Technology structure of SDI

– The ‘standard’ SDI is made of distributed nodes which can be referred to as ‘participant entity

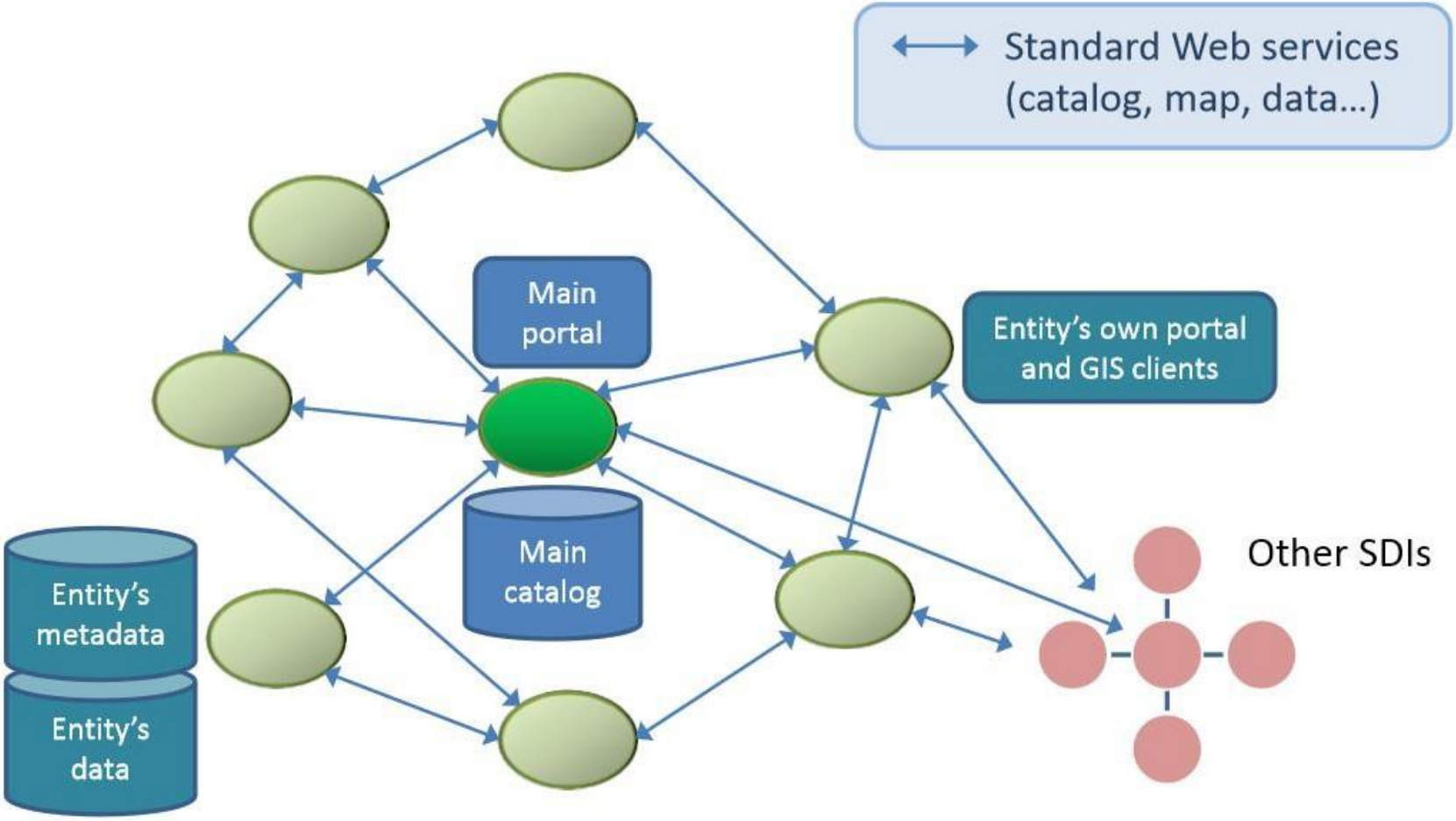
Each participant entity :

- Publishes standard services to provide access to its information
- Catalogs these services with metadata
- As a user, it can access metadata and services from other nodes

They also have Common resources:

- The SDI catalog collects all metadata and provides search service
- The SDI portal offers search, query, download and visualization

