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Comparative Study on Advanced NSDIs for the Future NGIS Implementation in Korea

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ABSTRACT

The NSDI concept has changed with the development of the NSDI. While the NSDI was initially established as a separate entity, recently more attention has been given to the SDI hierarchy, from a local level to a global level. As an advanced NSDI, the USA, the UK and Canada emphasize more on better citizen services through an e-Government GIS portal such as the USA's Geospatial One-Stop.

This study hypothesizes that the characteristics of NSDIs can be different from each nation in terms of vision, structure, evolution stages and a degree of integration with the e-Government. Rather than to describe differences just for comparison, more characteristics of NSDIs are identified and the comparisons are developed as recommendations for the future NGIS(National Geographic Information System) in Korea.

Keywords : NSDI, GIS Policy, Policy Comparison, SDI, NGIS

요 약

국가공간데이터기반 개념은 국가공간데이터기반의 발전과 더불어 변화한다. 초기의 국가공간데이터기반은 개별적이고 공간데이터기반 자체에 초점을 두었지만, 최근 국가공간데이터기반은 세계, 지역 및 지방공간데이터기반 간의 위계구조에서의 역할이 초점이 맞추어지고 있다. 본 논문에서는 최근의 국가공간데이터기반의 특성과 미국, 영국, 캐나다 국가공간데이터기반 등 각 국에 대한 비교, 분석을 통해 향후 우리나라의 차세대 국가공간데이터기반, 즉 국가GIS의 정책방향을 모색하도록 한다.

주요어 : 국가공간정보기반, 정책비교, 국가GIS, 국가GIS정책

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1. Introduction

In the digital knowledge society, GIS technology is recognized as an essential tool to solve various human problems on the earth. With increasing importance of spatial information, most nations have developed their own implementation strategies for the National Spatial Data Infrastructure(NSDI). By facilitating better access and wider use of data, the NSDI provide a common framework for various and creative applications.

While the NSDI was initially established as a separate entity, recently more attention has been given to the SDI hierarchy, from a local level to a global level. In addition, integration of the NSDI with e-Government becomes an important policy to meet the citizens' expectations. As an advanced NSDI, the USA, the UK and Canada emphasize more on better citizen services through an e-Government GIS portal such as the USA's Geospatial One-Stop.

This study hypothesizes that the characteristics of NSDIs can be different from each nation in terms of vision, structure, evolution stages and a degree of integration with the e-Government. Rather than to describe differences just for comparison, more characteristics of NSDIs are identified and the comparisons are developed as recommendations for the future NGIS(National Geographic Information System) in Korea.

2. Comparison of NSDI Characteristics

The NSDI concept has changed with the development of the NSDI. According to the comparative analysis of NSDI development (Williamson, 2003), two generations are introduced. In the first generation, data is the key issue for the NSDI development and the main focus is on techno-centric spatial data community. The second generation includes more socio-technical issues and focuses on the people as well as the data. Usage of the data and users' needs are driving forces for the NSDIs development. Although the development of SDIs is explicitly at a national level, the second generation of the NSDI requires a collaboration model that facilitates greater inter-jurisdictional information exchange from a local level, through to a state, a national, a regional and a global level. The relationship between the different levels of SDIs is complex and dynamic and the NSDI has an important effect on the upper and lower levels of the SDI hierarchy. <Figure 1>

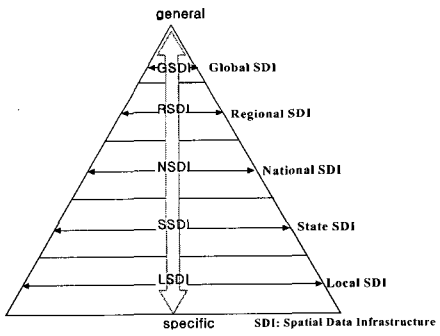

Figure 1. SDI hierarchy (Williamson, 2003)

2.1 Characteristics of the advanced NSDIs

2.1.1 The NSDI in the USA

Since the launch of the NSDI initiative in 1994, the NSDI has been reorganized and transformed to reflect technological changes and to focus on matters and places of national importance with an enterprise architecture for the Nation. Circular A-16, which describes the structures of NSDI and establishes the FGDC, has been revised from the 1990 version to the 2002. The revised Circular calls for continuing improvement in sharing and using geographical data. The revision proposes an integrated infrastructure system approach to provide multiple geospatial services for the e-Government[7].

