

# COMPARISON OF GEOPORTALS OF POLAND, GERMANY AND BULGARIA. EVALUATION OF DATASETS IN POLAND IN THE YEARS 2019-2022

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## **Abstract**

*Although the formal INSPIRE Directive (Infrastructure for Spatial Information in Europe) ended in 2020, its further development continues to improve the sharing and use of spatial data within the European Union.*

*The article is divided into two parts and aims to provide information about the implementation of the INSPIRE Directive in three Member Countries of the European Union. The introduction focuses on knowledge about Spatial Data Infrastructure and the European approach to that topic. This part includes a short history of INSPIRE and the differences in its implementation into national legislation, due to differences in the process of becoming a member of the European Union. The next part compares datasets available through metadata viewing and download services using data specified by the European Commission. The last part focuses on the evaluation of datasets provided by Poland from 2019 to 2022. The conclusion shows the changes that have occurred in the European Spatial Data Infrastructure over time.*

**Keywords:** INSPIRE, SDI, metadata, datasets accessibility

## **INTRODUCTION**

At the end of the 20th century, the demand to create and operate Spatial Data Infrastructure (SDI) at the national level became more important in plans and strategies. The necessity to exchange data between structures, while creating accessible and trustworthy data started to play a crucial role in national policy (Rajabifard et. al. 2003). Different countries presented individual approaches to national data infrastructure. Around the year 2000, the idea of creating a European Spatial Data Infrastructure appeared. It was a challenge to create a cross-border system that would provide free and accessible data, due to many mistakes in datasets, missing metadata, legal acts, and frameworks to create datasets and services (Vanderhaegen & De Groof, 2004).

Despite all the challenges that emerged during the process of creating European SDI, INSPIRE was launched.

INSPIRE is a European spatial data infrastructure to support community environmental policies, that enable cross-border data sharing and provide interoperable services in support of policymakers and implementers, as well as businesses, science, and citizens (European Commission, 2024). The key goal of the INSPIRE directive was to prepare and share data among interested bodies to provide information that can be used during the process of policy-making in public sectors (Annoni, 2011). Interoperability and accessibility of data help to provide better solutions for the most crucial decisions. With environmental information, we can understand that INSPIRE's goal is to help transfer data and make it understandable for every citizen and field of business in the European Union. It helps to understand the patterns, which can be seen in different countries and draw conclusions from them. But the biggest challenge was to change national infrastructure and adapt it to the European Commission standards. Each country had its plan to achieve this goal, and a comparison of their effectiveness will be shown later.

The Inspire project has a few main objectives aimed at ensuring free, open, and, most importantly, the most effective data. INSPIRE is based on several common principles:

- Data should only be gathered once and stored in the most efficient location for maintenance.
- Spatial data from various sources throughout Europe should be able to be efficiently combined and shared with a wide range of users and applications.
- All levels and scales should be able to access information gathered at one level or scale; general for strategic objectives, and detailed for in-depth research.
- Access to the geographic data has to be easy and open to reach successful governance at all levels.
- Finding out what geographic data is available, how to utilise it to fulfil a specific purpose, and the circumstances in which it may be obtained and used should be simple (European Union, 2024).

The INSPIRE Directive was implemented in several stages across all member states of the European Union until 2020. The main stages can be divided into several parts. By 2009, member states were supposed to have transposed the directive into national law. By 2010, discovery and view services were expected to become operational. By 2013, data for key datasets and access to spatial data services were meant to be harmonised.

By 2020, the directive was intended to be fully implemented, with varying levels of implementation across countries. Although the directive ended in 2020, infrastructure maintenance and development were expected to continue as part of ongoing efforts to improve the sharing and use of spatial data within the EU.

This research aims to gain information about the accessibility of data that can be found via free and open services in member countries of the European Union. Comparing the current situation helps to understand the progress that was made. It can also collect information about areas that still need to be addressed to provide fully accessible and useful datasets. Data for comparison was gathered in themes and divided into three groups called Annexes. Countries were obligated to provide necessary metadata and services firstly to Annex I and II (Roglia, 2014), due to the importance of themes included in those groups. According to Directive 2007/2 of the European Parliament and of the Council, accessibility to metadata and services in Annex III should be provided within 5 years from the implementation of law in country legislation (European Parliament and Council, 2007). For Annexes I and II this period is shortened to only 2 years.