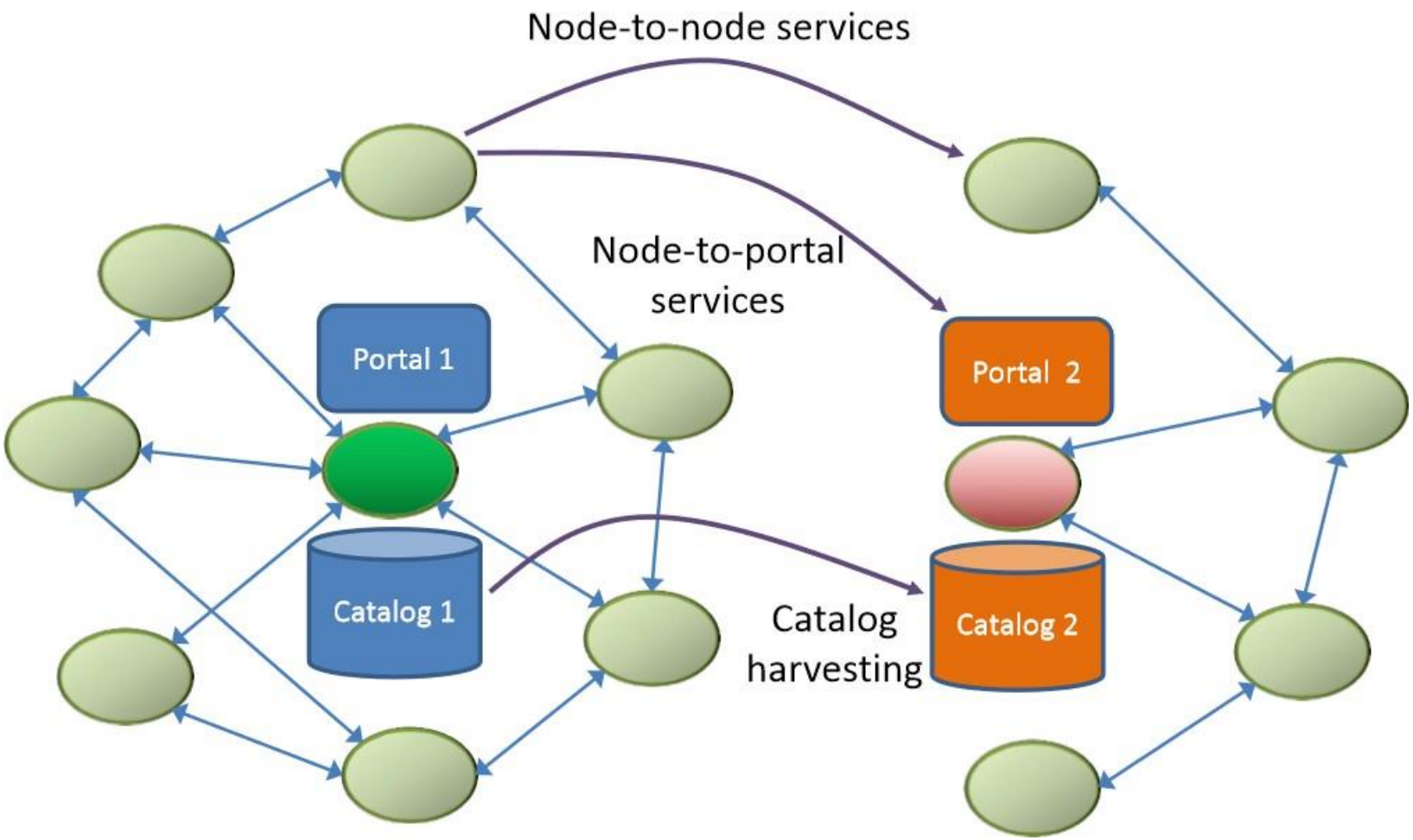
Technology structure of SDI



Technology structure of SDI

- Relationships between SDIs
- Thematic SDIs ; Participants share a common thematic interest (biodiversity, disaster management, land use and planning, geosciences…)
- Hierarchical SDIs; Defined at different levels (multinational, national, regional, municipalities). Each level aggregates the lower ones
- SDI Federation; Because of the distributed interoperability and access, SDIs can merge, reusing, composing and adding value on services and metadata. *SDIs don't have boundaries.*

Technology structure of SDI



Technology structure of SDI

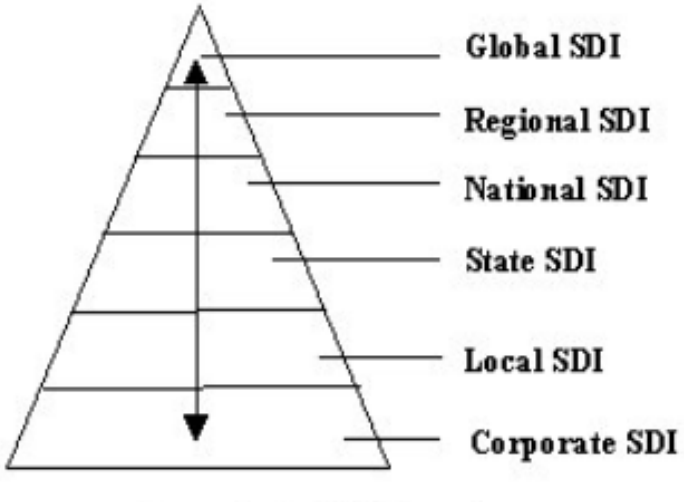
SDI HIERARCHY

- Many countries are developing SDI at different levels ranging from local to state/provincial, national and regional levels. Some countries are also participating in the creation of a global spatial data infrastructure.
- These initiatives facilitate better management and utilization of spatial data assets.
- The most important objectives of these initiatives are to promote economic development, to stimulate better government and to foster environmental sustainability.
- As a result of developing SDIs at different levels, a model of SDI hierarchy that includes SDIs developed at different political-administrative levels has been developed.
- SDI hierarchy is made up of inter-connected SDIs at corporate, local, state or provincial, national,regional and global levels

Technology structure of SDI

SDI HIERARCHY

- In the model, a corporate GIS is deemed to be an SDI at the corporate level-the base level of the hierarchy.
- Each SDI at the local level or above is primarily formed by the integration of spatial datasets originally developed for use in corporations operating at that level and below
- SDI hierarchy at different levels of jurisdiction:



Technology structure of SDI

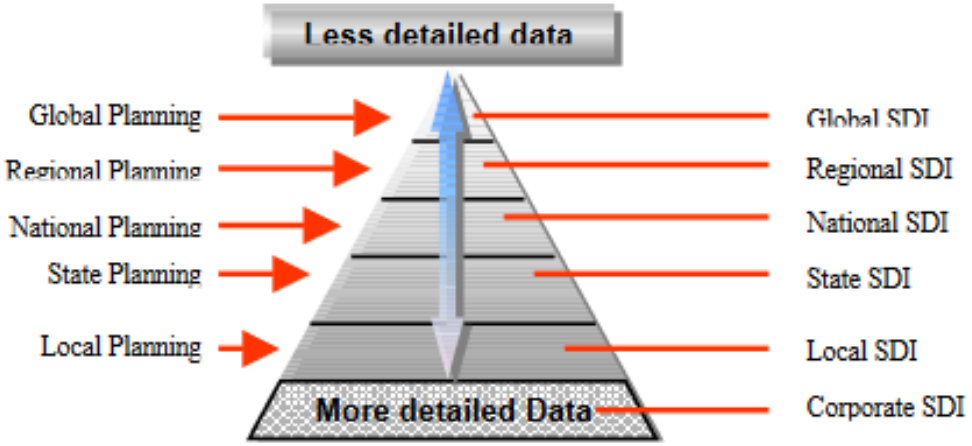
SDI HIERARCHY

- There two views on the nature of this SDI hierarchy i.e ***umbrella view*** and ***building block view***
- The first view is an umbrella view, in which the SDI at a higher level, say the global level, encompasses all the components of SDIs at levels below.
- The second view is the building block view, in which any level of SDI, say the state level, serves as the building block supporting the provision of spatial data needed by SDIs at higher levels in the hierarchy, such as the national or regional levels.
- Based on these two views, the SDI hierarchy creates an environment, in which decision-makers working at any level can draw on data from other levels, depending on the themes, scales, currency and coverage of the data needed

Technology structure of SDI

RELATIONSHIPS AMONG DIFFERENT SDIs

- Relationships among different levels of SDIs are complex due to the dynamic, inter- and intra-jurisdictional nature of SDIs.
- One way to observe and map these relationships in the context of an SDI hierarchy can be to assess the impact and relationships of each component of any level of SDI on the same component of an SDI at a different level.
- Relationship between data detail, different levels of SDIs and level of planning.



Technology structure of SDI

RELATIONSHIPS AMONG DIFFERENT SDIs

- National SDI has a full impact and relationship on the other levels of the SDI hierarchy through its components.
- In terms of policy, National SDIs have an important effect on the upper and lower levels. However, policy at a global level has only a direct impact on and relationship with Regional and National SDIs.
- In terms of fundamental data sets, a National SDI has an important role in forming this component of the upper levels, and its data sets are created based on the data sets from the lower levels of SDIs.
- In terms of technical standards, a National SDI has a direct influence on the State and Local SDIs, and its position is important for the upper levels to decide on their strategies and standards.
- A national level SDI therefore, has stronger relationships as well as a more important role, in building the other levels of SDI.

Technology structure of SDI

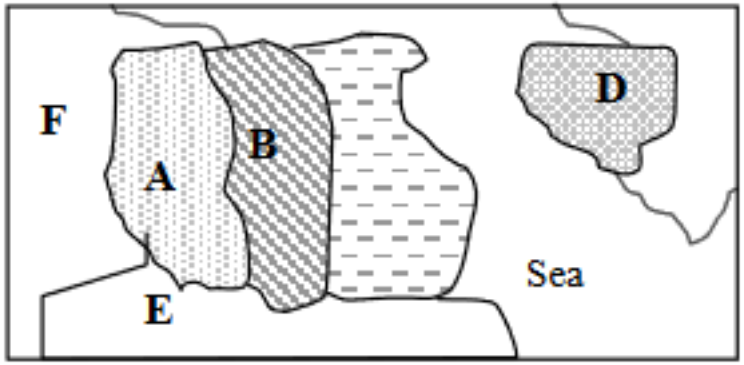
RELATIONSHIPS AMONG DIFFERENT SDIs

- Additional to the vertical relationships between different levels of SDIs, there are also *horizontal relationships* between individual SDI initiatives within any level of SDI hierarchy which should be taken into consideration.
- These relationships become more important when the respective jurisdictions are spatially adjacent and proximate.
- SDIs belonging to adjacent jurisdictions play more important roles and have more influence and impact on each other than on SDIs of non-adjacent jurisdictions

Technology structure of SDI

RELATIONSHIPS AMONG DIFFERENT SDIs

- For example, at a regional level, the policies and standards used on preparation of fundamental data sets of country A and country B, in Figure below, have more impact on each other than country A with country D, when they are supposed to be integrated together forming data sets of the region.



Technology structure of SDI

FUTURE DIRECTION OF SDI

- Based on the strategies, aims, objectives, and status of individual SDI initiatives in different levels, there are two models used in SDI development:

I. ***The product-based model :***represents the main aim of an SDI initiative being to link existing and upcoming databases of the respective political and administrative levels of the community.

II. ***The process-based model***: presents the main aim of an SDI initiative as defining a framework to facilitate the management of information assets i.e. the objectives behind the design of an SDI, by any coordinating agency, are to provide better communication channels for the community for sharing and using data assets, instead of aiming toward the linkage of available databases.

