



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



## GEOSPATIAL DATA POINTS THE WAY TO INTEGRATING GOVERNMENT FOR SUSTAINABLE DEVELOPMENT

**JOHN KEDAR**

Ordnance Survey

[john.kedar@os.uk](mailto:john.kedar@os.uk)

### Authors

**Darvill, James BSc(Hons)**

Principal Geospatial Consultant, Ordnance Survey

**Kedar, John, BSc(Hons), FInstRE, FRGS, CGeog(GIS)**

Director International Engagement, Ordnance Survey

**Worthy, Kimberley BSc, MMgt, MBA, FRGS, CGeog (GIS)**

Principal Geospatial Consultant, Ordnance Survey

**Paper prepared for presentation at the  
“2019 WORLD BANK CONFERENCE ON LAND AND POVERTY”  
The World Bank - Washington DC, March 25-29, 2019**

*Copyright 2019 by author(s). All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.*



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



## **Abstract:**

In 2018, the United Nations released two important documents. The first states 14 geospatial data themes that nations should consider essential. The second, in co-operation with the World Bank, was the first part of an Integrated Geospatial Information Framework. This aims to enable the efficient use of geospatial information by nations to effectively measure, monitor and achieve sustainable social, economic and environmental development.

National Mapping and Geospatial Agencies (NMGA) face existential threats, and some will wither and die if they do not transform to become stakeholder led, benefits oriented, geospatial data organisations, supporting all elements of society. This paper illustrates how these United Nations documents open doors for transformation, and that NMGAs now need to take the lead in using these to benefit their nations.

This Paper offers that long-term partnership is perhaps the most critical aspect of transformation, a pathway overlooked in conventional Spatial Data Infrastructure thinking.

## **Key Words:**

Mapping, Geospatial, United Nations, SDG, Ordnance Survey



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



## **GEOSPATIAL DATA POINTS THE WAY TO INTEGRATING GOVERNMENT FOR SUSTAINABLE DEVELOPMENT**

*‘Data are an infrastructural resource – a form of capital that cannot be depleted and that can be used for a theoretically unlimited range of purposes.’ (OECD, 2015)*

OECD likened data to roads and bridges that support a wide range of national and local uses from healthcare to profitable business, some anticipated, some not. Improved availability of fundamental trusted data, the foundation for better government, leads to more transparency, effective planning, improved resilience, increased resource/asset and environmental management, and new business opportunities.

Leading, enabling and funding an underpinning, cross-cutting, data infrastructure therefore needs to be considered centrally by national governments. But little investment is being made into national geospatial capabilities, the arguments still need to be won.

According to the UN Statistics Division, only 3% of Africa is mapped at 1:25k scale, against 87% of Europe. For national coverage several nations use mapping from the last century, perhaps 1:50,000 scale at best, but neither maintained nor created digitally. Compare that with nations such as the United Kingdom and Singapore, maintaining large scale, attributed and accurate data from addressing to topography, imagery to networks. There is a widening geospatial divide, contributing to the widening digital divide.

In Summer 2018, the United Nations Committee of Experts on Global Geospatial Information Management endorsed the first part of the Integrated Geospatial Information Framework and the structure and style for the rest. This is a landmark step in guiding nations on a 21<sup>st</sup> century benefits-centric geospatial journey. It provides both a strategic approach and the means to justify, plan and deliver geospatial enablement.

In the same meeting the Committee also endorsed 14 fundamental geospatial data themes; the core data themes deemed appropriate by and for all nations as part of a national infrastructure. Themes are not datasets. The authors, led by Great Britain’s Ordnance Survey, fully recognised that datasets, their specifications and their currency are national matters.

In agreeing these, two powerful tools were unleashed onto the global community in one meeting. These global frameworks will enable better data integration and interoperability in the public sector, and much



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



greater innovation in both public and private sector. This paper explores how, in particular, these tools will better enable sustainable development, focussing on some of the contributions National Mapping and Geospatial Agencies (NMGA) can consider.

## WHY IS DATA IMPORTANT TO SUSTAINABLE DEVELOPMENT?

In the UN, as well as some individual governments, data is a tool to measurement of progress, and the Agenda 2030 targets can be seen to substantiate this. However, data, including geospatial data, supports all aspects of national development. This is illustrated in Figure 1.



Figure 1: Good data underpins all aspects of delivering Sustainable Development Goals.

Previous papers by the authors and others have illustrated the benefits, whether economic, social or environmental. (Kedar 2017, Worthy, 2018)

**Economic benefits** include: Increased tax revenue; Land tenure and security; Investment; Government efficiency and effectiveness; Digital business; Industrial planning; Agriculture; Innovation; Control of minerals and extractives; National spatial planning.

### Example: United Kingdom

In UK, the 2018 established Geospatial Commission based on analysis that identified a potential £6-11 billion per annum economic value from private sector use cases from better use and adoption of geospatial data. Its job is to unlock this value. The five key sectors identified with the highest latent value were: Retail and logistics; Property and land; Infrastructure and construction; Mobility; Natural resources. All these sectors are relevant to developing nations, to a greater or lesser degree. This figure is also in line with global studies, the vast majority of which are of high income nations, that suggest 0.2% to 0.6% GDP increase through better use and adoption of geospatial data.



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



**Environmental benefits** include: Landslide management; Monitoring sea-levels and floods, planning mitigation; Forest management; Emission-reduction strategies; Selection for green energy sites; Optimised land use; National Park management; Refuse management; Maritime resource management

**Example: Zanzibar Sustainable Tourism**

Balancing coastal development, growth through tourism, citizen and environmental demands is challenging. Land use, fisheries, property rights and the environment all need to be considered and decisions taken based on ‘where’ development best balances conflicting demands. Unregulated or illegal development can be identified and equally tourists, using innovative locally produced smartphone apps, can be encouraged to visit heritage sites. Integrated location data from different agencies helps deliver evidence-based decisions.

