Evolution of the Function of Spatial Data Infrastructures Through Land Administration Projects in Vietnam

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by

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Abstract

Spatial data infrastructures (SDIs) have naturally and predominantly evolved through directives, initiatives and spatial data coordination activities while others have evolved, to a lesser extent, through development projects such as land administration projects over time.

Over the past twenty years, the SDI development in Vietnam has been as a result of land administration projects which have been implemented with the assistance of external donor agencies. The objective of this study was to determine the degree to which spatial data infrastructures have evolved through land administration projects and to understand to what extent development projects have affected the natural course of SDI. The influence of external donors within land administration projects was also considered.

To determine the evolution of the SDI in Vietnam, its components have been used as the basis for data collection. Interviews were conducted and online questionnaires distributed to individuals from land administration organizations, universities and other land related organizations at the central, provincial and district levels in Vietnam. Using the components of SDIs, concepts and indicators which relate to them were used to determine the evolution of the SDI, and also the influence of external donors within land administration projects.

Based on the responses, it was observed that eventhough there are formal mandates that describe how organizations should interact, their relations continue to be based on personal contact and not the respective mandates. Furthermore, the gap between land administration projects and policy inclusion influences the way in which the SDI is regulated as there is no prescribed format through which the SDI should evolve. As a result of the gap, adoption of SDI technology is predominantly at the central and province levels of public administration thus ignoring the lowers levels as well as across-level collaboration. Additionally, at these levels, the technology is merely used for land registration and land use planning (routine land administration tasks).

The twenty year evolution of the SDI in Vietnam has occurred in parallel to the land administration projects. Thus, when the project comes to an end, SDI evolution is interrupted until another project is implemented to enable its continued development. Hence, Vietnam's SDI development has remained a part of the first generation of SDIs and to this end the evolution of SDIs through land administration projects has not been effective.

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Table of contents

List of figures

List of tables

List of abbreviations

CIREN	Centre for Natural Resources and Environment
CPLAR	Cooperation Programme on Land Administration Reform
DONRE	Department of Natural Resources and Environment
ELIS	Environment and Land Information System
GDI	Geospatial Data Infrastructure
GDLA	General Department of Land Administration
GII	Geospatial Information Infrastructure
GIS	Geographical Information System
GSDI	Global Spatial Data Infrastructure
HUEGIS	GIS Project of the Thua Thien Hue Province
ICT	Information and Communication Technology
LA	Land Administration
LII	Land Information Infrastructure
LIS	Land Information System
MONRE	Ministry of Natural Resources and Environment
NSDI	Natural Spatial Data Infrastructure
SDI	Spatial Data Infrastructure
SEMLA	Strengthening Environmental Management and Land Administration Programme
SIDA	Swedish International Development Cooperation Agency
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
VILIS	Vietnam Land Information System
VLAP	Vietnam Land Administration Programme
VSDI	Vietnam Spatial Data Infrastructure

1. Introduction

1.1. Background

The ability to meet the range of land administration functions in the areas of land tenure (securing and transferring rights in land and natural resources); land value (valuation and taxation of land and properties); land use (planning and control of the use of land and natural resources); and land development (implementing utilities, infrastructure and construction planning) require access to complete and up-to-date information about the built and natural environments (Binns and Rajabifard 2006). Improved access and integration of the built and natural environments data sets can be facilitated by the introduction of a spatial data infrastructure (SDI).

The Global Spatial Data Infrastructure (GSDI) Association defines an SDI as a relevant base collection of technologies, policies and institutional arrangements that facilitate the availability and access to spatial data (Nebert 2004). (Rajabifard 2002) also says that a spatial data infrastructure (SDI) is an initiative intended to create an environment in which all stakeholders can co-operate with each other and interact with technology, to better achieve their objectives at different political and administrative levels. In other words, a SDI is an infrastructure that links people to data and is comprised of policies, access technologies and standards (data and metadata) (Binns and Rajabifard 2006). However, it is seen as an evolving concept of facilitation and organization of exchanging and sharing of spatial data between stakeholders from different departments and organizations in the spatial data society. Hence, a spatial data infrastructure (SDI) is attributed to improving the decision-making processes of Government and enhancing the work practices of all ministries, international collaborators and donor agencies as well as other support agencies (Mund 2007).

Furthermore, many countries are developing spatial data infrastructures at different levels ranging from local to state/provincial, national and regional levels, to a global level, in order to improve management and utilization of spatial datasets (Rajabifard, Feeney et al. 2003). The merging of these datasets (cadastral and topographic) at a local level has been achieved to some degree, however, attempts to integrate the datasets at a national level, even where spatial data infrastructures are well developed, has been difficult and problematic internationally (Holland, Williamson et al. 2005).

Some spatial data infrastructures have been developed with initiatives such as INSPIRE (Infrastructure for Spatial Information in Europe) in 2004, the US Executive Order of President Clinton in 1994 (Longhorn 2004). Initiatives such as these have lead to the formation of coordinating bodies that are responsible for carrying out these initiatives. Such organizations are the Canadian GeoSpatial Data Infrastructure (CGSDI) for Canada, the European Umbrella Organization for Geographic Information (EUROGI) for European countries, the Permanent Committee on SDI for the Americas (PCIDEA) and the Permanent Committee on GIS Infrastructure for ASIA and the Pacific (PCGIAP) (Rajabifard, Feeney et al. 2003; Masser 2005a). Other bodies are the Global Spatial Data Infrastructure Association (GSDI) which is an inclusive organization of organizations, agencies, firms, and individuals from around the world. The purpose of the organization is to promote international cooperation and

collaboration in support of local, national and international spatial data infrastructure developments that will allow nations to better address social, economic, and environmental issues of pressing importance (GSDI). However, Vietnam's SDI initiatives have been developing and evolving through land administration Projects (LAP) by donor agencies.

Over the past 10-15 years the focus of organizations (donor agencies) such as the United Nations, World Bank and the Swedish Government within land administration projects has been primarily on access to land, security of tenure and the operation of land markets. The focus has been on either documenting or improving the administration of private rights. This is due to the complexity in addressing national land administration reform, and as such the focus has not been on the development of national land administration infrastructures which incorporate both private as well as public rights (Williamson 2001). (Dalrymple, Wallace et al. 2004) also confirms that in Southeast Asia, land administration projects primarily concentrate on delivering security of tenure to privately held land.

Moreover, when a land administration project is initiated and funded by a donor agency, the government's institutional arrangements of departments make it very difficult to access information and involve the skills and knowledge between different departments, e.g. between the survey and mapping functional area and justice and legal functional area (FIG 2004). The challenge of developing a successful SDI depends largely on its implementation which is so significant that no one organization or stakeholder can address on their own. With Vietnam's SDI development initiatives evolving through land administration projects, there have been overlaps of ideas, both internally and externally between the Vietnamese and the donor agencies and also with the Vietnamese themselves.

1.2. Research Problem

More than half of the countries in the world are developing spatial data infrastructures (SDIs) (Masser 2005a). These SDI initiatives are developed and implemented through Executive Orders, as is the case in the United States, laws, decrees, and through organizations that have been created to carry out such initiatives. In the case of Vietnam, the SDI has been evolving through land administration (LA) projects by donor agencies such as the Swedish Government, United Nations and the World Bank.

With these land administration projects more focusing on tenure security, access to land and the organization of land markets, the focus has not been on developing the SDI. This has led to overlaps of ideas and concepts in SDI development and initiatives between the Vietnamese people (internal) themselves and the Vietnamese and donor agencies (external) thus impacting on the evolution. This overlap is a result of developments of concepts in the international and regional environment.

Hence, the evolution of spatial data infrastructures (SDI) through LA projects is unknown since existing literature, previous researches and practical experiences have failed to contribute to the overall knowledge of evolution of SDIs in this way. Since the natural course of the evolution of SDIs in land administration is via data sharing, access, integration and interoperability projects, the knowledge is lacking in the use of LA projects in the development and evolution of SDIs.

1.3. Research Objectives

Based on the research problem, the following objectives were derived:

- **Objective 1:** To describe how concepts in Land Administration and SDI have changed over time.
- **Objective 2:** To describe the nature of land administration projects developed for Vietnam over time and the perception of the Vietnamese government organizations towards them.
- **Objective 3:** To observe and interpret any differences or similarities between donor projects and internal policies of Vietnamese government organizations.
- **Objective 4:** To interpret the trends associated with SDI Development objectives and the aspects that lead to conflict between donor agency projects and internal policies of Vietnamese government organizations.
- **Objective 5:** To appraise the role of donor interventions in the evolution of SDI.

Objective 1 seeks to address the research problem where the description of LA and SDI concepts over time will show the ways in which LA & SDI have developed and who were responsible for these developments. This is relevant due to the fact that it highlights how these concepts have either remained the same or have changed over time globally and thus lead towards the knowledge that there are many ways to which these concepts can be adopted by an individual, organization or country.

Objective 2 seeks to show the ways in which LA projects have been carried out in Vietnam and the reasons for carrying them out. This will lead to determining the main reasons and ideas of the projects by the persons responsible or involved and the inter-relations of all stakeholders. This is related to objective 1 whereby from the knowledge of land administration and SDI and the courses to which each have taken, we can now compare the LA projects carried out in Vietnam to determine the trends of these projects.

Objective 3 seeks to show how the SDI have evolved through LA projects by donor agencies (external) only, by the policies of the Vietnamese (internal) only or a combination of both LA projects and Vietnamese policies. It also seeks to show if there are any similarities or differences of the previously mentioned actions. This builds on objective 2 in the sense that it will show how the SDI have evolved in Vietnam and for what purpose.

Objective 4 seeks to highlight the reasons and results of developing the SDI through LA projects and what elements of doing it this way have lead to problems between stakeholders i.e. donor agency and Vietnamese.

Objective 5 seeks to show whether or not LA projects have and will affect the natural course of SDI evolution and the ways in which it has, where possible. This then leads to additional knowledge of SDI evolution beyond what is already known.

1.4. Research Question

The research question selected is as follows;

How do the changes in the fundamental concepts in Spatial Data Infrastructures affect the natural course of its evolution through Land Administration Projects?

This question allows us to look at the various ways in which SDI concepts have evolved through land administration projects. Additionally, there are more specific/focused questions that will assist in the data collection process and in answering the overall research question. These questions are listed in Table 1 below.

1.5. Research Methodology

Research objective 1 is addressed by the literature review and secondary data sources such as research papers, journal articles, proceedings of conferences, past theses, annual reports, books and web site references. Research objectives 2 - 5 is addressed through interviews and questionnaire as primary data sources and also some secondary data sources such as annual project reports and journal articles.

1.6. Research Structure

Chapter 1 – Introduction

This chapter provides the general overview of the research to give an idea as to what the research is about and how it is organized. Some of the contents of the chapter are: background, research problem, research question and objectives, research methodology and research structure.

Chapter 2 – The Theory of SDI Evolution and The Presence of Land Administration Projects

This chapter gives a review on how scientists currently look at SDI development, the main concepts and policies in SDI and the evolution of SDI through land administration projects, the main actors/stakeholders involved in these projects and main processes and structures on land administration. ***Research question 1*** is addressed here in this chapter.

Chapter 3 - Data Collection for Observing and Describing SDI Evolution

This chapter deals with the data collection methods and strategies and the justification for using the selected methods. ***Research question 2*** is addressed in this chapter.

Chapter 4 – The Practice of SDI Evolution Through Land Administration Projects in Vietnam

This chapter deals with the results from the data collected via interviews, questionnaire, document reviews and linked to the data matrix developed in chapter 2 as it relates to SDI evolution through land administration projects carried out in Vietnam. ***Research question 3*** is addressed here in this chapter.

Chapter 5 - Interpreting Results in Terms of SDI Evolutionary Concepts

This chapter deals with the interpreting the results obtain in the previous chapter and linking statements made to findings based on the conceptual framework in chapter 2. ***Research question 4*** is addressed here in this chapter.

Chapter 6 – Modifying the Theory on the Evolution of Spatial Data Infrastructures

This chapter deals with the discussion of the findings obtained from analysis in the previous chapters. ***Research question 5*** is addressed here in this chapter.

Chapter 7 - Conclusion and Recommendation

This chapter gives an overall summary of all conclusions drawn from each of the previous chapters. Answers to the research questions are summarized and recommendation for further research is giving here in this chapter.

Table 1 - Conceptual Framework for the Evolution of the Function of Spatial Data Infrastructures Through Land Administration Projects in Vietnam

Research Objective	Research Specific/Focused Questions	Methods & Approach	Expected Data	Expected Output
1	**1.1** – Who are the main actors and what are the main processes and structures of Land Administration in Vietnam? **1.2** – How has the system developed and what were the main concepts and policies in SDI, Land Administration over time?	Descriptive Questionnaire Interviews	Names of donors that have implemented LA Projects in Vietnam from 1990-2009	Table of the actors/donors that have implemented LA Projects in Vietnam 1990-2009
2	**2.1** – What have the respective donor agencies aimed to do in terms of the Land Administration Projects? **2.2** – How are the concepts and donors reflected in the literature documents and perceived by the Vietnamese government organizations **2.3** – What trends have there been in terms of SDI & Land Administration?	Descriptive Interviews	Annual Reports, Contract Documents, Memorandums of Understanding, Newspaper, Magazine & Journal Articles	Table/list of the ideas based on existing SDI & land administration literature
3	**3.0** – What are the similarities and differences between the Land Administration and/or SDI Projects and the Vietnamese government organizations priorities for system development?	Observant Interviews Questionnaires	Annual Reports, Contract Documents, Memorandums of Understanding, Project Documents	Table/List of Results of data collected
4	**4.1** – What are the implications of trends in terms of SDI development objectives? **4.2** – What aspects lead to conflicts between donor agency projects and internal (Vietnamese government organizations) policies? **4.3** – What are the reasons for conflicts and why is this so?	Interpretative	Interpretation of tables & figures from collected data	Table/List of Interpretation of the results obtained from data collected
5	**5.0** – Have the development projects affected the natural course of Land Administration and SDI evolution? If yes, in what way and how and if no, why not? What is it that we know now that we did not know before?	Interpretative	Analysis of interpreted and collected data	Text on discussion on the Interpretation of the results obtained from data collected

2. The Theory of Spatial Data Infrastructure (SDI) Evolution & The Presence of Land Administration Projects

2.1. Introduction

This chapter addresses the research question/objective one as outlined in Table 1. Additionally, this chapter will address further questions on how scientists currently look at SDI evolution and how has land administration projects globally dealt with SDI issues.

The chapter first addresses the evolution of SDIs by looking at the varying definitions of SDI by scientists and scholars over time. This gives an impression as to the changing nature of the concept and how difficult it is to have one global definition which can be used by everyone. I then look at the evolution of SDI concepts, focus and relationships over time from first generation SDIs to present as depicted in Figure 4. Further I look at the indicators which are a result of decomposing the derived concepts into sub-concepts and dimensions as shown in Table 4.

Finally, we look at land administration projects globally to show how these projects have dealt with SDI issues thus far. We then show the conceptual framework which links all of the previously stated elements of this chapter and the remainder of the thesis. Figure 4 and Figure 5 show the conceptual framework. A conclusion wraps up the chapter.

2.2. Evolution of Spatial Data Infrastructure (SDI) Concept

The old adage that Rome wasn't built in a day is equally applicable to SDIs. The creation of SDIs is a long term task that may take several years or even decades in some cases before they are fully operational. This process is likely to be an evolving one that will also reflect the extent to which the organizations that are involved reinvent themselves overtime. As a result major changes in the form and content of SDIs can be expected over time as they reinvent themselves and in some instances actually leads to the closing down of a SDI as was the case with the British national Geospatial Data Framework in 2002 (Masser 2005b; Masser 2009).

However, experiences of those such as the Victoria Spatial Information Strategy show that a combination of internal and external factors affects the evolution of SDIs over time. Internally, those involved participate in a process of learning by doing that takes account of the experiences of earlier stages of SDI implementation. Externally, important changes in the nature of the SDI may be a consequence of the restructuring of other activities within government as a whole. The interaction between these two strands will govern the trajectory of SDI development (Masser 2009).

The fact that spatial data infrastructures can evolve over a long period of time and be constantly changing their nature, scale and purpose, has a significant impact on how we can distinguish the measures that describe the evolution of spatial data infrastructures. When do large-scale GISs become a spatial data infrastructure? When one or a group of spatial data infrastructures can be considered a regional spatial data infrastructure? (Wachowicz, Bregt et al. 2006).

The thoughts of centralized land information databanks in the 1960's and 1970's began the momentum towards principles of data sharing. This was followed by the ideas of more complexed distributed land information networks in the 1980's where they linked together organizations that were responsible for the management of land-related information into a network to form a virtual geographic information system. This would allow the systems to be queried in a manner similar to a single database (Coleman and McLaughlin 1998).

However, the evolution of the spatial data infrastructure concept can be traced back to the late 1980s when discussions on information infrastructures and the information superhighway were occurring. The British Government Committee of Enquiry on the Handling of Geographic Information, chaired by Lord Chorley, identified the advent of geographical information systems (GIS) as "the biggest step forward in handling geographic information since the invention of the map" (Masser 2005a). The recommendations of the Chorley Report were subsequently rejected but it put the wheels in motion for successive discussions on SDIs around the world in countries such as the United Kingdom (McDougall 2006).

In Canada, the Canadian Council on Geomatics requested that Geoplan Consultants prepare a plan for an integrated spatial data model for the country in 1995 (Masser 2005a). The Canadian Council then recommended that the federal Inter-Agency Committee on Geomatics guide the creation of the Canadian Geospatial Data Infrastructure in 1996 and the establishment of GeoConnections in 1999 which was funded by the government of Canada (Masser 2005a; McDougall 2006).

Furthermore, the natural course of SDI evolution has been through two main categories. Such categories are where the SDI is a result of a formal mandate from the government. (e.g. the US National SDI - http://www.fgdc.gov - by Presidential Executive Order in April 1994 and the Portuguese National Geographic Information System - http://www.cnig.pt); and those that are largely grown out of existing national spatial information coordination activities (e.g. the Australia/New Zealand Land Information Council development, relating SDI to other information infrastructures (http://www.auslig.gov.au) and the coordination amongst participants in the Dutch Ravi to develop a Netherlands Clearinghouse for Geographic Information,- http://www.ncgi.nl) (Moellering and Aalders 2001).

To this end, SDIs were implemented as a mechanism to facilitate access to and sharing of spatial data hosted in distributed GIS formats. Users require precise spatial information in real time about real world objects, and the ability to develop and implement cross-jurisdictional and inter-agency solutions to meet priorities, such as emergency management, natural resource management, water rights trading, and animal, pest and disease control. The concept of an SDI has now evolved to a new business model, in which the SDI promotes partnerships of spatial information organizations (public/private), allowing access to a wider scope of data and services, of greater size and complexity than they could individually provide (Williamson, Enemark et al. 2010).

2.2.1. Evolution and Objectives of Spatial Data Infrastructures (SDIs)

In 1982, the term "information infrastructure" which referred collectively to the various media, carriers and even physical infrastructure used in information delivery was introduced by Anne Branscomb. In the late 1980's the notion of infrastructure as an enabling agent was adopted by the larger information processing community. The concept of spatial data infrastructure (SDI) development in the early 1990's was then promoted in support of the ever increasing geographic information exchange standards efforts, selected national mapping programs and the establishment of nation-wide spatial information (SI) networks in the United States (Coleman and McLaughlin 1998).

The term "spatial data infrastructure" (SDI) is interchangeably used with the terms "geo-information infrastructure" (GII) and "geospatial information infrastructure" (also GII). SDI seems to be the term preferred in literature from the United States. In Europe, particularly in Britain, the term "geospatial" is often used. However, the abbreviation can be confused with that of "global information infrastructure" (GII) (Groot 1997).

As the United States Vice President Al Gore was promoting the concept of an "information superhighway" and moving ahead with the idea that an advanced communications and information infrastructure should be a national priority in 1993, President Bill Clinton in 1994 took it one step further and decided that this "information superhighway" should be called a spatial data infrastructure (SDI). This spatial data infrastructure (SDI), as stated in (Clinton 1994), would be the technology, policies, standards and human resources necessary to acquire, process, store, distribute and improve the utilization of geospatial data.

However, (Coleman and McLaughlin 1998), after much deliberation on a working definition concluded that a SDI encompasses the policies, technologies, standards and human resources necessary for the effective collection, management, access, delivery and utilization of geospatial data in a community.

The war of definitions did not end there as (Groot and McLaughlin 2000) decided that a SDI encompasses the networked geospatial databases and data handling facilities, the complex of institutional, organizational, technological, human and economic resources which interact with one another and underpin the design, implementation and maintenance of mechanisms facilitating the sharing, access to, and responsible use of geospatial data at an affordable cost for a specific application domain or enterprise.

