Report: Outcomes of the INSPIRE regulations 2009 review

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Open Data Institute

Contents

About

This report has been researched and produced by the Open Data Institute (ODI) in collaboration with Defra and published in July 2023. Its lead authors were David Warrell and Rachel Wilson, with supporting contributions from Lisa Allen.

This report assesses the extent to which the INSPIRE Regulations 2009 (INSPIRE) have achieved the objectives of improving how geospatial data is made findable, accessible, interoperable and reusable for enabling environmental reporting, policymaking and evaluation, through means of a spatial data infrastructure. Based on this evaluation, it makes recommendations for INSPIRE's future in the UK policy context. The evidence that underpins the recommendations in this report is available upon request.

We would like to thank all of our interviewees for being so generous with their time and insights. We would also like to thank Defra for its support throughout the research process.

Executive summary

Most environmental data, such as those describing emissions and biodiversity, are geospatial in nature: contained within them is the description of a location. Understanding the geospatial element of our environmental data (i.e. where things relating to the environment are happening) enables us to better protect and replenish the environment in a targeted and efficient way.

The objects and events that geospatial data describe often cross political jurisdictions, and administrative and geographical boundaries. This creates a number of issues for environmental data and, as a result, environmental reporting, policymaking and evaluation. Consultations carried out prior to 2001 identified critical obstacles[1] preventing the widespread use of geospatial data needed for environmental policies and policies having an impact on the environment.

To address these obstacles, the INSPIRE[2] Regulations 2009[3] (INSPIRE) defined a framework of standardised approaches to publishing all public sector geospatial data relating to the environment, as defined by 34 themes.[4]

The technical objective of INSPIRE was to bring together a fragmented data ecosystem and ensure that all public sector geospatial data relating to the environment was easily accessible to policymakers through the same set of systems, creating a national 'spatial data infrastructure' (SDI).

In providing the technical basis for making data findable, accessible, interoperable and reusable (FAIR[5]), the policy objective of this SDI was to improve the quality and availability of evidence informing environmental policymaking and evaluation.

This report assesses the extent to which INSPIRE has achieved its objectives, and makes recommendations for INSPIRE's future in the UK policy context.

[1] European Commission (n.d.), 'INSPIRE Policy Background: Infrastructure for spatial information in Europe'
[2] Infrastructure for Spatial Information in Europe
[3] Legislation.gov.uk (2009), 'The INSPIRE Regulations 2009'
[4] European Commission (n.d.), 'INSPIRE Specifications > Themes: Infrastructure for spatial information in EuropeData'
[5] Geospatial Commission (2022), 'How FAIR are the UK's National geospatial data assets?'

Findings – to what extent has INSPIRE achieved its objectives?

INSPIRE was the UK's first data standards policy of this scale and scope. Enacting the policy at the time required novel approaches to technical implementation within a complex policy context. It is therefore helpful to consider the technical and policy perspectives separately. We also include the important generalisable lessons learned about the development and implementation of standards in the UK during more than a decade's practice.

Technical implementation – building data infrastructure

- INSPIRE was implemented in several stages over the course of more than a decade. The UK Location Programme (UKLP) was tasked with coordinating the implementation of INSPIRE across the public sector, which included engagement with public bodies across the UK regarding their new responsibilities.
- The initial stage – completed at the end of 2010 – required public bodies to publish metadata according to INSPIRE standards. This was generally well implemented. Metadata editors were developed, ensuring metadata was compliant. This paved the way for thousands of metadata records to be published and harvested to **data.gov.uk** (DGU). Data was either harvested directly, via an organisational geospatial data portal, or – in the case of the devolved administrations – a national geospatial data portal.
- By ensuring the provision of view and download services, INSPIRE made relevant data more easily accessible, particularly for non-expert audiences. By providing an interface that did not require technical geospatial expertise and specialist software, INSPIRE made data far more widely accessible.
- As part of INSPIRE, public bodies were required to publish data relating to the 34 themes in new and specific ways, which required them to transform their existing datasets. However, very few public bodies adopted data specifications, which had been envisaged as a way to achieve interoperability and reusability. The reasons for this are discussed below (see: Barriers to technical implementation).
- Reusability was improved through the provision of view services that made data more understandable to non-experts, and through driving the development of the Open Government License (OGL) and the Public Sector Mapping Agreement (PSMA) with Ordnance Survey (OS).

Barriers to technical implementation

- Despite high adoption of metadata standards, technical implementation appeared to tail off as the INSPIRE implementation process progressed. Several factors likely impacted this:

  Increasing complexity of implementation

  Demands on data publishers became increasingly complex. Implementing metadata standards and access services was achievable for many public bodies, but the barrier to the technical implementation of data specifications was too high for the majority, particularly for local authorities with fewer resources and limited expertise.

