Developing a Framework for National Institutional Arrangements in Geospatial Information Management

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Strong national institutional arrangements in geospatial information management are essential for successful implementation of the Sustainable Development Goals. This chapter presents a comprehensive framework based on a set of core instruments that has been developed to assist stakeholders. Examples of good practices in member states were collected for each instrument, enabling stakeholders to apply the framework in their decision making processes.

9.1 Introduction

The strategic importance of national institutional arrangements in geospatial information management was recognized by the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) at its third session in July 2013 when it identified the need for countries to examine institutional arrangements in geospatial information management, and thereby provide governments with options on how best to create national geospatial entities [12]. This need arose from earlier discussions at its second session in August 2012, when the Committee of Experts considered an inventory of issues that should be addressed in the coming years.

At its third session, the Committee of Experts further agreed that there was an urgent need to identify good practices related to national institutional arrangements for geospatial information management. A small Working Group

on National Institutional Arrangements (WG-NIA) was established to continue the work with Member States and regional and international entities. WG-NIA aims to examine national institutional arrangements (NIAs) that support geospatial information management. The output of the WG-NIA identifies good practices of institutional arrangements in Member States to provide national governments with principles and guidelines for institutionalizing geospatial information management. Relevant institutional arrangements contribute to the strengthening of geospatial information management taking into account (technological) issues related to digitalization, geo-referencing, standardization, fundamental geospatial datasets. Moreover, new aspects such as volunteered geographic information and open data are also taken into account.

At its fourth session in August 2014, the Committee of Experts reiterated the strategic importance of national institutional arrangements, noting that Member States are at different stages of geospatial development, and that institutional and policy frameworks are dependent on these legal, fiscal arrangements and governance models, which are quite different across the globe [13]. At this session the WG-NIA proposed the following definition for institutional arrangements: “National Institutional Arrangements (NIA) for Geospatial Information Management (GIM) may be defined as formal and informal cooperation structures that supports and links public and private institutions and/or organizations and which are used to establish the legal, organizational and productive frameworks to allow for sustainable management of geospatial information, inclusive of its creation, updating and dissemination, thereby providing an authoritative, reliable and sustainable geospatial information base for all users.”

At its fifth session in August 2015, the WG-NIA presented to the Committee of Experts an extensive analysis of the results of a set of questionnaires from Member States which provided evidence to the importance and complexity of national institutional arrangements, and which generated a valuable source of information to be used in the future [14]. The Committee, in its decisions, provided guidance on how the WG-NIA might evaluate the status of efforts on progress in national institutional arrangements, including providing additional clarity on the process and on the conclusions drafted.

At its sixth session in August 2016, the Committee of Experts recognized the complex and broad scope of the work that the WG-NIA was undertaking, noting that there is no single universal solution or model that fits all countries [15]. Reiterating the need to provide Member States with options on how best to create robust national geospatial institutional structures, the Committee encouraged the WG-NIA to continue its work and, in order to give the work greater focus, to report on its progress to the UN-GGIM Bureau prior to presenting it to the Committee at its next session.

Subsequent to the sixth session, the WG-NIA made presentations at two UN-GGIM regional meetings. Based on discussions coming out of these meetings and interventions from Member States representatives and the Bureau, it was agreed that the WG-NIA should focus on generic elements that provide

Member States with guidelines and principles with which to make decisions on their national institutional arrangements, and not delve into technical methods and detail.

The next step was the execution of a small project “To develop a framework and guidelines in support of national institutional arrangements in geospatial information management for Member States”. The purpose of this small project was to support the WG-NIA by evaluating the work done to date, package, develop and deliver outputs that will satisfy the objectives of the Committee of Experts under the agenda item “trends in national institutional arrangements in global geospatial information management.” The project was executed from the end of February until the beginning of June 2017. The results were presented by the chair of the Working Group and approved by the experts during the seventh session (August 2017) [16].

The approved framework consisting of NIA-instruments forms the foundation for the current WG-NIA activities focusing on the development of a Foundational Guide to NIA-instruments for Geospatial Information Management.

Before the development of the framework, key documents were reviewed, such as UN Economic and Social Council (2013; 2014; 2015; 2016) and WG-NIA meeting reports, and discussions with key persons of WG-NIA took place.

