues between the INSPIRE Directive and the Open Data Directive might however arise in the future and could require aligning INSPIRE with the open data legal framework.

INSPIRE is internally coherent, however, the implementing rules are outdated with regards to Articles 290 and 291 of the Lisbon Treaty on Delegated and Implementing Acts.

5.5. EU Added Value

5.5.1. What is the EU-added value of INSPIRE in comparison to what could be achieved at Member States national and/or regional level activities?

The evaluation showed that due to the incomplete implementation of the INSPIRE Directive the full potential of its EU added value has not materialized yet. However, significant EU added value of the Directive could be achieved through its effective positioning in the emerging European data governance landscape and its potential to become a key driver for the Green Deal data space.

This evaluation had more possibilities to assess the EU added value than was possible in the mid-term evaluation, as the INSPIRE implementation deadlines are now mostly in the past. Nevertheless, the evaluation showed that due to the incomplete implementation of the INSPIRE Directive the full potential of the EU added value has not materialized yet. The evaluation indicated that there is an EU added value potential that would likely not have been possible in the absence of the Directive. For example, for policy makers in terms of environmental reporting, optimization of national data management and data policies, the gains from the improved interoperability with others and the creation of EU level expertise. However, it must be noted that its EU added value in relation to standardisation, cross-border and cross-sector data sharing and collaboration was recognised by several sectoral stakeholders. On the other hand, the EU added value for common users has not been fully recognised so far.

Significant EU added value of the Directive could be achieved through its effective positioning in the emerging European data governance landscape and its potential to become a key driver for the Green Deal data space.

Furthermore, the link between existing Environmental Information Systems and national INSPIRE portals could be strengthened. (see also 5.2.6 and 5.4.4) to improve the connection between the environmental information platforms and INSPIRE and streamline approaches for sharing environmental data under the Public Access to Environmental Information Directive and the INSPIRE Directive.

EU added value for different users

User needs are changing over time and the user landscape is broadening. The Directive itself has not put much emphasis on users and their needs and mainly acts from the policy maker perspective. In this context the EU added value stemming from the INSPIRE Directive is mostly linked to the optimization of national data management and data policies, the gains from the improved interoperability with others (e.g. cross-border and cross-sector data sharing) and the creation of the EU level expertise.

The midterm evaluation lists the progress in terms of more effective sharing of information of spatial data between public authorities and across borders due to the reduction of internal obstacles, following the simplification and harmonisation of data policies, licences and establishment of technical infrastructure.¹²⁴ Thus, the discovery, access and use of data had become easier and several countries reported efficiency gains in the midterm evaluation.¹²⁵ The optimization of internal data management in public administration is considered as an important benefit, as it has led to:¹²⁶

- operating of resources through metadata,
- a lesser duplication of data between organisations,
- the use of services for internal purposes,
- establishing of identification patterns based on Uniform Resource Identifier (IRU),
- reinforcing the e-Government initiatives and making data available for private actors and citizens,
- ***supporting open data developments.***

When considering the national level, a clear benefit is the establishment of an efficient governance structure, bringing together various stakeholders and giving them clear roles based on their existing data responsibilities. A better collaboration has been achieved

¹²⁴ European Commission (2016), Commission Staff Working Document: Evaluation on the implementation of Directive 2007/2/EC of March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) pursuant to article 23.

¹²⁵ Belgium, Germany, Italy, the Netherlands, and United Kingdom.

¹²⁶ Cetl V., Tomas R., Kotsev A., de Lima V.N., Smith R.S., Jobst M. (2019), Establishing Common Ground Through INSPIRE: The Legally-Driven European Spatial Data Infrastructure. In: Döllner J., Jobst M., Schmitz P. (eds) Service-Oriented Mapping. Lecture Notes in Geoinformation and Cartography. Springer, Cham.

between public authorities, including between different levels of government (e.g. sub-national).¹²⁷

Furthermore, additional EU added value as acknowledged by the midterm evaluation relates to the EU level expertise and knowledge pool generated, by bringing together experts from the Member States through the coordinated development of the implementing provisions and the Maintenance and Implementation support work programme.¹²⁸ This and numerous other platforms of collaboration have led to a number of solutions and a development of reusable tools, sharing of good practices, an improved common understanding and the possibility to learn from each other, achievements that would likely not have been made in the absence of EU level actions.

When considering other types of users across different sectors that may reap the benefits of the INSPIRE Directive (e.g. companies, small businesses, citizens), the EU added value is difficult to determine. There is no systematic monitoring of users (see also 5.2.7, 5.2.8, 5.2.9) and as such there is no evidence of the effects of the Directive on various users. However, several positive examples of benefits found in this evaluation are noteworthy (see the efficiency assessment). Furthermore, the use of the INSPIRE-related data sets by a wider community of common users is hampered due to the lack of user-friendly information products affecting the availability of end-user applications (see also 5.3.3).

