LESSON 7:
TRUSTED AND AUTHORITATIVE FOUNDATION DATA

Clare Hadley
Ordnance Survey
Objectives for this session

By the end you should:

1. understand the range of foundation data encapsulated within GKI and the GKI Foundation Data initiatives
2. have considered the changing roles of national geospatial agencies
3. have considered the move to continuously maintained authoritative geospatial data
Topics we are going to cover:

1. The range of GKI foundation data types and the UN-GGIM fundamental geospatial data themes
2. The changing role of national geospatial agencies
3. Changing workflows to produce foundation geospatial data
4. National geospatial agencies interfaces with stakeholders
5. Exercises for you all
FOUNDATION DATA
What is Foundation Data?

In the context of GKI, Foundation Data refers to national data that is **substantially geospatial in nature** and seen as **part of the national digital infrastructure** meeting national public task requirements.

As data capture, analytical capabilities and demand increase, so does the scope and role Foundational Data, with dynamic, continuously updated, findable and accessible datasets now the norm.
Types of Foundational Geospatial Data

Legal & Political
- Administrative Boundaries
- Regulated Zoning
- Emergency Response
- Land Ownership

Economic
- Utilities Networks
  - Energy, Comms, Sanitation...etc.
- Land Use
- Transport
- Addressing

Environmental
- Geodesy
- Topography
- Tide Lines
- Land Cover
- Geological
- Meteorology
UN-GGIM Fundamental Data Themes

- Global fundamental geospatial data themes were defined by UN-GGIM in 2017. The aim was to develop:
  ‘a minimum list of global fundamental geospatial data themes that could be harmonized in order to enable the measurement, monitoring and management of sustainable development in a consistent way over time and to facilitate evidence-based decision-making and policy-making’

- The themes built on existing work in this field from several regions

- They are designed to support dialogue with non-geospatial policy makers

- They support the UN-GGIM Integrated Geospatial Information Framework
UN-GGIM Fundamental Data Themes

They are intended to be high level only.

This document sets out for each theme:

• Why the theme is fundamental
• Which sustainable development goals (SDGs) it will it help to meet
• The geospatial data features in more detail
• Possible sources of data for the theme
• Existing data standards

UK Delivery of Fundamental Data Themes

Setting policies to enable better delivery
Collecting Fundamental Data
Creating Application-Specific Data
Connecting Geospatial Data to Users

Office of National Statistics
Local Authorities
Valuation Office Agency
HM Land Registry
UKHO
Ordnance Survey (PSGA)
British Geological Survey
Coal Authority
UK Space Agency
Met Office
Defra

Government Digital Service
Geospatial Commission

Creating Application - Specific Data
Setting policies to enable better delivery
Collecting Fundamental Data
Connecting Geospatial Data to Users

Population Distribution
Local Authorities
Valuation Office Agency
HM Land Registry
UKHO
Ordnance Survey (PSGA)
British Geological Survey
Coal Authority
UK Space Agency
Met Office
Defra

Global Geodetic Reference Frames
Addresses
Buildings and Settlements
Elevation and Depth
Water
Functional Areas
Geographical Names
Land Cover and Land Use
Physical Infrastructure
Orthophotos
Transport Networks
Geology and Soils
Geology and Soils

© Ordnance Survey
## Fundamental data themes and Foundation data

<table>
<thead>
<tr>
<th>Fundamental Data themes</th>
<th>Foundation Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overarching use case: sustainable development (SDGs)</td>
<td>Overarching use case: national public task</td>
</tr>
<tr>
<td>Defined at high level and adopted in 2017</td>
<td>Undefined - part of a national digital infrastructure</td>
</tr>
<tr>
<td>Global harmonisation scope</td>
<td>Primarily national in scope</td>
</tr>
<tr>
<td>Aimed at non-geospatial audience</td>
<td>Part of GKI initiative to support NGAs development</td>
</tr>
<tr>
<td>Can be considered as a defined subset of foundation data</td>
<td>Can be considered to include the fundamental data themes</td>
</tr>
</tbody>
</table>
EXERCISE
Exercise – Fundamental geospatial data