Important work has been carried out by WG-NIA providing a strong grounding in the mechanisms of many parts of national geospatial information management. For the purposes of supporting the WG-NIA's objectives, a method to better identify how various mechanisms combine to deliver effective geospatial information management was required. There was scope to consider those institutional arrangements related to setting direction(s) through prioritisation and decision making, and monitoring performance, compliance and progress against agreed-on direction and objectives. Consequently, strong case studies were welcomed so that a set of key examples of good practices of institutional arrangements in context could be identified.

The development of the NIA-framework would benefit from drawing from existing governance and/or institutionalization disciplinary expertise and literature dealing with relevant governance structures and business models. These generally provide frameworks for allocating tasks and resources and/or taking into account appropriate instruments for collaboration, regulation and/or market forces which extend to the various levels of government. Such frameworks also take into account the distribution of powers and responsibilities within the Member States (e.g. partnership building, legal frameworks, market regulations).

As a means to assist the WG-NIA and enable it to have a renewed and greater focus, it was strongly recommended to develop a relevant, specific and comprehensive framework for national institutional arrangements based on a set of core instruments, while taking into consideration that no single universal approach exists which fits all Member States of the United Nations. Such a framework needs to be able to logically generate generic elements

and/or improving on the national institutional arrangements. In this context, the challenge was to develop a framework that is simple and straightforward in design, so that the key examples of good practices are logically borne out of the application. Another final challenge was that the framework had to be able to simply aggregate the findings at a global level while remaining relevant for individual Member States. The framework developed forms the foundation for identifying key examples of good practices of institutional arrangements.

This chapter is divided in five sections. This introductory section 1 included the review of the achievements of WG-NIA. The next section 2 “Framework development” introduces the framework for national institutional arrangements based on a set of core NIA-instruments followed by section 3 “Framework application” in which the followed application approach is presented. Section 4 ‘Key examples’ presents the descriptions of key examples of good NIA-instrument practices. The reports ends with a short section presenting the main lessons learnt.

9.2 Framework Development

9.2.1 Introduction

To assist the WG-NIA, the development of a relevant overarching framework for NIAs based on a set of core instruments was recommended. While taking into consideration that no single universal approach exists which will fit all Member States of the United Nations, such a framework nonetheless needs to be able to generate generic elements that support delivery and/or improvement on current NIAs. There are two key challenges inherent to the development of a framework. First, the design should be simple and straightforward to enable key examples of good practices to be logically borne out of the application. Second, to support the ability to aggregate elements to be applicable at a more global level while remaining relevant for individual Member States.

9.2.2 Concepts

In this context, institutionalization is considered to be a process of creating ‘appropriate’ routines that become habitualized or internalized as legitimate behavior, and institutional arrangements provide instruments that governments can use to facilitate this (policy) process within and/or between organizations or programs. Institutionalization here refers to formal and informal structures that aim to enhance, frame or regulate the voluntary or forced alignment of tasks and efforts of organizations in the pursuit of geospatial information management. These instruments are used to create greater coher-

ence and to reduce redundancy, lacunae and contradictions with and between policies, implementation or management [5].

Three mechanisms underpinning institutional arrangements (in the public sector) – with an emphasis on coordination – can be distinguished: hierarchies, markets and networks. Each of these mechanisms has something to contribute to understanding the causes of problems experienced in institutional arrangements, the gains to be achieved through institutional arrangements, and the mechanisms through which better institutional arrangements can be achieved. The distinction between hierarchies, markets and networks of institutional arrangements in social life is widely accepted [11].

In hierarchy-based institutional arrangements, patterns of interaction have two main drivers: authority, operationalized in administrative orders, rules and planning on the one hand, and dominance and authority as the basic control system on the other. 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 different actors by creating an ‘invisible hand’. Network-based institutional arrangements take the form of cooperation between actors, where inter-organizational relations are ruled by the acknowledgement of mutual interdependencies, trust and the responsibilities of each actor [5].

Each of these mechanisms illuminate different aspects of institutional arrangements, but each also has some important explanatory deficiencies. Although these mechanisms are introduced as alternatives to one another, in reality many attempts on the part of government to enhance institutional arrangements will involve more than one of these forms. Under certain circumstances, attempts to impose direct hierarchical control over an organization or set of organizations will work better if the institutional ‘arrangers’ can build a more cooperative network among the organizations involved or among lower-level employees in those organizations. On the other hand, attempts to embed institutional arrangements that are more bottom up will work better if hierarchy casts a deep, dark shadow on the participants. As well as providing an intellectual understanding of policy making and evaluation, these mechanisms are also closely related to a set of instruments that can be leveraged to deliver national institutional arrangements.