  Decreasing support and engagement

  While Defra did provide financial support for public bodies to implement INSPIRE, practical technical advice, guidance and engagement regarding the benefits have not been available to implementers since 2012, when the UKLP was wound up. This occurred just after discovery services were to be provided, and before public bodies were required to adopt data specifications.

  Complexity of data specifications relative to use case

  Where the appropriate expertise did exist, there was some resistance around implementation. The data specifications were intended to suit all possible use cases of data, meaning that for some use cases, the data specifications were perceived as unnecessarily complex.

  Lack of incentives for implementation

  For most data publishers, there was no immediate use case for adopting data specifications, and the benefits were not immediately clear. Combined with the winding up of the UKLP, the incentive to implement INSPIRE therefore became increasingly unclear relative to the resources required to implement it.

- The pattern of decreasing compliance with increased technical complexity was observed in other implementing countries. Some were able to implement data specifications to a greater extent than the UK, but none are fully compliant.

- In some cases, interoperable INSPIRE data was achieved without individual data publishers adopting data specifications. Here, the barrier to achieving interoperable data was decreased through the provision of centralised services provided by data intermediaries, such as the Spatial Hub run by the Improvement Service in Scotland. The Improvement Service had the requisite resources and expertise to publish data. By requesting data in a consistent format from local authorities, it was able to combine datasets. However, the

Improvement Service faces an uncertain future, due to its unclear funding model. Similar services also appear at an international level around use case-specific (e.g. marine biodiversity) portals.

- The National Land and Property Gazetteer (NLPG) and National Street Gazetteer (NSG) both demonstrate that local authorities are able to reliably contribute interoperable data. The conditions for this appear to be:
    - A clear driver to share the data, which requires a use case for the data – in this case, creating an authoritative dataset of the country's properties and streets, which OS packages as a product.
    - A data intermediary providing technical expertise and sufficient resources – in this case, GeoPlace.
    - An incentive for data publishers – in this case, the Data Co-operation Agreement, which gives local authorities access to certain OS products.

Technical implementation: key findings

- Sustained engagement with the benefits of data standards is necessary for their optimal adoption. This requires secure funding.
- Public bodies tend to weigh up whether to share data based on the perceived cost-benefit, their capacity, and their data maturity.
- The perceived cost-benefit to public bodies can be influenced by introducing incentives for data-sharing, reducing the barrier to implementation of data standards, and demonstrating the benefits of adopting data standards:
    - Incentives for data-sharing may include giving data publishers access to the end product in exchange for their data, as in the example of the NLPG and NSG.
    - Reducing the barrier to implementing standards can be achieved by providing tools (such as metadata editors) and data intermediaries (such as the Improvement Service). This is particularly important for helping public bodies with fewer resources and lower data literacy to adopt standards.
    - Demonstrating the benefits of adopting standards can be achieved by incentivising public bodies to develop and present case studies at relevant conferences, and the ongoing collation and analysis of these case studies.

Learning #1

Funding for public sector data-sharing initiatives must include funding for sustained technical support for data publishers and engagement with data publishers, including funding for publishing, collating and analysing case studies.

Learning #2

Initiatives that require public bodies to publish data according to data standards should consider how to reduce the barrier to implementation of those standards, particularly where those public bodies may have lower levels of data maturity and fewer resources.

Learning #3

Initiatives that require data publishers to adopt new practices should consider introducing incentives for data publishers.

Was legislation an effective means of encouraging implementation?

- The question of whether legislation was an effective tool for driving uptake of the INSPIRE standards is confused by two factors.
    - First, means of mandating data-sharing in line with the legislation was wteak. The process is reliant on complaints made by the public to individual public bodies, or to the Information Commissioner's Office (ICO). Individual public bodies have no obligation to deal with complaints, while there have only ever been a handful of complaints to the ICO. This further compounds the issue of there being little incentive for public bodies to comply with INSPIRE: non-compliance carries little risk of consequences.
    - Second, because legislation made engagement through the UKLP to communicate new responsibilities to public bodies necessary, it was difficult to separate the effects of the engagement from the legislation itself.
- There are poor means of mandating the INSPIRE legislation, and/or the engagement around it through the UKLP. However, despite this it initially appears to have drastically accelerated desirable data-publishing behaviours around the findability of data. Particularly, it removed any debate about which metadata standard to use. Making all geospatial data relating to the environment findable through the same set of systems established the foundations for the UK's SDI.
- Metadata is of crucial importance to building data infrastructure and facilitating new dataflows by improving the findability of data. Because the maturity required for its implementation is minimal (given the availability of tools such as metadata editors), and its benefit is potentially huge, legislating public bodies to publish metadata according to standards appears to be proportionate.
- The Marine Environmental Data and Information Network (MEDIN) provides a useful example of how data infrastructure can be built and maintained despite there being limited benefit to data publishers. Contribution to MEDIN is voluntary. All contributors must adopt the MEDIN discovery metadata standards, which allows their data to be found through the MEDIN portal. MEDIN recommends, but does not demand, how the data itself is structured. This provides the basis for further engagement with data providers around the benefits of adopting data specifications. MEDIN receives funding from a consortium of 15 public body sponsors.