**Social benefits** include: National Defence and Security; Comprehensive urban and rural planning; Land tenure; Disease control; eGovernment services; Resilience and disaster response, Sustainable Development Goals.

**Example: Rwanda (DfID)**

Esperance, 39, a mother of four used to be in constant dispute with her neighbours over ownership of the land she lived on. Through a DFID-funded land registration programme, the dispute is now settled and she is a proud landowner. Esperance says: “I will now work and invest confidently in my land to provide a better future to my four children as I now know that nobody can take my land from me.”

(DfID, 2013)

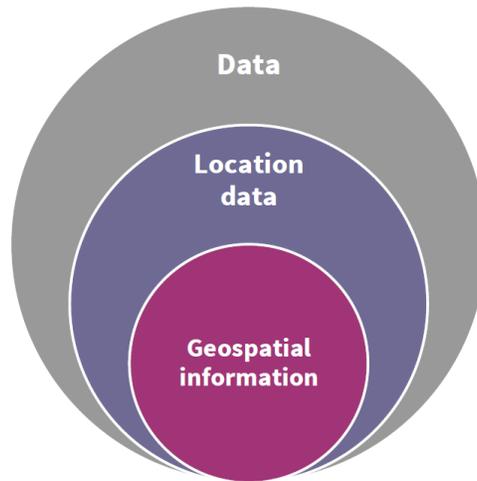
## FUNDAMENTAL GEOSPATIAL DATA

Like all commodities there is a cost in delivery, particularly for trusted data to be used across a nation. Whether based on cost or value, capturing, processing, maintaining and serving data requires resource. Much of the data collected across a nation has very little or no value. Data can be moved up the value chain to generate understanding, decision making and measurement. This was why the world developed maps, probably one of the most efficient means of communicating information for over a millennium. Understanding can be gained, evidenced decisions taken and measurement made directly, as well as a full range of wider spatial data integrated.

To differentiate, Fundamental geospatial data is a foundation. Location data, or spatial data, is all data with position. The relationship is represented at Figure 2. Location data is incredibly broad in nature and touches all aspects of socio-economic development. But, just as nations need trusted statistical and wider management data, much of which is location-based, so too the need for trusted fundamental geospatial data that enables a foundation of knowledge. This is often missing, hence Dar es Salaam’s World Bank



funded programme to capture OpenStreetMap. It is often disparate, held in pockets by different departments to different standards and conflicting content. Integrated government systems require common underpinning trusted data, and need it managed efficiently. If automated private vehicles use different data to government automated vehicles, if address systems are incomplete in the tax system, or if different emergency services use different coordinate reference systems or out of date data, the impacts are obvious.



*Figure 2: Relationship between Geospatial Data (in this case termed Geospatial Information by Ordnance Survey), Location data and Data. (Ordnance Survey, 2018).*

Fundamental geospatial data is the framework upon which all location data can be referenced and the underpinning digital twin of the real world. The first theme is not data at all – it is the Global Geodetic Reference Framework that enables position to be determined to a common reference, so that it can be used and integrated however and wherever collected. The other 13 cover: addresses, buildings and settlements, elevation and depth, functional areas, geographical names, geology and soils, land cover and land use, land parcels, orthoimagery, physical infrastructure, population distribution, transport networks, and water. These are shown graphically, with agreed symbology, at Figure 3. This data will be maintained by several agencies, and potentially at national and local levels, and so the need for governance and standards is clear.

The United Nations Fundamental Data Themes document (UN GGIM, 2018) links the themes to standards and to the sustainable development goals but it only defines themes. The authors, led by Great Britain's Ordnance Survey, fully recognised that specifying national datasets is a national matter based upon city, national or regional needs. Helpfully, the work describes, for each theme:

- A description



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



- Why the theme is fundamental
- Which SDGs it will help to meet
- The data features in more detail
- Possible sources of the data
- Existing standards



Figure 3. United Nations Fundamental Geospatial Data Themes. (UN GGIM, 2018)

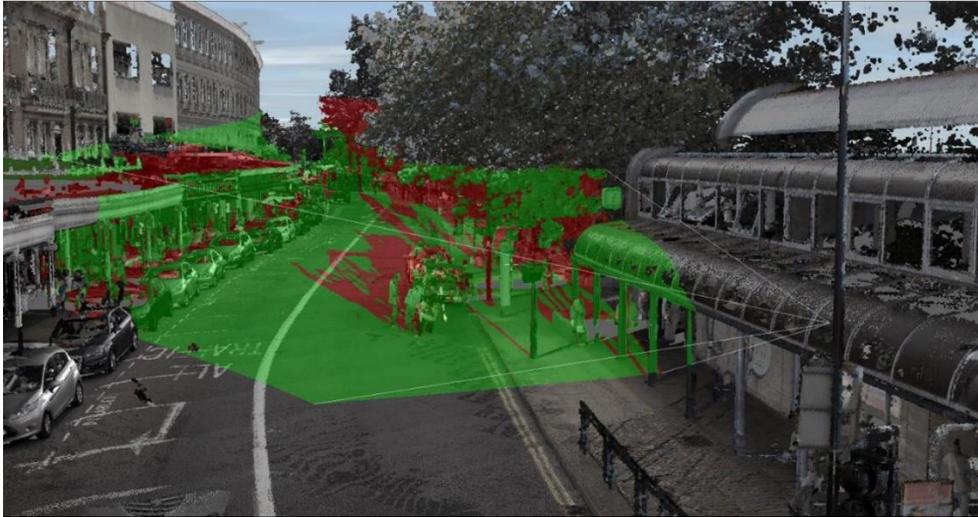
To illustrate the need for national leadership in determining data set design consider the following two examples:

