A practical guide to preparing, implementing and ensuring sustainability of reforms to property rights registration systems.

Real Estate Registration and Cadastre

Practical Lessons and Experiences - Chapter 9. Land Information Services.

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Chapter 9　　Land Information Services

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The previous chapters have helped readers understand how to efficiently create and maintain land registration and cadastral data, how to build robust and sustainable ICT solutions to manage these data and to deliver land administration services to customers. However, this is not the end of the journey. Further significant value can be added by integrating these data into a wider and more comprehensive Land Information Service (LIS) to support the extraction of knowledge and insights. This will lead to more effective policy making, decision making and contribute significantly to achieving the Sustainable Development Goals. Chapter 9 explores how to achieve this challenge and deliver significant economic, societal and environmental benefits.

Context of Land Information Services

Land Administration agencies have traditionally been at the heart of initiatives to facilitate comprehensive LIS that provide interoperable information about all aspects of land and the marine environment to support an integrated approach to land management and ensure the sustainability of land and marine environment within a country. This will then drive evidence based policies and decision making and provide knowledge and insights and not just data.

Before describing the experiences of implementing LIS and associated land information infrastructures, it is worthwhile understanding the context and role of LIS in delivering good land governance and sustainable development.

Land governance is about the policies, processes and institutions by which land, property and natural resources are managed. The organisational structures for land governance and administration differ widely between countries and regions throughout the world and reflect the cultural and judicial setting of the country and jurisdiction. The judicial and institutional arrangements may change over time to better support implementation of land policies and good land governance. Within this country context, the land governance activities may be described by three components: Land Policies, Land Information Infrastructures and Land Administration Functions, in support of Sustainable Development as shown in Figure 9.1 below.
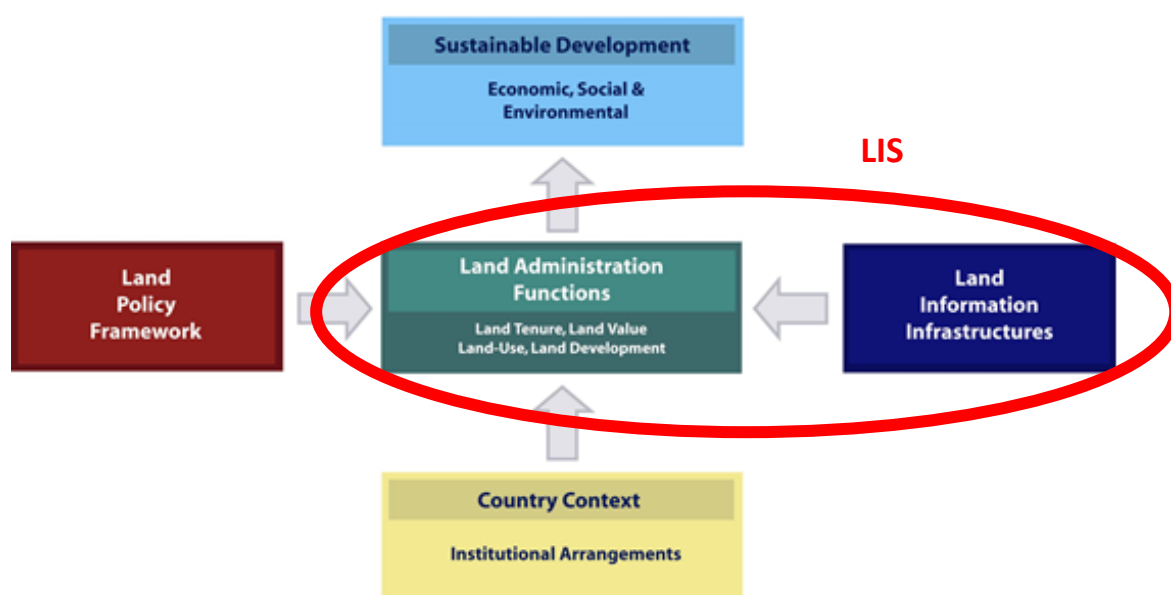

Figure 9.1: Land Governance and Administration (Enemark, 2004, Williamson et al. 2010)

Land policy is a part of the national policy on promoting objectives such as economic development, social justice and equity, and political stability. Land policies may be associated with: security of tenure; land transactions and access to credit; sustainable management and control of natural resources and the environment; the provision of land for the poor, youth, ethnic minorities and women; land use and physical planning; real property taxation; and measures to prevent land speculation and to manage land disputes. Although a National Land Policy should ideally be established before embarking on the definition and implementation of a LIS, a more pragmatic approach is to incrementally create the National Land Policy over time.

Sound land governance requires a legal and regulatory framework, operational processes and capacity to implement policies consistently within a jurisdiction or country in sustainable ways. In this regard, land administration systems and associated LIS provide a country with an infrastructure for implementing land policies and land management strategies in support of sustainable development. The operational component of the land governance concept is then the range of land administration functions, delivered through LIS, that include the areas of: land tenure (securing and transferring rights in land and natural resources); land value (valuation and taxation of land and properties); land use (planning and control of the use of land and natural resources); and land development (implementing utilities, infrastructure, construction works, and urban and rural developments).

These functions interact to deliver overall policy objectives, and they are fundamentally facilitated by access to the appropriate land related data and services – normally called Land Information Services (LIS). LIS require access to a comprehensive land information infrastructure on the built and natural environment that are integral parts of a National Spatial Data Infrastructure (NSDI). More recently (2018) the United Nations – Global Geographic Information Management (UN-GGIM) initiative has created an Integrated Geospatial Information Framework (IGIF) that is being used as a framework to implement NSDIs.

This chapter focuses on experiences in designing and implementing LIS and the underlying land information infrastructure. LIS are complex and particularly difficult to implement due to the wide range of interoperable land information required, and the diverse set of stakeholders involved in creating and managing the land information. Many LIS initiatives have failed by being too ambitious in the early implementation phases, not adopting a sustainable business model and not having sufficient political support to mandate data standards and to build effective partnerships across the public and private sectors.

The LIS Origins

In 1977 the city of Basel in Switzerland had a vision of a digital mapping IT system to manage their cadastral and land registration data and to link it to their mainframe computer managing their valuation data. The solution would also have a surveying module to support the maintenance of the data through cadastral surveying. A Scottish company, Ferranti-Cetec Ltd, won the contract and delivered the world's first LIS. The solution, Cadastral and Land Use Management Information System (CLUMIS), was also subsequently delivered to the city of Munich, in Germany. The Author was one of the software programmers on this project using DEC PDP/11 computers and the assembler programming language. Unfortunately, the company migrated to focus on CAD / CAM rather than LIS and Scotland missed out on a global Geographic Information System (GIS) corporation!