EU added value in terms of cross-domain and cross-border collaboration

Interoperability is one of the biggest achievements of INSPIRE and is important because it allows cross-domain and cross-border usage of geospatial data in Europe.¹²⁹ The assessment of efficiency (see 5.3.1) confirmed that harmonisation and interoperability is one of the main benefits. INSPIRE benefits also public access to environmental information, as it establishes standards in order to ensure that the appropriate services are in place to share data in an appropriate quality. In many cases INSPIRE establishes standards for other instruments that deal with data sharing, transparency and open data. Examples of combining data from multiple domains include environmental impact assessments¹³⁰, natural hazards and disaster reduction.¹³¹

When it comes to cross-border collaboration outside the environment policy domains, the existing literature provides limited evidence on the EU added value. Due to the incomplete implementation of the INSPIRE Directive up to date, the EU added value in terms of cross-border collaboration is also limited. Some examples of cross-border collaborations were collected and are presented in Table 13.

¹²⁷ Ibid.

¹²⁸ European Commission (2016), Commission Staff Working Document: Evaluation on the implementation of Directive 2007/2/EC of March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) pursuant to article 23.

¹²⁹ Ibid.

¹³⁰ Vanderhaegen M, Muro E. (2005), Contribution of a European spatial infrastructure to the effectiveness of EIA and SEA studies. *Environmental Impact Assessment Review* 25(2): 123-142. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0195925504000782>

¹³¹ Tomas, R., Harrison M., Barredo J. I. et al. (2015), Towards a cross-domain interoperable framework for natural hazards and disaster risk reduction information. *Natural Hazards* 78 (2015): 1545-1563. Available at: <https://link.springer.com/article/10.1007/s11069-015-1786-7>

Table 13 Examples of cross border collaboration

An Interreg project connecting inter alia the French Région Provence Alpes Côte d'Azur and the Italian region Valle d'Aosta as regards the harmonisation related to natural risks¹³²; a project funded by DG CNECT involving stakeholders from Slovenia and Italy to create common structure related to landslide and floods risks; an Interreg project (Harmo-Data) involving Slovenia and two Italian regions (Veneto region, Friuli-Venezia Giulia region) to establish a common approach to some aspects of mobility and transport¹³³.

EU added value stemming from a broader legislative context in the field of data governance and Digital Single Market

Another important EU-added value stemming from the INSPIRE Directive relates to the effective contribution to the creation of the Digital Single Market by unlocking public data.¹³⁴ Besides the INSPIRE Directive, there are other initiatives in the context of the Digital Single Market, forming the European data governance landscape, which are also expected to contribute to the implementation of the INSPIRE Directive (e.g. the European Interoperability Framework, European Data Strategy, revised Open Data and PSI Directive introducing the concept of High Value Data Sets, upcoming Data Governance Act). As shown in the coherence analysis (see 5.4.5), some of these initiatives such as Open Data Directive serve different purpose than the INSPIRE Directive. Nevertheless, they are complementary and reinforcing each other. The coherence analysis also pointed to the need for a close coordination to ensure coherent future developments, by further aligning the INSPIRE directive with the open data legal framework.

The upcoming Data Governance Act¹³⁵ will aim to facilitate data sharing, strengthen mechanisms to increase data availability and data reuse, as well as support the development of common European data spaces in strategic domains (i.e. health, environment, energy, agriculture, mobility, finance, manufacturing, public administration and skills). According to the OECD data from 2019, data sharing can “generate social and economic benefits worth between 0.1% and 1.5% of GDP in the case of public-sector data, and between 1% and 2.5% of GDP (in a few studies up to 4% of GDP) when also including private-sector”.¹³⁶ In order to unlock these potentials, the Impact Assessment on enhancing the use of data in Europe among others includes looks into options to establish a European structure for governance aspects of data sharing by meeting the necessary conditions in relation to the agreement and implementation of data standards, metadata standards, data schemes and interoperability principles.¹³⁷ Although spatial data is only a small part of all data, it is crucial to keep the INSPIRE Directive aligned with the broader data governance framework in order to achieve the best outcome.

¹³² <http://www.risknet-alcotra.org>

¹³³ <https://harmodata.dia.units.it/en/the-project>

¹³⁴ Cetl V., Tomas R., Kotsev A., de Lima V.N., Smith R.S., Jobst M. (2019), Establishing Common Ground Through INSPIRE: The Legally-Driven European Spatial Data Infrastructure. In: Döllner J., Jobst M., Schmitz P. (eds) Service-Oriented Mapping. Lecture Notes in Geoinformation and Cartography. Springer, Cham.

¹³⁵ European Commission (2020), Proposal for a Regulation of the European Parliament and of the Council on European data governance (Data Governance Act), COM/2020/767 final.

¹³⁶ OECD (2019), Enhancing Access to and Sharing of Data: Reconciling Risks and Benefits for Data Re-use across Societies.

¹³⁷ European Commission (2020), Impact Assessment on enhancing the use of data in Europe. Report on Task 1 – Data governance, written by Deloitte, The Lisbon Council, JIIP, GOVLAB, TIMELEX.

For example, spatial data is becoming an important tool for delivering on the objectives of the European Green Deal. Through the broader accessibility and use of environmental and climate-related spatial data one can better assess and understand the state of the environment and how it affects society and the economy. In this context also citizen science data should be considered as a data source supported by the INSPIRE and the Public Access to Environmental information Directives.

An effective data governance is required to strengthen transparency, underpin evidence-based policy-making and implementation. Due to the fast legislative changes in the field of data and sectoral policies, it is important to ensure a continuous calibration of INSPIRE so it fits in and contributes to the broader data governance landscape.