Technology structure of SDI

FUTURE DIRECTION OF SDI

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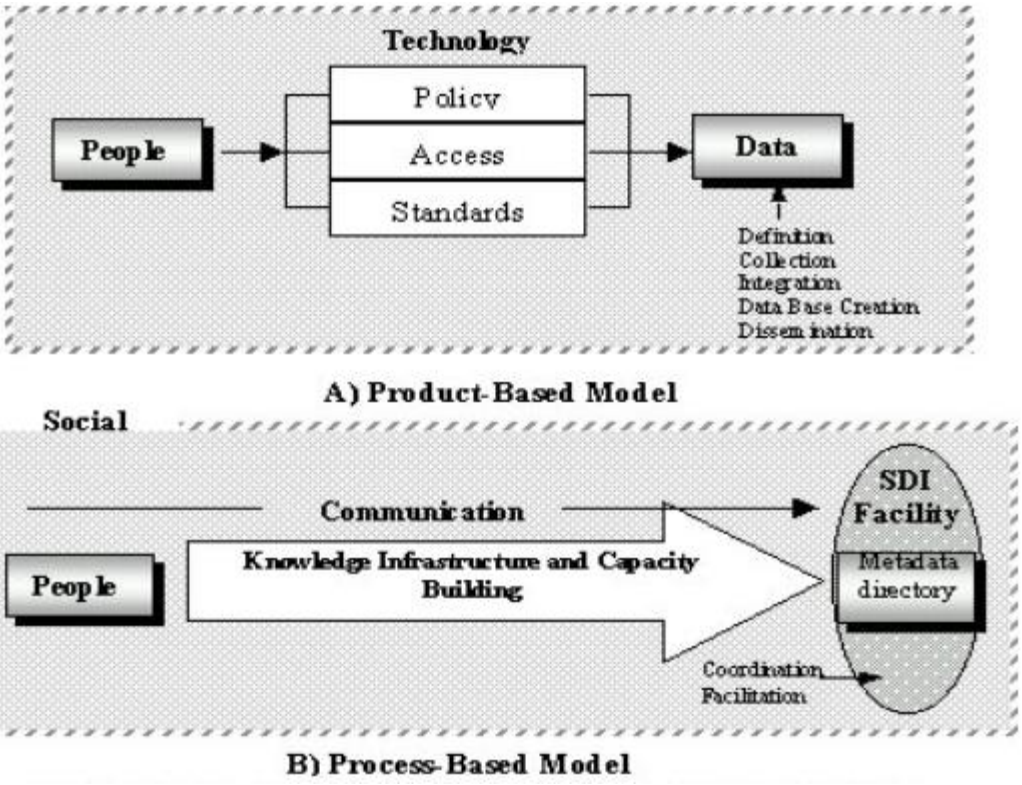
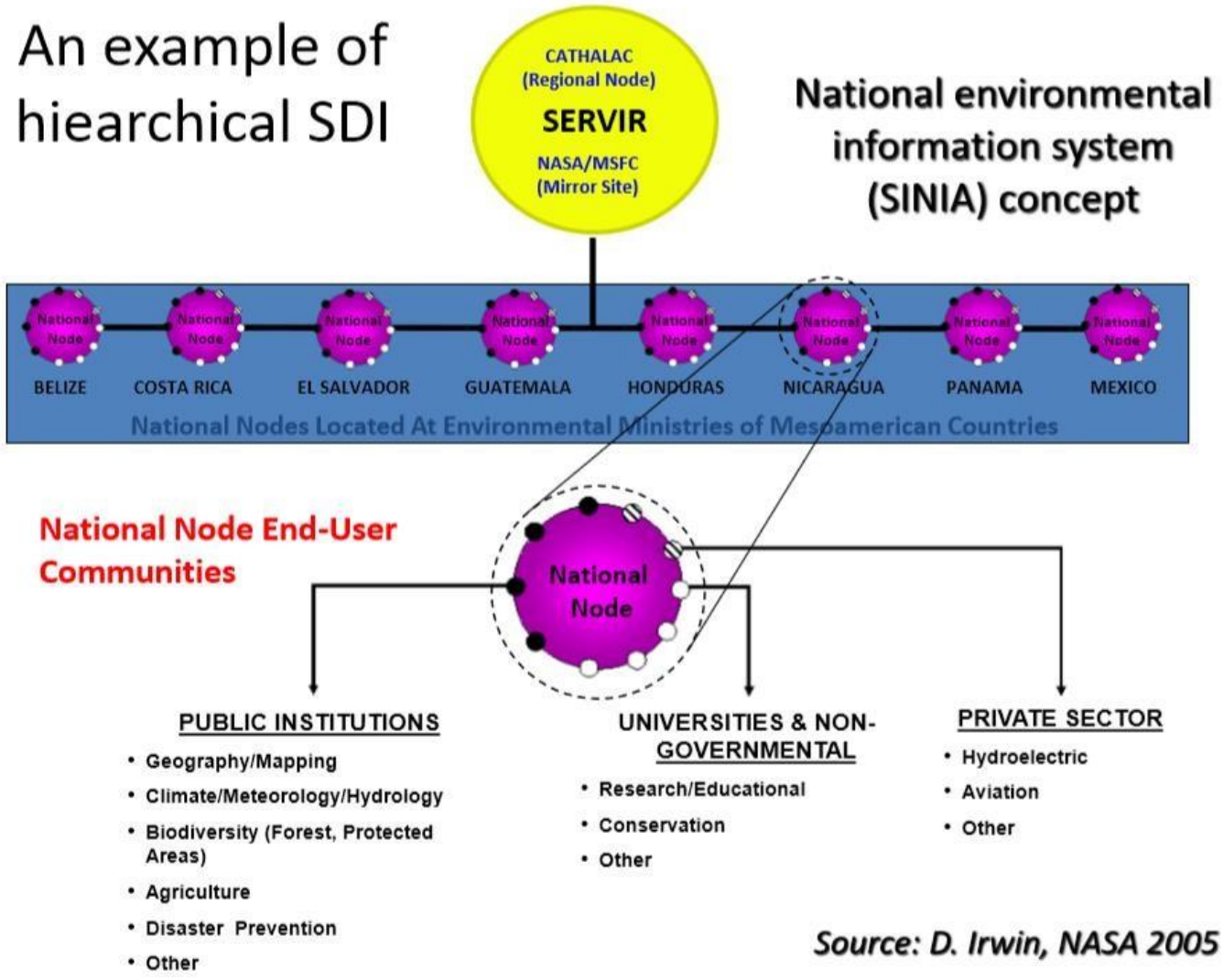