For strategic consolidation of national geospatial programs, the USGS created the National Geospatial Programs Office (NGPO) in 2004 to lead the programs[8]. The NGPO will manage the essential components of the NSDI as a unified portfolio that can benefit the entire geospatial community. The goal of "bold step" of reorganization is to align national geospatial activities and responsibilities including the FGDC, Geospatial One-Stop (GOS), The National Map (TNM) and Interior Enterprise GIS. The geospatial profile will be added by the NGPO to the Federal Enterprise Architecture(FEA). The efforts imply that geographic information can be a major asset for most organizations in e-Government.

2.1.2 The NGDF in the UK

The objective of the NGDF(National Geographic Data Framework) is to facilitate and to encourage efficient access and widespread

Table 1. Characteristics of the NSDI in the USA

Component	Characteristics
Vision	• Current and accurate geospatial data will be readily available on a local, national and global basis to contribute to economic growth, environmental quality and stability and social progress.
Data	• Making Framework Real • The National Map
Metatdata and access service	• GOS Version 2 -"Two clicks to content" • Complete intelligent access to metadata with no license and restrictions
Partnership	• Clearly define agencies' role and FGDC responsibilities • Expand partnership into the public and private sectors • Creation of the NPGO as a unified portfolio
Integration with e-government	• Geospatial One-Stop is one of 24 E-Government initiatives. GOS Version 2 of the popular portal will be easier to use. • Geospatial profile for the Federal Enterprise Architecture

use of geospatial data. Despite that high quality geospatial data were already available, the national initiative of NGDF was established in 1997, which is much later than the USA's NSDI.

GIgateway is a free web service to increase awareness of and accessible chance to geospatial information in the UK[10]. This service is funded by the National Interest Mapping Services Agreement (NIMSA) and managed by the Association for Geographic Information(AGI) representing the interests of the UK's GI industry and playing an important role in the NGDF[11]. The NGDF tries to encourage direct private sector involvement and a market-oriented approach rather than a government-oriented approach in other countries. The characteristics of the NGDF can be summarized as follows:

① Intelligent geospatial information : For the 21st century, Ordnance Survey, Britain's national mapping agency and a market-leader in geographical information, has produced MasterMap. OS MasterMap contains more than 450 millions topographical objects (TOID) with unique IDs that can make daily-update possible[12].

② Integration of geospatial service with the e-Government : The UK's local e-governments define GIS as an enabler to implement the e-government[4] and the e-GIF (e-Government Interoperability Framework) includes spatial data as one of the e-government businesses[1]. The significant national e-government initiatives, such as the National Land and Property Gazetteer(NLPG), National Land Information Service(NLIS), and National Land Use Data(NLUD) are cooperated with the local governments. The UK's ODPM(Office of the Deputy Prime Ministers) formed the Geographic Information Panel in 2005, to take an advice on geographic information issues of national importance.

③ Partnership with the public and private sectors : As a cross-sectoral and mixed public-private body, the AGI(Association for Geographic Information) plays an important role in the NGDF.

2.1.3 The CGDI in Canada

To develop the Canadian Geospatial Data Infrastructure (CGDI), the Government of Canada funded the GeoConnections program with the objective of harmonizing Canada's geospatial databases and making them accessible on the Internet. Through partnerships with federal, provincial, local governments, and the private and academic sector, the GeoConnections program promotes the use of standards and protocols to facilitate access to Canadian geospatial data.

① Access : Provide the public with access to geospatial data and services in the GeoConnections Discovery Portal.

② Framework data : Seamless and fully integrated geospatial data that provides context and reference information for

the country.

③ Standard : To ensure that the CGDI is compatible with activities at a global level, stakeholders in Canada have agreed to take advantage of international GIS standards for the CGDI.

