Spatial Data Infrastructure-An Evolutionary Approach to GIS Technologies

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Abstract— Spatial Data Infrastructure focuses towards the collaborative approach of sharing and managing geospatial data globally. This paper draws focus over the applicability as well as the recent trends in spatial data infrastructure. Social challenges, environmental issues, and economic downturns all take cooperation to solve. A Spatial Data Infrastructure supports ready access to geographic information. This is achieved through the co-ordinated actions of nations and organisations that promote awareness and implementation of complimentary policies, common standards and effective mechanisms for the development and availability of interoperable digital geographic data and technologies to support decision making at all scales for multiple purposes. Working together to map and document the earth helps create a structure for managing knowledge.

Keywords— Spatial Data Infrastructure, Geospatial data, Social challenges, environmental issues, and economic downturns.

I. INTRODUCTION

There is no economic activity, which completely excludes geographic information and it has been often quoted that as much as 80% of all local government decisions are of spatial nature [2].

Spatial Data Infrastructure (SDI) is a promising initiative intended create an environment in which all the stakeholders (users, producers) can cooperate with each other and interact with technology, to better achieve their spatial data objectives at different political and administrative levels.

In SDI organizations and individuals are cooperating and using electronic technology to help find and share geographic information by following mutually accepted standards.

II. ORIGIN OF SDI

The term spatial data infrastructure was coined in 1993 by the U.S. National Research Council to denote a framework of technologies, policies, and institutional arrangements that together facilitate the creation, exchange, and use of geospatial data and related information resources across an information-sharing community [1]. Such a framework can be implemented narrowly to enable the sharing of geospatial information within an organization or more broadly for use at a national, regional, or global level. In all cases, an SDI will provide an institutionally sanctioned, automated means for posting, discovering, evaluating, and exchanging geospatial information by participating information producers and users.

SDI extends a GIS by ensuring geospatial data and standards are used to create authoritative datasets and policies that support it [3].

The basic need of incorporating the SDI can be summarized as:

1) 70-80 % cost of any GIS project spend for data collection, maintenance,...
2) The same data sets will be collected by different agencies again and again.
3) An estimated 90% of all information used by government has geo-spatial characteristics or attributes.
4) Spatial data/information is one of the most critical elements underpinning decision making in every discipline.
III. Nature and Vision of SDI

SDI is an initiative intended to create an environment in which all stakeholders can cooperate with each other and interact with technology, to achieve objectives at different political/administrative level.

An SDI is much more than data and goes far beyond surveying and mapping [2]. It provides an environment within the organizations and nations interact with technologies to foster activities for using, managing and producing geographic data.

The vision of SDI is to provide current and accurate geospatial data available to contribute locally, nationally, and globally to economic growth, environmental quality and stability, and social progress [4].

IV. Significance of SDI

The large amount of spatial information is created by the various organizations spread across the country for various applications by use of different methods and technology.

Following are some of the importance of SDI.

1) Support integrated decision making for substantial and sustainable development in both the developed and developing countries of the world.
2) Reduce duplication-cost and efforts.
3) Provide better data for decision making.
4) Support new business processes/create new business opportunities in geospatial information industry.

V. Applications and Practical Aspects of SDI

- **Better Governance, Better Business**

  Esri’s GIS technology, services, and training deliver a fully supported platform that allows organizations to provide access to geospatial data and resources regardless of location or type [6].

- **Reduce time and redundancy of data production.**

  By connecting geospatial data and service producers and consumers, infrastructure and costs can be kept economical.

  The technology is scalable and can fit into any infrastructure, including existing geospatial technology installations.

- **Enable easy search and discovery of existing geospatial data and services.**

  Users can create and post metadata records efficiently, which are necessary for inventoring, locating, and assessing the quality of geospatial data.

- **Maintain data integrity and security.**

  Organizations easily share the authoritative version of data among users and provide mechanisms for the creation of authentic data and metadata.

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**Reduce Time and Redundancy of Data Production**

SDI has evolved to enable geospatial information sharing at a significant scale. Esri provides a mechanism for posting, discovering, evaluating, and exchanging existing geospatial resources in support of both broadly based SDIs and narrowly framed local and organization-specific data sharing communities.