As time wore on, more and more definitions were developed for this "beast of nature" called a spatial data infrastructure (SDI). (Rajabifard, Feeney et al. 2002), after much research felt that a SDI is fundamentally about facilitating and coordinating the exchange and sharing of spatial data between stakeholders in the spatial community. But as stated in (Williamson, Rajabifard et al. 2003), SDIs have become multileveled in nature, formed from a hierarchy of interconnected SDIs at corporate, local, state or provincial, national and regional (multinational) and global levels.

The GSDI Association decided to take this evolution further and concluded that a SDI is a relevant base collection of technologies, policies and institutional arrangements that facilitate the availability and access to spatial data (Nebert 2004).

Furthermore, (Rajabifard, Binns et al. 2006) states that a Spatial Data Infrastructure (SDI) is an enabling platform for data sharing. It is based on a dynamic, hierarchic and multi-disciplinary concept that includes people, data, access networks, institutional policy, technical standards, and human-resources dimensions, which aims to facilitate and coordinate the exchange and sharing of spatial data between stakeholders in the spatial data community.

To this end, there have been other definitions of SDI by the European Commission, the Dutch Council for Real Estate Information, the Federal Geographic Data Committee, the Global Spatial Data Infrastructure Association and a host of other definitions. All of these definitions vary in some way and hence has lead to the changing nature of SDI over time. There is no one overriding definition established so whichever definition is chosen for a country's SDI initiatives is based on their internal ideas/beliefs and sometimes on external influences and developments of best practices. Table 2 gives a list of some of the definitions that have been developed for spatial data infrastructure (SDI) over time.

Table 2 - Definitions for Spatial Data Infrastructures

Source	Definition
Executive Office of the President (Clinton 1994)	SDI means the technology, policies, standards and human resources necessary to acquire process, store, distribute, and improve the utilization of geospatial data.
(Coleman and McLaughlin 1998)	SDI encompasses the policies, technologies, standards and human resources necessary for the effective collection, management, access, delivery and utilization of geospatial data in a global community.
(Groot and McLaughlin 2000)	SDI encompasses the networked geospatial databases and data handling facilities, the complex of institutional, organizational, technological, human and economic resources which interact with one another and underpin the design, implementation and maintenance of mechanisms facilitating the sharing, access to, and responsible use of geospatial data at an affordable cost for a specific application domain or enterprise.
(Rajabifard, Feeney et al. 2002)	SDI is fundamentally about facilitating and coordinating the exchange and sharing of spatial data between stakeholders in the spatial community.
(Nebert 2004)	SDI is a collection of technologies, policies and institutional arrangements that facilitates the availability of and access to spatial data.
Wikipedia (2008)	An SDI is a framework of spatial data, metadata, users and tools that are interactively connected in order to use spatial data in an efficient and flexible way. Another definition is the technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data.
(ANZLIC)	SDI is a framework for linking users with providers of spatial information. SDI comprises the people, policies and technologies necessary to enable the use of spatially referenced data through all levels of government, the private sector, non-profit organizations and academia.
(GSDI 2010)	SDI supports effective access to geographic information. This is achieved through the coordinated actions of nations and organizations that promote awareness and implementation of complementary 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.

2.2.2. Evolution of How Spatial Data Infrastructure Components Were Defined

Irrespective of the fact that stakeholders from various disciplines view SDIs differently, researchers have identified a number of core components that are common to all SDI implementations (Coleman and McLaughlin 1998; Davies 2003). These components are all part and parcel of the definitions of SDIs as stated in Table 2 above. However, I will explain how these core components have evolved through the years.

The components of spatial data infrastructures (SDI), as described by(McLaughlin, Nichols et al. 1992), included the sources of spatial data, databases and metadata, data networks, technology (dealing with data collection, management and representation), institutional arrangements, policies and standards and end-users (Coleman and McLaughlin 1998). However, the Australian and New Zealand Land Information Council stated that SDI components consist of institutional framework, technical standards, fundamental datasets, and clearinghouse networks (Rajabifard, Williamson et al. 2000). Furthermore, (Rajabifard and Williamson 2001b) defined the components of SDI to be data, people, policy framework, standards and access/distribution technology.

Table 3 shows a list of the components and a description of what each component is about. Figure 1 shows the relationship between the components of the SDI as developed in (Coleman and McLaughlin 1998). However, these concepts have transcended to Figure 2 as defined in (Rajabifard and Williamson 2001b). They have defined the key components of the SDI as data, people, policy framework, standards and access/distribution technology.

Table 3 - Components of Spatial Data Infrastructures

Component	Description/Composition
Data	Fundamental datasets are themes of spatial information regarded as primary in supporting the key functions of a country or jurisdiction, providing the common spatial reference and context which underpins many other forms of business information. An individual agency may consider fundamental data in terms of the most important strategic spatial information that supports its business functions and processes. Themes commonly considered fundamental can include geodetic control, cadastre, administrative boundaries, geographic names and localities, street address, transportation, elevation, hydrology and orthophoto imagery. The list is not definitive and is dependent on the priorities of the responsible agency within each jurisdiction.
People	Includes the users, providers, administrators and custodians of spatial data and also value-added re-sellers. Users can be corporate, small or large business or individuals, public or private. The broad application of SDI beyond the traditional mapping and land administration role means users and administrators of spatial information have very different qualifications and professional backgrounds.
Institutional Framework/Policy	Includes the administration, coordination, policy and legislation components of an SDI. The institutional framework is reliant on successful partnerships and communication between agencies within and between jurisdictions.
Standards	Consistent standards and policy are required to enable the sharing, integration and distribution of spatial data; hence standards for data models, metadata, transfer and interoperability of storage and analysis software. Policy particularly needs to be consistent for the pricing and access to spatial data within and between jurisdictions.
Access and Distribution Technology	Consists of the access and distribution networks, clearinghouse and other means for getting the spatial information or datasets to the users. Technology also involves the acquisition, storage, integration, maintenance, and enhancement of spatial data.

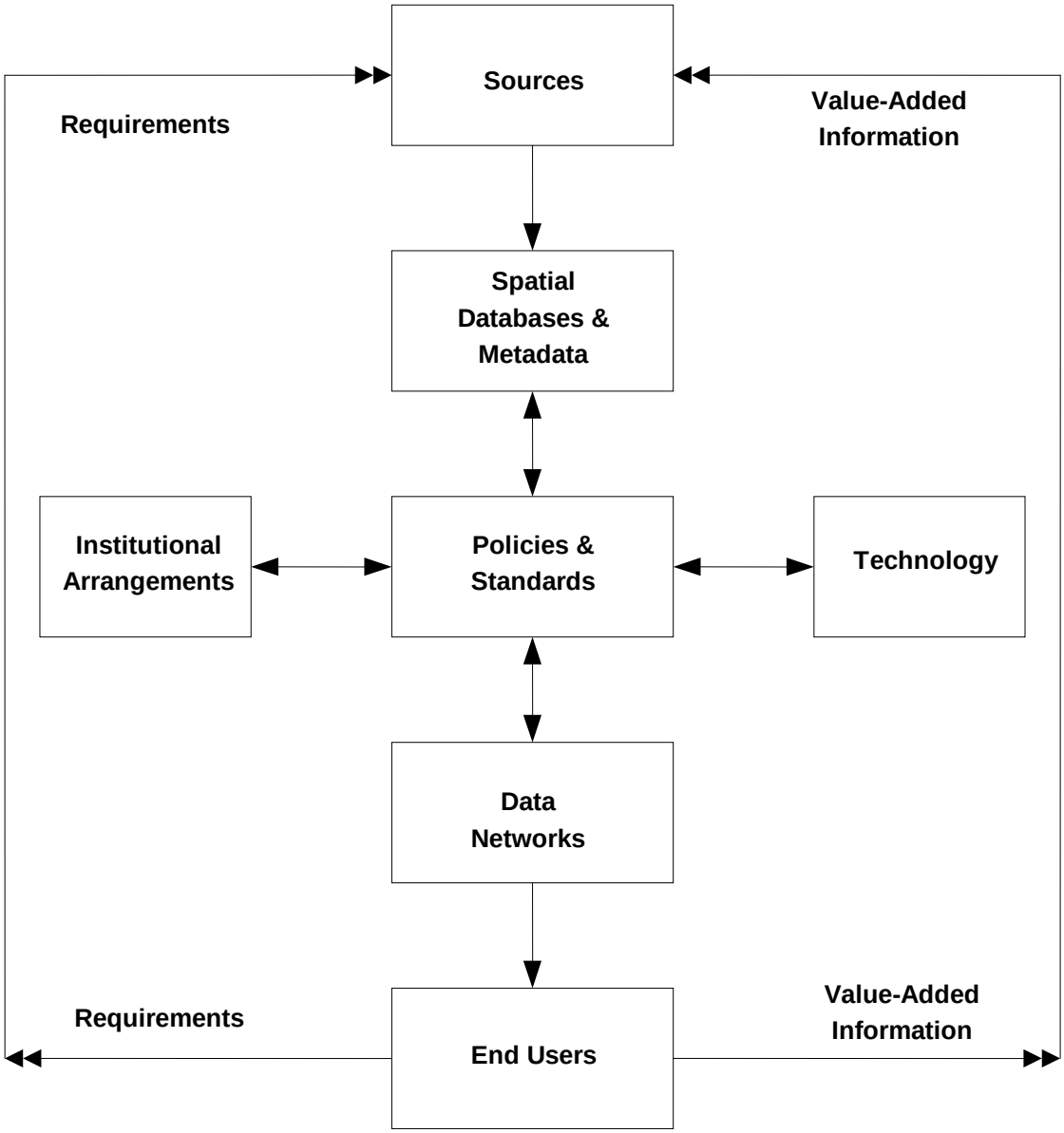

Figure 1 - SDI Components. Adapted From (Coleman and McLaughlin 1998)

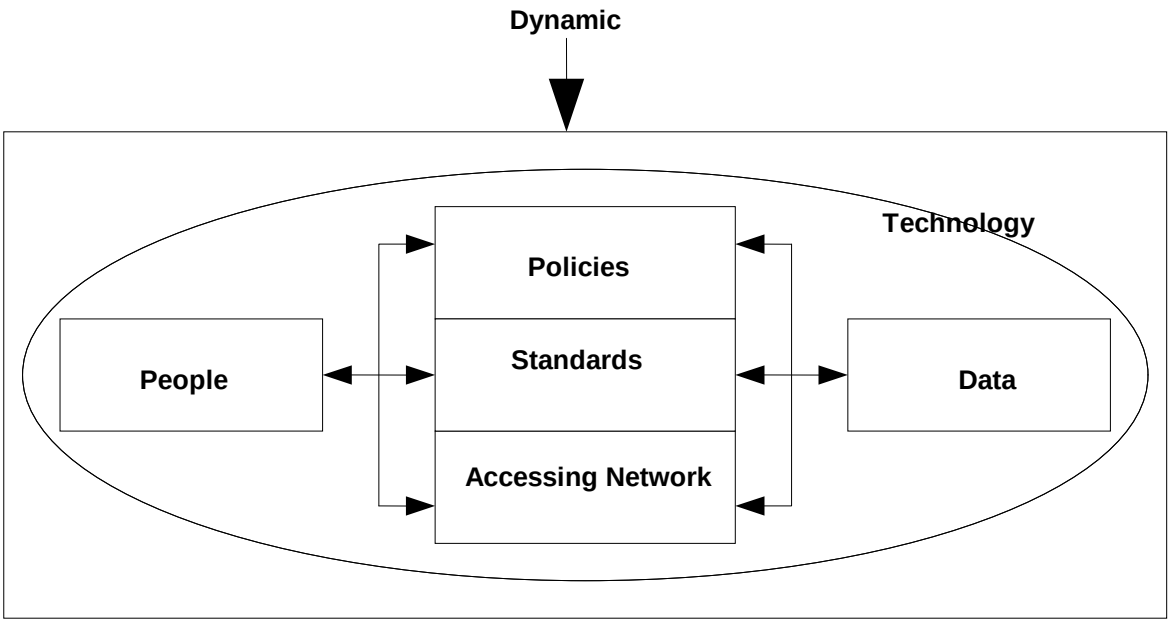

Figure 2 - Relationship Between SDI Components. Adapted From (Rajabifard and Williamson 2001b)

This does not mean that these are the only components that make up an SDI, or that there is another possible model. It is important to note that the SDI concept is dynamic in that it can be updated or expanded with changing technology or user needs, or to include a new environment (Strain 2006) as is the case in Figure 3 from the National Spatial Data infrastructure of the United States.

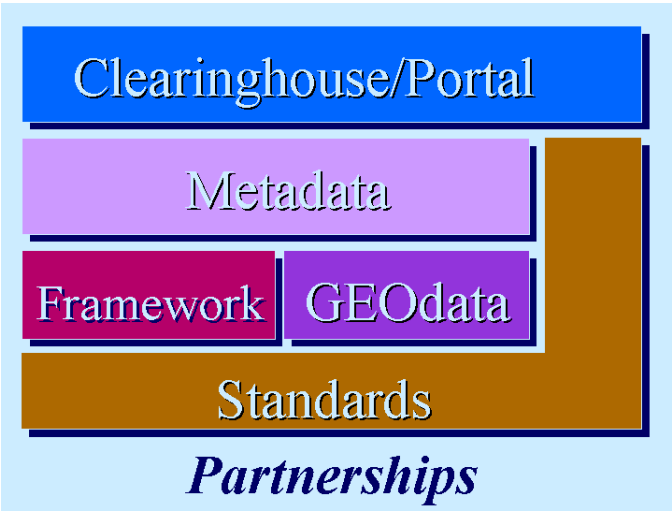

Figure 3 - SDI Components on the NSDI of the United States. Adapted From (F.G.D.C. 2010)

2.2.3. Evolution of Spatial Data Infrastructure Focus (Generations)

Most of the SDI policies in Africa, Asia and South America reflect the SDI efforts of either the United States or Europe. The United States SDI through the Federal Geographic Data Committee is normally made reference to as one of the earliest SDI initiatives in the way that we refer to SDI today (Masser 1999). The creation of an NSDI policy was part of the objectives of the Clinton Government as part of their Information Highway initiative (Groot 1997). This was a project aimed to facilitate access to and use of information to improve decision making. The information infrastructure directive preceded formal policies and an institutional framework for the NSDI. The emphasis in these "first generation of SDIs" laid on improving data availability and data access. Clearinghouses emerged therefore as the main products of this period.

Subsequently, the concept of SDI focus has shifted from a data-driven focus to a systems focus. This is not surprising as SDI possess the characteristics of Complex Adaptive systems (CAS) according to (Crompvoets 2006; de Man 2006; Grus, Crompvoets et al. 2006). Such CASs comprise of different elements which interact dynamically to exchange information. This can be marked by a change in focus on SDI development by several countries involved in developing the concept from the beginning. This new focus on SDI development did lead to a rapid increase in the number of countries becoming involved in SDI development which was fostered by the definition of an SDI community where experiences could be shared and exchanged experiences. This shows the continuum of strategic spatial data development. The second generation started around 2000 when some of the leading countries on SDI development changed their development strategies and updated their conceptual models. In second generation SDI, the strategy for SDI development changed towards a more process-based approach (Williamson, Rajabifard et al. 2003). This approach focused on the creation of a suitable infrastructure to facilitate the management of information assets instead of the linkage to existing and future databases (Rajabifard and Williamson 2004).

According to (Budhathoki, Bruce et al. 2008), the 3rd generation of SDIs which are emerging gradually are built upon the principles of the two preceding generations but magnify the role of the spatial data users. This implies that technologically tools are available which facilitate voluntary user input of spatial data through the web map interface of the Geoportal. This means that individual non-corporate users can draw features onto the web map or upload their own data to consume GIS services on the web. This data is termed Volunteered Geographic Information (VGI) and it becomes a part of the larger spatial database which is the engine of the SDI. Figure 4 shows the evolution of SDI from first generation to third generation.

However, SDI development is now being focused towards the spatial enablement of society and governments, in which location and spatial information are regarded as common goods that leverage effective business and efficient governance (Mohammadi 2008).

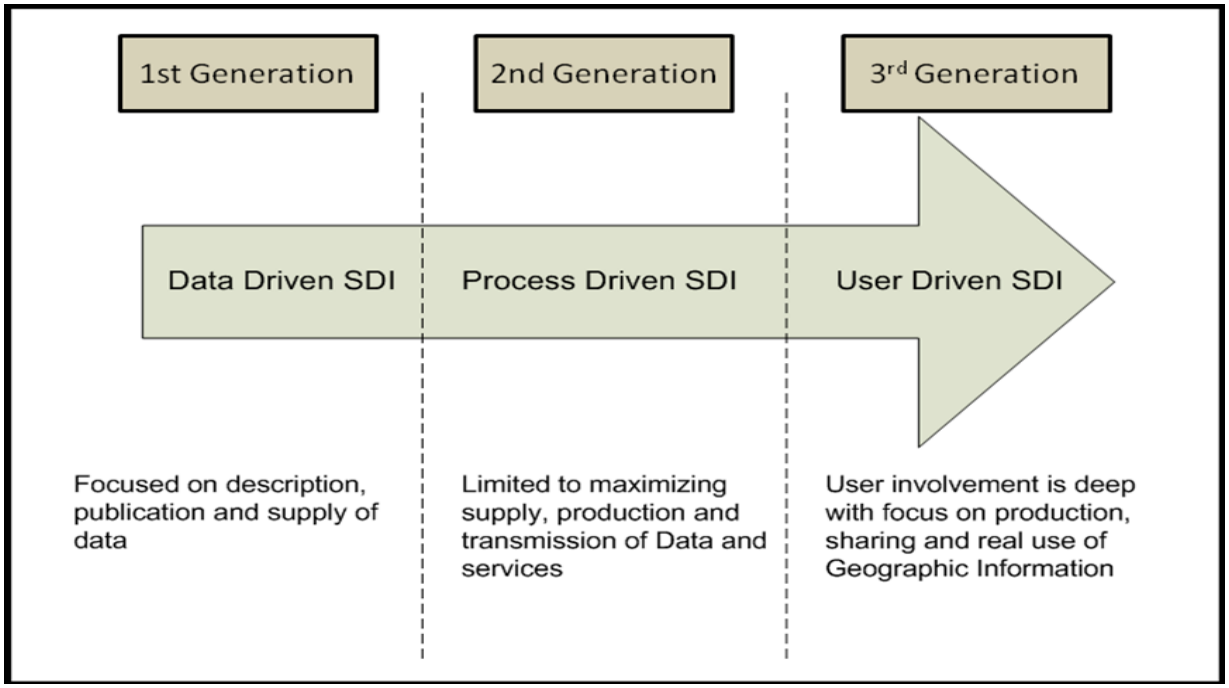

Figure 4 - The Focus of Spatial Data Infrastructures. Adapted From (Budhathoki, Bruce et al. 2008)

2.2.4. Evolution of Hierarchical Relationships of SDIs

Many countries are developing SDIs 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. Hence, a SDI hierarchy is made up of inter-connected SDIs at local, state or provincial, national, regional and global levels. 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 (Rajabifard and Williamson 2001a).

Gradually, infrastructures are becoming inter-related therefore the SDI hierarchy model was envisioned. See Figure 5. However, this model has gone through several changes to include the corporate level, which is the base level of the hierarchy where a corporate GIS is deemed to be an SDI at the this level (Chan and Williamson 1999; Rajabifard and Williamson 2001a).

From an SDI perspective, the parallels with political and administrative systems can be seen in the SDI development. It was proposed that these hierarchical systems of SDIs should be viewed from two perspectives: an umbrella view (top-down) from the global level looking down and a building block view (bottom-up) where each level of development supports the higher levels of development with their spatial data needs (Warnest 2005; McDougall 2006; Mansourian and Valadan-Zoje 2008).

