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# IMPLEMENTATION OF THE INSPIRE DIRECTIVE IN FINLAND

SITUATION IN JANUARY 2021

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## 1 Introduction

### 1.1 Background and goals

The Ministry of Agriculture and Forestry wanted to evaluate what is the current situation of the implementation of the INSPIRE directive in Finland. The main goal was to know how the implementation has proceeded at the national level and what could be improved in the future. The Ministry wanted to get answers to the following questions:

- What is the general situation of the implementation of INSPIRE in Finland?
- What has been the need for national support?
- What is the role of the support and guidance of the INSPIRE secretariat at the National Land Survey of Finland (NLSF) in the implementation and how the support has been organised?
- Have municipalities benefited from the implementation of INSPIRE?
- Has other societal development had a positive or/and negative impact on the implementation of INSPIRE?
- How the implementation of INSPIRE has succeeded in Finland compared to some other EU countries? And whether other countries have operating models that could be used also in Finland to advance the implementation?

The INSPIRE Directive has been implemented in stages and the deadline for the last

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<https://www.maanmittauslaitos.fi/sites/maanmittau>

obligations was on the 21<sup>st</sup> of October 2020. The INSPIRE directive will be evaluated at the European level during the year 2021. Therefore, it was an appropriate time to assess the situation also in Finland. And not only to look at and analyse official reports and statistics about available INSPIRE services and datasets but also to hear and understand how the obligated authorities, INSPIRE secretariat at NLS Finland, as well as IT and consulting companies, see the situation from their point of view.

In Finland INSPIRE obligated organisations are state, regional and local level authorities (municipalities) who manage spatial datasets within the scope of the INSPIRE directive<sup>1</sup> Totally 14 state authorities, 12 regional authorities including Åland and most of the 309 municipalities must follow the INSPIRE requirements if the national law demands it.

#### 1.1.1 Coordination of INSPIRE in Finland

The following organisations are in a key role in the coordination of the implementation of the INSPIRE directive and development of the national Spatial Data Infrastructure (SDI) in Finland.<sup>2</sup>

*The Ministry of Agriculture and Forestry* is the national contact point of INSPIRE and in charge of the legal transposition of the directive in the province of Åland and the rest of Finland. The Ministry of Agriculture and Forestry is represented in the MIG as well as in the INSPIRE committee.

[slaitos.fi/files/attachments/2020/12/INSPRE\\_kansallinen\\_aineistoluettelo\\_2020-11-17.pdf](https://slaitos.fi/files/attachments/2020/12/INSPRE_kansallinen_aineistoluettelo_2020-11-17.pdf)

<sup>2</sup> [Finland – Country Fiche 2019](#)

*The INSPIRE secretariat at the National Land Survey of Finland* provides support and guidance for Finnish organisations implementing INSPIRE and maintains national SDI services, such as the Finnish Geoportal. The INSPIRE secretariat is represented in the MIG and the permanent technical subgroup of the MIG and acts as the official secretariat of the National Council of Geographic Information and its extended secretariat.

*The National Council for Geographic Information* consists of representatives of ministries, major data providers, universities and cooperation networks. The following ministries are represented in the council: Ministry of the Interior, Ministry of Defence, Ministry of Finance, Ministry of Social Affairs and Health, Ministry of Agriculture and Forestry, Ministry of Transport and Communications, Ministry of Environment and Ministry of Employment and Economy. The role of the council is based on the demands in the INSPIRE directive and the national Act on Spatial Data Infrastructure.

*The Extended Secretariat of the National Council for Geographic Information* provides policy and implementation support. The following organisations are represented in the extended secretariat: National Land Survey, Finnish Environmental Institute, Meteorological Institute, Geological Research Centre, Finnish Transport Agency, Natural Resources Institute Finland, City of Helsinki as the representative of the municipalities.

*The network of geographic information* is an open voluntary network that aims to promote co-operation between actors in the domain of geographic information. It provides information on the implementation of the INSPIRE Directive, the development of the national spatial data infrastructure and other topics related to geographic information. The INSPIRE Secretariat at the National Land Survey of Finland supports and facilitates the activities in the network.

## 1.2 Study methods and materials

Interviews, a survey and national reports were used to collect both qualitative and quantitative data for the evaluation of the situation. Interviews were performed in December 2020 of 11 obligated authorities: four municipalities and seven state authorities, two big IT companies and two small consulting companies that provide services to small and midsize municipalities were interviewed. The questions are presented in Annex 1. Also, seven experts of the INSPIRE secretariat at the NLSF were interviewed. The results of the interviews were analysed and the summary is presented in Chapter 4.

A survey that was open 14.-22.1.2021 was sent to all obligated local, regional and state authorities. The topics of the questions were based on the goals of the study and the results of the interviews. The purpose was to get feedback from as many authorities as possible so that the results of this study would reflect reliably the situation of the implementation and

the views of obligated authorities. Therefore, the respondents chose their opinions from predefined alternatives as well as write open feedback to questions. The results of the survey were analysed and compared between state and local level authorities and to the results of the interviews. The questionnaire is presented in Annex 2. 127 people started to answer questions and 62 people completed the whole survey. 63% (80) of the respondents represented municipalities, 31% state authorities and 8% regional authorities. The representatives of municipalities were asked the size (number of inhabitants) of their municipality. Of the 80 respondents 17% were working in big cities that have over 180000 inhabitants, 21% in cities that have 50000-180000 inhabitants, 31% in municipalities that have 20000-50000 inhabitants, 18% having 10000-20000 and 12% in municipalities that have 5000-10000 inhabitants. Municipalities that have over 10 000 inhabitants are categorised as midsize. The results were analysed and are presented in Chapter 4.

The national INSPIRE contact points from Sweden and Belgium were interviewed in December 2020 and in January 2021. A comparison of the implementation in Finland, Belgium and Sweden is presented in Chapter 5.

## 2 Actions in 2016-2020

After Finland had in 2016 a discussion with the European Commission about the shortages in meeting the deadlines and other requirements

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<sup>3</sup> Interview of the INSPIRE secretariat

of the implementation of INSPIRE the Ministry of Agriculture and Forestry sent in spring 2017 a letter to all obligated authorities and asked them to provide a plan and start actions to complete the implementation. 59 organisations (9 state authorities, 47 municipalities and regional authorities) answered the letter with a joint plan. Many municipalities had not even heard before about the requirements of the implementation. It is still unknown how many municipalities have data for INSPIRE data themes only in paper format and are thus not obligated. In 2020 the INSPIRE secretariat has tried to clarify what are the INSPIRE obligations that municipalities have and what kind of possibilities there are to fulfil these in co-operation with state authorities. <sup>3</sup>

The core issues of INSPIRE implementation were also addressed in the Report on Spatial Data Policy <sup>4</sup> (“Paikkatietopoliittinen selonteko”). The policy report was approved by the Finnish Parliament in November 2018. The Report express the types of spatial data that are needed in Finnish society, how their production, management and distribution is developed, and how their use is promoted. Some of the key suggestions within the report were the creation of a new cooperation body for more efficient collaboration within the geospatial industry in Finland.

