Proposed Models for and Approaches to a Vietnam National Spatial Data Infrastructure

TUAN Vo Anh, Dr. XUAN Nguyen Truong, Vietnam

Key words: SDI; GDI; NSDI, VNSDI; Spatial Data Infrastructure.

SUMMARY

By now, several ministries and sectors of Vietnam have succeeded in developing GIS databases for their State administration and professional work. This initial achievement has resulted in great benefits in science-technology, socio-economic, national security terms. However, socio-economic and national defense policy making requires integrated data from various sources, in many cases from more than just one single institution, for correct and comprehensive decisions to be made to solve issues on global, cross-regional, cross-sector scales.

The purpose of this paper is to propose models for and approaches to a Vietnam National Spatial Data Infrastructure (VNSDI) using modern technology, taking into account lessons from advanced countries and the general Spatial Data Infrastructure trends in the world.

In this paper, the effectiveness and benefits from VNSDI will be addressed, and results from surveys of recent VNSDI studies and lessons from some advanced countries in this regard be presented. Models and approaches to VNSDI will then be proposed.

The benefits from VNSDI will be the possibility for sharing geo-data and geo-information across ministries and sectors of Vietnam, overcoming the problem of silo management of data, avoiding duplicated investments in creating and updating data, and for correct and comprehensive decisions to be made.

The proposal will serve as one of scientific justifications for VNSDI in the future and on the other hand contribute to improving the awareness of institutions and individuals about sharing geographic data.

For VNSDI development in the future, it will be critical to set models and approaches toward the general Spatial Data Infrastructure trends in the world in scientific and experience terms.

SUMMARY (Vietnamese)

Hiện nay một số bộ, ngành của Việt nam đã xây dựng các cơ sở dữ liệu GIS phục vụ công tác quản lý Nhà nước, hỗ trợ các hoạt động chuyên môn nghiệp vụ của mình. Các kết quả này bước đầu đã đem lại những hiệu quả rất lớn về mặt khoa học - công nghệ, kinh tế - xã hội và an ninh – quốc phòng. Tuy nhiên để hoạch định chính sách phát triển kinh tế - xã hội, phục vụ an ninh – quốc phòng đòi hỏi cần phải có sự tích hợp nhiều nguồn dữ liệu với nhau, nhằm đưa ra những quyết định chính xác và toàn diện, giải quyết các vấn đề mang tính toàn cầu, liên khu vực, liên ngành mà nhiều khi yêu cầu phải tích hợp dữ liệu vượt ra ngoài phạm vi dữ liệu của một tổ chức đang quản lý.

Mục tiêu của bài viết đề xuất mô hình và hướng tiếp cận để xây dựng VNSDI bằng công nghệ hiện đại, kế thừa kinh nghiệm của các nước tiên tiến và xu hướng phát triển chung về cơ sở hạ tầng dữ liệu không gian của thế giới.

Bài viết sẽ đề cập tính hiệu quả và lợi ích của VNSDI mang lại, khảo sát một số nghiên cứu liên quan tới triển khai xây dựng VNSDI trong thời gian vừa qua, nghiên cứu kinh nghiệm triển khai của một số nước tiên tiến và xu hướng phát triển chung của thế giới. Từ đó đề xuất mô hình và hướng tiếp cận để xây dựng VNSDI trong thời gian tới.

Lợi ích của hệ thống VNSDI mang lại chính là sự chia sẻ thông tin dữ liệu không gian địa lý giữa các bộ, ngành trong cả nước; khắc phục được tình trạng cát cứ thông tin dữ liệu, tránh được sự đầu tư trùng lặp, lãng phí trong việc thiết lập dữ liệu ban đầu cũng như cập nhật thông tin dữ liệu địa lý về sau nhằm đưa ra các quyết định chính xác và toàn diện.

Kết quả đề xuất này sẽ là một trong những luận cứ khoa học trong việc triển khai VNSDI trong thời gian tới đồng thời phần nào nâng cao nhận thức của các tổ chức, cá nhân trong việc chia sẻ thông tin dữ liệu đối với thông tin dữ liệu địa lý.