- A number of interviewees suggested that creating additional incentives for compliance was likely to be more effective and less controversial than improving the means of mandating INSPIRE compliance.

- The INSPIRE legislation, and/or the engagement around it, accelerated desirable data publishing behaviours around data findability. However, according to interviewees, the interoperability and reusability of data, via data models and specifications is best incentivised via strongly cohesive use cases rather than legislation. As outlined above, legislation is not the only instrument to drive the adoption of standards. However, coordinating standards adoption without strong mandates requires shared benefits as well as sustained effort, persuasion and engagement using significant resources.

Legislation: key findings

- Without improving the governance around INSPIRE, it seems unlikely that strengthening INSPIRE's means of mandating data-sharing would lead to improved data-sharing practices.

- Adopting the same metadata standards is a crucial early step on the path to building a coherent data infrastructure. Mandating their adoption appears to be a proportionate ask in most cases, owing to the minimal maturity required, and the potential (and sizeable) benefits.

- Interoperability and reusability of data through the mandated adoption of data specifications by individual publishers does not appear to be a realistic expectation.

- Other solutions, such as the publishing of data by data intermediaries with sufficient resources and expertise, appear to be a more realistic means of achieving interoperable data. In the presence of a strong use case and sufficient incentives, it is less likely that legislation will be necessary to achieve interoperability.

- The INSPIRE legislation does not specify that public bodies must adopt data specifications; it refers to the Implementing Rules of INSPIRE, which contains guidance on implementation. The INSPIRE standards revision process is ongoing and, given that this problem is not going to be unique to the UK, the INSPIRE standards revision process will revisit more feasible means of achieving interoperability and reusability of data. Given that interoperability and reusability of data is highly desirable, it may benefit the UK to wait for the outcome of this process before revising the INSPIRE legislation.

Learning #4

Any legislation that aims to implement data standards should have sufficient means of mandating data-sharing where necessary to deliver agreed use cases. However, mandatory data-sharing must be underpinned by sufficient technical support, engagement around benefits, and, if appropriate, incentives.

Learning #5

If there is sufficient engagement, technical support, and tools such as metadata editors, any initiatives intended to improve the availability of data can reasonably mandate the adoption of a metadata standard.

Recommendation 1

Public bodies should be required to adopt data specifications to achieve interoperability and reusability only where there is a specific use case.

Policy – impact and barriers

- The data made available as a result of INSPIRE has anecdotally informed policymaking. However, we were unable to find any specific examples, primarily because:
    - data users (e.g. policymakers) are generally unaware of INSPIRE
    - attributing particular policies to the availability of certain datasets and the availability of certain datasets to INSPIRE is challenging
    - our interviews primarily focused on technical stakeholders, owing to time constraints and necessary prioritisation.

Recommendation 2

Engage with external stakeholders and/or conduct research to understand their needs and develop use cases regarding geospatial-data infrastructure that benefits from INSPIRE.

- However, the data infrastructure resulting from INSPIRE does not appear to have realised its potential impact on policymaking.
- The INSPIRE standards framework was primarily designed by data providers, with little consultation with data users: environmental policymakers. The resulting infrastructure was therefore not designed to meet their needs. As a result, there was – and remains – confusion around the policy benefits of the data infrastructure that was created.
- In lieu of a clear idea of policy needs, the 34 INSPIRE data themes provided a useful guide to what could be identified as ‘data relevant for the environment’. However, this would be more useful if it was led by the needs of policymakers. The lack of prioritisation amongst these 34 data themes may have overwhelmed some data publishers, leading to inertia around data publishing.
- By contrast, in the context of international environmental reporting efforts, there are structures and processes in place that, based on policy needs, determine the data that needs to be published. This is communicated to a network of nature conservation bodies, which publish data according to required standards through use case-specific (e.g. marine biodiversity) data portals.
- This lack of coordination continued throughout the implementation of INSPIRE. Due to a lack of clarity regarding the purpose of INSPIRE, most public bodies did not see how it aligned with their objectives.

Policy teams generally saw it as a technical programme with little relevance to policy. Responsibility for implementation was therefore often given to technical teams that had insufficient insight into how implementation would benefit policy teams.

- So, while public bodies may have complied with aspects of implementation and therefore contributed to the building of data infrastructure, most failed to identify a use case for the infrastructure. As a result, INSPIRE's impact on policymaking in the UK was relatively limited, compared with its potential to transform how policymakers access critical data underpinning the environment.