5.5.2. To what extent do the issues addressed by INSPIRE continue to require action at EU level?

The evaluation confirmed that the demand for harmonised data has been growing, e.g. for ensuring an effective response to cross-border challenges such as climate change adaptation and natural disasters. A vast majority of respondents to the targeted surveys indicated that further action is required at EU level.

The aim of INSPIRE is to produce harmonized national datasets which can be used at cross-border and transnational levels thus facilitating the development of pan-European datasets,¹³⁸ and thereby providing a response to a need for relevant data to support effective environmental policy making and beyond. Even today, as climate change and natural disasters are extending across borders, the mitigation of such impacts and support to sustainable development should be accompanied by sharing of information and spatial data across organisations and borders.¹³⁹ INSPIRE is also beneficial for improving the quality of environmental information made available to the public, based on its relevant requirements on metadata, services and interoperability.

The evaluation confirmed that the demand for harmonised data – by multiple stakeholders, such as policy-makers, business, and ordinary citizens - has been growing, e.g. for ensuring an effective response to cross-border challenges such as climate change and natural disasters. A majority of respondents to the targeted surveys (106 out of 139 respondents from the agriculture, environment, spatial data and marine sectors; 79%) indicated that action is required at EU level to least some extent or even to a large or very large extent.

Table 14 Summary of the findings on EU added value

The added value of the Directive mainly consists of promoting data sharing as a common principle, the establishment of governance structures, achieving interoperability in a broader scope (EU-wide), unlocking public data, improving transparency and creating a pool of EU level expertise.

Important EU added value of the Directive can be maintained and further enhanced through its effective positioning in the emerging European data governance landscape and to become one of

¹³⁸ Minghini, M, V. Cetl, A. Kotsev, R. Tomas, and M. Lutz (2021), INSPIRE: The Entry Point to Europe's Big Geospatial Data Infrastructure. In: Werner M., Chiang YY. (eds.) Handbook of Big Geospatial Data. Springer, Cham. https://doi.org/10.1007/978-3-030-55462-0_24

¹³⁹ Rajabifard A., Feeney MEF, Williamson IP (2002), Future directions for SDI development. International Journal of Applied Earth Observation and Geoinformation 4(1): 11-22.

the key drivers of the upcoming Green Deal data space also supporting a higher level of transparency.

6. CONCLUSIONS

The INSPIRE Directive aimed to deliver an EU infrastructure for spatial information by the end of 2021 based on interoperable infrastructures in the Member States and useable in an EU and trans-boundary context. The Directive is not an end in itself, but is a crucial framework for data management in the EU and in the Member States. The Directive was adopted in 2007, with the aim to bring order to a fast growing field of data; often incomparable, inaccessible or otherwise of no practical use at a reasonable administrative cost. The Directive was conceived as an environmental policy instrument, but its value also has grown more broadly in recent years, notably for the following reasons:

- The volume of data has increased substantially, which provides significant opportunities for better policies, implementation, environmental protection and commercial applications. However, these benefits only occur if data are sifted, comparable and available in useful formats;
- Today's societal challenges call for cross-cutting interventions and many EU policies are so interwoven that new policies must inevitably aim to achieve multiple objectives c.f. the European Green Deal. This also calls for better data sharing to underpin better policy at less cost;
- A modern economy depends increasingly on data and, as highlighted in the EU digital strategy, INSPIRE is a key instrument.

This evaluation's evidence and much of the analysis builds on a high-quality external contractor's report, which includes information from written sources, stakeholder interviews and a public consultation. The overall conclusion drawn from this analysis is that the objectives of INSPIRE remains relevant, that the Directive has EU added value, it is partially effective given implementation challenges within its original limits, but these scope limits are not fully coherent with the European Green Deal or Digital policy needs. Finally, INSPIRE can be improved in terms of efficiency and is notably hampered by a combination of complex technical (standards) requirements and a too ambitious scope in terms of certain data requested beyond what Member States have been able to provide.

There was also a need to take stock of the experiences gained in the implementation of INSPIRE and its coherence with other relevant instruments notably the Public Access to Environmental Information Directive. The evaluation found that the two complimentary Directives are formally coherent, but the latter Directive is weakened by pre-dating INSPIRE and not anticipating better availability of digital data in the environmental area for the public, other authorities or businesses.

6.1. Conclusions in details

Overall, the implementation of the INSPIRE Directive has matured compared to the 2014 baseline and has lead to an increased availability and better access to spatial data and services. Although progress was made towards meeting the Directive's main and specific goals, the implementation is incomplete and heterogeneous across Europe. Realisation of the Directive's full potential will depend upon improved implementation. No single

Member State has yet achieved full implementation in alignment with the roadmap and several Member States lag behind.

In recent years, Member States and the EEA/EFTA countries are removing data sets that have not been harmonised with the interoperable data specifications (often richer data sets following non-INSPIRE data specifications) to improve their overall monitored implementation performance. There has also been data cleaning/aggregating processes at national or regional level. As an effect, there were fewer data sets available in 2020 than reported in previous years.