## **DATASETS AVAILABLE THROUGH METADATA VIEWING AND DOWNLOAD SERVICES**

Data is located in 34 themes included in Annexes, providing information about nearly all aspects of social-economic and nature data gathered by member countries. Annex I focuses on information that can be called a basic framework for other datasets. Those themes provide information that geolocalises other datasets localised in the rest of the Annexes. Annex II focuses on the environmental background that may affect datasets in Annex III. The last group provides information about both environmental and socio-economic data.

All data used for comparison was taken from the European Commission site from the INSPIRE geoportal section. Data was gathered before 29.03.2024, therefore changes in the current status of the availability of datasets are possible. The result of the analysis is provided in a table, showing accessibility to datasets in three countries: Poland, Germany, and Bulgaria. Each country had a different approach to implementation of the INSPIRE solution in their legislation, due to different years of becoming a member of the European Union. Germany is one of the ‘founding countries’, being a member of the European Union since the 1st of January 1958, Poland became part of the organisation on the 1st of May 2004. The last country that is being compared is Bulgaria, which became a member on the 1st of Jan 2007. Choosing those countries was driven by an interest in comparing states with different histories, different legal situations, and approaches to achieve goals defined in the INSPIRE Directive.

The first document that addressed the need for SDI on an international level was the „Action Plan” published by the European Commission in December 2001. The next step took place in July 2004, when the INSPIRE proposal was accepted by the Commission. The last step that gave a legal solution for geospatial infrastructure, was publishing the INSPIRE Directive in the Official Journal of the European Union on the 15th of May 2007. The directive set deadlines for creating access to datasets and services, for example: to provide metadata available for spatial data in Annex I and II up to December 2010 (United Nations, 2010). Comparing dates of publication of plans and legal acts with dates of accession to the European Union (Figure 1.) directly shows that Germany and Poland had more time than Bulgaria to adapt their national SDIs for implementation of INSPIRE rules. Bulgaria implemented INSPIRE into national legislation and spatial system through The Law on Access to Spatial Data in March of 2010, only a few months before the target date for publishing metadata for Annexes I and II (Danailova et.al 2016).



Figure 1. Timeline of accession and creating the INSPIRE legal acts

Figure

The compared functionalities were chosen to reflect the users' possibilities to use the available datasets: viewable, downloadable data, and metadata. The choice of those three components was dictated by the motivation to compare datasets that are used by different users. Viewable datasets used by European citizens address the 'accessible data' goal. This type of data used in viewable services provides information about spatial surroundings and helps to build the information society. Download datasets are mainly used to manipulate their content, to achieve a certain objective. Data are used to perform spatial analysis, spatial planning, and cartography presentations. Datasets provide crucial information about the spatial location of examined themes to perform the correct action. The last comparison was metadata. Information about differences between countries provides knowledge for coordinators who are responsible for creating and maintaining metadata for datasets located in INSPIRE Annexes.

The goal of comparison is to indicate differences, to address the areas with problems with implementation, and to find a potential solution based on strategies implemented in other European countries. With information about different years of becoming an EU member and a different approach in the implementation of the INSPIRE Directive into national legal acts, differences are expected. Table 1. provides information about datasets that can be found via the INSPIRE geoportal site (European Commission, 2024 a,b). According to the proposed classification, datasets are divided into 3 groups: viewable and downloadable datasets and metadata.

Table 1. Comparison of datasets provided in INSPIRE geoportal in themes for Annexes, (Source data: European Commission, 2024 a,b)

Indicators	Poland			Germany			Bulgaria		
	viewable	downloadable	metadata	viewable	downloadable	metadata	viewable	downloadable	metadata
Addresses	1	1	1	44	43	61	0	0	0
Administrative units	1	1	1	139	43	174	0	0	4
Cadastral parcels	1	0	1	20	22	32	0	0	1
Geographical grid system	0	0	0	0	0	0	0	0	0
Geographical names	1	1	1	39	41	61	0	0	2
Hydrography	1	1	1	53	58	112	12	12	17
Protected sites	1	1	39	116	110	316	0	0	2
Coordinate reference systems	0	0	0	0	0	0	0	0	1
Transport networks	7	7	7	98	104	254	0	0	33
Elevation	1	1	1	66	33	94	0	0	7
Geology	21	21	24	155	83	361	0	0	4