9.2.3 Instruments

The three mechanisms for institutional arrangements presented above are of a more general and abstract level. They refer to the basic processes which may underpin institutional arrangements (authority, price and competition or trust and solidarity) in a sustainability context. In turn, institutional arrangements rely on certain instruments, i.e. specific activities or structures, which may themselves refer to specific operational mechanisms.

Instruments can be either structural or managerial. Institutional arrangements may be realized by creating new or changing existing structures or

TABLE 9.1
Classification of NIA-instruments into structural and managerial instruments

Structural	Managerial
<ul style="list-style-type: none">- S1. Establishment of coordinating functions or entities- S2. Reshuffling division of competences- S3. Establishment of a legal framework- S4. Regulated markets- S5. Systems for information exchange and sharing- S6. Entities for collective decision-making- S7. Partnerships	<ul style="list-style-type: none">- M1. Strategic planning- M2. Financial management: input-oriented- M3. Financial management: performance-oriented- M4. Financial management: joined up working and cooperation- M5. Inter-organizational culture and knowledge management- M6. Capacity building

management forms within the government. Managerial instruments refer to procedures, incentives and values which plan, monitor and evaluate the use of resources (HRM, finance) or the implementation of policies. Relevant structural instruments in the context of NIA are: S1. Establishment of coordinating functions and entities, S2. Reshuffling of competencies, S3. Establishment of a legal framework, S4. Regulated markets, S5. Systems for information exchange and sharing, S6. Entities for collective decision-making, and S7. Partnerships. Relevant managerial instruments are: M1, Strategic planning, M2. Financial management: input-oriented, M3. Financial management: performance-oriented, M4. Financial management fostering joined up working and cooperation between public organizations, M5. Inter-organizational culture, knowledge management, and M6. Capacity building. [Table 9.1](#) presents the classification of NIA-instruments into structural and managerial instruments types. Each of these instrument will be briefly introduced below.

S1. Establishment of coordinating functions or entities. This structural NIA-instrument refers to the creation of influencing lines of control with the establishment of new functions or entities (e.g. coordination body) with clearly allocated roles, or responsibility tasks. In this context, a coordinator, respectively an individual or unit whose only or main function is to coordinate the geospatial information management activities of the different organizations in an inter-organizational system, and a lead organization which has besides its coordinating function, some operational line functions. The exact position of the coordinating entity vis-à-vis other organizations may determine to what extent hierarchical authority and power as resource is available. Most common coordinating functions or entities within the public sector imply some hierarchical difference between coordinator and the coordinated organizations. Moreover, their coordinating power is mostly stipulated and enforced by laws

and statutes. Their task is often to streamline, monitor and control the implementation of a centrally decided specific objective, goal or policy [5].

S2. Reshuffling of competencies. This structural NIA instrument contributes to new or changing structures and institutional forms in the context of the management of geospatial information. A well-known example is the reshuffling of competencies between ministries or departments in response to changing contextual pressures. NIA is enhanced by bringing related activities together by merging organizations or by separating them from other organizations with completely different activities. In addition, this instrument also takes into account the issue of (de)centralizing activities.

S3. Establishment of a legal framework. This structural NIA-instrument refers to the construction and adoption of a regulatory framework(s) for geospatial information management at different administrative levels and the associated legal conditions. Such a legal framework consists of a broad set of rules and regulations, aiming to organize a particular element in society (in this case the management of geospatial information). These rules and regulations are not necessarily developed specifically for a particular subject, but may have been created for other purposes in society and are now applied to the management of basic reference datasets. This can include legislation that deals with (digital) information, (open) data, standards or content, such as freedom of information, intellectual property rights or the protection of personal data. It can also involve legislation and policy with an even broader scope, such as tort liability and contract law, which apply to any kind of actor, situation or object falling within the field of application [6].

S4. Regulated markets. Another set of structural NIA instruments relates to the creation of regulated markets in order to create stimuli and sanctions that induce appropriate behavior by public organizations. The institutional arrangement of tasks and activities by different organizations is done through mechanisms of price and competition, offer and demand. Money and incentives are crucial. Providers of geospatial information are mainly funded through sales to their customers and purchasers, and their demand determines the activities of these providers. Such markets are generally created by government and, depending on the kind and number of users and providers, the kind and level of competition and the level of regulation, the market can be internal or external [5].