In 1979 Prof. Peter Dale published an article in the Survey Review on "A Systems View of the Cadastre" linking the ownership, value and use of land to conditions within the physical, economic and social environment. It was a bit ahead of its times and it took a decade before cadastral people began to see the bigger picture. But the article was considered the trigger for all further work on land information. The vision of a National Land Information Service (NLIS) for the UK was first conceptualised by Peter at the AutoCarto London conference in 1986. This envisaged fast and easy access to an authoritative,

accurate and comprehensive record of all land and property in the UK. We are still waiting for the solution! The LIService of LIS emphasised that LIS were focused on delivering high quality services rather than more generic GISystems.

Across the Atlantic in Canada, parallel LIS visions were emerging…..

Dr John McLaughlin of the University of New Brunswick developed the Multi-Purpose Cadastre concept as part of his 1975 PhD thesis at University of Wisconsin, "The Nature, Design and Development of Multipurpose Cadastres". Then in the early 1980s, the Multi-Purpose Cadastre concept was further developed by John through working with a group of academics who came to New Brunswick from afar and combined European traditions and standards with North American advanced technology. This initiative was also helped by a group of revolutionaries in Canada eager to re-engineer some very dated, almost Dickensian institutions. The Multi-Purpose Cadastre concept received a lot of traction courtesy of the US National Academy of Sciences and John's ideas continued to evolve and morph into the larger concept of land information management and LIS. This concept and its components were also heavily influenced and refined by programs and individuals across the EU, North America, Australia and New Zealand, with the cultivation of international networks and friendships leading to an important FIG Commission III International Symposium on "The Decision Maker and Land Information Systems" held in Edmonton, Canada in 1984. In 1985, at the CASLE Conference in Kuala Lumpur, it was agreed that there was a need for a book on the subject and Peter Dale and John McLaughlin were approached to write 'Land Information Management'. The book appeared in 1988.

The Multi-Purpose Cadastre concept at the time related to large mainframe computers (coming out of the original databank ideas). However, distributed networks and new paradigms were emerging and research in New Brunswick and Tasmania (David Coleman, Peter Zwart, YC Lee and David Palmer) helped John to elaborate the NSDI concept. The NSDI concept was finally introduced by John as a keynote speaker at a national conference in Ottawa in 1991 (McLaughlin, John. "Towards a National Spatial Data Infrastructure." In *Proceedings of the Canadian Conference on GIS*. Ottawa). John therefore took our inward looking, technically oriented profession and mind-set to a new and much more meaningful place within society. Building on this concept, Service New Brunswick developed a very early and innovative LIS. This triggered the LIS era with early implementations in Australia and Canada providing the foundations for many subsequent National LIS worldwide.

Fast forward to 2018 and the United Nations – Global Geographic Information Management (UN-GGIM) endorsed an overarching strategic framework called an 'Integrated Geospatial Information Framework' (IGIF). This provides the overarching strategic messages and more expansive and integrated national framework, particularly focusing on policy perspectives and elements of geospatial information.
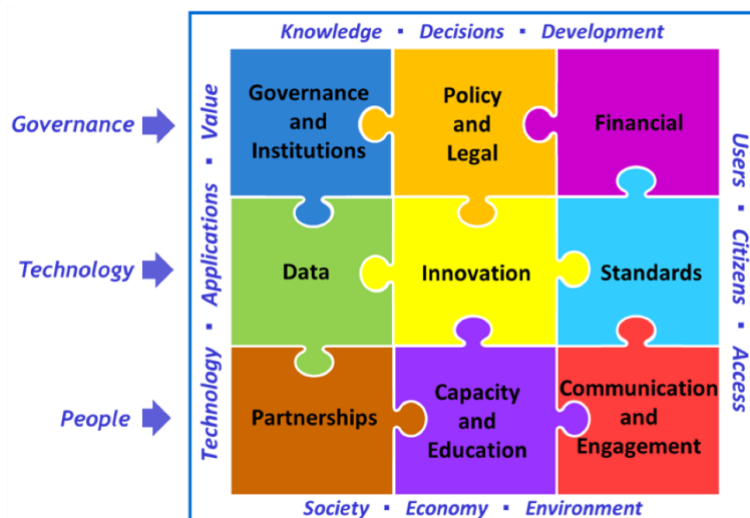

Figure 9.2: Integrated Geospatial Information Framework (UN-GGIM, 2018)

The IGIF is anchored by nine strategic pathways within three main areas of influence: governance; technology; and people. These nine strategic pathways seek to maximise the innovative and integral nature of geospatial information by making it available and accessible to governments, communities, businesses, academia, and civil societies. This provision serves to innovate, co-create and develop new products, services, and applications that deliver new knowledge for evidence-based policy and decision making.

The IGIF has a very ambitious set of objectives to provide "*a strategic guidance that enables country specific action plans to be prepared and implemented. The Framework aims to assist countries to move towards e-economies, e-service and e-commerce to improve services to citizens, build capacity for using geospatial technology, enhance informed government decision making processes, facilitate private sector development, take practical actions to achieve a digital transformation, and to bridge the geospatial digital divide in the implementation of national strategic priorities and the 2030 Agenda for Sustainable Development*".

This is the first of three separate, but connected, documents as illustrated below. The Implementation Guide is complete and was endorsed in 2020 and the Country-level Action Plans are works in progress and are being developed through case studies.
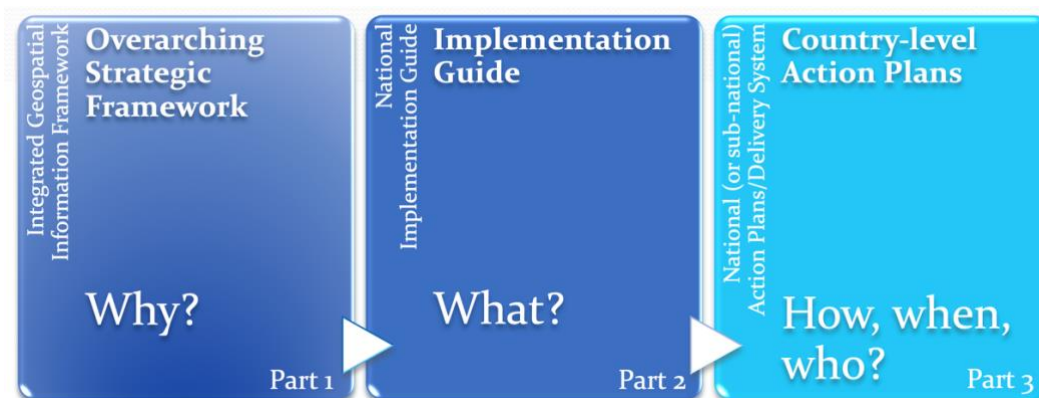
Figure 9.3: Suit of IGIF documents (UN-GGIM, 2018)

