Nordic Approaches to User Driven Integration of Statistics and Geospatial Information

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Abstract

The integration of statistics and geospatial information is of increased European strategic importance. However, national statistical institutes face challenges in statistical-geospatial data integration due to capacity issues that must partly be addressed by cross-institutional collaboration. To enable full user adaptation, data producers need to bring together statistics and geospatial data. In Finland, Iceland, and Sweden projects have been initiated that brings data together, in order to serve user needs for interoperable and accessible geostatistical data:

In 2021, the National Land Survey of *Finland* and Statistics Finland co-founded a national network for integration of statistical and geospatial information. This stakeholder network addresses cross-domain topics including data integration architecture, GeoAI and historical geodata. This collaboration has prompted EU-funded projects related to creating a new national small-area division and designing a national roadmap for coordinated data integration efforts. In *Iceland*, cooperation has been established through the EU GEOS-IBA funding program, with Statistics Iceland and the Natural Science Institute jointly developing a framework for data integration and a user-friendly data portal for viewing geospatial statistics (coined the “Geosocietal View”). This common goal provides both institutes to implement shared standards resulting in improved access to data. In 2023, Statistics *Sweden*, the mapping agency Lantmäteriet, and several other producers began standardizing geospatial data representing administrative and statistical divisions, with the aim to release the data in the national geodata platform, NGP. The work is being carried out with the assistance of a reference group, who have so far assembled on 15 occasions.

In this paper, we present these three cases, in which the Nordic statistical offices have successfully cooperated with mapping agencies to improve the integration of statistics and geospatial data based on user needs, and our plans for a closer cooperation across the Nordics when it comes to the geostatistical capacity building.

1. Context and background: statistics and geospatial information

With the onset of the European Data Strategy[1], the view that use and reuse of data will be the key to Europe´s future competitiveness and growth becoming ubiquitous. In line with this, data interoperability became a cornerstone for the implementation of the strategy, specifically the interoperability of data coined as *high value datasets* (HVDs). Prior to the conceptualization of the strategy, EU initiatives regarding the definition of HVDs was limited to *geospatial data* and its access enabling *infrastructure*[2]. However, with the incorporation of HVDs into the constellation of actions meant to support the European Data Strategy, the Commission adopted an *implementing act*[3] greatly expanding the definition of what constitutes as data of high value. Thus, the regulation identifies six key data categories of *public sector data*, recognized for their significant socioeconomic and environmental benefits, which should be free, machine-readable, and API-accessible; 1) *geospatial*, 2) *earth observation* and *environment* data, 3) *meteorological* data 4) *statistics*; and data on 5) *companies* and *company ownership*; and 6) *mobility*.

The inclusion of *statistics* as data of high value rests on the premises official statistics has high potential for socio-economic impact and is fundamental for evidence-based decisions and innovation in both the public and private sector. Yet, to fully realize its value, official statistics must not only be internally compatible and coherent within its own domain (as stated in the European Code of Practice[4]), but also interoperable *with different domains* of data. For example, from a user´s perspective, integrating geospatial and statistical information provides an additional dimension and depth to both types of data, which may provide new and innovative insights and support understanding of complex socioeconomic and environmental issues[5]. In addition, the use of geospatial and earth observation data may generate new data sources for innovative official statistics, for example for regional policy, environmental accounts and sustainable development goals[6]. Thus, the seamless integration of these different types of data promises to add value to their existing separate worth, implying that they are of even higher value as a coherent and interoperable whole.

Still, to enable full adaptation, NSIs must cultivate the skill and abilities needed to account for geospatial data in a way that makes sense to official statistics. Given that

NSIs all face considerable capacity issues in terms of geospatial know-how, this must partly be addressed by cross-institutional collaboration. Moreover, keeping in mind that any initiative towards capacity building in integrating geospatial and statistical data should be a key component in any strategy aiming at their long-term strategic use, user needs must be identified and prioritized. To facilitate this, the European Commission initiated a series of grants, the SMP-ESS-GEOS-IBA programme which ran from 2012 to 2025, - but has now been paused until the next multiannual framework[7].

In this paper, we present three Nordic projects which have all benefited from the programme, and in which Nordic NSIs have successfully built capacity by working with geospatial agencies or expert institutions on projects aimed at integrating geospatial information to the statistical process. Specifically, Finland, Iceland, and Sweden have all initiated projects which bring these data together to serve user needs for interoperable and accessible geostatistical data. These three projects are presented below and followed by recommendation on closer cooperation across the Nordic countries based on lessons learned and opportunities identified in the cases.

