The Development of NSDI - How to Start? The View on Number of Challenges and Solutions

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Key words: NSDI, Challenges, Governance, CSF's, Bridging Data Islands.

SUMMARY

The Paper discuss the possible strategy regarding the development and/or improvement of NSDI and related to it challenges.

It starts with **the need** for efficient and successful spatial data sharing within (e-)government concept and raises the question *"How to do it with help of NSDI?"* referring to EU INSPIRE Directive. Then, the conceptual model for sharing and integration of data via NSDI, and differences with e-Government is given.

After this introduction, the paper discusses the main NSDI challenges and provides some recommendations related to:
- **Data and integration of data** - indicating the 4 strategic principles for data integration,
- **(ICT) Systems and connectivity** challenges – discussing also the key thoughts for it,
- **NSDI Governance importance** - presenting a number of principles for it, like: Cooperation, Commitment, Ownership, Internal and External acceptance, Strategic & Business planning,
- Also, **a hidden fear of losing the ownership of data,** as observed mainly on the side of data Producers, caused by the crucial misunderstanding of the **difference between Data Exchange and Data Sharing,** when sharing/linking the data between various stakeholders occurs. This is usually the biggest mental barrier for successful NSDI acceptance and its implementation.
- **NSDI Technical concept** - The possible best contents/components like Data, Maps, Metadata, Discovery, View, Download & Sharing Service.

After that, the **CSF's for the NSDI Services** are presented, followed by the **Key Tasks** and necessary **Steps to be taken** for development of successful NSDI.

To conclude, based on international experience the expected **measurable outcomes/results** of NSDI are discussed, and an **example** demonstrating very strongly the **need for data sharing** the spatial data **via NSDI** on a specific geographic location in the Netherlands is given.

The paper ends with closing remark *"Are you ready for Bridging the Data Islands?"*.

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1. THE NEED TO SHARE AND INTEGRATE THE SPATIAL DATA

As it is very known in each country various Ministries and governmental agencies collecting, processing and maintaining the variety of spatial data to support their business processes. When we look then on it from the national perspective, we are discovering many so-called "Data Islands" (mostly by the Data Producers), and then if we analyse the content of the collected/stored data we discover very quickly that there is huge overlap of data collected and maintained between these agencies. It is obvious that this leads to multiplying the costs, waste of resources and processing time.
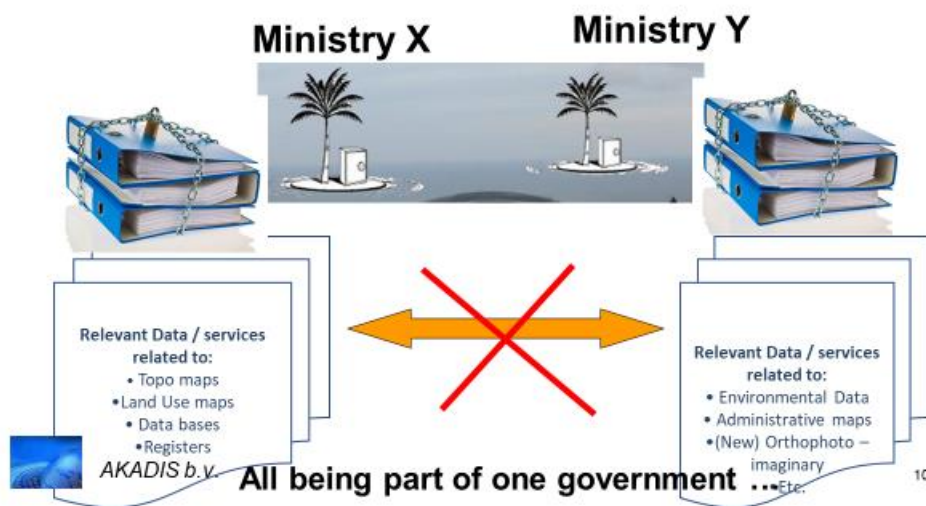
Then the sharing and integrating of the data sounds as very simple and logic solution, however we should to know first how to do it, and in efficient, successful and sustainable way.