S5. Systems for information exchange and sharing. Applying the creation and maintenance of this structural NIA-instrument may induce organizations to take into account the actions of other organizations through processes of mutual adjustment. Through new or re-oriented flows and systems of information, decision-making organizations can be better informed about the latest developments and activities in line with those of organizations [9]. Through systems and arrangements for information exchange, information flows and exchange can be better organized. For example, the development of national geoportals as a key element of geospatial data infrastructures – which are web portals used to effectively find and access geospatial information and associ-

ated geospatial services (e.g. display, editing, analysis), are a good example of this instrument in the context of geospatial information management [3]. Information from various organizations can also be integrated in a government-wide information system, giving a strategic overview of government activities. The focus would be on both technical ICT systems as a basis for making information accessible as well as on the content of the information systems.

S6. Entities for collective decision-making. This structural NIA-instrument refers to entities that can make binding decisions [1] affecting multiple actors. Strategic decision-making boards are established consisting of senior officials of different organizations belonging to the policy domain of geospatial information management in order to collectively set out strategy and control the implementation of it. Such joint decision-making bodies enable joint planning and joint working more easily than weaker forms of cooperation.

S7. Partnerships. The most extreme form of cooperation is the creation of a partnership between two or more organizations leading to a common organization controlled by the different 'parent' organizations. This enables the achievement of which these organizations are collectively responsible for, or simply perform joint tasks. Applying this structural NIA-instrument obviously stimulates ownership and creativity, but also assumes substantial autonomy, a common vision, and sufficient goodwill and capacity at organizational level to make collaboration possible. Public partnership can take myriad forms, but can be broadly categorised into: government to government partnerships (G2G); government to business (G2B); and government to community or citizen (G2C).

M1. Strategic planning. This management NIA-instrument refers to the existence, implementation status and political support of strategy plans regarding geospatial information management in which activities of public organizations are aligned to a system of interconnected levels of plans, objectives and targets. NIA is fostered by giving individual organizations clear objectives and targets within a framework of broader inter-organizational or even government-wide goals. These different levels of plans are linked to one another to avoid duplication, gaps and to enhance the pursuit of overarching goals. These plans are monitored and evaluated, after which plans can be adjusted and fine-tuned.

M2. Financial management: input-oriented. This is the first NIA-instrument related to financial management system encompassing processes and instruments of budgeting, accounting and auditing. The set of instruments may entail budgetary guidelines, framework letters. Expenditure review committees, bilateral negotiations and conflict resolution processes, budgetary advice at the centre, formats, systems and provisions for accounting and audits [8, 5]. The hierarchical, input-oriented budget process defines clearly what resources related to geospatial information management should be spent on, and in great detail. There is not much autonomy for organizations to spend the budget as they see fit. Making savings are expressed as a multilateral demand, to which

all organizations have to comply. Through the budget, policy priorities are set and communicated downwards.

M3. Financial management: performance-oriented. This second financial management NIA-instrument is result-oriented, with a heavy emphasis on organizational incentives for performance. The focus of the management system is on providing incentives to organizational units to improve their performance. The budget is linked to the expected or past performance (price times quantity: $p \cdot Q$) of the organizations, and financial sanctions in case of underperformance are possible. Such budgeting is a pre-condition of creating (quasi)markets.

M4. Financial management fostering joined up working and cooperation. This third financial managerial instrument aims to join-up working and cooperation between public organizations. In such a perspective, the focus of the financial management system is on the consolidation of financial and performance information across organizations and policy fields. The emphasis is on information consolidation and exchange, new budget formats, geared towards horizontal policies (for example, outcome- or program-based budgets related to geospatial information management), as well as joined and exchangeable budgets in order to achieve cross-cutting objectives [9, 1, 5]. If organizational or individual incentives for collaboration are present in financial management systems, they are heavily geared towards joined-up activities and cooperation. Such financial management systems oriented towards collaboration will usually include great flexibilities for budget shifts between organizations and years, a limitation of input controls, as well as longer time-span.

M5. Inter-organizational culture and knowledge management. Another NIA-instrument relates more to human resources as an important resource. This managerial instrument aims to enhance institutional arrangements by fostering shared visions, values, norms and knowledge between organizations. As such, this set of NIA-instruments fosters the creation and growth of inter-organizational networks [7] and hence is predominantly linked to the network mechanism to institutional arrangement. This could be achieved by means of the development of cross-cutting skills among staff; common education or common training; management development; mobility of staff between organizations; and the creation of systems for inter-organizational career management [9]. The introduction of behavioral and ethical codes for relevant staff members may be another vehicle for creating and cultivating such common values and norms.