Between 2016 and 2018 there was almost a threefold increase in spatial data sets that conform with EU commission regulation regarding interoperability of spatial data sets, and the percentage of interoperable data sets

<sup>4</sup>  
<https://julkaisut.valtioneuvosto.fi/handle/10024/160910>

out of all data sets rose from 6,45% to 15,03%. The number of spatial data services conformant with EU commission regulation regarding metadata also rose 21% during the same time.

### 3 Role of the INSPIRE secretariat<sup>5</sup>

National Land Survey of Finland provides support services related to the implementation of the INSPIRE directive in accordance with section 9 of the Spatial Data Infrastructure Act. This role was given to the INSPIRE secretariat at the NLSF. The secretariat offers support and guidance in many ways:

- INSPIRE web site (revised in 2020)<sup>6</sup>
- Training sessions (on the spot)
- Remote training sessions (webinars)
- Videos
- Possibility to contact experts directly by email and get answers to questions.
- Mutual meeting with experts of the secretariat.

#### 3.1.1 First years after 2007

During the first years after the INSPIRE Directive entered into force, the secretariat was strongly involved in developing the technical guidelines and organised multiple training sessions on how to create and publish metadata and develop view and download services (called network services or spatial web services) as well as for INSPIRE data products. The Finnish INSPIRE network and its thematic groups supported the

implementation activities. Experts from state authorities and IT and consulting companies were most active in participating in the training sessions. In general, 70-80% of the participants were the same people from one training session to another. A big challenge was municipalities that were not very active in the implementation. Small municipalities did not have any spatial data professionals who could have taken ownership of the implementation.

#### 3.1.2 Intensified support in 2016-2020

The INSPIRE secretariat has offered intensified support and guidance to obligated authorities in 2016-2020 to advance the implementation, especially in municipalities. Municipalities could publish INSPIRE services via the national Geospatial Platform. The Association of Finnish Municipalities (Kuntaliitto) promoted its joint KuntaTietopalvelu (KTP service) for municipalities to fulfil INSPIRE requirements. Unfortunately, the service was closed in 2019.

The secretariat has published between February 2016 and October 2020 in total 25 videos covering several topics: creation and validation of metadata, reporting, catalogue services, use of INSPIRE validator, search for spatial datasets etc. The total amount of video views was almost 1700 by October 2020. Videos are excellent in guiding how particular technical issues are solved, as a video enables learning and doing at the same time.

<sup>5</sup> Interview of the INSPIRE secretariat

<sup>6</sup> <https://www.maanmittauslaitos.fi/kartat-ja-paikkatieto/paikkatietojen-yhteentoimivuus/inspire>

The secretariat has got thanks for the activities that it has done. The most positive feedback has been received from training sessions that covered benefits from SDI – on why it is beneficial to invest in the development of SDI. This topic was especially discussed in training sessions given by information system providers who could show concrete examples of the benefits. The main task of the secretariat is to support the authorities in meeting the legal obligations. This covers 90% of the secretariat's working time. The rest 10% is used to more informal issues to bring up the benefits that authorities can achieve from the implementation.

### 3.1.3 Challenges in support and guidance

A big challenge has been how to reach all authorities that need support. Some of them have been reached through the national network of geospatial information. However, most of the municipalities have not taken part in the network but have been active in municipalities' own spatial data network activities.

The experts of the secretariat have not been able themselves to give concrete training in building of view and download services. This is because the secretariat wants to be unbiased and not favour any specific spatial technologies or information systems. Some training sessions were organised in which information services providers showed their solutions, but care was taken to give voice to many vendors and not focus on just one.

### 3.1.4 Successes

The experts of the secretariat think that they have succeeded well in the following activities:

1. Implementation of the *national geoportal Paikkatietoikkuna*

(<https://kartta.paikkatietoikkuna.fi/>)

Without INSPIRE it would not have been realised. The geoportal is used as a general channel to view services and spatial data, INSPIRE and others as well. It has enhanced the understanding of the importance of spatial data as well as APIs and metadata.

2. *Oskari software*. (<https://www.oskari.org/>).

Oskari is an open-source platform originally developed for Paikkatietoikkuna. Oskari is used in several organisations such as the cities of Tampere and Joensuu, Helsinki Region Environmental Services (HSY), Finnish Transport Infrastructure Agency, Statistics Finland as well as in SYKE's Liiteri service and the Arctic SDI Geoportal.

3. *All training* provided by the secretariat was seen as a success.

4. *Biggest success: INSPIRE has acted as a tool* and has made spatial data producers *implement APIs for data sharing* as well as *created understanding*:

- a. What does interoperability of spatial data mean and what are the benefits of it. Paikkatietoikkuna visualises this concretely.
- b. Open APIs from as-is spatial datasets

- c. INSPIRE showed the purpose and benefits of standard APIs.
5. *Impact on the pricing of spatial data.* Implementation of INSPIRE has advanced the opening of spatial data and created technical means to use open data.
6. Development of *networks*.
  - a. Networking and discussions between different authorities.
  - b. Impact of public-private partnerships.
  - c. Development of an ecosystem that includes different levels of government as well as the private sector.
  - d. Experts from the Finnish authorities have participated in international networks and standardisation work.
7. *Spatial datasets have been described and can be easily found.*
  - a. In 2009 only 20 datasets were described. At the end of 2020 over 1000 datasets have been described in the catalogue Paikkatietohakemisto ([www.paikkatietohakemisto.fi](http://www.paikkatietohakemisto.fi)).
  - b. Almost 2000 spatial data layers have been published at Paikkatietoikkuna. The requirement for publishing is that the spatial dataset is available from a network service.
  - c. Also, other spatial datasets than INSPIRE datasets have been published and described at Paikkatietoikkuna and

Paikkatietohakemisto (Helsinki, Helcom, University of Jyväskylä (Lipas), HSY, Metsäkeskus).