UK is the first example, where smart city requirements have demonstrated that data with more features at far greater detail, accuracy, content, and currency will be demanded in UK cities looking at future technologies, including smart and 5G. This was illustrated during a 5G trial in the city of Bournemouth, where the City, Ordnance Survey, the Meteorological Office and Surrey University pioneered thinking on how to efficiently site 5G infrastructure. It is not just a 3D problem, as demonstrated in Figure 3, the fourth dimension encompassing seasons for foliage on trees, the timing of heavy traffic and building surfaces all must be considered. Clearly the detailed design of city data sets from themes such as ‘physical infrastructure’ and ‘elevation’ amongst others will need to be designed to incorporate individual trees and street furniture, for example.



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



*Figure 4: A 5G experiment in Bournemouth, UK, determined geospatial data requirements and algorithms necessary to efficiently deliver ubiquitous very high bandwidth connectivity to a city (Ordnance Survey, 2018)*

Tanzania is the second example, where in the city of Arusha the driver is different. To collect revenue for the City, a complete geospatial database was created to support a revenue system. (McCluskey, W, 2017). This leads to city-wide collection of data sets across the 6 themes of physical infrastructure, buildings and settlements, land parcels, imagery, transport networks and addressing. Data sets were designed for revenue collection. However, that same data clearly has wider applicability, for example for city management, planning and emergency response. All these different known use cases should be considered in data set design. Maintenance of such data for this purpose is critical, as will integration with wider revenue and city data.

Both of these use cases use the same themes but differently designed data. The key is to make the same data applicable across a multiple of use cases.

Fundamental geospatial data is not a 'project. To be effective, national actionable data will have the attributes shown in Figure 5.

The authors have previously discussed the links between these themes and the sustainable development goals at national level (Worthy, 2018). Nations such as Mongolia are already using these UN themes as a basis to assess the nations fundamental geospatial data assets, a form of audit.



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019

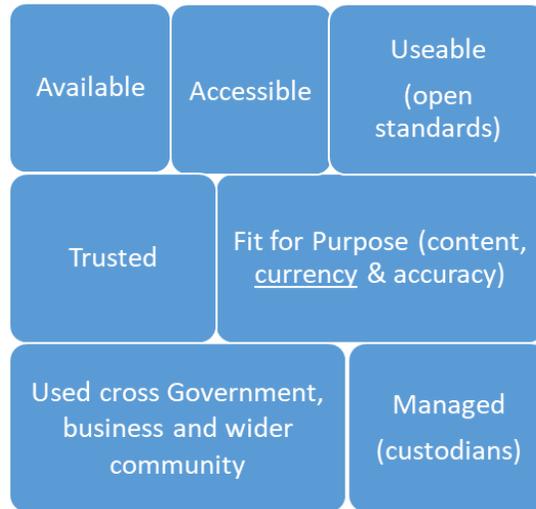


Figure 5: Attributes of actionable fundamental data.

But, many developing nations do not yet maintain trusted, fit for purpose, fundamental geospatial data, and transforming to do so is a significant undertaking. As with any change, there are hurdles to overcome. Sustainable solutions that simplify, take local factors into account and deliver early success, such as creating actionable data in parallel with building institutional capability, will succeed.

## INTEGRATING DATA FOR SUSTAINABLE DEVELOPMENT

Complexity is with us; maps have long provided a masterful way to integrate, understand and communicate information. That is why UK and others committed significant Official Development Assistance (ODA) to ‘mapping the world’ in the 1950s to 1980s. The same levels of resource are not evident now, in this data age. The value of data integration by location is widely experienced by smartphone users without realisation of the framework necessary to deliver it. In a machine to machine world, where there is no human interface, assurity in data becomes increasingly important; data must be fit for purpose. NMGAs must therefore understand the ‘problem’ and be close to stakeholders.

Data is both infrastructure and fuel for nations. Just as oil is refined into petrol, data needs to have the right content, currency, quality and standards to power nations. And it should be accessible to the national economy at large. Most data has location associated, or could do, and location has become a prime means to integrate data and interoperate across systems, departments and businesses. This is not just as overlays, but fully integrating data from different sources using unique property reference numbers or similar registers.

The 4th dimension is increasingly important in integrating data. Predictions to the future are well understood, whether traffic flows, pollution, or demand for government services as urbanisation



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



progresses. Prediction is best generated with reference to the past, and regular map/remote sensing updates have become a significant data source for this. But equally '4D' data provides the means to review past actions based on data available at the time, whether planning permission, land rights or automated vehicle accidents. New South Wales in Australia sees the 4th dimension as a critical component of its digital twin. But equally some African nations are seeking historical mapping to settle international border disputes or consider rightful land ownership.

Globally we see this need for integration of spatial data in government everywhere:

- Managing coastal zones in Zanzibar to balance land tenure, environmental, fisheries, oil industry, urban growth and tourist industries is a geospatial challenge.
- Bahrain has a significant land management challenge; there is no room to expand and already 10% of the island city state is reclaimed from the sea and yet underground assets are not well recorded, an issue that Bahrain seeks to resolve.
- In some Indian cities, integrating geospatial data from different sources provides spatial insights on basic infrastructure, other services and facilities, and the environmental condition of slums. This empowers local Government authorities in planning and executing slum improvement plans. Sustainable planning and management of population growth and urban expansion are achieved through continuous monitoring of an area. (Chopra, R, 2016)
- Climate change in the Indian Ocean impacts Bangladesh, where the monsoon season results in major changes to rivers and thus people and their livelihoods. This can only be managed in cities such as Dhaka through integrating fundamental geospatial data, statistics, environmental data, climate data and more.