2. NSDI AS SOLUTION

2.1 NSDI Definition

For many EU member states the NSDI is based on EU INSPIRE Directive and is defined as:

- NSDI – is a broad term for <u>systems</u> that are <u>designed to enable collaboration</u> and <u>wider sharing of spatial data</u>.
- NSDI - enables data to be <u>discovered</u> and <u>used seamlessly</u> and **without being tied to one or other GIS product**
- For NSDI best model/guidance is provided by **EU INSPIRE Initiative** as framework that obliges public sector organisations to:

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- publish key spatial data sets that support the discovery of the data, and
- provide access to these resources via product-neutral visualisation, and
- downloading services.

The INSIRE themes are defined in so-called 3 major Annexes wherein all data layers are defined.

However, learning the above NSDI definition, we could ask ourselves is there any difference between NSDI and e-Government concepts? Both looks very similar and are based on data sharing principle.

The below slide demonstrates the difference that is essential in sense of data contents (Textual and Spatial) and in sense of relation (horizontal and vertical/georeferenced).
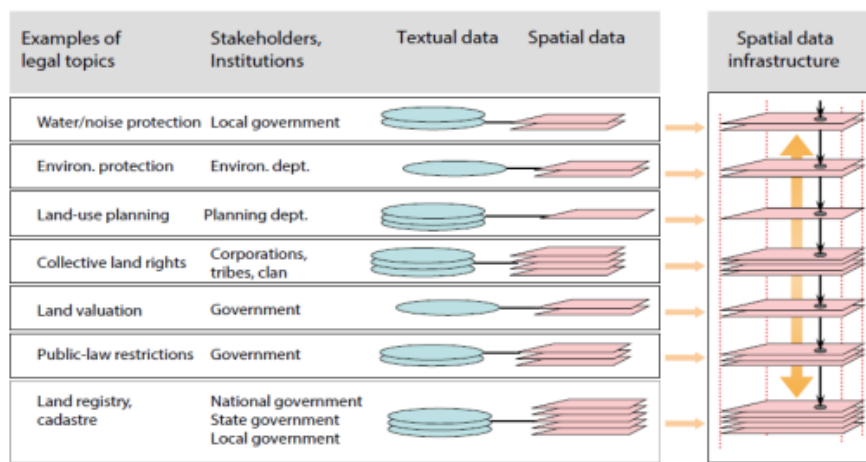
2.2 Main NSDI Challenges and Recommended Approaches/Solutions

2.2.1 Challenges

In principle there plenty of challenges that we are facing during the development/establishing of NSDI. Their difficulty depends often on the specific legal, digital status and awareness situation of the country, however for the author the following 3 are the most common and rationale ones:

- **Data and its integration,** wherein it is advisable to apply the 4 basic principles for a common data integration:
  - Respect the legal/institutional independence of partners/stakeholders,
  - Use a standardized data modelling,

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- Realising the logic relation between the objects in different theme's through geographic location (as above mentioned the vertical/geo-referenced relation)
- Using of common geodetic Reference Framework.

- **(ICT) Systems and connectivity** between them. Each governmental organisation uses mostly a totally different information ICT systems

- **Proper NSDI Governance model,** addressing issues e.g. *How much it will cost? What we will save it? How it will be organised? Who and how will we manage it? Who will finance it? Who will benefit it? What are the CSF's? etc., etc.*

- Next to the above 3 rationale challenges, there occurs always the **4th irrational one: a hidden fear of losing data ownership**, when sharing/exchanging/linking the data between various stakeholders. According to the author experience addressing this fear (its eliminating) is of great important. From very beginning the difference between Data Exchange and Data Sharing must be clear demonstrated, incl. fact that NSDI is mainly based on Data Sharing and not on Data Exchange. See below slide explaining the strategic difference.