### 3.1.5 What could have done better?

The experts of the INSPIRE secretariat discussed what they would have done in another way to enhance the implementation:

- *Practical benefits of INSPIRE* at a level and language *that decision-makers understand* should have been brought up more.
- *Mutual discussions with obligated authorities* if more resources would have been available:
  - sparring
  - easily understandable communication and demos: what benefits you get by doing like this
- The *message* has probably been *too technically oriented*.
- *A tour in Finland to meet municipalities and their decision-makers* would have been implemented if a sufficient amount of personnel resources would have been available (double the resources by rough estimate). A preliminary plan was done together with the Geospatial Platform in 2019 but it was not put into action.
- *More efforts to the use of national INSPIRE datasets* and to bring up the *benefits of SDI*.

### 3.1.6 Resources for the support

The resources of the secretariat have been the same from the beginning. It has not been possible to provide more support and guidance even if desired. The secretariat has a yearly allocation for approximately 3,5 person working years and altogether 10 people have been involved in support and guidance. The personnel are experts in different areas and contributed each in their different ways. Decentralization of competence is important. The secretariat has got continuously new support tasks such as catalogue services and validation services while the available resources have stayed the same. The resources of the secretariat have not been accurately designated in the annual budget agreement between NLSF and the Ministry of Agriculture and Forestry. Each year the resources are competing with other cost items at NLSF. However, the shared use of spatial data is one of the primary tasks of the NLSF and therefore the basic level of resources is thought to be quite stable.

The resources of the secretariat are budgeted to give support for the implementation of legal obligations of INSPIRE. There is no clear mandate in which operative roles in the SDI the secretariat can and should act: in the Geospatial Platform project, development of services etc. The impact of the actions of the secretariat has not been measured using predefined meters before. For the year 2021, the annual budget related agreement will include meters to measure the impact of the implementation of INSPIRE.

### 3.1.7 *Situation of the Finnish SDI*

The SDI has many strengths: spatial web services are available and spatial datasets have been described. There exists a clear vision that the SDI provides an architecture for services. But interoperability of spatial datasets has not yet reached optimal levels for wide shared use. For example, common identifiers and codes are not in use throughout. The national SDI has been implemented at the minimum level where national spatial data is quite comprehensively available in standard download services. But not much harmonised interoperable data is available. The target level could be much higher if ambition and political will would exist. At that level, spatial data would be interoperable and could be chained, would enable machine learning, analyses and visualisations, and could be used on different platforms.<sup>7</sup>

User-friendly, concrete tools and catalogues are needed to enhance the use of INSPIRE data. Bare instructions are not sufficient. INSPIRE and its standards have been developed from the data providers' point of view. Users need applications and libraries that help with the use of data. Finland itself should invest in these and boost ecosystems if this kind of development does not proceed in Europe.<sup>8</sup>

INSPIRE directive is itself quite old and the data specifications were made over ten years ago based on forecasts on how technologies will develop in the future. Are these specifications sustainable still in the 2020s?<sup>9</sup>

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<sup>7</sup> Interview of the secretariat at the NLSF

<sup>8</sup> Interviews of obligated organisations

<sup>9</sup> Interviews of IT and consulting companies

## 4 Implementation of INSPIRE in 2020

The following chapters 4.1-4.11 introduce the assessments and opinions from the interviews and the survey.

### 4.1 Situation of the implementation

#### 4.1.1 State authorities

In general, all interviewed state authorities have already completed or almost completed the implementation. INSPIRE datasets, view and download services as well as metadata has been validated and published. Some of the authorities have been early actors and completed the implementation already almost seven years ago. They also got thanks from the Commission for their good work. Challenges exist in the harmonisation of certain datasets. Some datasets are based on national standards that all main Finnish user groups use, and these datasets do not necessarily fit the INSPIRE schemas. All interviewed organisations have opened their INSPIRE datasets taking GDPR into consideration.

#### *Results from the survey*

The representatives of authorities were asked to assess the stage of the implementation of INSPIRE in their organisations using a scale from 0 (nothing done) to 5 (everything is ready). The mean value of 23 responses is 3.5. This is in line with interviews. Part of the

authorities have completed the implementation: INSPIRE data products and services are ready. Quite many authorities are still continuing some tasks such as modifying metadata or are finishing data products and/or network services.

#### 4.1.2 Local and regional authorities

All interviewed *municipalities* have implemented network services, most focused first on view services and download services later. All or a part of the required datasets have been published and are available for users. The quality of spatial data was stated as one reason why some data has not yet been published.

*Regional* councils are responsible for the implementation of INSPIRE requirements regarding land use plans. Most of the councils cooperate with Lounaistieto, the regional information service in Finland Proper, that has developed and published regional land use plans as WMS and Inspire Atom download services. WFS has not been implemented yet. Metadata has been created and submitted to Paikkatietohakemisto.

Lounaistieto is also helping some municipalities in INSPIRE related tasks. That is more challenging because municipalities use different information systems to manage land use plans. Small municipalities that buy land use planning from consulting companies cannot provide proper metadata because they have not agreed on the provision of metadata

with consultants. Officers of small municipalities, who order land use planning projects from consulting companies, usually have no competence to order INSPIRE compliant land use datasets.

### *Results from the survey*

In *municipalities*, the mean value of the stage of implementation is 2.7 based on 50 answers. Some advanced municipalities commented that they are waiting for national data models and instructions for land use plans to complete the requirements. In some cases, the whole implementation has been outsourced and thus completed. In other cases, technically all tasks have been done but data policy issues regarding the opening of data had to be decided in the municipal council.

In *regional authorities*, the mean value of the stage of implementation is 4.2 based on six answers. The good situation is based on good and coordinated co-operation between the regional councils and Lounaistieto.

#### *4.1.3 IT and consulting companies*

Interviewed private companies altogether have at least half of the Finnish municipalities as customers and state authorities as well. The IT companies have developed view and download services for their customers and helped them to publish INSPIRE datasets. They have also organised webinars and hackathons and informed customers about the schedules of INSPIRE implementation. One of

the companies provides a public web map as a service to tens of small and midsize municipalities and has also implemented network services to half of these customers. However, municipalities are themselves responsible for delivering metadata to Paikkatietohakemisto. Often these consulting companies maintain mainly data on detail plans on behalf of their customers, but not the metadata.