Ultimately data is of value when its integration benefits the community. Figure 6 explains the connection between data and the community. The location-based approach sees challenges and issues being tackled using the position and time of events, activities, objects and people. Other integration approaches such as network/relationship analysis and statistical analysis are equally valid and can often be combined with location analysis for powerful outcomes. The glue is the enabling framework that allows government, business and the citizen to use and integrate the data for community outcomes. This takes us neatly to looking at the UN Integrated Geospatial Information Framework (UN-IGIF).



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019

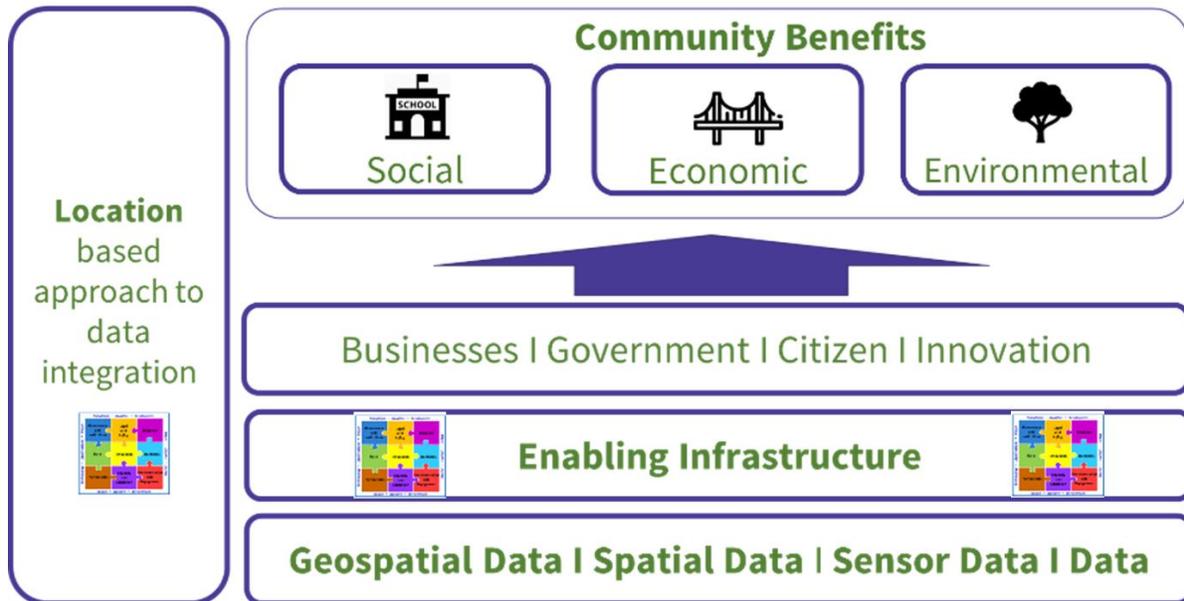


Figure 6: Demonstrating the relationship between data and the community, and the role of an enabling infrastructure.

## THE UNITED NATIONS INTEGRATED GEOSPATIAL INFORMATION FRAMEWORK

The enabling infrastructure shown in Fig 6 is often termed a Spatial Data Infrastructure (SDI), but the term has lost some impact and has a feeling of ‘technicality’ to it, even though very broad. Indeed, some nations and cities are looking to geo-enabling the national/city data infrastructure rather than looking to a separate SDI. In some developing nations, SDIs have not progressed beyond draft policy or a governance committee. There is often a desire to implement a textbook national spatial data infrastructure (NSDI) in a country; this does not exist as SDIs evolve and national needs differ. However, expressed, the conventional ‘NSDI’ approach is not winning funding in developing nations – it can be overly systematic and the benefits often poorly communicated.

The United Nations is developing the UN-IGIF (UNGGIM, 2018) to guide nations in the development and management of their geospatial information resources. This is a fresh approach, and draws upon the experience of its member nations, who then endorse it to give it authority. It is in 3 parts; part one explores ‘why?’ and is aimed at a broad readership and decision makers. Part 2 considers ‘what?’ across a range of pathways covering governance, technology and people. Part 3 sets out the concept and format of a national action plan that sets out the roadmap and benefits case for geospatial enablement of a nation.

The UN-IGIF is being written by experts across the World and is a partnership with the World Bank. Importantly, sustainability and the whole user community are considered in its approach. It is not just a



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



framework for low- and middle-income countries. In 2018, just months after Part 1 was endorsed, Ireland embraced it in developing Ordnance Survey Ireland’s strategy.

The UN-IGIF has a clear vision: ‘*The efficient use of geospatial information by all countries to effectively measure, monitor and achieve sustainable social, economic and environmental development – leaving no one behind*’ It also has a series of goals that lift the debate to national level.

For this paper, the UN-IGIF sets out 9 strategic pathways to guide governments towards implementing geospatial information management to deliver real social, environmental and economic benefit. These are shown in Figure 7. They are interconnected, hence the puzzle pieces. Part 2 of the UN-IGIF, in preparation during 2019, will look at each of these pathways in greater detail.