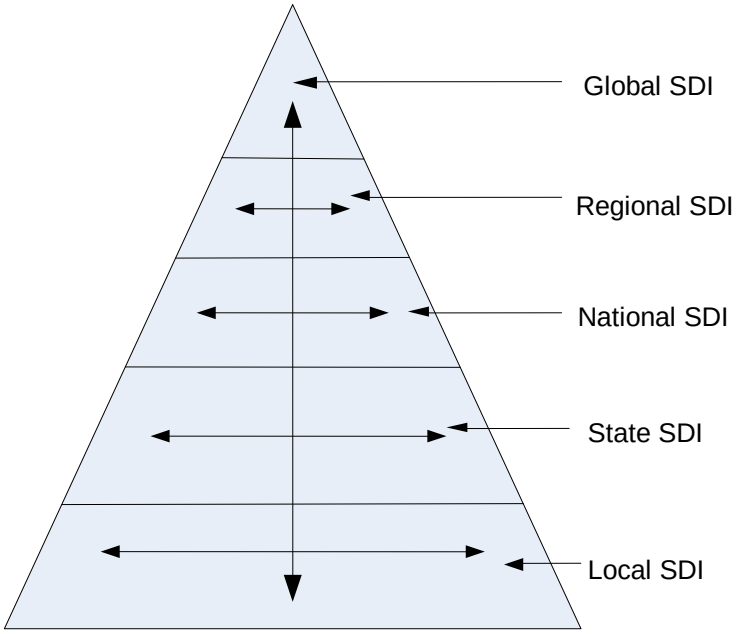

Figure 5 - SDI Hierarchy Model & the SDI Relationships within & between different Levels. Adapted From (Rajabifard and Williamson 2001b)

However, although the properties of hierarchical systems might be essential for the development of a consistent database or data structure, the absence of a strict hierarchical structure does not necessarily inhibit SDI development and implementation (Masser 2005a). For example national bodies such as FGDC work directly with local governments without reference to the state level (McDougall 2006).

2.2.5. Relating SDI with Land Information Systems (LIS) and Land Information Infrastructures (LII)

Throughout this thesis, and this chapter specifically, the terms land information systems (LIS), geographic information systems (GIS) and land information infrastructure (LII) will be utilized and discussed. It is therefore useful to clarify this terminology and to put in context their historical development and contemporary usage.

There is a worldwide tendency to create facilities on a National scale to collect and disseminate geoinformation (Crompvoets 2006). Geoinformation, which is made from spatial data with reference to a physical location, is increasingly used in organizations, governments and by the general public. It is mostly managed within organizations with Geographical Information Systems (GIS's), Land Information Systems (LIS's) and between government organizations through Spatial Data Infrastructures (SDIs) (Rajabifard and Williamson 2001b; Masser 2005a).

However, following the discussion on the SDI concept, a land information system (LIS) or a geographic information system (GIS) is not typically a SDI alone but can be comprised of a collection or association of connected LISs or GISs. A land information system (LIS) is described in literature as an information system that is specifically related to parcels of land (McDougall 2006). Traditionally, these systems have been closely linked with land administration systems including the computerization of the cadastral maps that underpin these systems. The focus of these systems was generally narrow, and they

were primarily developed to support the land administration and mapping activities within government agencies. This then lead the emergence of the concept of land information infrastructures (LIIs).

According to (Enemark 2004), a land information infrastructures (LII) is a network of integrated and interactive sub-systems which comprises cadastral and topographic datasets and aids in the provision of access to complete and up-to-date information on the built and natural environment on which land administration functions are facilitated and are based on.

Also, a land information infrastructure is considered as one of the operational components of the land management paradigm as adopted and stated by (Enemark 2004; Enemark, Williamson et al. 2005). This infrastructure contains information about land including land parcels, buildings and names of owners. To this end, a land information infrastructure can for the most part be considered as a land-based spatial data infrastructure or geospatial data information infrastructure.

2.3. Evolution of Land Administration Project Objectives (Global)

In any country, reform of land administration and management is a major investment of capital and human resources and requires strong and consistent leadership in order to achieve effective, sustainable outcomes. Such reforms require long-term commitment. Land is one of the main sources of collateral, used to obtain credit from established financial institutions such as banks, as well as from informal providers of credit (Bell 2009). Organizations such as the World Bank, with the support of development partners and civil society organizations, are continuing to support, land projects throughout the world (Bell 2006; Mitchell, Clarke et al. 2008).

In the early 1980's, the main focus of land administration project was on land tenure security and land market efficiency in rural and urban areas through the development of a land titling and administration system based on clear, transparent, coherent and consistent policies and laws and supported by an institutional structure. This is evident in countries such as the Philippines through their Land Administration and Management Project and in Latin America (Barnes 2003; Rebuelta-Teh 2005).

Then in the early 2000's, the focus shifted towards good governance by the decentralization of land functions including land use planning and issuance of location permits, land registration and cadastral mapping, as is the case in Indonesia and also to the increased privatization of traditional government cadastral services and land titling which includes gender equity and indigenous rights, as in Latin America (Barnes 2003; Zakout 2006).

From the early to mid 2000's, the primary focus of land administration projects then shifted towards service delivery, reduction in the levels of corruption and establishing real estate markets as is the case for countries in the European, African, South and Central Asia Regions (Bell 2006; Adlington, Stanley et al. 2009; Bell 2009).

At the present time, the current and future direction and focus are towards the innovation and the use of national spatial data infrastructures (NSDI) or spatial information underpinning new products and services and also whole-of-government land information system coordination for some countries in the European, African, South and Central Asia Regions such as Ghana and Vietnam (Bell 2006; Adlington,

Stanley et al. 2009; Bell 2009). Furthermore, the World Development Report 2010 of the World Bank contains a section entitled "Managing Land and Water to Feed Nine Billion People and Protect Natural Systems" makes a strong case for the investment of SDIs through land administration projects (Bell 2009).

To this end, the focus of land administration projects globally is changing their focus from the traditional security of tenure and establishment of land markets, service delivery, towards the inclusion of spatial data infrastructures (SDI) elements or components.

2.4. Conceptual Matrix

The above have shown various elements in transition. In order to investigate them, a concept matrix was developed. When generating new concepts, designers need a rigorous process to help them think about all possible concepts. Rather than haphazardly generating ideas, the Concept Matrix helps by providing a structured way to explore all possibilities. A concept matrix is a framework that helps to generate concepts in a structured and comprehensive manner (Harriss 2010).

In order to address the research questions for this research, I created a concept/data matrix. The concepts generated were decomposed into dimensions and then indicators. The concepts were deduced from the main research question of the research into two parts. The first concept is the evolution of SDI and the second, the influence of external donors in land administration projects.

Furthermore, the dimensions to the concepts were deduced based on literature. There have been a lot written about SDI evolution and development and can be found in (Groot 1997; Rajabifard and Williamson 2001b; Masser 2005a; Crompvoets 2006). They all make mention to SDI as including people, standards, access and policies in relation to spatial data. Therefore, the dimensions selected are shown in Table 5 as they relate to the components of an SDI highlighted previously. As it relates to the concept of the Influence of External Donors in Land Administration Projects, similar reasoning was used to address this concept. The dimension of Control was deduced as it relates to parts of the main research question. The structure and outline of this is also shown in Table 4.

Table 4 - Indicators for the Concepts of the Evolution of SDI & the Influence of External Donors in LA Projects

Concept	Dimension	Indicators
Evolution of SDI	Institutionalization of the SDI	Degree to which organizational structures are adapted to SDI
		Degree to which laymen are aware of SDI
		Degree to which SDI appears in Journals
		Degree to which SDI appears in memo's, documents, reports and newsletters
	Regulation of the SDI	Degree to which SDI is regulated
	Adoption of SDI Technology (New)	Degree to which SDI Technology is adopted
	Social Interaction Using the SDI Technology	Degree to which SDI is used to access land information
		Degree to which SDI is used to carry out land administration
Influence of External Donors in LA Projects	Control	Degree to which external donors influence SDI initiatives

Table 5 - Relation of Dimensions to SDI Components

Dimensions	Components of SDI (Rajabifard and Williamson 2001b)
Institutionalization of SDI	Standards
Regulation of SDI	Institutional Framework/Policy
Adoption of SDI Technology (New)	Access & Distribution Technology
Social Interaction Using SDI Technology	People

2.5. Challenges of Spatial Data Infrastructure Evolution

In order to assist the spatial community, spatial information resources should be used widely by a broad range of citizens through SDI initiatives. In this regard priority SDI research should be directed at knowledge advancement which helps stakeholders, including policy-makers, scientists, business leaders, and ordinary people to better utilize spatial information and understand the relationship between government information policies, spatial information resources, products and services (Onsrud, Poore et al. 2004)

SDI has been in the spatial community for less than two decades and there are still many gaps in SDI advancement and evolution, which should be filled through conducting research and study. (Onsrud, Poore et al. 2004) highlights social and institutional issues as the most outstanding issues to focus on in future developments of SDI. Hence the following sections of this research we will highlight the social

and institutional issues relating to SDI evolution. These elements relate to institutionalization, regulation, adoption of new SDI technology and social interaction using the SDI technology. The other element of focus is the area of the influence of external donor agencies as it relates to LA projects.

2.5.1. Institutionalization of the SDIs

The term institutionalization is the process of making something, for example a concept, a social role, particular values and norms, or modes of behaviour become embedded within an organization, social system, or society as an established custom or norm within that system (Wikipedia 2010). There are three "schools for thought" as it relates to institutionalization. These schools are the historical approach, the 'rational choice' approach, and the sociological approach as stated in (Hall and Taylor 1996; Alexander 2005).

The Historical approach defines institutions as systems of formal and informal rules, norms and practices in polities or political economies. The Rational approach is associated with institutional economics where its behavioural assumptions premise rational actors with fixed preferences and values. The Sociological approach is where institutionalization in organizations is not a result of a strategic search for maximum efficiency but where institutional forms and practices are adopted for legitimacy of social appropriateness rather than instrumentality. Hence, institutionalization is a significant accumulation of culturally specific forms and practices (even including organizational myths and ceremonies), with their origins and diffusion related to their specific contexts: sectors, societies and subcultures (Alexander 2005).

Also, institutionalization is both a process and a property variable. It is the process by which individual actors transmit what is socially defined as real and, at the same time, at any point in the process the meaning of an act can be defined as more or less a taken-for-granted part of this social reality (Zucker 1977). It can vary from low to high, and acts can possess degrees of institutionalization (Meyer, Scott et al. 2005).

(Kostova and Roth 2002; Fleck 2007) agrees that the institutionalization of a practice is affected by the external institutional context and the internal relational context. Hence, the level of institutionalization of the same practice will vary across countries and organizational units. To this end, for this research we adopt the concept of institutionalization as being according to (Alexander 2005) above.

As agencies function within the context of an increasingly digitally interconnected world, the ability for information to flow from a source to many other unanticipated individuals has been accelerated, especially through networks of other interested individuals (Tulloch and Harvey 2007). Sharing and coordination are to a large extent informal activities that correspond to these relationships. Formal arrangements are taken only at the final stages of establishing sharing or cooperation agreements; basically they manifest themselves at the conclusion to satisfy internal procedures and/or legal requirements. This however thus poses a problem when developing government's participation in SDI.

Therefore, institutionalization, as coined in (Silva 2007) refers to the adoption of systems by organizations thus leading to an institutionalized system becoming routinized in the practices and procedures of public organizations. It also implies the exercise of power, alignment, and enrolment of

different actors as well as the creation of alliances (Scott 1995; Silva 2007). (de Vries 2008), also states that institutionalization can be explained by means of the strategic behavior of organizations.

Furthermore, (de Man 2006) also states that institutionalization of the SDI refers to the ongoing process whereby the SDI is increasingly becoming valued and trusted within a spatial data community and, hence, will contribute to the exchange, sharing, accessibility, and use of spatial data. Moreover, institutionalization of SDI implies duality. A major condition in achieving this is feedback. Stakeholders continuously perceive the SDI as relevant and useful for their commonly perceived needs in spatial-data handling. The other side of the feedback mechanism is that the institutionalization process dies out whenever the positive perception vanishes.

However, institutionalization is also used to describe both the treatment of, and damage caused to, vulnerable human beings by the oppressive or corrupt application of inflexible systems of social, medical, or legal controls by publicly owned, private or not-for-profit organizations or to describe the process of becoming accustomed to life in an institution so that it is difficult to resume normal life after leaving (Wikipedia 2010). Institutionalization may also be used in a political sense to apply to the creation or organization of governmental institutions or particular bodies responsible for overseeing or implementing policy, for example in welfare or development. But for the purpose of this research this terminology will not be considered at all as it does not relate to the context within which this research is focusing on i.e. the norms and practices of an organization.

In a corporate context, individuals who work within large established organizations can become socialized into organizational values and norms, and values and norms may become institutionalized. It has been suggested by some writers that such supportive structure and routines may in some cases lead to a narrowing or reduction in individual critical judgment and reasoning. This accepting mental outlook can lead to oversight and slowed reaction to changes outside the organization, thus hindering adaptation to new circumstances. Institutionalization, therefore, is an important element of the analysis and management of corporate or organizational culture and important in relation to issues of organizational change (Wikipedia 2010).

Nonetheless, people are the key to transaction processing and decision-making. All decisions require data and as data becomes more volatile human issues of data sharing, security, accuracy and access forge the need for more defined relationships between people and data. The rights, restrictions and responsibilities influencing the relationship of people to data become increasingly complex, through compelling and often competing issues of social, environmental and economic management. Facilitating the role of people and data in governance that appropriately supports decision-making and sustainable development objectives is central to the concept of SDI (Williamson and Feeney 2001).

2.5.2. Regulation of the SDIs

One can differentiate between imposed legislation and information policy at the national government level or from the more senior administration of which the spatial data centre is a part and the set of related or complementary policies appropriate to the local spatial data centre (Groot 1997).

Therefore, policies are doctrines integrating behaviour in a sensible way, being a source of inspiration that experts, politicians and other participants in SDI development can use to enact social reality (Hood and Jackson 1991; Georgiadou and Stoter 2010). They are also seen as blueprints that are transportable by virtue of factual evidence of benefits and of rational analysis (Burkert and Weiss 2004; Georgiadou and Stoter 2010).

Also, different SDI Implementation strategies are used in different countries depending on the governance structures in the country. In cases where the national government has realised the importance of SDI for national development, the initiative is normally adopted as part of the broader national agenda and therefore has access to state funds for implementation. In such a case, structures are put in place to facilitate SDI implementation, policies are formulated and reporting mechanisms are put in place to communicate the progress of SDI development. Normally the strategy that is adopted for implementation in this case is hierarchical in nature, where National policy is formulated first and then later implemented at lower levels of governance (Smit, Makanga et al. 2009).

However, the incentive for government to disclose data would be for the purpose of providing the basic infrastructure of data to support the SDI and to encourage data sharing by the private sector. Government disclosure of data may be done on cost-recovery terms or as in the case of the US, it may be made more freely available because its availability is proven to encourage economic activity (Williamson and Rajabifard 2002).

2.5.3. Adoption of New SDI Technologies

New technologies have played an important role in the evolution of the SDI concept. The earliest SDIs were conceived before the internet and the World Wide Web (WWW) came into being and the opportunities opened up by their development have dramatically transformed the way that data is delivered to users (Masser 2009).

Also, the later years of the 20th Century saw the rapid development of information and communications technologies (ICT), together with the development of Global Positioning System (GPS) and Geographic Information System (GIS) technologies which revolutionized the collection, management, presentation and use of spatial information. This technology is now cheaper and more freely available and while the national mapping agencies availed themselves of these latest technologies, so did the cadastral and land administration agencies, often to a greater extent.

The result of this technological revolution has been that the large scale land administration sector has been revolutionized. The new technologies have enabled land administration organizations to create digital large scale cadastral data bases and increasingly large scale topographic data bases with many of them in the more developed countries attempting to create large scale virtual representations of their built and natural environments (Rajabifard, Binns et al. 2006).

However, according to (Binns and Rajabifard 2006) these two developments, small scale national mapping/environmental management and large scale land administration, utility and local government, have evolved and continue to evolve in isolation in many countries. Generally the large-scale level is governed by cadastral and land titling which is often located in a different government department from

the small scale national mapping. It is into this environment that the SDI concept, driven by technological advances as well as the potential economic, environmental and social benefits, has evolved over the last decade or so.

2.5.4. Social Interaction Using SDI Technology

The principal objective for developing SDI for any political/administrative level is to achieve better outcomes for the level through improved economic, social and environmental decision–making. The role of SDI is to provide an environment in which all stakeholders, both users and producers, of spatial information can cooperate with each other in a cost-efficient and cost-effective way to better achieve organizational goals (Feeney, Rajabifard et al. 2001).

Communication technologies such as the Internet and wireless are revolutionizing methods of maintaining, disseminating and accessing spatial data. To fully utilize these technologies there must be a clear understanding of how they impact on and assist in implementation of a SDI that supports the human-land relationship (Williamson and Feeney 2001).

Given the high costs of data collection and database creation, nations need to develop policies that are designed to invest and allocate spatial data resources wisely to ensure the greatest possible efficiency, effectiveness, and equity in the use of information.

2.5.5. Influence of External Donor Agencies

The restructuring of bureaucratic functions and responsibilities is something for which donors provide advice and promote awareness, for change in these areas is fundamentally determined by the degree of commitment by the various governments and authorities themselves. Drafting legislation, examining bureaucratic procedures, reorganizing departments, management restructuring and designing information systems, are typical examples of Technical Assistance interventions which are totally dependent on recipient commitment (“ownership”), and as such should be implemented with a maximum degree of flexibility (McCarty 1995).

Over the past 15-20 years, much of the SDI development has been from three main players including Federal/National Governments, Sub-National Governments and the private sector which includes donor agencies (Technical Assistance), and the role of each has been quite different. Initially SDI development was the domain of national governments whose role was to map and collect small-scale data about a nation. They played both a strategic and operational role in SDI development through a top-down policy development approach (Binns and Rajabifard 2006).

However, what is considered desirable for most projects is often heavily influenced by donors in their identification, design and implementation, to the detriment of development as some donors prefer to retain their functions in their own hands (Godfrey, Sophal et al. 2002). In many developing countries, where land administration reform is being undertaken, lack of technical and management capacity is commonly found. Considerable effort from development partners is often provided through grants for technical assistance to support capacity building and training (Bell 2007).

Furthermore, in (Berg 1993), Berg emphasized that the ‘‘donor- or supply-driven nature of technical assistance has led to excessive use, inefficient allocation, weak local ownership and hence limited commitment.” He further goes on to suggest that this contributes to disorderly decision making, deepens dependence on foreign experts and relieves local staff of responsibility, weakening rather than building local institutions and capacities (Godfrey, Sophal et al. 2002).

2.5.6. Partnerships (Public/Private)

Partnerships are critical to the development of SDIs and can be both inter-jurisdictional and intra-jurisdictional (Grant and Williamson 2003). Although SDI development over the past twenty years has seen three main players emerge, national governments, sub-national governments and the private sector, the role of each has been quite different (Grant and Williamson 2003; Rajabifard, Binns et al. 2006).

Initially, SDI development was the domain of national governments whose role was to map and collect small-scale data about a nation. This was not always the case in all countries, as was with the UK Ordnance Survey. The building of the infrastructure was also seen as a national role, especially within developing countries whose sub-national level of government is generally not as well developed as that of developed countries. The involvement of sub-national governments and the private sector was not as coordinated as that of a national government with generally uncoordinated SDI activity occurring. As policy development came from the national level, there was no real driving role for these two sectors to play in SDI development although there were exceptions, as is the case in Australia (Rajabifard, Binns et al. 2006).

Furthermore, the involvement of these three sectors has enabled the development of the initial concept of an SDI and the role that it plays in the reorganization of government activities, although the differing political and economic situations of nations has meant that it has not been possible to adopt one simple agreed concept. Overarching policies including national standards and concepts were also created, however these were not always implemented by sub-national governments. This is due to the needs of sub-national governments and the private sector beginning to change with the rapid advancement in information and communications technologies and the need for large-scale information to enable more efficient and effective decision-making in the wider community (Rajabifard, Binns et al. 2006).

More recently, the trends and development within SDIs have shown that the roles of the three major players have changed to meet the new large-scale focus of many SDIs, especially in the developed world. The previous influence of national governments at both strategic and operational levels has diminished, although there is still a strong case for a strategic national government role in SDI through coordination. The operational level of SDI that in the first generation was undertaken by national governments has now moved to the sub-national government level. It is at this level that large-scale land administration data is produced (most common form of spatial data is land related data). Also, the private sectors operational role has also increased as they are leading the drive for greater access to ‘people-relevant’ data that is utilized to effectively undertake their role within society as is the case in Alberta, Canada (Rajabifard, Binns et al. 2006).

However, privatization may severely hamper data flow activities such as sharing/exchange and distribution by giving total authority and responsibility to the private sector who may be interested in financial benefits only instead of provision of quality services to the citizens (Ali 2008).

Nonetheless, partnerships and not privatization is essential for the evolution and development of SDIs throughout as seen in Canada where partnership was a component of their SDI as is mentioned in the Guide to The Canadian Geospatial Data Infrastructure, Chapter 2 and Section 2.5 entitled "Building the CGDI" http://www.geoconnections.org/publications/Technical_Manual/html_e/toc.html (Rajabifard, Binns et al. 2006; GeoConnections 2010).