Recommendations put forward in the INSPIRE midterm evaluation for the Member States have to some extent been implemented. The Member States increased the overall availability of environmental priority data sets according to one of the recommendations. In terms of coordination between the national INSPIRE implementation and other relevant sectors and administrations (e.g. eGovernment, open data, environment, marine, mobility, agriculture), there are some linkages in terms of logistical work and cooperation. Nevertheless, it is mostly considered that these initiatives are not contradicting the main principles of the INSPIRE Directive, and that in some cases, the national data policies benefit from its implementation by facilitating an environment of free and open data. A coherent and effective legal and operational framework for sharing spatial data and services across the EU has not yet fully been established. In particular the legal arrangements for data sharing, such as data policies, are still too complex and/or too heterogeneous in many Member States to be effective.

The INSPIRE monitoring indicators are generally low. Around half of available data sets are not yet accessible across the EU Member States and EEA/EFTA countries. In general, there is a low conformity of metadata for spatial data sets and spatial data services (less than 60%). Half of all listed data sets are in conformity with relevant legislation as regards the interoperability of spatial data sets. The conformity of network services has improved since 2019, but several countries still offer only a few interoperable network services.

The low average values of the INSPIRE indicators in reference years 2019 and 2020 are not fully surprising. Commission Decision (EU) 2019/1372 introduced significant changes to their calculation in 2019. The new automated approach is based on the processing of all metadata harvested from countries discovery services and entails a validation of the provisions on metadata, network services and data specifications that is stricter and more comparable than the previous self-declared assessments. The new approach has initially led to decreasing performance indicators in 2019 but already showed a positive trend in most countries in 2020, indicating that the automated approach is helping countries improve the maturity of their INSPIRE implementation.

6.2. Relevance

Although the objectives of the INSPIRE Directive are still very relevant and further action is required at the EU level to address the identified obstacles, the legal framework can be improved in terms of effectiveness.

To remain relevant and support the Green Deal ambitions by bringing environmental data into the Green Deal data space, the INSPIRE Directive and relevant provisions of the Public Access to Environmental Information Directive need to better consider evolving technology and information requirements.

The evaluation demonstrates that public authorities have a need for spatial data for the different phases of their policy-making (design of policy, implementation of policy, monitoring of policy and assessment of results and effects). INSPIRE addresses these needs and justifies an action at EU level. As regards actors outside of the public domain, although their needs have not been precisely assessed and identified, the reasoning is that if spatial data are made available and accessible they would be used and dedicated services would be developed. However, at this stage, the evidence to support this causality is scarce.

Regarding barriers for sharing and accessing spatial data, the INSPIRE Directive is considered as a relevant intervention to overcome them and thereby make data available, accessible, and reusable.

INSPIRE establishes a framework for sharing relevant spatial data within the European Union for users and applications in the environmental domain. The evaluation concluded that current technical requirements constitute a barrier to its implementation and use. More specifically, the objective of harmonisation and interoperability within the INSPIRE framework entails technical specificities that were ground-breaking at the time of its entering into force, but have shown to be too prescriptive and rigid to be fit-for-the-future in the context of evolving information requirements, standards and technologies. Within the Local Digital Twins environment a first approach has been launched by the Living-in.EU community through the Minimum Interoperability Mechanism (MIM) number 7, which should be considered due to its future evolution to the standardization bodies.

The evaluation did not find any inconsistencies between the INSPIRE Directive and the Public Access to Environmental Information Directive. The INSPIRE Directive has been designed to be consistent with the EU legal framework on data sharing and dissemination and could further support the implementation of active and systematic dissemination of environmental information to the public and become a key instrument for populating the Green Deal data space.

6.3. Effectiveness

Member States have progressed in the implementation of the Directive. Still, no Member State has achieved full implementation yet, with significant implementation gaps remaining.

The INSPIRE Directive's objective for interoperability has not been met because of the (limited) geographical coverage achieved so far.

The implementation of the INSPIRE Directive as well as the sharing and reuse of existing spatial data still face barriers already identified in the previous evaluation of the Directive. These barriers are primarily of a technical nature.

The different ways that Member States can describe the same data limits cross-border application. It requires extra effort to align standards as has been done by the marine community through EMODnet.

Several EU Member States provide INSPIRE datasets and services as a standalone activity that is only marginally linked to the national infrastructure, often supplying access to only a subset of the rich spatial data available in national catalogues and limiting the usefulness and effectiveness of INSPIRE. The use of datasets and services through the INSPIRE framework is developing both in a data-sharing and active dissemination context. However, Member States' additional efforts would be needed to increase the use of the INSPIRE framework – be it for EU level, national or regional purposes. Revising INSPIRE and the Public Access to Information Directive

should be considered to improve its effectiveness and as a result their implementation.

As of June 2021, and close to the last deadline set for implementing the INSPIRE Directive (December 2021), overall progress at Member States level was observed but full implementation is not yet achieved.

The geographical coverage of the implementation of the INSPIRE Directive is uneven across Member States, and at national and regional level. The heterogeneity of datasets that are made available by Member States affect the capacity to combine data from different regions and different Member States. The combination of these facts explain why more work is needed to achieve the INSPIRE Directive's ambition of cross-border interoperability.