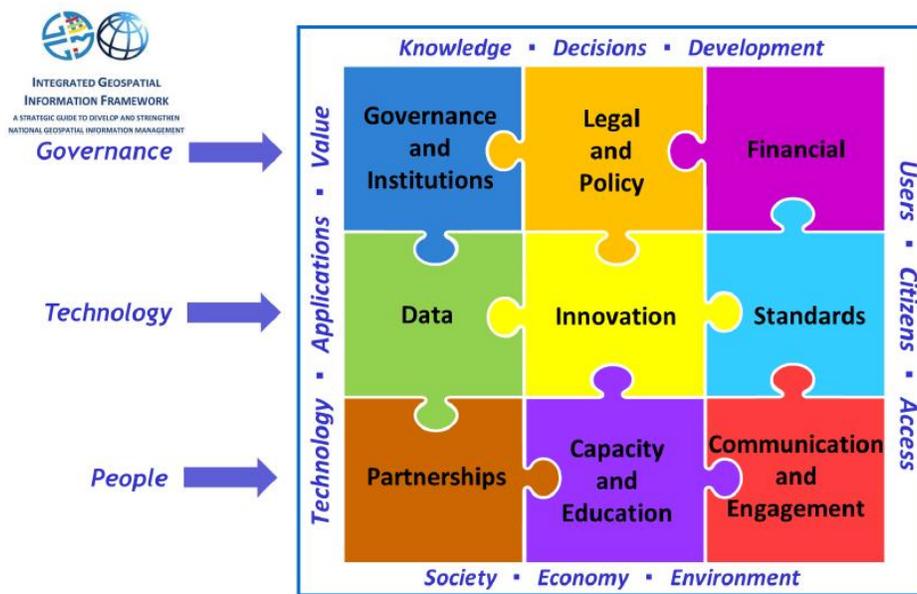


Figure 7. The UN-IGIF strategic pathways. (UN GGIM, 2018)

The remaining element of this paper examines some of the NMGA aspects of UN-IGIF. It is not holistic but rather demonstrates that the UN-IGIF is coherent with debate in previous papers and at the 2017 Cambridge Conference.

## DEVELOPING NATIONAL GEOSPATIAL AGENCIES FOR SUSTAINABLE DEVELOPMENT

Some NMGAs have not recognised the changing world, and most have found it difficult to deploy the winning arguments for investment. These NMGAs are now left facing the stark reality that the World is



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



moving on, that there are many geospatial players in government, business and civil society. It is no longer a simple customer/supplier relationship. Without change these agencies could become irrelevant.

On the contrary other agencies are becoming ever more important as the means to ensure trusted, fit for purpose, fundamental geospatial data is accessible to all, and that it is done so efficiently. Loss of relevance is linked to an inability to fulfil this function, and can also be linked to failing of political, fiscal and capacity investment over the decades. Now is the time to invest, to bring the benefits of geospatial enablement to the nation.

Transforming NMGAs from a ‘surveying and mapping’ focus to one of ‘delivering underpinning geospatial data to a nation’ is a challenge, a challenge that in UK has taken Ordnance Survey 30 years so far. It continues; Ordnance Survey now has a data office looking at how to derive more benefit from the data resources. The recent Ethiopian Government announcement that the Ethiopian Mapping Agency is being re-established as the Ethiopian Geospatial Information Agency shows that nations are rising to the challenge. But nations need data now if SDG achievement is to benefit from this data, and so 30 year, or even 10-year, sustainable transformation programmes can only be part of the answer.

The UN-IGIF draws on global experience and is designed to help all nations understand the potential benefits and make evidenced change.

## **Pathway 1: Governance and Institutions – NMGA leadership**

It is a truism that, without the drive of leadership, achieving the benefits of geospatial information at national scale is not possible. Equally, in any cross-Government enterprise, overcoming behavioural reluctance to share is often the real challenge. Leadership through example is needed. Experience shows that identifying and incubating those political and business leaders is important. With leadership then governance can follow to help build a ‘coalition of the willing’. This then leads to policies that have ‘buy in’. Others will follow.

In wider government, NMGAs can assist in integrating cross-government digital public services, helping realise their value in delivering SDGs. It is not enough to produce data; NMGAs need to be close to their customers and work to understand and solve their problems. In other words, start with national challenges and work back to the data, not vice-versa.

Development programmes funded by development banks and national aid can also set an example by insisting or encouraging that all collected data, particularly imagery, land use, infrastructure and cadastre, is shared. Passing the data to national mapping agencies to manage access builds capacity. It also requires programmes to include some capability enhancement at a NMGA to enable data management,



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



access and maintenance. For ODA donors, this ‘collect once use many’ approach also results in greater value from investment.

## **Legal and Policy – changing behaviours**

The digital economy is built upon data. Changing national culture to one of sharing is a behavior fundamentally alien to departments and businesses, almost globally. Policy might drive change, but often a law change is necessary (Europe’s Inspire for example). This change in behavior applies to all data; nations should not consider geospatial data in isolation. However, geospatial data has a different set of national security and personal data issues, that are often used to prevent widespread sharing. Policy can help unblock these issues, often based on experience from international partners.

Nations do have geospatial information and many different government departments, agencies and businesses are collecting or procuring similar data for similar purposes. Bringing focus to ‘make once, use many’ as a policy driver is efficient and effective. It covers a sharing (including open data) but also clarity on who produces what data and services. Engendering the sharing of existing data is essential, not only will it improve efficiency but suppliers will seek to improve the data.

Policy also needs to consider data theme priorities based on current and future government objectives. Whilst the UN has developed the concept of ‘fundamental national geospatial data themes’, nations need to adapt this to their stakeholder needs – for example a nation may decide its data should support national priorities in sustainability of natural resources, green energy, health, agriculture, pollution abatement and resilience and prioritise creation and maintenance accordingly. Conversely if the nation does not provide then internet retailers, car manufacturers, utilities and mobile network companies will create their own data, to the detriment of wider national benefit. Focusing on how geospatial solves government, business and citizen problems will lead to opportunities for agile data-centric NMGAs.