Land Administration is an integral component of UN-GGIM and there is a current initiative to link and integrate land administration with IGIF. The nine IGIF Strategic Pathways are also critical for good tenure governance. The UN-GGIM Working Group on Land Administration is developing a Framework for Effective Land Administration and builds on the SDGs, Voluntary Guidelines on Tenure and the IGIF. This uses the same nine IGIF strategic pathways and defines the importance of having all on place to make Land Administration work effectively. The concept due to be endorsed in 2021 is illustrated below:

Figure 9.4: Framework for Effective Land Administration (UN-GGIM, 2019)
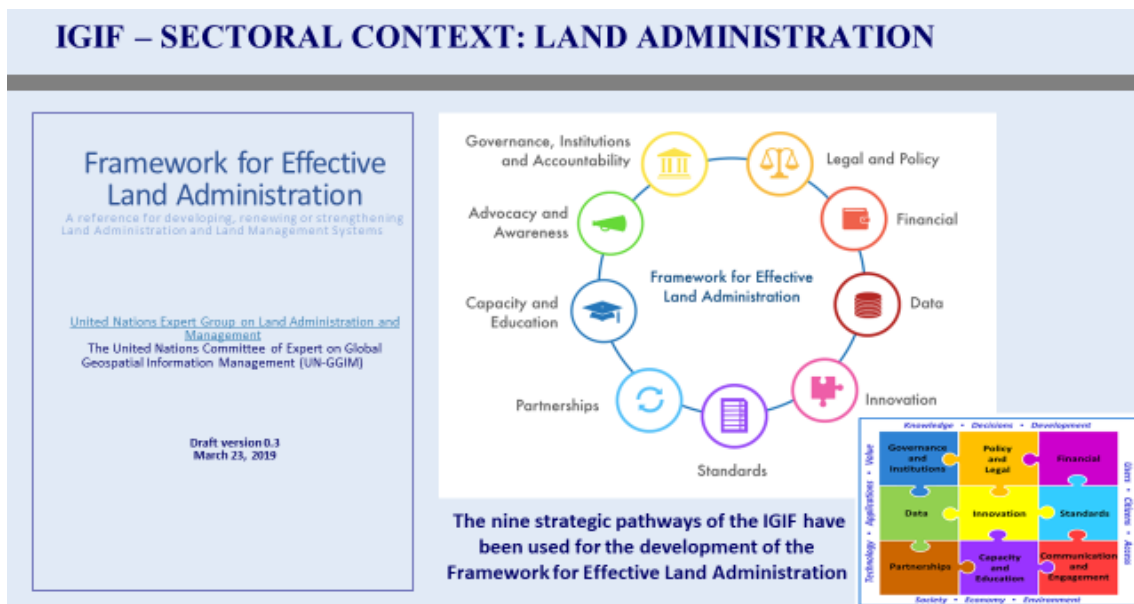
The LIS Drivers

There are two basic approaches that have been adopted in developing LIS. The most common approach simply creates land / geospatial data and hopes that the data will be used by the public and private sectors and information services will emerge. This approach is behind the EU directive on Infrastructure for Spatial Information in Europe (INSPIRE) (https://inspire.ec.europa.eu) with the majority of countries just producing dedicated websites to support the discovery and access of the land / geospatial data. The subsequent development of information services is ad hoc and not always successful.

The alternative approach is to drive the development of the data and services within the LIS to support priorities for government land policies. This much more focused approach generates greater political support and funding, raises the profile of the LIS initiative, is not too ambitious and is generally more successful and sustainable. This was the initial strategy adopted within the Canadian Geospatial Data Infrastructure where the initial focus was on supporting sustainable development and the environment, First Nation issues, public health, and public safety.

In Hungary in the early 1990s, the Author was technical advisor to the Government for the implementation of the PHARE[1] program in the land administration domain. The initial investment in the LIS was to internally manage the cadastral and land registration data of restituted properties across over 100 District Offices. However, to support the creation of a land market in Hungary, which was part of the EU accession requirements, it was decided to initially deliver information services to the financial services, to encourage the development of the mortgage market and build a land market. This was a highly successful, initial information service and led to many more being developed.

The World Bank helped a country in the Balkans to identify their priorities through investigating:

- The national economy to determine what sectors contribute most to the overall GDP of the country;

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[1]Created in 1989 as a pre-accession instrument financed by the European Union as the **Poland and Hungary: Assistance for Restructuring their Economies** (**PHARE**) program. It was later expanded to cover ten countries.

- The political agenda with government leaders to determine key policy objectives and the associated intervention framework;
- External influences, such as political, economic, social, technological, legislative and environmental, e.g. accession to the EU; and
- Existing business case approaches for national projects that have been prepared and appraised by decision makers.

Six priority sectors were identified for strategic investment in an Integrated Land Management program: Energy and Mining; Transport, Telecommunication, Infrastructure and Urban Waste; Tourism; Agriculture and Fisheries; Economic Zones; and Priority Development Areas.

In contrast, a country in the Middle East has prioritised the identification of government land for housing Internally Displaced People and some small island states have focused on mitigating climate change as their priority.

Selling the LIS concept within a country requires politicians and senior decision makers to be convinced of the benefits of the investment. However, land professionals normally use a very technical professional language that is quite different from political speak. Therefore, it is recommended that economists form part of the LIS team to conduct robust socio-economic analyses, create strong value propositions and use the appropriate language to convince decision makers.

Experiences in Implementing LIS

LIS Governance Arrangements

Strong and high level governance of LIS programs is key to success. As in project management methodologies, LIS programs need a Program Board, i.e. a National LIS Advisory Committee. The mandate of a National LIS Advisory Committee is to oversee the creation and maintenance of a complete and sustainable LIS. The committee's purpose will be to ensure that the LIS supports the needs of the country through coordinated and collaborative planning, sustainable business model and funding, sharing of resources and information, and endorsement and promotion from the work plans of key institutions. The committee should include representatives from key public sector agencies, the private sector, the academic sector and civil society.

To be inclusive, there is a tendency for these committees to be very large to engage with a large number of stakeholders. These large committees then become very unfocussed and inefficient. It is recommended that these high level committees are limited to less than ten stakeholders and representatives should be very senior with responsibilities for finance and resources within their organisations. The chair of the committee should be from a ministry / agency critical for the delivery of the LIS. In Denmark, this was the Ministry of Finance and this lead led to sustainable funding of the LIS program within government.

Over time, the services being developed for the LIS will change and this is an opportunity to change the composition of the high level committee.

Supporting the high level committee should be a series of Working Groups, focused on different aspects of the LIS, e.g. ICT, capacity development, communication, finance, data, etc.

A recent transition in governance arrangements has seen separate LIS / NSDI governance arrangements being merged into wider government arrangements, such as Government Digital Transformation strategies. This is a positive move as land / geospatial services are perceived as mainstream.