IT companies told that in the KuntaGML project that was started already in 2007 WMS and WFS services and publication processes of spatial data from municipalities' geographic information systems and registers were developed. All municipalities got the network services for use free of charge. KuntaGML project was already a direction towards INSPIRE. The actual INSPIRE compatibility was planned to be fulfilled by the KTP service. That is why the IT companies did not develop any similar service for their customers.

How the companies' customers have responded to the INSPIRE requirements varies greatly. Small municipalities might not know what INSPIRE is because they do not have the required expertise in spatial data issues in the organisation. A mayor, technical director or building inspector take care of spatial data issues among other business. Big cities have larger resources and they have been active, and they have bought consulting services to advance implementation. Overall, municipalities have made their own decisions regarding deadlines and mandatory

requirements. Many municipalities have thought that publishing spatial data in open WMS is enough.

Municipalities have also had different attitudes to the readiness to publish INSPIRE datasets. Some municipalities published datasets as-is and others felt necessary to improve the quality of the datasets before publishing. This is despite the directive stating that datasets can be published as-is.

## 4.2 *Biggest successes*

Almost all interviewed state authorities stated that one success has been that they have been able to fulfil the requirements of INSPIRE, but it has taken a great effort. During the implementation, their own competence has grown. Not only technical know-how but competence for international co-operation has increased as well.

In general, open data is a big success. It has increased the use of spatial data greatly. Opening the national forest resource database for users required even a change to the national legislation related to the management of the national forest data system. This change was sped up not only by INSPIRE but in a larger part by the environmental directive.

INSPIRE has given a good example for the implementation of open data using standard APIs. Without open standards, a heterogeneous mix of different types of APIs (including proprietary technologies) would have been used. The use of international standards in data models has been

implemented in the planning of data management systems in general.

Some state authorities mentioned administrative aspects such as that the organisation set up their own INSPIRE team that has regular follow-ups and meetings. Some organisations established internal projects to fulfil the implementation and also mentioned the importance of having full support from management. One success is a good co-operation between authorities in Finland. For example, NLSF has helped state authorities to develop network services and publish their INSPIRE datasets.

The interviewed municipalities listed as biggest successes that they produced descriptions of both spatial datasets and APIs. This was viewed to have further increased the use of published open data. One interviewee said that co-operation between subdivisions of municipal government has increased especially related to open data. The opening of spatial data has also enhanced business and brought income to the municipality. One municipality suggested that the state could give economic support to municipalities based on how beneficial its spatial web services are.

At the regional level, significant successes are the fulfilment of INSPIRE, the creation of successful co-operation between all actors and a centralised service<sup>10</sup> that provides information on INSPIRE datasets and network services. All co-operation activities have saved time and money. Almost all regional land use plans are stored in data models and the rest will be completed in 2021.<sup>11</sup>

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<sup>10</sup> [maakuntakaavat.fi](http://maakuntakaavat.fi)

<sup>11</sup> Interviews of obligated authorities

### *Results from the survey*

Altogether 82 respondents from local, regional and state authorities chose one or more alternatives from the choices for successes in the implementation of INSPIRE. At least one third agreed that successes are 1) opening of spatial datasets, 2) faster realisation of network services, 3) automated spatial data delivery by network services, 4) ability to use network services and 5) increased competence.

### **4.3 Biggest obstacles**

In this study, the term *obstacle* is used to express the things that have *prevented*, at least for a period, or *slowed down* significantly the implementation of INSPIRE. The interviewed state authorities mentioned several big obstacles that have made the implementation process slow. It has been complicated both to create and use INSPIRE data products because the specifications are complex. Instructions have been difficult to understand, contradictory, missing, delayed and changed mid-implementation. The order of certain requirements was illogical. For example, metadata had to be ready before INSPIRE datasets and had to be modified when real data products were ready. Finland was already quite far in the implementations of national data standards that serve the needs of national users. To produce a corresponding INSPIRE dataset has required an added economic investment. It is a challenge to

guarantee the quality of datasets when two versions, national and INSPIRE, exist.

Some obstacles were related to the information systems used. For example, ArcGIS could not publish INSPIRE compliant data products nor view and download services. In some cases, the IT infrastructure of the authority did not contain a solution to publish spatial data, or the solution would have been prohibitively expensive. NLSF uses GeoNetwork to manage metadata. Geonetwork is an open-source catalogue application and several technical changes to the application caused delays to authorities' metadata work.

Submission of metadata to Paikkatietohakemisto is time-consuming because metadata for each dataset must be filled in manually. When an authority has a large number of different datasets, the submission of metadata takes a lot of time. This task also needs to be repeated every time there are changes, even with small changes. The deadline for implementation of INSPIRE was in October 2020 but the official validator has not been complete enough to serve all data themes and authorities in time. Overall, a lot of resources have been spent in Finland because each authority has solved problems independently.

The interviewed municipalities listed partly the same kind of obstacles: lack of resources (time and people), difficult to understand what is required and what are the benefits INSPIRE

brings, KuntaGML (municipality GML) is a national standard and not INSPIRE compliant, KTP service that was planned to solve INSPIRE requirements was closed, and quality of spatial data had to be improved before publishing. From a small municipality's point of view, INSPIRE is very abstract and disconnected from daily tasks, and even a GIS expert gets out of his comfort zone in the implementation tasks. One of the interviewed private companies said that it was very difficult for municipalities to know what to do and where to get correct information. The Association of Finnish Municipalities' point of view was that KTP service solves all INSPIRE requirements. The NLSF told that the Geospatial Platform offers INSPIRE services to municipalities and consulting companies said that municipalities must implement their own network services. This was very confusing to municipalities and delayed actions.

From the regional authorities' point of view, the visualisation of land use plans is challenging because visualisation has been defined only for a paper version. This is also related to the use of data models but has been solved in the HAME project<sup>12</sup>. One obstacle has been the very slow publication of data using complex data models and WFS 2.0 service. A solution to this and a good direction in standardisation is the new OGC API – Features and the simple features data profile.

### *Results from the survey*

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<sup>12</sup> A joint project of regional councils to produce harmonised INSPIRE compliant regional land use plan data that serves much better the data needs

Half of the state authorities (12 of 24 respondents) chose two main obstacles in the implementation: complicated production of INSPIRE data products and it is unclear what benefits INSPIRE brings. Also, open comments such as INSPIRE data models are weak, no definitions for INSPIRE data products and legal restrictions were given.

Respondents from municipalities (50) emphasized mainly different obstacles. Human resources were chosen by 29 respondents and one-third of 50 respondents chose: understanding what is required in the implementation, competence, and lacking, complex and contradictory instructions. About 25% of the respondents answered that shortcomings in the quality of spatial data prevented publishing the data.