M6. Capacity building. Capacity building or development is defined by United Nations Development Program as the process by which individuals, organizations, institutions and societies develop abilities to perform functions, solve problems and set and achieve objectives [20]. Applied to the geospatial information management context, this means establishing effective strategies for capacity assessment, development, and promoting geospatial advocacy and awareness. For example, the development of a competency framework to articulate the skillsets and knowledge required to function in the geospatial

TABLE 9.2

Classification of NIA-instruments into structural and managerial instruments

Instruments	Hierarchy	Market	Network
Structural	S1. Establishment of coordinating functions or entities S2. Reshuffling division of competencies S3. Legal framework	S4. Regulated markets	S5. Systems for information exchange and sharing S6. Entities for collective decision-making S7. Partnerships
Managerial	M1. Strategic planning M2. Financial management: input-oriented	M3. Financial management: performance-oriented	M4. Financial management: joined up working and cooperation M5. Inter-organizational culture and knowledge management M6. Capacity building

industry could serve as a basis for capacity assessment and development. Facilitating education and skills training at all levels, from building basic awareness to the development of specialist skills could help to ensure a sustainable pipeline of talent for the geospatial information workforce.

The structural and managerial NIA instruments can be clustered into the underlying mechanisms allowing to guide the application of the key instruments for strengthening a specific NIA-mechanism (see [table 9.2](#)). The instruments clustered can be considered as complementary to each other and it is up to the decision-maker (and policy makers) which one and/or how to apply.

Being aware that no single universal NIA approach exists which will fit all Member States of the United Nations, it is important to note that some NIA-instruments may appear more relevant than others in a specific national context. It is up to the decision-makers (and policy makers) to decide which NIA-instrument is more relevant, feasible, efficient and/or effective.

9.3 Framework Application

9.3.1 Introduction

In order to apply the identified NIA-instruments in the context of geospatial information management, existing good practices in Member States were collected for each NIA-instrument and described in a standardized template. To better understand how these instruments can be used effectively to support geospatial information management in practice, examples of good practices of these instruments were sought mainly through WG-NIA members.

The notion of a ‘good’ practice is highly subjective: it is a consequence of any number of variables including political stability, resource commitment, effective governance and management structures, application of guiding principles for geospatial information management [19], etc. Therefore, instead of imposing a definition of what constitutes a ‘good’ practice of a national institutional arrangement, we have left the selection of examples up to the WG-NIA members (deemed as experts) and assumed that the reported practice represents an example of a ‘good’ practice because it demonstrates outputs or outcomes that facilitate geospatial information management in that country. A field in the standardized template for describing the good practices (‘Good Practice Motivation’) aims to provide justification to its selection for readers. All the completed templates were reviewed by the WG-NIA members as a validation process.

This contextual assessment implies that what might be a good practice for one country may not necessarily be transferable to another country. This underscores the UN-GGIM's initial statement that there will not be a one-size-fits-all solution. To overcome this specificity, section 5 will draw out key lessons based on the recurrence of these themes across the examples to develop generalized principles and guidelines.

The instruments of the overarching framework for NIAs are applied to Member States with geographical representations of the UN-GGIM's five regions (UN-GGIM Africa, UN-GGIM Americas, UN-GGIM Arab States UN-GGIM Asia-Pacific, UN-GGIM Europe) to present good practices for each NIA-instrument and to derive principles and guidelines from these practice presentations.

9.3.2 Application Approach

The structural and managerial instruments of the overarching framework for NIAs were applied to Member States to: 1) identify and describe good practice examples of institutional arrangements; and 2) elicit generic elements and lessons learnt, making partial use of the previous works executed by WG-NIA. In section 4 the key examples of each NIA-instrument are briefly presented.

The first steps in the identification of good practices for each type of NIA-

instrument were the intensive reviews of existing key source materials and documents, as well as provision of good practices by members of WG-NIA. The Key source materials used were:

- Detailed answers of two questionnaires executed by WG-NIA Task Groups (TG) 1, 2 and 3 (2015) [18]. Questionnaire 1 was a shared questionnaire of the three TGs (TG1: Geospatial Reference Information production systems analysis; TG2: Geospatial Reference Information (GRI) funding structures, dissemination systems and data policy models; TG3 Role of Volunteered Geographic Information). Questionnaire 2, from TG3, was on the Structure of Geospatial Management Organization (2015) [17].
- Documents stored in the UN-GGIM Knowledge Base with descriptions of National Spatial Data Infrastructures (2015-2016), examples of geospatial information laws/directives/regulatory practices (2015-2016), Case studies/best practices (2013-2014), country reports (2011-2016), and Country profiles (2014-2016).
- INSPIRE Member States Reports¹ (2010-2016) [10].
- INSPIRE State of Play reports² [2].