2.6. Conceptual Framework

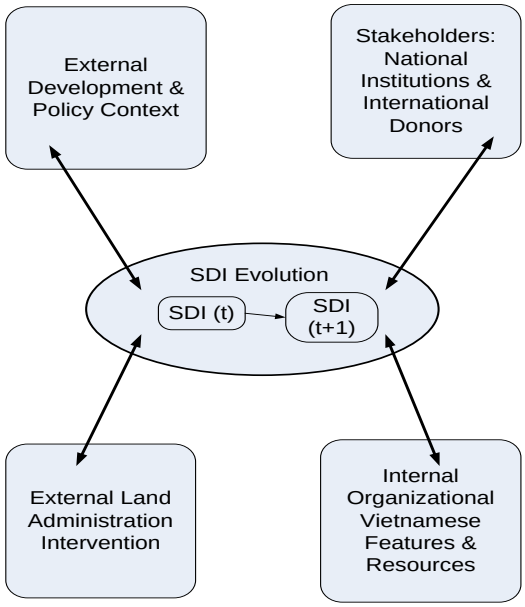

Figure 6 - SDI Concepts from Theory & Literature

As the SDI evolves, it is influenced by various elements over time. Based on literature, these elements can be both internal (inside a country or organization) as well as external (outside of the country or organization). Also, these elements are also influenced by the evolving SDI and may at times influence each other (internal and external elements). Using Figure 6 above, as the SDI moves from one state to the next over time, that is from SDI(t) to SDI(t+1), it is influenced by elements such as external land administration interventions, stakeholders such as national institutions and internal donors and also the features and resources of the coordinating organization whether governmental, private or a combination of both. These elements are also influenced as the SDI evolves in terms of organization structure and coordination of relevant resources in terms of surveying and mapping or technology, policy development to mirror the way in which the SDI is evolving or even to change the direction according to the overall goals of the implementing organization, the degree of influence of institutions such that and also the level and nature of external land administration interventions as depicted by the two-directional arrows shown.

SDI(t) is the state where the SDI has first been developed. SDI(t+1) represents the state in which after a period of time, the SDI is at or have evolved to over time. For Vietnam, the evolution of development of the SDI started in 1991 i.e. SDI(t) and it has now evolved over time to SDI(t+1) which represents 2009

From the context of Vietnam, the study case for this research, as the evolution of the SDI takes place, the SDI is influenced by elements that are similar to the ones described earlier in this section. Stakeholders that will influence and who will be influenced by the evolving SDI are such as the Ministry of Natural Resources and Environment (MoNRE) and the departments that fall under this ministry, Academic Institutions such as the Institute of Geography and also the Vietnam Association of Geodesy,

Cartography and Remote Sensing and all surveying and mapping agencies at all Public Administration (PA) levels.

Furthermore, the external land administration interventions that influence this case come in the form of land administration projects which are implemented by external donors with the assistance of non-governmental organizations (NGOs). Now with these projects being implemented by external donors, they will incorporate their ways of thinking through these projects which will also influence the way and direction of the evolving SDI. Also, as countries around the world continue to develop SDIs, the results from them, whether successful or not, are used as a conduit or "best practices" for the way forward for the evolving SDI.

However, the internal features and resources of the Vietnamese also influence the evolution as funding is one of the major aspects that need to be incorporated. Also, the structure of the organizations that are involved and responsible for the SDI is influenced as there may be a collaboration of public, private or a combination of both domains as well as academia as is the case in the Netherlands. Hence, both the evolving SDI in Vietnam and the internal and external elements influence each other.

Nonetheless for this research, we take a closer and a more focused look into what exactly influences the evolution of the SDI in Vietnam. There are several aspects or challenges as highlighted in Section 2.4 and Section 2.5 that we take into consideration. The related aspects being focused on are the Institutionalization of the SDI, the Regulation of the SDI, the Adoption of SDI Technology, the Social Interaction using the SDI Technology and finally, the Influence of external donors. All of these have and will continue to influence and will be influenced by the SDI as it evolves in Vietnam. Figure 7 below depicts the evolution of SDI in Vietnam and the influences that take place over time.

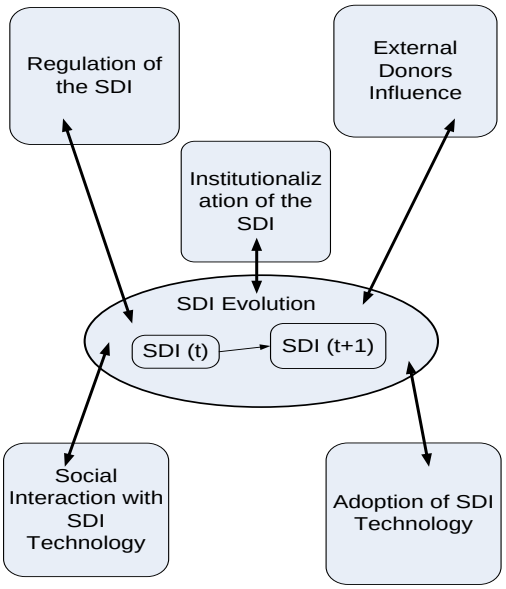

Figure 7 - SDI Concepts for the Evolution of SDI Through Land Administration Infrastructures

2.7. Conclusion

The main actors of Land Administration have been external donor agencies, the politicians who are responsible for passing the laws that govern the realm that the projects can incorporate, government organizations at all levels of public administration and most of all, the citizens of the country where the project is being implemented.

Also, in the development of SDIs, globally the system has developed from formal mandates, initiatives and directives. They have also developed as a result of spatial data coordination activities between the levels of government and across levels (vertically and horizontally). Hence, the main concepts have been about data sharing and access to data.

However, donors are now incorporating the development of SDIs within land administration projects as is the case in Vietnam, eventhough the initial development of SDI was the domain of national governments.

To this end, the conceptual framework depicted in Figure 6 and Figure 7 reflects the SDI status at certain times during its development, the influencing factors such as external development which includes SDI development internationally, external intervention from donors, NGOs and other stakeholders such as local government agencies. Furthermore, the evolution of SDI from 1st Generation to 3rd Generation in Figure 4 shows how far the concept has come from since it was first adopted in the early 1990's. This is a part of the basis of this research and one where we develop and decompose our concepts to be addressed throughout and is explained in Chapter 3.

3. Data Collection Methods and Strategy for Observing and Describing SDI Evolution

3.1. Introduction

In the previous chapter the concept of SDI was explored and linked to emerging results of LA projects. This chapter addresses research question/objective 2 where the focus is to describe the aims of the donor agencies in LA projects, the ways in which their concepts are perceived by the Vietnamese and also the trends that have been present in SDI and land administration. The focus of the data collection is to find the factors describing SDI evolution. I conclude the chapter with a conclusion which answers the research stated above.

3.2. Research Methods

There are two approaches for data collection through primary and secondary data sources. These approaches are qualitative and quantitative approaches. The qualitative approach is used for finding evidence that relates to the evolution of the SDI in Vietnam. The quantitative approach will focus on how the concepts of SDI and donors are reflected in literature documents and also perceived by the Vietnamese. For the concepts stated, the methods and techniques I used to find data on these concepts are interviews, questionnaires and document scanning.

Before the questionnaire and interviews were undertaken, a framework for the Evolution of SDI and the Influence of External Donor Agencies concepts with indicators and dimensions that was to be investigated was created. This was done using the concept matrix depicted in Table 4. With this matrix a range of provisional questions with possible answers were included as well as the potential respondents to the questions for each indicator.

With this completed data matrix, the questionnaire to be used was created and tested. Comments resulting from the test enabled the questionnaire to be enhanced in order to get the most appropriate responses that will assist in answering the research questions as it relates to SDI evolution through land administration projects in Vietnam. The following sections will give a description and justification of the indicators that were used as proxies for the concepts mention above.

The literature search strategies created and used for this research were all based on the concepts and dimensions as composed in the data matrix based on the main research question in Section 1.4. For example, using Google Scholar for the dimension Institutionalization of the SDI, one strategy is “institutionalization*” AND “Spatial Data Infrastructure”. This strategy was placed in the “exact phrase” area of the Advanced Search scheme. This yielded 81 records, a combination of books, citations and articles. These results were not limited to any time period. The strategy was also changed to yield results from 1991 to present. This yielded 41 records. Similar strategies were developed for the other

elements of regulation of the SDI, adoption of SDI technology, social interaction using SDI technology and also the external donor's influence in LA projects.

3.2.1. Indicators for Dimensions

The Indicators that were selected to describe the Dimensions of the derived concepts for data collection are shown in Table 4. These indicators were selected based on the relevance towards the dimensions. For example, for the dimension Institutionalization of SDI, four indicators were selected to best describe this.

As coined in (Harvey and Tulloch 2006), institutionalization relates to data sharing arrangements, as data sharing is a key component of SDI and is the precept for improving geographic information integration and analysis through easier data access. In other words, institutionalization is the rules of the game as adopted by individuals and or organizations in carrying various functions between each other. The indicators shown in Table 4 cover a broad scope of institutionalization in terms of data sharing, awareness, where and how often persons get their understanding and knowledge of the concept of SDI. See Table 6 for further details as it relates to the operationalization to determine institutionalization and the degree to which practices become institutionalized.

The other dimensions in the data matrix were selected in the same manner, i.e. the relevance of the indicators to the dimension in explaining the concept further. For the dimension Regulation of SDI, the indicator selected was "degree to which SDI is regulated". This is to show whether or not there is a policy, directive or law that should be followed for actually coordinating efforts to develop an SDI. Table 4 and Table 7 give further details as to the operationalization to determine the issue of regulation of the SDI and the degree to which the SDI is regulated.

"The degree to which SDI technology is adopted" is to show what are the technology being used and when was it first used seeing that technology changes rapidly. As technology changes so does the required capacity to utilize this technology. Therefore the indicator would show who uses the technology and for what purpose. Table 4 and Table 7 give further details as to the operationalization to determine the degree to which the SDI technology is adopted.

With the advent of computers and information systems within the information age, it is coined in (Wallace and Williamson 2006), the use of computers would enhance the workings of individuals and make them more efficient and effective. Hence, the "degree to which SDI is used to access and use spatial data" would show if ordinary citizens have the facilities to access data from organizations and how easy is it. Also the "degree to which SDI is used to carry out land administration functions" shows if land registration and other functions are carried out using these information systems or if it is still done manually. It will also show if the information system have enhanced the working procedures and processes of organizations doing land registration and other land administration functions. See Table 4 and Table 8 for further details as it relates to the operationalization to determine the degree to which there is interaction with the SDI technology.

The "degree to which external donors influence SDI initiatives" would show how much control external donors have in land administration projects. This is very important as the level of control determines the

degree of implementation cohesion and completeness of these projects. The more control that external donors have leads to conflicts arising or the less they have will result in ad hoc implementation and an unsuccessful project. Hence the indicator will show the level of control involved. Table 4 and Table 9 give more details to the operationalization that will help to determine the degree to which external donors influence SDI initiatives through land administration projects.

However, to get the full information about these indicators are not only through survey questionnaires but also from results of documents collected as well. The documents that have been collected gives some added information to the indicators in the data matrix which helps to better describe the dimension to the concepts.

3.2.2. Operationalization for the Concept of Institutionalization of the SDI

Table 6 - Operationalization for the concept of Institutionalization of SDIs

(Survey) Question	Possible (Range of) Answers	Relation of answers to Indicators/Concepts	Targeted (type of) Respondent
How was data sharing organized 10 years ago?	There were regulations There were no regulations	If there are (still) no formal agreements or regulations on how data is shared, then data sharing is not institutionalized. If any internal regulations emerge over time, then institutionalization has started	Internal system manager of LA organization Project manager of information systems Systems designers Donor Agency personnel
How is spatial data sharing formally organized in your organization?	Regulations appeared only at a certain moment		
Do you exchange spatial data with others?	No, I do not share with other organizations Yes, I do share with other organizations		
Have you ever heard about spatial data infrastructures?	No I have never heard about it	If there is no awareness, then capacity building is non-existent. If there is awareness, then capacity building is exists.	Citizens: Customers to front desk Provincial, District & Local Levels LA personnel (Department Heads) Scholars, Professors, Think Tanks, Experts
Where did you hear about it?	From Central Government From Donor Agencies During meetings & workshops During LA projects		
Have you read about SDI in journals?	Yes I have read about SDIs No I have not read about SDIs	If SDI is read in journals then there is awareness. If SDI is not read in journals then there is no awareness.	Internal system manager of LA organization Project manager of information systems Systems designers Donor Agency personnel Citizens: Customers to front desk
How often do you read about SDI in journals?	Weekly, Monthly, Yearly		
Has the content about SDI changed over time?	Yes the content has changed over time No the content has not changed over time		
Have you read about SDI in memos and documents?	Yes I have read about SDI in memos & documents No I have not read about SDI in memos & documents	If SDI appears in memos and documents then there is decentralization taking place. If SDI does not appear in memos and documents then there is no decentralization taking place.	Internal system manager of LA organization Project manager of information systems Systems designers Donor Agency personnel Citizens: Customers to front desk
How often do you read about SDI in memos & documents?	Weekly, Monthly, Yearly		
Has the content about SDI changed in memos & documents?	Yes the content has changed in memos & documents No the content has not changed in memos & documents		

3.2.3. Operationalization for the Concept of Regulation & Adoption of the SDI

Table 7 - Operationalization for the concepts of Regulation & Adoption of SDIs

(Survey) Question	Possible (Range of) Answers	Relation of answers to Indicators/Concepts	Targeted (type of) Respondent
Are there any directives for regulating SDI development?	There were directives There were no directives I do not know	If there are no directives then SDI development is adhoc. If there are directives then SDI development is regulated.	Internal system manager of LA organization Project manager of information systems Systems designers Donor agency personnel
Are the directives within or a part of legislation or land law?	The directives are a part of legislation or land law The directives are not a part of legislation or land law I do not know		
Are the directives mandatory or flexible?	The directives are mandatory The directives are flexible		
Are there any new SDI technology being used?	Yes there are new technology being used No there are no new technology being used I do not know	Full adoption of new SDI technology Partial adoption of new SDI technology No adoption of new SDI technology	Internal system manager of LA organization Project manager of information systems Systems designers Donor agency personnel Central, Provincial, District & Local Levels LA personnel (Department Heads)
When was the SDI technology adopted?	Before 1986 1988 1993 2003 After 2003 I do not know		
What kind of SDI technology is being used?	Yes I have read about SDIs No I have not read about SDIs		
Who uses the new SDI technology?	All levels of government Only at central level		

3.2.4. Operationalization for the Concept of Social Interaction Using the new SDI Technology

Table 8 - Operationalization for the Concept of Social Interaction using new SDI Technology

(Survey) Question	Possible (Range of) Answers	Relation of answers to Indicators/Concepts	Targeted (type of) Respondent
Are the citizens aware of new SDI technologies?	Yes they are aware No they are not aware I do not know	Public contact and relations have not changed with the use of the new SDI technology and have become more complexed. Public contact and relations have increased with the use of the new SDI technology and have become simpler.	Internal system manager of LA organization Project manager of information systems Systems designers Donor agency personnel Central, Provincial, District & Local Levels LA personnel (Department Heads) Citizens: Customers to front desk
Are the SDI technologies used to access land information?	Yes the technologies are used No the technologies are not used I do not know		
Is it easy for citizens to use or access information using the technologies?	Yes it is easy for citizens No it is not easy for citizens I do not know		
Is the SDI technology used to carry out land administration activities?	Yes the technologies are used No the technologies are not used I do not know	LA activities have increased with the use of the new SDI technologies and have allowed more flexibility. Better decision making can be made. LA activities have not changed with the use of the new SDI technologies and have become more complex and time consuming.	Internal system manager of LA organization Project manager of information systems Systems designers Donor agency personnel Central, Provincial, District & Local Levels LA personnel (Department Heads) Citizens: Customers to front desk
Does the SDI technology help to save time, resources and money doing land transactions?	Yes it does No it does not I do not know		
Does the SDI technology help to increase transparency and eliminate corruption?	Yes it does No it does not I do not know		
Have spatial planning, urban planning, land use planning services and other decision makings improved with the new SDI technologies?	Yes it has No it has not I do not know		

3.2.5. Operationalization for the Concept of Influence of External Donors in Land Administration Projects

Table 9 - Operationalization for the Concept of Influence of External Donors in Land Administration Projects

(Survey) Question	Possible (Range of) Answers	Relation of answers to Indicators/Concepts	Targeted (type of) Respondent
Have external donors been involved in LA projects?	Yes they have No they have not I do not know	If donor ideas and concepts are not accepted then their influence is low. If donor ideas and concepts are accepted then their influence is high.	Internal system manager of LA organization Project manager of information systems Systems designers Donor agency personnel Central, Provincial, District & Local Levels LA personnel (Department Heads) Citizens: Customers to front desk
What level of control do they have?	Full control Little control No control I do not know		
Are their ideas and concepts accepted?	Every time Some times Never I do not know		
Have there been conflicts between the external donors and the Vietnam government organizations?	Yes there have been No there have not been I do not know		
What was the resulting outcome of the project?	Updated & continued Cancelled Postponed Nothing		

3.3. Primary Data

3.3.1. Interviews and Interviewees

The primary data relies on seven interviews. The persons that I interviewed were Heads of Departments of Land Registration Office and the Department of Natural Resources & Environment (DoNRE) of the People's Committee of Thanh Xuan District, Head of Department of the New General Department of Land Administration (GDLA), Professor of the Vietnam National University, Hanoi within the International Centre for Advanced Research on Global Change, Director of ESRI Vietnam, Project Manager within the Department of Information Technology, MoNRE and other experts in Land Administration in Vietnam. More details about the interviewees are in Appendix 3.

Two of the interviews lasted between 5-10 minutes and was conducted in Vietnamese as the interviewees were somewhat occupied with their daily tasks as reported to the translator. Others were in the form of a presentation by the interviewee and followed by questions from the interviewer while others were in the traditional question and answer format.

Furthermore, donor agencies were targeted for conducting interviews but unfortunately, they were unavailable at the time of fieldwork. Contact was made with the Swedish Government Ministry of Foreign Affairs in Vietnam which had a role in the Co-operation Programme on Land Administration Reform (CPLAR) and the Strengthening Environmental and Land Administration (SEMLA) projects. They however gave directions to their contact person for further assistance but were unable to get in contact with the individual. A similar situation occurred when contacting the World Bank Officials. They gave directions to the person most involved and responsible for the Land Administration Project but I was unable to make contact. Emails were sent to this individual for making contact on many occasions.

3.3.2. Questionnaire

This form of data collection has provided the quantitative, as well as the qualitative aspects of the research. Fifty questionnaires were sent via email with the link to the survey/questionnaire to individuals who work at MoNRE (Department of Surveying & Mapping and Department of International Cooperation), individuals from the Hanoi University of Mining and geology, General Department of Land Administration, Hanoi University of Science, Vietnam Association of Geodesy, Department of land Registration and Statistics, Hanoi University of Agriculture, The joint Stock Company of Consultancy Service and Technology and also independent consultants for Land Administration System. The survey/questionnaire was created using Survey Monkey and is comprised of five main sections. These sections are as follows;

1. Institutionalization of SDI
2. Regulation of SDI
3. Adoption of New SDI Technology
4. Social Interaction using SDI Technology
5. External Donors' Influence in Land Administration Projects

The sections of the questionnaire stated above are the main dimensions of the concepts within the data matrix. Sections one to four are related to the "Evolution of SDI" concept and section 5 is related to the "External Donors Influence in LA Projects" concept. As each dimension has several indicators, there were potential questions designed to generate responses that seek to show the relation of the indicator to the dimension and dimension to concept. The respondents selected were not random. These respondents have knowledge of land administration, GIS or LIS, land administration projects and also the concept of Spatial Data Infrastructures (SDI) in Vietnam and where also recommended by Professor van der Molen and Professor Dang Hun Vo as persons with the required knowledge as it relates to land administration and SDIs.

3.4. Secondary Data

Secondary data was also collected during the fieldwork to validate and to complement the primary data. These include LA project reports, presented documents from FIG regional conference, Vietnam country reports, website addresses and documents with relevant information on LA projects carried out in Vietnam.

3.4.1. FIG Regional Conference, Hanoi

The 7th Regional Conference was organized and held in Hanoi, Vietnam from October 19-22, by the International Federation of Surveyors (FIG) and the Vietnam Association of Geodesy, Cartography and Remote Sensing (VGCR) provided an additional opportunity for data collection. The Technical Sessions that were of interest and importance were

1. SDI and Land Administration
2. Legal Aspects in Land Administration
3. SDI in Support of Urban Management
4. Spatial Data Infrastructures Advanced Technology for Cadastre and Land Management

Papers of various presentations in particular to issues of SDIs and Land Administration were collected as they were posted to the FIG website for the conference (http://www.fig.net/vietnam/) and (http://www.fig.net/vietnam_2009/index.htm).