Technology structure of SDI

FUTURE DIRECTION OF SDI

- The process-based model emphasizes the communication channel of knowledge infrastructure and capacity building, by following certain steps towards the creation of an infrastructure in which to facilitate all parties of the spatial data community in the cooperation and exchange of their datasets.
- These steps are
  i. Awareness,
  ii. Knowledge infrastructure,
  iii. Alignment,
  iv. Persuasion,
  v. Decisions,
  vi. Participation and
  vii. Utilisation.

Examples SDI



SDI examples

– SDIs are often used to provide services to municipalities, which in turn create portals offering local information, e-government functions, etc.

• Example in Spain: municipalities use National Cadaster Office service to get property information and provide access to egovernment services:

http://ide.ayto-fuenlabrada.es/

• Another example in Spain: Valencia City offers portal to check the approved land use and city planning, as well as request official certifications:

http://mapas.valencia.es/

•Street finding (geocoding): This is a big problem in many countries, there is no 'regularized' geocoding scheme.

SDIs can provide an efficient way to create digital geocoding services and develop added-value applications:

A prototype for a San Jose neighborhood in Costa Rica

http://costarica.iver.es/

SDI examples

•National SDIs: – In some countries, NSDIs are forming as a way to publish results of land property regularization and base cartography programs.

Example in Abu Dhabi; http://geoportal.abudhabi.ae/geoportal/

• Multi-National SDIs:

i. Formed by aggregation-federation based on common rules e.g EU Inspire: http://inspire-geoportal.ec.europa.eu

ii. Services provided by multinational agencies (UN, EU) to which countries subscribe by formal agreement e.g Access to spatial imagery for environmental and risk management: GEOSS, GMES –

iii. Formed around regional thematic interests: e.g.

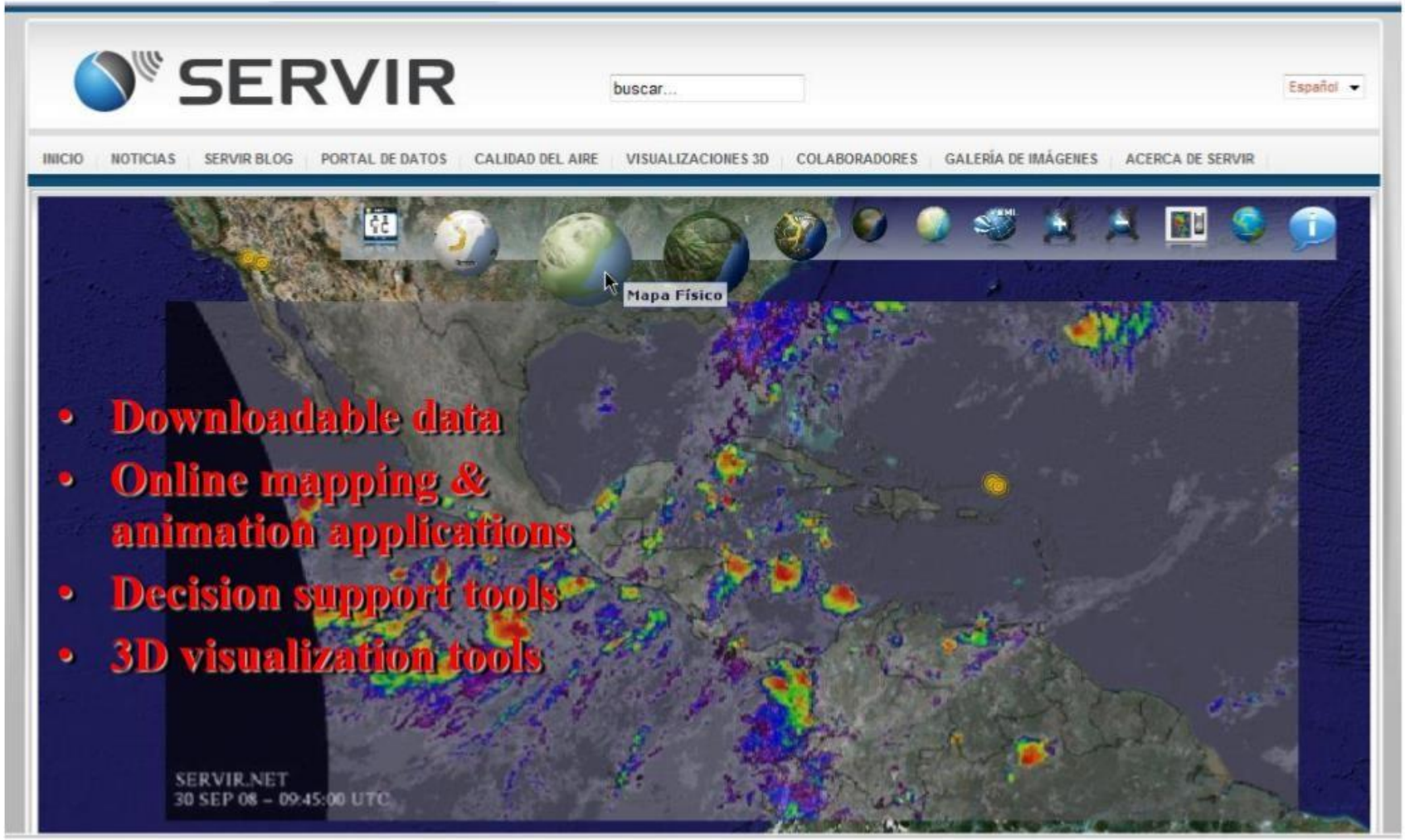
Andean Information System for Disaster Prevention and Relief (SIAPAD)
SMIT http://smit.cathalac.org/