- Where geospatial and environmental expertise have co-existed, there appears to have been greater buy-in to, and adoption of, INSPIRE. For example, Natural England appears to have implemented INSPIRE very well. This is likely due to:

    - A clear use case for the organisation. Producing robust evidence pertaining to the environment aligns clearly with its organisational goals as an advisory body, and has generated efficiencies in combining datasets from across the UK.
    - Data providers and data users being located in a single organisation, making it easy to tailor implementation to users' needs.

- In some cases, the data published as a result of INSPIRE does not appear to be of use to policymakers. This has led to some frustration and disillusionment with INSPIRE.

- The confusion around the purpose of INSPIRE has also led to confusion around appropriate ownership of the technical infrastructure created as a result of the regulations. This confusion has contributed to the degradation of the infrastructure, and limited technical implementation.

- By contrast, infrastructure has been better maintained around specific use cases. For example, international efforts to create dataflows, to improve reporting around marine biodiversity, in line with the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR convention).

- In the UK, Defra gave responsibility for identifying relevant data to individual public bodies, possibly owing to the lack of clarity regarding the purpose of INSPIRE data. For a number of reasons, particularly combined with weak enforcement mechanisms, this led to difficulties with implementation in the UK:

    - Public bodies could easily avoid compliance by not publishing relevant data. There were a number of disincentives to public bodies for complying: for example, it had no immediate benefit to them, and they were wary of the technical difficulty of implementing future INSPIRE requirements (e.g. data specifications). This was

compounded in later stages, when it became clear they were very unlikely to face any consequences.

    - Conversely, public bodies could easily demonstrate compliance, despite publishing data of limited use.

- By contrast, the Netherlands took a more centralised approach to identify which datasets were used to meet its national obligations for compliance with INSPIRE in a minimal way, identifying core datasets that met the INSPIRE criteria.[6] The Netherlands' approach resulted in fewer metadata records than the UK (211 as of 5 January 2023, versus the UK's 20,000 in 2015)[7], but those publishers responsible for the most valuable datasets did not avoid publishing their data.

Barriers to impact: key findings

- There was a lack of clarity regarding the purpose of INSPIRE, which led to confusion around appropriate ownership of the data infrastructure built as a result of it. This suggests that clear ownership of critical data infrastructure is required for it to be built and maintained appropriately.

- INSPIRE suffered due to a lack of alignment with policy use cases, and the resulting lack of policy ownership. This suggests that data infrastructure should be aligned with users' needs and owned by those who benefit from it.

- The future ownership of the INSPIRE data infrastructure depends on what the infrastructure is for, and therefore who is best placed to steward it.

- Coordination between technical implementers and users (in this case, policymakers) is required for the successful construction and adoption of data infrastructure. It is essential that users can provide feedback to publishers.

- Exercises to identify datasets that would be valuable in achieving certain policy goals, and prioritise which data is published accordingly, are likely to be more beneficial than a blanket approach to mandating publishing data. Oversight and coordination between relevant data publishers is necessary to ensure minimal duplication of effort, and therefore efficient use of time.

[6] van Houtum *et al* (2019), 'Vision INSPIRE: From steering the implementation…to managing the benefits'.
[7] European Commission (n.d.), 'INSPIRE Geoportal'.

Learning #8

Any data-sharing initiatives that are intended to benefit policymakers should be led by policymakers' needs and priorities, and be implemented and governed through collaboration between policymakers and those involved in technical implementation.

Learning #9

If more public sector data is needed for a particular policy objective, relevant policy teams should collaborate with data publishers to identify which datasets can meet their policy objectives most efficiently.

Current status of INSPIRE in the UK

Current status of INSPIRE data infrastructure

- The infrastructure built as a result of INSPIRE remains largely intact. However, its maintenance has fallen by the wayside in recent years.
- Two key factors currently make DGU an ineffective means of making INSPIRE data findable:
    - Firstly, approaches to finding data have changed. People tend to use search engines rather than a central metadata repository to find data. Without search engine optimisation (SEO) built into the INSPIRE standards, INSPIRE data published through DGU is not as 'findable' relative to data with SEO-optimised metadata. The Scottish Spatial Data Infrastructure (SSDI) tool demonstrates that combining considerations of SEO with INSPIRE standards can make INSPIRE data easily findable, and help its value to be realised.
    - Secondly, DGU, and the infrastructure around it, have suffered from a lack of maintenance. In part, this owes to the waning political and financial support for the open data agenda in central government. This means that limited resources are dedicated to addressing errors in metadata harvesting, and, more generally, there is less interest and motivation to use DGU. As discussed below, the confusion around the ownership of INSPIRE has also likely contributed.
- This has important implications for the Data Marketplace for sharing public sector data (referred to in the Digital and Data Roadmap[8]), for example. It is reassuring to see the user research that has taken place around the Data Marketplace.[9]

Learning #10

As with physical infrastructure, data infrastructure needs a sustainable funding model. The UK government should ensure that all critical data infrastructure has guaranteed funding – both for its creation and its maintenance.