Land cover	1	1	1	49	53	90	0	0	2
Ortho-imagery	1	1	1	22	9	37	0	0	4
Atmospheric conditions	4	4	5	8	8	11	0	0	0
Agricultural and aquaculture facilities	0	0	0	6	6	11	0	1	1
Area management/restriction / regulation zones & reporting units	18	18	19	81	64	164	16	20	72
Bio-geographical regions	0	0	1	10	10	19	0	0	3
Buildings	2	1	2	24	30	53	0	0	3
Environmental monitoring facilities	16	17	19	48	46	119	3	4	4
Energy resources	2	1	3	34	30	63	0	0	2
Habitats and biotopes	1	1	4	83	74	123	0	2	8
Human health and safety	13	13	13	112	66	194	0	0	47
Land use	1	1	1	78853	18907	105241	0	0	1
Meteorological Geographical features	2	2	3	27	7	61	0	0	0
Mineral resources	2	1	3	36	34	64	0	0	1
Natural risk zones	6	6	7	114	28	154	0	0	20
Oceanographic geographical features	1	1	1	82	17	161	0	0	0
Population distribution demography	2	2	3	18	22	22	0	0	1
Production and industrial facilities	3	3	4	33	30	128	0	3	4
Species distribution	2	3	7	21	15	48	0	6	7
Soil	1	2	2	211	143	273	0	0	1
Sea regions	1	2	2	1	1	1	1	1	2
Statistical units	12	10	15	30	29	62	0	0	0
Utility and governmental services	3	3	4	218	196	571	2	2	3

After creating the table, graphs were prepared to visualise differences between countries. The general distribution of accessibility was calculated with the rule: if even one of the examined aspects has a number 0 in the row in the table, the whole theme (according to Annexes themes) has a value of 0.

The first graph (Figure 2.) shows overall accessibility to data in countries. Poland and Germany show similar percentage values of each compared aspect (88% to 94% for viewable datasets, 85% to 94% for downloadable ones, and 91% to 94% for metadata). Areas that are not covered in Polish geoportal but exist in Germany's one are agricultural, aquaculture facilities and Bio-geographical regions. Moreover, there is no possibility of downloading the data for Cadastral parcels,

which was possible in 2023 (Cetl et.al. 2023). Bulgaria provided successively values of 15%, 26%, and 82% for each aspect. Themes that cannot be found in any of the geoportals are the Geographical grid system and Coordinate reference systems (however Bulgaria provides metadata for the second of them).

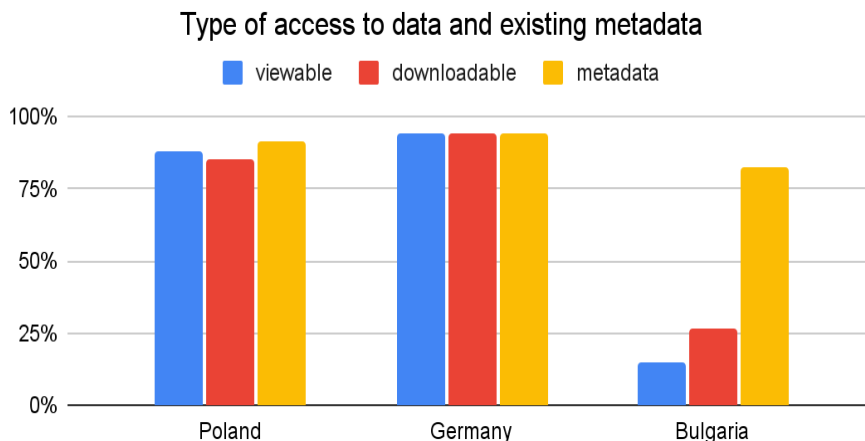


Figure 2. Percentage of viewable and downloadable datasets and provided metadata in individual countries

The second graph (Figure 3.) shows accessibility to viewable data in countries in each of the Annexes. Poland and Germany again show similar percentage values in each group (78% in both countries for Annex I, 100% for Annex II, and 90% for Poland to 100% for Germany in Annex III). Themes that are not viewable in both SDI's, are again the Geographical grid system and Coordinate reference systems. The difference in percentage values in Annex III between Poland and Germany results from the absence of the themes of Agricultural and aquaculture facilities and Biogeographical regions in the Polish geoportal. The themes that were added to Bulgaria for viewable services covered 11% of themes in Annex I, 0% in Annex II, and 19% in the last of them. Values of datasets provided by Bulgaria differ from the level of accessibility shown in Poland and Germany. Later accession to the European Union and problems with the implementation of the INSPIRE Directive into the legal system (Pashova and Badrova, 2017) generate narrow areas of provided datasets in INSPIRE annexes.