SERVIR http://www.servir.net/

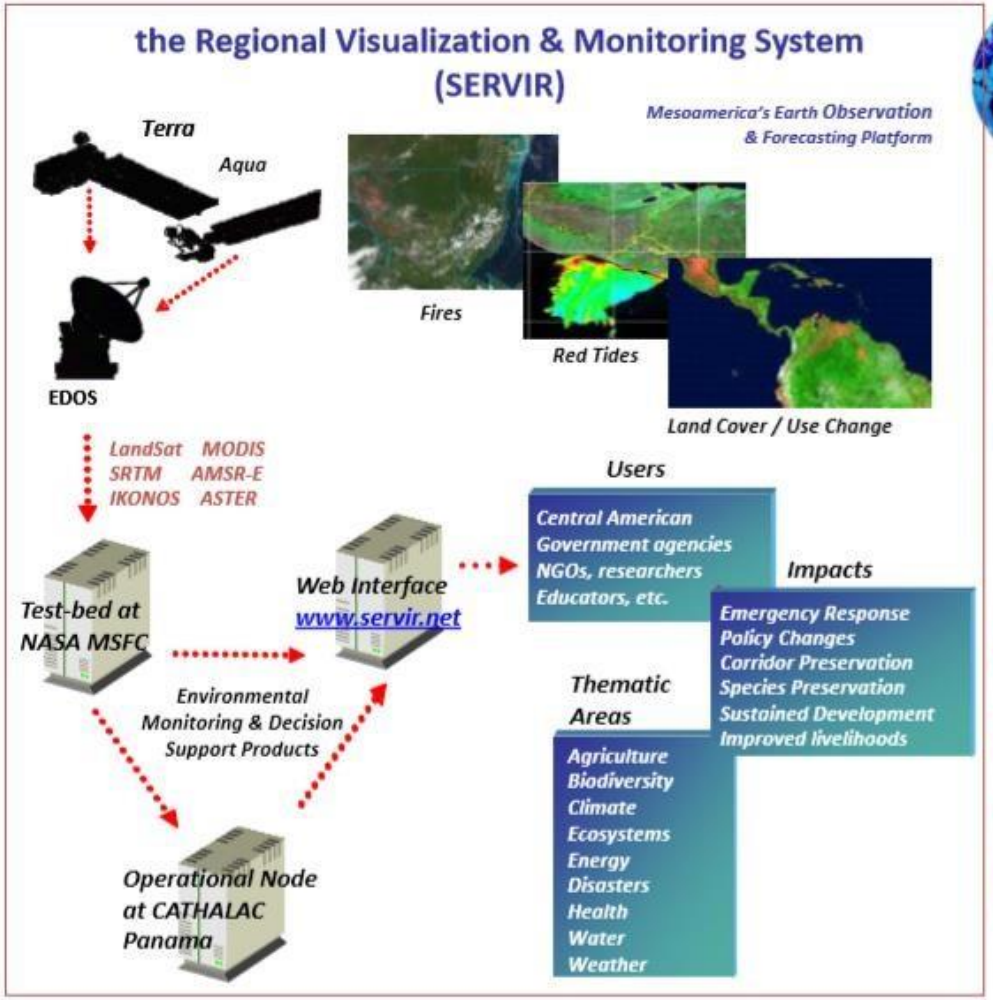
Arctic SDI http://arctic-sdi.org/

SDI examples

www.servir.net



SDI examples



- Global Earth Observation System of Systems (GEOSS)
- International Charter on Space and Major Disasters
- Mesoamerican Environmental Information System (SIAM)

SERVIR is a completely open-access system w/ products in range of formats

Review of SDIs in Africa

- The dream of a functioning SDI in Africa has been there for a long time since information requirements for sustainable development require integrated diverse datasets into an SDI.
- Most African countries have inadequate SDI policies, standards and guidelines, with most agencies still independently collecting spatial data that support specific projects.
- This has resulted in duplication in spatial data collection and management, poor data quality and lack of standards to guide stakeholders.
- The Nairobi Statement on spatial information for sustainable development was one of the pioneer initiatives that set the scene for SDI in Africa. It recommended that:

i. Formation of steering groups that would formulate policy and institutional frameworks
ii. Solutions starting with realistic objectives that grow through political and market needs.
iii. Establishment of regional co-operation to support cross border and common interests.

Review of SDIs in Africa

- United Nations Economic Commission for Africa (UNECA) is an institution that promotes geospatial initiatives in Africa, through raising awareness, supporting implementation of relevant policies and advocating for the Africa Regional Spatial Data Infrastructure (RSDI).
- UNECA recommends that;

i. SDI should be made an integral part of ICT policies, strategies and plans

ii. Member states should establish their NSDI with all the necessary components

iii. SDI policies, and institutional, legal and technical frameworks should be developed.