Respondents from regional authorities chose two main obstacles: competence and human resources.

### *4.4 Most important sources of support*

The INSPIRE secretariat and consulting companies have helped state authorities to solve practical technical problems. In the beginning Inspire Network (now Network of geographic information) generated strong enthusiasm and co-operation in Finland. As many as 150 experts participated in the meetings. According to one authority, the biggest help was gained from their contacts in their international network. INSPIRE Geoportal was also mentioned. Peer support

of regional councils, state administrations and other society.

has been received from other organisations in the same domain and even from within their organisation.

Municipalities mentioned also consulting and IT companies, training provided by the INSPIRE secretariat, NLSF and the Network of geographic information as sources of support. Also, strong co-operation between municipalities that use the same commercial geographic information systems has advanced the implementation. The importance of the existence of the national SDI for the success of the municipality was stated as well.

At the regional level co-operation partners NLSF, Finnish Environment Institute and the University of Turku have supported the implementation. Annual INSPIRE events and guidance videos at the INSPIRE web site are mentioned as sources of support.

#### *Results from the survey*

The results of the survey strengthen and support the results from the interviews. The main things that have supported state authorities (78 respondents) are 1) their own activity in the search for information and development of competence and 2) the INSPIRE secretariat at the NLSF. One-fourth of the respondents chose the national INSPIRE network (now Network of geographic information) and information system providers. JRC was mentioned in the open comments as well.

Whereas municipalities (50 respondents) emphasized 1) their own activity in the search for information and development of competence and 2) information system providers. 30% of respondents chose the INSPIRE secretariat at the NLSF and 22% INSPIRE network. Also, the Association of Finnish Municipalities (Kuntaliitto) was mentioned.

All respondents (6) from regional authorities chose peer organisations and 80% the INSPIRE secretariat at the NLSF.

#### *4.5 Support and guidance from the INSPIRE secretariat*

According to the interviewees, help and support is always given as well as answers to questions. The secretariat has encouraged people to ask. Mutual meetings, discussions by email and webinars that can be viewed also later are appreciated.

The information package on the INSPIRE web site is great. Municipalities do not have to interpret the directive as that work has already been done for them.

In the beginning, training was targeted at a small group of experts. It was unclear to the respondent whether special training for municipalities was actualised. Also marketing to municipalities failed because it was mainly sending circular letters. Marketing was done in co-operation with Kuntaliitto. On the other

hand, one state authority said that it was good that the secretariat “kicked the assess”.

Some experts in the secretariat have had the opportunity to take part in MIG and MIG-T work and that way have been able to participate in and guide the development of INSPIRE.

A low level of support to the definition of INSPIRE data products and to general features in the harmonisation was listed as negative things. Also, lack of resources in the secretariat and competence especially in the beginning affected negatively the implementation work.

Some state authorities said that they have not got much support from the secretariat mainly because their domains are so special. Whereas a representative of one municipality said that the implementation would not have succeeded if the support of the secretariat did not exist. A wish was expressed whether the secretariat could help to build co-operation between authorities.

### *Results from the survey*

Authorities were asked how well the following support services of the INSPIRE secretariat at the NLSF have served them:

- New INSPIRE web site
- Training sessions (on the spot)
- Remote training sessions (webinars)
- Guidance videos

- Possibility to contact directly by email and get answers to questions
- One-to-one meetings with experts of the secretariat.

The options for the assessment were: very well, moderately, to some extent, not at all, we have not used, and I cannot say. The most beneficial way of support has been direct contacts by email. 21% of the respondents assessed that this has served them very well and 53% to some extent or very well. The second best was the new INSPIRE website and the third was webinars. The fourth were guidance videos, the fifth mutual meetings and the sixth training sessions on the spot. The training sessions have been mainly arranged in Helsinki and because of covid-19, not arranged during 2020.

Municipalities have used the INSPIRE website, attended in webinars, and received email support. They have not had meetings with the experts of the INSPIRE secretariat. Whereas state and regional authorities have had one-to-one meetings with the secretariat and used email for discussions.

### *4.6 Needs for support in the future*

Authorities gave their open comments in the survey to the question “What kind of support do you wish to get in the future for the implementation of INSPIRE?” Municipalities wish to get in Finnish very clear, detailed and unambiguous instructions on what must be done and when. And that instructions are sent

directly to municipalities. Municipalities also want to get more information on why the implementation of INSPIRE is important and how it benefits them. Also, more focused training sessions were mentioned.

State authorities want that training sessions, events and possibilities to network with other authorities continue. They also wish to get quick responses to emails from the INSPIRE secretariat and low-threshold access to remote meetings with its experts.

Long-term implementation planning requires anticipation of future changes from the EU. A roadmap for the next five years would be useful. The implementation of INSPIRE would be better supported if it were better integrated into other initiatives and programs related to the opening and dissemination of spatial data at the national or EU level.

#### *4.7 Other benefits of the implementation*

INSPIRE speeded up the implementation of spatial web services. These are also used to publish other datasets than INSPIRE datasets. Metadata descriptions for other than INSPIRE datasets have been created and submitted to Paikkatietohakemisto.

Increasing competence including international OGC standards and understanding and creation of APIs were mentioned. One state authority said that now when new API policies are introduced by the Ministry of Finance, the community is familiar with the subject and they

have the readiness to implement the new policies.

The interviewees mentioned also other benefits: 1) the development of the Finnish SDI and data policy, 2) opening of spatial data, 3) easy use of other spatial data providers' (domestic and international) spatial web services and datasets because they are based on the same standards and 4) use of spatial web services in the organisation's own operations. One municipality stated that INSPIRE has developed municipalities' work because it has forced them into the right direction. Also, small regional councils would have not developed network services without INSPIRE.

Benefits also include a competitive advantage in international research applications and export projects in which INSPIRE and standards competence is required.

#### *Results from the survey*

The authorities were asked whether they have received benefits from the implementation of INSPIRE to their own operations. State authorities assessed networking as the most important benefit (68% of respondents) and 37% thought that the creation of metadata for other spatial datasets than INSPIRE datasets and opening of other spatial datasets has been beneficial.

Municipalities assessed that use of own spatial web services in internal operations, use

of other spatial data providers' spatial web services and opening of other spatial datasets than INSPIRE datasets are the main benefits. However, almost one-third of the respondents could not mention any benefits.

All regional respondents assessed that networking has been the biggest benefit and 80% chose option: the use of other spatial data providers' spatial web services as the second biggest benefit.