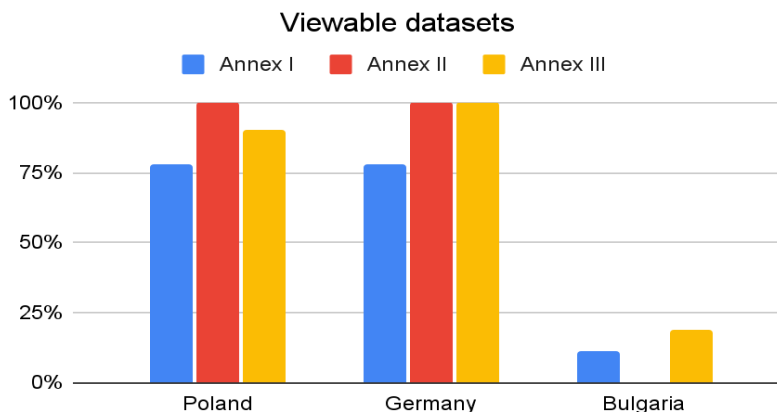


Figure 3. Percentage of viewable datasets in individual countries

The third graph (Figure 4.) shows similarities to the previous one (viewable datasets) in percentage values of accessibility to datasets located in Annexes. Poland provides 67% of the downloadable dataset in Annex I, 100% in Annex II, and 95% in the last one. In 2020, Annex III did not have datasets available for download in the themes of Oceanographic geographical features and Species distribution (Krawczyk, 2020). While gathering data for the article, datasets were uploaded correctly and are part of the INSPIRE geoportal system. The difference in accessibility value with the previous graph occurred in Annex I, the 'Cadastral parcels' theme, which can only be viewed in Polish SDI. Germany provides the same percentage value in both viewable and downloadable themes, successively 78%, 100%, and 100%. However significant distinction appeared in Bulgarian geoportal. An increase can be noticed by comparing values between viewable

and downloadable datasets in Annex III. In Annex I and II the values are the same: 11% and 0%, however in the last Annex, the value has reached up to 38%.

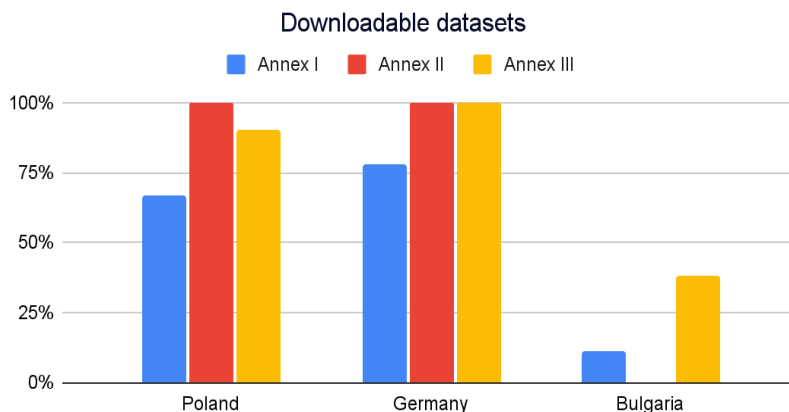


Figure 4. Percentage of downloadable datasets in individual countries

The last aspect that was compared was the accessibility to metadata. In this field, countries present the biggest similarity (Figure 5.). Metadata in the INSPIRE programme is information that describes datasets and spatial data services, helping to find, catalogue, and operate. (European Parliament and Council, 2007). In the first Annex, all compared countries provided the same value of themes which was 78%. In Poland and Germany, themes for metadata that are not provided are Geographical grid system and Coordinate reference systems. In Bulgaria despite the same value of accessibility, differences occur in provided themes. The absent ones are Addresses and the Geographical grid system which is also absent in the rest of the countries. Bulgaria provides metadata for Coordinate reference systems. In Annex II all countries provide 100% accessibility to metadata. That situation occurs only once in this comparison. In Annex III there is the biggest diversity in this part of comparison. Accessibility to metadata has successively been valued at 95% in Poland, 100% in Germany, and 81% in Bulgaria.