In pairs or threes with the people sitting near you
Choose one, maybe two, of the fundamental data themes
Discuss:
• Who in your country(s) produces this data?
• Is it available at a national level?
• Are there any gaps, inconsistencies, lack of interoperability?
• What, if anything, could be done to improve the situation?
CHANGING ROLE OF NATIONAL GEOSPATIAL AGENCIES
# Changing roles of national geospatial agencies

<table>
<thead>
<tr>
<th>Revolution</th>
<th>NGA Focus</th>
<th>Defining Product</th>
<th>Core Value Offer</th>
<th>Competitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Industrial</td>
<td>Map the geography to support large scale planning</td>
<td>Age of enlightenment leading to technologies that could support large scale mapping; supporting a national emergency (Jacobites uprising)</td>
<td>Providing visibility of place</td>
<td>No competitors; only the state has the resources to undertake this task</td>
</tr>
<tr>
<td>1st/2nd Industrial Revolution</td>
<td>Map infrastructure to geography to support national planning</td>
<td>Industrialisation leading to large scale anthropogenic changes to the landscape through infrastructure e.g. rail, roads, ports etc.</td>
<td>Providing national scale trusted maps</td>
<td>No competitors; only the state has the resources to undertake this task</td>
</tr>
<tr>
<td>3rd Industrial Revolution</td>
<td>Map data to geography; showing the relationship between events and geography</td>
<td>Access to computing processing power permitting complex calculations. The advent of GIS permits data to be overlaid onto geography to support complex analysis.</td>
<td>Providing trusted digital cartography (Raster &amp; Vector Mapping)</td>
<td>Democratisation of technology and data leads to a rise in competition</td>
</tr>
<tr>
<td>4th Industrial Revolution</td>
<td>Hyper connected geospatial infrastructure and data to drive better outcomes</td>
<td>Rise of big &amp; mass data pushes forward a need for AI for analysis and ultimately to drive data driven decision making by humans and machines alike at unprecedented rates, scales and complexities.</td>
<td>The assurance, standards and expertise to enable geospatial interconnectivity</td>
<td>Democratisation of technology and data including AI leads to an exponential rise in competition</td>
</tr>
</tbody>
</table>
Demand for geospatial content has changed

New opportunities and new use cases present a different demand. Data is now needed:

• in real time
• representing the real world
• for machine to machine processing
• for predictive modelling

and is coming:

• from sensors
• as unstructured big data
• in high volumes
Moving up the DIKW hierarchy

- **Data**: individual facts, figures, signals, measurements
- **Information**: organized, structured, categorized, useful, condensed, calculated
- **Knowledge**: idea, learning, notion, concept, synthesized, compared, thought-out, discussed
- **Wisdom**: understanding, integration, applied, reflected upon, actionable, accumulated, principles, patterns, decision-making process

https://creativecommons.org/licenses/by-nc/4.0/
How is this impacting NGAs activities?

• Reduced barriers to entry has introduced competition
• Increased globalisation means more focus on interoperability and standards
• Technological change moving fast making investment decisions challenging
• Many more players – making an ecosystem
• User demands have changed – pull not push
• Maps → Data → Solutions → Services → Platforms
• Questions on our role
How does this impact NMGA activities? – Case Study Ordnance Survey

We are responding by:

• Taking a stronger role in our national ecosystem
Switching our perspective from data production lines to data ecosystems – and understanding our role within that - will allow us to evolve. Our areas of sustainable advantage will benefit from the ongoing growth in demand for geospatial insight.

We provided data

- Users
- Data
- The World

To ensure we stay relevant and successful we need to move our value contribution from collecting and providing data....