3.4.2. Documents from External Donors and Government Organizations in Vietnamese

In developing the scope of the research in terms of the objectives and the research questions, along with the appropriate data collection methods, data such as annual reports of land administration projects and other project documents that would assist in answering the research questions, was taken into consideration. Table 1 gives a overview as to the expected data required for each objective and research questions. Therefore, the type of documents that were sought after are shown in Table 10.

Table 10 - Types of documents for collection and the relation to the data matrix

Documents	Relation to Data Matrix
Annual Reports of LA projects	Concept of Evolution of SDI
Contract Documents between Donor & Vietnamese	Institutionalization and Regulation
Memorandums of Understanding of LA projects	Institutionalization and Regulation
Journal Articles relating to SDI	Social Interaction
LA Project Documents	Influence of External Donors and Adoption
Vietnam Country Reports	Institutionalization, Regulation and Adoption
Geomatics Magazines (GPS World,)	Institutionalization

Annual reports of LA projects were a good source of information because these reports gave a clear synopsis of the project itself, its objectives, where it is to be implemented and what transpired within a specific time period, mainly for the previous year. This helped to see the status or progress of the project in terms of its objectives and procedures, and what should be done to maintain its current trend or to redirect where necessary. Hence, for this research, annual reports helped to assess the evolution of the SDI.

Vietnam LA project contract documents between the external donor and the Vietnamese, Vietnam LA Project Documents, Vietnam Country Reports and Memorandums of Understandings between external donor and Vietnamese give some of the same information as Annual reports. Such information is description of the project highlighting the components to be a part of the project, objectives of the project, the stakeholders in terms of where the project will be carried out and who will be involved in carrying out the tasks and also contain some lessons learned from previous experiences or research of the country/area for implementation of the project. This sort of information helps to justify the choice of the concepts, dimensions and indicators.

Journal articles and magazines are more of a research type source of data. From these you get some of the experiences of the authors in relation to the subject matter. Since land administration and SDI are artefacts that are constantly being researched on, the knowledge from these experiences help to better describe and understand the elements of the dimensions and indicators for each concept in the data matrix.

3.5. Securing Validity

The interviews provided primary data, which were obviously subjective (collection of opinions). These documents served as a source of comparing the validity between documents and also responses that may be made to questions relating to the concepts being research. This validity check is relevant as the responses you receive from respondents may not be accurate at times or not consistent.

Therefore, the responses from the respondents of the questionnaire were checked against the documents received as they required to be validated. Also, as it was not possible to get responses from more than

one person within an organization, these responses were also checked against responses received from other respondents for consistency as to the facts.

3.6. Conclusion

The chapter has addressed researched question/objective 2 in the following way;

Through the land administration projects that have been carried out in Vietnam, the aim of the donors was to develop information systems, especially Land Information System (LIS) to enhance land administration functions such as land registration, land use planning and land consolidation. The aim of the LIS has now moved towards the development of a spatial data infrastructure through the SEMLA and VLAP projects. Also, the perception of the Vietnamese to the concepts and donors in documents are such that the concepts and donors are generally accepted but not without dialog and discussion on the benefits for the Vietnamese themselves. Hence, the trend thus far of SDI and land administration within Vietnam is where land administration projects are used to develop and implement the SDI as it is seen as a way for enhancing the land registration system which assists in developing the market economy model that Vietnam has adopted. The next chapter will address the SDI developments and Vietnamese priorities for system development and look at any similarities and differences between both elements.

4. The Practice of SDI Evolution Through Land Administration Projects in Vietnam

4.1. Introduction

This chapter addresses research question 3 where the results obtained from the methods of data collection carried to determine the function of spatial data infrastructures (SDI) through land administration projects in Vietnam over time. The chapter begins with some basic statistics of the respondents, statistics about the responses themselves and the documentary evidence. We then address the validity of the documents and results obtained to verify if they are enough to answer the research questions highlighted earlier. Finally, the chapter concludes with a summary of the elements addressed here.

4.2. General Statistics of Data

4.2.1. Statistics of Respondents & Responses from Questionnaire

Overall, fourteen responses were received from the fifty questionnaires that was sent out, giving a response rate of 28%. The questionnaire was sent to heads of departments and experts within the MoNRE, professors, lecturers and students at various land, remote sensing and GIS related universities in Vietnam (University of Mining and Geology, Hanoi University of Science, Hanoi Agricultural University), independent consultant for land administration system, researchers and director of a project management organization relating to land administration.

Also, out of the fourteen respondents that started the questionnaire, eleven of them completed the questionnaire, giving a completion rate of 79%.

4.2.2. Statistics on Documentary Evidence

Overall, some 47 documents were collected from both Vietnamese Government Departments and External Donor Agency's websites as well as from general document searching online. Table 11 below gives a summary of documents with the type, title and agency responsible for the document.

Table 11 - List of collected documents and the Institutions that are responsible for the documents

Document	Agency Responsible	Document Type
Project Appraisal Document for the Vietnam Land Administration Project (February 2008)	World Bank	Project Document
Vietnam - Sweden Cooperation Programme on Strengthening Environmental Management and Land Administration (Final Completion Report) July 2006	SIDA / MoNRE	Project Document
Vietnam - Sweden Cooperation Programme on Strengthening Environmental Management and Land Administration (Programme Document) May 2004	SIDA / MoNRE	Project Document
Vietnam - Sweden Cooperation Programme on Strengthening Environmental Management and Land Administration (2007 Annual and Mid-Term Report) January 2008	SIDA / MoNRE	Project Document
Vietnam - Sweden Cooperation Programme on Strengthening Environmental Management and Land Administration (Progress & Final Report) 07.2006 – 12.2006 (Implementation Stage) January 2007	SIDA / MoNRE	Project Document
Vietnam - Sweden Cooperation Programme on Strengthening Environmental Management and Land Administration (Strategic Plan of Operation and Organization of SEMLA Programme) 2006 – 2009 (30 June 2006)	SIDA / MoNRE	Project Document
Memorandum of Understanding (MoU) on The Implementation of The Vietnam - Sweden Cooperation Programme on "Strengthening Environmental Management and Land Administration", Special Component at Vietnam Environment Protection Agency, During 2006 to 2009 (17 July 2006)	SIDA / MoNRE	Memorandum of Understanding
Vietnam – Sweden Co-operation Programme on Land Administration Reform (LAND INFORMATION SYSTEM PROJECT – Implementation of System) December 2000	GDLA / SwedeSurvey	Project Document
Vietnam - Sweden Cooperation Programme on Strengthening Environmental Management and Land Administration (Enhancing Land Registration in Vietnam) March 5, 2008	SIDA / MoNRE	Project Paper
The Strengthening Environmental Management and Land Administration Programme in Vietnam - Sida Evaluation 2008:45	SIDA	Project Paper
Vietnam-Denmark Partnership (Strategy for Development Cooperation) 2006-2010	DANIDA	Policy Document
Land Legislation Construction Issue in Developing and Transition Economy Countries With Practical Experiences in Vietnam (August 2008)	PCGIAP	Conference Paper
JOINT CIRCULAR # 38 (Guiding the Function, Task, Power, and Organization of Land Registration Office and Land Source Development Agency) December 31, 2004	MoNRE / MoIA	Policy Document
Land Administration Reform: Indicators of Success and Future Challenges (2008)	World Bank	Discussion Paper
Comparative Study of Land Administration Systems - Global Synthesis of Critical Issues and Future Challenges (March 19, 2003)	World Bank	Report
Vietnam - Sweden Cooperation Programme on Strengthening Environmental Management and Land Administration - National Component (ELIS Thematic Advisory Group) - Environmental and Land Information System (ELIS) – The Next Steps Toward a National Implementation (2008)	SIDA / MoNRE	Project Document

4.3. Results Relating to the Evolution of SDI Concept

4.3.1. Institutionalization of the SDI

In the context of Vietnam and based on the data collected from the questionnaires, six of the fourteen respondents reported that the 2003 Land Law makes specific mention to the use, dissemination, and sharing of spatial data whereas other respondents gave varying responses from the 1988, 1993 Land Laws to No Land Law whatsoever. Figure 8 gives a view of these results.

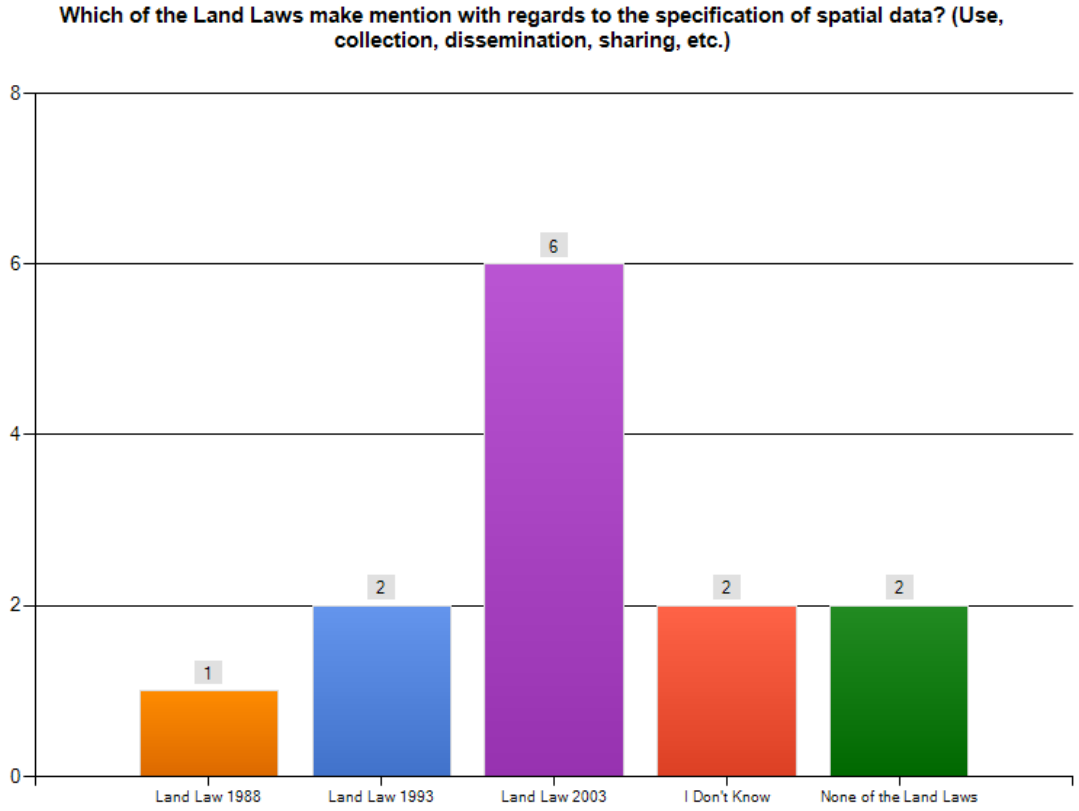

Figure 8 - Land Law that makes mention regarding spatial data

However when it comes to the way in which spatial data is received, eight of the fourteen respondents reported that they receive spatial data through personal contacts. Of the remaining six respondents, four stated that it does not require a law neither a regulation to receive spatial data. However, one of the remaining two respondents did state that the 2003 Land Law makes it possible to receive spatial data. Figure 9 shows these results.

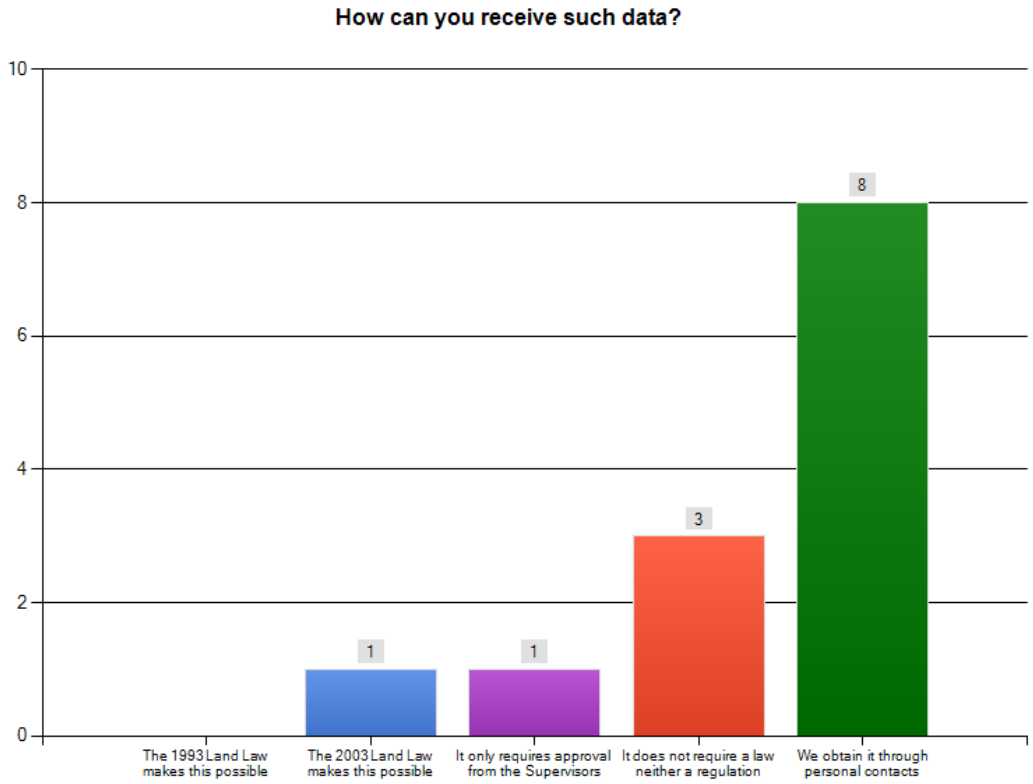

Figure 9 - The ways in which data is received by individuals

According to (Harvey 2001; Harvey and Tulloch 2006), much of the research on SDIs that have been carried out in previous years illustrate that the SDI concept is still very much an unknown phenomena but some of the concepts and policies have made their way into every day practices. Thirteen of the respondents (questionnaire and interview combined) stated that they have heard of spatial data infrastructure (SDI) whereas three other respondents stated that they have never heard about it before. It must also be stated that from the interviews conducted at the Department of Natural Resources and Environment (DoNRE) and the Land Registration Office, the interviewees also made the claim that they have never heard about SDI before.

From the interviews conducted, various quotes and responses were made as it relates to the dimensions and indicators from the data matrix above. One of the main responses towards institutionalization of SDI is where the MoNRE have now created a new General Department of Land Administration (GDLA) which is responsible for the creation of standards as it relates to data and metadata, especially cadastral data. It was also mentioned that every Province have their own way for making land information which makes the holistic creation of spatial data cumbersome and problematic. Also, only 30% of Vietnam's spatial data is in digital format and the remainder is in a digital/analogue state. However, the aim is to convert all data from analogue to digital form beginning in 2009 and until 2015. This will be a part of the VLAP being implemented by the World Bank. The completion of this aspect of the project will improve data sharing which will allow more autonomy at the Provincial Levels and allow the Central Level to focus on synchronizing the activities.

Also, from 1996 to 2009, the GDLA has been responsible for the Land Information System (LIS) which was a component of the Vietnam – Sweden Co-operation Programme on Land Administration Reform (CPLAR). This is also stated in the Vietnam – Sweden Co-operation Programme on Land Administration Reform (CPLAR) project document entitled "Land Information System Project – Monitoring and Evaluation of Pilot Projects) of May 2000.

Furthermore, the ICT Department of MoNRE was designated with the responsibility and strategy for the Vietnam Spatial Data Infrastructure (VSDI) which is a part of the Environment and Land Information System (ELIS) component of the Strengthening Environmental Management and Land Administration Programme (SEMLA) conducted in Vietnam by SIDA and MoNRE. This is also confirmed in the SEMLA Programme Document of May 2004.

4.3.2. Regulation of the SDI

From the data collected via the questionnaire, six of the fourteen respondents stated that there is a directive with regards to spatial data infrastructures (SDI) in Vietnam. Of those six, four gave the name of a directive that they know or have worked with in regards to SDI. See Figure 10.

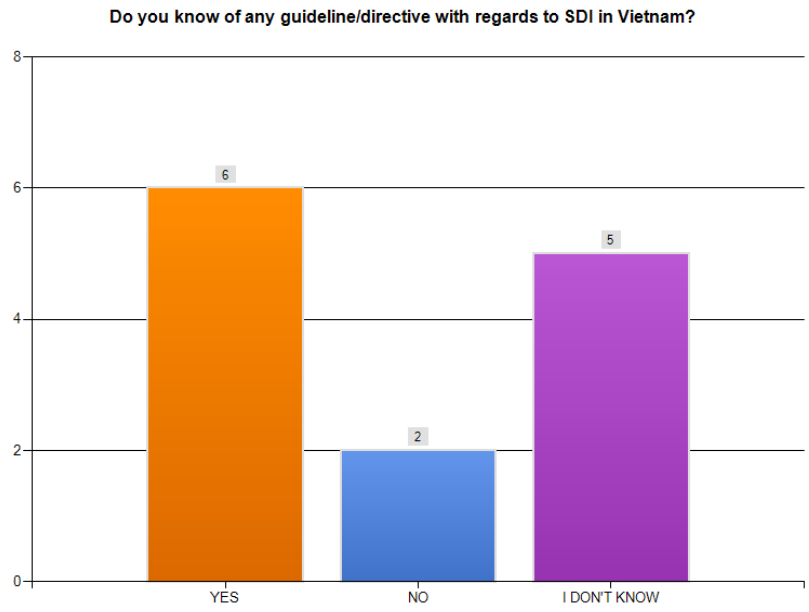

Figure 10 - The knowledge of a directive by individuals regarding SDIs in Vietnam

Directives referred to by respondents included:

1. The World Bank Project currently being undertaken in Vietnam (VLAP) (1)
2. The Vietnam Spatial Data Infrastructure (VSDI) Project (1)
3. The Technical Regulation for Basic Geographical Database in Vietnam (1)
4. The Technical Regulation for Cadastral Data in Vietnam (1)

5. Decree 102, Circular 07, Strategy 179 (1)

The other eight respondents either said they do not know of any or that there was no directive regarding SDI.

Three of the six that said there is a directive regarding SDI state that this guideline is located in the 2003 Land Law and the other three state that it is not in any of the Land Laws. Also, out of the eight respondents that stated that they did not know *of* or that there is no guideline regarding SDI, four of the respondents stated that the guideline is found in either the 1988 Land Law (1), 1993 Land Law (1) or the 2003 Land Law (2). See Figure 11.

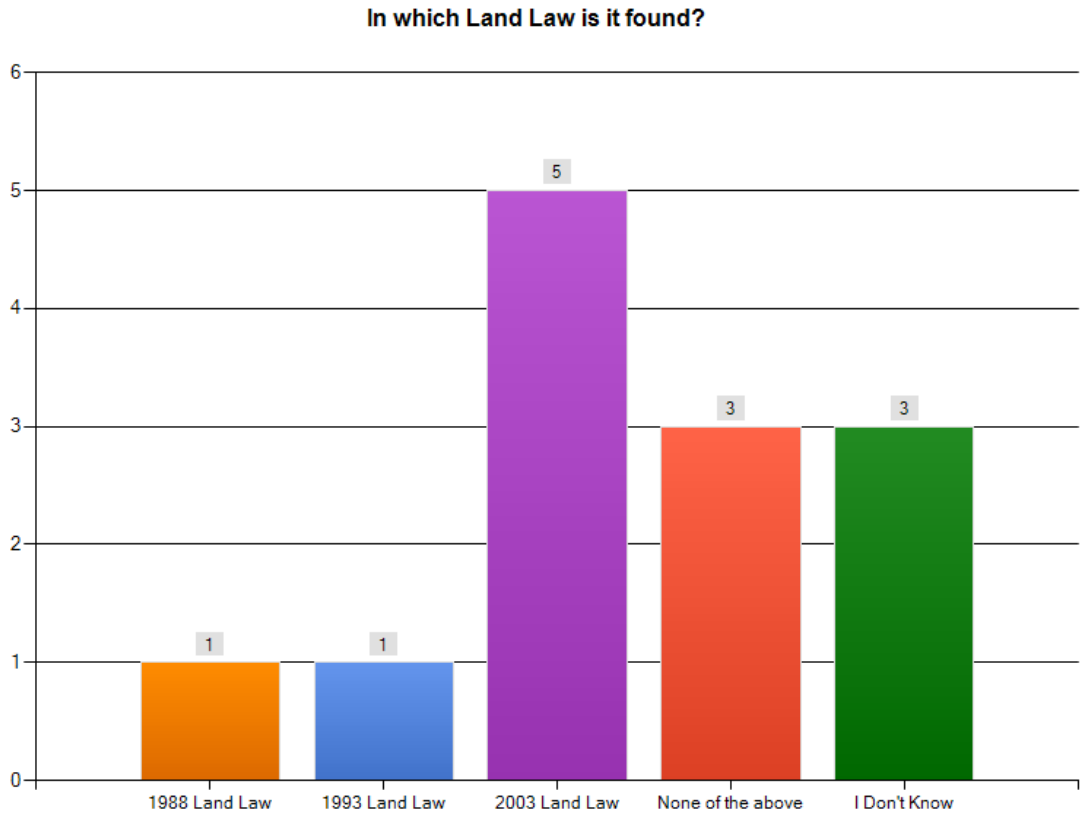

Figure 11 - The Land Law that contains the directive regarding SDIs in Vietnam

Also, it was mentioned by one respondent from the National Remote Sensing Center during the interview that the use of GIS is not compulsory and that no policy exists for SDI diffusion. This was also confirmed by a respondent from the GDLA as they mentioned that there is a gap between land administration projects and policy inclusion into law.