[8] Central Digital and Data Office (2022), 'Transforming for a digital future: 2022 to 2025 roadmap for digital and data'
[9] Ibid.

Learning #11

Any services intended to maximise the findability of data should factor in how people find data, established through regular user testing. Services should also be reviewed regularly against industry standards to ensure data infrastructure remains relevant. The UK government should ensure that appropriate governance is in place around services that form part of critical data infrastructure, to stay up to date with changing industry standards and user behaviours.

- Functionality was initially included in DGU to view geospatial data. However, this has since been lost. The standards for viewing data recommended by INSPIRE have largely been surpassed by industry standards. Some public bodies continue to maintain infrequently-used, INSPIRE-compliant access services alongside more frequently-used industry standard (but non-INSPIRE-compliant) services that perform the same function.
- The standards comprising the INSPIRE framework distilled best practice for the time and were heavily influenced by UK geospatial expertise. However, they were produced at a time of relative technical immaturity and emerging technical solutions. As time has gone on, some of these standards have become increasingly obsolete, making compliance with INSPIRE increasingly ineffective with regard to the goal of making data FAIR.

Learning #12

Any legislation that aims to implement data standards should have the means of ensuring those standards do not become obsolete; for example, by referring to an authoritative, maintained register of standards that is reviewed regularly. The UK Geospatial Data Standards Register can serve as an example.[10]

- The specific standards underpinning INSPIRE have lagged behind industry standards; in particular, alternative geospatial formats and modern approaches to APIs (Application Programming Interfaces). As is the case for developing standards[11] generally, standards evolve and mature as lessons are learned in practice. At the time of writing, the original European standards framework is in a review phase, during which the regulations and guidance are both being reviewed and simplified based on Europe-wide consultation.

[10] Cabinet Office and Geospatial Commission (2023), 'Geospatial Data Standards Register'
[11] ODI (2018), 'Open Standards for Data'

Current impact of legislation

- As it stands, the INSPIRE legislation does not appear to be having a significant effect on the UK public sector's data-publishing habits. Many public bodies have realised the mechanism for mandating data-sharing is weak, and therefore carries a limited risk of non-compliance. Many of the lasting impacts of INSPIRE appear to be a result of systems and processes designed to facilitate compliance with INSPIRE, or international environmental reporting efforts revolving around specific use cases.
- Repealing INSPIRE could result in the future divergence of standards adopted by public bodies. However, given that many relevant stakeholders in the public sector are only somewhat aware of INSPIRE, or are misinformed about it, it may be the case that this divergence will happen regardless of legislation. This is likely to be exacerbated by the inability of current mechanisms to mandate data-sharing, and the lack of engagement around the standards.
- However, there is a significant degree of uncertainty around these observations. Given the importance of environmental reporting in general, and the adoption of standards to maximise environmental reporting in particular, retaining the legislation in the short term, and staying aligned with the standards as they are revised as part of the normal standards development process, represents a pragmatic and conservative approach.
- It is important to note that, without further engagement around INSPIRE, the legislation is likely to have little to no further impact.

Recommendation 3

The UK government should retain the current INSPIRE legislation in the short term to enable cross-border data-sharing, while remaining updated on any revisions to the INSPIRE standards. The general principles and aims of INSPIRE remain valid. Removing INSPIRE would require a consultation, and a proposal for a replacement.

Recommendation 4

Defra group should use the INSPIRE UK GEMINI (GEo spatial Metadata Interoperability Initiative) metadata standards for all environmental reporting data that it creates and, if appropriate and practicable, that it uses.

Current policy landscape – identifying use cases

As outlined above, the use case for the technical infrastructure must be aligned with policy objectives for the technical infrastructure to be useful and maintained.