④ Partnership : To strengthen a national partnership initiative, the CGDI involves the public and private sectors, academia and non-governmental organizations.

⑤ Policy : The objectives of the CGDI policy are to foster increased access to and use of geospatial data in the public and private sectors, to resolve licensing and distribution issues in supporting data-sharing and use, to facilitate inter-agency geospatial data-sharing arrangements, to expand partnerships, and to reduce the cost of the collection, maintenance and distribution of geospatial data.

To ensure that government information is managed effectively and efficiently the Government of Canada ratified the Management of Government Information Policy in 2003. The policy provides direction on how governmental institutions, departments and agencies should create, use, manage and preserve information in a comprehensive and strategic manner.

On June 15, 2005, the Government of Canada announced to fund $60 million for renewal of the five-year GeoConnections program[14]. While the first phase of GeoConnections focused on developing policies, standards, technologies and partnerships required to build a Canadian Geospatial Data Infrastructure (CGDI), the second phase aims to ensure more Canadians can actively adopt, use and benefit from the CGDI. From 2005 to 2010, the renewed GeoConnections program will work with its existing partners to ensure that CGDI technologies remain current, but will also pursue partnerships with new end-user communities of practice. Specifically, GeoConnections will seek to understand the needs of users better in four key areas: sustainable development and the environment, aboriginal issues, public health, and public safety.

The first phase of GeoConnections was recognized internationally as a model partnership, and its success was attributed to its governance approach. The new GeoConnections program will operate in the almost same way: it will be led by Natural Resources Canada and be governed by a management board and several advisory boards; and it will undertake cost-shared partnership projects with the public and private sectors and other organizations in support of the CGDI.

2.2 Lessons learned form the compared characteristics

The fore-mentioned NSDI cases for the USA, the UK and Canada have proved that the emphasis of NSDIs can be different to reflect their own situations. While the USA can have more political and governmental support with Executive Order 12906, the UK has more market-orientated strategies. The

Table 2. The comparisons of the advanced NSDIs

	USA	UK	Canada
Intelligent geospatial information and service	• The National Map • Complete intelligent access to metadata with no license and restriction	• OS MasterMap • Knowledge based search for metadata	• Seamless geospatial data integration and access • Web-based geospatial service and access
Much effort for the integration of the NSDI with e-Government	• GOS Version 2 -"Two clicks to content" • Disaster preparedness service using geospatial data • Geospatial profile for the Federal Enterprise Architecture	• GIS as an enabler to implement local e-government • Spatial data as one of the e-government businesses in e-GIF • Formation of Geographic Information Panel, to take an advice on geographic information issues of national importance	• Focused on citizen-centered service • Life cycle event service integrated with geospatial data • Geoconnections portal integrated with the e-Government portal
Collaborative partnership with the public and private sector	• Clear definition of agencies' role and FGDC responsibilities • Expand partnerships to the public and private sectors • Creation of NPGO as a unified portfolio	• Improvement of partnership with the federal and local governments • Partnership into the public and private sectors	• Improvement of partnership with the federal and local governments
Geospatial portals for easy access and wide use of geosptial information and services	• GOS Version 2	• GIgateway	• Geoconnections
The future directions of NSDI implementation	• Interoperability with NII and within NSDI • Expansion of NSDI • Support to GSDI	• Interoperability • Intelligent geoaptial service	• Partnerships with new end-user communities • Better understanding users' need in four key areas: sustainable development and the environment, aboriginal issues, public health, and public safety

Canada's Geoconnections can be characterized as an exemplary partnership with the public sector, the private and academic sector.

Lessons learned from the comparisons can be summarized as follows: ① The main direction of the NSDI is intelligent geospatial information and service, ② Much efforts are being made for the integration of NSDIs with the e-Government ③ Collaborative partnership with the public and private sectors is considered the most efficient way of implementing the NSDIs ④ Geospatial portals play a key role for easy access and wide use of geosptial information and services ⑤ Future directions for NSDI implementation: interoperability with NII and within the NSDI, expansion of the NSDI, and support to the GSDI.