#### 4.8 *Implementation costs*

Not all interviewed authorities have estimated the costs of the implementation of INSPIRE. Part of the authorities could give quite exact numbers because the implementation had been executed as a separate project or services have been bought from private companies.

All state authorities have invested substantially in the implementation. One interviewed organisation used hundreds of hours of working time and another organisation estimated seven to eight man-years in the implementation of open data and spatial web services in which INSPIRE has been part. In the third state authority, approximately a couple of man-years have been used to develop the platform for publishing INSPIRE services and datasets, and from now on the annual labour cost to maintain INSPIRE datasets and services will be about 40000-50000€. One authority has invested 20000-55000€ per year during the

last three years. Another authority estimated that they have paid about 250000€ for the development of their network services including the technical infrastructure.

A midsize municipality had invested in the implementation and maintenance of network services a total of 40 000€ during the last five years. The network services are used to publish other datasets than INSPIRE as well.

In conclusion, the recognized costs have been from a few thousand euro in small municipalities to hundreds of thousands in state authorities.

It was estimated in Finland in 2008 that the cost for the maintenance of network services would be about 10 000€ / obligated authority. It seems that the costs mentioned by the interviewees are in line with the original estimation.

#### 4.9 *Impact on EU environment reporting*

The instructions for environment reporting emphasise interoperability with INSPIRE when reporting includes spatial data. One of the central goals of INSPIRE has been to change environment reporting to data-based reporting. However, instructions for reporting conflict with those of the INSPIRE directive. The only working reporting is CDDA (Nationally designated areas) that reads INSPIRE protected sites directly without problems.

Spatial data are only one part of environment reporting. In most cases, spatial data are reported as Esri Shapefiles and not as GML. When GML is used, spatial data can be validated using an online validator. But reported GML is not interoperable with INSPIRE. For all spatial datasets that are reported to the EU, first a version is generated for environmental reporting and later another version for INSPIRE.

Air quality reporting is regulated by a very detailed decision of commission: "Commission Implementing Decision laying down rules for Directives 2004/107/EC and 2008/50/EC of the European Parliament and of the Council as regards the reciprocal exchange of information and reporting on ambient air". INSPIRE directive has very little impact on the reporting. Therefore, INSPIRE data products and services have not reduced the burden of reporting.<sup>13</sup>

#### 4.10 Impact of other societal development

Developments such as eGovernment, digital government and standardisation (linked data, spatial data on the web) that are enhanced in the EU have had a positive impact on the development of the national SDI and implementation of INSPIRE. Fighting climate change requires interoperable spatial data across borders.<sup>14</sup>

Implementation of INSPIRE has enhanced the opening of spatial data and this has had a positive impact on open data policies in other sectors as well.<sup>15</sup>

Overreaction to data protection has had a negative impact on SDI development. National data protection can hinder the opening of some spatial datasets or even prompt organisations to close spatial datasets that had already been opened during the implementation of INSPIRE. Data protection issues are very important, but if not clearly defined they risk the added value that is achieved in the combination of datasets.

National SDI is a cross-administrative issue and silos between ministries slow the development of the SDI.<sup>16</sup>

#### 4.11 Actions to advance the implementation of INSPIRE

Authorities gave comments in the survey to the open question "What do you think is needed that the implementation of INSPIRE would progress further?"

The following issues were mentioned in the state authorities' comments:

- More simple network services.
- Easier automated solutions.
- Promotion of popular Geopackage format.
- Support of Paikkatietohakemisto to data producers.
- Implementation rules could be more simple and more flexible (technology solutions etc.).
- Renewal of INSPIRE technical guidance to match better with current mainstream software development practices would

<sup>13</sup> Interviews of obligated authorities

<sup>14</sup> Interview of the INSPIRE secretariat at NLSF

<sup>15</sup> Interview of the INSPIRE secretariat at NLSF

<sup>16</sup> Interview of the INSPIRE secretariat at NLSF

make spatial datasets easier to produce and use and more popular.

Respondents from municipalities gave the following comments:

- A supportive and beneficial procedure for the management and sharing of spatial data also in INSPIRE format so that municipalities need to maintain spatial datasets only once.
- Simple solutions to transform basic WMS and WFS services to the format that meets INSPIRE requirements. Solutions that do not require a high level of technical competence.
- The basis for municipalities' geographic information systems and spatial data maintenance should be a well-defined spatial data flow instead of delivering single big image-like files. The Finnish legislation requires municipalities to produce map images for example from land-use plans.
- More software development is needed for municipalities' geographic information systems. This development work would be improved if the requirements and data models would be clear and stable.
- It would be much more sensible to gather spatial data to one central place and share the data according to INSPIRE requirements, than that all municipalities share their own data separately.
- Stronger steering from the top or working together to ensure that instructions are clear.

And regional authorities commented as follows:

- Clear instructions on requirements and implementation of network services and how to add metadata.
- If the harvesting of metadata and other automated systems would work well, much frustration could be avoided.
- The top management of organisations are not necessarily aware of the obligation and demanding tasks and therefore resources and support are lacking. Communication and technical competence are needed.

## 5 Comparison to Belgium and Sweden

The following chapters introduce the current situation of the implementation of INSPIRE in Belgium and Sweden and how the support has been organised in these countries. Successes and obstacles are discussed as well.

### 5.1 *Current situation of the implementation of INSPIRE*

#### *Belgium*

In *Belgium*, the implementation of INSPIRE has advanced well. A lot of data harmonisation has been done. Also, a lot of services are available but some technical finetuning needs to be done so that the Commission finds the services. In 2015-2016 a shift to priority datasets was done and they were published in

the INSPIRE framework. An internal action plan for 2021-2024 will be completed in June 2021. Evaluation of the current situation will be done in March. It seems that only minor things need to be completed. However, it is important to understand that INSPIRE is just a small part of the data offering of the SDI. For example, in Flanders, there are currently 4630 datasets and 201 services whereas approximately only 316 datasets and 80+ services are reported to INSPIRE.

SDIs are now much more advanced and concrete. Geographic information is not special anymore and needs to be addressed as a part of PSI. The whole society wants to be data-driven and SDI is part of this development. All these are slowing the further development of SDI. Opinions such as 'now you only need to maintain SDI' and 'you can let the private sector to come in and use the data' have been voiced. Data-driven movement is good, the more demand in the future exists the more there is potential for development – demand is fuel to further development. The public sector is possibility driven and the private sector is demand-driven.