4.3.3. Adoption of New SDI Technologies

From the collected data using the questionnaire, eleven of the fourteen respondents stated that they use LIS within their organization regularly. However of the three that stated that they did not or did not answer that question, one mentioned that they have just started a LIS project within their organization.

Of the eleven that use LIS, only six of them stated that they use it for Land Administration activities. Such activities include:

1. Land Planning
2. Building of Vietnam's basic Geographical Database
3. Land Data Management
4. Land Consolidation Studies & Land Use change analysis
5. ELIS, ViLIS, CiLIS

Of the eleven respondents that use LIS within their organizations, four began using it between 1988 – 2003, five between 1993 - 2003 and four began after 2003. These time periods are significant as they relate to the times of the passage of the Land Laws within Vietnam. Of the three respondents that stated that they do not use LIS or did not respond to the question, one of them stated that they started using LIS After 2003. See Table 12 below shows this information. These responses will be analyzed in Chapter 5

Table 12 - Timeframe of LIS implementation by organizations as related to the passing of the Land Laws

LIS Use (Time started by organizations)	No. of Respondents
1988 - 1993	4
1993 - 2003	5
After 2003	3

Furthermore, six of the respondents stated that they work at the Central Level of Public Administration, five at the Provincial Level, one at the District Level, one does not work for any public level administration and one did not respond to the question. Table 13 shows the compilation of this section.

Table 13 - Number of respondents of the questionnaire as per Public Administration level

Public Administration Level	No. of Respondents
Central Level	6
Provincial Level	5
District Level	1
Commune Level	0
Private Sector	1

From the interviews conducted, it was reported that the ArcView GIS desktop software that was being used by some government agencies is now being replaced by ArcGIS Desktop. It was also mentioned

that the base geographical data for databases is in an ArcGIS format for the entire country at a scale of 1:50,000. As technology changes and updates become more available, there has been a move towards the Enterprise GIS Server technology but this is something that has not been agreed upon and is still in discussion by government agencies.

Also, ORACLE is being used for database management while MicroStation and ArcGIS is used for data capture within the GDLA.

A digital land database has not been established for Vietnam as was stated hence land data is still being managed on paper within two registers at the Land Titles Office of the Department of Natural Resources and Environment (DoNRE) of the Peoples Committee of the Thanh Xuan District. With this in mind, it was also mentioned by the Head of Land Titles Office of DoNRE during the interview that the Thanh Xuan District have not made any efforts to move towards and apply ICT technology to the Land Registration and Data Management functions of the Land Registration Offices, hence resulting in maps which are of low accuracy which have been measured and surveyed by tape since 1994.

Nonetheless, with the formation of the new GDLA, the Cadastre 2014 document would be used to develop cadastral data standard which will be adopted for the standardization of all cadastral data within Vietnam (Kaufmann and Steudler 1998). The view is that the adoption of standards will help to facilitate better collection and management of cadastral data, thus encouraging other agencies to apply ICT technology to their Land Registration and Data management functions.

4.3.4. Social Interaction Using SDI Technologies

Six respondents stated that there is an initiative for citizens to work with GIS, LIS or WebGIS, seven stated that there were no initiative and one did not respond. Of the six that said there is an initiative, three gave the name of such an initiative. Such an initiative is ViLIS and also HUEGIS. Also, of those six, only three stated that citizens can access parcel data via the World Wide Web (WWW). However, from the seven that stated there is no initiative, two stated that citizens can access parcel data via the Web.

Furthermore, nine of the fourteen respondents replied that Land Administration activities are carried out using GIS or LIS, three replied no they are not, one replied that they did not know if it was and one did not respond. Of the nine that replied yes, only six stated what activities are actually carried out. Such activities are as follows;

1. Land Use Planning
2. Land Database
3. Cadastral Mapping
4. Land Registration
5. Land Valuation
6. Certification of Land & Housing on land transaction

As it relates to the use of GIS or LIS in the reduction of operational costs of storing data, nine of the respondents state that Yes, LIS reduces operational costs, one respondent states that it does not, 3 respondents state that they do not know if it does, while one respondent did not respond. One respondent state that operational costs are reduced by 30-50%, while another state it is reduced by 50%. One respondent stated that GIS or LIS reduces operational costs of storing data mentioned that it reduces the work of the staff but did not give an actual amount.

As it relates to GIS or LIS making operational work processes more transparent to citizens, eight respondents stated that it does, two respondents state that it does not, three respondents state that they did not know, while one respondent did not respond. Also, one of the respondents that stated they did not know if GIS or LIS makes operational work processes more transparent to citizens mentioned that this is due to the fact that they have just started a LIS project in one small part of the whole land registration process in their organization.

When it comes to GIS or LIS reducing the time to carry out LA activities within their organizations, ten respondents indicated that it reduces the time, one respondent stated that it would not, two respondents did not know, while one respondent did not respond.

The responses from the interviews highlight some of the same results received through the questionnaire. For example, it was stated that the private sector does not have much input in the development of the SDI. This is also similarly show in the conceptual framework Figure 2 as it shows that the SDI evolution is affected by and all affects the internal organizational Vietnamese features. Such features are that only government agencies are responsible for the development of the SDI, eventhough in literature it is regularly stated that public private partnership is the best way for developing a successful SDI. However, it was also highlighted that eventhough the technology is available some locals are not ready for the new technology as it is too advanced for them at times. Hence, training and education is the key to unlocking this issue.

4.4. Results Relating to the Influence of External Donors

From Figure 7 in Section 2.6, the responses that relate to the external donors influence on SDI evolution is as follows. Eleven respondents stated that Yes, donor agencies have been involved in LA projects in Vietnam, one respondent stated No, while two respondents did not respond. Of the eleven respondents that stated donors have been involved in LA projects, four stated that they have perceived changes by the LA projects in their daily activities. The projects stated that have impacted their daily activities are the Cooperation Programme for Land Administration Reform (CPLAR), the Strengthening Environmental Management and Land Administration (SEMLA) & the Vietnam Land Administration Programme (VLAP) Projects respectively. One respondent also mentioned that the contents of the project for implementation was only on paper but not implemented within their organization.

Furthermore, eight of the respondents have been involved in at least one of the LA projects carried out in Vietnam, four have not, while two did not respond. Of the eight respondents that have been involved in LA projects, only six stated what project they were involved in. The two respondents that did not state the project they were involved in stated the project that is still in operation that they were involved.

Such projects that were stated as still being operational are CPLAR, SEMLA, and VLAP. Some respondents only gave the location and aspect of the project they are involved in. However, one respondent did state that the SEMLA project was no longer operational.

Of the eight respondents that were a part of a LA project, the roles of the respondents stated within these projects were varied. Table 14 below shows such roles of the respondents within the projects they were a part of.

Table 14 - Role of respondent within LA projects

Role within LA Project	No. of Respondents
Technical Assistance (Technological Aspects)	2
Project Development	1
Consultant	2
Manager of Provincial Deployment Project (ELIS aspect)	1
Guidance & Training in using software (ViLIS, MicroStation), as well as instructing on Standardized Cadastral Data	1

Concerning conflicts between Vietnamese government organizations and external donor agencies with regards to the Land Administration projects carried out in Vietnam, one respondent stated that there have been conflicts, five denied conflicts existed, six stated that they did not know of any conflicts, and two did not respond. When asked to specify the nature of the conflict, if there were any conflict, no responses were given to this effect.

From the responses from the interviews there have been four major land administration projects which have been implemented by donor agencies within Vietnam. See Table 15 for a list of these projects.

Table 15 - LA projects carried out in Vietnam from 1991 to 2009

Land Administration Projects	Donor (Technical Assistance)	Time Span
UNDP for Land Management	United Nations	1991 - 1994
CPLAR (Land Administration Reform)	Government of Sweden	1996 - 2001
SEMLA (Strengthening Environmental Management & Land Administration)	Government of Sweden	2004 - 2009
VLAP (Vietnam Land Administration Programme)	World Bank	2007 - 2015

Within these projects the SDI concept has been introduced and has evolved into different shapes through these projects. First, the Vietnam – Sweden Cooperation Programme on Land Administration Reform

(CPLAR) project focused on Land Information Systems development. Land Registration was the land administration function that was being developed through this project. This was the beginning of the SDI evolution in Vietnam. This was followed by the Strengthening Environmental Management and Land Administration (SEMLA) project which was a continuation of the CPLAR project. Here, the SDI evolved even more as an agency was given the mandate to facilitate the VSDI and ICT strategy for Vietnam. The Environmental and Land Information System (ELIS) was created through this project as well as the Natural Resource and Environmental Database (NREDB) initiative. These two initiatives were the responsibility of the ICT Agency/Department and are echoed in the project documents collected as well. This confirms the findings in (Andersen, Sinh et al. 2008), which is an valuation of the SEMLA project.

However, there have been conflicts as it pertains to the agreement on the selection of software for these projects which have now lead to discussions on the structure of the land database of the VLAP project. No final consensus or agreement has yet to be reached in this matter. It was noted that compromise would be the way forward

Hence, as these projects have been developed and implemented as pilots, selected Provinces can boast to the fact that they were the first to be using this new found technology and a part of the evolving concept of SDI within Vietnam to enhance their land administration functions such as land use planning, land management and land registration.

4.5. Partnerships (Public/Private)

As it relates to the issues of privatization in terms of the privatization of services and the inclusion of the private sector in the evolution of SDIs, three of the respondents during the interviews stated that there is little to no input by the private sector and that there is little private use of spatial data in this regard. This is also seen in the SEMLA and CPLAR evaluation reports where only the government organizations such as ministries and departments at all levels are the sole entrepreneurs and users of spatial data and responsible for the development of the SDI in Vietnam.

4.6. Conclusion

The chapter discussed the type of data collected from the questionnaire, interviews and documents collected. Such documents are project documents of the SEMLA, CPLAR and the recent VLAP projects.

The similarities of these land administration projects are such that they have focused on the development of a land information system as the building block for the SDI. From the CPLAR project which dealt with Land Information Systems development and Land Registration, the SEMLA project was a continuation of the CPLAR. The SEMLA then extended the Land Information Systems idea based on the then new Land Law 2003 which placed emphasis on Land Use Rights Registration and Certification of all lands within Vietnam. The VSDI concept was also introduced through the SEMLA project. Now, the VLAP project is a further extension of the CPLAR and SEMLA projects where it now focuses to

support land registration throughout Vietnam. One difference is that the VLAP project is not by SIDA but by the World Bank.

However, the collected data about the land administration projects and SDI in Vietnam has not been as complete as required for achieving the overall objective of the research. Responses from actual donor agencies would have been helpful in drawing a better comparison in terms of the similarities and differences between the land administration projects. Responses from the Vietnamese only give one side to the story and do not give the true picture of the projects carried out in Vietnam. Actual project documents and other related documents from external donors would have been instrumental in validating some of the responses given by the interviewees.

Based on the concepts, dimensions and indicators developed in the data matrix in Table 4, responses from the external donors would have been critical and useful as the external donors would be more familiar with the actual regulation of the SDI in terms of current initiatives and directives, the land law that focuses specifically in the issue as they would have done a thorough research of the existing situation before undertaking any project. Seeing that most of the documents from the Vietnamese relating to land administration projects are in their local language, it is very difficult to get the English version of these documents.

In terms of the interviews carried out, these were somewhat “hand-picked” by a well known LA expert and consultant in Vietnam based on the availability of data and the organizations that are more involved in land administration and the evolving SDI. These interviews gave the perspective of various departments at the Central Level or from the MoNRE. Responses from the actual Provinces where the land administration projects were carried out would have been of enormous benefit as I may have been able to receive “first hand” knowledge and data from these provinces. That is not to say the responses would not have had an element of bias in them but you ask yourself, which data does not have such an element.

Nonetheless, the data collected serves as the basis for the interpretation of the existing situation in the context of the evolution of the SDI through land administration projects where in the next chapter we will look at the implications of trends of SDI development objectives, the aspects that may lead to conflicts between donor agency projects and internal Vietnamese policies and finally, what are the reasons for these conflicts and why is this happening.

5. Interpreting Results in Terms of SDI Evolutionary Concepts

5.1. Introduction

In chapter 4, the analysis rendered results of the evolution of SDI through land administration projects carried out in Vietnam over time. Each of these projects has had the access component of SDI incorporated into it by the development and implementation of a land information system (LIS). Based on the results from the data collected, I look at the evolution of the SDI from the case of Vietnam while addressing research question 4 in the process as it relates to the implications of trends in terms of SDI development objectives, the aspects the lead to conflicts between external donor agency projects and internal Vietnamese policies and finally the reasons for the conflicts and why these things happen the way they do. To do this I focus on the indicators for the concepts the Evolution of SDI and the External Influence of Donor Agencies in LA Projects. In the end, I give a conclusion to the chapter which serves as a basis for the following chapter.

5.2. Evolution of Spatial Data Infrastructures (SDIs)

The results presented in chapter 4 under the concept of the evolution of SDI in relation to the indicators are analyzed individually in this section.

5.2.1. Institutionalization of the SDI

The findings for the institutionalization of the SDI in chapter 4 show that the 1988, 1993 and 2003 land laws of Vietnam make provisions for the use, dissemination and sharing of data between individuals and organizations. However, data sharing is more conducted on having a personal contact with the individual or organization that data is being shared with instead of following the land law. This is confirmed and supported by data from the responses of the questionnaire and the interviews in shown in Figure 8 in Section 4.3.1.

Furthermore, with the capacity of almost all the respondents being developed over time through workshops and journal literature about the concept of SDIs and what is required for developing an SDI in terms of standards, data, policies, etc., the practices of the organizations in which they work have remained the same where two-thirds do not follow what is stated in the Land Laws with regards to data sharing. See Figure 9.

Additionally, since half of the respondents stated that data sharing occurs on a personal contacts basis and with “data being seen as a secret”, according to one-fifth of the respondents, the need to disseminate data produces illegal transactions where persons charge extraordinary sums of money for the data that they have as there is no political will on behalf of the government to intervene in combating this practice. The policy is to be very efficient as stated in the SEMLA project document and Land Law

2003, yet one-third of the respondents, refer to the current practice as being very bureaucratic, hence there is a gap between policy and reality and the inclusion of policies in law.

To this end, we can see that institutionalization of the practices have become caved in. This has been the trend on the evolution of the SDI in Vietnam from the early 1990's to the present. However, there is a move towards increasing institutionalization with the recent creation of the new GDLA by the MoNRE. This creation gives the GDLA responsibility to develop standards as it relates to data and metadata with specific reference to cadastral data. Now, with standards being created for data, this leads to increased use, dissemination and sharing of data but at the same time it may not have the desired effect. There are laws that already exist for this but are not followed, so the creation of standards may not fix the problem at hand.

5.2.2. Regulation of the SDI

Figure 10 of Section 4.3.2 of Chapter 4 shows that from 1990 to 2009, the degree of regulation of the SDI has been low, but there have been directives that have been produced for assisting in the evolution of SDI within Vietnam. These directives have been a part of the LA projects that have been carried out during this time period. The Vietnam Spatial Data Infrastructure (VSDI) was a component introduced within the SEMLA project. This project was completed in 2009 by SIDA and MoNRE. Other directives were the Technical Regulation for Cadastral Data and the Technical Regulation for basic Geographical Database in Vietnam. The main issue is to locate where exactly the directive is within the Land Laws. From the responses of the respondents there seems to be a discrepancy to whether the directive is on the 2003 Land Law or the 1993 and 1988 Land Laws or even if it actually exists with any of the Land Laws whatsoever.

Hence, I state that there is a directive with reference to the SDI in Vietnam and it is found in the 2003 Land Law, Section . This knowledge is gained from the responses of respondents of the GDLA and the Vietnam Association of Geodesy, Cartography and Remote Sensing organizations and also comparing these responses to documents from the SEMLA project. The content of the documents confirm the responses of the respondents from the GDLA and Vietnam Association of Geodesy, Cartography and Remote Sensing organizations as being correct as to there being a directive with regards to SDI in Vietnam.

Nonetheless, the directives have laid a foundation as the SDI concept has evolved within Vietnam but mostly at the Central and Provincial Levels with pilots being included at some district level locations. Therefore, for the SDI to evolve throughout the entire Vietnam, organizations need to know what the directive is and where to find it in order to be effective and efficient in carrying out their land administration activities as the now VLAP project is focusing on.

5.2.3. Adoption of New SDI Technologies

The findings for the adoption of new SDI technology show that technology adoption is very mixed from 1990 to present. It is slow in some areas and sometimes non-existent in others. This is because most of the locations at the lower levels of public administration i.e. district and commune levels, are still undertaking land administration activities manually. Only in the SEMLA project so far has the use of

the internet been incorporated and adopted at some districts. New technology such as WebGIS have not been adopted as the internet connection in Vietnam is via ADSL which has very slow rate of transfer of data. This has resulted in districts that are not a part of LA projects mostly utilizing manual methods or the use of silo database systems as stated in the response from the People's Committee of Thanh Xuan District.

One problem identified as noted through responses from the ESRI Vietnam and ICT department of MoNRE, is the capacity of the local people in order to use the technology. There is a lack of understanding of the use of SDI technology by citizens of both rural and urban areas. The internet is sometimes too advanced for some people therefore limiting the adoption of the technology. This causes the citizens to revert to their normal way of working.

Also, the lack of funding is another reason why new SDI technology is not adopted as is reported through the responses in Section 4.3.3. If you do not have adequate funding then there is no capability to invest in such technology.

Another critical aspect of adopting technology is the agreement as to what type of technology is to be used. This has been a constant problem between the Vietnamese and the external donors who are undertaking LA projects. For instance, the Vietnamese chose to use Oracle for database management while using MicroStation and ArcGIS for data capture. From observation and as stated in the ELIS Report of the SEMLA project, July 6, 2009, ArcSDE along with ArcGIS Server is used for both database management and data capture for Natural Resources and Environment data. Here is where the disagreement comes in as to what to use for what aspect. In truth, the use of the various technologies instead of one standard technology is due to the knowledge and prolonged use of the currently used technology. Specific individuals use specific technology to do specific processes of their work and for them to suddenly change to a different one leads to loss of time during the learning and training process.

However, new technology such as ArcGIS is mostly adopted at the Central Level and at some provinces at the Provincial Level. The budget and mandates of organizations such as the ICT Department of the MoNRE and GDLA at these administration levels make it possible for the adoption of technology as it becomes available. Also, the capacity is very high at these levels as most of the individuals have either attained some sort of higher education or training in the use of the technology thus enabling it to be adopted over time very easily.

Nonetheless, systems such as LIS is slowly being introduced and adopted at Land Registration Offices that have not been a part of the LA projects carried out.

To this end, the creation of the New GDLA, with the mandate to create data standards for Vietnam, will facilitate the adoption of the Cadastre 2014 cadastral data standard at all levels of administration for the standardization of all cadastral data from 2009 onwards. This would assist in the process of better collection and management of cadastral data thus encouraging agencies to apply ICT technology to their land registration and data management functions. The VLAP project focuses on this aspect thus enabling the SDI to evolve through the project as there is an SDI component included.