Volunteered Geographical Information and Citizen Science are creating ecosystems such as Open Street Map. Crowdsourcing requires different thinking about quality but has a valuable place in a nation. Likewise, EO and other new collection techniques bring more data into the mix. These both have clear benefit to a nation and policy can maximise benefits of these.

## **Financial – understanding benefits, reducing cost**



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



Many funded projects to address geospatial issues work at local level. These can be very successful, such as Rumani Huria in Tanzania, and provide pointers to the future. But until a nation takes a national approach, the benefits of a location approach to integration are only partially realised, SDGs only partially enabled and sustainability not possible. Ghana is taking this step, bringing the need for a new national basemap into its programme, with the Vice President championing.

Lack of finance is a major inhibitor. The UN-IGIF leads towards an action plan that demonstrates the value mapping agencies bring, and that action can be specified to demonstrate the incremental value in delivering SDGs. This socio-economic evidence is necessary and must be nation specific. But it does not tell the whole story.

In 2015 the OECD stated: *'Physical infrastructure such as roads and bridges enables benefits to 'spill over', for instance, by fostering trade and social exchanges. In the same way, greater access to data also has beneficial spill-overs, whereby data can be used and re-used to open up significant growth opportunities, or to generate benefits across society in ways that could not be foreseen when the data were created. But some of the spill-overs of data cannot be easily observed or quantified.... As a result, countries – and governments in particular – risk under-investing in data and data analytics and may end up giving access to data for a narrower range of uses than socially optimal. This risks undermining countries' capacity to innovate...'*

So, whilst the direct benefits of an infrastructure might be observable and measurable, and contribute to a business case, the spill-over benefits are not. The relative invisibility of these can lead Government to under-prioritise funding for the infrastructure. A paradigm shift is required: from government-funded data collection for its own purposes, to funding the facilitation of an ecosystem around an infrastructure.

Transforming a mapping agency into an effective geospatial agency is a long-term programme, a rolling programme not a 4-year project. Yet Governments will only invest if results can be seen in the short-term. This paradigm needs to be considered in the UN-IGIF Action Plan and a range of options considered:

- Governments finance a long-term 'in-house' capacity building approach, which may take a decade or longer to achieve, particularly developing the human capacity to meet technical capability.
- A technology solution through a project approach, with inherent project delivery and sustainability risks.
- A data collection project to provide useable data and services 'once off'.



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



- A partnership, managed service, approach that provides different components of capability and long term in partnership. This can bring ‘data today’, provide proven technology as a service and capacity building for tomorrow. This might be a combination of a funded project to collect data with a long-term contractual arrangement with a managed service partner, the latter potentially under a PPP.

Technology is reducing costs and will continue to do so. A solution procured in 2019 is unlikely to be cost effective in 2029. Conventional procurement may now be hampering nations deliver and use the geospatial information needed. Long-term partnerships with modular and nationally tailored managed services, potentially on the cloud, offer to enable nations to capitalise upon changing technology and user requirements. At the same time, they can reduce some of the more difficult skills requirements, particularly in IT and data science. They also open the door to alternative financing opportunities, such as PPP, and can be run alongside funded projects that deliver an initial set of fundamental geospatial data to a nation.

## Data

For geo-political reasons, NMGAs are often ‘the authority’ for certain data themes and datasets. This has benefits, for example in the philosophy ‘create once, use many’, but it also places a responsibility on them to deliver the fundamental geospatial data that underpins the Nation’s data infrastructure. But it is also a vicious circle, success breeds success and agencies delivering data will win arguments for new funding to transform. National mapping agencies must release data for wide use, no matter what quality or content, being honest about shortfalls and helping users understand how to use and benefit from the data.

NMGAs need to focus more on the user and their requirements over the next 10 years to deliver real value and their data must remain authoritative where necessary, trustworthy always and widely accessible. Data must be fit for purpose, and that purpose is evolving. The trend is towards increasing accuracy, frequent update, metadata and attribution, greater access and open standards. At national level, and thus particularly in pursuit of SDGs, national coverage is important although data specifications might vary between urban and rural as do the use cases. SDGs also point to maintained data; not least because measurement of progress is not possible if the very data has not changed over the period of measurement.

Slightly novel, but nations will want to capitalise on all geospatial data and services available, but which do they trust, which are fit for purpose? NMGAs may therefore become data brokers as well as collectors/managers. In so doing they can provide a level of assurance to users and add value through feature extraction, generalisation and integration services.



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



With 14 fundamental data themes, custodianship of data themes become important, with several agencies likely to be involved.

## **Innovation**

There is a growing need to deliver Geospatial Information and Services quicker, cheaper and to a wider range of technological platforms and people. ‘Leapfrogging’ the digital divide is unlikely without close partnerships and a long-term approach to procurement

New solutions, such as cloud based managed services and greater use of cheap, accurate remote sensing coupled with automated feature extraction, will enable nations to remove risk and increase resilience whilst remaining in control and building internal capacity.

Breakthroughs are happening all the time. High Altitude Pseudo-satellites (HAPS) linked with automated feature extraction and automated generalization could reduce the cost to developing nations of high-quality trusted and authoritative data by an order of magnitude.

Take the examples of data collection and Artificial Intelligence (AI). Couple HAPS, automated feature extraction and crowd sourcing with AI techniques to improve outcomes, and the unaffordable can be affordable, and maintained. Many of these emerging technologies, such as a cloud technology approach, are sensibly realised at national level; Bahrain only this year declared that it will move government onto the cloud.