....to managing, assuring and combining its use in others systems using data from a range of sources

We enable systems

- Data Connections
- Systems
- Ecosystems
- The World
Many of these capabilities and services may be provided by a business ecosystem of 3rd suppliers or partners. NGAs should define, manage and assure this ecosystem of services to ensure authoritative geospatial data and insights.
OS as case study

OS Capabilities

Surveying (data capture)
Change Intelligence
Data Processing photogrammetry
Cartography & GIS
PNT incl. Geodesy

Data Science & Analytics
Data Standards
Data Assurance & Management

Technical Management (Software & related services)
Software & API Development

Consultancy Incl. International
Research, Innovation, Design & Rapid Development
Incubation (Geovation)

Physical Products; books & outdoor gear
Paper Maps
The Public Sector Geospatial Agreement (PSGA), a £1Bn contract to:

- Create, maintain and improve the National Geographic Database (NGD). This contains the data that describes the geography of Britain.
- Give leadership, domestically and internationally, on best practice with regards geospatial data, standards and services.
- Provide technical and customer support to maximise the use, value and benefit of the NGD.
- Maintain and develop the underlying physical infrastructure that is needed to support mapping applications.
- Provide access to the NGD to the public and private sectors.
Revenue sources 2020-21

- £100m public sector revenue
- £170m revenue
- £70m commercial revenue
How does this impact NMGA activities? – Case Study Ordnance Survey

We are responding by:

• Taking a stronger role in our national ecosystem
• Engaging even more strongly with our stakeholders of all kinds

www.ordnancesurvey.co.uk/business-government/products/case-studies
How does this impact NMGA activities? – Case Study Ordnance Survey

We are responding by:

• Taking a stronger role in our national ecosystem

• Engaging even more strongly with our stakeholders of all kinds

• Developing a wider range of partnership approaches

OS Partnership examples

http://www.naturalhazardspartnership.org.uk/

https://www.geoplace.co.uk/
How does this impact NMGA activities? – Case Study Ordnance Survey

We are responding by:

- Taking a stronger role in our national ecosystem
- Engaging even more strongly with our stakeholders of all kinds
- Developing a wider range of partnership approaches
- Setting up an innovation hub and supporting start-ups
- Developing APIs and a Data Hub for data supply
- Introducing unique identifiers to enable data integration

https://geovation.uk/

https://osdatahub.os.uk/
How does this impact NMGA activities? – Case Study Ordnance Survey

We are responding by:

• Taking a stronger role in our national ecosystem
• Engaging even more strongly with our stakeholders of all kinds
• Developing a wider range of partnership approaches
• Setting up an innovation hub and supporting start-ups
• Developing APIs and a Data Hub for data supply
• Introducing unique identifiers to enable data integration
• Using AI in our work flows

https://geovation.uk/
https://osdatahub.os.uk/
WORKFLOW CHANGES
Old world – Traditional data capture and product creation

Acquisition of sensed data and imagery ➔ Manual geospatial vector data production ➔ National Geospatial Datasets ➔ Manual cartographic map production ➔ Publication of static, cartographic and print maps already out of date

Production time = 1-2 years
New world – Traditional data capture & automatic product creation

Acquisition of sensed data and imagery  
Automated Data Creation  
National Geospatial Database  
Automated Product Creation  
Publication of consistent, up to date cartographic and analytical data in multiple formats  
Production time = 0–3 weeks
Providing Up to Date Data: Data Capture

OS’s move towards three month currency on our National Cyclic Revision programme required:

- Surveyors working on tighter timelines to respond to change and prioritise jobs
- Round-the-year planning for the flying programme
- Upgrading internal software for managing surveying jobs, storing data and adding attribution
- Exploring new ways to acquire data
  - Satellite Imagery, UAV’s, Automated Feature Extraction, Automated Change Detection
  - Better derived data from other sources, such as local authorities
Automated data creation example - Lusaka

Creation of new Digital Base Maps through an Automatic Feature Extraction (AFE) process so that informal settlements in Lusaka can be identified and monitored.