Essential Difference between Data Exchange vs Data Sharing

Organisation 1   Organisation 2

Data Exchange : In fact transfer of (copy) full data set (semi ownership transfer) with status on specific Cut-off day

Transfer Copy of Data = ownership change
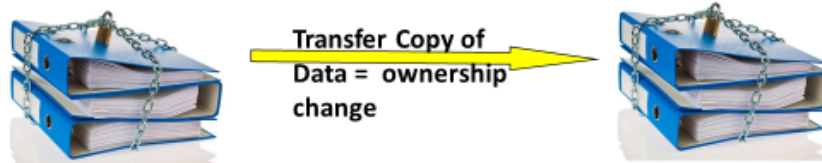
Data Sharing - Key Register principle: usage of specific small data sets from each other via Web-Services based on specific need. The ownership, responsibility, maintenance remains still by the Owner. Data usage is pre-defined in dedicated agreement conditions.

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No ownership change! Nothing to loose!

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2.2.2 NSDI Governance Approach

Conform the best international practices the NSDI Governance approach should address a few principles and be structured conform the recognized Kaplan's Strategy Pyramid.
The below slide presents these topics.
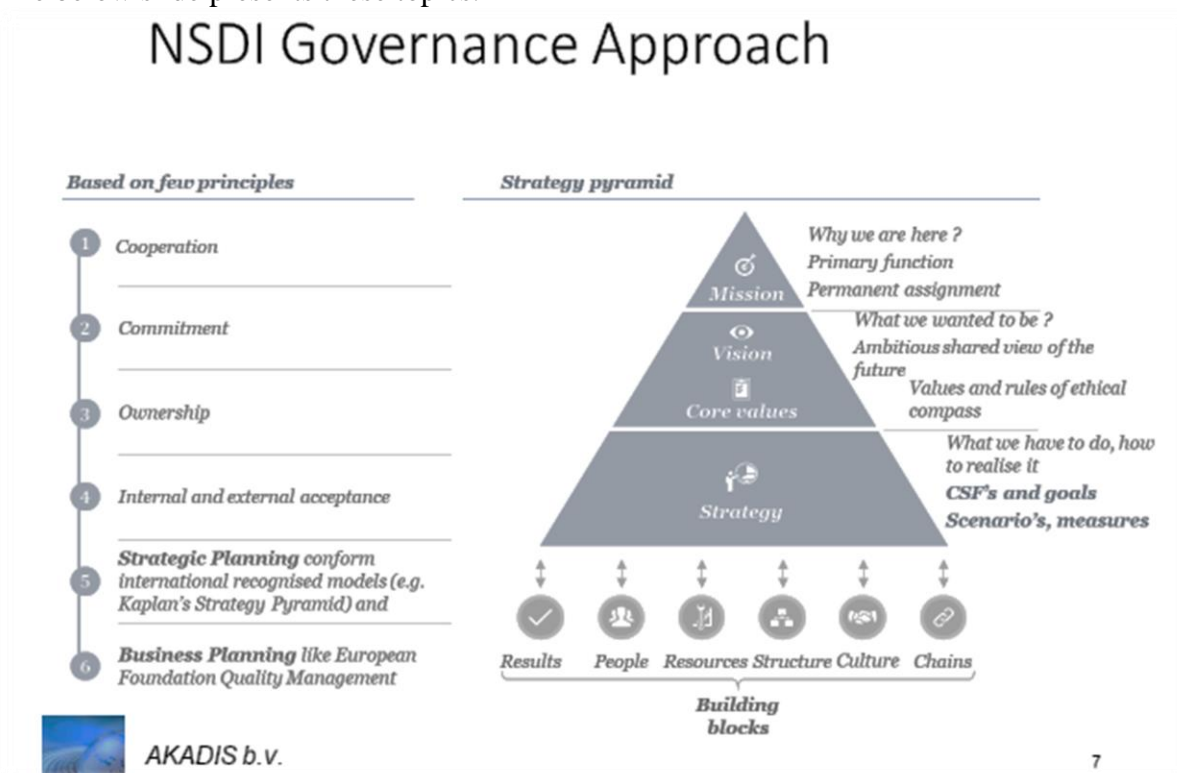
Then taking into account the **EU INSPIRE Initiative,** the NSDI model/guidance should be build fulfilling the following criteria and take into consideration some key thoughts – see slide below.