Đối với Việt Nam thì việc xác định mô hình và cách tiếp cận hiện đại theo xu hướng phát triển chung của thế giới sẽ đóng vai trò rất quan trọng về mặt cơ sở khoa học, công nghệ và kinh nghiệm triển khai thực hiện xây dựng VNSDI trong thời gian tới.

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1. INTRODUCTION

Geographical Information System (GIS) has been looked into and applied in Vietnam since the early 90s. By now, several ministries of Vietnam have been able to develop GIS databases for their State management and professional purposes. There have been many GIS studies and application projects undertaken to address critical issues relevant to the need for national development. These have resulted in significant benefits in scientific – technological, socio-economic, and national security and defense terms.

However, in the current circumstances, for scientific – technological, socio-economic, and national security and defense purposes, it is necessary to have integrated data from various sources to ensure decisions made will be correct and comprehensive. The trend of joint progress toward a connected economy is a trend of the time which is also the goal for technological and institutional development. But in fact, there are still challenges encountered by not only Vietnam but also other countries (including developed ones), including:

- To keep the various existing information systems in general and GIS systems in particular currently managed and used by different owners but to make sure provision, distribution, sharing of data and information to the general users community is enabled;
- To accept differences in the way geo-objects are organized in GIS databases in different sectors as long as data integration to a certain extent is still possible;
- To address global, inter-regional, and cross-sector issues where there is a need for data integration that goes beyond a sector's boundary, e.g. environmental, land use planning issues,…
- To address to some extent the matter of understanding by institutions and individuals in relation to data sharing; to reduce the problem of silo-management of data and information in general and geo-data and geo-information in particular.

One of the answers to the question of "solutions to those challenges" lies with National Spatial Data Infrastructure (NSDI).

Or in other words, the benefits from an NSDI is the sharing of geo-spatial data across the producers and users of geo-data and geo-information, avoiding duplicated investments in creating and updating data and information for correct and comprehensive decisions to be made.

Thus, models and approaches to a modern Vietnam National Spatial Data Infrastructure (VNSDI) that agrees with the general international trend will provide important scientific and technological justifications and practical lessons for Vietnam in the future. That will also help address Vietnam's need to join the general international scientific and technological development as well as the trend of international exchange of geo-data.

2. SDI DEVELOPMENT IN THE WORLD AND IN VIETNAM

2.1. In the world

Development of Spatial Data Infrastructure (SDI) has taken place since the mid-90s in developed countries. Depending on their specific conditions, their NSDI have been built differently but all based on high technology and continuously updated with the development of scientific and technological theories. Pioneers with highly efficient NSDIs are Canada, the USA, India, Australia and the EU countries.

Take the INSPIRE project of Europe as an example. This project was aimed at building a geo-spatial database of high availability and usefulness for sustainable development and strengthened environmental protection. INSPIRE was implemented by the EU. Through the project, various types of geodata has been corrected and integrated, setting the path toward a successful ESDI. The first intention of INSPIRE was to set up an European spatial information infrastructure that would provide integrated spatial information services. Those services would allow users to identify and access geodata from various sources, from local to global, for various purposes.

Similarly, other NSDI projects of other countries have also been implemented and brought about immense benefits such as the Geo-One-Stop of the USA, the SIDP of Australia, the GeoConnections of Canada, …

Moreover, SDI has not stopped as a national infrastructure. There has been a development association of Global Spatial Data Infrastructure (GSDI) set up, which aims at studying and promoting a global SDI. The purpose of GSDI is to support international access to geodata, enabled via coordination across countries and organizations in shaping understanding and implementing common policies, technologies and standards and exchanging mechanisms for geodata. These include policies, organization, data, technology, standards, sharing mechanisms, human and financial resources.

The GSDI association has set up working committees for SDI activities in different regions. GSDI association is playing an increasingly proactive role in supporting countries to develop and implement their NSDI strategies an operate their NSDI.