- The policy objective of INSPIRE – to improve environmental policymaking – is more relevant than ever. Recent bills, such as the Environment Act, Agriculture Act and Marine Act, as well as strategic programmes like the 25-Year Environment Plan and the Natural Capital and Ecosystem Assessment Programme (NCEA), will all require coordinated and targeted action, which requires a comprehensive, robust and granular evidence-base. The public sector can facilitate this by taking standardised approaches to sharing data about the environment. A large number of UK public bodies provide data that allows us to better understand the environment, making the case for standards very strong. INSPIRE's technical objectives are therefore also still highly relevant.
- However, SDI's potential purpose is not limited to the environment. Any policy goals that require information regarding where something is happening can benefit from SDI. For example, delivering the levelling up agenda requires granular geospatial data on socioeconomic factors. Geospatial data underpins many policy domains, and taking an integrated approach to geospatial data across policy domains is critical to developing coherent national data infrastructure and working in a complementary way across agendas. For example, environmental and transport policymakers use foundational Annex I INSPIRE datasets such as the National Land and Property Gazetteer and National Street Register.
- Furthermore, data and technical standards are a vital practical component of data policy; for example, the Central Digital and Data Office (CDDO) roadmap, the Data Sharing Governance Framework, and its ambition of integrated government standards at national and international levels.
- Data standards, including those comprising INSPIRE, underpin the UK and international geospatial strategy in the UN's Integrated Geospatial Information Framework (IGIF). Many of the standards in the INSPIRE framework and approach are being adopted and recommended in the international agreements and conventions that the UK is a party to.

For example, UN-IGIF, reporting on Sustainable Development Goals (SDGs), and international environmental conventions such as OSPAR and Bern, both utilise standards from the INSPIRE framework.

- Frameworks like INSPIRE and UN-IGIF distil international best practice and underpin current policy strategies for the UK as an international partner. Reporting on strategic progress relies on standardisation. Automation, digital services, AI (Artificial Intelligence) and advanced analytics all rely on standards to align, combine and compare data.

- The approach to standardising data-sharing is therefore highly aligned with national and international approaches, and there are a plethora of potential use cases for many standards within the INSPIRE framework.

- Whether or not legislation is required ultimately depends on what the use cases for the infrastructure created by INSPIRE are, the policy objectives with which they align, and the extent to which legislation is a useful tool to encourage data-sharing in that context. If the government decides that greater availability of geospatial data is desirable, legislation may present a means of accelerating desired behaviours.

- INSPIRE standards could be attached to existing regulations and legislation, for example, the Environment Act 2021, Agriculture Act 2020, and Fisheries Act 2021. Individual acts have the advantage of a clear purpose and use cases. However, current legislation does not yet cover every theme necessary for joined-up environmental policymaking, nor does it compel foundational (Annex I) data publishers to publish.

- We were only able to interview public sector stakeholders owing to time constraints; future consultations around the purpose of spatial-data infrastructure should also include external stakeholders.

- While awaiting the outcome of the INSPIRE standards revision process, and before decisions are made on the future of the INSPIRE legislation, Defra should establish whether there are environmental (e.g. the NCEA), data (e.g. the Data Marketplace), and/or geospatial use cases that the INSPIRE infrastructure could meet, and therefore determine the appropriate policy stakeholders for INSPIRE.

Recommendation 5

Standards are critical to the cross-boundary delivery of data policies, and should be promoted in relation to all public sector data-sharing initiatives

Recommendation 6

Continued alignment with international standards is important. Defra should determine if there are any environmental, data or geospatial use cases that the INSPIRE infrastructure could fulfil prior to making decisions regarding the future of the INSPIRE legislation

Recommendation 7

Geospatial data is a core UK data infrastructure. This requires effective cross-government governance of the standards used by public authorities to ensure a coherent data infrastructure

How could the standards framework be taken forward?

- Establishing the appropriate ownership with the necessary jurisdiction, authority, personnel and skills was far from straightforward. INSPIRE is a groundbreaking data initiative in the UK, encompassing infrastructure and technology capability; geospatial data; general technical standards; domain expertise; and cross-department and multi-agency coordination. It ranges across themes from mapping systems and geology to oceans, energy and health.

- The necessary organisational structures and experience of the UK public sector are relatively immature in their coordination of standards of this scale and scope. When taken together with the wide range of thematic domains involved, this has led to confusion about ownership.

- In addition, there are many more relevant stakeholders for INSPIRE today than a decade ago. For example, the UK now has a central body dedicated to encouraging the adoption of standards across central government in the DSA, part of the Central Data and Digital Office (CDDO). In addition, the GC is a unit dedicated to steering the UK's geospatial data strategy.

- Because INSPIRE is a framework of component standards covering data-sharing, geospatial data and environmental data, the appropriate ownership of the underlying standards does not naturally rest with a single body. The proliferation of potentially relevant stakeholders compounds the issue of INSPIRE's confused ownership.

- Two crucial themes regarding ownership and purpose emerged from the findings. The question of how best to establish ownership of the standards framework in the future is intrinsically related to the purpose of the regulation: is it fundamentally a geospatial, a 'general' data, or an environmental regulation? Answering these questions becomes easier when viewing INSPIRE as a framework of component standards rather than a standard in its own right.

- The ownership of strategy, standards, coordination, implementation, oversight and enforcement for a standards programme as ambitious as INSPIRE is a complex undertaking.