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INSPIRE – the European way of SDI

- Build data once and use it many times for many applications
- Integrate distributed providers of data: *Cooperative governance*
- 'Place-based management'
- 'Share costs of data creation and maintenance
- Support sustainable economic, social, and environmental development

AKADIS b.v.

Key thoughts

- We **need to have data** but we need **learn how to share it**
- We need to have/create the **cooperation & willingness** to do so
- We need to **combine the strengths of various organisations**
- We need to investigate **the advantages of Open data**
- We need to **explore the crowd sourcing** possibilities
- We need to **learn how to define better the end-users needs**
- **We need to learn to be realistic**
- We need to apply the **good guidance/best practices** that should be the rule and not exception :
  - EU **Inspire directive**
  - FIG- **"Fit for purpose principle"** – concept
  - **Solid Governance Model.**

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2.2.3 Technical NSDI Concept

Next to the above presented governance aspects and other objectives also the attention needs to be paid to the Technical NSDI Architecture, wherein the focus needs to go to the various technical aspects and services and also aiming mainly the sharing and linking of data sets.

The below slide present this more in detail.

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Technical NSDI concepts

NSDI Technical Contents/Components Concept

*Our Technical NSDI Concept is based not only on classical for NSDI Data Bridging contents like:*

1. **Data**
2. **Maps**
3. **Metadata**
4. **Discovery service**
5. **View service**
6. **Download Service** *but also*

*on **Data Sharing** Service.*

NSDI Technical Concept

The model is based on a step-wise improvement of the data and services, aiming at **increased sharing and linking of data sets**. The model consists of the following levels (Inkdroid, 2011):

- **Data** must be **available on the web** (whatever format)
- **Data** must be **available as structured data** (e.g shape files instead of image scan)
- **Use non-proprietary formats** (e.g csv instead of excel, GML instead of shape files)
- **Use URI's to identify things**, so that others can link to your data
- **Link your data** to other people's data to provide context

The first 3 levels concerns **Data Sharing**, while the remaining 2 relates to **Institutional Interoperability**. Such an interoperability also requires that the data sets are harmonized.
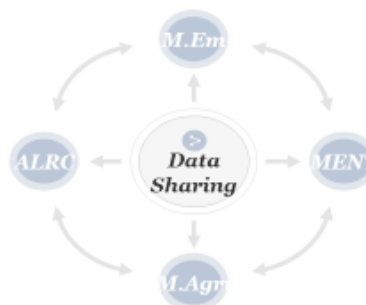
When discussing the technical aspects for NSDI it is obvious that **NSDI services are realized based on Web-Services**.

The basic definition for this type of services is given below.

NSDI concept is realised with help of Web Services - what are these?

Web services are *loosely coupled, contracted components* that communicate via *XML-based interfaces* [Schmelzer 2002]

loosely coupled: - they can be changed independently
  - platform independent

contracted: in and output are publicly available

components: interface encapsulates the code

XML-based interfaces: - human readable
  - firewall friendly
  - self-describing (allows for discovery of their functionality)

- **Examples of GIS Web services:**
- **Web map service; Geo-name service; Geo-referencing service; Weather data services; Route service; National atlas services;**
- **Google maps, Google earth**

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3. NSDI IMPLEMENTATION

3.1 Critical Success Factors (CSF's) and Key tasks

Before starting implementation of NSDI, the author recommends to consider in the first place a number of the CSF's and define some necessary key tasks. The below slide presents all this.