Training data creation
20cm Ground Sample Distance RGBI aerial imagery is the input to the feature extraction process, training data is created for each specification type.

Segmentation and Rules based Classification approach to Machine Learning
Feature Classes Captured

Roofed structures – Buildings deemed to be permanent (over 12m² in area)
Water – rivers, lakes, ponds, oceans.
Unsealed surface – dirt, gravel, sand
Sealed surface – paved, asphalt, concrete
Roads – Roads if definable
Grass/shrubland – low/medium vegetation
Tree/forest - High vegetation with visible canopy
Other structures – Building sites, walls, jetties, statues etc
Cloud cover/no data – No data and complete obscuration by cloud cover.
A 1km square area in Lusaka, which would normally take 2 months to create took 22 minutes!

In Summary

- Automatic capture
- Accuracy & high level attribution
- Reduce production time & cost
- Meet stakeholder expectations
- Widely applicable
- Kick start transition

A video about this work can be found here: https://youtu.be/4VDTQMrnj-w
Providing Up to Date Data: Data Management & Delivery

Meeting customers’ requirements needed:

• Connecting data sets to create on National Geospatial Database, not several data silos
• More Big Data storage proficiency
• Recruiting more Data Scientists to allow data to be ingested and manipulated automatically
• Developing APIs
• Collaborating on Digital Twins
NGA data needs to be...

Findable  Accessible  Interoperable  Reusable

https://www.go-fair.org/
What is FAIR data?

Findable: Persistent identifiers (PIDs)
Accessible: Standard communications protocol
Interoperable: Vocabularies
Reusable: Metadata have multiple attributes

Rich metadata
Open, free protocol
Vocabularies are FAIR
Usage license

Indexed data repositories
Authentication, where necessary
Linked metadata
Provenance

PIDs in metadata
Metadata is always available
Community standards

https://findwise.com/blog/data-that-really-saves-lives-and-possibly-your-organisation/
WORKING WITH STAKEHOLDERS
Who are your stakeholders and why are you engaging with them?

**Direction**
To engender trust and credibility and deliver against mandate
‘Government and Regulators’

**Money**
To understand the requirement, secure the business and deliver against contract
‘Customers’

**Influence**
To develop credibility and use it appropriately to influence action
‘Influencers’

**Knowledge and Information**
To listen, probe and understand
‘Experts and peers’

**Collaboration**
To share and develop mutual benefit
‘Partners’

**Data Use**
To ensure continued relevance to their requirements
‘Users’

**Product and/or Service**
To provide clarity in our requirements and get value for money
‘Suppliers’
Exercise - Stakeholders

In pairs or threes with the people sitting near you map some of your key stakeholders into the categories below

Discuss:

• Do you proactively engage with all stakeholders?
• Are some organisations more than one type of stakeholder?
• Do you proactively fit your method of engagement to the outcome you want?
• How do you know if your engagement is productive?
Summary

National Geospatial Agencies are critical to the production of some of the foundation data for their countries.

Multiple agencies must work together to produce foundation data which is findable, accessible, interoperable and reusable (FAIR)

NGAs have a very different role now as integrators, enablers, sources of authority and expertise. They operate in a complex ecosystem.

Technology has enabled changes to work flows which in turn has allowed automated production of geospatial data which is much more current and timely.

User needs are developing fast. NGAs must engage with a wider range of stakeholders to keep abreast of them and provide for them.
Objectives for this session

By now you should:

1. understand the range of foundation data encapsulated within GKI and the GKI Foundation Data initiatives
2. have considered the changing roles of national geospatial agencies
3. have considered the move to continuously maintained authoritative geospatial data
THANK YOU FOR YOUR PARTICIPATION!

Clare.Hadley@os.uk
+44 77 48 33 34 91
@chadley_OS
www.ordnancesurvey.co.uk