The implementation of the Directive as well as the sharing and reuse of existing spatial information has progressed since the last evaluation. However, the technical complexity of the framework required by INSPIRE remains a challenge with impacts on implementation as well as to the use of the infrastructure. Another important remaining barrier lies in the heterogeneous licensing conditions which hampers the reuse of data. Other identified barriers (legal, knowledge, financial, cooperation and organization) were generally not regarded as an implementation bottleneck by the consulted stakeholders for the implementation and use of the INSPIRE framework.

Some Member States have implemented INSPIRE in parallel to a national spatial data infrastructure to satisfy their INSPIRE obligations. More and richer non-harmonised data sets are often being made available through the national infrastructure while a limited offering satisfying the more complex technical and interoperability specifications is published on the INSPIRE Geoportal. Consequently, the data-richer national infrastructures are favoured by end-users. The technical complexity, embedded in the current Directive, seemed appropriate in 2007 when the Directive was adopted. Today, there is a need to modernise it.

There has been progress in use for reporting and efforts have been deployed to align effectively INSPIRE to EU reporting requirements. The results of these efforts are welcomed by Member States, as the main effect of INSPIRE at the EU policy level for the moment. Yet, the evaluation was not conclusive on the use of the INSPIRE framework for reporting under the environmental acquis and for policy making in the field of environment in general. Since the low level of permeation of the INSPIRE Directive at regional and local level, evidence on the use of the infrastructure on these administrative levels is limited.

INSPIRE does not require Member States to monitor the use of the INSPIRE infrastructure, neither was the directive originally put in place to provide private parties with data. However, as access to and use of data have become more important in today's data economy this aspect has been included in the evaluation. Even if not part of INSPIRE's original objectives, the evaluation also looked at effects on users active in economic sectors influencing environment, including small businesses using spatial data. Data from the INSPIRE infrastructure is only to a limited extent used by users other than national public authorities and agencies.

6.4. Efficiency

INSPIRE facilitates the work of stakeholders in the area of spatial data provision through improved discoverability, availability and accessibility to spatial data.

Interoperability (of data and services) is the most important cost factor in the INSPIRE implementation.

There is a simplification potential of the implementation in terms of addressing the requirement for interoperability.

The results achieved so far are commensurate with the resources put forward and are in line with the ones expected from the ex-ante evaluation of INSPIRE in observed cases. However, implementation is not yet complete and hence results cannot be fully assessed yet.

Stakeholders perceive the costs as 'asymmetrical'. Most costs relate to the implementation of the Directive and are largely borne by national governments, but differ significantly in function of how INSPIRE has been implemented notably if it is part of or independent from SDI. A proportion of these costs can therefore not necessarily be attributed to the Directive as such. Users of the spatial data infrastructure do not perceive extraordinary costs.

In most cases, the resources for implementation were available, but some Member States have perceived it as a challenge to secure the resources. In these Member States, costs have been perceived as higher.

The INSPIRE Directive has proven to be a valuable instrument to achieve legal interoperability by streamlining concepts and reporting provisions across different environmental acts (e.g. on environmental emissions).

The INSPIRE Directive can support the implementation of the Public Access to Information Directive by providing a technical framework for electronic data sharing.

While the INSPIRE Directive performs satisfactorily at making geospatial environmental data accessible, simplification, modernisation and future-proofing would mitigate the challenges linked to the costs of implementing the Directive.

Despite the fact that the implementation of INSPIRE is not complete, the benefits are beginning to emerge and have contributed to improving the operational efficiency of concerned stakeholders. The key direct benefits are experienced by stakeholders in regards to better discoverability, availability, accessibility of data and especially harmonisation and interoperability. In Member States where data were previously stored in many different formats and some of these formats were not readable using the most common GIS systems, creating services and formats that can be used by all users is one of the most important benefits.

In terms of indirect benefits, two factors were pointed to most significantly by Member States: openness to share spatial data by providers and national infrastructures and development of national geoportals. Overall, this suggests that INSPIRE has been instrumental in furthering the development of the national geoportals as well as in promoting an increased sharing of data.

Interoperability of spatial data and services is one of the key benefits of INSPIRE. Mirroring this however, these are also the costliest elements of implementation. This relates both to financial costs and human resource/expertise needs mainly in national governments. The activities that are necessary to achieve coherent, consistent and harmonised data sets that adhere to shared data models on a national level and at a pan-European level are perceived as costs intensive. The evidence gathered in the evaluation confirms that interoperability of data (harmonising data with the INSPIRE data specifications) and services are the main cost drivers. For users (who are not also producers), the majority perceives that there are no additional costs, and if there are, these relate to purchasing additional or new software to access/use the spatial data.

The evaluation shows that it is difficult to point to specific provisions which would make the INSPIRE implementation more cost-efficient. This largely depends on the institution and/or administrative level in question. The costs of implementation are also influenced by the approach taken by the individual Member States to INSPIRE implementation. The INSPIRE Directive might be implemented as an integral part of the national SDI as originally intended or implemented as a separate system. The latter can lead to disjointed data foundation and/or separate IT-infrastructure which again influences the cost (and the perceived value) of INSPIRE. Further, Member States that implement INSPIRE as a separate system, in parallel to the national SDI, may tend to perceive the harmonization linked to INSPIRE as more costly and/or invoking additional costs. Member States that implement INSPIRE as part of the national SDI system cannot in general identify the costs. This suggest that the activities are integrated in these situations.