2. The cases studies: three Nordic projects on interoperable and accessible geostatistical data

Finland – a national network for integration of statistical and geospatial information

In Finland, the integration of statistical and geospatial information has been advanced through a network based, needs oriented collaboration model. In 2021, the National Land Survey of Finland, Statistics Finland, and the Finnish Environment Institute jointly initiated a national stakeholder network to respond to growing demand for interoperable geostatistical information that cannot be produced by individual organizations acting alone.

The network brings together producers and users of geostatistical information from national authorities, municipalities, academia, and the private sector. It provides a forum for identifying shared needs and coordinating development activities, addressing topics such as areal divisions, GeoAI related use cases, and the integration of historical geospatial data with statistical time series[8]. While the network operates largely on a voluntary basis and independently of formal administrative structure, its activities are

supported by a strategic level steering group formed by the three organizations, which provide strategic guidance and helps align network activities with national priorities and long-term development objectives. This structure has enabled the network to act as a catalyst for concrete development initiatives, most notably the ongoing development of a national sub municipal small area division. From a user perspective, the new division is expected to reduce reliance on ad hoc spatial delineations, improve comparability between datasets, and enable more systematic reuse of geostatistical data across policy analysis, research, and local decision making. In addition, the network has supported the development of a national roadmap to coordinate future integration efforts, including a shared vocabulary[9].

Despite the progress achieved, challenges remain. Sustaining voluntary collaboration across organizations with different mandates and funding models requires continuous coordination, and translating shared integration concepts into operational services demands ongoing interaction between strategic level actors and technical experts. Overall, the Finnish case illustrates how a voluntary network can support coordinated national geostatistical integration and offer transferable lessons for other national contexts.

Iceland – The Icelandic Geosocietal View

The Icelandic project[10] aimed to integrate Iceland's official statistics with geospatial data by developing a "*Geosocietal View*", a map-based and user-friendly way to present data for citizens, policymakers, and researchers. Over a 24-month period, the project addressed the fragmentation between statistical and geospatial systems by building a harmonized infrastructure that included a master geospatial database, standardized variables and coding systems, and scalable API-first architecture supporting geocoding, spatial validation, and data integration across the statistical production process. This transformed geospatial information into a core component of statistical work rather than an add-on and enabled seamless linking of datasets such as population and labor statistics with spatial outputs.

At the same time, the project focused on mapping Sustainable Development Goal (SDG) indicators, which required careful handling of data availability, methodological

challenges, and disclosure risks due to Iceland's small population; solutions included using proxy indicators, restricting geographic detail where necessary, and iteratively refining map design to ensure both usability and confidentiality. Strong collaboration, cased on subcontracting, between Statistics Iceland, the National Land Survey (later the Natural Science Institute of Iceland), and the University of Iceland was central to progress, contributing to improved cartographic methods, user-centered visualization practices, and innovative approaches such as hexagon cartograms that better represent population distribution.

The main output of the project was the launch of an interactive platform (hagstofa.gis.is) that integrates statistical tables, metadata, and a wide range of thematic maps, including SDG indicators, socioeconomic datasets, labor market data, environmental statistics, and experimental visualizations, into a coherent and accessible system. Dissemination and ecosystem development were further advanced through seminars and hackathons in 2024 and 2025, organized in collaboration with the European Digital Innovation Hub in Iceland[11], which expanded stakeholder engagement, promoted the use of high-value datasets and artificial intelligence, and strengthened alignment with European data strategies.

Overall, the project demonstrated that integrating statistical and geospatial systems requires not only technical solutions but also interdisciplinary collaboration, standardization and thoughtful visualization while simultaneously building long term institutional awareness and geospatial capacity by sharing a common cross-institutional goal.