5.2.4. Social Interaction Using SDI Technologies

The findings for the social interaction using SDI technology show that there is limited to no social interaction using SDI technology. There have been initiatives where citizens have an opportunity to work with LIS or access parcel data via the web. Such initiatives are the Vietnam Land Information System (ViLIS) (http://www.vilis.vn) website and ELIS (Environmental Land Information System). Citizens at the district and commune levels continue to go to the land registration offices for parcel data and any other land administration activity. One of the interviewees said that this was due to the low bandwidth (slow rate of transfer) of the internet infrastructure in Vietnam where only ADSL is used and also most persons not having access or being able to afford internet services. When I checked the bandwidth I found that ADSL was the internet connection being used. When compared to other countries such as Australia and the United States who uses high-speed internet connection (fibre-optics, LAN, WAN), I found that there is a high user rate of the technology. Therefore,

Furthermore, from the initiatives stated before, land administration activities are carried out using the LIS that has evolved through the CPLAR and SEMLA projects. Such activities are land registration, cadastral mapping and land use planning, just to name a few which have all been included in the 2003 Land Law as part of these projects. However, only persons who have an understanding of how to use the technology or have a notion of the land administration activities would use the technology. Hence, this results in the limited social interaction with the SDI technology. This was confirmed by responses OP11, SS5, SS7 and SS2 found in Appendix 2.

However, as the knowledge and use of the internet increases, the level of sharing and access also increases. But with the slow nature of ADSL connection, the delivery of services is limited. For one of the Land Registration Offices that have recently implemented a LIS, their work process and operation costs for storing data have been reduced as well as the time it takes to carry out their work with the use of the internet. This then have increased the speed in the transferring of data from one organization to another and also reduced the time in carrying out land registration activities such as land use planning, thus making the work process more transparent to some citizens. This was one of the aims through which the SDI would be developed and evolved through the LA projects as stated in the VLAP project document February 2009.

Also, with the private sector not being involved in the development as is mentioned by OP9, SS8, SS5 in Appendix 2 and reported in Section 4.3 .1 and evolution of the SDI as reported in Section 4.3.4, the number of users are mostly limited to government organizations that have seem to take the responsibility upon themselves. As World Bank, SEMLA, CPLAR project reports and Sida Evaluation Reports have stated that the public private collaboration will aid in the effective development and evolution of the SDI, this is not the case here. This will, in my view, continue to limit the way and direction of the evolving SDI and may ultimately lead to its failure because public private partnerships have

Nonetheless, as the SDI evolves in Vietnam, four interviewees made mention that much work needs to be done by the Vietnamese Government and departments, along with the external donors, in order for citizens and private organizations to be able to use the SDI technology as the access for some citizens is

limited as reported in Section 4.3.4**.** This was also deduced from responses IS7, IS4, IS4.1, IS1, IS1.1 IS1.2, IS8, RS1, RS4, AS5, AS7, OP7 and OP11, all in Appendix 2.

5.3. Influence of External Donors in Land Administration Projects

The results presented in Chapter 4, Section 4.4 are analyzed in this section.

The influence of external donors in LA projects are somewhat mixed. There have been several LA projects carried out in Vietnam from 1990 to 2009. These projects have been organized by external donor organization such as the World Bank, the Swedish Government and the United Nations. A list of the projects and related details are shown in Table 14.

Furthermore, the proposed outcomes, changes and components such as the development of an LIS for improving land registration, of these external donor projects have found their way within the daily activities of organizations such as the GDLA, National Remote Sensing Centre, ICT Department of MoNRE and some Land Registration Offices at the Central and Provincial Levels of public administration and even for a few organizations that are not a part of the public administration domain. However, for a few organizations, they have not implemented any of the proposed initiatives and components of these projects as to them it was not a mandatory thing to do and the way they were working was sufficient enough. So this follows the sayings that "if it's not broken, don't fix it". With this being the mentality, how can the SDI really evolve throughout Vietnam? I do not realistically see the way forward with such blatant disregard for improving the way things are done.

However, the influences on the LA projects seem to not come from external donors alone but from the local institutions such as departments of the MoNRE and other personnel within government organizations as well. No one group have outright or full control of these projects in terms of what should be done and who should do what. Indeed, evaluations of the external consultants of the donor organizations seek to highlight what they call the 'shortcomings' of the government organizations (Provincial & District Levels) in terms of providing adequate qualified personnel to undertake the various responsibilities of the projects thus giving the donor a bit more responsibility and control. This is rebuffed by responses from interviewees (OP4, OP5 and OP6) in Appendix 2 that they are adequately qualified and capable of undertaking such responsibilities, even to the point where they are more qualified than the external consultants themselves. This has caused some conflict between Vietnamese government departments and the external donors but the problem is quickly discussed and ratified and compromise gained for the continuation of the projects.

5.4. Partnerships (Public/Private)

The findings as it relates to issues of partnerships show that the SDI evolution in Vietnam is predominantly carried out by the public sector i.e. government ministries and departments with the help of the external donor agencies through LA projects. As stated in Section 4.5, one-third of the responses from the interviews states that the private sector is not involved and does not have any input in the development of the SDI within Vietnam. SS8 and OP9 of the categorized responses and quotes section in Appendix 2 give verification to this statement. Also, with there being limited private use of spatial

data in Vietnam as reported by respondents, the full potential of the data may not be realized as the role of the cadastre becomes more and more important for spatial land data acquisition.

5.5. Conclusion

Based on the interpretation of Sections 5.2 – 5.4 and using the concepts and indicators in Table 4, the implications of trends in SDI development objectives are that the objectives of data sharing, interoperability and data accessibility have developed through LA projects that are carried out by external donor agencies. However, the Vietnamese themselves have a lot to say in how these objectives are carried out and even included in these projects. The implications of such trends are such that it is very difficult to have a consensus as to what path to follow as these trends are affected by various elements. Such elements are the technology that should be used and its adoption by the relevant stakeholders. This is seen happening in Vietnam as the decision on what software to use is still an issue between government organizations (Ministry of Lands and Ministry of Construction) and also with the external donors and the government organizations at the various administrative levels. As technologies such as the web, wireless, and mobile changes rapidly, it may be difficult to keep abreast with the training and costs that is required as it is sometimes too advanced for the Vietnamese in some instances.

Furthermore, these implications in trends do lead to conflicts between the LA projects through which the SDI is developed and evolutes and the internal policies of the MoNRE. One aspect is the implementation of one LA project before the end of another. For example, the SEMLA project was still in operation while the VLAP was being incorporated into the system. Various aspects have not been fully realized such as an efficient land registration system with the LIS being completely in operation and functional. Now the VLAP is to try to build on the existing SDI situation developed by the SEMLA and hopefully enhance the nature of the SDI and its components. Most times it's just a matter of what technology to use, which organization should be responsible at the various administrative levels.

Also, the many small and incremental changes of instructions that have been implemented from the national or central level by provincial and district level organizations have only created more administrative work without making any real improvements to how the SDI should evolve.

The nature or reasons of the conflicts between the external donors LA projects and the Vietnamese are not known as these were not mentioned or seen through any of the documents and reports. Hence, what can be said is that if there are conflicts, they are dealt with before hand and a compromise is reached by all involved in order to continue with the projects.

To this end, as the SDI continues to evolve through these LA projects in Vietnam, no one group has more control of the projects than any other group. There seems to be a level playing field where it's a give and take situation from all sides involved. The proposed revised Land Law 2008 will need to have clear directions on the direction that the SDI should take in order for it to become a reality and success and not a failure as it seems to be heading in that direction. This should now give some direction towards the next chapter as we seek to investigate and discuss the evolution of SDIs and how these development projects affect the natural course of this evolution.

6. Modifying the Theory & Collecting Insights on the Evolution of Spatial Data Infrastructures

6.1. Introduction

This chapter relates the findings and interpretation in chapter 5 to the knowledge of SDI evolution and the role of LA projects through which SDIs have evolved. The chapter addresses research question/objective 5 as it relates to how development projects have affected the natural course of SDI evolution and if they have, in what way. The chapter establishes SDI evolution from a global perspective and compares and contrasts it with the evolution of SDI through LA projects as is the case in Vietnam. I then end with a conclusion to the discussion on our findings which answers our research question/objective.

6.2. Evolution of Spatial Data Infrastructures

Many countries and governments have tried to build Spatial Data Infrastructure since its inception in the early 1990's. The theory in Chapter Two and Section 2.2.2 states that the components of an SDI are data, access and distribution technology in terms of clearinghouses and geo-portals, people, institutional framework/policy and standards. We shall look at each element separately in the context of SDI components, as well as looking at the evolution and hierarchical structure of spatial data infrastructures, and also the influence of external donors. These elements are shown in Table 16 below.

Table 16 - Similarities and differences of Global & LA Project SDIs based on SDI Components

SDI Components, Evolution & Hierarchy	Global SDI	LA Projects (Vietnam)	Similarities	Difference	Conclusion
Evolution	Is a result of formal mandates or out of existing spatial data coordination activities	Is a result of LA project intervention	SDI progress can be steered	SDI as a result of LA project is very discrete	SDI evolution is not 100% directable through projects
Policy / Regulation of SDI	SDI's can be steered through regulations	LA projects include SDI type of regulations along with other types of regulations	The fundamental assumption of organizations' compliance to regulations	There is a hierarchy of compliance which is parallel to national compliance	The issue of regulations need to be linked to issues of compliance & degree of compliance

SDI Components, Evolution & Hierarchy	Global SDI	LA Projects (Vietnam)	Similarities	Difference	Conclusion
Institutional Framework	Public/Private Partnership will emerge over time	Only public sector organizations are involved	Institutional frameworks assures partnerships	The inclusion of the private sector is not automatic	The inclusion of the private sector requires private sector pressure and active involvement
Standards	Standards provide a basis from which to develop national or discipline-oriented profiles	Standards are mostly used for providing cadastral and environmental data	The emphasis on adoption of ISO and other standards	Each SDI initiative develops its own best practice to which standard & version is used	SDIs may be interoperable within its own community, but it might not be interoperable with its neighbours
People / Social Interaction Using SDI Technology	Access to and knowledge of SDI technology and other technology is available at all levels of PA	Access to and knowledge of SDI technology is predominantly available at Central & Provincial Levels of PA	Hierarchical distribution of access and knowledge	Distribution of access & knowledge remains at top level	The issue of people needs to be linked to issues of institutionalization and culture
Access Technology	The use of Geospatial Clearinghouse relies on interoperability of databases	Land Information Systems relies on a combination of distributed databases	The emphasis on database use and interoperability	Databases are not interoperable, and are only related to single departments	Interoperability is an ideal but often an impractical perception
Hierarchy	SDI hierarchy is both vertical and horizontal in nature	SDI hierarchy is mostly vertical in nature but has some horizontal aspects	Hierarchy exists	Top-Down Approach is more dominant than bottom-up approach	There are gaps between design and reality
External donor Influence	SDI can be steered and progressed through projects	SDI is progressed through project interventions	There is an element of steering	Donor influence is assured or not assured	Actual influence of donors is dependent on SDI progress

6.2.1. Access Technology

From the theory that relates to SDIs, it is mentioned that interoperability of and access to the SDI technology is enhanced by the use of geospatial clearinghouses, geo-portals and the World Wide Web or internet. Therefore, the use of geospatial clearinghouses relies on interoperability of databases.

However, from the evidence of the case of Vietnam where the SDI has evoluted through LA projects, instead of clearinghouses or geo-portals as the form of access technology, land information systems are

used and rely on a combination of distributed systems. The use of silo land information systems, and in some cases, geographical information systems are mostly used in government organizations and the academic arena for accessing and distributing data. They also rely on and use paper-based maps for data access and distribution.

Nonetheless, both forms of evolution (global & LA projects) are similar in the sense that the emphasis placed on access is based on database use and interoperability. However, databases are not always interoperable and are related to single individual departments as was the findings of the case. This is to say that each organization and institution possess their own silo information or database system for their own purpose and needs hence there is no connectivity between systems.

To this end, I can conclude that reality shows that databases are not always interoperable and do not need to be all the time as some databases are only relevant for a specific activity and specific department. Hence, there is a limit to what needs to be interoperable and interoperability is an ideal but often an impractical perception.

6.2.2. Policy/Regulation of the SDI

Theory says that having a policy on the regulation of the SDI would achieve the objectives and vision of the SDI through delineated goals and roles. In other words, SDIs can be steered through regulations and policies.

From the findings of the case, the projects include SDI types of regulations with other national regulations that are parallel. This means that even though there may be SDI type regulations, individual organizations and institutions will have their own regulations to adhere to.

Nonetheless, as the evolution of SDIs continues, there is the fundamental assumption of organizations' compliance or complying with regulations throughout. These regulations are regarded as of paramount importance to the development of SDIs. However, given the LA structure that exists, there is a hierarchy of compliance which is parallel to national, organizational and or individual compliance. Policies are created and developed at the upper levels of public administration and are then handed down to the other levels of administration without being tailored to suit the on-ground situation of these levels. Therefore, the degree of compliance to these policies along with the existence of parallel regulations that organizations and institutions need to adhere to can be extremely low as they do not reflect and suit the local situation that is currently present. People just simply follow regulations they know and are familiar with. Hence, parallel regulations may be conflicting to the SDI type regulations as to who does what, when, where, how, and so forth.

To this end, I can conclude that as there continue to have regulations being parallel to each other, whether national or organizational along with SDI type regulations, conflicts will arise as these regulations may clash with each other. Hence the issue of regulations needs to be linked to issues of compliance and the degree of compliance as well and a strong political will may facilitate this.

6.2.3. People/Social Interaction Using SDI Technology

People impact on all aspects of SDI evolution at all levels of public administration as every SDI component requires human resources to operate. The important aspect with respect to people is their skills and capabilities. Hence, from theory, the access to and knowledge of SDI and other technologies is or should be available at all levels of public administration i.e. Central (National), Provincial (State), District and Local levels.

However from the findings of the case, in reality the access to and knowledge of SDI and other technology is predominantly available at the Central (National) and Provincial Levels of public administration. The lower levels of the District and Local have little to no access and knowledge to such technology. The lack of use of SDI technology does not affect the way in which data is utilized as before there was SDI technology, the manual paper-based or silo database systems were utilized and worked for the tasks at hand at that time.

Nonetheless, there exists a hierarchical distribution of access and knowledge of SDI and other technologies which influences SDI evolution. This is to say that access and knowledge are shared vertically and horizontally as is continuously distributed to all public administration levels stated in SDI theory and literature. However, in reality distribution of access and knowledge, both horizontally and vertically, remain at the upper levels i.e. national and provincial levels. This can be attributed to the culture and traditions that exist between organizations and individuals as regardless of regulations and policies exist, personal contacts often override and dominate the entire time.

To this end, I can conclude that institutionalization and culture has a tremendous influence on the distribution of the access to and knowledge of SDI and other technologies. Yes, the technology exists and should be utilized but not everyone will see the need to use the technology as it is intended for. Social structures dictate the manner in which things are done every where therefore the issue of people and social interaction needs to be linked to the issues of institutionalization and culture.

6.2.4. Institutional Framework and Arrangements

Institutional arrangements are a critical component of SDI evolution and will influence and also be influenced by the SDI evolution. As the global trend to privatize many areas of traditional government services and infrastructure such as communication, transport, health and water continues, it is not surprising that some areas of traditional spatial information capture or management will be undertaken by the private sector worldwide. Therefore, public-private partnerships are emerging around the world which build infrastructure such as roads, health systems and communication networks. This same concept have transcended to SDIs as stated by theory.

However, the findings from the case show the opposite, in the sense that public sector organizations are the ones involved and responsible for the evolution of the SDI. The donor agencies that have implemented the LA projects are all public organizations i.e. UNDP, World Bank and the Swedish Government. Also, each stakeholder has their own rules, norms and practices embedded into their organization. So for these rules, norms, etc of each organization to be tailored to meet the expectations of policies that are developed for the SDI, resistance to this change will very much likely occur.

Nonetheless, the following scenarios are possible given similar developments in other infrastructures. Institutional frameworks may give surety to partnerships being developed. However, the inclusion of the private sector within partnerships is not automatic as is found in the case. Given the land administration structure, limited institutional cooperation and coordination between organizations will often occur and this may lead to an adhoc and unsuccessful SDIs. But, the opposite can occur where limited cooperation with the private sector can lead to a very successful SDI evolution.

Hence, I can conclude that the inclusion of the private sector within institutional frameworks and partnerships require pressure and active involvement of the private sector because this has also happened in other domains.

6.2.5. Standards

Standards provide a basis from which to develop national or discipline-oriented profiles as stated in literature. Standards are an important component of any data sharing arrangement, particularly if the data sharing is to become systemized and include a large number of multiple partners.

However, from the findings of the case, standards are mostly used for providing cadastral and environmental data. Different organizations maintain their own data using their own formats and tools.

Seeing to the fact that databases are not always interoperable and integrable, the emphasis on the adoption of standards has been critically important in establishing interoperability and integrability. Not having interoperability and integrability does not mean that the SDI will not evolve. It just means that SDIs can evolve without standards, or that different kinds of standards emerge than those that have been agreed nationally and internationally.

To this end as each SDI initiative develops its own best practice to which standard and version is used, SDIs may be interoperable within its community but it might not be interoperable outside of its community. Hence I can conclude that the process of sharing and exchanging data encourages the use of a standardized approach which assists the reduction of time, effort and resources that is taken in the conversion of data.

6.2.6. Evolution

The evolution of SDIs is as a result of formal mandates or out of existing spatial data coordination activities, according to theory. This has been the case in countries such as the United States, Canada and the United Kingdom.

However, from the findings of the case, the evolution of the SDI is as a result of land administration project interventions. This is to say that the evolution of SDIs is also donor driven instead of just from formal mandates and coordination of spatial data activities. Does donor driven SDI evolution affect the way in which the SDI evolves? I will say no, it does not. Typically, it is just another way in which the SDI can evolve. There has not been a prescribed way that says that SDIs should only result from formal mandates or coordination activities. Those were just the more familiar ways that have been recorded since this evolution began. Every country will unearth the best way that benefits their local situation.

This is not to say that what a donor tries to implement is always the "gospel" and the only way. Knowledge of the field and phenomenon of SDI by the country is vital and obligatory. This helps in the implementing to the local context in order for it to be successful.

As mentioned in Section 2.2.3 and in (Masser 1999), SDIs that are (a) explicitly national in nature (b) refer either to geographical information, spatial data, geospatial data and (c) refer to terms such as infrastructure, system or framework, which imply the existence of some form of coordinating mechanism for policy formulation and implementation purposes in one case, to land information, are considered to be first generation SDIs. Therefore, looking at Vietnam's SDI development over the past twenty years, I can say that this is also a part of the first generations of SDIs. But according to (Williamson, Rajabifard et al. 2003; Budhathoki, Bruce et al. 2008; Masser 2009) there is a development path (focus) or generations that SDIs should or will progress through over time i.e. first generation (product or data driven) to second generation (process driven) and then third generation (user driven). But after twenty years of SDI development and it is still in the first stage of generation of development then the maybe the path that has been envisioned needs to be revisited as it does not apply to or has not worked for the case of Vietnam.

Nonetheless, throughout the evolution of SDIs, reality shows that their progress follows an approved course of action. But as is seen, SDIs that result from land administration project interventions are very discrete in the sense that they more specific to the land administration domain and not a part of mandates and spatial data coordination activities.

To this end, I can conclude that eventhough SDI evolution have been mainly as a result of formal mandates and spatial data coordination activities, the evolution is not 100% directable through land administration projects. Eventually, donor driven initiatives can be another direction that is adopted and utilized as it gives the evolution from another perspective.

6.2.7. Influence of External Donor

From theoretical literature, SDIs have been steered or directed and developed through SDI projects. However, the findings from the study give a totally different view to this aspect. External donors have a high degree of influence as they not only influence from a financial standpoint but their initiatives for the way SDIs should evolve are pushed through the development projects whether technologically or otherwise. This is more evident in developing countries or countries in transition where most projects are implemented.

Therefore, I can conclude that the actual influence of donors is dependent on the progress of the SDI. If the evolution of the SDI struggles or does not become a reality then the influence of the external donor is diminished or becomes non-existent. If the progress is favourable and shows signs of maturity then the influence of the external donor increases. However, the opposite can be true also where as the evolution shows maturity and progress, the influence of the external donor reduces as is seen through the case of Vietnam.

6.2.8. Hierarchy

Literature showed that a country's system of governance impacts the nature of National SDI and how it is administered. Furthermore, National SDI coordination structures are needed to balance the interests and mandates of agencies at different levels of government and across many jurisdictions (horizontally and vertically). Therefore, SDI hierarchy should be a combination of both top-down and bottom-up approaches.

However, from the findings of the researched case, SDI hierarchy is predominantly vertical in nature and in a top-down manner but there exists very limited horizontal aspects such as cross-organizational. Everything is developed at the Central Level and funnelled down to the other levels of administration. Also, horizontal development is in an informal state and not formalized.