UN Geospatial Future Trends is another casualty of the rapidly changing environment. Published by the UN in 2012, UN-GGIM Future Trends (UN GGIM, 2015) carries global ‘authority’ and is used by nations for strategy development, emerging markets insight and resource evidence. It was revised in 2015 and a new version will complement UN-IGIF, with publication intended in April 2019.

## **Standards**

No matter who is producing, maintaining or the custodian for fundamental geospatial data, geospatial and location datasets must be interoperable as data and with applications. Open geospatial standards are increasingly providing the means to achieve this and should be adopted where possible. However, NMGAs are not always confident in use of these standards. The involvement of NMGA standards staff in international standards bodies helps overcome this whilst ensuring that standards take all nations needs into account. This in turn enables NMGAs to take a leading role in UN-IGIF and NSDI implementation.

## **Partnerships**



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



This paper has frequently mentioned partnerships. This is a key step, and a major addition to previous thinking. The digital and geospatial divides are often too great for nations to overcome unilaterally.

Partnerships by NMGAs can take many forms;

- Internal to the nation, normally with Government departments through MOUs, a Government-wide governance process or, as in Great Britain's case, through a single public sector agreement with Government.
- With funding organisations.
- With private sector partners, local or international.
- Customers. It is no longer enough to produce data and services; NMGAs need to be close to their customers and work to understand and solve their problems.
- With international bodies such as the UN,
- With practicing NMGAs from other nations, who may additionally be considered a private sector partner, but with the added benefit of understanding the practical issues of being a sustainable NMGA.
- Universities, academia and industry innovation facilities.

Given that winning support for transformation requires stakeholder support, these partnerships need to be formed by an NMGA early in the transformation journey.

## **Capacity and Education**

People – whether in NMGAs, businesses, government or are innovators – need the understanding, skills and environment to deliver benefits. For NMGAs skills requirements are changing, rapidly. Skills span from traditional survey skills into GIS skills, data scientists, software developers.

Training NMGA staff, surveyors, data scientists, database managers, cyber security professionals, GIS operators etc. takes time and is expensive. Such individuals can be in short supply, and governments often lose such experienced professionals to the private sector. This is a real problem in low and middle income nations and can hold back NMGA development. It is another reason where alternatives, such as a managed services partnership for aspects of delivery may be beneficial. NMGAs can work with professional associations and Ministries of Education to promote the need for a suitable education pipeline. Diversity in our industry is sadly also a major issue, and NMGAs can and should be proactive in recruiting from a wide pool.

More widely, populations are increasingly using geospatial data without realising it – Uber and Google being obvious examples. Some education systems are recognising that there is an education component,



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



using geospatial tools to help with school and University projects for example, and in some countries, national curricula mandate this. NMGAs can encourage this, and make their data available.

Looking to government and business, NMGAs can help users gain more value through running cross-cutting workshops and masterclasses, both for government and business users, aimed at helping customers gain more value from geospatial data. Some of these could focus on particular SDGs and bring relevant ministries and businesses together to solve cross-cutting issues using a geospatial approach and data from the ministries concerned. The World Bank delivered just such a programme in Tanzania in 2017/18 with Ordnance Survey.

Innovation. Businesses grow economies and create jobs, and in many developing countries governments prioritise diversification and private sector job creation. Helping grow new geospatial businesses is therefore in the interests of governments and their NMGAs. Two UK examples have wider relevance, ‘geovation challenges’ and a geospatial innovation incubator, the Geovation Hub. The latter is led by Ordnance Survey, supported by HM Land Registry and several other ‘big’ businesses and the Open Geospatial Consortium. It provides a real opportunity for entrepreneurs to develop ideas and then, if they have real value, and helps in finding funding, including venture capital.

## **Communication and Engagement**

People drive change. Educating decision makers, at all levels, in the benefits they can gain from geospatial capabilities, is a challenge.

The increasing reliance on location, from delivery of SDGs to the internet of things, is an opportunity. Managing the fundamental geospatial data layer, fit for purpose, maintained and trusted, underpins the integration of all spatial data and allows better decisions and efficient delivery and operations.

To be relevant, NMGAs and their partners must be the ‘go to’ authorities for trusted fundamental geospatial data. But many NMGAs are significantly under-invested for today’s data challenge, and so arguments need to be built that open doors to investment, whether capital, operational or human.

Communication is essential to winning funding. Ask a layman ‘should we invest in a ‘national spatial data infrastructure’ or three new hospitals and it is obvious what they will answer. We instill an element of separation through the terms like ‘spatial data’. We should be shielding the complexity from the user and talking about achieving government priorities.

The UK Government’s Chief scientific advisor expressed the problem bluntly: Maps matter – It’s not enough to know they are important but WHY they are important. The local appropriation of simple, practical and tangible use cases is therefore essential - a universal approach is neither desired nor



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



appropriate, with cultural and infrastructural variations as crucial considerations. Understanding the political drivers of a government offers the opportunity to approach geospatial matters in an accessible way, presenting the relevance of NMGAs in advancing towards sustainable development. In Jamaica, factors contributing to susceptibility to hazards include a lack of adherence to building codes and development in high risk areas. Reliable and timely geospatial information linked to data from other government agencies is helping reduce disaster risk and save lives.

Benefit studies of geospatial enablement are largely of high-income nations, and tend to indicate 0.2% to 0.6% GDP uplift. There are very few studies of low and middle income nations. One exception is Albania, where work to understand the financial benefits of an SDI was reported at the World Bank Conference on Land and Poverty in 2017 (Anand, A et al).