The objective of the application was to collect a minimum of three good practices for each type of NIA-instrument. The collection criteria were the following: 1) Relevance of the practice example clearly showcasing the meaning of the application of the NIA-instrument; 2) Availability of information from reliable sources (e.g. policy documents, official websites, documents stored in the UN-GGIM Knowledge Base, etc.); 3) Currency – practices older than 10 years were considered to be outdated except those that very clearly showcase the meaning of the instrument; 4) Geographical representation of all the good practices as per the UN-GGIM's five regions; 5) Submissions of good practices provided by members of WG-NIA.

The collected examples of good practices were mainly described by members of the WG-NIA. Some practice descriptions include contributions of representatives of UN Member States who had detailed knowledge about a specific good practice (Brazil, Canada, Chile, Ecuador, Slovenia, Sweden). In total, 61 key examples of good practices of NIA-instruments were identified and described of which twenty are from the UN-GGIM region Europe, sixteen from Asia-Pacific, seventeen from Americas, five from the Africa, and three from Arab States.

¹According to Article 21 of EU INSPIRE Directive, EU Member States shall send a report about the implementation progress of the directive every 3 years including issues related to institutional arrangements.

²These studies were executed by the Spatial Applications Division of KU Leuven on the status of national spatial data infrastructures across Europe. The studies began in 2002, and the reports were updated every year up to 2007. Further studies were carried out using the same approach in 2010 and 2011. These studies also referred to institutional arrangements of geospatial information management in the countries

The descriptions were based on a standardized template. This template was designed so that those who have an interest in good practices of NIA-instruments would find the content accessible and easily understood. The template contained the following topics: Title, Country, Type of NIA-instrument, Aim, NIA-instrument description, Background, Use, Good practice motivation, a visualization illustrating the NIA-instrument practice, and Reference. These topics together introduce a good practice of a specific NIA-instrument in one of the Member States. The applicability of the template was tested and approved by members of the WG-NIA.

9.4 Key Examples

9.4.1 Introduction

The instruments of the overarching framework for NIAs were applied for Member States to identify good practices of each type of NIA-instrument in Member States. This application was presented in the previous section 3.

The objective of this section 4 is to showcase key examples of good practices for each NIA-instrument. Based on the input of members of WG-NIA, a list of minimum three key practice examples per NIA-instrument was compiled reflecting the meaning and the applicability of each instrument.

9.4.2 Description of Key Practice Examples

Table 9.3 below presents an overview of all described key examples of good practices for each NIA-instrument as introduced in section 2 “Framework Development” followed by country and title of the good NIA-instrument practice. Annex 3 of the consultancy report [4] presents the full descriptions of all the collected key examples of good practices for each NIA-instrument. The descriptions are based on the standardized template as introduced in section 3 “Framework application”

TABLE 9.3: Overview of all described key examples of good practices for each NIA-instrument

NIA-Instrument	Country	Title
S1	Mexico	Coordination of the National Information System Statistical and Geographic
	New Zealand	A Clear Geospatial Governance Framework
	Panama	Coordinating structure of the National Spatial Data Infrastructure of Panama

S2	Spain	SIGPAC Coordination Board
	Belgium	Reshuffling of agencies in the Belgian region of Flanders
	Czech Republic	Governmental role clarification and the development of an SDI Coordination Structure
	Portugal	Reshuffling division of competences in the Portuguese Spatial Data Infrastructure within the broader governmental reform context
S3	Mexico	Legal Framework of the National Information System for Statistics and Geography
	The Netherlands	Legal Framework of the National Information System for Statistics and Geography
	Russia	Law on geodesy, cartography and spatial data
S4	Denmark	Open Standard Licensing
	Rwanda	Rwanda Open Data Policy
S4 + S5	United Kingdom	Open data platform data.gov.uk
S5	Canada	Federal Geospatial Platform
	Ecuador	Spatial data infrastructure facilitating emergency response in case of earthquakes
	France	National geoportal of the French administration
	Indonesia	Coordinating Data Sharing Through Indonesia's National Geospatial Information Networks
	Kenya	National land information management system
	Mexico	Digital Map of Mexico
	Morocco	Development of governmental geoportals
	New Zealand	LINZ Data Service
	Republic of Korea	Integrated Approach Towards Data Sharing through NIIS
	Rwanda	SpIDeRR: Spatial Information and Data Portal for Disaster Risk Reduction
	Singapore	Sharing Data, Delivering Services and Building Communities in GeoPlatforms