A key success factor in implementing a LIS is ensuring that the underlying data are fit-for-purpose, findable, accessible, interoperable (comply with agreed national standards), reusable and maintained. Only then can innovative land information services be built from a diverse set of land / geospatial data. Too often projects fail or are seriously delayed due to inadequate data or insufficient budgets to support data improvement programs.

In many projects, 75 per cent of the LIS budget relates to investments in data. A good example is in The Netherlands where an initial cost / benefit analysis was conducted in 2002 around the creation of six key registers: Register of Persons, Cadastral Register, Register of Companies, Register of Addresses, Register of Buildings and Register of Topography. Although the municipal personal records and the cadastre existed and only required small adaptations, the other registers required substantial investments. For example, the Register of Buildings was created from scratch and cost Central Government €48M and the Municipalities €84M. The total level of investment was estimated at around €446M (cash value prices 2002). The following significant quantifiable benefits were identified:

- Efficiency gain at the users' side through easy access: €149M
- Less fraud: €346M
- Efficiency gain information managers: €11M
- Efficiency gain citizens for submitting data only once: €73M
- Need for less acquisition of data: €1M
- New applications business sector: €11M

The total quantifiable benefits were €591M (cash value prices 2002). The analysis concerned a period of 20 years and the return on investment was 9 per cent, while the costs and benefits break even after 12 years.[2]

The financial model underlying the LIS initiatives must integrate the on-going costs of maintaining the data. Without this essential revenue for data maintenance, the currency of the data quickly erodes, and the value of the LIS rapidly diminishes as users confidence in the LIS is lost.

It is important to expose the data to the users of LIS as soon as possible so that feedback on the quality of the data can be harnessed to continually improve the quality of that data. Under the perfection mentality, often embraced by the surveying community, data have to be 'perfect' before they can be exposed for use. This approach significantly increases the cost of LIS programs and delays the launch of new services. Wherever possible, the Fit-For-Purpose approach to data should be adopted where a Minimum Viable Product is initially introduced to the market and then improved over time, when there is market demand.

One innovative way of improving the quality of data is through crowdsourcing with citizens. During the World Bank-funded land administration program in Ukraine, 16.8 million ownership documents (35 million pages) were scanned, indexed, data entered, verified and uploaded to a secure database environment in just five months. The agency was well aware that the quality of the data was limited and decided to expose these records to their customers openly via web services to crowdsource improvements to their records. An on-line service for reporting errors was created. During the first month of operation, 11,000 errors were reported, and 8,000 records were corrected. The feedback from customers provided the Agency with an insight into the types of errors prevalent within their records. For example, out of 88 errors reported, 56 were found to be similar. This led to the automatic correction of over 2,000 errors. Automatic tools for error identification, classification and correction were subsequently created.

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[2] Molen, P. van der (2005). Authentic Registers and Good Governance. Proceedings FIG-Working Week, Cairo, Egypt.

The Czech Republic cadastral agency has opened up a consultation with their customers where they can report errors in the data and provide proposed corrections. As part of this engagement, the agency has colour-coded the boundary points defining the parcels based on their accuracy, where green boundaries are high quality and red boundaries are poor quality. This quality classification has been achieved by combining the digital parcel boundaries with digital orthophotomaps to identify the level of discrepancies. Customers can then decide if they want to involve surveyors to upgrade the quality of their boundary definitions.

Remember that once you open the crowdsourcing door, you have to support the process well and the door can't be closed again! Otherwise, you will lose the trust and good will of the citizens.

High resolution satellite imagery is becoming pervasive and is opening up opportunities for new approaches to capturing and maintaining land parcel data. The combination of using AI based algorithms with satellite imagery is supporting the automatic extraction of parcel boundaries. Although in its infancy, the approach is proving successful and will hopefully accelerate the completion of security of tenure for those presently excluded.

Sharing Data

One of the basic premises of LIS is that land / geospatial data custodians will make their data interoperable, through the adoption of agreed standards, and share their data. However, this depends on trust amongst the LIS stakeholders and the adoption of a culture of sharing. This is not always guaranteed despite the appropriate legal frameworks and decrees. In one Middle Eastern country, the LIS program was stalled because the stakeholders did not trust each other and did not share any data despite a decree from Government. It is recommended that a LIS prototype / pilot be created early in the program to expose these non-technical issues that can be showstoppers.

There has always been considerable tension between institutions managing the land registration and cadastral data and institutions managing the fiscal cadastral data. The institutions should clearly share data, but too often they pursue their independent data collection solutions. This is still happening in some Balkan countries.

Key Registers Underlying LIS

Several countries, including Denmark, the Netherlands, Lithuania and New Zealand, have initiated and driven their LIS initiatives through the creation of what are termed 'Key Registers'. These interoperable registers include information about individuals, businesses, real properties, buildings and addresses, for example, and underpin a wide range of public services and business applications. The vision is that these data are to be the high-quality common foundation for public sector administration, efficiently updated at one place and used by everyone – including the private sector. Open data will benefit public sector efficiency as well as innovation and value creation by society in general. With basic data as a new digital raw material, commercial products can be developed, and public information and services can be improved, providing for greater insight and stronger democracy.

A good example of this implementation model in supporting key registers is in Denmark[3] where there is a long-established practice of public authorities registering various core information referred to there as "basic data". The potential to use such core information to drive efficiency in government was recognised relatively early. In 2002, one of the first initiatives to progress this agenda was the decision to make official Danish Address data "free of charge" at the point of delivery.

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[3] Summary paper available at https://eurogeographics.org/wp-content/uploads/2018/04/EGAR-2017-Denmark-GA.pdf

The European INSPIRE directive in 2007 provided fresh impetus to the Danish Government for widening this initiative in order to cover other basic information. There then followed an extended period during which standard EU-wide data specifications were developed and regulations to support INSPIRE written into national legislation.

By 2012, the Danish Ministry of Finance had taken the lead in pushing forward this "joined up" information agenda under its Basic Data for Everyone initiative (Danish Government and Danish Local Government, 2012). This report identified the potential of access to public data as being an important contribution towards modernising the public sector and its interactions with the public and businesses.

Even if basic data are made accessible for everyone, the public authorities will still have to spend resources on producing, maintaining and ensuring the quality of the data. This work will still have to be financed to ensure the continued availability of quality basic data. Therefore, the Government and Local Government Denmark have agreed to redistribute the costs of basic data, so that public authorities contribute to basic data via their allocation or block grant.