The goal for the GSDI association is to enable organizations and countries to exchange and share geodata with the best efficiency.

2.2. In Vietnam

SDI has not been fully concerned in Vietnam. Training institutions in Vietnam have not incorporated this in their training curricula at both graduate and post-graduate levels. Investment by the Government in this regard has been just inconsiderable for the development

of separate specialized databases has been only started. In addition, the constraints in legal, institutional, organizational, technological and resource terms have also been a big hamper on the process in Vietnam.

So far, the studies and projects undertaken in relation to an NSDI for Vietnam have mainly by Ministry of Natural Resources and Environments (MoNRE):

- The Project "standardization of the basic national geodata system", which aimed at developing a set of technical standards including standard documentations, basic data sets, metadata to ensure consistency in collecting, managing, archiving, using, distributing, and sharing geodata for natural resource management and environmental protection;
- The Project "building a national integrated Natural Resources and Environments (NRE) database", which aimed at integrating data from the six mandated areas of MONRE, including land, water resrouces, geo-mineral resources, environment, hydrology and meteorology, surveying and mapping;
- The Study "Scientific and technological justifications for designing and developing SDI";
- The Project "Building geodatabase at 1:10.000 scale in combination with Digital Elevation Model for the whole country";
- The Project "Building geodatabase at 1:2.000 and 1:5.000 scales for urban, industrial and key economic areas";
- The project "Building national marine database of baseline for the marine natural resource and environment of Vietnam";
- The "Vietnam Land Administration Project–VLAP", which includes one component about building a land information portal at central level to be linked with the land databases of the 9 project provinces.

Though the above mentioned projects and studies were related to VNSDI, a comprehensive scientific ground for VNSDI still remains a new and interesting study topic. On the other hand, scientific grounds for NSDI in general are still insufficient and insystematic. It is therefore very necessary to to study and recommend models for and approaches to the development of an international styled NSDI, basic scientific justifications and methodologies for NSDI in Vietnam.

3. BENEFITS FROM VNSDI

Knowing the importance of sharing information in addressing global issues such as natural disasters, diseases and epidemics, poverty, environment, protection of natural resources, etc. many countries have started to develop their NSDI.

For Vietnam, once VNSDI is in place, it will strengthen geodata sharing between producers and users of the data, reducing duplication, avoiding silo-management of data, avoiding duplicated investments in creating and updating geodata. It will be a good tool for decision

makers (the Government, ministries, sectors provincial peoples committees) to make more accurate and comprehensive decisions.

As such, VNSDI will develop and become an important part of the e-government – a strategic tool for the national development of Vietnam, where the use of NSDI for decisions related to natural resources, environment, nature, socio-economic development, social and national security and defense will be of fundamental importance.

4. VNSDI VS THE COMING FUTURE

For the efficiency and benefits that come from an NSDI as mentioned, the need for an NSDI in Vietnam in the coming future will be based on:

- The GIS technology that has been touched upon since the 90s of the previous century and is currently being widely used by State bodies, private enterprises and the society;
- The national projects implemented by ministries that dealt with GIS and specialized geodatabases. In other words, the separate spatial data are becoming more varied and have positively supported the socio-economic development.
- Bringing the outputs from geo-spatial data related projects to use needs to be promoted.
- Spatial data is playing important role in supporting socio-economic development, environmental protection and sustainable development;
- The need to share spatial data across the State bodies and other organizations, and the community is very high;
- The need to integrate, share spatial data for State management work of various ministries is very big.
- Building an NSDI to connect the various spatial data blocks is the job to be done quickly.
- The need to use spatial data by the Government, the ministries, sectors and provinces is very big. MONRE, Ministry of Agriculture and Rural Development (MARD), Ministry of Construction etc. then the provinces, NGOs, and enterprises and individuals are examples of potential users.
- Gradual application of IT technology to the implementation of Decree 102/2008/ND-CP dated 15/9/2008 by the Government regarding collecting, managing and using NRE data;