3. Possible directions for the NGIS in Korea

From the lessons mentioned, several directions can be suggested for the NGIS in Korea.

3.1 3Is for the Ubiquitous NSDI

As a NSDI develops, it becomes more important to utilize and expand the existing the NSDI for the problem-solving purpose. As a GIS paradigm shifts, the NSDI evolves to require more geospatial data, information and knowledge.

The <Figure 2> shows the evolution from the data(supplier)-centered NSDI to the user-centered NSDI with a more socio-technical viewpoint. The GIS paradigm shift requires new ideas, new services, and more creative applications of the NSDI. The advanced NSDI can provide seamless 24/7 data for citizens and interoperability within the e-Government for geospatial services. Furthermore, a degree of integration, interoperability, and intelligence can determine maturity and effectiveness of the NSDI in an e-Government perspective.

As mentioned, the NSDI has an important effect on the upper and lower levels of the SDI hierarchy <Figure 3>. Vertical and horizontal expansion of the NSDI in the hierarchy can

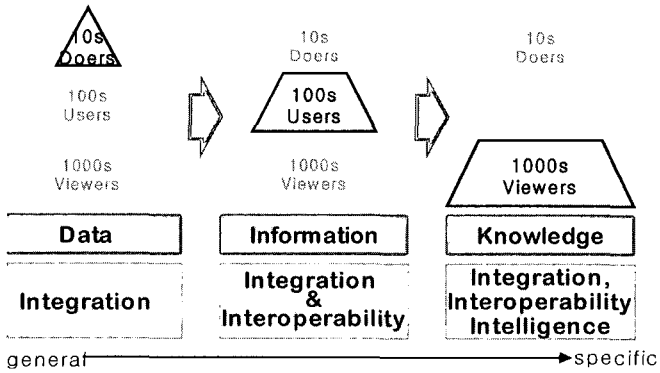

Figure 2. Future directions of NSDI according to GIS paradigm shifts

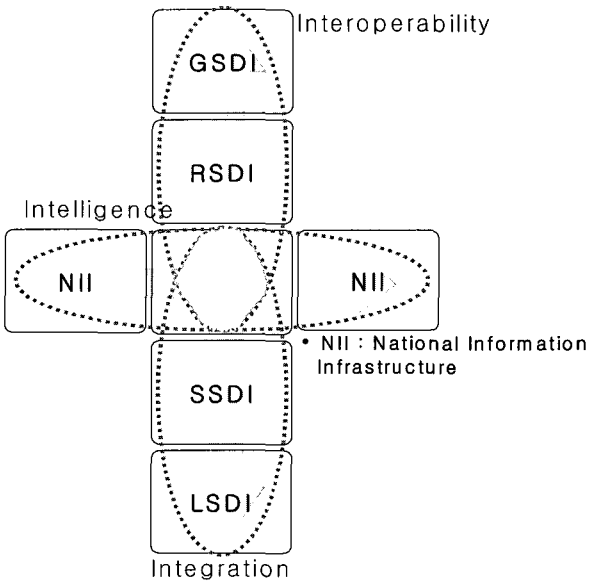

Figure 3. The NSDI in SDI hierarchy

provide a basis for integration strategies for the future. The integrated NSDI with e-Government means harmonization of the NSDI and the NII(National Information Infrastructure) with a more emphasis on geospatial information than ever.

Additionally, ubiquitous technology has emerged as a more powerful integration tool for another stage of the NSDI evolution.

Ubiquitous service with 5As(Anytime, Anywhere, Anyservice, Anydevice, Anynetwork) will impact the future NSDI for government administration and citizen services. Especially, "context aware," an important characteristic of the ubiquitous technology, will contribute to the future intelligent NSDI.

The three key concepts of integration, interoperability and intelligence will be a basis for the ubiquitous NSDI. The <Table 3> shows reorganization of the lessons in terms of 3Is and provides practical examples for the future NSDI.

3.2 Strategies for the future NGIS in Korea

Strategies for the future NGIS can be summarized in terms of 6 NSDI components: data, access and metadata, standard, technology, partnership, and law/regulations and institutional policy. Each component is analyzed in the perspective of integration, interoperability and intelligence.