To support this investment, the government commissioned the creation of a business case[4] for the basic data initiative. This concluded that free access to good basic data for everyone is good business; for the public sector and for society in general. Once the initiatives have been fully implemented in 2020, revenues for society are expected to be approximately Danish Kroner DKK 800 million (US$ 94 million) annually. Private sector revenues will be up to DKK half a billion (US$58 million) annually, and it is expected that, for example, the real estate, insurance, financial, and telecom sectors, as well as GPS (sat-nav) manufacturers, public companies and entrepreneurs will be among those to benefit hugely from the initiatives. See figure below.
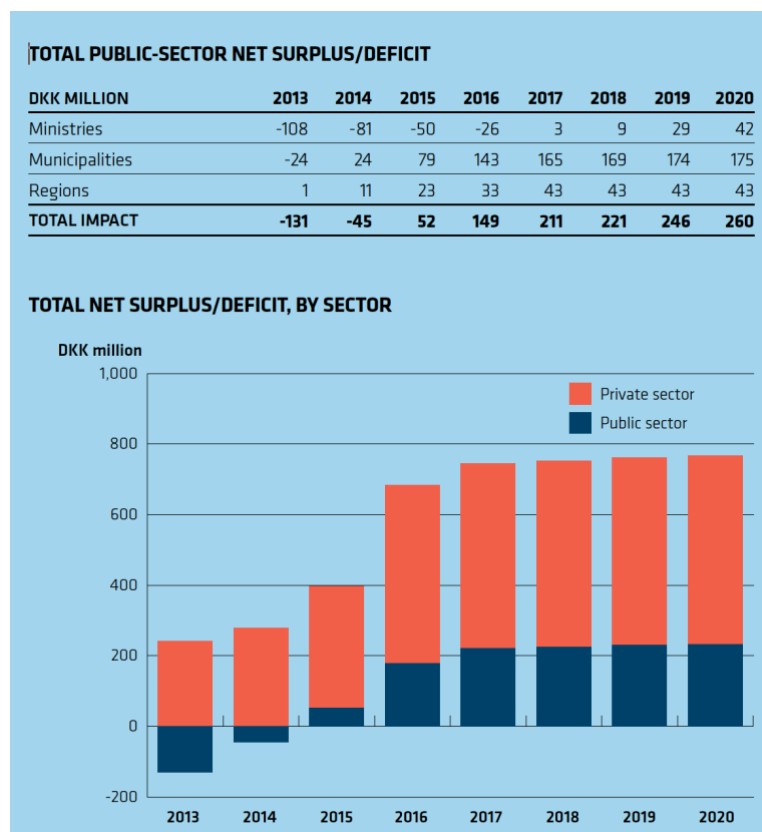
TOTAL PUBLIC-SECTOR NET SURPLUS/DEFICIT

DKK MILLION	2013	2014	2015	2016	2017	2018	2019	2020
Ministries	-108	-81	-50	-26	3	9	29	42
Municipalities	-24	24	79	143	165	169	174	175
Regions	1	11	23	33	43	43	43	43
TOTAL IMPACT	**-131**	**-45**	**52**	**149**	**211**	**221**	**246**	**260**

TOTAL NET SURPLUS/DEFICIT, BY SECTOR

Figure 9.5: Business Case - Basic Data for Everyone

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[4] https://en.digst.dk/media/14139/grunddata_uk_web_05102012_publication.pdf

Similar Key Register investments have been made by the Netherlands, Lithuania and New Zealand, for example, with similar success and benefits. New Zealand is Nº 1 in the World Bank *Doing Business* report for registering property. Registration is achieved in one day. Less, really, because it is all digital. All the 'searches' are done online and answers are available immediately - provided at minimal cost by the local government. Then the agreements are signed, lodged online and registered while you wait. All their records are digital and available.

Building Partnerships

Since no single organisation can build a LIS, collaborative efforts are essential for the success of any LIS initiative, and particularly so when the voluntary model, as opposed to the mandated model imposed by Governments, is adopted to implement the LIS. Cooperation and partnerships across different levels of the public sector and with the private sector are an important means at every stage of development for collecting, building, sharing, and maintaining geospatial information.

To support the formation of effective and productive partnerships, it is recommended that a set of guiding partnership principles is established and agreed across all the partners. A good example is the set of principles created to support partnerships within the Canadian Geospatial Data Infrastructure (CGDI) program (see Good Practice text box).

Good Practice
Canadian Geospatial Data Infrastructure (CGDI)

Principles for Data Partnership:

1. Data should be collected once, closest to the source and in the most efficient way possible.
2. Data should be as seamless as possible, with coordination across jurisdictions and boundaries when possible.
3. Data should be collected, processed and maintained according to international standards.
4. Partners should contribute equitably to the costs of collecting and managing the data and should be allowed to integrate the resulting information into their own databases and distribute it to their stakeholders.
5. There should be an attempt to harmonize terms and conditions for use where practical.
6. Partnerships between agencies should be simple and support the principles of the CGDI, open to the participation of interested stakeholders within any level of government, the education communities or the private sector.
7. A group or agency within each province and within the federal government should be designated to promote and coordinate the development of a common geospatial data infrastructure, both within its jurisdiction and between jurisdictions.
8. CGDI is national in scope and must meet the needs of a wide range of geospatial user communities, data producers and different areas of the private sector.
9. CGDI must consist of a set of coordinated and interrelated policies, practices and possibilities that build on the vision.
10. Agreements between agencies will normally be negotiated on a case-by-case bilateral or multilateral

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Sources of land information are increasingly being produced and integrated by the private sector. For example, Rightmove (www.rightmove.co.uk) in the UK supports users to easily find the areas that match their budget and needs. However, LIS are still perceived by many countries to be solely within the public sector's domain. There is a reluctance to open up public sector data to private sector partners through appropriate legal frameworks and partnership agreements to develop a diverse range of services for citizens and businesses. Countries are encouraged to adopt an open market arrangement to develop LIS.

Think Beyond Data to Services and Insights

Too often countries believe that by making land information discoverable and accessible that this is the end of their journey in delivering a LIS. A prime example of this thinking is the INSPIRE EU directive that has, over the past decade, mandated EU countries to deliver a wide range of geospatial data on dedicated websites. Rarely has this spatial information been subsequently used to deliver meaningful applications and services to policy makers, businesses and citizens – just delivering the data has ticked the EU box.

Designers of LIS should support the concept of applications / services that lead customers (citizens and professionals) through a business process and provide them with answers rather than expecting them to perform the analyses themselves using geospatial data. A great example an application to assess the potential of installing solar panels on buildings (http://www.uvek-gis.admin.ch/BFE/sonnendach/?lang=en) developed jointly by the Swiss Federal Energy Office, MeteoSwiss and swisstopo (National Mapping Agency). The user is unaware that the application makes extensive use of geospatial information, including Digital Elevation Models and 3D buildings data. It is the answer that the user is interested in. This the real value-add of LIS.

Data Driven Innovation through data science is accelerating the extraction of knowledge and insights from geospatial data. A good example is the Geovation (https://geovation.uk) initiative in the UK, where accelerator programs, community events and hands-on development resources help guide start-ups from initial vision to sustainable growth.