The Lithuanian Geographic Information Infrastructure (LGII) ensures the interoperability of datasets from government institutions and state-owned enterprises. The national geoportal (www.geoportal.lt) provides access to methodological documents such as business models, data specifications and standards, and relevant legal acts.

**Enable Easy Search and Discovery**

Organizations can improve knowledge sharing, reduce duplication of effort, direct people toward the best available data, and improve the overall quality of geospatial data and information.

**Maintain Data Integrity and Security**

Esri SDI technology integrates with service-oriented architecture (SOA) principles that support existing IT, Web, and geospatial interoperability standards, including the industry specifications of the Open Geospatial Consortium, Inc.® (OGC®). Enhanced security features and policies controlling record-level metadata access ensure the right data is available to the users who need it.

In Singapore, the GIS-based Land Information Network (LandNet) acts as an online GIS data warehouse for government agencies. This spatial data-sharing portal, created by the Singapore Land Authority (SLA), propels interagency information sharing to a high level by providing a real-time data exchange platform.

**VI. RECENT DEVELOPMENT IN SDI**

Spatial data infrastructure evolutionary approach has lead to development of data infrastructures both in global as well in national level. National Spatial Data Infrastructure (NSDI) encompasses the policies, organizational responsibilities, data, information, technologies, standards, services, and financial and human resources necessary to achieve this vision. The NSDI has become a critical vehicle for facilitating seamless data development, information sharing, and collaborative decision making across multiple sectors of the economy.
Fig. Collaboration of various geospatial data into one platform is the vision of NSDI.

The tremendous growth and evolution of geospatial technologies, industries, and applications in recent years has highlighted the need to update and modernize the strategic direction of Federal geospatial programs to align with and leverage these advancements. The Federal Geographic Data Committee’s (FGDC) 2014–2016 Strategic Plan for the National Spatial Data Infrastructure (NSDI) sets priorities and describes the actions the FGDC community will take, in collaboration with partners, to develop and maintain the Nation’s critical geospatial infrastructure.

This Strategic Plan was developed during 2013. This plan describes a shared national vision of the NSDI and includes a set of goals and objectives for the role of Federal agencies in achieving this vision.

The goals and objectives in the plan define areas of critical importance to the continued development of the NSDI and provide a framework for the Federal geospatial community’s responsibilities over the next 3 years [5].

**Goal 1 – Develop Capabilities for National Shared Services**

**Goal 2 – Ensure Accountability and Effective Development and Management of Federal Geospatial Resources**

**Goal 3 – Convene Leadership of the National Geospatial Community**

SDI has provided a new dimension in the field of geospatial technologies, although there still exists some issues that are still to be overcome.

1) The GeoSpatial Community plays an important role in providing leadership, policy development, and facilitation of the broad range of organizations and interests involved in the SDI.
This leadership role has been identified by stakeholders as a critical responsibility.

2) The diversification among the geospatial community relies for metadata guidance and the coordination of standards.

3) It is difficult to quantify the entire magnitude of geospatial investment across the geospatial community because these investments are typically dispersed across multiple programs and services.

4) Geospatial data management [7] is not fully integrated into global IT management processes, and many programs that have geospatial components are not visible through existing IT management and budgeting processes.

5) Expansion and Scalability of geospatial data and services, lead to new challenges that are arising like authentication threats, loss of data.

6) It may come as something of a surprise to find that matters relating to data interoperability come last in terms of priority for future SDI development. This is because the development and implementation of SDIs involves much more than database creation.

VIII. Conclusions

Most The geospatial technology field is at a remarkable point in its evolution, presenting an opportunity to rethink the deployment and use of these resources across SDI, and to enhance our ability to solve problems using geographic information while ultimately saving time and money.

The nature of an SDI is socio-technical, multi-layered, complex, and dynamic. It needs to take into account local government and their spatial resources to develop successfully.

Though an SDI is often envisaged as a socio-technical infrastructure involving technology and the people and organizations that use it, many SDI initiatives do not fully take these non-technical issues on board at a sufficiently early stage. Although the national level has a very data-centric focus on SDI implementation.

REFERENCES