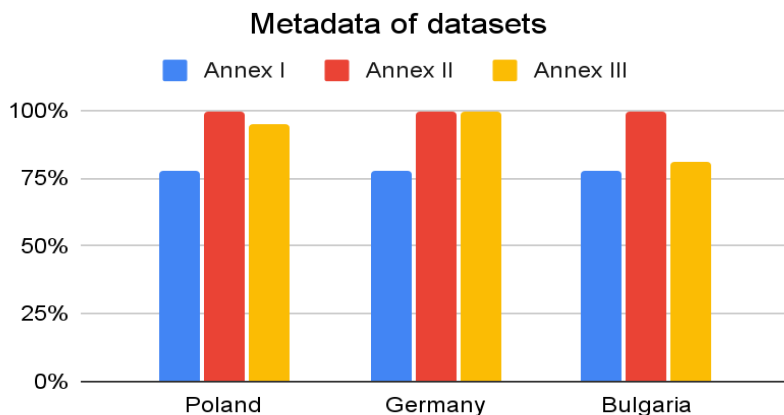


Figure 5. Percentage of metadata of datasets in individual countries

## EVALUATION OF DATASETS PROVIDED IN POLAND

After comparing national datasets located in Annexes, which are accessible through INSPIRE geoportal, a year-to-year comparison of datasets in Poland was created. A comparison of datasets was conducted on datasets that are already in the databases of INSPIRE. For that reason, in some groups, values achieve 100% accessibility, even if Figure 1. shows that not every Annexes theme is provided.

Analysis of the period 2019 - 2022 was performed with information located in reports that can be found at the INSPIRE Knowledge Base site in the 'Inspire in your country' tab. Reports are made at the end of each year, and published in the first half of the new year. For example, a report from 2020 provides information about the year 2019. Reports include

information about stages of implementation of the INSPIRE Directive in Polish SDI, set further goals for development, and evaluate progress in fulfilling rules that were set in 2007. National Spatial Infrastructure has a hierarchical structure with different bodies being in charge of the implementation of datasets. The coordinator of implementation and the person responsible for creating the list of datasets was the Minister of Economic Development (now the Minister of Economic Development and Technology). Lead authorities in the form of Ministers and chiefs of central agencies in agreement with the Minister of Economic Development and Technology collect data to create datasets, develop, harmonise, and make them functional. (Sejm, 2010). Lower in the hierarchy stands administrative authorities which maintained public registers. The role of those bodies is to provide technical solutions for enhancing the interoperability and harmonisation of data located in Annexes at the local level (Ganczar, 2020).

Groups that are created by the European Commission to distinguish data and services are free to find in the INSPIRE Knowledge Base. Data and services are collected in groups and subgroups. The main groups are divided by different approaches to checking accessibility and interoperability: Monitoring of the availability of spatial data and services (DSi 1), Monitoring of the conformity of metadata with Commission Regulation (EC) No 1205/2008 (MDi), Monitoring of the conformity of spatial data sets with Commission Regulation (EU) No 1089/2010 (8) on interoperability (DSi 2), Monitoring of the accessibility of spatial data sets through view and download services (NSi 2) and Monitoring of the conformity of network services with Commission Regulation (EC) No 976/2009 (NSi 4) (European Commission, 2019). Subgroups corresponding with main groups were created to provide the most thorough analysis of datasets.

Analysis of three main groups: DSi2, NSi2, and NSi4 was performed. Examination of progress started with a group that focused on “Monitoring of the conformity of spatial data sets with Commission Regulation (EU) No 1089/2010 (8) on interoperability” (European Commission, 2010). Data that are located there, need to follow rules to provide harmonic and practical use of spatial datasets and services (European Commission, 2010). The main group is divided into four subgroups: DSi2- percentage value of spatial data sets compatible with Commission Regulation (EU) No 1089/2010 regarding interoperability of data sets, DSi2.1- percentage value of spatial data sets located in Annex I compatible with same legal act, DSi2.2- percentage value of spatial data sets located in Annex II and DSi2.3- percentage value of spatial data sets located in Annex III (Minghini et.al. 2020).