### *Sweden*

Sweden is now working with the priority data sets within INSPIRE. The work is focused on the harmonization of priority data sets and GML files are published for download. Currently (2020-12-09) Sweden has published 62 metadata records, 50 downloadable datasets and 54 viewable datasets in the EU's geodata portal Priority datasets. Regarding

Thematic datasets, Sweden has published 253 metadata records, 183 downloadable datasets and 199 viewable datasets.

The Geodata Council creates the prerequisite and it is important that INSPIRE is included in the national Geodata Strategy's action plan with activities. Together it has been decided (May 2019) the focus areas after 2020 for INSPIRE in Sweden. The Geodata Council helps to link several initiatives and the digitization of public administration in Sweden. INSPIRE after 2020 Statements:

- Sweden will maintain INSPIRE in a stable way
- Sweden will work for the simplification of INSPIRE
- Sweden will be more active in matters of INSPIRE at the European level
- Sweden will be more active in describing the benefits of INSPIRE

### *5.2 Obligated authorities*

Regional spatial data providers and the National Geographic Institute of Belgium are obligated authorities *in Belgium* to follow the requirements of the INSPIRE directive. Municipalities are not obligated. But if municipalities manage spatial databases (such as addresses) that have regional coverage the spatial data must meet INSPIRE requirements. In Flanders, Informatie Vlaanderen helps data owners (administrations and where applicable municipalities) to harmonise and publish the

data. At the federal level, it is the National Geographic institute that provides this service for federal administrations.

The *Swedish* municipalities provide data to authorities. The updating of address and building information, as well as information about other topography, takes place in collaboration between Lantmäteriet and the municipalities. This means that no municipality in Sweden is the responsible authority within the INSPIRE directive. In the year 2021, municipalities will be responsible for detailed development plan information and Lantmäteriet will offer the national access point for this data.

### 5.3 *Coordination and support*

#### *Belgium*

In Belgium, the national SDI consists of four SDIs: the regional SDIs of Flanders, Wallonia and Brussels and the federal level SDI. The INSPIRE Coordination Committee coordinates the implementation of INSPIRE both at the regional and federal level.

There is no central organisation for support. Support is given at federal and at regional levels. The supporting organisations are in Flanders: Informatie Vlaanderen, in Wallonia: Service Public de Wallonie, Direction de l'intégration des géodonnées, in Brussels: CIRB and Bruxelles Environment and at Federal level: the National Mapping agency (IGN/NGI). In Wallonia, one person creates

metadata for all obligated organisations. In Flanders, every data producer is responsible for doing metadata and services. However, Informatie Vlaanderen helps organisations based on demand. In Brussels support works like in Flanders. At the federal level, NGI provides centralised support for federal organisations.

The positive thing in the specific federal setup where territory related responsibilities are transferred to the regions is that it ensures that supporting organisations are close to the data owners and obligated organisations. However, this federated setup requires the necessary coordination between all parties to ensure a unified approach at the Member State level.

About 30 people are heavily involved in the Belgian INSPIRE community. If this were to be expressed as full-time equivalent personnel, it would amount to approximately 10 people.

#### *Sweden*

Until 2016, INSPIRE was managed as a special organization within Lantmäteriet's Geodata Secretariat. Since then, the work with INSPIRE has been organized into the line operations and since 2018/2019 the coordination is included in Lantmäteriet/Geodata/Market relations and collaboration, with a designated responsible manager. Within Lantmäteriet, the work on publishing metadata and providing services according to INSPIRE is based on its information responsibility and is done in

regular line operations and the support for the Swedish geodata portal also provides support for INSPIRE. The coordination handles Lantmäteriet's production in the same way as they handle the production in other information authorities. The coordination consists of five people working 75% each on average with INSPIRE in 2020.

Lantmäteriet has a digital channel where they inform responsible authorities, communicate, host an FAQ and have a dialogue.

The efforts and support of Professor emeritus Anders Östman in the harmonization of data and detailed knowledge in GML and HALE (data transformation) have been invaluable. Similarly, consultant Michael Östling's detailed knowledge and experience in metadata and geodata portal are highly valued. These two external resources have been engaged in coordination and will also continue this work in 2021. A system developer from Lantmäteriet has also contributed programming knowledge in XML and GML, which was completed in October 2020.

Technology coordination group holds technology forums twice a year where problems are discussed, and knowledge is disseminated. Often these meetings have generated opportunities to go in-depth into various issues such as harmonization and solutions for the future such as geopackage and OAPIF and more.

## 5.4 Success factors

### *Belgium*

INSPIRE Coordination Committee gathers all experts together to discuss and co-operate. From the beginning, all spatial data providers were invited to co-operate and give feedback on how to move things forward. The data providers were not just told that what they have to do but the message to them was that they have a voice and their opinions are important.

The big positive thing is that people now know that spatial data is available. User days under the theme of digitalisation are organised every year and the days gather about 2000 participants. These events foster the use of spatial data.

The organisation of the INSPIRE Conference (together with the Netherlands) in Antwerp in 2018 had a positive impact on data providers as INSPIRE crystallised on their doorstep and the importance was highlighted at the same time as it was made very accessible.

### *Sweden*

Four years ago, Lantmäteriet separated the coordination of INSPIRE from production. A decisive event was when the EU pointed out shortcomings in Sweden's participation in INSPIRE for the Ministry of the Environment in the summer of 2018. The management of Lantmäteriet and the management of the responsible information authorities became

more engaged and more committed in their respective roles after that. The support of management is an important prerequisite and part of success.

Coordination has experienced greater commitment and that the authorities have accepted the mission and are now being helped to a much greater extent than in the past. Some obligated authorities have technical consultants involved in the work and others have their own resources. In December 2019, the working group with representatives from all authorities met at SKR (Swedish Municipalities and Regions) and kicked off for 2020. Regular reconciliation meetings (digitally) once a month have great attendance and everyone helps everyone, and problems are solved. There is strong competence in several authorities and more and more people are building up their competence with cooperation.

## 5.5 Obstacles

### *Belgium*

Both economic and technical obstacles exist. At the federal level, a big obstacle has been to find funding for data providers to compensate for the opening of INSPIRE datasets. The providers have got income from selling their spatial datasets. INSPIRE specifications have been evolving. That has caused double work for those obligated organisations that started quickly to implement INSPIRE. On the other hand, for those obligated organisations that

started implementation not until in the last couple of years, it has meant a lot of work in a short time. The EU Commission could have done the preparation better. If it would have been possible to provide 100% right metadata descriptions and simple examples of requirements that would have simplified everything. Flanders uses GeoNetwork that is an open-source catalogue application. Many technical changes to GeoNetwork (both internally as in the main branch) caused a lot of double work and time delay in the implementation of new requirements.