3.2 Possible implementation steps

It is obvious that many roads" leads to Rome", however the author present below of list of possible steps, next to above presented CFS's and Key tasks, that should be considered/taken when starting the implementation.

A. AS-IS analysis of the present situation regarding <u>the current</u>:
- <u>Institutional structure</u>,
- <u>Legal framework</u>, Analysing legislation
- <u>Governance model</u>, incl. mapping the exiting tasks, roles, responsibilities, financing methods, status of National ICT/NSDI Strategy, organizational structure and resources of NSDI, the existing and potential users, etc.)
- <u>Technical aspects</u> (type and format of data, the accuracies, frequency of updates, applied methodologies, processes, used ICT/GIS systems, ICT infrastructure, etc.)

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B. Developing TO – BE model – wherein the support of a sort NSDI Board in development of the national policies for infrastructure programme, development of NSDI Mission, Vision, Goals and Strategies, standards, technical specs, piloting etc. will be defined facilitated and should include:
- Defining target operating model/concept for NSDI
- Defining target business processes as well as roles and responsibilities in the organizational structure of NSDI
- Defining target standards of geospatial data
- Proposing necessary changes in legislation required for successful implementation of the new NSDI
- Developing the concept of ICT system and required infrastructure, followed by defining requirements for the IT system (specs).

C. Development of Governance for the Geospatial information sector – including:
- Establishing the roles of supervising, producing, maintaining and disseminating geospatial information,
- Defining marketing, data sharing and financial plans and budgets of NSDI
- Development of various Strategic and Implementation Plans.

D. Implementation – including:
- Capability building and training
- Developing change management and communication strategy
- Designing of awareness program for the public sector, private sector, civil society and the general public needs
- Development of Technical specs, RFP's, etc.
- Tendering, Supervision, monitoring the results, Intervention, etc. After that is coming the tendering of Data and System(s) **but it should never to be a first step(!),** as it has been observed in some countries.

4. TO CONCLUDE

4.1 Measurable outcomes

When we need to convince the decision makers they will always ask "*what will be the measurable outcomes/savings?*" Indicating the measurable outcomes/results when using the NSDI it is not an easy task, because we deal mostly with the indirect results/cost saving, and often not on the side of the data producer, but aften by the data users (actors in the business value chain). However, to illustrate some of them, the below table is demonstrating the possible Measurable outcomes, based on some international experiences.

Measurable outcomes	
Outcomes	**by**
• Reduction of Foundation Data duplication	50% reduction in 8-12 months
• Reduction in cost of Foundation Data provision	40% reduction in 2 years
• Increase in number of Geospatially enabled services across government sectors	100% in 2 years
Impact on strategic objectives	
• Improvement of public sector services	High
• Improving Efficiency	High
• Creating more Jobs for Saudis	Medium
• Diversification of the Economy	High