Different stakeholders in Member States also have different perceptions on costs and benefits depending on whether they are spatial data providers or spatial data users, their administrative level or specific type of stakeholder.

The evaluation identified that further efficiency measures may happen at two levels: A) Simplifying the implementation and thereby reducing costs of harmonisation and enabling interoperability and B) align with other digital processes and making use and data reuse easier. The latter may not necessarily lead to reduced cost but to an increased use. Further, increasing the correspondence between national SDI and INSPIRE will not only reduce cost but also increase the value of national SDI data that is more targeted for specific use cases.

Users perceive that data models and the way data is available is too complicated for a number of users. Different types of users have different needs regarding data models: Advanced users might need quite complex data structures for the data to match their needs - but using data models with this complexity will be a burden to other users with simpler needs. INSPIRE specifies data models for each data theme covered by INSPIRE, which cover the combined needs from the most advanced users.

A limited number of cost-benefit assessments of the implementation of INSPIRE are available supplementing those that were included in the 2016 mid-term evaluation. Most of those focus on the benefits of an SDI in general (and not specifically on INSPIRE). Overall, they conclude that the benefits of a national SDI by far outweigh the costs. The reviewed Cost Benefit Analysis found that when the SDI is implemented this has a large positive impact/benefit for both the public (cost savings) and private sector (costs savings and business opportunities). However, a number of Member States found that it is too early to really assess the costs and benefits of INSPIRE, especially as INSPIRE is not fully implemented yet.

Overall, national authorities and agencies are the stakeholders who bear the biggest share of the cost and where less of the (direct) benefits are expected to fall. Depending on the administrative structure of the Member State and of the responsibilities allocated, the cost distribution can vary considerably between Member States. In countries with a federal structure, some implementation responsibilities may lie at subnational level. The main costs identified by national and local level institutions relate to the production and harmonization of data and data services.

Member States have applied different ways of funding the implementation of INSPIRE. In most cases, INSPIRE implementation has been funded as part of the budget allocation for the institution in question (with some difference in terms of which costs are carried by the different government levels, mostly the funding is provided by the national level government (state budget)). Some Member States have also used funding via European Structural Investment Funds (ESIF).

For some Member States the key problem is not the availability of resources (capacity), but the availability of the required expertise (competence). Many different institutions can be involved in the implementation of INSPIRE, which further complicates its implementation.

Environmental authorities to some extent make use of the spatial data that are made available through INSPIRE. It is noted that this does not necessarily reflect on the reporting burden. More work in terms of making it technically more efficient will be needed before INSPIRE can really support the reduction of the administrative burden for the reporting under the environmental acquis.

There are no inconsistencies between the INSPIRE Directive and the Public Access to Environmental Information Directive. The two Directives have different scopes (despite some overlap), but have a very important common element, namely active dissemination of information to the public. INSPIRE being the more advanced of the two, can support the implementation of the Public Access to Information Directive by providing a technical framework for electronic data sharing. Stakeholders perceive that INSPIRE supports the implementation of the Public Access to Information Directive by improving the capacity of stakeholders to provide spatial data, which should have an effect on the administrative burden also by potentially avoiding duplication of efforts in implementation.

6.5. Coherence

INSPIRE is legally coherent with environmental legislation with geospatial reporting obligations and with other relevant areas of EU policy with geospatial reporting obligations. In practice however, data specifications are not yet fully aligned, leading to instances of duplication of reporting processes.

The INSPIRE Directive has been designed to be consistent with the EU legal framework on data sharing and dissemination and can support implementation of the Public Access to Environmental Information Directive and the Open Data Directive. Synergies between the three Directives could however be better exploited, in particular, INSPIRE can be useful in support of improving dissemination of information under other aforementioned two Directives.

Coherence issues between the INSPIRE Directive and the Open Data Directive might however arise in the future and could require aligning INSPIRE with the open data legal framework.

INSPIRE is internally coherent, however, the implementing rules are outdated with regards to Articles 290 and 291 of the Lisbon Treaty on Delegated and Implementing Acts.

Although INSPIRE consists of several layers of rules and technical guidance, with different statuses and revision procedures, the evaluation presented no instances of incoherence. However, identified overlaps by stakeholders between data themes in the Annexes of the INSPIRE Directive should be resolved in the relevant technical expert groups. Revision procedures applied to Implementing Rules may also appear cumbersome for the revision of technical elements. Aligning the comitology procedures

referred to in the INSPIRE Directive to the Lisbon treaty might lead to more flexible revision procedures.

INSPIRE applies to all environmental policies and other policies or activities which may have an impact on the environment. A review of the relevant EU legislation did not find provisions that would potentially impede the applicability of INSPIRE rules within the scope of the legislation. In fact, many pieces of legislation make direct reference to INSPIRE rules and it was found that such references do support compliance in practice.