The first graph of that section (Figure 6.) shows values of the overall accessibility of datasets provided by Polish SDI. Although the trend of increase can be seen, the sudden drop in percentage value appeared in 2020 (data obtained from 2021 report). In 2020 various Polish agencies created a great amount of new datasets in areas confirmed by Annex II and III. Datasets were published by the Ministry of Climate and Environment, The Polish Geological Institute - National Research Institute, the Chief Inspectorate of Environmental Protection, and the Head Office of Geodesy and Cartography. The need for the usage of spatial datasets by society rises rapidly in year-to-year comparison. To fulfil this need, new undertakings appeared to implement informatics solutions for the development, harmonisation, and maintenance of datasets (European Commission, 2021). Added datasets in some cases did not correspond with requirements set by the rules from the INSPIRE Directive. That resulted in the drop of reliable datasets. However, next year’s trend has changed providing conformed datasets.

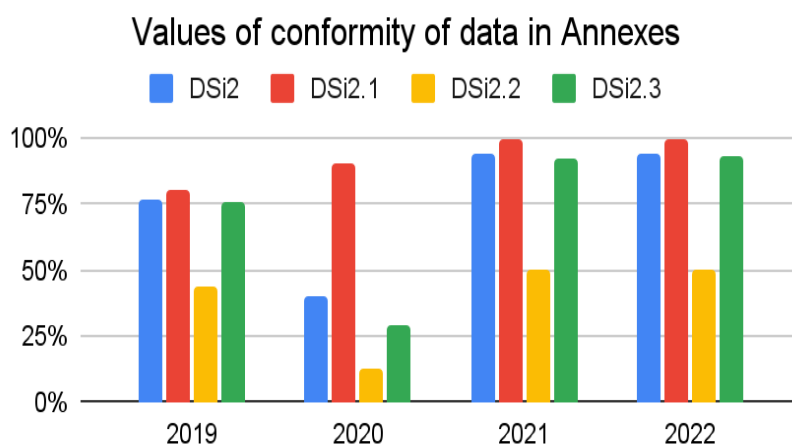


Figure 6. Percentage of conformity of datasets corresponding to Annexes

The next analysed group is focused on ‘Monitoring of the accessibility of spatial data sets through view and download services’. The group provides information about the amount of datasets available to be viewed and downloaded for future use. Group plays a crucial role in fulfilling one of the principle INSPIRE goals- accessible and free data for citizens of



the European Union. The main group is divided into three subgroups: NSi2- datasets available via view and download services, NSi2.1- datasets available via view services, and NSi2.2- datasets available via download services (Minghini et.al. 2020).

The effect of analysis (Figure 7.) showed the steady growth in accessible datasets in the examined time. In 2019 the INSPIRE Directive should have been implemented in all membership countries with all areas fulfilled. It is clearly shown that Polish agencies weren't able to reach that goal- only 35% of datasets were able to reach via view service (while only 1% of both download and download and viewable datasets were operable at that time). In 2020 Chief Inspectorate of Environmental Protection emitted services for viewing and downloading datasets. Among them, WMS, WFS, CSW, SoS, and ATOM can be distinguished. WMS (Web Map Service) provides vector datasets for viewable purposes, WFS (Web Feature Service) provides vector, downloadable datasets, CSW (Catalogue Service for Web) focused on sharing metadata, ATOM provides viewable and downloadable prepared sets of data, and SoS (System of Systems) that merge datasets and services to provide more complex, receiver-oriented service. Those services are free and accessible to find at Polish Geoportal. To implement the INSPIRE Directive into land planning in Poland, various solutions appear. In 2020 a QGIS plug-in to support the creation of spatial datasets and metadata corresponding with INSPIRE Directive was launched. For validation of Planning Data, an online validator was created in 2021, also a plan for launching urban registers to help provide referencing sources of data and spatial information appeared (European Commission, 2022).