Thus, the need for VNSDI is very big. Such VNSDI will to be used primarily for MONRE in its seven mandated areas, then the society ranging from the Government, ministries, sectors, provinces, other organizations and individuals

5. PROPOSED APPROACHES AND MODELS FOR VNSDI

5.1. Approaches

In view of one of the definitions of SDI, which says: "SDI is technologies, policies and human resources required to promote the sharing of geo-spatial data across all State bodies, private companies, NGOs, and the research community", we see that NSDI is a complex problem in all technical, technological and social terms. Therefore, for a successful NSDI, the roadmap for it should include: (i) development of an NSDI strategy, and (ii) implementation of such strategy focusing on:

- Setting up a national steering committee for VNSDI;
- Learning international trends and lessons from advanced countries in the region and in the world about NSDI;
- Developing and issuing legal documents that govern procedures, methods for updating, sharing, using, providing the data from VNDSI;
- Setting up a nationally unique data framework;
- Setting up strong enough IT infrastructures for the operation of the VNSDI;
- Making the best use of the support and commitments from the Stakeholders;

5.2. Key technical solutions to VNSDI

The architecture of the VNSDI includes 4 main components: the data, the service, the application and the user. For those components to work properly, the followings need to be addressed:

5.2.1. Legal framework

- Developing and issuing legal documents that govern procedures, methods for updating, sharing, using, providing the data from VNDSI
- Developing standard documentations for NSDI:
  + Standards for data framework
  + Standards for exchanging, integrating component spatial data
  + Standards for metadata of the VNSDI
  + Standards for retrieving and providing requested spatial data.

5.2.2. Technical – Technological

This is an important part of VNSDI. The success in the future will depend on how proper the selection of technological solution is. Such solutions include:

- GIS technology.
- Database management system
- Solutions to online map (Map Online, WebGIS)
- Designing geodata models
- Designing, developing national Data Clearing House.

5.2.3. Geodata framework for VNSDI

The framework geodata of VNSDI include:

- Basic national geodata system:
  + Topographic maps at 1/50.000 for the whole country

+ Seabed topographic maps for the whole sea areas of Vietnam
- Digital Elevation Model (DEM) for the whole country
- Digital images (satellite images, arieal photos) for the whole country

5.2.4. Specialized geodata

Including:
- NRE database (land, environment, geo-mineral resources, water resources, seas and islands, surveying and mapping, hydrology and meteorology);
- Geodatabase related to agriculture and rural development;
- Geodatabase related to construction
- Geodatabase related to frontiers and boundaries
- Geodatabase related to national defense
- Geodatabase related to security
- Land databases in provinces

etc.

5.2.5. ICT infrastructures

- Develop ICT infrastructures of sufficient capacity that can enable security for VNSDI

5.2.6. Human resources

- Capacity building to have a good array of technical human resources capable for developing, managing and operating VNSDI;
- Public awareness raising in relation to VNSDI;

5.3. Proposed solutions to VNSDI

Based on international experience, the current development of GIS, the IT infrastructures conditions, geodata, organizational arrangements, and the human resources available in Vietnam, the following solutions are recommended to VNSDI for the time to come:
- MONRE develops a VNSDI development strategy to be submitted to the Govenrment for approval;
- Based on the approved strategy, MONRE shall develop a VNSDI development project to be approved by the Government;
- Set up a national steering board for VNSDI where MONRE is the standing member;
- Assign ministries, sectors, provinces to develop and implement project components, including:

i) MONRE as the host agency:

- Developing and issuing legal documents that govern procedures, methods for updating, sharing, using, providing the data from VNDSI
- Developing geodata standards, standards for exchanging and distributing geodata
- Developing a nationally unique geodatabase framework;
- Developing a system for access and retrieving, distributing geodata on a national scale (the Geospatial Clearing House), integrating the component databases of VNSDI.