The evaluation also identified many ongoing initiatives, both from the Commission services/agencies and stakeholders, to develop synergies between INSPIRE and data collection and sharing processes and instruments under other pieces of legislation. In particular in the environmental field of particular relevance is the ongoing work to align reporting obligations in EU environmental legislation with INSPIRE rules. Such initiatives are supported by reporting guidance and increased cooperation between sectoral authorities and authorities responsible for INSPIRE both at EU and national level. However, stakeholders stressed that environmental reporting obligations are not yet fully coherent with INSPIRE, both in terms of data content and models. Similar comments were made in relation to non-environmental policy areas. Such situations may lead to duplication of data processing and dissemination efforts.

Alignment initiatives are especially relevant in the context of the recently announced ambition to develop common European data spaces, in particular the Green Deal data space, as INSPIRE could become an important instrument for building these data spaces. Some of these initiatives (for instance in the transport sector) also show that INSPIRE services, as they are, cannot satisfy all data needs in all sectors. Some current developments, such as the new Climate Adaptation Strategy, point to a need for a possible expansion of the scope of INSPIRE to be more in line with sectoral data needs.

In the case of the Public Access to Environmental Information Directive, there are limited synergies with INSPIRE. Public Access to Environmental Information Directive, which requires the dissemination of environmental information held by public authorities, including through electronic means, does not refer to INSPIRE rules for disseminating geospatial data covered by Article 7(e), or to the open data framework (formerly PSI Directive, now Open Data Directive). The Directive is in this regard outdated and could benefit from stronger alignment with INSPIRE.

The evaluation has identified a possible need for alignment in relation to the Open Data Directive and the upcoming implementing Regulation on High Value Datasets to serve a general and consistent purpose (the Green Deal). Moreover, provisions in Articles 13, 14 and 17 of the INSPIRE Directive provide ample possibilities to limit public access to spatial data, and to license and/or require payment for spatial datasets and services. Given the evolution of the legal framework on open data, alignment of these Articles in the INSPIRE Directive with the open data legal framework might be considered in the future.

Although the Open Data Directive does not set legal obligations in terms of technical standards or data format and makes several references to INSPIRE, it will nonetheless be crucial to ensure that future developments, supporting guidance, and recommendations for both directives remain compatible.

6.6. EU added value

The added value of the Directive mainly consists of promoting data sharing as a common principle, the establishment of governance structures, achieving interoperability in a broader scope (EU-wide), unlocking public data, improving transparency and creating a pool of EU level expertise.

Important EU added value of the Directive can be maintained and further enhanced through its effective positioning in the emerging European data governance landscape and to become one of the key drivers of the upcoming Green Deal data space also supporting a higher level of transparency.

Due to the on-going implementation of the INSPIRE Directive, the EU added value has been not fully realised so far. The EU added value of the Directive as acknowledged by the majority of stakeholders relates mostly to the policy-making and implementation purposes at national and European level. One of the key benefits concerns the environmental reporting by the Member States. At a national level, the Directive has led to EU added value through the establishment of governance structures, achieving interoperability in a broader scope (EU-wide), unlocking public data, improving transparency and creating a pool of EU level expertise. The EU added value of the Directive in terms of data sharing is limited when it comes to benefits for users outside the policy-making field and could be further exploited, e.g. by providing more user-friendly applications. Cross-border collaboration is not always smooth due to technical challenges. Nevertheless, the stakeholders in the targeted survey agree that EU-wide data sharing and cross-border collaboration has improved due to the INSPIRE Directive.

Environmental and climate-related spatial data is becoming an important tool for delivering on the objectives of the European Green Deal, which is also acknowledged in the European Strategy for Data by putting forward the GreenData4all initiative. Interoperable data of high quality is crucial to ensure informed and evidence-based policy making and implementation. INSPIRE-relevant data must be aligned with other data policy initiatives in order to achieve its full potential at the European level. A close collaboration between policy makers and other relevant stakeholders is crucial in shaping future developments.

INSPIRE benefits also public access to environmental information, as it establishes standards in order to ensure that the data services are in place to share data in an appropriate quality. This can be considered as a standard for other instruments that deal with data sharing, transparency and open data. Coherence between various initiatives and instruments is key for developing the Green Deal data space. In this context also citizen science data should be considered as data source for the Green Deal data space, supported by the INSPIRE and the Public Access to Environmental information Directives.

The demand for harmonised data has been growing in Europe, especially for ensuring an effective response to cross-border challenges such as climate change and natural disasters. Most of the stakeholders acknowledge that the action is required at EU level and that the rationale behind and the principles of the INSPIRE Directive are justified.

6.7. Lessons Learned

There are lessons to be learned from the past fourteen years of application of the INSPIRE Directive since its entry into force. Despite the obvious issues and difficulties triggered by the process, the INSPIRE Directive has been, and still is today, seen as a reference example by many countries and organisations all over the world that intend to establish Spatial Data Infrastructures from the local to the national and international level. During these 14 years, the context around geospatial data sharing across Europe has radically changed, as a consequence of both a non-stop, disruptive technological innovation in standards and technical approaches, and a new European political framework. The new policies put data and data sharing at the centre of the digital transformation to address urgent societal and environmental challenges. The European Green Deal recognised the potential of digitalisation and the availability of data as essential enablers of the changes needed for a just, green transition. The European Strategy for Data announced a common European Green Deal data space, to use the major potential of data in support of the Green Deal priority actions on climate change, circular economy, zero-pollution, biodiversity, deforestation and compliance assurance.