ICT Infrastructure

LIS depend on ICT infrastructure to provide an efficient, highly distributed network of information systems that are interoperable to access services – a services-oriented architecture. This ICT infrastructure is normally part of a common government wide infrastructure to support Digital Transformation. Representatives of the LIS program need to be represented on these government ICT infrastructure committees to ensure LIS specifications are being designed into the common infrastructure.

How to Finance a LIS

The range of approaches to financing LIS is very diverse. These variations are primarily influenced by fiscal policy, other policy frameworks and regulations imposed by governments, institutional arrangements and relationships, and the maturity of the geospatial information markets and associated suppliers of products and services.

National institutional arrangements play a significant role in shaping the approach to financing LIS. There are three types of mechanisms that normally underpin institutional arrangements:[5]

- In hierarchy-based institutional arrangements, patterns of interaction have two main drivers: authority, operationalised in administrative orders, rules and planning on the one hand, and dominance and authority as the basic control system on the other. This is typical of arrangements in Middle Eastern countries, for example.
- Market-based institutional arrangements are based on competition, bargaining and exchange between actors. The price mechanism, incentives and self-interest of actors steer activities of

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[5] National Institutional Arrangements: Instruments, Principles and Guidelines, UN-GGIM Working Group on National Institutional Arrangements, July 2017
http://ggim.un.org/ggim_20171012/docs/meetings/GGIM7/Agenda%207%20NIA%20Instruments,%20Principles%20and%20Guidelines.pdf

different actors by creating an 'invisible hand'. This more open market arrangement is operated in the UK to some degree, for example.

- Network-based institutional arrangements take the form of cooperation between actors, where inter-organisational relations are ruled by the acknowledgement of mutual interdependencies, trust and the responsibilities of each actor. A great example is the Norwegian cost sharing model.

At one extreme in financial approaches, some countries will require full cost recovery associated with operating the LIS. This will require a government department / agency to obtain revenue raised from license fees for access to geospatial products and services by the public and private sectors. The level of cost recovery demanded by governments also varies and, in these situations, central funding is used to finance the short fall of operational costs not covered by revenues from license fees.

The costs of implementing and operating the LIS is sometimes shared across public sector geospatial providers and user stakeholders. A good example of this shared financial model operates in Norway and is described below.

Although the level of revenues demanded from departments / agencies is being controlled and subsidised by government, the capability of raising revenues may well be limited by market demand, market competition and the level of added value that the government department / agency is allowed to provide though products and services. Some governments have a clear distinction between public good[6] data and value-added products and services to clearly differentiate between the remits of the public and private sectors.

Ironically, even though income from the licensing of data may be the most tangible result for a government department / agency, it may not overall be the most significant benefit, and the associated costs may hinder the wider use of data in government or by the private sector.

At the other end of the spectrum, some governments are adopting Open Government policies and improving access to public sector geospatial information. Under this policy, governments will centrally fund LIS and support data free for re-use since the resulting products and services support wider economic benefits to justify the approach. These Open Government initiatives normally have three main strands:

- **Open Data:** offering government data in a more useful format to enable citizens, the private sector and non-government organisations to leverage it in innovative and value-added ways;
- **Open Information:** proactively releasing information, including information on government activities, e.g. civil servant salaries and budgets, to citizens on an on-going basis to increase transparency; and
- **Open Dialogue:** giving citizens a stronger say in Government policies and priorities and expanding engagement through Web 2.0 technologies. For example, "It's Your Parliament" (www.itsyourparliament.eu) gives citizens a unique overview of the votes cast in the European Parliament. You can find and compare voting records of Members of the European Parliament and political groups, make your own comments and cast your own "votes".

The opening up of governmental data, free for re-use, has been justified on economic grounds since access to these data will have major benefits for citizens, businesses, and society and for the governments themselves. This public sector sourced data can include geospatial data, statistics, meteorological data, data from publicly funded research projects, and digitised books from libraries. Some of the benefits include:

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[6] A public good is a product that one individual can consume without reducing its availability to another individual, and from which no one is excluded. Economists refer to public goods as "non-rivalrous" and "nonexcludable." National defence, sewer systems, public parks and other basic societal goods can all be considered public goods

- **New businesses can be built on the back of this data**: data are an essential raw material and can be integrated into a wide range of new information products and services, which build on new possibilities to analyse and visualise data from different sources. Opportunities for re-use have multiplied in recent years as technological developments have spurred advances in data production as well as data analysis, processing, visualisation and exploitation. Facilitating re-use of this raw data will create jobs and thus stimulate growth;
- **Greater Transparency**: open data are a powerful instrument to increase transparency in public administration, improving the visibility of previously inaccessible information, informing citizens and business about policies, public spending and outcomes; and
- **Evidence-based policy making and administrative efficiency**: the availability of robust public data will lead to better evidence-based policy making at all levels of government, resulting in better public services.

Countries therefore have a wide variety of good practices in business models and financing arrangements to choose from across the world. However, the adopted model must be compatible with the government's fiscal and funding capabilities, not be too draconian to limit the wider use of geospatial data in government or by the private sector and be truly sustainable.

Norway – Cost Sharing Model[7]
Experience in Norway offers an excellent example of the impact of high-level political support, a long tradition of co-operation, and institutional adjustments on the business model adopted. The Norwegian Mapping Authority (NMA) obtains most of its revenue through central governmental funding, with only a small portion of revenue coming from sales; most data are free and open data. The funding model is stable and secures production and maintenance of many kinds of data, including physical infrastructure, hydrography, elevation, place names, cadastre, building registers, address register etc.

Geovekst is a 15 - 20-year-old joint funding regime in Norway for financing detailed, reference geospatial data where several stakeholders have agreed on long-term co-operation. National, regional and municipal public organisations and some public/private organisations, with given specific service and infrastructure responsibilities, cooperate by joint funding of geospatial data. This participation includes 422 municipalities, the NMA, road authorities, agriculture authorities and others. The actual share of investment from each party varies somewhat from one year to the next. This joint investment leads to cheaper data capture and management and more standardised data, resulting in better services to end users.

The joint funding focuses on the production and maintenance of accurate, reference geospatial data, such as large-scale topographical maps, cadastral parcels, buildings, transport network, other infrastructure, land cover data, orthophoto and height data from LiDAR acquisition. More than 95 per cent of all municipalities participate in the program, with only some major cities directly managing their geospatial information.