S6	Spain	Cadastral Electronic Site (SEC)
	Fiji	Fiji Geospatial Information Council
	Singapore	Joint decision-making committee with multiple Government agencies to drive geospatial development
	Slovenia	Slovenian coordination mechanism for infrastructure for spatial information
S7	Australia	Building National Datasets Through Intergovernmental Partnerships in PSMA Australia Limited
	Canada	Canadian Ocean Mapping Research and Educational Network (COMREN)
	Japan	GSI Maps Partner Network
	Mexico	National and international arrangement signed by INEGI
	Spain	Public Agreements of the Spanish National Plan for Land Observation (PNOT)
	Sweden	Data sharing model – The Swedish Geo-data Cooperation Agreement
Combined S1 S2 S3	Ghana	Land administration project and subsequent reforms of the National Institutional Arrangements
M1	Australia	The Consultative Approach of Australia’s 2026 Spatial Industry Transformation and Growth Agenda
	Brazil	Action Plan for the Implementation of INDE
	Denmark	Good Basic Data Everyone – A driver for growth and efficiency
	Former Yugoslav Republic of Macedonia	Strategy for National Spatial Data Infrastructure of the Former Yugoslav Republic of Macedonia
	Mexico	Programs of the National System of Statistical and Geographic Information (SNIEG or System)
	Namibia	Namibia National Spatial Data Infrastructure (NSDI): Strategy and Action plan 2015-2020
	Singapore	The Comprehensive Scope of the Singapore Geospatial Master Plan
	United Kingdom	Place matters: the Location Strategy for the United Kingdom

M2	Bahrein	Government Investment in Bahrein Spatial Data Infrastructure
	China	Financial investments in Chinese geospatial information Management
	India	NSDI Financial Strategy and Funding Models
	Mexico	Cadastral Modernization Program
M3	Germany	Automated performance procedure for German SDI Monitoring
	United Arab Emirates	Geomaturity Assessment of Abu Dhabi Spatial Data Infrastructure
	USA	Geospatial Maturity Assessment
M4	Australia/New Zealand	Australia and New Zealand Cooperative Research Centre for Spatial Information
	The Netherlands	Geonovum
	Norway	Digital Norway (NSDI) shared financing of basis geodata
M5	Canada	Federal Committee on Geomatics and Earth Observations (FCGEO) and Canadian Committee on Geomatics (CCOG) – Public Sector Geomatics Cooperation in Canada
	Canada	The Canadian Geomatics Community Roundtable and GeoAlliance Canada
	Japan	Enhanced cooperation among relevant stakeholders of geospatial information applications and services at local level
	Poland	Training cycle on INSPIRE Directive implementation
	USA	The COGO Report
M6	Brazil	Capacity Building in the National Spatial Data Infrastructure of Brazil (INDE)
	Chile	Regional training workshops for managing the National System on Territorial Information (SNIT)
	Singapore	Strengthening geospatial information capacity and the use of Geospatial Information, Science & Technology

In total, 61 key examples of good practices of NIA-instruments have been identified and described of which twenty are from the UN-GGIM region Eu-

rope, seventeen from Americas, sixteen from Asia-Pacific, five from the Africa, and three from Arab States.

Examples of good practices of NIA-instruments from 38 UN Member States were collected: Australia, Bahrain, Belgium, Brazil, Canada, Chile, China, Czech Republic, Denmark, Ecuador, Fiji, France, Germany, Ghana, India, Indonesia, Japan, Kenya, Republic of Korea, Former Yugoslav Republic of Macedonia, Mexico, Morocco, Namibia, New Zealand, The Netherlands, Norway, Panama, Poland, Portugal, Russia, Rwanda, Singapore, Slovenia, Spain, Sweden, United Arab Emirates, United Kingdom, and USA. These examples reflect practice across a range of UN Member States. More than one good practice is described for 13 UN Member States.

The collected examples demonstrate that some NIA instruments are fairly easy to identify and describe. This is seen in the diversity of practice applications for the structural NIA-instrument, S5. “Systems for information exchange and sharing”, and the managerial NIA-instrument, M1. “Strategic Planning”.

Conversely, it was difficult to obtain good practice examples of some NIA instruments such as S2. “Reshuffling division of competences” and M5.