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4.2 Practical Example of a need for data sharing with help of NSDI (from the Netherlands)
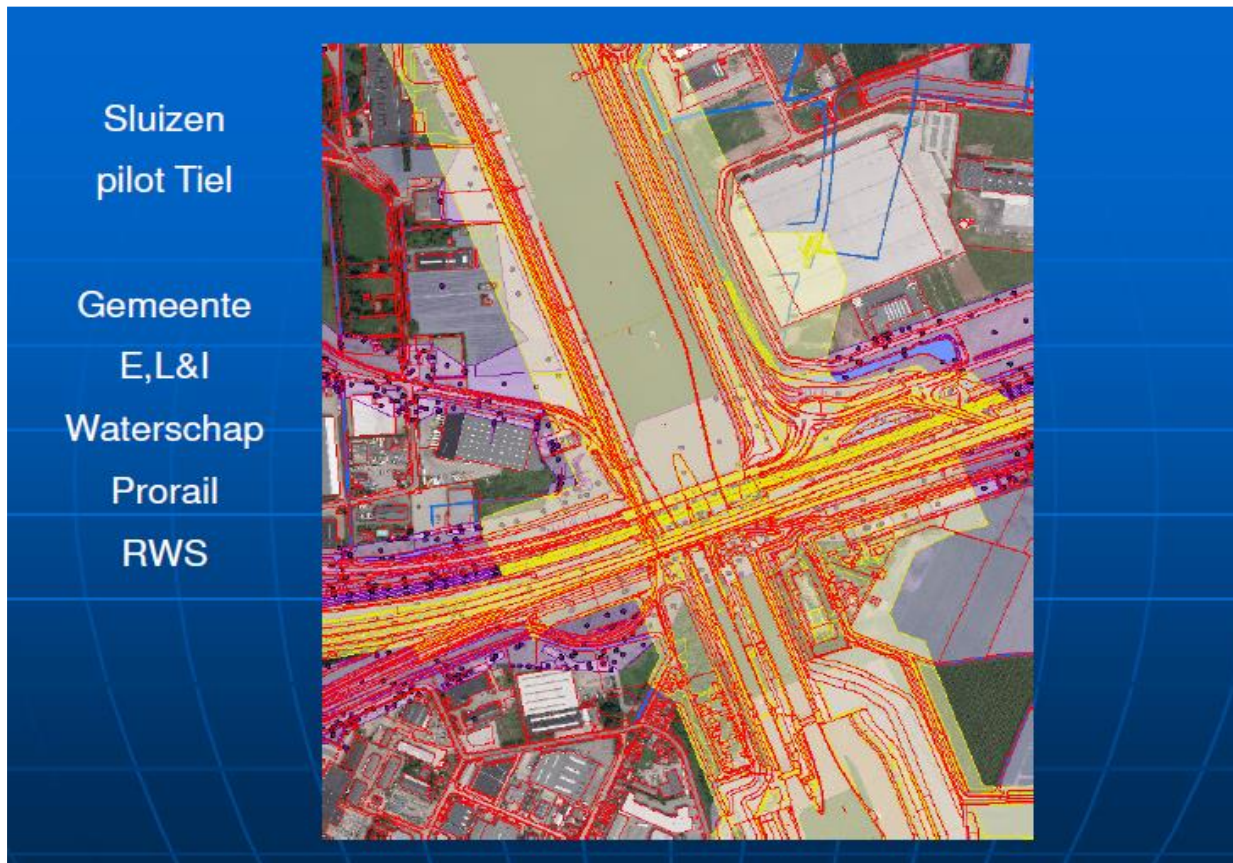
During the FIG Working Week 2020 in Amsterdam, the author will present the above slide in an interactive way, demonstrating the overlaps of spatial data as collected and maintained by various governmental organisations for a specific area in the Netherlands.

It's very clearly demonstrates the need for NSDI spatial data sharing: *Collect data once, use many times and by many applications.*

4.3 Closing remark

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BIOGRAPHICAL NOTES

Mr. Kwitowski is a Senior Expert with >35 years of professional experience in Land Administration, ICT, e-Government, Digital Transformation, ICT Road-maps, Business Process Engineering, Strategic and Business Planning, NSDI, Cost recovery, etc. all mainly for Land Administration and ICT domain. He has developed/designed various concepts of on-line systems/e-services, web-portals, data sharing concepts for the governmental organisation, incl. implementation of the EU Digital Agenda – external projection of EU Policy.

Usually, he has been working as Key Expert in many innovative projects financed by the EU, World Bank, ADB, UN, etc., and also working as an individual Consultant for these organizations. All this already in ca. 30 countries.
He is the member of Netherlands Society for Geo-Information; Correspondent of WB's Doing Business; Member of UN Working Party on Land Administration (WPLA), Member of FAO's LANDNET.
Often, he has been given as a key speaker the lectures on many international Land Administration, e-Gov conferences, ICT Summits and as guest lecturer by various Universities all over the world.

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