There is, however, a shortfall in national-level data available to convince decision in low and middle income nations. The benefits demonstrated in this paper, and many others, only serve to ‘whet the appetite’. Hard financial arguments based on the needs of the individual nation are necessary. The ‘business case’ needs to include an evidenced ‘return on investment’ for the nation that shows demonstrable economic benefit, revenue benefit to government and the wider social benefits that are often difficult to place a dollar value upon. This is where the UN-IGIF is set to play its part.

## CONCLUSION

Delivering sustainable development requires trusted, sometimes authoritative, data. Amongst statistics and other data essential for national decision making sits fundamental geospatial data. This fundamental geospatial data coupled with a location-based approach to integration, services and problem solving is powerful. And it reaches to all elements of government, business and society.

Technology, learning, data sources and use of geospatial are all moving rapidly, leaving many nations standing-still; the so-called growing digital and geospatial divide. Many nations do not have the knowledge and evidence to win political and fiscal arguments for resource. The UN-IGIF is designed to assist and provides a window of opportunity for NMGAs to regain the initiative in nations.

Often the biggest hurdles to implementation are lack of understanding by decision makers and behavioural. New technologies will assist in reducing cost and improving outcomes, and improve the business case, but the UN-IGIF gives NMGAs and others an authority from which to make a case.

The need for large scale projects supported by funders remains relevant in delivering or enhance priority fundamental data themes datasets, and establishing necessary infrastructure and training. However, the authors believe that sustainable success requires a second component to transformation - long-term



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



partnerships. This may include cloud-based managed services for some elements of delivery, and certainly a transfer of practical experience at all levels, from CEO to technician, as challenges arise.

## REFERENCES

**Anand, A,** et al, (2017, March), Economic and Financial Analysis of National Spatial Data Infrastructure: An Albania Case Study, Annual World Bank Conference on Land and Poverty 2017 – Conference Paper

**Chopra, R,** (2016, June), ‘Urbanisation, Smart Cities, Slums and Geospatial Technology’, LinkedIn.

**Department for International Development,** (2013, September), Summary of DFID’s work in Rwanda 2011-2015.

**Kedar, J,** (2017, March) ‘Geospatial Information drives benefits beyond land administration – why aren’t we taking them?’ at 2017 World Bank Conference on Land and Poverty.

**Konecny, G,** Breitkopf, U, Radtke, A, Lee, K, (2016, April), The status of topographic mapping in the World a UNGGIM - ISPRS project 2012 – 2014.

**McCluskey, W et al,** (2017, March) The role of ICT in delivering efficient revenue collection in developing countries: The Tanzanian experience, World Bank Land and Property Conference 2017.

**OECD** (2015), ‘Data-Driven Innovation for Growth and Well-Being. What Implications for Governments and Businesses?’, Directorate for Science, Technology and Innovation Policy Note, October 2015.

<http://www.oecd.org/sti/ieconomy/PolicyNote-DDI.pdf>

**Ordnance Survey,** (2018), Response to the Geospatial Commission National Geospatial Strategy Call for Evidence.

**Scott, G,** (2016, March), ‘Positioning Geospatial Information to Address Global Challenges’, Annual World Bank Conference on Land and Poverty 2016 – Conference Paper

**UN GGIM,** (2018), Determination of global fundamental geospatial data themes,

[http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/E-C20-2018-7-Add\\_1-Global-fundamental-geospatial-data-themes.pdf](http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/E-C20-2018-7-Add_1-Global-fundamental-geospatial-data-themes.pdf)

**UN GGIM,** (2018), ‘Integrated Geospatial Information Framework’,

<http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Part%201-IGIF-Overarching-Strategic-Framework-24July2018.pdf>



# Catalyzing Innovation

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 25-29, 2019



**UN GGIM**, (2015), Future Trends in Geospatial Information Management: the five to ten year vision, [http://ggim.un.org/documents/UN-GGIM-Future-trends\\_Second%20edition.pdf](http://ggim.un.org/documents/UN-GGIM-Future-trends_Second%20edition.pdf)

**UN GGIM**, 'The Role of Geospatial Information in the Sustainable Development Goals' [www.ggim.un.org](http://www.ggim.un.org)

**UNSD and World Bank**, (2017, August), 'Roadmap for collaboration between world bank's global practice on social, urban and rural development, and resilience and united nations statistics division to assist countries to bridge geospatial digital divide', <http://ggim.un.org/meetings/GGIM-committee/7th-Session/documents/UNSD-GSURR%20Roadmap%20for%20Collaboration-July17.pdf>

**Worthy, K**, Kedar, J, Darvill, J, Giddings, V, (2018, March) 'Future National Geospatial Agencies: Shaping their contribution to society and the Sustainable Development Goals' at 2018 World Bank Conference on Land and Poverty.

## TABLE OF FIGURES

Figure 1: Good data underpins all aspects of delivering Sustainable Development Goals.

Figure 2: Relationship between Geospatial Data (in this case termed Geospatial Information by Ordnance Survey), Location data and Data. (Ordnance Survey, 2018).

Figure 3. United Nations Fundamental Geospatial Data Themes. (UN GGIM, 2018)

Figure 4: A 5G experiment in Bournemouth, UK, determined geospatial data requirements and algorithms necessary to efficiently deliver ubiquitous very high bandwidth connectivity to a city (Ordnance Survey, 2018)

Figure 5: Attributes of actionable fundamental data.

Figure 6: Demonstrating the relationship between data and the community, and the role of an enabling infrastructure.

Figure 7. The UN-IGIF strategic pathways. (UN GGIM, 2018)