☐ Data

- ***NGIS Data specifications for framework data**: Arrangement of data model and*

Table 3. The advanced NSDIs in terms of NSDI future direction

	USA	UK	Canada
Integration	• Bluebook for NSDI Stewardship Guidance • Creation of NPGO as a unified portfolio		• Seamless geospatial data integration and access
Interoperability	• Geospatial profile for Federal Enterprise Architecture	• Partnership with the public and private sectors • Significant national e-government initiatives, such as NLPG, NLIS, and NLUD with the cooperation of the local governments	• Life cycle event service integrated with geospatial data • Geoconnections portal integrated with e-Government portal
Intelligence	• The National Map • Complete intelligent access to metadata with no license and restrictions' • GOS Version 2 -"Two clicks to content"	• OS MasterMap • Knowledge based search for metadata	• Web-based geospatial service and access • Focused on citizen-centered service

specifications for framework data will provide the vertical integration with the central and local governments and horizontal interoperability for the NGIS such as the USA bluebook.

- ***Data currency and intelligence with UFID***: *The UFID(Unique Feature IDentification) are very useful to adding intelligence to data and real-time update. As seen in the UK's mastermap, the definition and assignment of the UFID will be needed for NGIS.*

☐ Access and metadata

- ***Evolution of the Korean geospatial clearinghouse***: *The current the national geospatial clearinghouse provide limited services, it needs to expand and provide more improved geospatial services such as Geospatial One-Stop in the USA case.*
- ***More recognition of importance of metatdata*** *: Metadata is a key for data access, distribution, and the intelligent NGIS. It is necessary to have more informative metadata in a GIS portal with "2 clicks to context".*

☐ Standard

- ***Standard for geospatial interoperability in e-Government***: More international GIS standards need to be profiled for interoperability, but inconsistency and

incomparability can be founded.

☐ Technology

- ***Geospatial profile for the Korean e-Government Enterprise Architecture*** *: Integration of NGIS with e-Government will require geospatial profiles for e-Government.*

☐ Partnership

- ***Enhance collaborative partnership*** *: Central-central, central-local and local-local government partnerships are essential for the establishment of seamless geospatial integration.*
- ***NGIS as a unified portfolio*** *: more control and guidance on NGIS projects: As seen in the USA's NGPO, more top down guidance for NGIS is needed to improve integration, interoperability and intelligence of the NGIS.*

☐ Law/ Regulations and institutional policy

- ***More practical and feasible vision statement in the NGIS master plan****: The NGIS needs to have more focus matters and places of national importance, such as national security.*
- ***Adaptation of existing regulations for fitness for use of geospatial information*** *: Existing regulations need to be expanded for data custody, data security and privacy, and to be improved for wider use of the NGIS.*
- ***Harmonized integration of the NGIS law with the e-Government law*** *: Separation of the two laws in terms of geospatial information predicts less efficiency and effectiveness of the future e-Government implementation.*

4. Conclusion

With the increase of population and continuing quality improvement of life, development will happen continuously on the earth and increase complexity of our spatial problems. To solve the emerging spatial problems, more creative and effective solutions are required. The NSDI can serve as a useful integration vehicle for matters and places of national importance, such as national security and emergency prevention and management. In the USA, the 911 accident provided a momentum to recognize importance of geospatial data and transformed the existing NSDI to a more integrated and problem-solving structure. To meet the emerging requirements properly, more specific data at the level of local government and the broader range of existing framework data are needed. Initially, the bottom-up approach of the NSDI in the USA now phases into a compromized stage with the top-down approach exemplified in geospatial profile in the Federal Enterprise Architecture.

It might be a proper time to accept good ideas for the future NGIS in Korea to the degree that can deal with complex spatial problems of national importance and utilize the NGIS in a citizen perspective. Shortage of resources and funds, as opposed to increasing citizens' needs, will require more capabilities

of integration, interoperability and intelligence in NGIS. In addition to the capabilities, matured culture of better communication, cooperation and collaboration will be mandatory for the ubiquitous NGIS.

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