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Introduction

In Denmark, the national spatial data infrastructure (SDI) has been an integrated part of eGovernment for several years. Decision-making in the public sector has been strengthened through the SDI's shared, location-based knowledge. Also through the SDI, civil servants in the central government, municipalities and regions have access to the geodata and adjunct information that they need to perform their duties optimally. When all levels of the public sector work in the same context and with the same associations to location, the results are more streamlined, comprehensive and efficient administration.

Until 2013, access to Denmark's national SDI was restricted by a complex set of funding mechanisms and contractual limitations. The launch of a Basic Data Programme on January 1, 2013, however, has replaced these limitations with open and free access to a wide range of public sector information, including a majority of the geodata in the national SDI. This has resulted in much broader access to the national geodata collections and greater use of these data in the public and private sectors alike.

In this report, we identify the main actors and agreements that are engaged in development of Denmark's national SDI. We also describe a few of the most notable and pioneering developments in the SDI over the past year.

Main actors in the Danish SDI

Building the Danish SDI is a shared public sector initiative that covers the country's three administrative levels. In the central government, the Ministry of Environment has principal responsibility for the national SDI; this responsibility is anchored in the ministry's Danish Geodata Agency. The country's 5 regions and 98 municipalities also contribute directly to the SDI and participate actively in its development.

An important characteristic of Denmark's SDI lies in its ability to support broader eGovernment and more effective and efficient public sector administration. The

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Danish Geodata Agency works directly with a number of authorities on the development of geodata-based solutions that can improve key administrative processes via integration with the national SDI.

Beyond the direct remit and influence of the Danish Geodata Agency is an array of solutions that draw on public sector information, including geodata. A range of private sector companies are active in this market, using the national SDI to create new products while advising and assisting customers in developing and utilising geodata. Thus, the national SDI also supports growth and innovation in the private sector. A branch organisation (Geoforum) assists in sharing knowledge and creating synergies within the market and between its diverse actors and stakeholders.

The public and private sectors work together in a number of capacities surrounding the national SDI. Among these is a Coordinating Committee, which advises the Minister of the Environment on overall development of the national SDI. The Committee includes representatives of the public and private sectors as well as related research institutions.

Key agreements surrounding the Danish SDI

Development of Denmark's national SDI is reinforced by national law. Six separate laws guide the process, identify key actors and ensure simultaneous fulfilment of EU requirements, including the INSPIRE Directive. In 2013, several of these laws were revised to reflect new developments.

A new and keystone agreement from 2013 resides in the nationwide Basic Data Programme. Part of the eGovernment strategy, the programme has fostered the release of a variety of public sector data for free and open reuse. The release was supported by a business plan that indicated an annual growth potential in these data in excess of €100 million from 2020. Among the data that are now accessible to citizens, private sector companies and public authorities alike are topographic data, the national digital elevation model and the property register. The launch of the Basic Data Programme entailed a new funding structure for the Danish Geodata Agency, which now bases its annual budget on public appropriations instead of revenue-generating activities. Beyond the geodata that are elemental within the Basic Data Programme are a range of additional public sector information registers, including the Company register, the Civil Registration System and the Building and Dwelling Register. A new distribution platform is currently under development, and will ease access to the variety of data that are part of the programme, further reinforcing wider use of public sector information in new, innovative and interconnected ways.

An organisation known as FOTdanmark is a key public sector actor in the production of topographic data according to a standardised methodology. All 98 municipalities, which have responsibility for local planning, permitting and oversight of their respective geographies, are also responsible for maintaining geodata that make these activities possible. The municipalities have all voluntarily joined FOTdanmark and produce and share their geodata according to a joint standard. Combined, the municipalities' standardized and updated data comprise the official national topographic dataset, which is accessible through the SDI and is included in the Basic Data Programme. This makes it possible to conduct planning and analysis that are cross-border in nature and to reach new synergies in nationwide applications of topographic geodata. In 2013, FOTdanmark's members

agreed to revise the organisation's business model in order to better reflect its members' responsibilities, obligations and financial contributions.

Recent developments in the SDI and its applications

In addition to the more overarching developments within Denmark's geodata sector and the national SDI, 2013 saw focused progress in a variety of areas and applications. The following includes a selection of examples; it is not intended to be an exhaustive review of Denmark's national SDI evolution in 2013.