The previous and current evaluation of the INSPIRE Directive confirmed that the overarching vision for a European spatial data infrastructure for the purposes of EU's environmental policies as well as policies or activities which have an impact on the environment is still very relevant in view of the European Green Deal and Digital strategies. The ambition to promote data sharing and put in place easy-to-use, transparent, interoperable spatial data services which are used in the daily work of environmental and other policy makers and policy implementers across the EU at all levels of governance as well as businesses, science and citizens is well aligned with the objectives of the European Strategy for Data.

The evaluations and stakeholder workshops helped to identify lessons learned and issues that should be addressed to enable full implementation of the Directive. This has given direction and guidance to a set of recommendations for the future development of the legal framework.

Remaining implementation gaps in Member States should be closed to optimise the reuse of spatial data and facilitate its pan-European use. The further implementation of the INSPIRE Directive should be user-driven by a common demand across administrative levels to improve the EU added value of the infrastructure and its cost-benefit balance.

Many EU Member States share only a limited number of datasets within the INSPIRE infrastructure with a varying offering, making it difficult to achieve pan-European coverage for specific themes. In many cases, the INSPIRE infrastructure is a standalone effort, implemented in parallel and only indirectly linked to the national spatial data infrastructures and portals that serve identified national use cases. This is because INSPIRE requirements are different, more limited or go beyond the requirements adopted at the national level.

Despite the remaining implementation gaps, the INSPIRE Directive has proven to be a particularly useful framework for improving the discoverability of existing spatial data through the compilation and exposure of metadata, as well as the accessibility through the implementation of download services. The implementation should be continued and further streamlined to achieve a common level of comparable technical maturity and data

offering across countries that supports regional, national, trans-boundary and pan-European use cases, maximally building on existing national initiatives.

The legal framework needs to be technology neutral and future proof. Implementers should have the option and the freedom to deploy cost-effective off-the-shelf tools that apply state of the art technology to share data in a user-friendly way.¹⁴⁰

In the conceptualisation of the INSPIRE Directive and its implementing acts, it was assumed in multiple cases that technical requirements which were during the scoping stage not supported by existing software tools, would be implemented once the acts would enter into force. Unfortunately, this rarely happened.

The implementation of the INSPIRE Directive is based on several crosscutting and domain-specific standards (e.g. from ISO and OGC). The implementation of the Directive has led to probably the largest uptake of the OGC standards worldwide. However, at the same time the strong, formal utilisation of particular standards has slowed down the implementation process. From that perspective, it is critically important to ensure that mature and well-supported standards are considered for the technical provisions related to the evolution of INSPIRE.

It is essential that the technical requirements put forward by INSPIRE are easy to implement, do not disrupt data providers technology stacks and promote usage by a broad community of stakeholders. Leveraging on out-of-the-box solutions and standards should therefore be the default approach for all technical developments.

The need was identified for more work on standardising data reuse conditions and licensing.¹⁴¹

INSPIRE was conceptualised with an inclusive and open approach in mind. In fact, collaboration on multiple levels between a broad spectrum of users is critical to the overall success of the implementation.

The licensing approaches, based on the metadata made available by EU Member States, are very heterogeneous. Even more substantially, in a vast majority of cases, licensing information is not available at all. This lack of consistency and the absence of harmonisation poses a serious obstacle to the uptake and reusability of the data.

The effectiveness and efficiency of the INSPIRE Directive and the Public Access to Environmental Information Directive are insufficient if they are to be enabling instruments for implementing data sharing in Europe and building a Common European Green Deal data space. Dealing proactively with new requirements coming from the twin digital and green transition and possible coherence issues with recent and emerging EU data legislation (Open Data Directive and its implementing Regulation on High Value datasets, Data Governance Act, Data Act) by aligning the existing legislative framework

¹⁴⁰ See also: Kotsev, A., Minghini, M., Cetl, V., Penninga, F., Robbrecht, J. and Lutz, M., INSPIRE - A Public Sector Contribution to the European Green Deal Data Space, EUR 30832 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-41564-0, doi:10.2760/8563, JRC126319.

¹⁴¹ See also : Hernandez Quiros, L., Nunes De Lima, M. and Smith, R.S., Study of the terms of use applied in the INSPIRE resources and their usability barriers, EUR 29119 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-79910-5, doi:10.2760/555208, JRC109943.

and implementation guidance could prevent or minimize implementation burden on the Member States.

To boost the relevance and added value of the INSPIRE Directive for supporting the dual digital and green transition and achieving the objectives of the European Green Deal and the Green Deal Data Space:

- the current interoperability and technical provisions should make better use of contemporary and state-of –the-art digital technology;
- and new data sources could be considered (IoT¹⁴² data, citizen-generated data, data from the private sector, open research data ...) beyond the current spatial data scope to better address information needs of a larger stakeholder community.

The existing Maintenance and Implementation Framework (MIF) governance structure with its technical and policy arms ensures that the different organisational, legal and technical questions are being addressed by the right fora. However, this governance structure has not always been flexible and fast in accommodating novelties and responding to changing user requirements.

¹⁴² The Internet of Things (IoT) describes physical objects (or groups of such objects) that connect and exchange data with other devices and systems over the Internet or other communications networks.