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[7] https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwip-fC8_I3fAhXIAsAKHSU5D4UQFjAAegQICBAC&url=https%3A%2F%2Fwww.conftool.com%2Flandandpoverty2018%2Findex.php%2F09-01-Lillethun-1069_paper.pdf%3Fpage%3DdownloadPaper%26filename%3D09-01-Lillethun-1069_paper.pdf%26form_id%3D1069%26form_version%3Dfinal&usg=AOvVaw1imdGGRhwtICFS6FtkGIxI
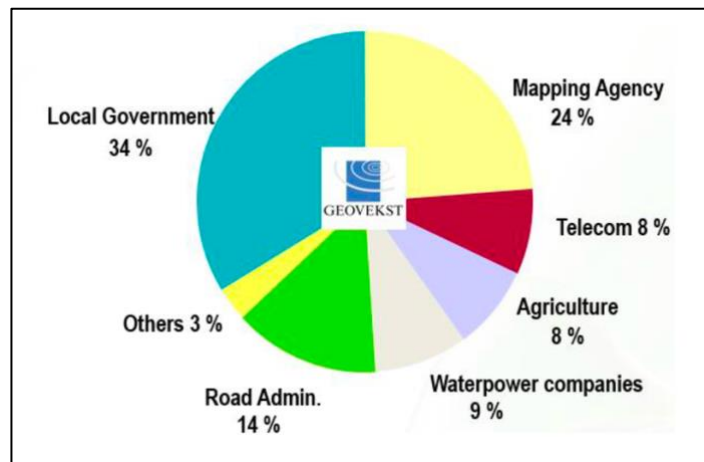
Figure 9.6: Geovekst Data Sharing Stakeholders

The Value Proposition

LIS can play an important role in improving productivity, supporting sustainable development and mitigating and managing the impact of natural disasters in both developed and developing countries. A key challenge for policy makers and program managers has been in evaluating the net benefits of policy change or investment in these solutions.

There are many methodologies[8] for evaluating the economic impact of policy change and/or investment in the field of geospatial information, but no single best practice solution has yet been identified. Benefit-cost analysis (and its variants) will continue to be essential for project-scale investments because it is widely understood and so offers a mechanism for comparison of heterogeneous investment choices.

The Strategic Pathway 3 Finance in the IGIF Implementation Guide provides an excellent description of the steps typically conducted to perform a socio-economic analysis to justify investments in LIS.

The socio-economic analysis identifies and defines the expected benefits. However, benefits realisation management needs to continue to monitor the delivery of the benefits during the LIS implementation. This requires a Monitoring and Evaluation Framework to be established prior to implementation to ensure that the corresponding strategy and action plan is delivering the Key Performance Indicators and the predicted benefits. Feedback from the benefits realisation monitoring process at key milestones will allow changes to the LIS program to be applied to optimise the benefits. These changes may, for example, abandon elements of the LIS since it is not delivering benefits, or accelerate elements since they are delivering greater than expected benefits.

At the end of the LIS implementation project or at key milestones, the delivered benefits will be evaluated to determine if the IGIF benefits have actually been realised. Benefits realisation management should be considered a business change process.

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[8] Economic and Financial Modelling of the Impact of Geospatial Information - Techniques and Results for land administration in developing Nations' https://www.conftool.com/landandpoverty2017/index.php/04-11-Smart-426_paper.pdf?page=downloadPaper&filename=04-11-Smart-426_paper.pdf&form_id=426&form_version=final

Determine Current State of Key Stakeholders

Before embarking on the transition to a LIS, it is essential that the stakeholders' organisations are baselined to establish their current land / geospatial data and information services maturity and capabilities. This will allow a clear action plan to be created that will support the transition.

The World Bank Group has established a methodology and corresponding analytical toolkit to support the use of the IGIF and incrementally create NSDIs customized to specific countries and priorities. The graphic below illustrates the sequence and relationship of these analytical tools used to arrive at the implementation of the NSDI. The symbology shows the analytical tools (in orange), key inputs (in blue), the IGIF in purple, outcomes (in green) and uses arrows to different types of information flows.
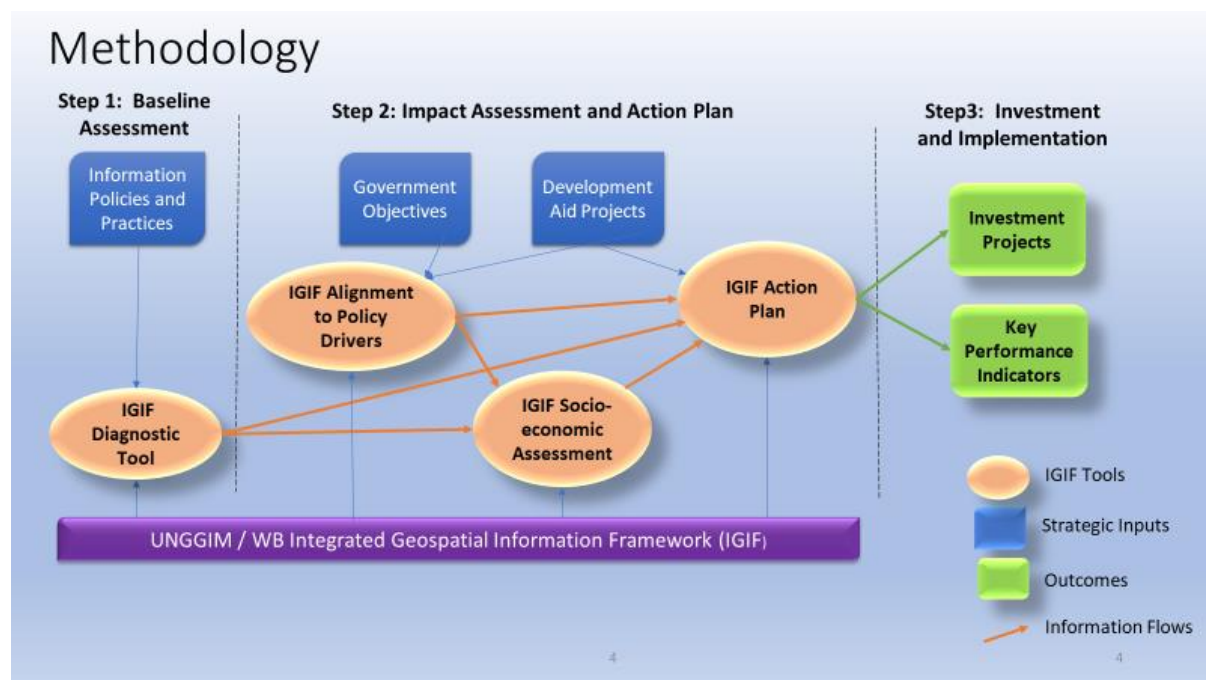

Figure 9.7: World Bank IGIF Implementation Methodology

The IGIF Diagnostic Tool package supports a standard measure and approach to assessing a country's NSDI readiness and geospatial-maturity, initially at national level.