- Creating geodata related to NRE such as land, environment, geo-mineral resources, water resources, seas and islands, surveying and mapping, hydrology and meteorology
- Improving the management and operation of VNSDI.

ii) Ministry of Information and Communication to be in charge of the following project components:

- Developing standards for ICT
- Developing ICT infrastructures of sufficient capacity to ensure security for VNSDI;

iii) Other ministries to be in charge of the following project components:

- MARD: developing geodatabase related to agriculture and rural development
- Ministry of Construction: developing geodatabase related to construction
- Ministry of Home Affairs: developing geodatabase related to frontiers and boundaries
- Minisry of National Defense: developing geodatabase related to national defense
- Ministry of Police: developing geodatabase related to security

Etc.

iv) The provinces to be in charge of the following project components:

- Each province will develop a geodatabase for their territory;

6. CONCLUSION

The efficiency and benefits from a VNSDI is the sharing of geo-spatial data across the producers and users of geo-data and geo-information, avoiding silo-management of geodata and duplicated investments in creating and updating data and information for correct and comprehensive decisions to be made.

At present, when ministries are just developing their own specialized databases to serve the performance of their mandates, VNSDI is still something in the distance. Therefore, MONRE as the organization in charge of developing GIS infrastructures and standards, spatial, remote sensing and geodata techniques, will play an important coordinating role in designing, implementing and operating the VNSDI in the coming time. This is also the opportunity for Decree 102/2008/ND-CP dated 15/9/2008 by the Government regarding collecting, managing and using NRE data to be implemented with the best results.

The models for and approaches to a VNSDI are proposed based on modern technology, taking into account lessons from advanced countries and the general SDI trends in the world.

The proposed solutions to VNSDI are feasible in the existing conditions of Vietnam, aiming at arranging accurate and updated geodata available for economic growth, environmental sustainability, and social development at both national and local levels.

The proposal will serve as one of scientific justifications for VNSDI in the future and on the other hand contribute to improving the awareness of institutions and individuals about sharing geographic data. For Vietnam, taking international styled models and approaches will be very important for developing VNSDI in the coming time.

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BIOGRAPHICAL NOTES

Tuan Vo Anh holds engineering degree in Survey and Mapping in Hanoi, 1993 and obtains M.Sc. degree in Geo-Information Management at International Institute for Geo-information Science and Earth Science (ITC), The Netherlands in 2006. Since last sixteen years he has been working in the fields of Survey and Mapping, Land Administration, and IT applications, Spatial Data Infrastructure and he has long experiences in digital map technology, Land Information System development, implementation of Government, International cooperation projects in LIS/GIS and Land statistics database in Vietnam. His current is Deputy Director, Centre of Archives and Land Information, General Department of Land Administration.
He is member of Vietnam Association of Geodesy, Cartography and Remote sensing (VGCR).

Dr. Xuan Nguyen Truong is Assoc.Prof. of Remote Sensing and Geo-Information Science at the Faculty Surveying and Mapping and Faculty of Information Technology, Hanoi University of Mining and Geology (HUMG), Vietnam. His current is Vice-Rector of Hanoi University of Mining and Geology, Dean of Faculty of Information Technology.
He is member of Vietnam Association of Geodesy, Cartography and Remote sensing (VGCR).

CONTACTS

Mr. TUAN Vo Anh
Centre of Archives and Land Information,
General Department of Land Administration (GDLA)
Ministry of Natural Resources and Environments (MoNRE)
78/9 Giai phong Rd. – Phuong Mai – Dong Da – Hanoi
VIETNAM
Tel: (84.4) 38693318 – Fax: (84.4) 36 90207
Email: tuanva@tnmt.vn
Website: www.gdla.gov.vn

Assoc.Prof. Dr. XUAN Nguyen Truong
Vice-Rector
Hanoi University of Mining and Geology (HUMG)
Dong Ngac – Tu Liem – Hanoi
VIETNAM
Tel: (84.4) 38385093 – Fax: (84.4) 38389668
Email: nguyentruong xuan@ humg.edu.vn
Website: www.humg.edu.vn