Sweden – a reference group on standardizing geospatial data that constitute administrative and statistical divisions

In 2023, Statistics Sweden, Lantmäteriet, and various producers of administrative and statistical information, initiated work[12] to standardize geospatial data such as municipal boundaries, urban areas, and electoral divisions. The aim was to ensure interoperability and make the data accessible through the National Geodata Platform (NGP)[13] The NGP provides both download and API services, and requires that data be machine-readable, documented through national specifications, and modelled

according to a common architectural framework. This framework is based on Sweden's national fundamental data domains ("data spaces"), established by the Swedish Agency for Digital Government (DIGG), which promote principles such as "once only" to ensure consistency, quality, and interoperability across the data infrastructure.14

As the government agency responsible for the domain on cadastral and geographical information and owner of the NGP, Lantmäteriet assigned the NSI to lead the standardization of administrative and statistical geographies. Initially, around 150 geographies from approximately 45 producers were identified. The project revealed several obstacles to standardization, including a lack of harmonized and quality-assured master data. Many datasets showed inconsistencies (such as geometry gaps), insufficient maintenance and unclear practices for timestamping. Furthermore, with each producer managing its own data, dissemination practices were fragmented.

To address this, Statistics Sweden engaged with data producers to explain the benefits of interoperability and the "once only" principle, encouraging them to publish their data through the NGP. Producers joining the initiative were supported in developing specifications and improving data modelling and structure, in collaboration with Statistics Sweden and Lantmäteriet. A reference group of around 90 GIS specialists, analysts, developers, and other stakeholders from approximately 30 organizations was established to ensure that the standardized data would meet user needs.

By spring 2026, standardization efforts had begun for roughly 40 of the identified geographies. The reference group, which had met around 15 times, played an important role in shaping requirements, including the introduction of timestamping for geospatial data. This concept has traditionally been less prominent in the geospatial community, while timestamping is essential for statistical users, as it allows geospatial data to be linked accurately to statistics of specific time periods.

The project demonstrates that integrating and standardizing geospatial and statistical data requires technical solutions, a clear architectural framework, and sufficient funding, and a strong collaboration between mapping and statistical authorities and active involvement from users to ensure that the needs of both communities are met.

3. Conclusions and recommendations for future Nordic collaboration

Taken together, these cases show the importance of funding actions aimed at obtaining a shared goal across NSIs and mapping agencies. The shared goal, in all projects, that facilitated institutional successful collaboration rested on the work being user oriented. In short, the shared goal was not focused on the needs and standard workflows of the respective institutions, but on providing easier access to data for the external user (i.e., the public). While this showcases the importance that data producers (in this case the national statistical institute and the mapping agency) collaborate, and communicate with the potential users and stakeholders, it also shows that such a higher order goal may be useful in order to overcome intra-institutional inertia and adopt new skills that provide the basis for innovation. Moreover, it demonstrates the need for funding such joint ventures that may result in innovative solutions as well as skill building.

With this in mind, we propose that the lessons from these cases should be applied to Nordic collaboration and closer Nordic cooperation on geospatial statistics should be strengthened through several concrete steps. A priority, building on the Finnish model, is to be to establish a Nordic coordination platform or network that brings together NSIs, mapping agencies, and key stakeholders, to facilitate regular knowledge exchange, joint prioritization, and alignment Nordic needs. This could for example be done by systemically including geospatial agencies in the Nordic Network for Geospatial Statistics. Second, developing shared technical solutions and infrastructures, such as open-source tools, and reusable workflows for geocoding, spatial analysis, and metadata dissemination, would reduce duplication of effort and accelerate innovation. Third, the Nordics could initiate joint pilot projects and experimental use cases, for example on SDG indicators, regional development, or environmental monitoring, to test integrated data solutions in a comparable framework and demonstrate added value. Fourth, sustained investment in joint training, staff exchanges, and communities of practice would support capacity building and foster a common professional culture around geospatial statistics. Finally, building on the Icelandic model, strengthening external engagement and visibility, for example through joint seminars, hackathons, or contributions to European data spaces, would help position the Nordics as a leading region in geostatistical integration while ensuring that development remains closely aligned

with user needs. Together, these steps would build on the shared strengths of the Nordic countries and move from parallel national initiatives towards a more coordinated regional approach, enhancing both efficiency and impact in the development of integrated, user-driven geospatial statistics.

Importantly, these actions need to be wrapped in a joint project and funded as such. Excluding governmental budgeting, the funding does not need to come from a single source (such as the SMP-ESS programme) but could be obtained from multiple funding sources aimed at supporting the European data strategy, such as The Digital Europe Programme[15], Europe Horizon[16], or Nordic funding sources such as Nordforsk or The Nordic Council. Still, for any collaborative co-funding to be realistic, the Nordics need to have already identified the shared project goal.

4. Appendix: List of references and notes

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