Improving Interoperability of National Geospatial Services in International Context

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Abstract:

Interoperability is highly relevant in today's digitized, globalised, and interconnected world. It is a term that allows systems, platforms, services and organisations to talk and understand each others without requiring additional effort from end-users (European Commission (2017), International Organization for Standardization (ISO) (2011)). Interoperability is needed to enable effective and sustainable collaboration and information sharing, accelerating progress towards the Sustainable Development Goals (SDG) defined by the United Nations (Revez et al. (2022)).

However, despite significant progress in the field of geospatial data, such as the development of standards and guidelines, full interoperability remains elusive. One of the main challenges has been siloed solutions (Costin and Eastman (2019)), which only provide interoperability in specific fields or areas. For example, Open Geospatial Consortium (OGC) has provided multiple encoding and interface standards (see Open Geospatial Consortium (2022)), but these do not fully address the complexity of interoperability.

One wider approach was provided by European Commission (2017). They published the European Interoperability Framework (EIF), which acts as a common framework for promoting the interoperability of geospatial services at all regional, national and EU levels. It offered 47 concrete recommendations for improving interoperability from legal, organisational, semantic and technical perspectives.

There are also plenty of other approaches for similar purposes, including FAIR principles and the GeoE3 (Geospatially Enabled Ecosystem for Europe) project. The firstly mentioned FAIR principles provide practical guidelines for improving **f**indability, **a**ccessibility, **i**nteroperability and **r**eusability of single data and metadata sets (Research Data Alliance Foundation (RDA) (2020)).

The one goal of the GeoE3 project is, on the other hand, also to improve the access and interoperability of geospatial data and services between European countries. To support this, it has provided an interoperability map that gives data producers recommendations to evaluate and improve their data sets' interoperability (GeoE3 (2022)).
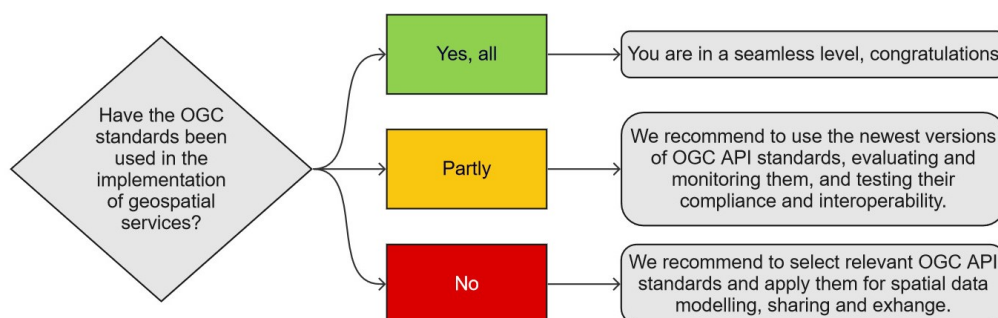
Figure 1. Example workflow of GeoE3 interoperability checks

In this GeoE3 project, we used our expertise, the European Interoperability Framework (EIF) recommendations, the FAIR principles, and the interoperability map to develop a total of 21 interoperability checks for evaluating the interoperability of geospatial data services. Our focus was on national-level geospatial services rather than individual web services or data

sets, as we wanted to create a tool that addresses interoperability at the country level. This is particularly important, as previous tools have not considered interoperability from this broader and more practical perspective.

As you can see from Figure 1, each interoperability check consists of a question with predetermined, colour-coded example answers, which ensure consistency and comparability. For instance, the interoperability check might ask whether a geospatial service uses OGC standards. If the answer is yes, this is considered the most interoperable option and is assigned a green colour. If the answer is no, the service may still be interoperable, but to a lesser degree, and is assigned an orange or red colour. In these cases, recommendations are provided to help the service improve its interoperability.

All GeoE3 partner countries (Finland, The Netherlands, Norway, Spain and Estonia) answered the questionnaire. In Finland, geospatial services are a bit dispersed, so we mainly evaluated services names Paikkatietoikkuna and Paikkatietohakemisto in addition to a few supporting services. In the Netherlands, services are more centralised. Therefore, we evaluated Publike Dienstverlening Op de Kaart (PDOK), which is mainly maintained by Kadaster. In Norway the situation is similar, so we evaluated Geonorge geoportal (or platform), which is maintained by Kartverket. In Spain, there are many geoportals and SDI nodes at the state, regional and local levels, which are centralised through the geoportal of the Spatial Data Infrastructure of Spain (IDEE). And for Estonia, we mainly focused on Estonian geoportal, which publishes and makes available spatial data owned by the Estonian state, local governments and other legal persons governed by public law.

Our study found that while most countries make geospatial data available as open data, there is still a lot of variation in legal interoperability. This is likely to improve as countries adopt the principles of high-value data sets outlined in the EU's Open Data Directive. However, semantic interoperability is still underdeveloped, with data sets often published in varying resolutions and across multiple platforms. Organizational interoperability is generally good, but there are still areas for improvement, such as multilingual accessibility, feedback mechanisms, and support services. For example, the PDOK is currently only available in Dutch. Technical interoperability is well-managed for standard usage and metadata, but there are challenges when it comes to integrating data across country borders due to variations in coordinate systems.

Our interoperability checks enable countries to assess their current levels of interoperability and use our recommendations to improve them. Improved interoperability between geospatial services can have numerous practical applications and promote sustainable development. It directly contributes to several Sustainable Development Goals (SDGs), including SDG 8 (Decent work and economic growth), SDG 9 (Industry, innovation and infrastructure), and SDG 11 (Sustainable cities and communities), as well as SDG 17 (Partnerships for the goals). Additionally, research by Revez et al. has shown that better interoperability also indirectly supports several other SDGs, such as SDG 2 (Zero hunger), SDG 6 (Clean water and sanitation), SDG 13 (Climate action), SDG 14 (Life below water), and SDG 15 (Life on land).

The interoperability between geospatial data and services is only the first step. We need to take into account also other data services. We believe that meeting the interoperability at the national level is the only way to ensure good quality base data, which is needed in many use cases. The next step of our project is to create implementation plans to support all countries to emphasise interoperability even more. We will provide help for implementing OGC APIs and EU-based tools, such as eTranslate services to add multilingualism for national platforms and geo-enabled CEF context Brokers to facilitate data integration.

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