Within the tool, a series of 99 questions have been defined and grouped into 9 main categories, aligned with the strategic pathways of the IGIF:

- Governance and Institutions (10)
- Policy and Legal (11)
- Financial (9)
- Data (14)
- Innovation (11)
- Standards (8)
- Partnerships (8)
- Capacity and Education (9)
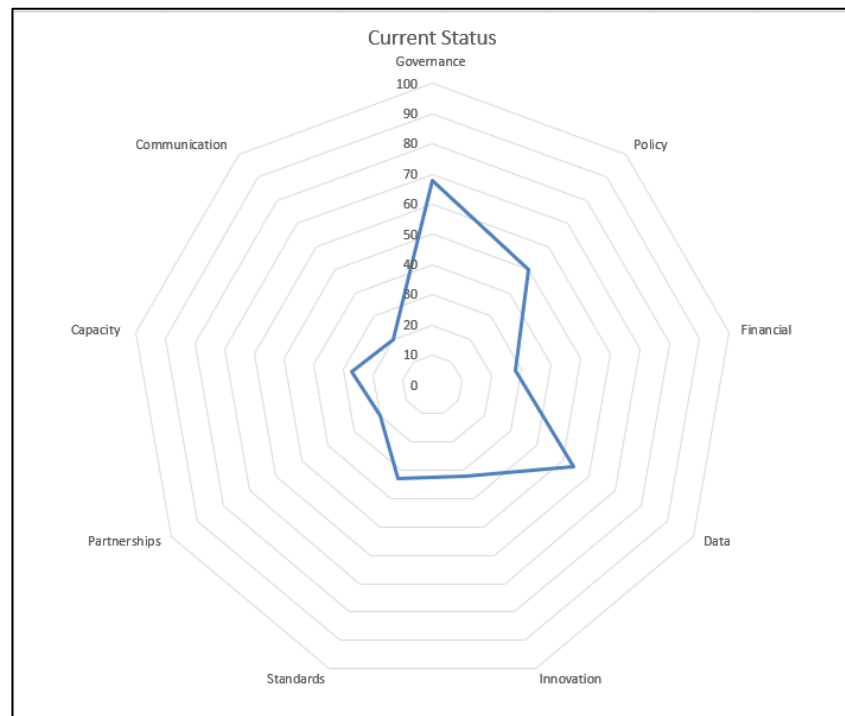- Communication and Engagement (9)

Figure 9.8: Example of Summary of IGIF Diagnostic Tool Results

The results (summarized in a diagram illustrated above) allow countries to identify missing or underperforming elements of their NSDI and to support the preparation of action plans with investment programs to maximize the benefits of this critical part of the information infrastructure. These action plans will also need to be informed by the results of the Alignment with Policy Drivers and Socio-Economic Impact Assessment tools.

Although this IGIF Diagnostic Tool is not specifically designed for a LIS, the majority of the diagnostics are directly related.

Capacity Development

Effective capacity development is fundamental to the success of LIS. Society must understand, through well-targeted communication campaigns that these information services are secure, can be trusted and can deliver significant benefits. Formal organisations, such as government agencies, private sector and community based organisations, need to ensure awareness and up-to-date skills of their members and staff. The largest change will be focused on the public sector where this may involve some institutional and organisational reforms. Governments need to implement capacity development measures across their land institutions.

Summary

Comprehensive Land Information Services (LIS) supported by interoperable information about all aspects of land and the marine environment provide services to support an integrated approach to land management and to ensure the sustainability of land and marine environment within a country. LIS drive evidence based policies and decision making and provide knowledge and insights - not just access to data.

The land information infrastructure on the built and natural environment is an integral subset of a National Spatial Data Infrastructure (NSDI). More recently (2018) the UN-GGIM initiative has coined

the term Integrated Geospatial Information Framework (IGIF) that will eventually replace the term NSDI. It should be noted that the UN-GGIM Working Group on Land Administration is developing a Framework for Effective Land Administration and builds on the SDGs, Voluntary Guidelines on Tenure and the IGIF.

There are two basic approaches that have been adopted in developing LIS. The most common approach simply creates land / geospatial data and hopes that the data will be used by the public and private sectors and that information services will emerge. The alternative approach is to drive the development of the data and services within the LIS to support priorities for government land policies. This much more focused approach generates greater political support and funding, raises the profile of the LIS initiative, is not too ambitious and is generally more successful and sustainable.

A recent transition in governance arrangements has seen separate LIS / NSDI governance arrangements being merged into wider government arrangement, such as Government Digital Transformation strategies. This is a positive move as land / geospatial services are perceived as mainstream.

A key success factor in implementing a LIS is ensuring that the underlying data are fit-for-purpose, findable, accessible, interoperable (comply with agreed national standards), reusable and maintained. Only then can innovative land information services be built from a diverse set of land / geospatial data. Too often projects fail or are seriously delayed due to inadequate data or insufficient budgets to support data improvement programs.

It is important to expose the data to the users of LIS as soon as possible so that feedback on the quality of the data can be harnessed to continually improve the quality of that data. Under the perfection mentality, often embraced by the surveying community, data have to be 'perfect' before they can be exposed for use. This approach significantly increases the cost of LIS programs and delays the launch of new services. Wherever possible, the Fit-For-Purpose approach to data should be adopted, where a Minimum Viable Product is initially introduced to the market and then improved over time, when there is market demand.

One of the basic premises of LIS is that land / geospatial data custodians will make their data interoperable, through the adoption of agreed standards, and share their data. However, this depends on trust amongst the LIS stakeholders and the adoption of a culture of sharing. This is not always guaranteed despite the appropriate legal frameworks and decrees.

Several countries have initiated and driven their LIS initiatives through the creation of what are termed 'Key Registers'. These interoperable registers include information about individuals, businesses, real properties, buildings and addresses, for example, and underpin a wide range of public services and business applications. These have been very successful and delivered significant benefits.

Since no single organisation can build a LIS, collaborative efforts are essential for the success of any LIS initiative. To support the formation of effective and productive partnerships, it is recommended that a set of guiding partnership principles is established and agreed across all the partners.

Designers of LIS should support the concept of applications / services that lead customers (citizens and professionals) through a business process and provide them with answers rather than expecting them to perform the analyses themselves using geospatial data.

Countries have a wide variety of good practices in business models and financing arrangements to choose from across the world, including the open data model. However, the adopted model must be compatible with the government's fiscal and funding capabilities, not be too draconian so that it limits the wider use of geospatial data in government or by the private sector, and be truly sustainable.

Selling the LIS concept within a country requires politicians and senior decision makers to be convinced of the benefits of the investment. However, land professionals normally use a very technical professional language that is quite different from political speak. Therefore, it is recommended that economists form part of the LIS team to conduct robust socio-economic analyses, create strong value propositions and use the appropriate language to convince decision makers.

Effective capacity development is fundamental to the success of LIS. The largest change will be focused on the public sector where this may involve some institutional and organisational reforms. Governments need to implement capacity development measures across their land institutions.