The available technologies for collecting raw data and updating existing geodata are rapidly expanding. Traditionally, orthophotography and satellite-based data collection have complemented ground-based registration, and in Denmark, these have contributed the bulk of raw data upon which terrestrial geodata are based. Over the past year, however, the capacity of drones to collect georeferenced, highly detailed data covering geographically limited areas has gained interest. A new network of public sector authorities and private sector companies has been established to further examine the opportunities that drone-based data collection can offer, and the technology has already been used in several cases where monitoring of landscape change could be conducted most effectively via drones. Further potential uses of drones for collecting and updating spatial data reside in monitoring such diverse phenomena as national forestry resources, air pollution from ships at sea and progress in larger-scale infrastructure projects. These are being actively investigated.

In 2013, the digitization of archival records in the Danish national property register (cadaster) was completed. Now included in the digital property register are records dating back to 1950, which in analogue format otherwise cover 2½ kilometers of shelving. The historical records' accessibility makes it faster and more efficient to identify current property conditions and make changes to the property register. The benefits are not only clear within the Danish Geodata Agency, which is responsible for the national property register, but also vis a vis chartered land surveyors and individual property owners, for whom access to current property records is of central value.

The implementation of the European INSPIRE Directive completed its first phase in 2013, and in Denmark, this included standardization and improved access to more than 400 annex 1 data sets through the national metadata portal geodata-info.dk. The annex 1 data sets include a range of themes, from point-based air pollution to geomorphology to marine salinity. With the conclusion of annex 1 implementation, data owners have progressed to the initial phase of bringing Denmark's Annex 2 and 3 data into compliance with INSPIRE.

Marine data are a key element of the Danish SDI, though they are not included in the Basic Data Programme. Updates to marine data sets and to the official nautical charts and publications are processed continuously and through close cooperation between the marine authorities. The Danish Geodata Agency has responsibility for issuing updates to the authorized nautical charts in both paper and electronic versions on a weekly basis. In 2013, the Agency issued 25 new editions of nautical charts covering Danish waters. At the same time, progress was made on the use of a new, next-generation software platform for producing nautical charts.

Distribution of environment-related geodata in Denmark is the remit of the Danish Natural Environment Portal. Here, over 100 data sets on nationwide environmental conditions can be accessed, updated, downloaded and utilized in

municipal, regional and central government administration. The portal also includes a map function that permits users to view interactions and overlap between environmental phenomena. In 2013, new data sets were integrated into the portal, including data on air pollution, wastewater and environmental impact assessments, and the map function was released in an improved version.

In a movement towards greater anchoring of public sector processes in location-based data and achieving new synergies and efficiencies as a result, the Danish Geodata Agency and the Nature Agency developed a new approach to conducting public hearings in 2013. The EU Water Framework Directive stipulates the development of river basin management plans, and in Denmark, these were subject to public hearing in 2013. By designing a location-based hearing portal for public input, the Nature Agency was able to structure the public hearing in a way that was more intuitive for submitters and, simultaneously, more transparent and systematic in processing the submissions. This meant that the 6,500 written submissions could be processed in a few weeks, with greater coherence and streamlined handling of feedback that related to the same locations and areas. The hearings portal with its geodata-based setup is now available for other public authorities to use in their own hearing processes.

While geodata are traditionally thought of in two dimensions – latitude and longitude – the third dimension of elevation is gaining an increasingly operative role in several new applications of the Danish SDI. The first of these is a new database for the Royal Danish Air Force and defense sector, in which potential obstacles to low-altitude flight are registered. Pilots can access and update the contents of the database, ensuring a shared, updated resource that can improve flight safety, especially in low-visibility conditions.

An additional three dimensional development to the Danish SDI is found in the country's growing initiatives around climate change mitigation and planning. In 2013, the first update to the nationwide digital elevation and terrain models began. Evolution of these models is key to climate change efforts surrounding flood risk and prevention, and a new model of drainage systems and slopes across the country is being developed alongside the elevation and terrain models.

A final and particularly novel application of the Denmark's national SDI is the production of a 112-app, which has been downloaded more than 500,000 times since its launch in the spring of 2013. When the emergency services are contacted by a mobile phone user, the app simultaneously sends the caller's location in latitude and longitude to the dispatch centre. This makes it easier for the police, ambulance or fire services to respond to the correct location, which the caller may or may not be able to describe accurately – especially in stressed or time critical situations. Presently, the app is used for calls to the emergency services approximately 30 times each day.

More information
More information on the developments described in this report and on the Danish SDI and Basic Data Programme in general can be found at the links below, or through direct contact to the Danish Geodata Agency (gst@gst.dk).

- http://eng.gst.dk/
- http://inspire-danmark.dk/for-the-eu-(english)/

- http://www.geodata-info.dk/Portal/SimpleSearch.aspx
- http://www.digst.dk/Home/Servicemenu/English/Digitisation/Basic%20Data
- http://internet.miljoeportal.dk/English/Sider/default.aspx