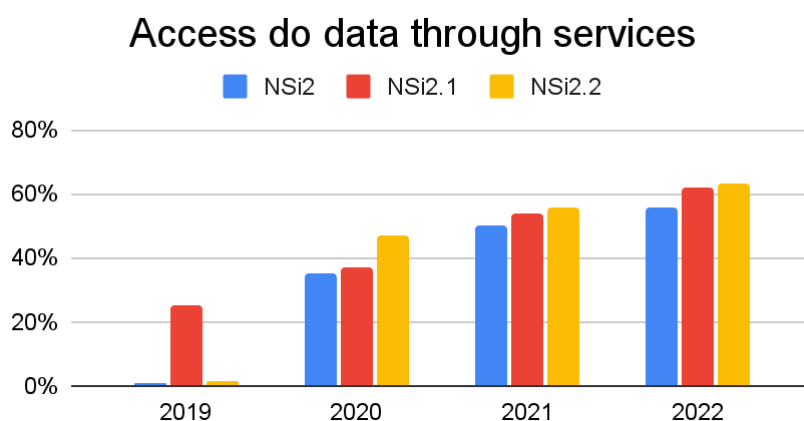


Figure 7. Percentage of accessibility to data via services

The last compared group focused on “(...) services that conform with Commission Regulation (EC) No 976/2009 as regards the network services” (European Commission, 2010). Services that are provided by national authorities and agencies, need to follow conditions for the creation and usage of the Network Services and availability of those services for public users (European Commission and Council, 2009). The document sets rules that need to be achieved to provide comfortable and effective usage of INSPIRE services. Subgroups can be defined in that area: NSi4- percentage value of the network services compatible with Commission Regulation (EC) No 976/2009 regarding the network services, NSi4.1- percentage value of the discovery services compatible with the same legal act regarding the network services, NSi4.2- percentage value of the view services, NSi4.3- percentage value of the download services and NSi4.4- percentage value of the transformation services (Minghini et.al. 2020).

The examination provides information about the technical capabilities of services hosted by Polish national agencies. Launching new services in 2020 increased the value of conformity. It means that newly created portals are operable and reach the INSPIRE requirements. However, Poland faces a lot of difficulties with the implementation of some of the rules into national SDIs. One of those is technological solutions which are responsible for problems with the implementation of the Directive, causing issues with efficiency (European Commission, 2023). Despite these problems, it is clearly shown (Figure 8.) that this area has the highest percentage value of conformity (compared to other presented areas) with the INSPIRE Directive. In 2022 services provide successively 97%, 100%, 95%, and 99% of value. Important to mention is the fact that subgroup NSi4.4 is not provided in Polish SDI. That area is focused on transformation services, which contribute to obtaining the datasets in expected models, from datasets in different ones (European Commission Joint Research Centre, 2013).



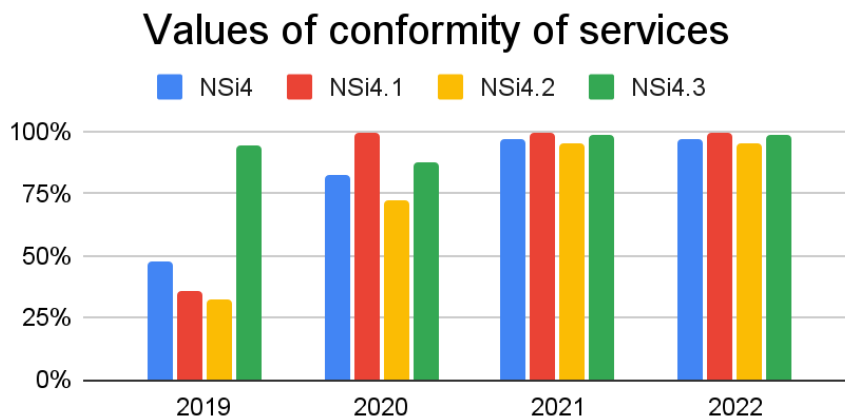


Figure 8. Percentage of services that conform with regulations

## CONCLUSION

Information plays a crucial role in the modern world. Data surrounds us from everywhere. Being able to make decisions, to plan the development and maintenance of society is inseparably connected with access to dataset. To answer the challenges in sustainable development and growth of European cooperation INSPIRE has been created. Data availability and reliability are the main components of this Infrastructure. Data that are free to download and use, should include all areas of themes and datasets. The comparison shows that even high-development countries have not reached that goal. Progress however was made. In the example of Poland, it is shown that the process of gathering data and making it accessible to everyone is long and hard, but gradually happening. New datasets are uploaded, and old ones are updated in the year-time period. However, there are still areas that suffer from the incompleteness of available datasets. The comparison clearly shows differences between countries that are caused mostly by legal factors. The most important aspect that distinguishes countries is the date of accession to the European Union. This event generates a base for future implementation of legal solutions in a wide range. Individual approaches to the implementation of the INSPIRE Directive into national law generate unique difficulties and solutions. The shared goal of membership countries is to provide the most reliable datasets, free and accessible to every citizen. That imposes an obligation to constantly provide new datasets, and also harmonise and improve the existing ones. International cooperation, trans-border exchange of knowledge, and tested solutions can help achieve the goal of countries with less value of conformed datasets and ultimately help create an information society of the European Union.

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