Review of SDIs in Africa

Status of SDI in Selected African Countries

– SDI inception epochs in selected countries

Approximate Date of SDI Inception	Country	Status of SDI (year 2014)
1996	Algeria	**Average**
1996	Senegal	**Good**
1997	South Africa	**Very Good**
1998	Ghana	**Average**
2001	Botswana	**Average**
2001	Kenya	**Average**
2002	Ethiopia	**Average**
2002	Mali	**Average**
2002	Nigeria	**Good**
2003	Tanzania	**Average**
2003	Uganda	**Average**
2006	Libya	**Average**
2006	**Rwanda**	**Very Good**

Review of SDIs in Africa

Status of SDI in Selected African Countries

- *Uganda*:
  - The Government of Uganda has designated the National Planning Authority (NPA), which falls under the Ministry of Finance and Economic Planning, as the lead agency to coordinate the development of the Uganda NSDI (UNSDI) .
  - As at 2016, there was no policy, legal framework or standards to guide the UNSDI.
- *South Africa:*
  - South Africa has consistently devoted the resources required to develop its NSDI, the SASDI.
  - As early as 1997, the National Spatial Information Framework (NSIF) had been established, representing the SDI initiative at the time .
  - A comprehensive legal framework, the Spatial Data Infrastructure Act No 54 , has established the SASDI.
  - However, the Committee for Spatial Information (CSI) only began to operate in 2010.
  - More recently, the Pricing of Spatial Information Products and Services and the Base Data Set Custodianship policies were ratified.
  - Despite these progressive strides in South Africa, several challenges have been reported:
    - including the lack of capacity at provincial and municipal levels, under- representation of the private sector, and resistance to change [42]. This serves to underlie that SDIs are large-scale and long-term initiatives that improve with time.

Review of SDIs in Africa

Status of SDI in Selected African Countries

- *South Africa:*
  - Despite these progressive strides in South Africa, several challenges have been reported:
    - The lack of capacity at provincial and municipal levels, under- representation of the private sector, and resistance to change . This serves to underlie that SDIs are large-scale and long-term initiatives that improve with time.
- *Botswana:*
  - Since the early 1990's, Botswana recognised the need for a coordinated approach to spatial data management.
  - It was one of the first African countries to establish a national coordination committee, indicating early recognition of the need for SDI.
  - Several systems towards this objective were initiated, notably the Integrated Geographic Information System, State Land Information Management System, and the Tribal Land Management Information System .
  - The need to integrate these systems may have given impetus to the Botswana National Spatial Data Infrastructure (BNSDI).
  - However, the BNSDI has been developing slowly, which can be attributed to its starting off on a much wider scope . This may appear to contravene the recommendations of the Nairobi Statement on Spatial Information for Sustainable Development . In spite of this, Botswana's Digital Information Policy was approved by its cabinet in 2015, with reports indicating that the e-Government initiative has re-invigorated the BNSDI.

Review of SDIs in Africa

Status of SDI in Selected African Countries

- *Rwanda:*
  - The awareness of the importance of GI in Rwanda was emphasised by the NSDI conference held in 2006.
  - Prior to the conference, the government had recognised that GI is vital for socio-economic planning and development.
  - Rwanda experienced several problems while developing its NSDI, such as institutional, human resources and technical challenges .
  - However, July 2015 saw the launch of the country's SDI geoportal, reflecting the important progress over NSDI.
  - Rwanda is one of the few countries in Africa with a substantial availability of spatial datasets in digital format.
  - Recent reports indicate that Rwanda has 10.3 million parcel records, and orthophotographs developed between 2008 and 2009, covering 96% of the country at 0.25m resolution .
  - Other milestones include strengthening institutional and organisational frameworks, evidenced by the National Geo- Information Committee (NGIC) I and II meetings held in 2013 and 2014.

Review of SDIs in Africa

Status of SDI in Selected African Countries

- *Ghana:*
  - In an attempt to ascertain the problems facing land administrators in Ghana, established that land-sector agencies in the country needed reorganisation to improve efficiency in service delivery. To do this they suggested the identification and correction of inefficiencies, bottlenecks, duplication, weaknesses, threats, and opportunities in each agency.
  - In 2015, the Ministry of Lands and Natural Resources through the Land Administration Project (LAP) furnished funds for the development of a National Spatial Development Framework (NSDF) for the entire country from 2015 to 2035 .
  - The NSDF is expected to provide support towards development of Ghana's NSDI, which is supported by the same project.

Review of SDIs in Africa

Status of SDI in Selected African Countries

- *Algeria:*
  - The definition and promotion of Algeria's NSDI is led by the National Geographic Information Council (CNIG), which aims to integrate GI policy with the country's information society and digital economy agenda, including the NSDI.
  - In 2015, its government set up a high- level national committee under the leadership of CNIG, to develop the national strategy for the development of the country's NSDI.
  - The NSDI is expected to facilitate the exchange of information and promote widespread use in diverse areas such as defence, security, health, transport of energy and education.

Review of SDIs in Africa

Status of SDI in Selected African Countries

- *Namibia:*
  - In 2015, the government of Namibia approved a policy to guide the establishment of its NSDI.
  - Earlier, section 47 of the Statistics Act No. 9 (2011) had established a committee for spatial data .
  - The committee, comprising of 10 members including the Surveyor General (who acts as the Chairperson) and the Statistician General, came into effect in 2013.
  - The primary responsibility of the committee is to determine data custodians, but it also acts as an authority on NSDI standards.