### *Sweden*

Solid competence is required to put INSPIRE specifications and regulations into practice. The work is perceived as time demanding and the technical specifications are not entirely modern.

A major obstacle is the lack of conviction about the benefits and that INSPIRE data has not come to greater use. This is one of the major issues in the forthcoming evaluation in the EU to be presented in 2022. It can be difficult to use data provided according to INSPIRE specifications.

Differences between the national geodata services provided by the authorities and distributed in Sweden and provide services according to INSPIRE means some duplication, although exceptions exist. The prevailing view is that INSPIRE data is generalized and adapted to the point that it

does not fit the purposes for which data is needed.

One obstacle is the demand for resources. There is a lack of IT developers who can provide support in services; programming and setting up services and perform data harmonization; stow shapefiles according to INSPIRE, use FME and HALE.

## 5.6 Discussion

The biggest difference between Finland and Belgium and Sweden is that in Finland municipalities that manage required INSPIRE data are obligated authorities whereas in Sweden municipalities are not. The state authority Lantmäteriet coordinates maintenance of building address etc. data with municipalities and publishes INSPIRE services and datasets. In Belgium, a regional authority helps municipalities to harmonise and publish INSPIRE data.

In Belgium, the support to authorities is provided at the regional level and closer to people who are responsible for the development of INSPIRE services and datasets. In Finland same kind of successful “closer” support has been given to the Finnish regional councils by the regional actor Lounaistieto.

The coordination of INSPIRE in Lantmäteriet consists of five people working 75% each on average with INSPIRE in 2020. They provide the same kind of support to authorities as the

INSPIRE secretariat in Finland. Also, two external consultants work with the coordination group to supplement their technical competence with data harmonisation and metadata knowledge. Lantmäteriet’s coordination group has almost double the number of resources for support than the INSPIRE secretariat at NLSF. In Belgium, very concrete support is provided in Wallonia where one expert creates metadata for all obligated organisations. This saves time and speeds up the implementation of metadata.

Both Belgium and Sweden have had a challenge in the opening of spatial data: how to compensate the revenue that authorities have got from the sale of data. Finland has been a forerunner in open data and during the last eight years, most of the INSPIRE obligated authorities have opened their spatial datasets.

The challenge related to the benefits of INSPIRE services and datasets exists in all three countries. Concrete benefits would motivate authorities to finalise the implementation of INSPIRE.

## 6 Conclusion

Authorities that have been able to integrate the implementation of INSPIRE in their other operations have succeeded best. State and regional authorities are at an advanced level even if some of them still have some work left to reach full compliance. Regional authorities have built a good joint network and they have

worked together with Lounaistieto that has developed network services and published their INSPIRE datasets. Municipalities have advanced to different stages. For example, small municipalities, in general, are in the beginning or have been able to meet the very minimum requirements and have published some INSPIRE datasets using their own view service or bought the maintenance and publishing of datasets from a private company.

Different kinds of support providers are all important and have their part to play:

the INSPIRE secretariat has focused resources and comprehensive competence, while information system providers and consulting companies work more closely with the obligated authorities. State authorities have got the most support from the INSPIRE secretariat and the Network of geographic information as well as from the development of their own competence. Municipalities have got support from their information system providers and from the development of their own competence. Regional authorities have got support from the co-operation and from Lounaistieto.

Based on the results of the survey, those obligated authorities that have taken advantage of the INSPIRE secretariat's support services and guidance have succeeded better in the implementation of INSPIRE and have got more benefits to their operations. Authorities that have not at all used the INSPIRE secretariat's support services felt that the biggest obstacles have

been human resources, competence and understanding of the requirements of implementation. These authorities have not leaned on other support such as private companies or peer organisations either.

Municipalities assessed that the main benefits of INSPIRE have been the opening of data and development of network services. INSPIRE has speeded up or even enabled the implementation of network services. These actions have made the spatial data flow both to external users and internal users in their own organisation.

Finland's open data policy has contributed to the opening of spatial data. On the other hand, spatial data have been the first official data that has been opened. This has had a positive impact on the implementation of INSPIRE. National data protection policies especially those regarding private data, if not clearly defined, may cause reluctance in organisations to move forward with open data. This can hinder the opening of and the use of certain spatial datasets or lead to closing back up of such spatial datasets that were already opened during the implementation of INSPIRE. This can lead to reduced value especially in cases where additional value is gained by combining multiple datasets.

The biggest difference between Finland and Belgium and Sweden is that in Finland municipalities are responsible for the implementation of INSPIRE whereas in Sweden and Belgium state or regional level

authorities aggregate spatial datasets from municipalities and publish the INSPIRE datasets and services. In Sweden, Lantmäteriet has more resources for the support and guidance than the INSPIRE secretariat in Finland considering the fact that municipalities in Sweden are not INSPIRE obligated authorities. General administration in Belgium is decentralized to the regional level and therefore also INSPIRE support services are closer to obligated authorities.

The benefits of INSPIRE services and datasets were discussed both in the interviews and assessed in the survey. Most of the authorities answered that the opening of spatial data, publishing of network services, and improved competence as the biggest benefits. All these have contributed to the development of the national SDI and speeded up the shared use of spatial data in society.

Five key recommendations for further actions:

- Decentralizing the responsibility for publishing INSPIRE data and services to municipalities has led to slow and incomplete implementation. A centralized authority working with the municipalities would improve the situation and relieve municipalities of a big burden. This approach already works for address and building data themes in Finland and is the general approach taken in Sweden and

Belgium for INSPIRE data themes collected by the municipalities.

- Organisation specific status dashboards would give a clear indication of what stage of implementation each obligated authority is at now, and guide what are the next steps to proceed. This would ensure that authorities focus on the right tasks in the right order.
- The INSPIRE secretariat at the NLSF would benefit from using external consultants to fix the lack of resources and to strengthen technical and business competencies. This method has proven to work well in Sweden.
- The needs for support of obligated authorities and the role of the INSPIRE secretariat evolve. Therefore, the support services of the secretariat must develop as well. We recommend assessments including interviews and surveys to ensure that support and guidance are appropriate and reach the right audiences.
- Both the impacts and benefits of the implementation of EU obligations should be better integrated with the national implementation such as national SDI and shared use of spatial data.