- For example, while the DSA has responsibility for endorsing open standards across government and supporting standards development processes, it is not responsible for enforcement, mandating, coordination or technical assistance for adopting standards. Nor does the DSA have sufficient resources to take on a framework as comprehensive as INSPIRE, given its current resource, maturity and capacity.

- Ownership of INSPIRE was placed originally with Defra as the lead department for the environment. However, the utility of the SDI is not only limited to environmental uses but reaches much further, underpinning much of a geospatial infrastructure to define place-related activities, services etc, as per the GC's geospatial strategy.[12] Similarly, the widely applicable nature of the technical standards suggests a wider utility as part of CDDO's general data policy.

- Attempting to pigeonhole ownership of INSPIRE has so far been counterproductive. Instead of being driven by environmental policy – where the technical implementation is explicitly to enable environmental policymaking – the attempts to place ownership of the standard and policy with the geospatial community have confused its purpose.

Recommendation 8

A new consortium of relevant stakeholders should be established to oversee the future delivery of a spatial data infrastructure, whether that is INSPIRE or a replacement. The exact composition of this consortium should be agreed upon through cross-government consultation.

[12]Cabinet Office and Geospatial Commission (2020), 'Unlocking the power of location: The UK's geospatial strategy'.

Who could be accountable for infrastructure and standards? The future ownership of INSPIRE

- As outlined above, a collaboration between parties is necessary for the ownership of the INSPIRE standards going forward, and for establishing the policy objectives that the INSPIRE standards are contributing towards. The INSPIRE framework contains geospatial data standards, a number of thematic data standards and general data standards, all of which now have different logical owners in the current landscape. Furthermore, there are separate environmental policy leads, data policy leads and geospatial policy leads, each of whom may benefit from SDI.

- Several bodies were suggested throughout the interview process as well-placed to take responsibility for the coordination and enforcement of the INSPIRE framework in the UK. None stand out as being appropriate to take responsibility for all necessary roles and responsibilities (see **Annex 1**). This is not unsurprising; it is commonplace[13] for standards to be co-owned by partnerships and consortia. It is again worth noting here that only internal stakeholders were interviewed during this research, and that external stakeholders may well play an important role in managing the INSPIRE framework.

There are several options for the future ownership of INSPIRE:

- If INSPIRE became a general data regulation, CDDO would be responsible for the standard via the DSA. In this scenario, the DSA would mandate that environmental data publishers use INSPIRE's metadata, geospatial data exchange formats and theme-specific data models. However, DSA does not currently mandate data publishing, nor does it provide technical support or coordinate implementation. Instead, it evaluates, endorses and recommends standards that are brought to it to address specific 'challenges'. Every standard brought to the DSA requires a 'challenge owner' to coordinate its development, oversee its adoption and coordinate implementation. Its remit is also limited to central government. The question would remain: who should own the INSPIRE framework, and who would coordinate its implementation?

- As a geospatial regulation, the INSPIRE framework could align with the GC's objectives to make public sector geospatial data FAIR. The GC may therefore be best positioned to determine how INSPIRE aligns with geospatial policy. The GC is not an implementation body, but acts as a convener and enabler for the national geospatial

[13] Open Data Services (2018), 'Towards a toolkit for policy focussed open data standards'

strategy. Geospatial standards are best maintained by specialist organisations and consortia: for example, the UK GEMINI metadata standard is maintained by the AGI (Association for Geographic Information). BSI IST/36 acts as the control body for the UK's geospatial standards register, and therefore may usefully own the other geospatial components of the INSPIRE standards framework. However, not all of the INSPIRE standards are geospatial.

- As an environmental regulation, Defra could be responsible for the framework. However, as outlined above, it is not currently clear how findable and accessible environmental data is at present. If environmental data is lacking, this also raises the question of why INSPIRE should be limited to geospatial data. The framework could align with legislation that was introduced primarily to replace environmental EU legislation, such as the Environment Act 2021, the Agriculture Act 2020 and the Fisheries Act 2021. This would position the Office of Environmental Protection (OEP) as the logical owner of the framework. However, the OEP is unlikely to have the relevant geospatial expertise to coordinate implementation.

- Adoption and enforcement of INSPIRE standards should be aligned with the public task of those public bodies, and regulation should be done in accordance with ensuring public bodies are performing their public task, and enforced by appropriate bodies. Sector-specific and use case-oriented regulation is likely to be more effective in incentivising the use of standards than general data-publishing regulation. It would also make it clearer who the potential stakeholders are and which funding bodies would contribute to the maintenance of the data infrastructure, as with the example of MEDIN given above.

- Ultimately, accountability for the framework will depend on the framework's users, which will require further consultation. At present, it is clear that no single public body has the requisite expertise or mandate to own, implement and coordinate the framework. It is common practice when developing standards to establish different owners for

  (a) the standard
  (b) the associated strategy
  (c) the standard's enforcement and
  (d) coordinating bodies.