Nonetheless, from both realms of SDI evolution (global and LA projects) hierarchy exists as is stated in theory regardless of the nature of it. However, as the top-down approach is more dominant than the bottom-up approach in reality such as in the LA projects in Vietnam, SDIs have continued to evolve and exist regardless. So then you ask the question, why should there be a horizontal and vertical collaboration? If it works and is not broken, why fix it?

Hence, I conclude that the idea of having both a top-down and bottom-up approach for the evolution of the SDI debatable. Some organizations appear more comfortable and appear to perform better when things are driven from top-down. In this way, there can be more accountability as with the bottom-up approach many personal ideas have to be incorporated in arriving at a final consensus or decision. What I can say is that there are gaps between the design of SDIs and reality.

6.3. Conclusion

Looking at SDI evolution, the concept appears to be rather dynamic, much more dynamic than the theory in chapter 2 on evolution claims it to be.

The evolution of SDIs through development projects (LA) is a very unique avenue for SDIs to evolve. According to theory, this form of evolution is not the natural way that SDIs have evolved over time. Hence the evolution of SDIs is in a continuum of avenues and not that distinct as first thought. This gives a wider understanding of the magnitude to which this infrastructure can be beneficial to the people and government of a country in aiding better decision making as most things do have a link to the environment (built and natural).

Also, the influence of external donors determine the direction and nature of the SDI through these LA projects as they see it fit to include SDI development in this way for developing or transitional countries.

However, regardless of land administration projects, SDIs in any country appear to evolve the same way but in different arenas. This may be as a result of environmental issues, a global or regional crisis in Asia after the Tsunami in 2004, and even down to political interventions as is evident in the United States after the attempted plane bombing on December 25, 2009.

Furthermore, these projects often run in parallel to the development of the SDI and with or without a SDI component in these projects, the projects would continue.

Nonetheless, SDIs that evolve through LA projects are specialist types of SDIs that contribute to the existing generic and general purpose SDIs. However, this course of evolution has not worked for Vietnam as not much has changed in terms of SDI development over the past twenty years. The practices and rules of the game remain as it relates to data sharing and the knowledge about SDIs, policies exist but again, old habits die hard resulting in informal data sharing being dominant. Political will is needed is needed in facilitating the inclusion of policies into law as this is one that lacks in some countries.

To this end, there have been many projects but they have done little in moving the SDI forward.

7. Conclusion and Recommendation

7.1. Conclusion

The objective of this research is to investigate the extent to which spatial data infrastructures have evolved through land administration projects. To achieve the objective of the research, the research questions are formulated such that their answers would contribute towards fulfilling the objective. The research objectives and questions are presented below as defined in Section 1.3 and Section 1.4 together with the provided answers. Finally recommendations are given which should be applicable for future research.

Research Objective 1: To describe how concepts in Land Administration and SDI have changed over time.

The concepts in Land Administration and SDI have migrated over time due to numerous undertakings of these projects worldwide. As the SDI began in the early 1990s with the Executive Order of the Office of the President of the United States (Clinton 1994), the concept has been adopted in regions such as Europe, Africa, Asia and Pacific and even to Antarctica. During that time the definitions have changed from country to country and by different scholars and experts' perception of them and also from the advancement in technology. The main actors of Land Administration have been (a) external donor agencies, (b) the politicians who are responsible for passing the laws that govern the realm that the projects can incorporate, (c) government organizations at all levels of public administration, (d) coordinating bodies that have been created and (e) most of all, the citizens of the country.

Also, in the global development of SDIs, they (the SDI's) have developed through or as a result of mandates, initiatives and directives, spatial data coordination activities between the various levels of government and across levels (vertically and horizontally) and now include being developed through land administration projects.

Research Objective 2: To describe the nature of land administration projects developed for Vietnam over time and the perception of the Vietnamese government organizations towards them.

The nature of land administration projects developed for Vietnam was for developing information systems, especially Land Information Systems (LISs) to enhance land administration functions such as land registration, land use planning and land consolidation. The nature of the land administration project has now moved towards the development of a spatial data infrastructure through the Strengthening Environmental Management and Land Administration (SEMLA) and the Vietnam Land Administration Programme (VLAP) projects. These projects are also an incentive and justification for enacting land

laws or updates to the current land law by the Vietnamese. It can be concluded that when a land administration project is to be implemented, an update or new land law is to be enacted.

Also, the perception or view of the Vietnamese towards these projects is that these projects support them in changing their economic status to a market-driven economy from the command driven economy that existed until 1986.

Research Objective 3: To observe and interpret any differences or similarities between donor projects and the internal policies of the Vietnamese Government organizations.

The similarities of these land administration projects are such that they have focused on the development of a land information system as the building block for the SDI. From the Cooperation Programme on Land Administration Reform (CPLAR) project which dealt with Land Information Systems development and Land Registration, the Strengthening Environmental Management and Land Administration Programme (SEMLA) project was a continuation of the CPLAR. The SEMLA then extended the Land Information Systems idea based on the then new Land Law 2003 which placed emphasis on Land Use Rights Registration and Certification of all lands within Vietnam. The Vietnam Spatial Data Infrastructure (VSDI) concept was also introduced through the SEMLA project. Now, the Vietnam Land Administration Programme (VLAP) project is a further extension of the CPLAR and SEMLA projects where it now focuses on supporting land registration throughout Vietnam. One difference is that the VLAP project is not by the Swedish International Development Cooperation Agency (Sida) but is by the World Bank.

Research Objective 4: To interpret the trends associated with SDI development objectives and the aspects that lead to conflict between donor projects and internal policies of Vietnamese government organizations.

The implications of trends in terms of SDI development objectives are such that the initiatives for SDI development come from the external donors through the land administration projects that are implemented. This sort of it is difficult to have a consensus as to what path to follow as these trends are affected by various elements. Such elements are the technology that should be used and its adoption by the relevant stakeholders. This is seen happening in Vietnam as the decision on what software to use is still an issue between the Vietnamese government organizations themselves and also with the external donors and the Vietnamese government organizations. As technology changes rapidly, it is difficult to keep abreast with the training and costs that is required as it is sometimes too advanced for the Vietnamese in some instances.

Aspects that lead to conflict between external donors and internal policies is such as who should be responsible for what, where the data comes from, the scale and the standard to use. The recommendations from the external donors and even between local authorities themselves may

contradict with what is accepted within the country and organizations. This may lead to policies being amended or the creation of new laws to regulate the development.

Research Objective 5: To appraise the role of donor interventions in the evolution of Spatial Data Infrastructures.

The evolution of SDIs through development projects is a unique avenue for SDIs to evolve. According to theory, this form of evolution is not the natural way that SDIs have evolved over time. Hence the evolution of SDIs is in a continuum of avenues and not that distinct as first thought. This gives a wider understanding of the magnitude to which this infrastructure can be beneficial to the people and government of a country in aiding better decision making as most things do have a link to the environment (built and natural).

Also, the influence of external donors determine the direction and nature of the SDI through these land administration projects as they see it fit to include SDI components in this way for developing or transitional countries.

However, regardless of land administration projects, the SDIs in Vietnam and other countries in Asia and Africa, appear to evolve the same way but just in different arenas. This may be as a result of environmental issues, a global or regional crisis as in Asia after the Tsunami disaster in 2004, and even down to strong political will and interventions or the lack thereof.

Furthermore, these projects often run in parallel to the development of the SDI and with or without a SDI component incorporated, the projects would continue in any case.

Also, looking at Vietnam's SDI development over the past twenty years, I can say that it is a part of the first generations of SDIs as described in (Masser 1999). But according to (Williamson, Rajabifard et al. 2003; Budhathoki, Bruce et al. 2008; Masser 2009) there is a development path (focus) or generations that SDIs should or will progress through over time i.e. first generation (product or data driven) to second generation (process driven) and then third generation (user driven). But after twenty years of SDI development and it is still in the first stage of generation of development then the maybe the development path that has been envisioned and mentioned previously, needs to be revisited and re-examined as it seems to have missed Vietnam over time.

Nonetheless, SDIs that evolve through land administration projects are consultant SDIs that contribute to the existing standard and wide-ranging function of SDIs. However, this course of evolution has not worked for Vietnam as not much has changed in terms of SDI development over the past twenty years. As stated in the results in Section 4.3 and the interpretation in Section 5.2, the practices and rules of the game have remained as it relates to data sharing and the knowledge about SDIs, policies exist but again, old habits die hard resulting in informal data sharing being dominant. There should be an element of political will incorporated into the evolving SDI in terms of having policies and regulations, as part of

the law thus paving the way for the elimination of much of the bureaucracy and non-transparency that may be present and are maintained.

To this end, based on the results in Section 4.4, Table 15 and the interpretation in little in moving the SDI forward, therefore projects do not have an effect on SDIs and are not useful.

7.2. Recommendations

The limited nature and time of any research will not allow for a more in-depth study into the subject matter and this research is of no different.

From the literature, the evolution of spatial data infrastructures through land administration projects has not been looked at as it seems to be a rare avenue for SDIs to evolve. I have found through this research that the SDI concept is not as straightforward as first thought based on the differing definitions and models that continue to evolve and with the advancement of technology.

During the research the concentration was drawn to the social issues (institutionalization and social interaction between people) rather than the technological issues (ICT issues) that surround SDIs. This was in part to the limited development of such technology for the case. Hence, the outcomes of this research highlight the following directions for further investigation in the future.

Firstly, a more in-depth look at the role, intentions and motivations of external donor agencies in developing SDIs through land administration projects or including them as a component of such projects. As I was unable to meet with any external donor agencies during the field exercise, this limited my understanding of what they actually seek to achieve from such a venture.

Secondly, as SDI technology such as clearinghouses and geoportals are stated in literature to enhance the functionality of SDIs, this should be looked at in the context of integrating them into land administration projects, not only at the central or national level but also at the lower levels from the provincial to the local levels and also the practicability of incorporating them.

Thirdly, as Cadastre 2014, a view from 1998 on how cadastres would develop in land administration and where the idea of infrastructures as integrated systems was considered, more attention should be made at the reality or how realistic the proposals made in the document are still valid and would be reached in the next 4-5 years as organizations and countries struggle with the accessibility and integration of such integrated systems.

Finally, as the comparison of the evolution of SDIs in developed and developing countries was beyond the scope of this research, I think that this research and along with other literature relating to SDIs can be used in taking that aspect further as well as looking at the development path (generations) that SDIs have been envisioned to take over time.

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The Embassy of Sweden, Hanoi (Sida) - http://www.swedenabroad.com/Start____9053.aspx

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Appendices

Appendix 1: Questionnaire to assess the evolution of Spatial Data Infrasturctures Through Land Administration Projects

Spatial Data Infrastructure in Land Administration in Vietnam

The Evolution of Spatial Data Infrastructures in Land Administration in Vie...

The following questionnaire belongs to a research being carried out on the topic "The Evolution of Spatial Data Infrastructures in Land Administration in Hanoi, Vietnam" by Norval Young from The British Virgin Islands and an Msc Student of the Land Administration Course at the International Institute for Geoinformation Science & Earth Observation, ITC, The Netherlands. The purpose of this survey is to find out the Evolution of Spatial Data Infrastructures (SDI) over time, the effects within Land Administration and the level of influence from external factors in Vietnam. We are committed to keep privacy of the personal information provided by the respondents and the information will be used for study purposes only.

Profile of Interviewee/Respondent

1. What is your Organization/Department?

2. What is your Job Title?

3. What is your function within the Organization/Department?

4. What type of activities do you do?

Institutionalization of Spatial Data Infrastructures (SDI)

5. Did the 1993 Land Law make any specification with regards to spatial data?

- ◯ YES
- ◯ NO
- ◯ I Don't Know

If so, please specify

Spatial Data Infrastructure in Land Administration in Vietnam

6. Did the 2003 Land Law make any specification with regards to spatial data?

- ◯ YES
- ◯ NO
- ◯ I Don't Know

If so, please specify

7. Do you work regularly with spatial data?

- ◯ YES
- ◯ NO

8. How do you work with spatial data? (Select all that apply)

- ☐ I work with GIS/LIS regularly
- ☐ I am a manager of GIS/LIS projects
- ☐ I am contributing to National GIS/LIS discussions

9. Did you ever receive maps, aerial photos or satellite images from other organizations than your own?

- ◯ YES
- ◯ NO

10. How can you receive such data?

- ◯ The 1993 Land Law makes this possible
- ◯ The 2003 Land Law makes this possible
- ◯ It only requires approval from the Supervisors
- ◯ It does not require a law nor a regulation
- ◯ We obtain it through personal contacts

11. Have you ever heard about Spatial Data Infrastructure (SDI)?

- ◯ YES
- ◯ NO

12. When (in which year) was the first time that you heard about SDI?

13. Where (from whom) did you hear about SDI?

Spatial Data Infrastructure in Land Administration in Vietnam

14. Have you read about SDI in any of the following? (Select all that apply)

- [ ] Journals
- [ ] Memos
- [ ] Reports
- [ ] Newsletters
- [ ] Articles

15. Have you yourself ever written about SDI?

- ◯ YES
- ◯ NO

Regulation of Spatial Data Infrastructure (SDI)

16. Do you know of any guideline/directive with regards to SDI in Vietnam?

- ◯ YES
- ◯ NO
- ◯ I DON'T KNOW

If so, please specify

17. In which Land Law is it found?

- ◯ 1988 Land Law
- ◯ 1993 Land Law
- ◯ 2003 Land Law

Adoption of SDI Technology (New)

18. Do you use GIS/LIS in your organization?

- ◯ YES
- ◯ NO

19. Do you use GIS/LIS for any Land Administration activity?

- ◯ YES
- ◯ NO

If YES, please specify

Spatial Data Infrastructure in Land Administration in Vietnam

20. When did your organization start using GIS/LIS?

- ◯ Before 1986
- ◯ 1988-1993
- ◯ 1993-2003
- ◯ After 2003

21. To which Public Administrative level are your daily working activities mostly relevant?

- ◯ Central Level
- ◯ Provincial Level
- ◯ District Level
- ◯ Commune Level
- ◯ I do not work for any public sector activity

Social Interaction Using SDI Technology

22. Do you know of any initiatives where citizens have worked with GIS/LIS or WebGIS?

- ◯ YES
- ◯ NO

If so, please specify

23. Can any citizen access parcel data through the web?

- ◯ YES
- ◯ NO

24. Are Land Administration Activities carried out using GIS/LIS?
(Land Administration Activities – Land Registration, Land Use Planning, Land Allocation)

- ◯ YES
- ◯ NO
- ◯ I Don't Know

If so, please specify which Land Administration Activity

Spatial Data Infrastructure in Land Administration in Vietnam

25. Did using GIS/LIS reduce the operational costs of storing data?

- ◯ YES
- ◯ NO
- ◯ I Don't Know

If so, please specify how much

26. Do you find that using GIS/LIS makes operational work processes more transparent to citizens?

- ◯ YES
- ◯ NO
- ◯ I Don't Know

27. Do you find that using GIS/LIS reduces the time to do Land Administration activities in your organization?

- ◯ YES
- ◯ NO
- ◯ I Don't Know

External Factor's Influence/Control in Land Administration Projects

28. Have there been Donor Agencies involved in Land Administration Projects in Vietnam?

- ◯ YES
- ◯ NO

29. Do you perceive any change by external donors (technical assistance) projects in your daily activities?

- ◯ YES
- ◯ NO

If so, please specify which projects

Spatial Data Infrastructure in Land Administration in Vietnam

30. Have you been involved in any Land Administration Project?

- ◯ YES
- ◯ NO

If so, please specify which Land Administration project & by whom

31. Which of the Land Administration projects that you were involved in is still operational?

32. What was your role in these projects?

33. Have there been conflicts between external donor agencies & government organizations with regards to Land Administration projects in Vietnam? (Answers will be treated confidentially)

- ◯ YES
- ◯ NO
- ◯ I Don't Know

If so, please specify

Additional Information

34. What would you like to add to any of the above questions?

35. Do you want to receive the results of this survey?

- ◯ YES
- ◯ NO

If so, please specify your email or address

Thank You

Thank you very much for your time and cooperation.

Appendix 2: Categorized themes of respondents quotes and responses used for analysis of fieldwork

Evolution of SDI

Institutionalization of SDI (IS)

IS1: Convert all analogue data to digital to improve data sharing.

IS1.1: To allow Province level more autonomy.

IS1.2: Central Level will only synchronize efforts.

IS2: Central Level deals with metadata such as Land Use Planning Statistics.

IS3: SDI was introduced at training courses.

IS4: Results of NREDB are not only applied in NRE domains, at National level, but also used in local level and in other fields.

IS4.1: Ha Giang, Yen Bai, Phu Yen, Hai Phong, Dong Nai, etc. are provinces that are using NREDB integrated data in various systems

IS4.2: NREDB data is also used in other agencies' systems: General Statistic Office, Ministry of Public Security, Ministry of Agriculture and Rural Development, etc.

IS5: The Thanh Xuan District has no aim to apply the ISO standard in management.

IS5.1: There is a project for it but the funding is very limited.

IS5.2: The Land Registration Office only received 100 million VND (less than 4000 euros).

IS6: Digitized spatial data from MoNRE is problematic and contains numerous errors.

IS7: Every Province has their way for making land Information.

IS8: Some central cities have good enough data for management only.

IS9: There has been a newly created General Department of Land Administration (GDLA)

IS10: I have never heard about SDI

Regulation of SDI (RS)

RS1: There is a gap between LA Projects and Policy inclusion (Law).

RS2: There is no policy for SDI diffusion.

RS3: The use of GIS is not compulsory

RS4: Policies need to be converted into Law.

Adoption of New SDI Technology (AS)

AS1: The GDLA uses ORACLE for Database Management and MicroStation for Data Capture.

AS2: GDLA also uses ArcGIS, Map Object and a locally developed program called ViLIS.

AS3: GDLA function is to develop Cadastral Standard for standardizing Cadastral Data using the Cadastre 2014 documentation.

AS4: The Land Titles Office of the Thanh Xuan district manages land data on paper within two registers.

AS5: A digital land database is not established for Vietnam.

AS6: Cadastral maps are in captured in the Microstation's "dgn" format.

AS6.1: Attribute data is on paper.

AS7: The Land Titles Office of the Thanh Xuan district land spatial data comprises of 1:200 parcel maps which were surveyed 1990 – 1994.

AS7.1: These maps are of low accuracy, mostly measured by tape.

AS7.2: They are not up to date.

AS7.3: Thanh Xuan Nam and Kim Giang are two "wards" that have newly surveyed cadastral maps, surveyed by total stations 4-5 years ago.

AS7.4: The Thanh Xuan district has no efforts to apply ICT technology to land registration and data management.

AS7.5: Land registration software has been developed by a Hai Hoa company

AS8: The base geographic data for databases is in ArcGIS format at a scale of 1:50,000 for the entire Vietnam.

AS9: ArcGIS is now being used instead of ArcView.

Social Interaction Using SDI Technology (SS)

SS1: Most used software is ArcGIS

SS2: The task in the objective and methodology of spatial land data acquisition is becoming more difficult for the Department of Natural Resources & Environment of the Thanh Xuan district .

SS3: Before it only included management of cadastre at commune (ward) level, field checking and issuing land certificates.

SS4: The Department of Natural Resources & Environment of the Thanh Xuan district has to maintain the cadastre up to date.

SS5: There is very little private use of spatial data.

SS6: All levels of government work with ArcGIS software.

SS7: Some locals are not ready for new technology as it is too advanced for them at times.

SS8: The private sector does not have much input in SDI development.

Influence of External Donors in LA Projects (IL)

Control

IL1: There have not been any donor financed projects in the district of Thanh Xuan.

IL2:. There has been conflict in opinions between external donors and Vietnamese.

IL3: There has been conflict in the selection of software.

IL4: The structure of the land database of the VLAP project is still in discussion as there is no final agreement or consensus.

Opinions (OP)

OP1: These LA projects are more dealing with Provincial (city) level and higher or they may be implemented as some selected districts.

OP2: The role of the cadastre becomes more and more important for spatial land data acquisition.

OP3: Hanoi City and the Hai Ba Trung District achieve positive results in application of ICT technology in Land Registration and land data management.

OP4: External donors do not understand the Vietnam context.

OP5: Local Vietnamese are paid less than external donor personnel in the donor projects.

OP6: The qualification of the external donor personnel has more priority than Vietnamese qualification.

OP7: Public administration is problematic, corrupt and bureaucratic.

OP8: Open source data should be utilized more often.

OP9: The private sector should become more involved in SDI development.

OP10: The SDI development in Vietnam is different than in other countries.

OP11: Data is hidden in Vietnam from citizens.

Appendix 3: List of Interviewees

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