Review of SDIs in Africa

Status of SDI in Selected African Countries

- *Nigeria:*
  - The agency mandated to coordinate SDI development in Nigeria is the National Space Research & Development Agency (NASRDA) .
  - A draft policy has been prepared, which aims to ensure development, implementation and optimal use of geospatial information. Nigeria actively participates in continental activities, such as the African Geodetic Reference Frame (AFREF).
- *Kenya:*
  - Kenya has made considerable progress with its NSDI, the Kenya National Spatial Data Infrastructure (KNSDI).
  - In the KNSDI geoportal, most geospatial data not only existed in analogue format, but also lacked temporal accuracy. In spite of these drawbacks, several achievements have been made.
  - For instance, some KNSDI standards have been established, along with digitization manuals and guidelines for data sharing .
  - The KNSDI draft policy, which will form the basis for legal and institutional frameworks for KNSDI management, has been developed.
  - However, it is not clear when this policy will be approved.
  - Progress has also been made by relevant agencies: for instance, the Survey of Kenya reported a program of updating topographic map sheets since June 2008.

Review of SDIs in Africa

Status of SDI in Selected African Countries

- *Ethiopia:*
  - In 2009, the Ethiopian Mapping Agency drafted the Ethiopian National Spatial Data Infrastructure (ENSDI) policy, which is expected to provide a framework for the collection, integration, archiving, distribution, use, and sharing of geospatial information.
  - In 2011, the Ethiopian Information Network Security Agency (INSA) established a geoportal to monitor the collection, processing and dissemination of imagery.
  - Since 2014, the ENSDI's mandate has been moved to INSA, which has continued to develop the draft polity, aside from organising a number of workshops.
  - In 2015, INSA was in the process of establishing working groups to facilitate development of the ENSDI components.

Review of SDIs in Africa

Status of SDI in Selected African Countries

- *Zambia:*
  - Previous efforts to establish Zambia's NSDI stalled, due to lack of funding.
  - The Environmental Support Programme was one of the earlier efforts, resulting in development of mapping standards.
  - In 2010, the country held a GIS stakeholders' meeting where a committee was established to spearhead revival of the NSDI.
  - Through e-Government support programmes in 2012, the secretary to the cabinet called a meeting to discuss interlinking all government departments.
  - In 2014, NSDI was established as part of the land audit programme , resulting in the aerial photography of 1,800 square km at 0.10m resolution in the main cities, and 36,500 square km at 0.20m resolution for the State Land Areas.

Review of SDIs in Africa

Status of SDI in Selected African Countries

- *Malawi:*
  - In Malawi, the need for coordination of production and management of spatial data arose as early as 1990 .
  - Recent efforts have been geared towards the establishment of the Malawi Geographic Information Council (MAGIC) and a National Spatial Data Centre (NSDC) to coordinate the acquisition and sharing of geoinformation, and to support the development of the NSDI .
  - Some of the challenges that Malawi faces in pursuit of its NSDI include inadequate funding, human resource capacity and legal constraints.
  - A key legal instrument (the Land Bill) has not been ratified, thus affecting development of the NSDI.

Review of SDIs in Africa

Status of SDI in Selected African Countries

- *Tanzania:*
  - The efforts to establish Tanzania's NSDI can be traced back to 2003, when a steering committee was set up to oversee its development.
  - Apart from a SDI draft policy prepared in 2005, little progress has been reported to-date.
  - The main factors contributing to the slow development of the NSDI include the lack of awareness on SDI, lack of an SDI policy, limited funding, lack of institutional leadership, and lack of political commitment.

Review of SDIs in Africa

Status of SDI in Selected African Countries

- *Senegal:*
  - An agreement was signed between Senegal and Canada in 2009, for the establishment of a project to support the development and implementation of Senegal's National Geomatics Plan .
  - To ensure effective implementation of the project (scheduled from 2009 to 2015), Senegal has set up a Consultative Group on Coordination and Geomatics.
  - The project has six components: strengthening of the spatial reference system; development of a geo-directory; development of a web-based geospatial database; implementation of GIS in priority areas to demonstrate their benefits; training; and communication .

Review of SDIs in Africa

Status of SDI in Selected African Countries

Country	Recent SDI activities
Botswana	Digital information policy approved by the Cabinet in March 2015
Ethiopia	Received technical assistance from Namibia in 2015 in preparation for census mapping
Ghana	The 20-year National Spatial Development Framework (2015-2035) was approved in 2015
Kenya	Construction of the Kenya Geospatial Data Centre was completed in 2015
Malawi	Three-day workshop held in 2015 to present the atlas and GIS database
Nigeria	A large-scale SDI for the Nasarawa state was completed in 2015
Rwanda	Launched its national SDI geoportal in July 2015
Senegal	An Open Data workshop on access to Geospatial Data was held in September 2015
South Africa	Pricing and dataset custodianship policies were ratified in March 2015
Tanzania	In 2012, Tanzania initiated a project to develop an Integrated Land Information System
Zambia	NSDI Committee appointed by the Secretary to the Cabinet in June 2015
Zimbabwe	In 2015, the Zim-geospatial tool was created to pool geospatial data from multiple sources

Source: GSDI, and Country reports presented at the regional NSDI Forum, Kigali, Rwanda (July 2015)

Review of SDIs in Africa

Status of SDI in Selected African Countries

- *The issues affecting SDI in Africa can be summarized as follows:*
  - low mapping coverage, resulting in lack of data, and outdated data;
  - lack of standards, resulting in low inter-operability between datasets;
  - lack of cooperation between agencies resulting in redundant production of data;
  - lack of metadata giving rise to poor use of data;
  - lack of qualified human resources;
  - lack of financial resources;
  - poor prioritization and lack of political will; and
  - lack of policy and legislation.

Review of SDIs in Africa

Assignment

- *Discuss in details the history and status of SDI in the following countries;*

1. *United states of America*
2. *Rwanda*
3. *Japan*
4. *Germany*
5. *Brazil*