- Standards that cross domains, such as INSPIRE, are typically co-owned by partnerships and consortia with clear roles and responsibilities in relation to their expertise and mandate. **Annex 1** outlines some current stakeholders relevant to implementing an SDI in the UK at present.

- The ‘stakeholder consortia’ body should continue to participate in the standards development processes internationally, to harmonise effectively and contribute UK expertise. Standards development is a collaborative, iterative process. INSPIRE is being reviewed and updated at the European level as per normal standards processes. Many of the standards in the INSPIRE framework are being adopted and recommended at an international level. Therefore, whoever owns the standard in the UK must involve themselves in the usual development processes to maintain interoperability and international cooperation, such as reporting on SDGs and international conventions.

Recommendation 9

The new consortium model, among other areas, should consider:

- the exact composition of the consortium. Annex 1’s table can serve as a guide for stakeholders to include in the initial consultation on the composition
- how to secure adequate funding and resources for the framework and its associated data infrastructure
- how to work with the DSA and the GC to ensure alignment of INSPIRE standards with geospatial, central data, and digital policies
- how to remain engaged in international standards development processes, actively contributing UK expertise and working towards effective harmonisation
- how consortium members invest in the technical, coordination and engagement skills required to maintain and coordinate the adoption of standards at this scale and scope

Learning from test cases

- The scale, novelty and ambition of INSPIRE required a novel approach to implementation by, and coordination of, public bodies. There are generalisable lessons to be learned from INSPIRE about implementing standards programmes, geospatial standards and implementing data standards more widely.

  These lessons include:

  - the need for appropriate ownership
  - clarity of ownership
  - the need for early test cases and aligning around use cases
  - the range and limitations of incentives
  - where and where *not* to invest in centralised data infrastructure
  - and where to invest in specialist skills

- It is important to learn and share these lessons, given the widespread strategic ambitions to adopt standards more generally.
- Previous complex and ambitious government data programmes have suffered from trying to do too much at once. INSPIRE itself is the first of its kind, flagship programme in the UK – a test case of sorts – for implementing standards across government that touch on complex, multi-dimensional aspects of both geospatial data and policy.
- An argument is made to retain INSPIRE's environmental focus in the short- to medium-term so that it acts as a learning exercise that can be applied more widely. Generalisable lessons about processes, structures and technical implementation can be shared with other sectors as the standards, data infrastructure, skills and capability mature.
- INSPIRE should be treated as a flagship spatial-data infrastructure programme to capture and share lessons about how best to develop and adopt multi-partner and cross-departmental standards.
- Defra could also consider rebranding INSPIRE as a flagship or 'test case' geospatial standards programme with an environmental use case, for the benefit of the geospatial-data community in the public sector.

Annex 1

Table of potential owners of components for a UK SDI

Body	Ownership of strategy for the data infrastructure	Ownership of the standards	Enforcement	Coordination
Defra	Appropriate if INSPIRE is considered as environmental policy	Only appropriate for domain-specific data specifications (i.e. Annex 3)[14]	No	Well positioned to coordinate across environmental themes
CDDO via the DSA	Appropriate if INSPIRE is considered as general data policy	No	No, although it does have means of encouraging the adoption of standards through spend controls	May be able to encourage appropriate ownership of standards, but not to coordinate implementation
Geospatial Commission	Appropriate if INSPIRE is considered a geospatial-data policy	No	No	Could be well positioned to advise regarding coordination across geospatial themes. Well positioned to coordinate in relation to specific use cases, as in the National Underground Asset Register
BSI IST/36	No	Yes: most likely limited to geospatial components	No	No
Ordnance Survey	No	No	No	Well positioned to assist with engagement across the geospatial community
ICO (Information Commissioner's Office)	No	No	Weak enforcement through complaint mechanism only	No
OEP	No	No	Appropriate as an environmental regulator, but not for geospatial data standards generally	No
UK-EOF	No	No	Not an enforcement body	Possibly for environmental data only
AGI	No	Only geospatial metadata standards (UK GEMINI)	No	No
New consortium	No	Co-owned by partners cf Open Contracting[15] [16] and Beneficial Ownership[17] and others[18]	No	Perhaps? Could be cross-sector

[14] EU (n.d.), 'Inspire Knowledge Base. Data Specifications > Themes'
[15] Cabinet Office and Central Digital and Data Office (2022), 'Publishing contract data'
[16] Open Contracting Partnership (n.d.), 'Open Contracting Data Standard v1.1'
[17] Cabinet Office (2022), 'Collect, use and exchange beneficial ownership information'
[18] Open Data Services (2018), 'Open standards for data: Open Data Services'