“Inter-organizational culture and knowledge management”. This is not necessarily an indication of an absence of these practices, rather an absence of available information on these practices as NIA-instruments.

9.5 Lessons Learnt

Some lessons learnt can be derived from the collected examples.

Emergence of a common model. The examples show there exists an array of institutional strategies to achieve good geospatial information management, but there are also commonalities. These commonalities have been abstracted and are shown as a possible roadmap for institutional design in Figure 1. This should not be read as the ideal model for implementing the NIA instruments, but simply as a way to support a user's understanding of how to commence use and implementation of the instruments. This needs to be done with sensitivity to contextual variables in the country (e.g. sources of legitimacy for decision-making, resources, number of agencies involved, pre-existing inter-organizational relationships, etc.).

Figure 1. Proposed model of function and relationship of NIA instruments

Clear trends. Examples from Member States demonstrate some clear trends: that geospatial information is now considered a national asset; that the publishing and sharing of geospatial information has socioeconomic benefits and as such, is gaining characteristics of a public good; that this represents challenges in terms of operations and funding structures.

The need for an integrated change process. Governments are cog-

nizant of these emerging and/or established characteristics and are seeking to legislate to establish the appropriate facilitative governance structures. However, the examples also demonstrate that it often falls to managers to negotiate the operational challenges that these structural changes bring. Therefore, it is important that these NIA-instruments are considered in an integrated way as much as possible, and not perceived as a hierarchical change process.

The importance of a strategic plan. Many countries had an element of strategic planning, that was conducted as a first step to identify the vision, mission, aim and objectives of the geospatial information management initiative. This provided the direction for selecting the appropriate instrument for instigating a new structure. Whether this was more hierarchy- (S3) or networks-based (S7), is really a function of a contextual variables like where authority comes from, previous initiatives that may have worked or failed, resource flows, existing successful relationships, etc.

Catalysing institutional change. Legal frameworks were also often used to catalyse an institutional change process as it represents a coercive force and demands a mandatory shift in mental models and culture. Often the benefit of legislation is the provision of enforcement mechanisms to ensure that organisations comply with changes. However, the example from the Netherlands also shows that a consolidated legal framework is also a strategic mechanism that aligns the development, use and management of geospatial data with sustainable development principles – a strategy that can enhance the legitimacy for change.

The need for clarity. Regardless of the coordinating mechanism, it was apparent that in a multi-organisational, and multi-sectoral collaboration, clarity over who did what was necessary. This is reflected in the link to S2. S1 and S6 can be seen as potential outcomes of S2, and its operationalisation into a governance structure. For managers on the ground, the change trajectory marked by S1. Establishment of coordinating functions and entities, and S2. Reshuffling division of competencies needs to be considered carefully as this has implications for M5. Inter-organizational culture and knowledge management and M6. Capacity building.

Being open to ‘open’ data. It is strongly recommended that governments explore the possibilities of open data policies by making use of Creative Commons licenses as open standard licenses allowing providers of public sector (geospatial) data to publish their data without the need to develop and update custom licenses. However, issues related to accountability, transparency and sustainable financing need to be also taken into account. In order to have a strong regulated market, the main guideline is to establish a consistent pricing policy regarding the use of geospatial data and services.

Diverse business models. The three financial management NIA-instruments (M2. Input-oriented, M3. Performance-oriented, M4. Joined up working and cooperation) represent funding and business model options. Each have their own benefits and limitations, but it is evident that an initial injection of funds is necessary for getting an large-scale geospatial system up

and running. There is a growing tension between the cost of geospatial data production and maintenance and the diffused economic benefits that accrue from facilitating its use and reuse. Norway provides a good example of the use of obligatory co-financing of basic data to manage this financial tension.

The challenge of culture and capacity. NIA-instruments M5. Inter-organizational culture and knowledge management and M6. Capacity building can be difficult instruments to apply in practice. The normal approaches, as seen in the examples, tend to be trainings and workshops. While these should not be discounted, they do not necessarily translate to the types of culture change and capacity building that is required to sustain new ways of working. Singapore's example of multiple approaches at different demographics provides a good example of an approach.

Acknowledgements

This paper is the result of the consultancy 'To develop a framework and guidelines in support of national institutional arrangements on geospatial information management for Member States' for the United Nations Committee of Experts on Global Geospatial Information Management. The authors are grateful for all the support given by the Working Group members on 'Trends in National Institutional Arrangements in global geospatial information management'. Moreover, to all persons who kindly provided us key examples of each NIA-instrument. Without their support it would have been impossible to achieve this document.

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